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OCCURRENCE OF CHLORINATED BIPHENYLS
IN MISSISSIPPI RIVER FISH

by
Paul Degurse and J. Ruhland

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Introduction

During the spring of 1970, a survey was initiated relative to pesticide and other organic contaminants in the fish of the Mississippi River bordering Wisconsin. This waterway provides a highly productive sport fishery and a commercial fishery of considerable value.

During previous years the Wisconsin Department of Natural Resources had completed an extensive survey of inland waters with the major objective of determining the pesticide residues in fish (Kleinert, et al 1968). During this survey note was made of chlorinated hydrocarbons other than pesticides. Some of these were observed to obscure results obtained for DDT. These additional contaminants were not related to pesticide residues, but were associated with industrial and domestic waste discharge.

Researchers at the University of Wisconsin, supported in part by a grant of funds from DNR, developed procedures for an analytical method and carried forth an investigation directed toward identification of these nonpesticide chlorinated hydrocarbons (Lee & Vieth, 1969), (Lee & Vieth, 1970), (Vieth, 1970). These workers have established these hydrocarbons as polychlorinated biphenyls (PCB's). They further established that high levels of PCB's occurred in fish taken from streams into which considerable discharge from industrial process and domestic sewage is made.

Toxicological data pertaining to the effects of PCB's on man and animals is somewhat limited. Indications from recent studies, however, are that these materials are toxic to domestic animals and wildlife. Studies conducted with house flies (*D. Melangaster*) indicated toxicity less than dieldrin (a chlorinated hydrocarbon pesticide) by a factor of 1,000. Chlorinated biphenyls increased the toxic effect of dieldrin and DDT (Lichtenstein et al 1969). Chlorinated biphenyl at 0.08% in the diet of domestic chickens produced mortalities of 90% of exposed animals in four weeks. Lower levels produced hydropericardium and ascites (McCune et al 1962). Flick et al (1965) noted pathology of internal organs but low mortality in chickens fed 400 ppm chlorinated biphenyl. Studies underway at this laboratory demonstrate no mortality of rainbow trout fed 4,000 ppm at 24 days. This study is continuing and observations for pathology will be made for longer term exposure.

The sources, use and chemical description of polychlorinated biphenyls have been well reviewed (Vieth, 1970). It suffices here to state that there are biphenyl-chloro compounds with widespread industrial and domestic use. The majority of PCB's used in this country are manufactured and sold under the registered trade name Aroclor (R) by Monsanto, Organic Chemical Division, St. Louis, Missouri. These compounds are coded by Monsanto as 1224, 1254 - 1260, etc. The first two digits refer to chlorinated biphenyl and the second to percent of total chlorine. Thus, 1254 is a chlorinated biphenyl with weight percentage of 54 chlorine. (Technical Bulletin O/PL-306, Monsanto).

Procedure

Personnel within the Bureau of Fisheries, Department of Natural Resources selected sampling sites. These personnel are experienced with the Mississippi River and with methods for fish population sampling and specimen collection. The sites were determined in such a way as to establish measurements upon the influence of major tributaries and industrial and domestic waste outfall. Fish samples were collected from 19 one-mile linear segments of the river over the entire river as it borders Wisconsin. Fish were collected by electric shocker technique. These were identified, measured, tagged and wrapped in aluminum foil and placed upon ice in the field. On the same day samples were collected they were placed in freezers at 20° C. Each sample was either an individual fish or a pool of individuals of the same species. All samples were kept frozen until prepared for analyses.

Samples of fish were prepared by grinding whole fish in the frozen state through a standard type meat grinder. Samples were mixed and reground twice and aliquots placed in 8-ounce glass bottles capped with aluminum foil and placed again in cold storage. Sub-aliquots of these finely ground samples were batch extracted with hexane (B.P. 68° C.) which had been redistilled in an all-glass reflux distillation system. Extraction was accomplished by mixing 10 grams of fish tissue with 75 grams anhydrous sodium sulphate and extracting three times with hexane, 100 ml, 50 ml, and 50 ml portions in 200 ml centrifuge bottles with mixing and shaking for five minutes. Samples were centrifuged 10 minutes and extracts decanted into 250 ml beakers after each extraction. The pooled extracts were concentrated to 10 ml in a water bath at 60° C. under gentle air jet. These concentrated extracts were washed onto floracil columns of 35 grams in chromatograph columns 22 mm inside diameter and 230 mm long fitted with 500 ml reservoirs and teflon stopcocks. Columns were eluted with 150 ml hexane followed by 200 ml 94-6 hexane ethyl ether mixture. Under these conditions biphenyls and DDE eluted with hexane, DDT, DDD and dieldrin eluted with 94-6 hexane ether mixture. Eluted samples were concentrated to 5 ml and made up to 25 ml in volumetric flasks. These were injected at these concentrations or diluted further with hexane as required.

Analysis was made using gas liquid chromatography. Detector was electron capture. Glass columns six feet long, 2 mm inside diameter with a mixed bed of DC 200 and QF 1 on gaschrom Q at ratio of 9 to 5 respectively were used. The column oven was maintained at 210° C. Standards of DDT, DDE, DDD, dieldrin, methoxychlor and Aroclor (R) (Monsanto), 1224, 1254 and 1260 were used to identify and quantify chromatograms. The fitting of peaks of known to unknown was made by matching retention time. PCB concentrations were calculated from peaks matched with Aroclor (R), rejecting peaks with close or direct overlay with DDE. Separation of DDT, DDD and dieldrin on florisil prevented interference by these pesticides. DDE was estimated from separate higher dilution injections with base line due to PCB subtracted on the basis of PCB concentrations estimated from lower dilutions.

Discussion of Procedures

The analytical system used during this survey is far from ideal, however, the best available to us at the time the study began. While the accuracy of this procedure as reflected in analysis of "spiked" samples of fish tissue demonstrated an excellent recovery, average 95 percent, choice of "best-match" standards of a mixed group of chlorinated biphenyls leaves much to be desired. Until specific standards can be obtained or until more specific detectors are available to the general laboratory, sacrifices of accuracy will need to be made. This is by no means an excuse for the method selection but indicates that we are aware that error can occur in the measurements made upon these environmental samples. The trend in levels can be demonstrated to be real and we do not, in view of spiked sample recovery data, suspect errors greater than twofold. This we believe is acceptable within the objectives of this particular survey. We suggest that specific standards and further verification of individual molecular species be used to identify these and other organic contaminants in the environment.

Findings

The highest concentrations of PCB's in Mississippi River fish were found in the upper reaches of the river (Figure 1). Pesticides in fish from the Lake Pepin area appeared to be variable but consistently higher than those downstream. There was a continuous decline in residue in downstream samples until a point at La Crosse, Wisconsin. Below this point levels appear stabilized. All samples below Trempealeau averaged below 5 ppm (the tentative level for action set by FDA) and from La Crosse downstream all samples ranged below 5 ppm (Table 1).

Difference of levels of PCB's between species could not be determined nor could fat content and PCB level be correlated. Sample selection and numbers are such that unknown factors such as age and sex would prevent real evaluation between species. However, game species such as walleye generally ranged higher than rough fish such as carp. In each sampling zone all species indicate residue level for that area of the river.

All species above Alma, Wisconsin, would be expected to contain more than 5 ppm in sizes that would be utilized in the sport or commercial fishery. Between Alma and Trempealeau, game fish would not meet FDA action guidelines of 5 ppm or less.

Evidence of precipitation or absorption exists in this system, since it is believed the input has gone on for several years, at least, and a continuous decline in residue is evident on a downstream view. This would point to the major source of input either in or above Lake Pepin. One would suspect the Minneapolis-St. Paul domestic and industrial area as the major source of input. If there is significant input from Wisconsin tributaries it is either below detection or is mixed into that portion of the upper river.

Pesticide levels in these samples were found to range below 5 ppm action guidelines for human food set by U. S. Food and Drug Administration.

Conclusions

The upper reaches of the Mississippi River as it borders Wisconsin, particularly Lake Pepin, has been contaminated with polychlorinated biphenyls to the extent that fish living therein have accumulated amounts of these compounds in excess of FDA action guidelines of 5 ppm for fish to be used for human food by as much as ten-fold. Downstream from Alma, Wisconsin, concentration of PCB's drop off rapidly and below Trempealeau, Wisconsin, all fish would meet FDA guidelines. The source of this contamination is most obviously above or in the Lake Pepin area. Since there is a major metropolitan area above this lake, one would conclude this to be the most likely source of high input.

Fish from Lake Pepin area and downstream to Trempealeau are contaminated to such a high degree that it is unlikely any amount of selection would produce fish with levels below 5 ppm PCB.

We are aware of a possibility of error in analytical procedure, however, we believe this not be more than doubled, and with this have demonstrated data which viewed upon standards for human food would suggest the upper Mississippi River fishery is lost to pollution.

Recommendations

Further study of contamination by PCB's in fish from the major rivers of this state should be made. Evaluation of the effect upon fish, per se, by these compounds must be determined. Further data on the toxicity of these compounds for animals should be obtained. (We understand there are several such studies underway in the United States.)

If action guidelines of 5 ppm PCB maximum have been set with realistic data, notice of the contamination of fish in the upper Mississippi River should be made public.

With all speed possible, improvements on analytical procedures for these and other organic contaminants should be made.

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Figure 1 - Level of PCB Residue in Mississippi River Fish
 Average of All Species at Each Station
 June - July 1970

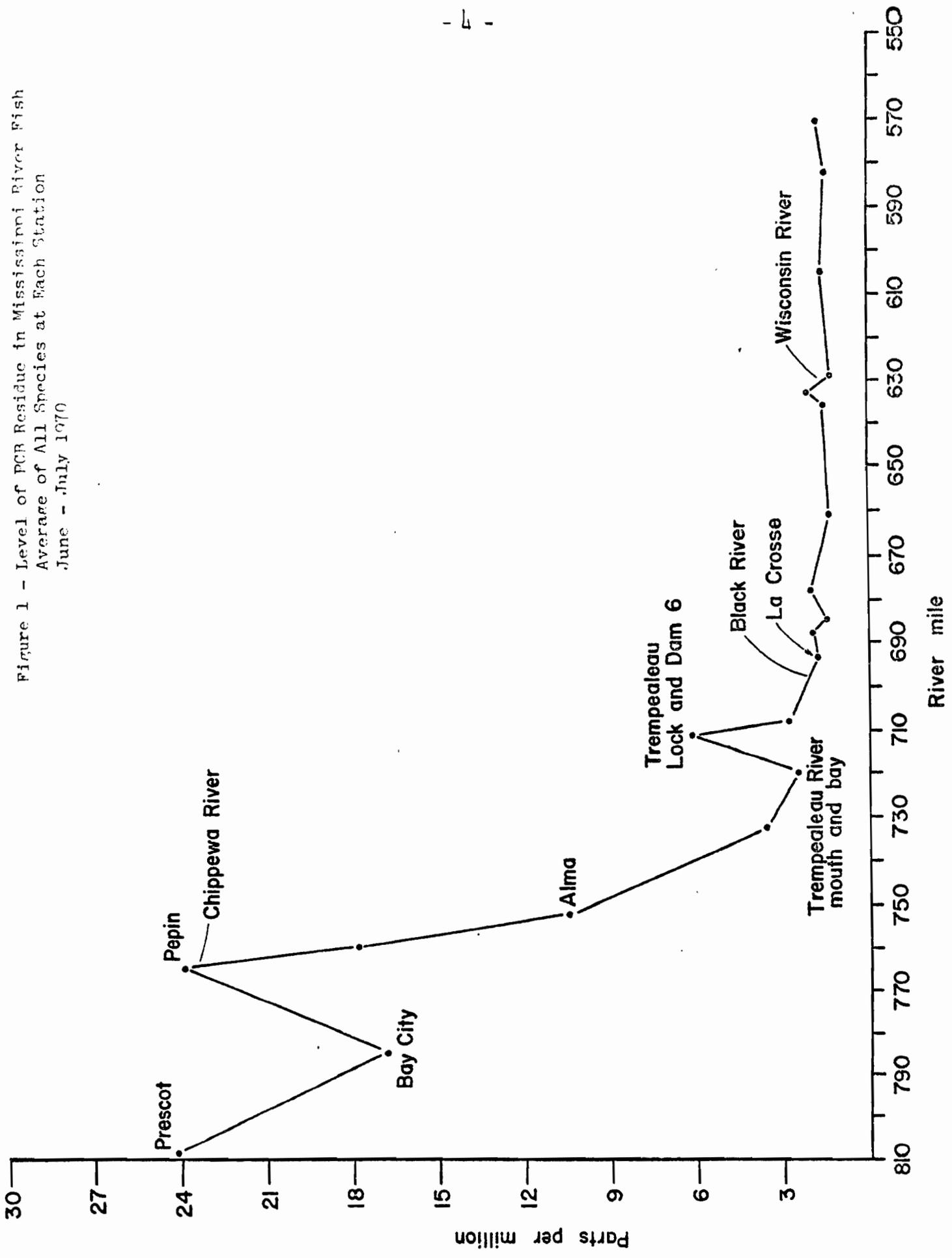


TABLE I. PCB & DDT RESIDUES IN MISSISSIPPI RIVER FISH - JUNE-JULY 1970

LOCATION - PRESCOTT - RIVER MILE 811

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
761	Walleye	20.5	68.6	9.2	20.6	.61	.32	.08	1.01
762	Walleye	18.2	70.1	7.7	33.3	.89	.82	.07	1.78
763	Walleye	16.7	70.8	7.7	28.1	.63	.11	.06	1.10
764	Walleye	17.6	70.0	8.0	38.3	.55	.17	--	.72
765	White Bass	14.0	68.2	9.3	50.3	1.03	.53	.10	1.66
766	(4) White Bass	5.5" to 13.5"	71.5	5.8	49.9	1.05	.49	.09	1.63
767	Quill Back Carp Sucker	17.6	68.6	8.5	22.9	.82	.42	.12	1.36
768	Northern Redhorse	16.0	71.5	2.7	15.8	.23	.10	.12	.45
769	Northern Redhorse	14.4	65.2	10.3	37.5	.81	.24	.09	1.14
770	(4) Northern Redhorse	-7.3" to 12.3"	69.0	7.1	19.8	.41	.19	.05	.65
771	Carp	17.7	70.4	6.98	35.3	.46	.19	.07	.72
772	Carp	20.2	67.5	9.86	7.64	.19	.10	.03	.32
773	(2) Carp	12.1" to 12.1"	76.3	2.70	10.7	.19	.11	.01	.31
774	Carp	19.8	67.7	11.3	10.8	.38	.08	.03	.49
775	Carp	15.6	72.7	7.6	5.48	.37	.03	.03	.43
776	Carp	22.6	73.8	1.7	8.90	.41	.13	.02	.56
Station Average					24.7				.84

LOCATION - BAY CITY - RIVER MILE 785-786

898	Walleye	20.4	75.1	3.2	4.74	.09	.18	.02	.29
899	Walleye	18.1	73.1	3.3	22.6	.26	.21	.10	.57
906	Walleye	18.7	72.8	3.5	20.9	.18	.11	.03	.32
900	Sauger	16.3	78.1	4.3	14.7	.20	.22	.03	.45
901	2 Drum	12.7" to 13.5"	79.2	2.7	4.52	.08	.12	.04	.24
902	1 Drum	17.1	77.3	2.9	5.54	.08	.07	.03	.18
903	White Bass	15.4	74.4	5.7	69.8	1.32	.52	.11	1.95
904	White Bass	14.4	74.2	5.1	33.3	1.60	.77	.10	2.47
905	Largemouth Bass	14.0	75.9	3.7	20.3	.14	.23	.03	.40
909	3 Largemouth Bass	10.3" to 11.8"	72.1	2.1	15.5	.14	.17	.02	.33
907	Black Crappie	12.8	73.1	5.3	14.0	.33	.37	.04	.74
908	3 Black Crappie	11.2" to 11.5"	71.4	3.7	17.7	.11	.27	.04	.42
910	White Sucker	18.3	80.4	.3	9.88	.10	.06	.01	.17
911	Carp	13.9	76.0	2.0	7.43	.07	.07	.01	.15
912	Carp	15.8	74.4	3.8	7.84	.07	.10	.01	.18
913	Carp	18.1	70.7	5.5	16.4	.13	.19	.01	.33
914	Carp	18.0	72.6	7.1	14.0	.14	.22	.01	.37
915	Carp	21.0	66.3	14.2	10.3	.19	.12	.02	.33
Station Average					17.2				.54

LOCATION - PEPIN - RIVER MILE 765-767

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
808	Walleye	23.5	73.9	--	20.1	.23	.12	.03	.38
809	Walleye	19.3	72.5	4.7	34.4	.40	.13	.02	.55
810	Walleye	17.0	68.2	9.5	72.0	2.00	.19	.02	2.21
811	Walleye	15.6	70.1	6.3	52.4	2.00	.28	--	2.28
812	2 Walleye	13.4" to 13.6"	71.5	5.3	32.0	.35	.17	--	.52
831	7 Walleye	7.2" to 12.4"	70.9	2.4	25.4	.40	.30	.01	.71
813	Bl. Crappie	12.2	68.7	9.0	58.8	.64	.39	.06	1.09
814	Drum	18.8	73.6	4.4	14.2	.55	.11	.03	.69
822	Drum	13.7	69.4	3.8	9.28	.26	.21	.03	.50
823	2 Drum	12.8" to 12.8"	70.2	2.9	20.6	.27	.23	.13	.63
815	White Bass	13.4	73.5	4.5	50.5	1.60	.26	.07	1.93
816	Northern Pike	24.1	67.8	3.7	18.5	.63	.30	.52	1.45
817	Largemouth Bass	12.4	70.2	1.0	7.92	.26	.15	.02	.43
818	Northern Redhorse	19.2	70.8	2.9	10.2	.44	.23	.09	.76
819	Golden Redhorse	14.9	69.3	4.0	6.28	.21	.14	.04	.39
820	Spotted Sucker	15.5	73.1	0.8	5.67	.10	.08	.02	.20
821	Spotted Sucker	17.8	72.2	.4	4.68	.14	.14	.01	.29
824	Carp	26.0	64.0	10.8	--	--	.23	.13	.36
825	Carp	17.0	67.1	7.8	13.7	.20	.23	.02	.45
826	Carp	20.7	67.6	6.2	18.4	.25	.17	.01	.43
827	Carp	14.3	67.6	7.2	10.5	.22	.20	.03	.45
828	Carp	24.1	64.9	11.5	16.7	.25	.30	.02	.57
829	Carp	15.3	63.8	10.3	21.6	.73	.28	.04	1.05
830	3 Sauger	10.3" to 14.1"	67.1	6.1	29.6	.39	.07	.06	.72
Station Average					24.0				.79

LOCATION - WABASHA - MISS. RIVER MILE 758-760

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
832	2 Walleye	16.5" to 17.8"	69.5	--	5.8	.18	.15	.04	.37
833	Walleye	15.5	67.0	4.6	8.60	.21	.18	.03	.42
834	Golden Redhorse	19.4	72.5	1.9	7.29	.18	.21	.19	.58
840	Golden Redhorse	20.9	73.5	1.1	14.20	.22	.22	.18	.62
835	Drum	17.2	69.9	2.7	6.47	.17	.21	.13	.51
842	2 Drum	13.4" to 12.6"	68.6	4.4	5.00	.18	.10	.07	.35
843	2 Drum	14.7" to 15.0"	69.0	4.7	12.6	.23	.22	.10	.55
836	Spotted Sucker	15.5	70.6	2.9	17.6	.38	.25	.17	.80
838	Spotted Sucker	17.7	72.2	1.1	1.41	.08	.09	.04	.21
837	White Bass	13.1	66.9	4.2	15.7	.26	.24	.09	.59
839	3 Smallmouth Bass	12.3" to 14.4"	69.8	1.1	6.91	.14	.13	.06	.33
841	2 Sauger	6.2" to 14.6"	66.9	5.6	18.5	.25	.29	.13	.67
844	2 Channel Cat	16.3" to 17.3"	62.0	3.9	8.67	.19	.18	.10	.47
845	2 Northern Redhorse	17.2" to 17.3"	65.9	7.8	40.0	.57	.32	.09	.98
846	2 Northern Redhorse	14.1" to 14.1"	69.3	3.3	28.1	.41	.31	.26	.98
847	4 Northern Redhorse	11.3" to 13.0"	66.7	5.7	17.7	.28	.20	.12	.60
848	Carp	18.0	65.4	7.3	12.0	.25	.20	.04	.49
849	Carp	18.9	65.2	8.1	12.6	.23	.21	.02	.46
850	Carp	23.1	63.4	10.6	53.4	.86	.35	.06	1.27
851	Carp	22.2	63.7	9.6	45.7	.71	.34	.08	1.13
852	Carp	21.5	62.5	9.4	34.8	.73	.30	.02	1.05
Station Average					17.8				.59

LOCATION - ALMA - LOCK & DAM #4 DOWN TO RIVER MILE 752

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
777	Walleye	19.7	63.4	12.6	21.6	.56	.20	.06	.82
778	Walleye	20.7	69.6	6.4	34.2	.45	.14	--	.59
779	Walleye	16.1	70.5	7.4	16.4	.24	.10	--	.34
805	5 Walleye	7.0" to 13.0"	75.6	1.0	6.26	.13	.06	.01	.20
780	Drum	20.2	72.0	5.8	6.87	.20	.06	.03	.29
786	Drum	17.0	73.5	3.6	11.8	.19	.08	--	.27
801	Drum	15.1	67.5	13.2	17.3	.22	.12	.06	.40
802	3 Drum	12.6" to 13.7"	68.3	9.8	10.5	.18	.12	.05	.35
781	Carp	24.1	78.3	.20	10.5	.20	.09	--	.29
782	Carp	23.3	65.1	9.8	6.53	.17	--	--	.17
796	Carp	15.3	76.1	1.2	1.31	--	.06	--	.06
797	Carp	17.4	77.0	1.3	1.15	--	.06	--	.06
798	Carp	20.1	64.6	12.2	20.7	.23	.16	.02	.41
783	Golden Redhorse	18.3	76.9	2.7	9.47	.10	.08	--	.18
784	Golden Redhorse	20.6	77.8	.50	11.4	.17	.05	.04	.26
785	Golden Redhorse	17.2	75.3	1.0	10.2	.18	.05	--	.23
792	2 Golden Redhorse	13.5" to 13.5"	74.1	2.2	4.73	.08	.07	.03	.18
787	Northern Redhorse	17.0	71.2	5.1	20.7	.28	.13	.11	.52
793	2 Northern Redhorse	13.2" to 14.2"	73.5	3.2	9.64	.15	.11	.06	.32
794	3 Northern Redhorse	9.6" to 12.3"	75.6	1.6	9.30	.12	.08	.04	.24
788	Spotted Sucker	17.4	73.1	2.1	8.72	.11	.09	.05	.25
789	Spotted Sucker	16.9	71.9	.60	3.17	--	.04	.04	.08
790	2 White Bass	12.8" to 13.0"	75.4	3.6	10.9	.16	.11	--	.27
791	Sm. Mouth Bass	15.5	72.0	3.9	9.01	--	.10	.05	.15
799	2 Sm. Mouth Bass	12.9" to 13.7"	72.0	2.8	12.6	.24	.09	.02	.35
800	3 Sm. Mouth Bass	12.4" to 12.6"	73.1	2.1	8.59	.12	.07	.03	.22
795	Quillback Carp Sucker	14.0	71.8	5.5	3.30	--	.07	.02	.09
803	3 Sauger	13.2" to 14.3"	70.0	6.6	14.5	.23	.11	.07	.41
804	13 Sauger	5.2" to 11.4"	74.2	2.3	7.54	.14	.06	.02	.22
806	4 Bl. Crappie	10.6" to 11.2"	73.0	3.0	10.1	.22	.09	.04	.35
807	4 Bl. Crappie	9.6" to 9.9"	73.4	1.6	9.79	.21	.07	.03	.31
Station Average					10.9				.28

LOCATION - FOUNTAIN CITY - RIVER MILE 731-733

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
929	Redhorse	17.2	73.6	4.9	4.62	.11	.12	.03	.26
930	2 Redhorse	13.8" to 15.0"	70.4	5.8	3.88	.09	.07	.02	.18
931	4 Walleye	7.5" to 12.0"	72.9	3.0	5.85	.12	.08	.02	.22
932	2 Saugers	13.0" to 14.9"	72.2	4.0	5.67	.11	.10	.02	.23
933	4 Saugers	11.2" to 12.8"	73.0	3.3	4.74	.08	.09	.02	.19
934	Carp	22.2	70.8	7.0	--	.11	.14	.01	.26
935	Carp	20.1	72.3	4.5	3.19	.09	.09	.01	.19
936	Carp	18.3	75.1	1.8	1.39	.03	.02	.01	.06
937	Carp	15.8	73.4	4.9	1.78	.04	.05	.01	.10
938	Bowfin	24.9	75.8	.90	.48	.01	.03	.01	.05

Station Average

3.51

.17

LOCATION - TREMPEALEAU - LOCK & DAM #6 - RIVER MILE 713

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
853	Golden Redhorse	25.1	71.4	3.7	10.7	.36	.23	.13	.72
871	Golden Redhorse	18.4	74.7	3.1	8.86	.21	.14	.06	.41
854	Spotted Sucker	17.5	79.6	.2	1.11	.06	.04	.01	.11
856	Spotted Sucker	15.5	75.3	2.0	2.39	.15	--	--	.15
857	Spotted Sucker	13.7	73.6	3.0	2.27	.09	.07	.02	.18
855	Drum	16.3	72.7	5.6	2.96	.12	.09	.02	.23
872	2 Drum	12.7" to 15.9"	69.4	10.0	18.59	.38	.20	.09	.67
858	Black Crappie	12.4	71.8	3.0	2.42	.11	.11	.04	.26
859	Walleye	16.5	71.2	5.4	6.17	.19	.20	.06	.45
860	2 Northern Pike	11.0" to 18.4"	75.1	1.6	2.01	.11	.09	.02	.22
861	Mooneye	14.5	67.4	11.6	6.70	.17	.05	.19	.41
862	2 Largemouth Bass	14.0" to 14.5"	72.9	2.9	5.80	.10	.08	.01	.19
863	2 Largemouth Bass	10.6" to 12.3"	74.7	1.1	6.34	.10	.08	.01	.19
864	2 Sauger	12.5" to 13.5"	73.2	3.8	9.39	.12	.12	.01	.25
865	5 Bluegill	6.3" to 2.5"	74.4	1.9	3.57	.05	.06	.02	.13
866	2 White Bass	12.1" to 13.3"	72.4	3.6	7.04	.12	.11	.08	.31
867	Northern Redhorse	18.3	74.0	3.1	5.48	.09	.15	.05	.29
868	2 Northern Redhorse	12.4" to 13.9"	71.1	5.5	7.14	.09	.04	.10	.23
869	2 Channel Cats	15.3" to 16.5"	75.2	3.8	8.43	.24	.14	.04	.38
870	Channel Cat	19.4	72.6	6.7	16.55	.36	.22	.07	.65
873	Carp	23.0	64.3	14.5	6.23	.25	.17	.03	.45
874	Carp	21.9	67.8	11.4	7.93	.23	.19	.02	.44
875	Carp	20.1	67.9	10.2	4.99	.16	.13	.02	.31
876	Carp	16.7	72.6	3.5	2.56	.06	.08	.01	.15

Station Average

6.4

.31

LOCATION - TREMPEALEAU - RIVER MOUTH & BAY

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
877	Northern Redhorse	19.1	72.4	6.0	11.9	.21	.20	.09	.50
878	Golden Redhorse	21.0	77.6	.8	2.34	.04	.01	.01	.06
879	Largemouth Bass	17.1	72.9	2.3	2.66	.07	.08	.05	.20
884	2 Largemouth Bass	13.0" to 13.5"	74.5	.9	1.33	.03	.04	.01	.08
885	4 Largemouth Bass	4.2" to 10.9"	73.9	1.0	3.01	.04	.04	.01	.09
880	2 Black Crappie	12.8" to 13.0"	71.9	2.4	5.14	.08	.07	.02	.17
881	3 Black Crappie	9.0" to 10.4"	72.5	1.5	3.52	.05	.07	.01	.13
882	2 Black Crappie	10.9" to 10.9"	72.8	1.7	3.99	.06	.09	.02	.17
883	2 Black Crappie	11.6" to 11.6"	72.4	1.4	2.46	.04	.04	.01	.09
886	Spotted Sucker	14.6	72.2	5.3	.721	.02	.04	.01	.07
887	Spotted Sucker	15.5	70.6	6.7	.571	.03	.03	.02	.08
888	2 White Bass	11.6" to 13.3"	72.3	3.2	5.52	.08	.16	.01	.25
889	7 Bluegill	5.4" to 7.9"	75.4	1.2	1.53	.06	.05	.02	.13
890	Channel Cat	21.2	72.0	9.3	1.50	.05	.07	.02	.14
891	Bowfin	16.9	79.2	2.2	2.35	.05	.08	.02	.15
892	2 Bowfin	14.2" to 15.3"	79.5	1.7	.321	.01	.01	.01	.03
893	Carp	24.2	75.0	4.1	1.58	.05	.08	.01	.14
894	Carp	21.6	72.5	8.1	6.17	.14	.16	.01	.31
895	Carp	20.0	75.6	4.6	1.57	.05	.08	.01	.14
896	Carp	17.2	75.0	3.9	.458	.02	.03	.01	.06
897	Carp	14.5	76.0	2.9	.468	.02	.03	.01	.06

Station Average

2.81

.14

LOCATION - LA CROSSE - RIVER MILE 693-694

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
939	Brown Bullhead	13.8	8.1	.4	.56	.02	.02	.01	.05
940	Spotted Sucker	17.7	77.3	1.2	1.46	.08	.13	.05	.26
941	Spotted Sucker	14.8	74.4	3.5	1.14	.05	.10	.02	.17
942	Spotted Sucker	16.6	77.7	.2	.10	.01	.01	.01	.03
943	3 Northern Pike	8.5" to 23.4"	77.2	.8	2.65	.10	.08	.05	.14
944	2 Largemouth Bass	12.2" to 12.3"	75.9	.8	1.21	.07	.11	.02	.20
945	1 Largemouth Bass	14.9	74.8	1.4	2.03	.11	.13	.04	.28
946	6 Largemouth Bass	6.9" to 10.5"	74.8	.6	1.24	.05	.08	.03	.16
947	Northern Redhorse	17.5	71.9	5.4	5.73	.34	.54	.48	1.36
948	3 Northern Redhorse	12.2" to 14.9"	72.9	4.2	2.94	.10	.11	.08	.29
949	19 Pumpkinseed	3.3" to 6.8"	75.5	1.1	1.04	.04	.05	.02	.11
950	Bowfin	22.5	76.6	1.2	.65	.04	.04	.02	.10
951	Bowfin	22.2	76.5	1.0	.49	.03	.04	.01	.08
952	5 Bluegills	6.2" to 7.8"	77.2	1.2	1.39	.05	.05	.02	.12
953	21 Bluegills	3.5" to 6.0"	76.3	1.3	.66	.03	.07	.03	.13
954	7 Bl. Crappies	7.2" to 11.0"	73.4	2.3	2.29	.04	.11	.03	.18
955	Carp	22.2	61.4	17.2	5.40	.97	.57	.01	1.55
956	Carp	20.8	60.6	17.4	3.51	.29	.71	--	1.00
957	Carp	23.1	57.3	21.6	4.24	.35	1.01	--	1.36
958	Carp	17.8	68.5	8.6	5.50	.26	.44	--	.70
959	Carp	15.4	70.4	7.4	3.10	.27	.11	--	.38
Station Average					2.25				.41

LOCATION - VERNON CO. - RIVER MILE 685-686 - STODDARD

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
960	Northern Pike	36.0	74.7	3.3	2.57	.13	.15	.06	.34
961	Northern Pike	21.5	73.0	1.3	1.74	.08	.05	--	.13
966	2 Northern Pike	12.1" to 19.3"	75.2	2.7	1.05	.03	.06	.02	.11
962	Spotted Sucker	16.6	72.5	3.9	1.21	.07	.19	.03	.29
963	Spotted Sucker	15.0	73.1	5.4	1.13	.05	.07	--	.12
964	3 Bl. Crappie	11.2" to 12.1"	71.9	2.5	2.12	.05	.08	.04	.17
965	4 Bl. Crappie	6.7" to 10.4"	72.9	3.2	1.42	.04	.10	.03	.17
967	Smallmouth Bass	12.8	74.3	5.1	1.79	.05	.05	.02	.12
974	14 Bluegill	4.3" to 8.0"	74.5	6.0	1.30	.05	.06	.10	.21
975	23 Pumpkinseed	3.2" to 7.1"	74.9	1.1	.58	.03	.04	.03	.10
976	Largemouth Bass	16.8	75.8	2.9	.91	.04	.09	.05	.18
977	Largemouth Bass	15.0	77.7	.20	.29	.02	.01	.01	.04
978	3 Largemouth Bass	12.3" to 13.6"	75.8	0.5	1.20	.05	.05	.02	.12
979	4 Largemouth Bass	4.2" to 12.3"	75.8	3.7	.77	.05	.02	.02	.09
980	Br. Bullhead	13.1	79.6	3.9	.53	.07	.02	--	.09
981	Carp	26.1	62.1	14.5	5.59	.75	.43	.42	1.60
982	Carp	23.2	67.5	11.6	3.12	.27	.09	--	.36
983	Carp	22.0	74.8	6.1	.59	.06	.06	--	.12
984	Carp	18.4	64.6	10.9	1.36	.13	.06	--	.19
985	Carp	16.1	64.7	9.3	2.41	.14	.07	--	.21
986	Bowfin	21.9	79.2	4.5	--	--	.02	--	.02
987	Bowfin	16.9	79.0	2.9	.54	.06	--	--	.06
Station Average					1.53				.22

LOCATION - VERNON - RIVER MILE 677-678 - GENOA

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
988	Northern Pike	26.3	75.1	3.9	3.18	.10	.10	.06	.26
989	Northern Pike	27.4	75.1	2.3	1.61	.06	.05	.02	.13
990	Drum	21.2	72.8	6.0	2.17	.07	.07	.04	.18
991	Drum	14.5	69.7	7.6	2.90	.04	.05	.04	.16
992	Northern Redhorse	16.3	72.1	5.8	3.00	.05	.08	.05	.18
993	Quillback	18.1	68.5	7.2	3.57	.03	.09	.03	.15
994	Quillback	15.9	69.7	5.9	2.22	.04	.07	.04	.15
995	2 L.M. Bass	13.2" to 13.7"	73.4	2.0	2.12	.09	.08	.02	.19
996	2 White Bass	12.5" to 12.6"	70.3	4.2	2.65	.06	.07	.02	.15
997	5 White Bass	5.2" to 11.7"	72.0	3.0	2.51	.04	.08	.02	.14
998	Walleye	15.3	73.4	2.3	2.24	.05	.04	.06	.15
999	5 Walleye	6.0" to 14.8"	73.8	3.0	2.21	.03	.05	--	.08
1000	6 Sauger	6.5" to 12.0"	74.0	2.5	2.95	.05	.06	.03	.14
1001	7 Bl. Crappie	7.4" to 10.7"	61.0	12.5	1.99	.03	.05	.02	.10
1002	Carp	24.5	68.6	8.0	3.38	.06	.06	.08	.20
1003	Carp	20.5	72.6	2.2	2.66	.07	.08	--	.15
1004	Carp	17.0	70.1	8.8	1.69	.07	.04	.01	.12
1005	Carp	13.9	73.0	5.9	1.13	.03	.03	--	.06
Station Average					2.45				.15

RIVER MILE 657-659 - FERRYVILLE

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
1006	2 Bl. Crappie	10.5" to 10.6"	76.2	2.8	.724	.04	.01	--	.05
1007	2 Northern Pike	11.9" to 13.2"	76.5	0.8	.52	.01	.02	--	.03
1008	Walleye	16.3	74.8	5.1	1.25	.05	.03	--	.08
1014	24 Walleye	5.5" to 8.7"	76.3	0.8	.88	.04	.01	--	.05
1009	2 Largemouth Bass	1.7" to 1.9"	75.0	1.2	1.52	.10	.02	.01	.13
1010	4 Largemouth Bass	6.7" to 14.8"	74.7	1.3	.83	.05	.02	.02	.09
1011	6 Bluegills	4.9" to 7.5"	74.2	1.9	.73	.04	.02	--	.06
1012	9 Rock Bass	6.8" to 9.6"	72.9	1.2	1.08	.06	.02	--	.08
1013	4 White Bass	5.7" to 12.2"	72.0	4.1	3.02	.09	.05	--	.14
1015	4 Carp	8.0" to 10.3"	76.0	2.4	1.13	.02	.05	--	.07
1016	2 Carp	11.7" to 12.0"	73.6	4.8	.90	.02	.04	--	.06
1017	Carp	22.0	59.2	15.3	2.78	.05	.14	--	.19
1018	Carp	20.5	65.6	11.4	1.17	.03	.06	--	.09
1019	Carp	19.3	65.4	13.5	1.39	.02	.06	--	.08
1020	Carp	17.2	66.0	7.4	1.15	.02	.06	--	.08
1021	Channel Catfish	13.9	72.3	8.6	1.88	.04	.06	--	.10
1022	2 Flathead Catfish	14.5" to 17.2"	77.9	8.3	1.00	.03	.02	--	.05
Station Average					1.29				.08

RIVER MILE 650-652 - LYNXVILLE

1023	Channel Catfish	18.4	67.9	6.0	2.07	.04	.05	--	.09
1024	3 Northern Redhorse	4.0" to 15.6"	72.0	5.8	2.39	.03	.05	--	.08
1025	4 Largemouth Bass	4.3" to 15.2"	72.4	3.2	2.22	.04	.03	--	.07
1026	3 Bl. Crappie	3.9" to 11.0"	71.7	3.2	3.64	.04	.04	--	.08
1027	8 Sauger	5.0" to 13.8"	73.6	2.1	3.64	.03	.04	--	.07
1028	13 Rock Bass	4.2" to 8.7"	74.1	4.7	1.14	.02	.01	--	.03
1029	7 White Bass	5.4" to 12.5"	72.4	5.8	3.82	.04	.05	--	.09
1030	Carp	24.7	68.5	10.0	5.80	.07	.08	--	.15
1031	Carp	21.8	67.8	11.4	3.75	.05	.15	--	.20
1032	Carp	19.6	66.5	10.6	3.67	.05	.14	--	.19
1033	Carp	16.21	69.0	9.1	2.08	.03	.06	--	.09
Station Average					3.11				.10

RIVER MILE 632-636 - PRAIRIE DU CHIEN

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
1034	Drum	14.0	70.9	8.3	2.93	.04	.04	--	.08
1035	Spotted Sucker	13.1	73.2	4.0	.84	.02	.03	--	.05
1036	Carp	19.0	71.7	6.0	1.17	.04	.03	--	.07
1037	Carp	17.1	72.7	6.1	1.77	.04	.05	--	.09
1038	Carp	23.3	60.8	19.7	2.66	.07	.17	--	.24
1039	Carp	21.5	69.6	10.1	2.26	.05	.14	--	.19
1040	Carp	23.6	70.9	7.6	3.80	.04	.12	--	.16
1041	3 Bl. Crappie	5.5" to 10.2"	74.6	3.0	2.00	.08	.06	.02	.16
1042	4 L.M. Bass	8.0" to 14.4"	74.6	4.8	1.24	.04	.04	.01	.09
1043	2 White Bass	5.6" to 14.1"	72.6	6.7	3.28	.10	.11	.01	.22
1044	Quillback	18.0	67.9	9.6	3.74	.07	.17	.01	.25
1045	White Carp	21.5	71.0	6.4	2.01	.13	.27	.14	.54
1046	Bigmouth Buffalo	22.7	68.8	8.7	2.99	.09	.20	--	.29
1047	Smallmouth Buffalo	19.3	60.7	12.7	.16	.08	.16	--	.24
1048	Smallmouth Buffalo	17.4	67.6	9.5	2.71	.08	.13	--	.21
1049	Smallmouth Buffalo	16.0	70.9	6.0	2.56	.09	.03	--	.12
Station Average					2.25				.19

ABOVE WISCONSIN RIVER - RIVER MILE 636-638

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
1116	Northern Pike	28.2	76.1	1.7	1.56	.066	.031	--	.097
1117	Northern Pike	28.2	75.2	3.9	2.07	.066	.055	--	.121
1118	Northern Pike	24.3	75.6	2.9	1.14	.073	.036	.009	.118
1119	Northern Pike	32.7	74.1	2.6	1.67	.093	.067	.023	.183
1120	S.M. Buffalo	16.5	62.0	9.8	1.63	.084	.059	.014	.157
1121	Flathead Catfish	14.1	77.8	4.7	1.52	.063	.046	.017	.126
1122	Northern Redhorse	16.4	71.5	5.7	1.43	.047	.041	.018	.106
1123	3 Northern Redhorse	9.8" to 12.6"	73.4	4.2	.841	.030	.022	.012	.064
1124	3 Largemouth Bass	7.9" to 8.5"	74.7	1.7	.570	.029	.010	.009	.048
1125	7 White Bass	5.4" to 13.1"	72.8	2.5	1.87	.065	.031	.009	.105
1126	4 Black Crappie	9.4" to 11.4"	73.1	3.6	1.24	.054	.030	.011	.095
1127	4 Bluegill	4.5" to 8.0"	72.0	3.4	.732	.067	.018	.008	.093
1128	Drum	15.1	71.3	5.4	1.74	.084	.048	.012	.144
1129	5 Drum	4.9" to 12.8"	70.2	5.2	1.10	.065	.021	--	.086
1130	Bowfin	16.9	74.9	4.0	.250	.024	.014	--	.038
1131	Bowfin	26.8	73.0	3.6	1.13	.058	.027	.009	.094
1132	Carp	27.2	63.3	8.9	5.15	.139	.102	--	.241
1133	Carp	21.1	68.7	7.0	2.56	.112	.073	.010	.195
1134	Carp	18.6	66.1	8.9	1.53	.065	.047	--	.112
1135	Carp	25.3	63.2	13.1	3.58	.092	.082	--	.174
Station Average					1.66				.120

BELOW WISCONSIN RIVER - RIVER MILE 627-628

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
1098	Carp Sucker	19.8	71.4	4.9	3.0	.035	.023	.016	.074
1099	Smallmouth Buffalo	19.7	67.9	8.3	1.28	.084	.059	.022	.165
1100	Northern Pike	20.1	74.7	1.1	.532	.034	.022	--	.056
1101	3 Northern Redhorse	5.6" to 17.9"	65.1	10.7	4.17	.126	.077	.046	.249
1102	Spotted Sucker	16.2	73.2	2.3	.656	.027	.021	--	.048
1103	7 White Bass	5.6" to 13.4"	72.8	2.4	.887	.053	--	--	.053
1104	4 Sauger	8.3" to 15.8"	74.0	1.8	.872	.047	.018	.009	.074
1105	Drum	15.9	62.8	14.4	1.82	.086	.022	--	.108
1106	3 Drum	6.0" to 14.3"	67.8	10.3	1.41	.064	.031	--	.095
1107	3 S.M. Bass	7.6" to 11.9"	73.2	2.2	.829	.045	.019	--	.064
1108	Largemouth Bass	15.1	74.5	1.6	.509	.049	.011	--	.060
1109	8 Bluegill	4.1" to 6.6"	74.5	2.5	.359	.029	.008	--	.037
1110	3 Black Crappie	5.7" to 10.8"	72.8	2.9	.765	.043	.012	--	.055
1111	Bowfin	20.1	73.2	4.4	.268	.019	.010	--	.029
1112	Carp	25.6	61.0	14.2	.123	.123	.064	--	.187
1113	Carp	20.1	64.1	12.7	3.18	.092	.064	--	.156
1114	Carp	19.5	68.4	7.6	1.35	.115	.060	--	.175
1115	Carp	19.1	68.2	6.7	1.08	.061	.039	.011	.111
Station Average					1.28				.100

CASSVILLE RIVER MILE 606-608

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
1066	Northern Pike	22.2	75.0	2.0	1.04	.054	.045	.013	.112
1067	Smallmouth Bass	12.6	74.1	2.4	.931	.046	.022	---	.068
1068	Drum	13.9	70.4	7.5	1.07	.045	.018	---	.063
1069	Northern Redhorse	17.6	71.5	5.8	4.90	.094	.071	.050	.215
1070	Golden Redhorse	17.4	73.0	3.7	1.12	.066	.040	.036	.142
1071	14 Saugers	6.0" to 9.7"	77.3	.7	.469	.023	.009	---	.032
1072	11 White Bass	5.1" to 10.6"	74.8	2.3	.905	.045	.017	---	.062
1073	Carp	19.5	66.6	9.8	2.65	.093	.040	---	.133
1074	Carp	23.3	64.4	13.0	3.12	.092	.053	---	.145
1075	Carp	15.7	70.5	6.8	1.15	.054	.016	---	.070
1076	Carp	14.5	69.8	8.5	.948	.045	.019	---	.064
1077	White Carp	18.7	68.5	11.8	1.38	.159	.111	.070	.340
1078	White Carp	16.7	69.0	11.1	3.18	.079	.096	.070	.245
1079	White Carp	15.3	72.0	3.2	1.78	.165	.188	.185	.538
Station Average					1.76				.159

DUBUQUE RIVER MILE 583.2-583.5

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
1050	2 Drum		65.2	9.0	2.19	.08	.08	.01	.17
1051	Northern Redhorse	17.5	72.1	7.4	3.43	.123	.105	.039	.267
1052	Northern Redhorse	17.9	69.1	8.5	2.06	.077	.119	.039	.235
1053	2 Sauger	14.8" - 9.3"	72.9	5.7	2.26	.068	.045	.008	.121
1054	S.M. Buffalo	17.7	69.3	8.0	1.26	.060	.074	.016	.150
1055	S.M. Buffalo	18.9	65.6	10.4	1.48	.070	.091	.051	.212
1056	S.M. Buffalo	15.0	70.4	7.5	.875	.048	.048	.006	.102
1057	Carp	23.1	65.9	9.0	1.54	.080	.103	.060	.243
1058	Carp	24.9	69.3	7.7	1.48	.077	.076	.038	.191
1059	Carp	19.5	68.7	10.1	2.68	.085	.126	.052	.263
1060	Carp	17.0	71.4	5.9	.926	.052	.038	.006	.096
1061	Largemouth Bass	18.5	75.2	3.0	.326	.035	.025	.022	.082
1062	3 IM Bass	4.8" to 14.5"	75.2	1.0	.647	.073	.033	.015	.121
1063	3 White Crappie	9.7" to 12.2"	74.2	1.1	.696	.038	.015	--	.053
1064	3 Channel Cats	14.9" to 17.7"	69.1	10.9	1.82	.132	.063	--	.195
1065	4 Channel Cats	13.1" to 14.3"	71.7	9.9	1.21	.065	.038	--	.103
Station Average					1.55				.163

WISCONSIN LINE RIVER MILE 580.7-581.5

No.	Species	Size in Inches	% H ₂ O	% Fat	PCB	DDE	DDD	DDT	Total DDT
1080	Walleye	27.5	73.0	3.8	3.47	.122	.069	.027	.218
1081	Walleye	24.8	71.7	5.1	2.51	.087	.079	.043	.209
1082	Walleye	22.5	71.5	4.2	2.97	.106	.093	.048	.247
1083	Walleye	21.2	72.0	4.8	3.96	.135	.099	.046	.280
1084	4 Walleye	14.0" to 16.5"	72.7	2.8	1.54	.087	.045	.013	.145
1085	2 Channel Cats	7.9" to 15.5"	72.0	10.7	1.10	.069	.057	.059	.185
1086	Golden Redhorse	21.1	72.2	3.0	1.20	.070	.056	.018	.144
1087	2 Northern Redhorse	15" - 16.3"	67.9	8.1	1.10	.069	.048	.016	.133
1088	3 S.M. Buffalo	6.5" to 14.7"	69.7	6.1	1.21	.063	.041	.009	.113
1089	5 Drum	6" to 14.7"	70.0	9.0	2.53	.107	.061	.029	.197
1090	5 Black Crappie	8.5" to 11.5"	72.5	3.6	1.11	.054	.038	.015	.107
1091	White Bass	13.8	70.3	5.1	2.80	.075	.081	.023	.179
1092	3 White Bass	12.1" to 12.7"	71.2	4.6	2.63	.153	.064	.015	.232
1093	6 White Bass	5.8" to 11.6"	72.9	3.5	1.40	.078	.036	.009	.123
1094	Carp	18.8	72.5	4.9	1.46	.087	.035	--	.122
1095	Carp	22.2	67.2	8.1	1.55	.081	.048	--	.129
1096	Carp	23.8	69.3	7.8	1.39	.036	.030	--	.066
1097	Carp	17.6	71.9	3.7	1.28	.072	.031	--	.103
Station Average					1.95				.166