Ohio Fish Tissue Contaminant Monitoring

Introduction

This volume of the 305(b) provides information on Ohio's fish tissue contaminant monitoring program. This volume is presented in 4 sections as summarized below:

- Section 1 defines the current status, methodologies, and rationale for fish tissue contaminant monitoring in Ohio including statewide summary information;
- Section 2 provides consumption advisory information;
- Section 3 provides a summary of current data analysis procedures and sample collection locations;
- Section 4 includes a summary of existing data organized by river basin.

Fish consumption impairment in streams and lakes is summarized in Tables A and B and in Volume 1 of the 305(b) which are repeated on the next two pages. Locations and information regarding fish consumption advisories are detailed in Table 2-1 in Section 2 of this report. They are also available in an Ohio Fish Consumption Fact Sheet available from the Ohio Department of Health (ODH).

Table A. Miles of streams and rivers in Ohio with fish tissue samples which exhibited no contamination, slightly elevated contamination, moderately elevated contamination, highly or extremely elevated contamination, and segments with a health advisory.

Status	Miles	Percent of Assessed	Percent of Total[1]
	All Years		
Not Elevated	436.0	11.7	1.5
Slightly/Moderately Elevated	2,434.9	65.6	8.4
High/Extremely Elevated or Partial Advisory	703.2	18.9	2.4
High/Extremely Elevated and All SpeciesAdvisory	139.1	3.8	0.5
Totals:	3,713.2	100.0	12.8
	pre-1988		
Not Elevated	453.3	36.7	1.6
Slightly/Moderately Elevated	361.0	29.3	1.3
High/Extremely Elevated or Partial Advisory	359.3	29.1	1.2
High/Extremely Elevated and All SpeciesAdvisory	60.3	4.9	0.2
Totals:	1,234.1	100.0	4.2
	1990-1996 Cycles Only		
Not Elevated	176.2	5.7	0.6
Slightly/Moderately Elevated	2,260.8	72.5	7.8
High/Extremely Elevated or Partial Advisory	574.8	18.4	2.0
High/Extremely Elevated and All SpeciesAdvisory	105.9	3.4	0.4
Totals:	3,117.8	100.0	10.7
	1996 Cycle Only		
Not Elevated	11.9	0.6	<0.1
Slightly/Moderately Elevated	1,627.3	82.2	5.6
High/Extremely Elevated or Partial Advisory	274.0	13.8	0.9
High/Extremely Elevated and All SpeciesAdvisory	66.7	3.4	0.2
Totals:	1,980.1	100.0	6.8

[1] Perennial streams on the basis of USEPA (1991a) estimates.

Table B. Fish tissue screening levels for tissue contaminants for Ohio's 447 public lakes, ponds, and reservoirs greater than 5 acres in size.

	Fish Consumption				
	Not Elevated	Slightly-Moderately Elevated	High-Extremly Elevated[2]	High-Extremly Elevated[3]	Totals
Number[1]:	31	30	2	0	63
	49.2%	47.6	3.2%	0	14.1% of All Lakes
Acres[1]:	41,496	43,930	180	0	85,606
	48.5%	51.3%	0.2%	0	72.1% of All Lakes

[1]447 Publicly-owned lakes (118,801 acres).
[2]or site specific public health advisory (through 1996) for selected species.
[3]and site specific public health advisory (through 1996) for all species.

Section 1

Program Status and Rationale

Cooperative Fish Tissue Consumption Monitoring Program

The State of Ohio operates a fish tissue consumption monitoring program as a cooperative effort between the Ohio Department of Health (ODH), the Ohio Department of Natural Resources (ODNR), the Ohio Environmental Protection Agency (Ohio EPA), and the Ohio Department of Agriculture (ODA). Each agency in this cooperative framework performs specific duties as shown in Table 1-1.

Table 1-1. Fish tissue consumption monitoring program cooperating agencies and duties. Boxes marked with a dark square indicate that an agency performs this duty.

Organization	Field Collection	Laboratory Analysis	Data Management	Data Distribution
Ohio EPA	■	■	■	■
ODH			■	■
ODNR	■			■
ODA		■		

The **primary objectives** of the fish tissue consumption monitoring program are **to identify the magnitude of chemical contaminants found in Ohio fishes**, and **to advise the public of the risks associated with the consumption of contaminated fish**. Secondary objectives include:

- Monitoring trends in fish tissue contaminant distribution;
- Reviewing the status of current fish advisories;
- Determining the success of pollution control and abatement efforts;
- Identification of new sources of contamination; and
- Providing additional data for evaluation of point and nonpoint sources of pollution.

Sportfish consumption advisories are issued by either ODH or a local health department (*e.g.*, county or city). Usually, the state and local health departments coordinate the issuance of sportfish consumption advisories and the dissemination of information to the public, although both Ohio EPA (via the 305b report) and ODNR (via

Ohio fishing license) support distribution of information to the public.

Advisory Decision Making Procedure

Beginning in January 1994, ODH began issuing tiered sportfish consumption advisories for Polychlorinated Biphenyls (PCBs) based upon a weight-of-evidence health protection value (HPV) of 0.05 µg/kg/day for PCB residue ingested from fish tissue. Consumption advisory groups are based on a concentration range of PCBs in fish tissue (Table 1-2). Similar tiered advisory systems were also developed for hexachlorobenzene (HCB) and mercury (the mercury limits are draft). Other HPVs will be developed as needed for other chemical contaminants based on reference doses presented in the Integrated Risk Information System (IRIS) database, developed and administrated by USEPA.

Table 1-2. Consumption advisory groups based upon fish tissue concentrations of PCBs, Hexachlorobenzene (HCB), or mercury in Ohio fishes.

Group	Consumption Recommendation	*Qualitative Description*	[PCB] µg/kg	[HCB] mg/kg	[Mercury] µg/kg (**Draft Only**)
1	Unrestricted	*Not elevated*	0 to 50	0 to 0.8	0 to 50
2	1 meal per week, 52 meals per year	*Slightly elevated*	51 to 300	0.81 to 3.5	51 to 200
3	1 meal per month, 12 meals per year	*Moderately elevated*	301 to 1000	3.51 to 15.1	201 to 1000
4	6 meals per year	*Highly elevated*	1001 to 1900	15.11 to 30.3	1000 to 2000
5	**Do not consume**	*Extremely elevated*	> 1900	> 30.3	>2000

Prior to January, 1994, fish advisories were issued based upon the U.S. Food and Drug Administration (USFDA) recommended action levels (Table 1-3). ODH also has issued 3 fish consumption advisories (Black River, Mahoning River, Little Scioto River near Marion) based upon the presence of fish tumor incidence since the sediments from these areas contain high concentrations of polynuclear aromatic hydrocarbons (PAHs).

Table 1-3. USFDA criteria used for Ohio fish consumption advisories prior to 1994.

Parameter	USFDA Action Level (µg/kg)
Aldrin	300
Chlordane	300
DDT (including metabolites DDE, DDD)	5000
Dieldrin	300
Dioxin (as 2,3,7,8 TCDD)	0.05
Endrin	300
Heptachlor	300
Heptachlor epoxide	300
Kepone	300
Mirex	100
Toxaphene	5000
PCBs (Total)	2000
Mercury	1000

Sample Information

Ideally, species-specific composite samples of two to five fish representing a particular size class are analyzed (Table 1-4). Occasionally, samples of single fish are used when sufficient fish cannot be collected for a composite sample. Samples are collected and prepared according to specific requirements as outlined in *Biological Criteria for the Protection of Aquatic Life, Volume 2: Users Manual for Biological Field Assessment of Ohio Surface Waters* and *Fish Tissue Guidance Manual: Ohio EPA Technical Bulletin MAS/1994-11-1*.

Table 1-4. Fish species obtained for fish tissue composite samples. Fillet samples are used for consumption monitoring, whereas whole fish are used in other contaminant assessment programs. The frequency of sample use is also given for each species.

Common Name	*Scientific Name*	Fillet Sample	Whole Fish Sample
Common Carp	*Cyprinus carpio*	Seldom	Often
Flathead Catfish	*Pylodictus olivaris*	Seldom	Rarely
Channel Catfish	*Ictalurus punctatus*	Often	Seldom
Yellow Bullhead	*Ameiurus natalis.*	Often	Seldom
Black Bullhead	*Ameiurus melas*	Often	Seldom
Brown Bullhead	*Ameiurus nebulosus*	Often	Seldom
White Sucker	*Catostomus commersoni*	Rarely	Seldom
Brown Trout	*Salmo trutta*	Rarely	Rarely
Steelhead	*Oncorhynchus mykiss*	Rarely	Rarely
Golden Redhorse	*Moxostoma erythrurum*	Seldom	Rarely
Silver Redhorse	*Moxostoma anisurum*	Rarely	Rarely
Muskellunge	*Esox masquinongy*	Seldom	Rarely
Northern Pike	*Esox lucius*	Seldom	Rarely
Walleye	*Stizostedion vitreum*	Seldom	Rarely
Sauger	*Stizostedion canadense*	Seldom	Rarely
Saugeye	*Stizostedion vitreum X Stizostedion canadense*	Seldom	Rarely
Yellow perch	*Perca flavescens*	Seldom	Rarely
White bass	*Morone chrysops*	Seldom	Rarely
Smallmouth bass	*Micropterus dolomieu*	Often	Rarely
Largemouth bass	*Micropterus salmoides*	Often	Rarely
Spotted bass	*Micropterus punctulatus*	Often	Rarely

Common Name	*Scientific Name*	Fillet Sample	Whole Fish Sample
Rock bass	*Ambloplites rupestris*	Often	Rarely
White crappie	*Pomoxis annularis*	Often	Rarely
Black Crappie	*Pomoxis nigromaculatus.*	Often	Rarely
Bluegill Sunfish	*Lepomis macrochirus*	Seldom	Rarely
Green Sunfish	*Lepomis cyanellus*	Seldom	Rarely
Longear Sunfish	*Lepomis megalotis.*	Rarely	Rarely

Program Efforts

Table 1-5 summarizes the general sampling effort since 1992. Fish tissue sampling for 1996 is projected to be about 660 samples from approximately 63 streams and a dozen reservoirs. For most fish tissue samples, pesticides, PCBs, and three metals (cadmium, lead, and mercury) are analyzed. Approximately 75 samples per year are allocated for additional analytical parameters such as the metals selenium and chromium, the metalloid arsenic, and various volatile and semivolatile compounds like benzene and phthalate esters. In rare cases, tests are performed for such compounds as dibenzofurans and dioxins. Table 1-6 lists the compounds and elements that are typically tested in fish tissue.

Table 1-5. Sampling effort for the years 1992 through 1995.

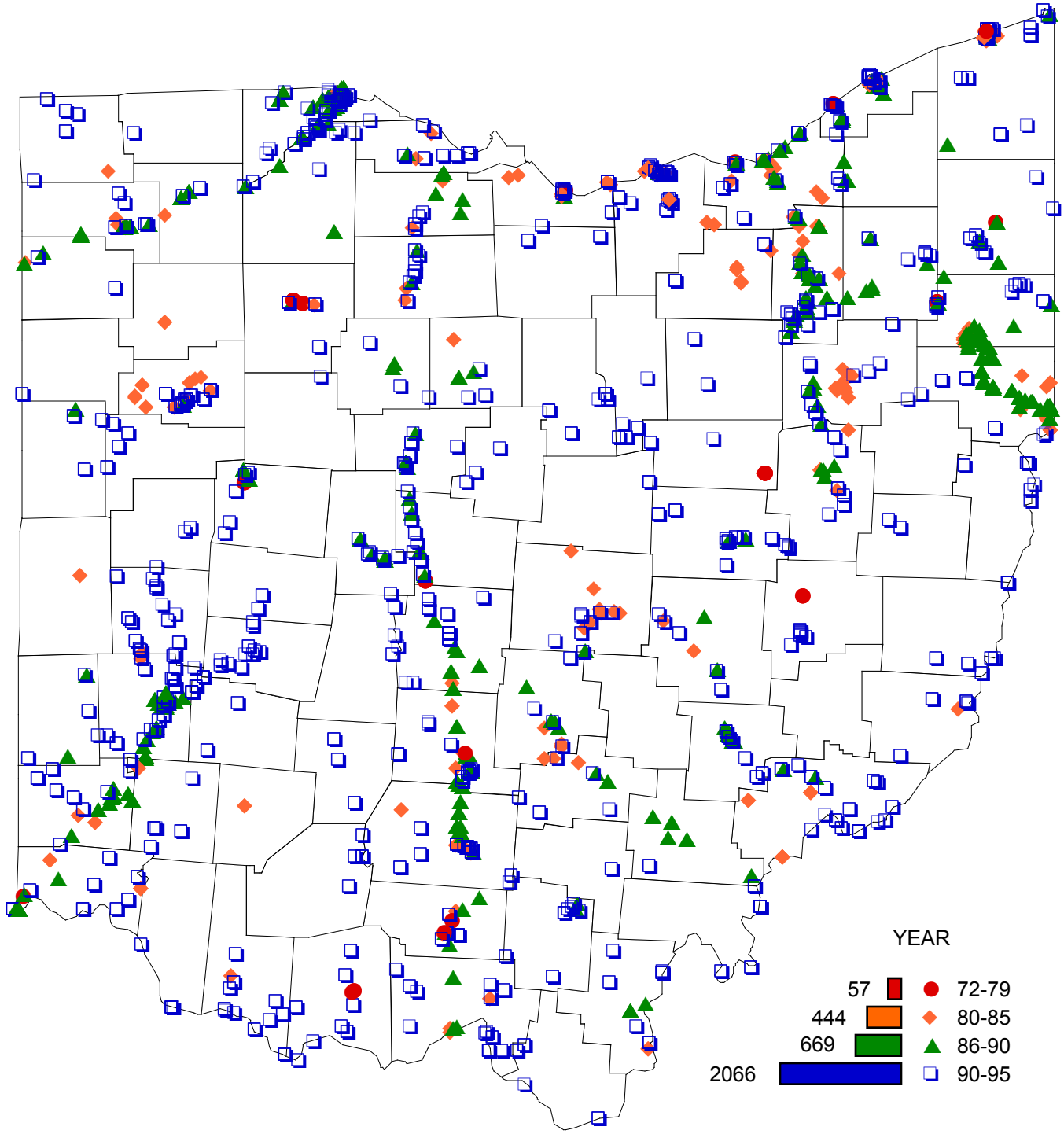
Year	Number of Fish Tissue Samples Obtained
1992	329
1993	375
1994	774
1995	532
TOTAL	**2010**

Table 1-6. Pesticides, PCBs, and heavy metals which are typically used in analysis of fish tissue samples.

Pesticide	PCB	Metal
Aldrin	Arochlor 1060	Arsenic (metalloid)
Alpha BHC	Arochlor 1221	Barium
Beta BHC	Arochlor 1232	**Cadmium***
Delta BHC	Arochlor 1242	Chromium
Gamma BHC (a.k.a. Lindane)	Arochlor 1248	Copper
Alpha Chlordane	Arochlor 1254	**Lead***
Gamma Chlordane	Arochlor 1260	**Mercury***
Oxychlordane		Nickel
Cis-nonachlor		Selenium
Trans-nonachlor		Sodium
4-4' DDT		Zinc
4-4' DDE		*Boldface metals are tested most frequently.
4-4' DDD		
Dieldrin		
Endosulfan I		
Endosulfan II		
Endosulfan Sulfate		
Endrin		
Heptachlor		
Heptachlor Epoxide		
Hexachlorobenzene		
Methoxychlor		
Mirex		

Since 1993, fish tissue sampling has been performed under the auspices of one of two programs. The *fish tissue consumption monitoring program* addresses the definition of contaminants in sportfish consumed by anglers. Over the last 3 years this program has accounted for the majority of fish tissue sampling effort in Ohio. This program is a multi-agency effort within Ohio. The *fish tissue baseline monitoring program* addresses the screening and definition of contaminant distribution as part of the regularly scheduled stream and river surveys used to assess the quality of Ohio's waterways. Typically, the baseline program is allocated 50 to 75 samples each year and is solely administered by the Ohio EPA.

In past years, up through 1993, fish tissue samples were collected by Ohio EPA as part of Remedial Action Plans for Lake Erie drainage rivers. Fish tissue sampling also occurs as part of hazardous waste site investigations and continues on an "as needed" basis. Site investigation sampling is performed by the Ohio EPA, Division of Emergency and Remedial Response.



Map 1-1. Locations of tissue sampling locations in Ohio (where electronic latitude/longitude data is available) by year. Ohio EPA data only, does not include ORSANCO data.

Section 2

Consumption Advisories

Sportfish Consumption Advisory Information

Fish consumption advisories are issued to notify the public of contaminated fisheries and present information to assist the public in making good choices regarding consumption of fish. Fish consumption advisories identify the water body impacted, the extent of the advisory (*e.g.*, an upstream and downstream river mile and/or an associated geographic feature identified), the species involved, the chemical(s) of concern, and the reasons for the advisory. Primary contact advisories (wading, swimming, etc.) which are generally issued as a result of contaminated sediments may result in recommended restriction of wading and swimming.

Advisories are issued by the ODH. Advisory information is disseminated by ODH or a local health department via media announcements (news releases to wire services, newspapers, television, and radio). The advisory area may be posted with signs at public access points. In addition, ODNR distributes sportfish advisory information in a publication to anyone purchasing an Ohio fishing license.

Fish consumption advisories that have been issued can be rescinded if new data indicate that fish tissue contaminant concentrations are below health protection values for two consecutive sampling events. To date, no advisories issued in Ohio have been rescinded, although some advisories are always under investigation for possible repeal.

Current Sportfish Advisories in Ohio

Because of low levels of mercury contamination in nearly all samples collected, there is a STATEWIDE advisory for women of childbearing age and children age 6 and younger of no more than ONE MEAL PER WEEK OF ANY SPECIES FROM ANY WATERBODY

Composition

Currently, there are 37 sportfish advisories issued for Ohio waters (Table 2-1). Sportfish advisories have been issued for 31 river/stream reaches (including the Ohio River), 5 lakes (including Lake Erie), and one recreational pond. There are 12 sportfish advisories recommending no consumption of fish that are caught. The remaining advisories recommend limiting the consumption of specific fish species or specific sizes of species (including Lake Erie and the Ohio River) based on the level of contaminants as summarized below. *Group 1* recommendations present no restrictions upon eating fish. *Group 2* advisories urge eating only 1 meal per week, or 52 meals per year of listed fish. *Group 3* advisories urge eating 1 meal per month, or 12 meals per year of listed fish. *Group 4* advisories urge eating only 1 meal every 2 months for listed fish, or 6 meals per year. *Group 5* advisories urge that listed fish **not** be eaten at all (**Do Not Eat**).

Table 2-1. Fish and primary contact advisories issued by ODH and local healt h departments for Ohio surface waters (■ = yes).

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Lake Erie	All waters			Yellow perch	1	None
		■		Walleye Freshwater drum Chinook salmon <19"	2	PCBs
		■		White perch Steelhead Coho salmon Chinook salmon ≥19" Smallmouth bass White Bass Carp < 20"	3	
		■		**Lake trout** **Channel catfish** **Carp > 20"**	4	
	Maumee Bay	■		**Carp, all sizes**	4	PCBs
		▰		***Channel catfish***	***5***	
Maumee River	All Waters			White Crappie	1	None
		■		Common Carp	3	PCBs
		■		Smallmouth Bass	3	Mercury
	Mouth to Waterville	■		Largemouth Bass	2	PCBs
		■		Freshwater Drum		
		■		***Channel Catfish***	5	
	Waterville to Indiana Border			Largemouth Bass Freshwater Drum		None
		■		Channel Catfish	2	PCBs
Cuyahoga River	Upstream of Edison Dam Pool			Smallmouth Bass, Rock Bass, Bluegill, Pumpkinseed	1	None
	Downstream of Edison Dam Pool	■		White sucker < 11"	2	PCBs
		■		Carp, White sucker ≥ 11"	3	
		■		Largemouth Bass	3	
		■		**Brown bullhead**	4	
		■		**Yellow bullhead**		

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Tuscarawas River	From Turkeyfoot Rd. (SR 219), Barberton to South Broadway St. (SR 416), New Philadelphia (Tuscarawas County)	■		Largemouth bass Rock bass	2	PCBs, HCB
		■		Channel catfish Smallmouth bass Yellow bullhead	3	
		■		Carp	4	PCBs, HCB
Ohio River	All Waters	■		Largemouth bass, Smallmouth bass , Spotted bass, Sauger	2	PCBs
		■		White bass, Striped x white bass Freshwater Drum	3	PCBs
		■		Flathead catfish	4	*PCBs, Mercury
		▰		Channel catfish	5	PCBs
		▰		Common Carp		*PCBs, Chlordane
Mill Creek (Cinci)	From I275 to the Ohio River	■		All species	3	PCBs
Mahoning River	NW Bridge Rd., Warren to Pennsylvania border	▰	▰	Channel Catfish Common Carp	5	PCBs, PAHs,Mirex, Phthalate Esters
	Berlin Dam to Pennsylvania border	▰		White Crappie	2	PCBs
				Spotted Bass	3	Mercury
				Smallmouth Bass Walleye	3	PCBs
Middle Fork Little Beaver Creek	SR Alt 14 at Allen Rd, Salem, to SR 11, South of Lisbon	▰	▰	All species	5	Mirex, Chlordane
Great Miami River .	All Waters	▰		Channel Catfish Common Carp	2	*PCBs, Lead
	All Waters	▰		White Bass	3	PCBs
				Largemouth Bass Rock Bass Smallmouth Bass	3	Mercury
	Monument Ave. Dam, Dayton to Ohio River	▰		All Suckers	5	PCBs
Little Miami River	All Waters	▰		Channel Catfish Smallmouth Bass	2	Lead
				Sauger	3	Mercury
Little Muskingum River	Hill's Covered Bridge to Ohio RIver	▰		Spotted Bass	3	Mercury

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Mad River	U. S. 36, Urbana to Dayton	■		Hogsucker, Rock Bass Smallmouth Bass	1	None
				White Sucker	*2*	PCBs
				Common Carp	*3*	PCBs
Paint Creek	All Waters	■		Largemouth Bass	*3*	Mercury
Portage River	Ohio Turnpike to Lake Erie	■		White Crappie	1	None
				Largemouth Bass Smallmouth Bass	*2*	*PCBs *Lead
				Channel Catfish Common Carp	*3*	PCBs
Ford Hydraulic Canal	Power plant spillway, Hamilton, to the Great Miami River	■		All species	*5*	PCBs, Organo-metallics
Scippo Creek	All Waters	■		All species	3	PCBs
Ottawa River	I-475 N of Wildwood Preserve, Toledo to Maumee Bay	■	■	All species	*5*	PCBs
Black River	31st Street. bridge, Sheffield to Lake Erie		■	Contact Advisory		PAHs
		■		Brown Bullhead Freshwater Drum	*2*	PCBs
				Common Carp	*3*	PCBs
Ashtabula River	24th Street. bridge, Ashtabula, to Lake Erie	■		Rock Bass	1	None
				Smallmouth Bass	*2*	PCBs
				Largemouth Bass, Walleye	*3*	*Mercury, PCBs
				Channel Catfish, Common Carp	4	PCBs
Auglaize River	US 33, Wapakoneta to Maumee River, Defiance	■		Smallmouth Bass	1	None
				Channel Catfish, Common Carp	2	PCBs
Chagrin River	All Waters	■		Rock Bass Smallouth Bass	3	*Mercury, Lead
Conneaut Creek	All Waters	■		Smallouth Bass	3	Mercury
Ohio Canal (Summit Co.)	All Waters	■		Carp	*5*	PCBs
		■		Catfish		

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Mogodore Reservoir	All Waters	■		Largemouth Bass	*3*	Mercury
Eastwood Lake	All waters	■		Common Carp	*3*	PCBs
Lake Nesmith	All waters	■		Carp	*5*	PCBs
				Catfish		
Summit Lake	All waters	■		Carp	*5*	PCBs
				Catfish		
Sandusky River	All Waters	■		Smallmouth Bass	**1**	None
				Common Carp	*2*	PCBs, *Mercury
				Channel Catfish Largemouth Bass	*3*	
Little Scioto River	SR 739 near Marion to Holland Rd., near Marion	■	■	All species	*5*	PAHs
Salt Creek	Laurelville to Queer Creek Confluence	■		Smallmouth Bass	*3*	Mercury
Scioto River	Green Camp to Warrensburg	■		Rock Bass	*3*	Mercury
	Greenlawn dam, Columbus to the Ohio River, Portsmouth	■		Carp	*5*	PCBs, chlordane
				Catfish		
St. Mary's River	All Waters	■		Saugeye	*3*	Mercury
St. Joseph's River	All Waters	■		Rock Bass	**1**	None
				Channel Catfish	*3*	*Mercury, PCBs
W. Br. St. Jos. R	All Waters	■		All Species	*2*	PCBs
Stillwater River	All Waters	■		Channel Catfish Smallmouth Bass	*3*	Mercury
Twin Creek	All Waters	■		Rock Bass Smallmouth Bass	**1**	None
				Channel Catfish	*2*	PCBs
Walhonding River	All Waters	■		Saugeye Smallmouth Bass	*2*	PCBs
		■		Channel Catfish	*3*	PCBs

** Chemical that drives the advisory.*
PCBs = Polychlorinated Biphenyls
HCB = hexachlorobenzene
PAHs = Polyaromatic Hydrocarbon

Contaminants of Concern

The following contaminants have been identified as a concern for the state of Ohio. This is not a comprehensive list of all the possible contaminants found in fish tissue but instead focuses on some of the most common and persistent contaminants in aquatic environments. Numerous studies have been conducted on these contaminants documenting potential human health risks as well as adverse effects on wildlife. Some of these contaminants are persistent in the environment and are bioaccumulative in nature (e.g., mercury). These contaminants therefore have been found to occur in fish tissue across the state.

Polychlorinated Biphenyls (PCBs)

The vast majority of fish consumption advisories are due to Polychlorinated Biphenyls (PCBs). PCBs were used in a wide variety of industrial applications such as electrical power distribution (e.g., dielectric fluid in electrical transformers) and office work (e.g., manufacturing of carbonless copy paper). PCB mixtures containing higher proportions of chlorine (i.e., Arochlor 1248, 1254, and 1260) do not readily biodegrade, and are therefore one of the most persistent and pervasive chemical contaminants in fish tissue. Their ubiquitous usage and resistance to biodegradation have ensured that PCBs have spread throughout atmospheric, terrestrial, and aquatic environments. The production and usage of PCBs ceased in the 1970s when they were identified as a persistent chemical in wildlife, but PCBs continue to leach from uncontrolled and abandoned hazardous waste sites and mobilize from contaminated sediments found in polluted rivers and streams. Maps of fillet and whole body PCB concentrations from 1978-1987 and 1987-1995 are illustrated in Maps 2-1 and 2-2.

Mercury

Mercury is a silvery metal element that is liquid at room temperature. It is a very common contaminant in fish tissue. Mercury is (or was) used in a variety of applications including fluorescent light tubes, medical equipment (thermometers, sphygmomanometers, dental amalgam etc.), electrical equipment (thermostats), and paint. It enters the atmosphere during combustion of coal, oil, and refuse. When mercury enters the environment, it can become methylated thus forming methyl mercury. Methyl mercury is especially mobile and readily bioconcentrates in tissues of animals and humans. The distribution of elevated concentrations of mercury in fish flesh illustrates the widespread deposition of this parameter across Ohio (Map 2-3).

PAHs (Polycyclic Aromatic Hydrocarbons)

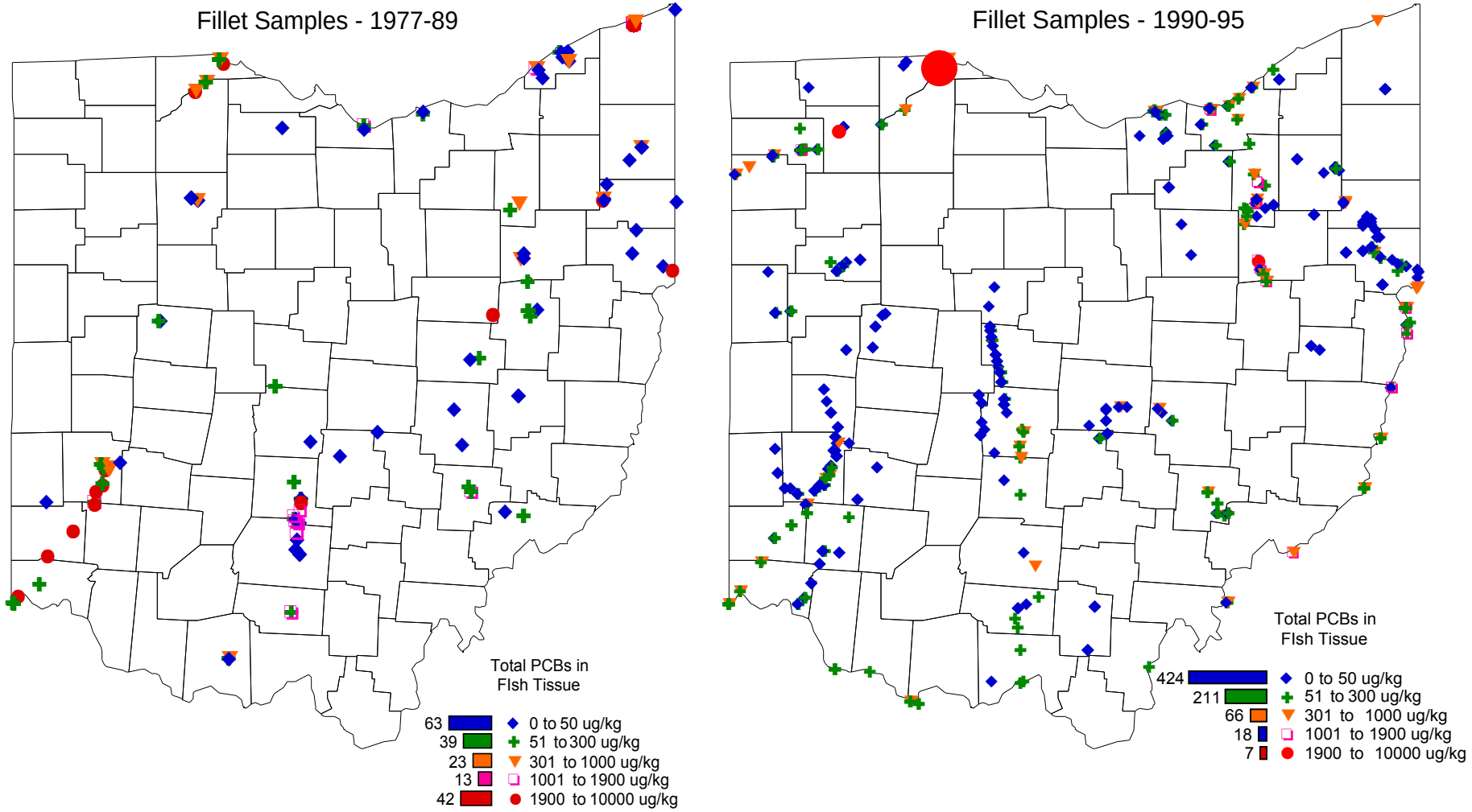
Polycyclic aromatic hydrocarbons (PAHs) are formed by the incomplete combustion of

other hydrocarbons. They are encountered in the atmosphere, soil, and elsewhere in the environment from sources such as engine exhausts, cigarette smoke, the manufacturing of coke from coal, and char-broiled food. High levels of PAHs can be found in coal tars and petroleum residues such as road and roofing asphalt. Areas with high levels of PAHs are of concern because they are linked to cancer-causing metabolites.

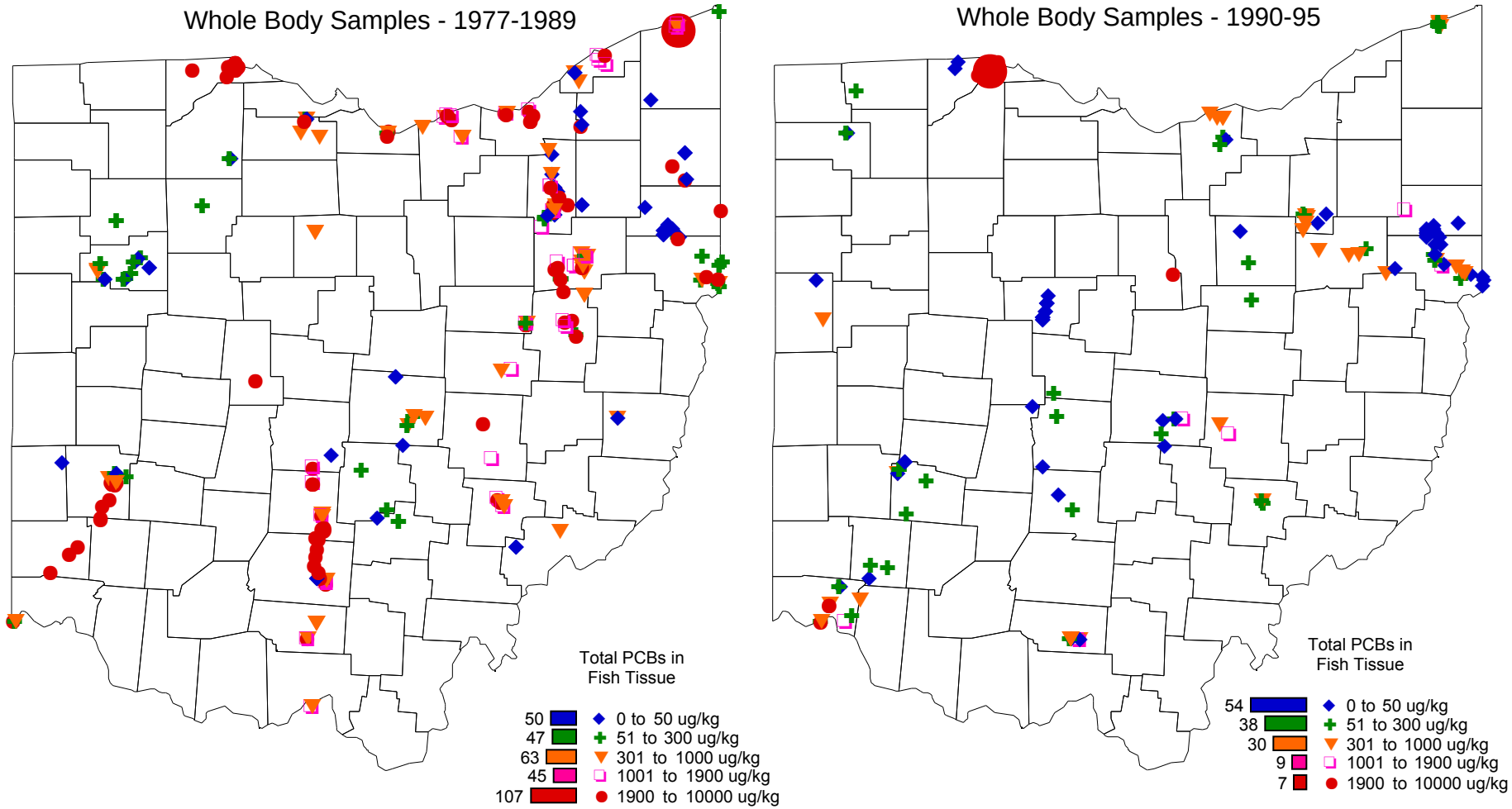
Chlordane

Chlordane is an organochlorine insecticide that was used in the U.S. from 1948 to 1988. It was banned for general use in 1983 but was still legally used for underground termite control until 1988. In 1988, all approved uses of chlordane in the United States were stopped, however it is still manufactured in the United States for export. Even though the use of chlordane has been virtually eliminated, due to its persistence, it continues to be recycled in the environment from prior applications. Short term exposure to chlordane can affect the nervous system causing headaches, irritation, confusion, tremors, weakness, and vision problems. Intermediate to long term exposure can lead to immune system effects, reproductive and developmental effects, and possibly cancer.

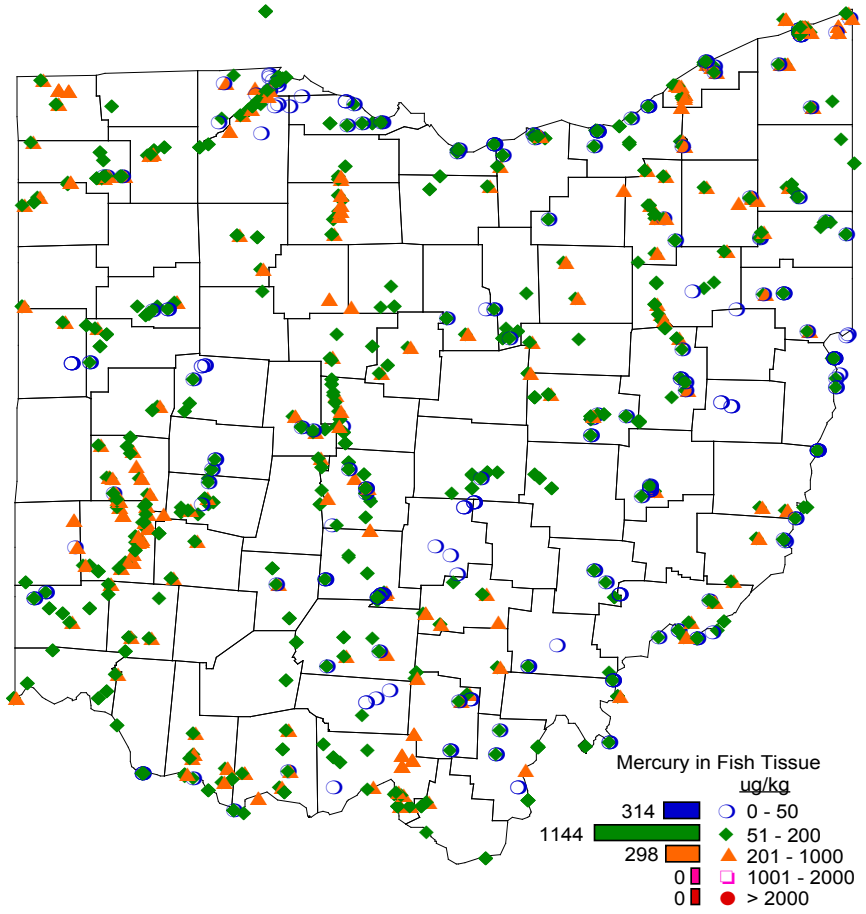
Map 2-1. Concentrations of PCBs in fillet samples of fish tissue collected in Ohio from 1977-1989 (left) and 1990-1995 (right) where electronic latitude/longitude data was readily available. Does not include data collected by ORSANCO.

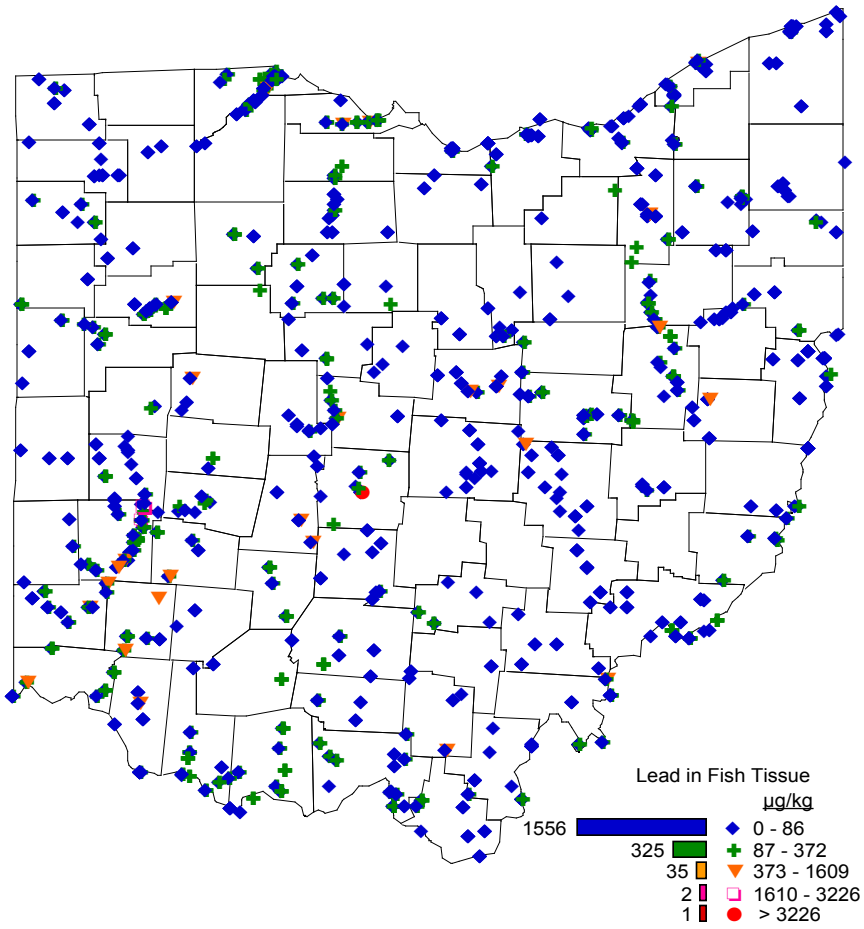


Map 2-2. Concentrations of PCBs in whole body samples of fish tissue collected in Ohio from 1977-1989 (left) and 1990-1995 (right) where electronic latitude/longitude data were readily available. Does not include data collected by ORSANCO.



Map 2-3. Concentrations of mercury (left) and lead (right) in fillet samples of fish tissue collected in Ohio from 1983-1995 where electronic latitude/longitude data were readily available. Does not include data collected by ORSANCO.





Tetrachloroethane

Tetrachloroethane is a non flamable solvent used in vapor degreasing of metals, paint, and ink formation, electrical components, refrigerant and heat exchange liquids, and in the rubber processing industry. At low exposure levels, tetrachloroethane can cause headaches and dizziness. At high levels, it can affect the nervous system and cause liver and kidney damage. Fish do not readily store tetrachloroethane but elevated levels have been found in fish tissue at certain locations (e.g., Ashtabula River).

Hexachlorobenzene (HCB)

Hexachlorobenzene (HCB) is formed as a waste product in the production of several chlorinated hydrocarbons and is a contaminant in some pesticides. HCB is persistent in the environment and will bioconcentrate in fish (Howard, 1990). HCB is a carcinogen and can cause damage to the liver, immune system, thyroid, and kidneys with high repeated exposure.

Mirex

Mirex is an insecticide used to control fire ants and other insects. It is of moderate toxicity and is extremely persistent in the environment due to its stability. When mirex is released to water, it would be expected to absorb to sediments and bioconcentrate in fish.

Phthalate Esters

Phthalate Esters are mostly used as plasticizers in manufacturing of flexible plastic. They are slightly persistent in water and can bioaccumulate in fish tissue. Phthalate esters may cause damage to human fetuses and also may be a carcinogen.

Section 3

Program Planning for 1996 and 1997

Fish tissue analytical data for Ohio for 1996 and 1997 will be generated from the following sources:

1. State of Ohio multi-agency sportfish consumption monitoring for human health assessment (fish fillet samples), also termed the fish tissue consumption monitoring program;

2. Ohio EPA, Division of Surface Water (DSW) environmental impact evaluation, also called the fish tissue baseline monitoring program, including whole body fish samples;

3. Ohio EPA, Division of Emergency and Remedial Response (DERR) site impact evaluations for hazardous waste sites, for environmental and human health assessment (as needed).

Table 3-1 shows the list of waterbodies where fish tissue samples were collected during the summer of calendar year 1996. Table 3-2 shows the proposed list of waterbodies where fish tissue may be sampled during the summer of calendar year 1997. Samples will be analyzed for organochlorine pesticides, PCBs, metals (mercury, cadmium, and lead). In some cases, other sample parameters may be analyzed for special circumstances (e.g., selenium, volatile organic compounds, base neutral/acid extractable compounds).

Table 3-1. Waterbodies for fish tissue consumption and baseline program sampling, 1996 where B = baseline monitoring program, C = consumption monitoring program.

Waterbody Name	*River Code*	*# of Samples*	*# of Sites*	*B or C*
Hocking River Basin (01)				
Hocking River	***01001***	***12***	***4***	***C***
TOTAL 01 BASIN		***12***	***4***	
Scioto River Basin (02)				
Walnut Creek	***02078***	***5***	***2***	***C***
Big Walnut Creek	***02100***	***13***	***4***	***C***
Alum Creek	***02110***	***6***	***4***	***B***

Waterbody Name	*River Code*	*# of Samples*	*# of Sites*	*B or C*
Rush Creek	*02165*	*3*	*1*	*C*
Deer Creek	*02300*	*16*	*5*	*C*
Lower Olentangy River	*02400*	*15*	*3*	*C*
Rattlesnake Creek	*02550*	*5*	*2*	*C*
Sunfish Creek	*02800*	*7*	*2*	*C*
TOTAL 02 BASIN		*70*	*23*	*C*
Grand River Basin (03)				
Grand River Harbor		*3*	*1*	*B*
TOTAL 03 BASIN		*3*	*1*	
Maumee River Basin (04)				
Flatrock Creek	*04185*	*6*	*2*	*B*
Blue Creek	*04120*	*2*	*2*	*B*
Eagle Creek	*04185*	*2*	*2*	*B*
Little Auglaize River	*04130*	*13*	*4*	*B*
Ottawa River	*04200*	*53*	*14*	*C/B*
Sibley Creek	*04310*	*1*	*1*	*C*
Tiffin River	*04600*	*9*	*3*	*C*
TOTAL 04 BASIN		*86*	*28*	
Sandusky River Basin (05)				
Broken Sword Creek	*05035*	*6*	*2*	*C*
Tymochtee Creek	*05300*	*15*	*5*	*C*
Honey Creek	*05200*	*6*	*2*	*C*
TOTAL 05 BASIN		*27*	*9*	
Southeast Ohio River Tribs (06)				
Cross Creek	*06200*	*4*	*1*	*C*
Yellow Creek	*06900*	*15*	*3*	*C*

Waterbody Name	*River Code*	*# of Samples*	*# of Sites*	*B or C*
North Fork Yellow Creek	*06910*	*4*	*1*	*C*
TOTAL 06 BASIN		*23*	*5*	
Central Ohio River Tributaries (09)				
Indian Guyan Creek	*09100*	*3*	*1*	*C*
Middle Branch Shade River	*09630*	*4*	*1*	*C*
Shade River	*09600*	*4*	*1*	*C*
Symmes Creek	*09700*	*19*	*4*	*C*
TOTAL 09 BASIN		*30*	*7*	
Little Miami River Basin (11)				
East Fork Little Miami River	*11100*	*16*	*4*	*C*
Stonlick Creek	*11107*	*4*	*1*	*C*
Todd Fork Little Miami River	*11200*	*14*	*3*	*C*
Massies Creek	*11400*	*6*	*2*	*C*
TOTAL 11 BASIN		*40*	*10*	*C*
Great Miami River Basin (14)				
Dicks Creek	*13001*	*2*	*1*	*C*
Greenville Creek	*14220*	*15*	*4*	*C*
TOTAL 13 BASIN		*17*	*5*	
Muskingum River Basin (17)				
Muskingum River	*17001*	*56*	*13*	*C*
Wolf Creek	*17030*	*10*	*3*	*C*
North Fork Licking River	*17250*	*17*	*4*	*C*
Jonathan Creek	*17310*	*6*	*2*	*C*
Stillwater Creek	*17350*	*12*	*3*	*C*
Little Stillwater Creek	*17360*	*6*	*1*	*C*
Sandy Creek	*17450*	*22*	*10*	*C*

Waterbody Name	*River Code*	*# of Samples*	*# of Sites*	*B or C*
Stillfork Sandy Creek	*17470*	*2*	*1*	*C*
Kokosing River	*17650*	*21*	*6*	*C*
Jelloway Creek	*17654*	*7*	*2*	*C*
North Branch Kokosing River	*17674*	*8*	*2*	*C*
Leatherwood Creek	*17840*	*7*	*2*	*C*
Salt Creek	*17940*	*4*	*1*	*C*
Wakatamika Creek	*17960*	*9*	*3*	*C*
Little Wakatamika Creek	*17961*	*2*	*1*	*C*
TOTAL 17 BASIN		*189*	*54*	*C*
Wabash River Basin (22)				
Wabash River	*22001*	*6*	*2*	*C*
TOTAL 21 BASIN		*6*	*2*	*C*
ODNR Sampling				
Shreve Lake		*4*	*1*	*C*
East Branch Res.		*5*	*2*	*C*
Deer Creek Res.		*7*	*1*	*C*
Mogador Res.		*4*	*1*	*C*
TOTAL ODNR SAMPLES		*20*	*5*	*C*
GRAND TOTAL		*523*	*153*	

Table 3-2. Waterbodies for fish tissue consumption and baseline program sampling, 1997 where B = baseline monitoring program, C = consumption monitoring program.

Waterbody Name	*River Code*	*Estimated # of Samples*	*Estimated # of Sites*	*B or C*
Hocking River Basin (01)				
Hocking River	*01001*	*18*	*6*	*C*
Federal Creek	*01100*	*12*	*4*	*C*
Sunday Creek	*01200*	*12*	*4*	*C*
Monday Creek	*01300*	*12*	*4*	*C*
TOTAL 01 BASIN		*54*	*18*	
Scioto River Basin (02)				
Walnut Creek	*02078*	*9*	*3*	*C*
Alum Creek	*02110*	*6*	*2*	*C*
Little Darby Creek	*02210*	*15*	*5*	*C*
Lower Scioto River	*02001*	*60*	*20*	*C*
TOTAL 02 BASIN		*90*	*30*	*C*
Grand River Basin (03)				
Grand River	*03001*	*66*	*22*	*C*
TOTAL 03 BASIN		*66*	*22*	
Maumee River Basin (04)				
Lower Blachard River	*04160*	*6*	*2*	*C*
Blue Creek	*04120*	*12*	*4*	*C*
Eagle Creek	*04185*	*12*	*4*	*C*
Tiffin River	*04600*	*18*	*6*	*C*
TOTAL 04 BASIN		*48*	*16*	
Sandusky River Basin (05)				

Waterbody Name	*River Code*	*Estimated # of Samples*	*Estimated # of Sites*	*B or C*
Muddy Creek	*05219*	*18*	*6*	*C*
TOTAL 05 BASIN		*18*	*6*	*C*
Southeast Ohio River Tribs (06)				
McMahon Creek	*06500*	*6*	*2*	*C*
Duck Creek	*06300*	*6*	*2*	*C*
TOTAL 06 BASIN		*12*	*4*	
Little Beaver Creek Basin(08)				
Little Beaver Creek	*08001*	*30*	*10*	*C*
TOTAL 08 BASIN		*30*	*10*	
Central Ohio River Tribs (09)				
Indian Guyan Creek	*09100*	*3*	*1*	*C*
Shade River	*09600*	*9*	*3*	*C*
Raccoon Creek	*09510*	*12*	*4*	*C*
Little Raccoon Creek	*09500*	*15*	*5*	*C*
TOTAL 09 BASIN		*39*	*13*	*C*
Huron River Basin (12)				
Huron River	*12001*	*9*	*3*	*C*
East Branch Huron River	*12100*	*6*	*2*	*C*
West Branch Huron River	*12200*	*6*	*2*	*C*
TOTAL 12 BASIN		*21*	*7*	*C*
Rocky River Basin (13)				
Rocky River	*13001*	*12*	*4*	*C*
TOTAL 13 BASIN		*12*	*4*	
Portage River Basin (16)				
Toussaint Creek	*16215*	*15*	*5*	*C*

Waterbody Name	*River Code*	*Estimated # of Samples*	*Estimated # of Sites*	*B or C*
TOTAL 16 BASIN		*15*	*5*	
Muskingum River (17)				
Licking River	*17200*	*36*	*12*	*C*
Conotton Creek	*17100*	*12*	*4*	*C*
Nimishillen Creek	*17460*	*12*	*4*	*C*
Black Fork Mohican River	*17730*	*12*	*4*	*C*
Clear Fork Mohican River	*17750*	*6*	*2*	*C*
Rocky Fork Mohican River	*17733*	*18*	*6*	*C*
Meigs Creek	*17920*	*6*	*2*	*C*
Sandy Creek	*17450*	*18*	*6*	*C*
Wakatamika Creek	*17960*	*9*	*3*	*C*
TOTAL 17 BASIN		*129*	*43*	*C*
Mahoning River Basin (18)				
Pymatuning Creek	*18550*	*18*	*6*	*C*
TOTAL 18 BASIN		*18*	*6*	
Vermilion River Basin (21)				
Vermilion River	*21001*	*12*	*4*	*C*
TOTAL 21 BASIN		*12*	*4*	*C*
ODNR Sampling				
Stonelick Lake		*12*	*4*	*C*
West Branch		*18*	*6*	*C*
Misc. Ponds, Lakes, Res.		*42*	*14*	*C*
TOTAL ODNR SAMPLES		*72*	*24*	*C*
GRAND TOTAL		*636*	*212*	

Waterbody Name	*River Code*	*Estimated # of Samples*	*Estimated # of Sites*	*B or C*
Ohio River				
Ohio River (ODNR)	***90-001***	***99***	***33***	***C***
Lake Erie				
Lake Erie (ODNR)	***24-001***	***72***	***24***	***C***

Fish Tissue Sample Collection and Analysis

Sample Collection

Fish tissue samples are generally collected after fish finish spawning activities. Fish that have spawned typically shed some of their body burden of organic chemicals. In our comparisons, we want to be sure we are using fish that are in similar condition. Waiting for the completion of spawning activities assures this factor is met.

Fish tissue samples are collected with a variety of passive capture gear including trap nets, gill nets, and hoop nets. Active capture techniques include electrofishing, seining, trawling, and angling. Fish are weighed and measured to ensure proper sizing, sacrificed, and processed. Fillets and/or whole body fish are then frozen using dry ice and transported into the lab at the end of the week. Fish samples are kept frozen until ready for analysis. For further details on the preparation of fish tissue samples, please see Ohio EPA Technical Bulletin MAS/1994-11-1, Fish Tissue Guidance Manual.

Laboratory Analysis

Metals

Metals analysis of fish tissue consists of preparation, digestion, and analysis. Preparation of the tissue involves mincing of the fish followed by mixing. The sample is then treated with hot acid and peroxide. One of two techniques is then used to analyze the sample, Inductively Coupled Plasma (ICP) emission spectrometry or Graphite Furnace Atomic Absorption spectrophotometry.

Mercury is analyzed by a different technique. The sample is minced and mixed as before and then oxidized by persulfate/permanganate digestion, reduced by tin

chloride, and subjected to Cold Vapor analysis

PCBs/Pesticides

Preparation of a fish tissue sample for PCB/Pesticide analysis involves several steps. First, the fish is ground with dry ice in a blender or meat grinder and mixed to produce a homogeneous sample. The tissue is then solvent extracted, a lipid determination made, and then processed through a gel permeation column. Sample analysis occurs using a properly calibrated Gas Chormatograph (GC).

Section 4

River Basin Information

The summaries of fish tissue data in the following section represents the most recent information in our database. Historical information has been excluded from the summary.

Hocking River Basin (01)

Description

The Hocking River drains approximately 1197 mi ^{2} of south central Ohio finally emptying into the Ohio River near the town of Coolville, Ohio. The Hocking River basin is comprised of 3 different ecoregions including Eastern Corn Belt Plains in the upper portion of the basin (5%), Erie-Ontario Lake Plain surrounding Lancaster, Ohio (20%), and Western Allegheny Plateau for the rest of the basin (75%). Clear Creek, Rush Creek, Sunday Creek, Monday Creek, and Federal Creek are the major tributaries of the Hocking River.

Results Summary

Hocking River (01001)

Tissue analysis is currently ongoing; no results are available.

Clear Creek (01400)

Tissue analysis is currently ongoing; no results are available.

Advisories

No human health related fish consumption advisories have been issued for the Hocking River or its tributaries.

Scioto River Basin (02)

Description

The Scioto River drains approximately 6517 mi ^{2} of south central and central Ohio. The basin is comprised of the following ecoregions: Eastern Corn

Belt Plains (74%), Western Allegheny Plateau (22%), Erie-Ontario Lake Plain (2%) and Interior Plateau (2%). Some of the major tributaries draining into the Scioto River include Big Darby Creek, Salt Creek, Paint Creek, Deer Creek, the Olentangy River, and Big Walnut Creek.

Results Summary

Scioto River (02001)

Fish tissue samples were collected from the upper half of the Scioto River in 1993. Unfortunately, a freezer failure thawed and ruined many of the samples. Samples used for analysis were obtained from RM 178.0 to RM 158.1. No organic pesticides or PCBs were detected in any of the samples except for 2 detections of dieldrin at low levels. Mercury was detected in every sample along with infrequent hits on cadmium and lead. Mercury concentrations ranged from slightly elevated (87.1 μg/kg) to moderately elevated (246 μg/kg).

Big Darby Creek (02200)

Fish tissue samples were collected from Big Darby Creek in 1993. At RM 53.2, whole carp, smallmouth bass fillets, and rock bass fillets were gathered for analysis. Whole carp contained slightly elevated concentrations of mercury (65.3 μg/kg) in addition to lead (132 μg/kg) and cadmium (57.1 μg/kg). DDT isomers and dieldrin were also detected at 65.46 μg/kg and 63.78 μg/kg respectively. Heptachlor epoxide was also found in low concentrations. Smallmouth bass fillets contained moderately elevated concentrations of mercury and insignificant levels of DDT isomers and dieldrin. Slightly elevated concentrations of mercury (188 μg/kg) were also noted.

Both rock bass and smallmouth bass fillets were collected at RM 49.5. Results of the analysis show much the same concentrations of contaminants as those found at RM 53.2. Both species contained slightly elevated concentrations of mercury (rock bass = 171 μg/kg and smallmouth bass = 177 μg/kg) and insignificant levels of DDT isomers and dieldrin.

A single fish tissue sample was taken at RM 38.9. Rock bass fillets contained 272 μg/kg mercury (moderately elevated). No other contaminants were detected in this sample.

Whole carp and rock bass fillets were collected at RM 26.8. The

sample of whole carp contained non-elevated concentrations of both mercury (39.3 μg/kg) and PCBs (38.61 μg/kg). The concentration of lead was 209 μg/kg, and that of cadmium, 42.8 μg/kg. Dieldrin was found in the sample at 50.94 μg/kg. DDT isomers were also discovered at insignificant levels. Rock bass fillets contained slightly elevated levels of mercury (188 μg/kg), cadmium (10.1 μg/kg), and lead at 132 μg/kg. Dieldrin was also detected at insignificant levels.

At RM 13.3, whole body golden redhorse and channel catfish fillets were examined. Whole golden redhorse were found to contain slightly elevated concentrations of mercury (65.8 μg/kg), non-elevated concentrations of PCBs (29.28 μg/kg), and insignificant amounts of DDT isomers, dieldrin, and heptachlor epoxide. Cadmium was also detected at 28.1 μg/kg. Channel catfish fillets contained slightly elevated concentrations of mercury (71.9 μg/kg) and non-elevated amounts of PCBs. DDT isomers and dieldrin were also detected at insignificant levels.

Olentangy River (02400)

Fish tissue samples were obtained in the Olentangy River in 1994. Samples from the 3 sites on the upper Olentangy River (RM 89.3 - RM 54.8) included whole white suckers and a fillet sample of a sport fish. Mercury concentrations in this upper portion were in the slightly elevated range (54.5 μg/kg to 172 μg/kg). Lead and cadmium were also found. PCBs were only discovered in whole white suckers at non-elevated to slightly elevated concentrations.

Sport fish fillet samples were also obtained from the lower Olentangy River in Columbus, Ohio (RM 6.0 - RM 0.0). Mercury was detected in every sample at various concentrations within the reach. Mercury levels ranged from non-elevated (43.0 μg/kg) to moderately elevated (383 μg/kg). PCB concentrations were noticeably higher in this downstream portion ranging from not detected to 802.07 μg/kg (moderately elevated). Lead concentrations were almost all below 100 μg/kg except a sauger found to have 6,154.0 μg/kg lead. DDT isomers, dieldrin, and chlordane isomers were also detected in the samples.

WHETSTONE CREEK (02450)

Fish tissue samples were obtained from Whetstone Creek in 1994 at three sites (RM 25.5, RM 12.9, and RM 9.2). Whole common carp

and rock bass fillets were collected and analyzed from RM 25.5. Neither species showed contamination from PCBs or pesticides although, each contained metals. Whole carp contained 56.8 µg/kg of cadmium, 91.7 µg/kg lead, and 73.8 µg/kg of mercury (slightly elevated). Rock bass fillets contained moderately elevated mercury at a concentration of 271 µg/kg.

Whole white sucker and rock bass fillets were collected from RM 12.9. Whole white sucker contained the metals cadmium (33.2 mg/kg), lead (125 mg/kg), and slightly elevated levels of mercury (78.7 mg/kg) as well as slightly elevated concentrations of PCBs (146 mg/kg) and low levels of DDT isomers and chlordane isomers. Rock bass fillets collected at this locale showed only slightly elevated contamination from mercury (155 mg/kg).

At RM 9.2, whole white sucker contained similar concentrations of metals as compared with whole white suckers collected at RM 12.9. PCBs were found to be non-elevated at 20 mg/kg and dieldrin was found at very low concentrations. Smallmouth bass fillets were found to contain only slightly elevated mercury at 107 mg/kg.

Salt Creek (02600)

Sport fish taken from Salt Creek in 1995 were contaminated with mercury. Fillet samples were obtained from RM 32.3 and RM 26.0. Mercury concentrations ranged from 122 µg/kg to 278 µg/kg (slightly to moderately elevated). Largemouth bass taken from RM 32.3 had 95 µg/kg PCBs (slightly elevated). Lead was also detected in the fillet samples ranging from not detected to 308 µg/kg.

SALT LICK CREEK (02610)

Golden redhorse and spotted bass fillets were collected from RM 3.9 of Salt Lick Creek. Golden redhorse fillets contained 165 µg/kg mercury (slightly elevated). Spotted bass contained 224 µg/kg of mercury (moderately elevated) and 72.5 µg/kg lead. PCBs and pesticides were undetected in both samples.

MIDDLE FORK SALT CREEK (02611)

Sport fish tissue samples were collected from sauger, freshwater drum, and spotted bass near the mouth (RM 0.3). PCBs and pesticides were not detected in any of the samples. Mercury

concentrations ranged from 106 µg/kg to 181 µg/kg (all slightly elevated). Lead was also detected at low concentrations.

Mill Creek (02109)

Fillet samples of sport fish (including carp, rock bass, largemouth bass, and suckers) were collected from Mill Creek in 1994. Mercury was detected in all samples ranging in concentration from 51.4 µg/kg to 296 µg/kg (slightly to moderately elevated). Insignificant amounts of cadmium and lead were also detected in a few samples. PCBs were not detected in any of the samples, however, chlordane isomers were found in all of the carp fillets. Concentrations ranged from 65.16 µg/kg to 430 µg/kg. DDT isomers, dieldrin, heptachlor epoxide, and beta-BHC were also detected solely in carp fillets, but at low levels.

Scioto Brush Creek (02700)

Sport fish tissue fillet samples were obtained from Scioto Brush Creek in 1995. PCBs and pesticides were not detected in any of the samples. Mercury was detected in all samples ranging from 80.0 µg/kg to 176 µg/kg (all slightly elevated). Spotted bass contained the highest concentrations of mercury within the range specified above. Lead and cadmium were also detected in several samples, but at insignificant concentrations.

Scippo Creek (02069)

Fish fillet samples obtained in 1994 showed contamination from PCBs and mercury. PCB contamination continues to be a problem and ranged from not detected in rock bass (RM 5.4) to 2104.33 (extremely elevated) µg/kg at RM 4.25. Mercury concentrations ranged from 66.1 µg/kg to 326 µg/kg (slightly to moderately elevated). Lead was also detected consistently in most samples.

Advisories

Waterbody	*Location*	*Advisory*		*Fish Species*	*Group*	*Pollutant*
		Fish	*Contact*			
Paint Creek	*All Waters*	■		*Smallmouth Bass*	*3*	*Mercury*
Little Scioto River	*SR 739 near Marion to Holland Rd.*	■	■	*All species*	*5*	*PAHs, metals*
	Green Camp to Warrensburg	■		*Rock Bass*	*3*	*Mercury*

Scioto River

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
	Greenlawn dam, Columbus to the Ohio River	■		Carp Catfish	5	PCBs, chlordane
Salt Creek	Laurelville to Queer Creek Confluence	■		Smallmouth Bass	3	Mercury
Scippo Creek	All Waters	■		All species	3	PCBs

Grand River Basin (03)

Description

The Grand River basin is situated in the northeastern corner of Ohio. It drains approximately 705 mi ^{2} directly to Lake Erie. The mouth is located at the town of Fairport Harbor, Ohio. The Grand River basin is located entirely within the Erie-Ontario Lake Plain ecoregion.

Results Summary

Most fish fillet composite samples collected in the Grand River did not contain elevated concentrations of PCBs except for fish in the Lake Erie affected area of the river. Rock bass, largemouth bass, and smallmouth bass rarely contained any detectable PCBs. In a few cases, PCBs were detected at slightly elevated concentrations in smallmouth and rock bass. DDT isomers were not found in any significant concentrations in fish flesh. Concentrations ranged from not detected to 86.4 mg/kg.

Mercury was found in nearly all of the fish tissue samples collected in the Grand River. The highest mercury value (410 mg/kg) was found in a fillet sample of walleye at RM 6.6, whereas several other fillet samples did not show detectable concentrations of mercury. These concentrations are not elevated to moderately elevated.

Advisories

No human health related fish consumption advisories have been issued for the Grand River or its tributaries.

Maumee River Basin (04)

Description

The Maumee River basin is located in the northwestern corner of Ohio. The Maumee River is formed in Indiana at the confluence of the St. Josephs River and the St. Marys River at Ft. Wayne. It flows east and north until it empties into Lake Erie at Toledo, Ohio. The Maumee River basin drains approximately 6608 mi^2 of the Huron-Erie Lake Plain ecoregion and the Eastern Corn Belt Plains ecoregion.

Results Summary

Maumee River (04001)

Fish tissue fillet samples were collected along the length of the Maumee River (the Ohio portion) in 1995. A variety of fish species were examined for body burdens of chemicals. Cadmium was detected in insignificant quantities in only 2 samples, both at the uppermost sampling station (RM 99.0). Lead was detected sporadically in various species throughout the river. The concentrations of lead ranged from not detected to 207 µg/kg with no real spacial pattern. Mercury was detected in every sample. Concentrations were fairly uniform throughout the river with small spikes here and there. Mercury values ranged from 50.3 µg/kg to 284 µg/kg (slightly to moderately elevated).

PCBs were detected in most of the samples. Concentrations of PCBs tended to increase in a downstream direction, although individual fish and several sites did not readily show this trend. Sites upstream of RM 30.0 had PCB ranges from not detected to 228 µg/kg (not elevated to slightly elevated). From RM 30.0, downstream, PCB values ranged from not detected to 2500 µg/kg (not elevated to extremely elevated). Additionally, insignificant concentrations of 3 pesticides were detected intermittently along the length of the river. Dieldrin, DDT isomers, and chlordane were the 3 pesticides detected.

Auglaize River (04100)

A variety of sport fish tissue fillet samples were collected from the Auglaize River beginning at RM 67.5 and ending near the mouth at RM 1.0. Mercury concentrations ranged from 23.9 µg/kg to 210 µg/kg (not elevated to slightly elevated). Other metals detected

included cadmium and lead, both of which were detected at insignificant concentrations. PCBs were detected ranging from 8 µg/kg to 175.43 µg/kg (not elevated to slightly elevated). Other pesticides detected in insignificant concentrations in the samples included DDT isomers, chlordane isomers, heptachlor epoxide, aldrin, lindane, pentachloroanisole, hexachlorobenzene, and DCPA.

BLANCHARD RIVER (04160)

Fish tissue fillet samples were obtained from the upper half of the Blanchard River during 1995 between RM 87.7 and RM 54.8. PCBs and pesticides were not detected in any sample. Mercury was detected in every sample and ranged from 52.6 µg/kg to 306 µg/kg (slightly to moderately elevated). Lead was also detected in about half of the samples and had a maximum concentration of 245 µg/kg.

OTTAWA RIVER (LIMA; 04200)

Fish tissue fillet samples were obtained from the Ottawa River in 1993 extending from RM 46.1 to RM 28.9. A variety of contaminants were detected in the fish flesh. Mercury ranged from 43.6 µg/kg (not elevated) to 323 µg/kg (moderately elevated). Lead concentrations ranged from undetected to 599 µg/kg. Cadmium was detected in only one sample at 67.7 µg/kg. PCBs ranged from 38.57 µg/kg to 138.40 µg/kg (not elevated to slightly elevated) whereas 3 pesticides (DDT isomers, α-BHC, and dieldrin) were detected in insignificant quantities in several of the samples.

St. Marys River (04500)

Sport fish tissue fillet samples were collected from the Ohio portion of the St. Marys River from RM 95.1 to RM 43.5 (anything downstream of RM 43 is in Indiana) in 1995. Samples indicated that contamination was present from mercury (68.8 µg/kg - 337 µg/kg, slightly elevated to moderately elevated), PCBs (not detected - 110 µg/kg, not elevated to slightly elevated), and lead (not detected - 183 µg/kg). Very low levels of dieldrin and DDT isomers were also detected.

St. Josephs River (04400)

The St. Joseph River was sampled to obtain sport fish for tissue analysis in 1995 between RM 84.1 and RM 50.4. Several different contaminants were detected including mercury, lead, PCBs and

several pesticides. Mercury concentrations ranged from 139 µg/kg to 372 µg/kg (slightly to moderately elevated). Lead was detected in a single sample at a concentration of 67.7 µg/kg. PCBs ranged from not detected to 850 µg/kg (not elevated to moderately elevated). Three other pesticides (DDT isomers, dieldrin, and methoxychlor) were detected in tissue, but not in significant amounts.

WEST BRANCH ST. JOSEPH RIVER (04414)

Sport fish fillets were collected for tissue analysis at two points (RM 4.0 and RM 10.5) along the West Branch St. Joseph River. Mercury concentrations were found to be slightly to moderately elevated ranging from 96.9 µg/kg to 467 µg/kg. PCB concentrations were not elevated to slightly elevated and ranged from not detected to 230 µg/kg. Lead was also detected in one sample at 110 µg/kg.

Ottawa River (Toledo; 04300)

Fish tissue samples were obtained from the Ottawa River in 1993 from three locations. At RM 11.1, whole body carp x goldfish hybrids were collected and found to contain numerous pollutants. These included cadmium (151 µg/kg), lead (1,770 µg/kg), slightly elevated concentrations of mercury (71.1 µg/kg), and selenium (63.2 µg/kg). Organic pollutants found in these same fish were moderately elevated concentrations of PCBs (575.21 µg/kg), DDT isomers (531.97 µg/kg), chlordane isomers (87 µg/kg), endosulfan I (33.37 µg/kg), endosulfan II (18.77 µg/kg), endosulfan sulfate (38.83 µg/kg) and low concentrations of heptachlor epoxide.

Whole body carp were collected at RM 6.4. Metals found in the tissue included cadmium (18.7 µg/kg), lead (538 µg/kg), selenium (227 µg/kg), and non-elevated concentrations of mercury (22.7 µg/kg). Extremely elevated concentrations of PCBs were detected in this sample (29,397.79 µg/kg) along with DDT isomers (1,131.35 µg/kg), chlordane isomers (58.3 µg/kg), endosulfan I (29.96 µg/kg), endosulfan II (12.10 µg/kg), endosulfan sulfate (26.25 µg/kg), dieldrin (97 µg/kg), and very low concentrations of heptachlor epoxide.

The third and final site sampled on the Ottawa River was RM 4.7. Carp x goldfish hybrids were again collected. Cadmium (44.4 µg/kg) and lead (542 µg/kg) were detected. PCBs were detected at extremely elevated concentrations (59,378.43 µg/kg), the highest concentration ever found in Ohio. Pesticides detected in this sample

included DDT isomers (339.44 μg/kg), dieldrin (151.24 μg/kg), chlordane isomers (174.67 μg/kg) and heptachlor (418.79 μg/kg).

TENMILE CREEK (04320)

Fish tissue samples were collected in 1993 at RM 5.7 of Tenmile Creek. Whole carp were taken for one sample, and northern pike fillets were collected for the second sample. Whole carp contained a variety of contaminants including, cadmium (85.6 μg/kg), lead (184 μg/kg), non-elevated concentrations of mercury (45.4 μg/kg), and selenium (362 μg/kg). Additional contaminants include moderately elevated concentrations of PCBs (563.01 μg/kg), DDT isomers (471.14 μg/kg), dieldrin (112.16 μg/kg), chlordane isomers (70.93 μg/kg), and very low concentrations of heptachlor epoxide and endosulfan sulfate.

Northern pike fillets contained lead (12.2 μg/kg), moderately elevated concentrations of mercury (228 μg/kg), and selenium (399 μg/kg). The only pesticides detected in pike fillets included DDT isomers (46.22 μg/kg) and dieldrin (8.74 μg/kg). PCBs were not detected in northern pike fillets.

NORTH BRANCH TENMILE CREEK (04321)

A single fish tissue sample was obtained from the mouth of North Branch Tenmile Creek (RM 0.1) during 1993. Whole creek chubs were collected and found to contain cadmium (32.1 μg/kg), lead (64.2 μg/kg),slightly elevated concentrations of mercury (62.4 μg/kg), and selenium (450 μg/kg). In addition, PCBs were found to be slightly elevated at 91.19 μg/kg. Other pesticides found included DDT isomers (70.44 μg/kg), chlordane isomers (10.14 μg/kg), and dieldrin (187.62 μg/kg).

Swan Creek (04003)

Fish tissue samples were obtained from Swan Creek in 1993. Four different locations were sampled. Largemouth bass fillets were collected at RM 0.5. Mercury concentrations (185 μg/kg) were slightly elevated. Lead (365 μg/kg), and selenium (381 μg/kg) were detected in the fillets along with slightly elevated concentrations of PCBs (225.5 μg/kg), and DDT isomers (27.64 μg/kg). Very low concentrations of dieldrin, aldrin, and chlordane isomers were also found.

Whole common carp collected at RM 2.6 contained cadmium (159 μg/kg), lead (766 μg/kg), non-elevated concentrations of mercury (25.7 μg/kg), and selenium (111 μg/kg) in addition to extremely elevated concentrations of PCBs (2715.82 μg/kg), chlordane isomers (244.78 μg/kg), DDT isomers (324.84 μg/kg), and dieldrin (79.39 μg/kg). Low levels of endosulfan sulfate and heptachlor epoxide were also detected.

Similar concentrations of metals and organic chemicals were detected in whole carp collected at RM 4.3. Cadmium (107 μg/kg), lead (767 μg/kg), non-elevated concentrations of mercury (35.7 μg/kg), and selenium (215 μg/kg) were all found in the sample. Pesticide concentrations were also noticeable. PCBs were found to be 1948.67 μg/kg in the sample. DDT isomers and chlordane isomers were detected at 224.02 μg/kg and 152.54 μg/kg respectively along with dieldrin (56.40 μg/kg). Aldrin and endosulfan sulfate were also detected at low levels.

Whole carp were also obtained for fish tissue analysis at RM 21.6. Similar metals results were obtained in this sample compared with those downstream. Cadmium (111 μg/kg), lead (475 μg/kg), non-elevated levels of mercury (65.1 μg/kg), and selenium (162 μg/kg) were all discovered in this sample. In addition, PCBs (1295.89 μg/kg) were detected at extremely elevated concentrations. DDT isomers (354.27 μg/kg), chlordane isomers (96.64 μg/kg), and dieldrin (208.44 μg/kg) were all found at significant concentrations. Aldrin, and heptachlor epoxide were both found at low concentrations.

BLUE CREEK (04006)

Whole rock bass were collected from RM 0.7 in Blue Creek during 1993. Non-elevated concentrations of mercury were detected (42.6 μg/kg) as well as selenium (273 μg/kg). PCB concentrations were not elevated as well (43.19 μg/kg). Both DDT isomers and chlordane isomers were detected at concentrations of 109.49 μg/kg and 26.07 μg/kg respectively. Dieldrin concentrations exceeded that of chlordane isomers at 33.30 μg/kg.

Duck Creek (04002)

Duck Creek was sampled in one location (RM 1.4) for fish tissue. Whole carp were collected and analyzed. Arsenic (432 μg/kg), lead (202 μg/kg) and selenium (1600 μg/kg) were all detected.

Additionally, slightly elevated concentrations of PCBs were detected (259.28 μg/kg) as well as DDT isomers (260.32 μg/kg). Aldrin, dieldrin, and chlordane isomers were detected at low levels in the sample.

Silver Creek (04069)

A single location (RM 2.0) was evaluated for fish tissue on Silver Creek using whole carp. Mercury was detected at non-elevated concentrations (27.6 μg/kg). Lead (1230 μg/kg), cadmium (62.8 μg/kg), and selenium (159 μg/kg) were also detected. PCBs were detected at highly elevated concentrations (987.23 μg/kg). DDT isomers and chlordane isomers were detected at 371.68 μg/kg and 164.73 μg/kg respectively. Aldrin, dieldrin, and heptachlor epoxide were detected at low concentrations in the sample.

Shantee Creek (04068)

Whole carp were collected from Shantee Creek during 1993 for fish tissue analysis. Several metals were detected in the tissue including cadmium (30.4 μg/kg), lead (279 μg/kg), selenium (436 μg/kg), and non- elevated concentrations of mercury (14.0 μg/kg). PCBs were detected at moderately elevated concentrations (489.92 μg/kg). Chlordane isomers and DDT isomers were detected at the following concentrations: 132.47 μg/kg and 186.04 μg/kg respectively. Low levels of aldrin and dieldrin were also detected.

Grassy Creek (04012)

A single fish tissue sample was obtained in Grassy Creek during 1993 at RM 2.9. Whole carp contained cadmium (14.3 μg/kg), chromium (4140 μg/kg), lead (176 μg/kg), mercury (95.2 μg/kg), and selenium (407 μg/kg) were all detected in whole body white suckers. PCBs were also slightly elevated in the sample at a concentration of 66.84 μg/kg. Both chlordane isomers and DDT isomers were detected at 15.36 μg/kg and 43.15 μg/kg respectively. Dieldrin was also detected at low levels (4.49 μg/kg).

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Maumee River	All Waters			White Crappie	1	None
		■		Common Carp	3	PCBs
		■		Smallmouth Bass	3	Mercury
	Mouth to Waterville	■		Largemouth Bass	2	PCBs
		■		Freshwater Drum		
		■		Channel Catfish	5	
	Waterville to Indiana Border			Largemouth Bass Freshwater Drum	1	None
		■		Channel Catfish	2	PCBs
Auglaize River	US 33 Wapakoneta to Maumee River, Defiance	■		Smallmouth Bass	1	None
				Channel Catfish, Common Carp	2	PCBs
Ottawa River	I-475 N of Wildwood Preserve, Toledo to Maumee Bay	■	■	All species	5	PCBs
St. Joseph's River	All Waters	■		Rock Bass	1	None
				Channel Catfish	3	PCBs
West Branch St. Joseph's River	All Waters	■		All Species	2	PCBs
St. Mary's River	All Waters	■		Saugeye	3	Mercury

Sandusky River Basin (05)

Description

The Sandusky River basin is located in the north central portion of Ohio. It drains approximately 1420 mi ^{2} and empties into Sandusky Bay, Lake Erie. About 33% of the Sandusky River basin lies in the Huron-Erie Lake Plain ecoregion whereas the balance belongs to the Eastern Corn Belt Plains ecoregion (a very small portion [~1%] of the drainage is in the Erie-Ontario Lake Plain near the town of Crestline). Major tributaries of the Sandusky River include Tymochtee Creek, Broken Sword Creek, and Honey Creek.

Results Summary

Sandusky River (05001)

Fish fillet samples were obtained from the Sandusky River during 1994 along the entire length of the river (RM 118.0 to RM 4.0) exclusive of Sandusky Bay. PCBs were detected in various concentrations throughout the length of the river, but only in bottom feeding fishes (common carp and channel catfish). No PCBs were detected in largemouth or smallmouth bass. Concentrations of PCBs carp and channel catfish ranged from not detected to 630.80 µg/kg (not elevated to moderately elevated). Pesticides were also detected in very limited (and insignificant) quantities and included DDT isomers, chlordane, dieldrin, and beta BHC. Mercury was detected in all samples and ranged from slightly elevated (59.9 µg/kg) to moderately elevated (472 µg/kg). Lead and cadmium were also found in insignificant quantities in a few samples.

Muddy Creek (05219)

Two fish fillet samples were taken from Muddy Creek in 1994 at RM 2.0. Carp fillets were found to contain slightly elevated concentrations of PCBs (233.42 µg/kg) along with DDT isomers, lead, and non-elevated concentrations of mercury (39.0 µg/kg). Brown bullhead fillets also contained slightly elevated concentrations of PCBs (79.61 µg/kg) and mercury (111 µg/kg). Lead was also detected in the sample at low levels.

Advisories

The following human health related fish consumption advisories were issued In June 1997 for the Sandusky River.

Waterbody	***Location***	***Advisory***		***Fish Species***	***Group***	***Pollutant***
		Fish	***Contact***			
Sandusky River	***All Waters***	■		***Smallmouth Bass***	***1***	***None***
				Common Carp	***2***	***PCBs, *Mercury***
				Channel Catfish Largemouth Bass	***3***	

Ohio River Tributaries (06, 09, 10)

Description

There are numerous small to mid size streams that flow directly into the Ohio River that are detailed here. The largest creek in this group is Raccoon Creek (09500) at 681 mi ^{2}. Symmes Creek (09700, 357 mi ^{2}), Ohio Brush Creek (10200, 435 mi ^{2}), and the Little Muskingum River (06400, 315 mi^2) are the other three largest streams. Other streams in this group include the following:

River Name	Basin Number	Drainage Area (mi^2)
Yellow Creek	***'06900***	***239***
Cross Creek	***'06200***	***128***
Short Creek	***'06600***	***148***
Wheeling Creek	***'06800***	***108***
McMahon Creek	***'06500***	***91***
Captina Creek	***'06100***	***180***
Sunfish Creek	***'06700***	***114***
Duck Creek	***'06300***	***287***
Shade River	***'09600***	***221***
Leading Creek	***'09200***	***150***
Pine Creek	***'09400***	***184***
Little Scioto River	***'09300***	***233***
Eagle Creek	***10100***	***~200***
Whiteoak Creek	***10400***	***235***

The grouping of these streams into larger "basins" uses the following logic. Small streams emptying into the central portion of the Ohio River north of the Muskingum River mouth, are given the basin number 06. Small streams discharging to the Ohio River in the southeastern portion of Ohio east of the Scioto River mouth and southwest of the Muskingum River mouth, are numbered 09, and small streams draining to the Ohio River in the southeastern portion of Ohio west of the Scioto River mouth to the mouth of the Little Miami River, are numbered 10 **.**

Results Summary

Central Ohio River Tributaries

LITTLE MUSKINGUM RIVER (06400)

Fillet samples were obtained from sport fish in the Little Muskingum River during 1995. Four sites were sampled along the river (RM 37.5 to RM 0.5). PCBs were detected sporadically at RM 6.9 and RM 37.5 at slightly elevated concentrations (50 µg/kg to 117 µg/kg). One white bass sample taken from the mouth contained 350 µg/kg PCBs (moderately elevated). Mercury was detected in each sample at concentrations which ranged from 99.4 µg/kg to 280 µg/kg. Concentrations varied along the length of the river. Cadmium and lead were found in just a few samples at low levels.

CAPTINA CREEK (06100)

Fish tissue fillet samples were collected in Captina Creek in 1995. Three locales were sampled (RM 22.1, RM 7.7, and RM 0.5). Fish fillets from the two upstream sampling areas were free of detectable concentrations of PCBs and pesticides. Fillets taken from the mouth site contained non-elevated to slightly elevated concentrations of PCBs. Mercury was detected at all locations in all samples and ranged from non-elevated (32.7 µg/kg) in spotted bass to moderately elevated (230 µg/kg) in smallmouth bass.

SUNFISH CREEK (06700)

Sunfish Creek was sampled for fish tissue in two locations (RM 15.1 and RM 0.2) during 1995. Fillet samples collected at the upper site showed no contamination from PCBs or pesticides. However, mercury was detected in every sample in the moderately elevated range (201 µg/kg to 232 µg/kg). All fillet samples from the mouth site, except one, were free of contamination from PCBs and pesticides. The sample of channel catfish contained moderately elevated concentrations of PCBs (680 µg/kg) and insignificant levels of DDT isomers and chlordane isomers. Mercury was detected in all samples at about half of the upstream concentrations (36.6 µg/kg to 114 µg/kg).

DUCK CREEK (06300)

Duck Creek was sampled at RM 1.0 during 1995. Flathead catfish fillets

contained slightly elevated concentrations of mercury (104 µg/kg) and PCBs (270 µg/kg). DDT isomers were detected at 323 µg/kg. Channel catfish fillets contained highly elevated concentrations of PCBs (1120 µg/kg). DDT isomers were also detected at 780 µg/kg along with non-elevated levels of hexachlorobenzene (16 µg/kg) and chlordane isomers (63 µg/kg). Similar chemicals were found in sauger fillets. PCB concentrations were moderately elevated at 305 µg/kg. DDT isomers were detected at 219 µg/kg along with non-elevated concentrations of hexachlorobenzene. Mercury was found to be slightly elevated at 57.9 µg/kg. Largemouth bass fillets were the least contaminated with organic chemicals. DDT isomers were the only organic detected (131 µg/kg). Mercury was found at 124 µg/kg (slightly elevated).

Southeast Ohio River Tributaries

LITTLE SCIOTO RIVER (09300)

Fish fillet samples were collected from the Little Scioto River in 1995. Mercury was the only contaminant detected in every sample. Mercury values were consistent among sample sites and fish species ranging from 228 µg/kg to 518 µg/kg (all moderately elevated). PCBs were detected in 1 sample of freshwater drum at 240 µg/kg (slightly elevated). Lead was also detected in about half of the samples at insignificant concentrations.

ROCKY FORK LITTLE SCIOTO RIVER (09310)

Rocky Fork Little Scioto River showed results similar to those in the Little Scioto River with mercury being the dominant contaminant at moderately elevated concentrations (297 µg/kg to 322 µg/kg).

PINE CREEK (09400)

Sport fish fillet samples were obtained from 5 sites along Pine Creek during 1995. PCBs were detected in sauger collected from 3 locations (RM 25.9, RM 22.2, and RM 13.4) at slightly elevated concentrations (56 µg/kg to 120 µg/kg). Mercury was detected in every sample at each site. Concentrations ranged from 77.2 µg/kg to 270 µg/kg (slightly to moderately elevated). Lead and cadmium were also detected in several of the samples. Cadmium results were not significantly elevated. Lead values ranged from not detected to 279 µg/kg.

Southwest Ohio River Tributaries

OHIO BRUSH CREEK (10200)

Sport fish fillet samples were collected in Ohio Brush Creek during 1995 from RM 34.15 down to RM 3.7 at 5 different sites. All samples contained lead (70.4 µg/kg to 214 µg/kg) and mercury (45.0 µg/kg to 367 µg/kg). Mercury ranged from non-elevated to moderately elevated. PCBs were found in 2 samples at slightly elevated concentrations (83 µg/kg in carp, and 220 µg/kg in sauger).

EAGLE CREEK (10100)

Fish tissue fillet samples were obtained from 3 locations on Eagle Creek during 1995 (RM 12.91, RM 6.2, and RM 0.5). No PCBs or pesticides were detected in any fillet samples. Lead and mercury were detected in all samples (one sample of spotted bass did not detect lead). Concentrations of mercury were fairly uniform throughout the creek ranging from 69.6 µg/kg to 306 µg/kg. In all but one sample, mercury levels were slightly elevated (69.6 µg/kg to 195 µg/kg). One spotted bass sample from RM 6.2 contained mercury in the moderately elevated range (306 µg/kg). Lead concentrations ranged from not detected to 151 µg/kg.

WEST FORK EAGLE CREEK (10120)

Sport fish tissue samples were collected from one site on West Fork Eagle Creek at RM 3.3 during 1995. As in Eagle Creek, no PCBs or pesticides were detected in fillet samples. Mercury and lead were again the main contaminants. Rock bass fillets contained 79.6 µg/kg lead and 188 µg/kg mercury (slightly elevated). Smallmouth bass fillets included moderately elevated concentrations of mercury (272 µg/kg), but undetectable lead. Finally, spotted bass fillets were found to contain 61.1 µg/kg lead and moderately elevated concentrations of mercury (450 µg/kg).

EAST FORK EAGLE CREEK (10110)

East Fork Eagle Creek was sampled for sport fish fillets at RM 4.3 during 1995. Results from this site were very similar to West Fork Eagle Creek and Eagle Creek. PCBs and pesticides were not detected in any sample. Mercury and lead were detected in all 4 samples. Rock bass fillets contained 85.6 µg/kg lead and moderately elevated concentrations of mercury (280 µg/kg). Smallmouth bass fillets included 82.4 µg/kg lead and 250 µg/kg mercury (moderately elevated). Two fillet samples of spotted bass (smaller and larger sizes) contained lead concentrations ranging from 68.4 µg/kg (smaller) to 132 µg/kg (larger). Mercury concentrations were slightly elevated in fillets from the smaller fish (194 µg/kg) and moderately elevated in the fillets from the larger fish (237 µg/kg)

WHITEOAK CREEK (10400)

Fish tissue fillets were collected from Whiteoak Creek at 4 sites (RM 20.6, RM 10.0, RM 6.6, and RM 0.5) during 1995. Fillet samples from the two upstream sites contained only lead and mercury. Lead concentrations ranged from not detected to 153 µg/kg. Mercury concentrations ranged from 76.1 µg/kg (slightly elevated) to 259 µg/kg (moderately elevated). No PCBs or pesticides were detected in any upstream sample.

Both mercury and lead were detected in approximately the same concentrations as those found upstream. Lead concentrations ranged from not detected to 182 µg/kg. Mercury concentrations ranged from slightly elevated (92.4 µg/kg) to moderately elevated (239 µg/kg). Unlike the upstream site, PCBs were detected at slightly elevated concentrations in sauger (112 µg/kg to 237 µg/kg), freshwater drum (148 µg/kg) and carp (66 µg/kg). Pesticides were not detected.

Advisories

The following human health related fish consumption advisories have been issued for the Little Muskingum River.

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Little Muskingum River	Hill's Covered Bridge to Ohio River	■		Spotted Bass	3	Mercury

Ashtabula River/Conneaut Creek Basin (07)

Description

The Ashtabula River drains approximately 137 mi^2 of the northwest corner of Ohio and northeastern Pennsylvania. The majority of the drainage of the Ashtabula River is within Ohio. It discharges into Lake Erie at the town of Ashtabula. Conneaut Creek has a drainage area of approximately 189 mi^2 in northeast Ohio/northwest Pennsylvania. The majority of the drainage of Conneaut Creek is in Pennsylvania. It discharges into Lake Erie at the town of Conneaut, Ohio. Both waterbodies are within the Erie-Ontario Lake Plain ecoregion.

Results Summary

Ashtabula River (07001)

Fish tissue fillet samples were obtained from the lower Ashtabula River (RM 2.5 to RM 0.2) during 1994. All samples contained PCBs ranging in concentration from slightly elevated (59.64 µg/kg) to highly elevated (1052.95 µg/kg). Fillets taken from RM 2.5 contained only slightly elevated levels of PCBs, whereas downstream sites contained the higher concentrations. Hexachlorobenzene was also present in fish fillets, but only those at RM 1.6 and RM 0.2. Concentrations ranged from 22.14 µg/kg to 76.01 µg/kg (all not elevated). Mercury was also detected in each sample obtained from the lower Ashtabula River. Concentrations ranged from 51.3 µg/kg (slightly elevated) to 247 µg/kg (moderately elevated). Cadmium and lead were also detected in a few samples at low levels.

FIELDS BROOK (07010)

Largemouth bass and carp fillets were obtained from the mouth of Fields Brook in 1994. Bass fillets contained highly elevated concentrations of PCBs (1186.49 µg/kg) and carp fillets contained extremely elevated concentrations of PCBs (3600 µg/kg). Mercury was found in both sets of fillets at slightly elevated concentrations (135 µg/kg to 143 µg/kg). Other contaminants detected in these fillets included hexachlorobenzene, DDT isomers, aldrin, dieldrin, and cadmium, all at low levels.

Advisories

Waterbody	*Location*	*Advisory*		*Fish Species*	*Group*	*Pollutant*
		Fish	*Contact*			
Ashtabula River	*24th Street. bridge, Ashtabula, to Lake Erie*	■		*Rock Bass*	*1*	*None*
				Smallmouth Bass	*2*	*PCBs*
				Largemouth Bass, Walleye	*3*	**Mercury, PCBs*
				Channel Catfish, Common Carp	*4*	*PCBs*
Conneaut Creek	*All Waters*	■		*Smallmouth Bass*	*3*	*Mercury*

Little Beaver Creek Basin (08)

Description

Little Beaver Creek drains approximately 503 mi^2 of the east central portion of Ohio. Little Beaver Creek empties into the Ohio River at East Liverpool, Ohio near the Ohio, Pennsylvania, West Virginia borders. The drainage is nearly evenly divided between the Erie-Ontario Lake Plain and the Western Allegheny Plateau ecoregions.

Results Summary

Little Beaver Creek has not been sampled recently (the most recent data is nearly 10 years old). Please see the advisory below.

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Middle Fork Little Beaver Creek	SR Alt 14 at Allen Rd, Salem to SR 11 south of Lisbon	■	■	All species	5	Mirex, Chlordane

Little Miami River Basin (11)

Description

The Little Miami River basin drains approximately 1757 mi^2 in the southwestern portion of Ohio. The river empties into the Ohio River just east of Cincinnati, Ohio. The Interior Plateau and Eastern Corn Belt Plain are the two ecoregions which roughly divide the basin in two south to north respectively. The Little Miami River basin is the 5th largest river basin in Ohio.

Results Summary

Little Miami River (11001)

Fish tissue samples (both whole body and fillet samples) were obtained from the Little Miami River at 11 sites ranging from RM 3.5 to RM 83.1 during 1993. Whole body carp were collected at 8 of the 11 sites along the river. Contaminants detected in whole carp included slightly to highly elevated PCBs (range = 50.88 µg/kg to 1049.51 µg/kg) and slightly to moderately elevated mercury (73.5 µg/kg to 274 µg/kg). Cadmium (21.5 µg/kg to 45.7 µg/kg), lead (50.88 µg/kg to 1880 µg/kg), DDT isomers (28.68 µg/kg to 183.32 µg/kg), and dieldrin (22.48 µg/kg to 68.74 µg/kg) were also detected.

Sport fish fillets were collected at all 11 sites and included such fish as channel catfish, rock bass, largemouth bass, smallmouth bass, and freshwater drum. PCB concentrations in these fillet samples ranged from not detected to 207.64 µg/kg (not elevated to slightly elevated). Cadmium, DDT isomers and dieldrin were detected in several samples at low concentrations. Mercury was detected in all samples at slightly to moderately elevated concentrations (53.0 µg/kg to 717 µg/kg). Lead was also found at concentrations ranging from not detected to 925 µg/kg.

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Little Miami River	*All Waters*	■		*Channel Catfish Smallmouth Bass*	*2*	*Lead*
				Sauger	*3*	*Mercury*

Huron River Basin (12)

Description

The Huron River basin drains approximately 406 mi ^{2} of north central Ohio. It drains into Lake Erie just east of Sandusky at the town of Huron, Ohio. The Huron River basin is divided by two different ecoregions. The Huron-Erie Lake Plain (HELP) comprises about 20% of the drainage in the lower part of the river near the lake, and the Eastern Corn Belt Plains (ECBP) comprises the other 80% of the drainage.

Results Summary

Huron River (12001)

Fish tissue fillet samples were obtained from the Huron River from 2 sites near the mouth (RM 1.0 and RM 0.0) during 1994. All fish (except brown bullhead) contained PCBs at slightly elevated concentrations (67.18 µg/kg to 254.03 µg/kg). White bass contained the highest concentrations at 254.03 µg/kg. Mercury was detected in every sample ranging from 43.3 µg/kg to 187 µg/kg (not elevated to slightly elevated). Lead, cadmium, DDT isomers, and dieldrin were also detected at low levels in some samples.

West Branch Huron River (12200)

Fish tissue fillet samples were collected from the West Branch Huron River from 2 sites (RM 0.4 and RM 8.2) in 1994. Mercury was the only contaminant found at appreciable levels (68.5 µg/kg to 177 µg/kg, all slightly elevated).

Advisories

No human health related fish consumption advisories have been issued for the Huron River or its tributaries.

Rocky River Basin *(13)*

Description

The Rocky River basin occupies about 293 mi^2 of drainage area in north central Ohio just west of Cleveland. The river empties into Lake Erie and lies in the Erie-Ontario Lake Plain ecoregion.

Results Summary

Tissue analysis is currently ongoing however, no results are available.

Advisories

No human health related fish consumption advisories have been issued for the Rocky River or its tributaries.

Great Miami River Basin (14)

Description

The Great Miami River basin is the 4th largest river basin in Ohio encompassing 5371 mi^2 (1425 mi^2 is in Indiana) and occupying the Eastern Corn Belt Plains and Interior Plateau ecoregions. The Great Miami River drains such cities as Dayton, Middletown, and Hamilton, Ohio. It discharges into the Ohio River at the Ohio, Indiana, Kentucky border. Some of the major tributaries to the Great Miami River include Loramie Creek, the Mad River, the Stillwater River, and the Whitewater River .

Results Summary

Great Miami River (14001)

The upper portion of the Great Miami River was sampled for fish tissue in 1994. Six sites were evaluated ranging from RM 143.8 to 95.9 .

Whole body carp were collected at each site. Smallmouth bass fillets were collected at 5 of the 6 sites. Channel catfish fillets were collected at one site. PCBs were detected in whole carp ranging in concentration from 57 µg/kg to 440 µg/kg. Mercury (61.4 µg/kg to 128 µg/kg), lead (110 µg/kg to 939 µg/kg), and cadmium (33.9 µg/kg to 251 µg/kg) were also detected along with low levels of DDT isomers, chlordane isomers, and dieldrin. Smallmouth bass fillets contained only non-elevated concentrations of PCBs (not detected to 31 µg/kg) and slightly elevated concentrations of mercury (121 µg/kg to 166 µg/kg). Cadmium and lead were also detected in smallmouth fillets. The single channel catfish fillet sample contained non-elevated concentrations of PCBs (43 µg/kg), slightly elevated concentrations of mercury (135 µg/kg), and low levels of DDT isomers, chlordane isomers, and dieldrin.

Mad River (14100)

Both whole body fish and fish fillets were collected from the Mad River and analyzed for contaminants. Eight sites were investigated. Whole body carp were collected at 6 of 8 sites and whole body white sucker were collected at 4 of the 8 sites. Fillet samples were collected at 7 of 8 sites and included brown trout, smallmouth bass, rock bass, and northern hogsucker. Whole white sucker contained PCBs from 25 µg/kg to 153 µg/kg. Whole carp contained sharply higher concentrations (319 µg/kg to 860 µg/kg) of PCBs. PCBs were not detected in samples of fish fillets. Several other organic pesticides were detected in whole fish and fish fillets including chlordane isomers, DDT isomers, dieldrin, aldrin, heptachlor epoxide, and beta-BHC. Cadmium and lead were also detected in both types of samples.

BUCK CREEK (14110)

Three different locations (Rms 6.4, 3.5, and 1.8) were sampled in 1994 along Buck Creek to characterize contamination in fish tissue. Whole common carp and smallmouth bass fillets were collected at each site. Whole carp contained moderately elevated concentrations of PCBs at RM 3.5 (770 µg/kg) and RM 1.8 (590 µg/kg) and slightly elevated concentrations of PCBs at RM 6.4 (64 µg/kg). Whole carp also contained up to 26.9 µg/kg cadmium, 286 µg/kg lead, 106 µg/kg mercury (slightly elevated), 107 µg/kg DDT isomers, and 247.5 µg/kg chlordane isomers.

Smallmouth bass fillets contained non-elevated concentrations of PCBs (range of 23-32 µg/kg). Mercury concentrations ranged from 106-136

µg/kg, which is slightly elevated, and lead levels of up to 99.8 µg/kg were found.

CHAPMAN CREEK (14120)

Chapman Creek was evaluated at two locations during 1994. Fish tissue samples were taken using whole white suckers and whole creek chubs at RM 4.0 and RM 0.9. Whole white suckers contained no pesticides or PCBs from RM 4.0. Cadmium (15.3 µg/kg), lead (76.7 µg/kg) and mercury (74.3 µg/kg) were found in the sample. Mercury concentrations were slightly elevated. Whole body creek chubs taken at the same place exhibited nearly the same concentrations of metals as white suckers. However, non-elevated concentrations of PCBs were also detected (20 µg/kg) as well as low levels of chlordane isomers (3.9 µg/kg). Similar results were encountered at RM 0.9 for metals although PCB concentrations in each species were somewhat higher (59 µg/kg in white suckers, 37 µg/kg in creek chubs).

Stillwater River (14200)

In 1994, fish tissue samples were taken from the Stillwater River between RM 41.3 and the mouth. Sportfish fillets analyzed (in order or numerical importance) included rock bass, smallmouth bass, yellow bullhead, largemouth bass, saugeye, white bass, and black crappie. PCBs and cadmium were not detected in any fillet sample. Mercury was detected in every fillet sample ranging from 75.4 µg/kg to 535 µg/kg (slightly to moderately elevated). Lead was also detected in the majority of samples ranging from 63.4 µg/kg to 265 µg/kg. DDT isomers, chlordane isomers, and dieldrin were also detected in a few samples at low concentrations.

Loramie Creek (14600)

Loramie Creek was sampled to obtain fish tissue in 1994. Two sites were investigated: RM 20.8 and RM 0.4. Whole quillback carpsucker and common carp fillets were obtained at RM 20.8. Quillback carpsucker showed contamination from cadmium (20.5 µg/kg), lead (208 µg/kg), and slightly elevated concentrations of mercury (73 µg/kg). PCBs were slightly elevated at 178 µg/kg and DDT isomers were also detected along with chlordane isomers and dieldrin. Common carp fillets contained only slightly elevated concentrations of mercury (108 µg/kg).

Whole white suckers and smallmouth bass were collected at RM 0.4 for

fish tissue analysis. White suckers had concentrations of cadmium (7.7 µg/kg) and slightly elevated concentrations of mercury (59. 6 µg/kg) along with slightly elevated amounts of PCBs (54 µg/kg) and low levels of DDT isomers, chlordane isomers, and dieldrin. Smallmouth bass fillet s contained only slightly elevated quantities of mercury (146 µg/kg).

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Ford Hydraulic Canal	Power plant spillway, Hamilton, Ohio to the Great Miami River	■		***All species***	***5***	PCBs
Great Miami River	Low head dam at Monument Ave., Dayton, to the Ohio River	■		***Channel Catfish Common Carp***	***2***	*PCBs, Lead
				White Bass	***3***	PCBs
				Largemouth Bass Rock Bass Smallmouth Bass	***3***	Mercury
				All Suckers	***5***	PCBs
Mad River	US 36, Urbana to Dayton	■		***Hogsucker Rock Bass Smallmouth Bass***	***1***	None
				White Sucker	***2***	PCBs
				Common Carp	***3***	PCBs
Stillwater River	All Waters	■		***Channel Catfish Smallmouth Bass***	***3***	Mercury
Twin Creek	All Waters	■		***Rock Bass Smallmouth Bass***	***1***	None
				Channel Catfish	***2***	PCBs

Chagrin River Basin (15)

Description

The Chagrin River basin occupies around 264 mi ^{2} of area in the Cleveland area of northeastern Ohio and resides entirely within the Erie-Ontario Lake Plain ecoregion.

Results Summary

Chagrin River (15001)

The Chagrin River was evaluated in 1994 by testing whole body carp and bass fillets. Two sites were sampled (RM 1.3 and RM 0.2). Whole body carp were evaluated at both sites. Whole carp contained PCBs ranging from 200 µg/kg to 310 µg/kg (slightly to moderately elevated) and mercury ranging from 53.6 µg/kg to 768 µg/kg (slightly to moderately elevated). Chlordane isomers, DDT isomers, cadmium and lead were also detected in whole carp. Smallmouth (RM 1.3) and largemouth (RM 0.2) bass were also collected and filleted. Smallmouth bass contained non-elevated concentrations of PCBs (50 µg/kg) along with slightly elevated concentrations of mercury (120 µg/kg). DDT isomers were also detected. Largemouth bass contained slightly elevated concentrations of mercury (198 µg/kg) and detectable quantities of DDT isomers. PCBs were not detected in largemouth bass.

Advisories

The following human health related fish consumption advisories has been issued for the Chagrin River:

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Chagrin River	***All Waters***	■		***Rock Bass Smallmouth Bass***	***3***	***Lead *Mercury***

Portage River Basin Including Western Lake Erie Tributaries (16)

Description

The Portage River drains approximately 581 mi ^{2} of northwestern Ohio and discharges to the western basin of Lake Erie near Port Clinton, Ohio. Other small creeks in this area which also drain directly to Lake Erie include Toussaint Creek, Turtle Creek, Packer Creek, and Cedar Creek.

Results Summary

Portage River (16001)

Fish tissue samples were obtained from the Portage River during 1994 from 6 locations (RM 16.5 to RM 0.0). Whole carp was collected at RM 16.5 and contained cadmium (173 µg/kg), lead (482 µg/kg), mercury (80.1 µg/kg), PCBs (860 µg/kg) and low levels of the pesticides aldrin, dieldrin, DDT isomers, and chlordane isomers. Fillet samples taken at RM 16.5 and throughout the rest of the river to the mouth showed slightly to moderately elevated contamination from PCBs mostly in catfish and carp fillets, plus largemouth bass. White crappies were untainted by PCBs. Mercury was discovered in all fish fillets ranging from 29.1 µg/kg to 166 µg/kg (not elevated to slightly elevated). Fish fillets also contained lead (72.2 µg/kg to 424 µg/kg). DDT isomers and cadmium were also detected in insignificant amounts in several fillet samples.

CEDAR CREEK (16202)

Whole body fish samples were obtained from 2 sites on Cedar Creek (Drouillard Road bridge and Cousino Road bridge) in 1993. Both samples showed that contaminants were detected. PCBs ranged from 92.82 µg/kg to 138.19 µg/kg. DDT isomers, dieldrin, and chlordane isomers were also detected. Several metals were also found in considerable quantities. Chromium was detected in a range from 5950 µg/kg to 13300 µg/kg and copper was found at 2380 µg/kg to 14100 µg/kg. Lead, cadmium, selenium, and mercury were also detected.

DRY CREEK (16203)

One sample of whole carp was collected in Dry Creek in 1993. PCBs were detected at 154.73 µg/kg. DDT isomers, chlordane isomers, and endosulfans (endosulfan I and II, endosulfan sulfate) were also detected. Copper was detected at 31,900 µg/kg and lead at 2380 µg/kg. Chromium, cadmium, mercury, and selenium were also detected.

CRANE CREEK (16205)

Crane creek was sampled at one locale during 1993. Creek chubs were collected for whole body analysis. PCBs were detected at 69.44 µg/kg along with low levels of DDT isomers and chlordane isomers. Copper (3860 µg/kg) and chromium (5830 µg/kg) were also detected along with cadmium, lead, mercury, and selenium.

TURTLE CREEK (16210)

Whole carp and two sport fish fillets were collected from Turtle Creek at RM 1.4 during 1995. Whole carp contained 820 µg/kg PCBs, , 1220 µg/kg copper, 905 µg/kg selenium, 223 µg/kg lead, and 202 µg/kg cadmium. White crappie and largemouth bass fillets were also collected from this site. PCBs and mercury were detected in both species at non-elevated concentrations (21 µg/kg to 40 µg/kg PCBs, 18.8 µg/kg to 22.5 µg/kg mercury). Selenium and lead were also detected in both fillet samples.

Advisories

The following human health related fish consumption advisories has been issued for the Portage River.

Waterbody	*Location*	*Advisory*		*Fish Species*	*Group*	*Pollutant*
		Fish	*Contact*			
Portage River	*Ohio Turnpike to Lake Erie*	■		*White Crappie*	*1*	*None*
				Rock Bass *Smallmouth Bass*	*2*	**PCBs*, **Lead*
				Channel Catfish *Common Carp*	*3*	*PCBs*

Muskingum River Basin (17)

Description

The Muskingum River basin is the largest drainage in Ohio. It drains some 8051 mi^2 of east central Ohio including the Erie-Ontario Lake Plain and Western Allegheny Plateau ecoregions. Some of the larger rivers that drain into the Muskingum River or its tributaries include the Tuscarawas and Walhonding Rivers (both of which combine to form the Muskingum), the Mohican River, the Kokosing River, the Licking River, Killbuck Creek, and Wills Creek.

Results Summary

Muskingum River (17001)

Only one site has been sampled in the Muskingum River in the last couple of years (further sampling was performed in 1996 to characterize the entire river, but the results are not yet available). A site at RM 105.7 was examined and fish tissue fillet samples obtained during 1994. One whole body sample and 3 fillet samples were collected. Whole channel catfish contained moderately elevated PCBs (330 µg/kg) as well as small amounts of chlordane isomers, DDT isomers, aldrin, dieldrin, and mercury. Lead was also detected at 188 µg/kg. Hexachlorobenzene was detected at 350 µg/kg (not elevated).

Fillet samples of channel catfish, saugeye, and smallmouth bass contained similar amounts of contaminants. Concentrations of PCBs ranged from 89 µg/kg to 116 µg/kg (all slightly elevated). Hexachlorobenzene was detected at a range of 55 µg/kg to 95 µg/kg (all not elevated). Mercury values ranged from 35.9 µg/kg (not elevated) to 75.8 µg/kg (slightly elevated). DDT isomers, chlordane isomers, and aldrin were all detected in small quantities.

Walhonding River (17600)

Tissue analysis is currently ongoing however, no results are available.

MOHICAN RIVER (17700)

Fish tissue sampling in the Mohican River found a variety of contamination, the most important of which is PCB related. Most fish sampled along the length of the river contained slightly to moderately

elevated concentrations of PCBs. Rock bass fillets were notable in that they were not contaminated with PCBs. In one case, a carp fillet sample taken at the mouth (RM 0.5) contained extremely elevated concentrations of PCBs (2359.53 µg/kg). Mercury contamination was also notable and found in every sample in a range from 87.1 µg/kg to 214 µg/kg (slightly to moderately elevated). Lead, cadmium, chlordane isomers and DDT isomers were also found in several samples at insignificant concentrations.

ROCKY FORK MOHICAN RIVER (17733)

Whole body carp taken from RM 6.5 were found to contain extremely elevated concentrations of PCBs (nearly 4000 µg/kg) in addition to significant concentrations of DDT isomers (~170 µg/kg), dieldrin (6.67 µg/kg), cadmium (30.1 µg/kg), lead (183 µg/kg) and non-elevated concentrations of mercury (39.8 µg/kg). This sample was taken in 1993.

BLACK FORK MOHICAN RIVER (17730)

Three sites were sampled along the Black Fork during 1994. At the most upstream site (RM 18.6) saugeye, channel catfish and largemouth bass were taken for analysis of fillets. Saugeye fillets contained moderately elevated concentrations (381.5 µg/kg) of PCBs and 14.9 µg/kg mercury (not elevated). Channel catfish fillets were found to have slightly elevated concentrations of PCBs (182.89 µg/kg) and mercury (69.9 µg/kg). Largemouth bass fillets did not contain detectable concentrations of PCBs, however, they did contain non-elevated concentrations of mercury (9.46 µg/kg).

Common carp fillets were obtained from RM 7.9 and found to have moderately elevated concentrations of PCBs (823.04 µg/kg) in addition to lead (80.5 µg/kg) and slightly elevated concentrations of mercury (93.9 µg/kg).

The final site sampled was at RM 2.5. Three species were collected. Common carp fillets contained moderately elevated concentrations of PCBs (760.65 µg/kg) and low levels of DDT isomers (23.4 µg/kg) and slightly elevated concentrations of mercury (92.2 µg/kg). Golden redhorse fillets incorporated slightly elevated concentrations of PCBs (224.96 µg/kg) and slightly elevated concentrations of mercury (123 µg/kg). Moderately elevated levels of PCBs were also found in smallmouth bass fillets (502.58 µg/kg) in addition to slightly elevated concentrations of mercury (191 µg/kg).

JEROME FORK MOHICAN RIVER (17718)

A single sample of common carp fillets was collected at RM 5.6 of Jerome Fork. Chlordane isomers were detected at a concentration of 11.26 µg/kg and mercury was detected at 70.3 µg/kg (slightly elevated).

CLEAR FORK MOHICAN RIVER (17750)

Clear Fork was sampled for fish tissue at four different locations. The site at RM 30.6 included fillet samples from common carp, largemouth bass (2 different samples), white bass, and muskellunge. Carp fillets contained mercury at a concentration of 109 µg/kg. Two size classes of largemouth bass each contained mercury, with the smaller size class (235-251 mm) containing 53.3 µg/kg Hg, and the larger size class (361-379 mm) containing 199 µg/kg Hg both of which are slightly elevated. White bass fillets did not contain detectable concentrations of any contaminants. Muskellunge fillets contained slightly elevated concentrations of PCBs (58.24 µg/kg), low levels of DDT isomers (11.51 µg/kg) and slightly elevated concentrations of mercury (74.2 µg/kg).

Fish tissue samples taken from RM 19.8 included fillets from white bass, smallmouth bass, and rock bass. White bass, unlike the previous sample, contained contamination from 83.0 µg/kg of mercury (slightly elevated). Smallmouth bass fillets contained moderately elevated levels of mercury (462 µg/kg) and lead (62.6 µg/kg) in addition to low levels of DDT isomers (11.79 µg/kg). Rock bass fillets were contaminated with lead (62.6 µg/kg) and moderately elevated concentrations of mercury (268 µg/kg).

Fish fillets from yellow bullhead, northern hogsucker, smallmouth bass, and rock bass were collected from the location at RM 4.0. Mercury was the only contaminant found in fish fillets from this site. Yellow bullhead fillets contained 172 µg/kg mercury (slightly elevated). Northern hogsucker fillets contained non-elevated concentrations (4.8 µg/kg) of mercury. Smallmouth bass fillets had a slightly elevated mercury concentration of 86.6 µg/kg. Rock bass fillets also contained slightly elevated mercury at a concentration of 109 µg/kg.

The final sample obtained from Clear Fork was taken from RM 1.0 near the mouth. Carp, smallmouth bass, and black redhorse were the species selected for fillet samples. Carp fillets contained non-elevated concentrations of PCBs (49.15 µg/kg) and 153 µg/kg lead. Smallmouth bass had slightly elevated concentrations of both PCBs (82.86 µg/kg)

and mercury (158 µg/kg). Black redhorse sucker fillets contained 126 µg/kg mercury (slightly elevated).

Tuscarawas River (17500)

The lower portion of the Tuscarawas River was sampled for fish tissue during 1994. Fillet samples were obtained from 12 sites between RM 68.7 and RM 0.4. PCBs were found in concentrations ranging from 6100 µg/kg (extremely elevated) in common carp, to not detected (not elevated) in flathead catfish. Most fish were in the slightly to moderately elevated range. Hexachlorobenzene was detected in every sample ranging from 79.48 µg/kg to 2800 µg/kg (not elevated to slightly elevated). In addition, mercury was detected in all samples and ranged from 32.4 µg/kg (not elevated) to 396 µg/kg (moderately elevated). Cadmium, lead, DDT isomers, chlordane isomers, and aldrin were also detected in several samples at insignificant concentrations.

SANDY CREEK (17450)

Samples of fish tissue were obtained from Sandy Creek in 1993. Whole body white suckers were taken from two locations. White suckers from RM 33.0 contained non-elevated concentrations of PCBs (26.72 µg/kg) and low levels of DDT isomers (10.05 µg/kg) as well as non-elevated concentrations of mercury (36.2 µg/kg) At RM 30.7 white suckers contained a variety of pesticides including, DDT isomers (31.54 µg/kg), mirex (18.06 µg/kg), and moderately elevated concentrations of PCBs (435.83 µg/kg). Mercury was also found at a concentration of 35.2 µg/kg (not elevated).

E. BRANCH NIMISHILLEN CREEK (17463)

Fish tissue samples were obtained in East Branch Nimishillen Creek during 1993. Three sites were investigated and samples of whole white suckers were obtained at each site. PCB concentrations ranged from 189.52 µg/kg at RM 8.9 to 763.56 µg/kg at RM 0.1. PCBs concentrations changed from slightly elevated upstream to moderately elevated downstream. Mercury was also detected in each sample ranging from 21.5 µg/kg at the mouth to 79.5 µg/kg at RM 4.2 (non-elevated to slightly elevated)

Killbuck Creek (17150)

Fish tissue samples were obtained in Killbuck Creek during 1993.

Samples of yellow bullhead fillets taken from RM 60.6 showed no contamination from PCBs or pesticides, however, mercury was moderately elevated (226 µg/kg). Whole white suckers taken at RM 60.6 showed non-elevated concentrations of PCBs (33.43 µg/kg) and detectable concentrations of DDT isomers (<100 µg/kg) and dieldrin (14.50 µg/kg) in addition to cadmium (11.0 µg/kg) and slightly elevated concentrations of mercury (110 µg/kg).

Whole body carp were sampled at RM 49.7 and found to contain 132.48 µg/kg of PCBs (slightly elevated) in addition to >120 µg/kg of DDT isomers and a small amount of dieldrin. In addition, cadmium (12.7 µg/kg), lead (202 µg/kg), and slightly elevated levels of mercury (53.5 µg/kg) were found. Largemouth bass taken from this same locale showed little contamination from PCBs and pesticides (10.98 µg/kg DDT isomers was the only organic) and moderately elevated contamination from mercury (226 µg/kg).

Whole body golden redhorse were sampled at RM 35.6. Slightly elevated concentrations of PCBs were found (51.21 µg/kg) in addition to DDT isomers (~141 µg/kg) and dieldrin (16.76 µg/kg). Slightly elevated concentrations of mercury were also found (65.8 µg/kg).

Licking River (17200)

The Licking River was sampled during the summer of 1993. Three locations were selected for screening the river. In all locations, whole carp exhibited highly elevated concentrations of PCBs (between 1100 µg/kg and 1700 µg/kg) and showed a variety of metals. Channel catfish fillets taken from RM 28.3 showed no detectable concentrations of PCBs or pesticides, but contained both cadmium (7.77 µg/kg) and slightly elevated concentrations of mercury (61.3 µg/kg).

Channel catfish fillets from RM 5.5 (about 23 miles downstream) showed slightly elevated concentrations of PCBs (283.28 µg/kg) and also mercury (147 µg/kg). Common carp fillets taken at RM 13.0 showed moderately elevated concentrations of PCBs (559.10 µg/kg) along with cadmium (9.64 µg/kg) and slightly elevated concentrations of mercury (169 µg/kg) and selenium (277 µg/kg).

Largemouth bass fillets taken from RM 13.0 and RM 5.5 showed undetectable concentrations of PCBs and pesticides. Mercury concentrations were slightly elevated at 78.3 µg/kg.

NORTH FORK LICKING RIVER (17250)

Samples taken in 1993 from the mouth of the North Fork Licking River indicated moderately elevated contamination from PCBs (337.41 µg/kg) in catfish fillets in addition to detectable concentrations of cadmium (8.71 µg/kg), lead (81.1 µg/kg) and slightly elevated concentrations of mercury (196 µg/kg). Whole white suckers taken from the same location contained non elevated concentrations of PCBs (31.25 µg/kg) and slightly elevated concentrations of mercury (151 µg/kg), lead (175 µg/kg), selenium (119 µg/kg) and cadmium (16.5 µg/kg). North Fork Licking River was reevaluated during the summer of 1996. This data is not yet available.

SOUTH FORK LICKING RIVER (17220)

Fish tissue samples were obtained from the South Fork Licking River in 4 locations in 1993. At RM 21.1, no organic contaminants were detected in the sample of largemouth bass fillets. Several metals were detected in the sample including slightly elevated concentrations of mercury (116 µg/kg), lead (78.2 µg/kg), selenium (306 µg/kg), nickel (15000 µg/kg), and chromium (1900 µg/kg).

Both whole body and fillet samples of common carp were obtained at RM 8.7. PCBs were detected in both samples, slightly elevated (118.79 µg/kg) in whole body carp and not elevated (26.15 µg/kg) in carp fillets. Cadmium (WBC=63.4 µg/kg, SFFC=9.09 µg/kg), selenium (WBC=81.4 µg/kg, SFFC=282 µg/kg) and slightly elevated concentrations of mercury (WBC=71.9 µg/kg, SFFC=139 µg/kg) were also detected in both samples.

Whole body carp and largemouth bass fillets were collected from RM 0.2 near the mouth. Whole carp contained slightly elevated concentrations of PCBs (183.06 µg/kg) in addition small amounts of pesticides including DDT isomers (45.18 µg/kg) and dieldrin (12.96 µg/kg). Metals detected in whole carp included cadmium (63.7 µg/kg), lead (506 µg/kg), selenium (168 µg/kg), and slightly elevated concentrations of mercury (50.4 µg/kg). Largemouth bass fillets contained non-elevated concentrations of PCBs (18.55 µg/kg) and slightly elevated concentrations of mercury (198 µg/kg) and selenium (375 µg/kg).

RACCOON CREEK (17221)

Fish tissue samples were obtained in 1993 at one location (RM 5.8) in

Raccoon Creek. Whole body carp contained very low concentrations of DDT isomers (8.63 µg/kg) and dieldrin (11.23 µg/kg) along with cadmium (40.6 µg/kg), lead (127 µg/kg), and slightly elevated concentrations of mercury (83.6 µg/kg). Carp fillets provided similar results with whole body carp. Smallmouth bass fillets showed no detectable organic contaminants along with slightly elevated concentrations of mercury (135 µg/kg) and selenium (313 µg/kg).

Wills Creek (17800)

Fish tissue samples were obtained at one locale (RM 70.4) in 1994. Whole body carp were found to contain non-elevated concentrations of PCBs (46 µg/kg) in addition to chlordane isomers (36.1 µg/kg), cadmium (35.5 µg/kg), lead (226 µg/kg), and slightly elevated concentrations of mercury (60.4 µg/kg). Flathead catfish fillets contained no detectable concentrations of PCBs and pesticides. A moderately elevated concentration of mercury was the only metal detected in flathead catfish (341 µg/kg). PCBs and pesticides were not detected in saugeye fillets, however, both slightly elevated concentrations of mercury (103 µg/kg) and lead (89.2 µg/kg) were detected.

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Tuscarawas River	*From Turkeyfoot Rd. (SR 219), Barberton to South Broadway St. (SR 416), New Philadelphia (Tuscarawas County)*	■		*Largemouth bass*	*2*	*PCBs, HCB*
		■		*Rock bass*		
		■		*Channel catfish*	*3*	
		■		*Smallmouth bass*		
		■		*Yellow bullhead*		
Tuscarawas River	*From Turkeyfoot Rd. (SR 219), Barberton to South Broadway St. (SR 416), New Philadelphia (Tuscarawas County)*	■		*Carp*	*4*	*PCBs, HCB*

Mahoning River Basin (18)

Description

The Mahoning River basin drains approximately 1140 mi^2 of northeastern Ohio and a small area of western Pennsylvania. In Pennsylvania, the Shenango and Mahoning Rivers combine to form the Beaver River which is a major tributary of the Ohio River. The Mahoning River is within the Erie-Ontario Lake Plain ecoregion exclusively. Much of the basin is urbanized.

Results Summary

Mahoning River (18001)

The most recent fish tissue sampling of the Mahoning River was performed in 1994. Samples collected from RM 70.3, RM 44.3, and RM 40.6 showed very little contamination other than mercury and one catfish sample containing slightly elevated concentrations of PCBs. Downstream of RM 38.8 inclusive, PCB concentrations move sharply upward and ranged from 123.35 µg/kg in white crappie (slightly elevated) to over 8500 µg/kg in channel catfish (extremely elevated). In addition, cadmium and lead appear in about 1/3 of the samples Mercury was present in every sample in slightly to moderately elevated concentrations.

Mill Creek (18020)

Fish tissue samples were obtained from Mill Creek in two locations (RM 0.3 and RM 1.9) during the summer of 1994. Whole common carp taken from RM 1.9 showed contamination from cadmium (11.0 µg/kg), lead (532 µg/kg), and slightly elevated concentrations of mercury (78.9 µg/kg). Organic contaminants included DDT isomers (36.8 µg/kg), chlordane isomers (14.5 µg/kg) and slightly elevated concentrations of PCBs (120 µg/kg). Whole common carp and largemouth bass fillets were also collected from RM 0.3. Contaminant concentrations in whole carp at RM 0.3 were in the same order of magnitude as those found at RM 1.9. Largemouth bass did not contain detectable concentrations of cadmium, but contained nearly double the concentrations of mercury (144 µg/kg) and approximately 20-40% of the concentrations of PCBs (46 µg/kg) compared to whole carp.

Pymatuning Creek (18550)

In 1994, three locations were sampled for fish tissue on Pymatuning Creek. At RM 30.45, whole common carp were found to contain cadmium (64.2 µg/kg) lead (78.2 µg/kg) and slightly elevated concentrations of mercury (110 µg/kg) in addition to non-elevated levels of PCBs (40 µg/kg). Whole carp were also obtained at RM 15.9 and contained 122 µg/kg cadmium, 263 µg/kg lead, 75.8 µg/kg mercury (slightly elevated), and 219 µg/kg PCBs. Whole carp and white crappie fillets were collected at RM 2.2. Whole carp contained 79.4 µg/kg cadmium, 207 µg/kg lead, 144 µg/kg mercury (slightly elevated), and 169 µg/kg PCBs (slightly elevated). White crappie fillets contained undetectable concentrations of cadmium and lead and slightly elevated concentrations of mercury (75.6 µg/kg), and 30 µg/kg PCBs (not elevated).

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Mahoning River	*Berlin Dam to Pennsylvania border*	■	■	*All species*	*5*	*PCBs, PAHs, mirex, phthalate esters*
				White Crappie	*2*	*PCBs*
				Spotted Bass	*3*	*Mercury*
				Smallmouth Bass Walleye	*3*	*PCBs*
				Channel Catfish Common Carp	*5*	*PCBs*

Cuyahoga River Basin (19)

Description

The Cuyahoga River basin drains about 809 mi^2 of northeast Ohio in the Cleveland/Akron area. The river is within the Erie-Ontario Lake Plain ecoregion and empties into the central basin of Lake Erie. The Cuyahoga River has an unusual claim-to-fame. In the late 1960s the river caught fire due to the high levels of pollution. This served as one impetus for the creation of

the Clean Water Act.

Results Summary

Fish fillet samples were obtained from the Cuyahoga River in 1992. Carp and white suckers were the main types of fish used with a smattering of smallmouth bass, largemouth bass, and rock bass. PCBs ranged from not detected to 1372.94 µg/kg (not elevated to highly elevated). Mercury concentrations on fish fillets ranged from 52.2 µg/kg to 226 µg/kg (slightly to moderately elevated). Copper was also found at concentrations ranging from 286 µg/kg to 710 µg/kg. DDT isomers, dieldrin, methoxychlor, and cadmium were also detected at low concentrations.

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Cuyahoga River	Upstream of Edison Dam Pool			Smallmouth Bass, Rock Bass, Bluegill, Pumpkinseed	1	None
		■		Largemouth Bass	3	Mercury
	Downstream of Edison Dam Pool	■		White sucker < 11"	2	PCBs
		■		Carp, White sucker ≥ 11"	3	
		■		Brown bullhead	4	
		■		Yellow bullhead		

Black River Basin (20)

Description

The Black River occupies a drainage area of about 470 mi^2 in the Erie-Ontario Lake Plain ecoregion in the north-central part of the state. It empties into Lake Erie at the city of Lorain, Ohio.

Results Summary

Initial evaluations of the Black River focused on the lower portion and concentrated on PAHs. The lower portion of the Black River (RM 5.8 to RM 1.05) was evaluated again in the summer of 1994 for pesticides, PCBs, and certain metals. Low concentrations of DDT isomers were detected in most fish fillets collected. PCBs were also found in slightly to highly elevated concentrations in the majority of fish samples. Common carp, smallmouth buffalo, and freshwater drum contained moderately to highly elevated concentrations of PCBs whereas largemouth bass, smallmouth bass, white crappie, and brown bullhead showed slightly or non-elevated concentrations of PCBs.

Mercury was detected in every fillet sample collected in 1994. Concentrations ranged from non-elevated (21.7 µg/kg) to moderately elevated (418 µg/kg).

Advisories

The current advisory for the Black River was issued in 1983 due to contamination of river sediments from polynuclear aromatic hydrocarbons (PAHs)

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Black River	31st Street. bridge, Lorain to Lake Erie	■	■	Brown Bullhead Freshwater Drum	2	PCBs
				Common Carp	3	PCBs
				All Species	5	PAHs?

Vermilion River Basin (21)

Description

The Vermilion River drains about 268 mi^2 of north central Ohio divided evenly between the Eastern Corn Belt Plain and Erie-Ontario Lake Plain ecoregions. The Vermilion empties into Lake Erie at the town of Vermilion, Ohio. Fish tissue samples were obtained at 4 sites along the Vermilion River in 1994.

Results Summary

The Vermilion River presented an unusual pattern of contamination. Some fish from the mouth of the river contained PCBs that were slightly to moderately elevated.(white bass - 124.20 µg/kg and large common carp - 779.79 µg/kg) whereas other fish did not show PCB contamination (white crappie, rock bass, and small common carp). The PCBs detected in fish from the mouth are likely an artifact from Lake Erie which is currently under a fish advisory for PCBs. Other pesticides including DDT isomers, dieldrin, and chlordane isomers were detected only in large common carp. Mercury concentrations were non-elevated (31.8 µg/kg) to slightly elevated (98.6 µg/kg) in carp and rock bass respectively.

Certain fish from RM 6.2 also displayed moderate to slight contamination from PCBs including channel catfish (460 µg/kg, PCBs) and white crappie (53.44 µg/kg). Smallmouth bass and rock bass did not contain detectable amounts of PCBs however, all species sampled at this locale contained low levels of DDT isomers. Mercury concentrations ranged from non-elevated (48.9 µg/kg) in rock bass to slightly elevated (116 µg/kg) in smallmouth bass.

Two sites sampled in the upstream reaches of the Vermilion River (RM 14.3 and RM 23.7) did not show detectable concentrations of PCBs in fish flesh. The only pesticides to be detected included low concentrations of DDT isomers found in fish from RM 14.3. Mercury concentrations were slightly to moderately elevated (109 µg/kg to 249 µg/kg).

Advisories

No human health related fish consumption advisories have been issued for the Vermilion River or its tributaries.

Wabash River Basin (22)

Description

The headwaters of the Wabash River drain a small portion (about 250 mi^2) of west-central Ohio near the Indiana border. This drainage is in the Eastern Corn Belt Plain ecoregion. Although the Wabash is a major river, most of it drains through Indiana. Coldwater, Ohio is one of the small cities located in the Ohio drainage of the Wabash River.

Results Summary

No fish tissue samples have been obtained from the Ohio portion of the Wabash River and its tributaries. The Wabash River is scheduled to be evaluated in 1996.

Advisories

Currently, there are no fish consumption advisories for the Ohio portion of the Wabash River or its tributaries.

Mill Creek Basin (23)

Description

Mill Creek is a direct tributary of the Ohio River. It drains the Cincinnati, Ohio metropolitan area (drainage area ~ 200 mi^2) and is entirely within the Interior Plateau ecoregion.

Advisories

Waterbody	***Location***	***Advisory***		***Fish Species***	***Group***	***Pollutant***
		Fish	***Contact***			
Mill Creek	*From I-275 to the Ohio River*	■		*All species*	***2***	*PCBs*

Ohio River (90)

Description

The Ohio River forms at the confluence of the Monongahela River and th e Allegheny River in Pittsburgh, Pennsylvania. After it flows out of Pennsylvania, it forms the southern boundary of Ohio, flowing from East Liverpool, Ohio t o Cincinnati, Ohio. The Ohio Riv er is the ultimate drainage point for nearly 66% of the State of Ohio.

Advisories

Waterbody	Location	Advisory		Fish Species	Group	Pollutant
		Fish	Contact			
Ohio River	Pennsylvania border near East Liverpool to Cincinnati	■		Largemouth bass	2	PCBs
		■		Smallmouth bass		
		■		Sauger		
		■		White bass	3	
		■		Striped x white bass		
		■		Freshwater drum		
		■		**Flathead catfish**	4	
		■		**Channel catfish**	5	PCBs
		■		**Carp**		PCBs, Chlordane