



*Transmitted Via First Class Mail*

April 1, 2003

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Re: Sheboygan River and Harbor Annual IMP Report  
Project #: 176.33.008 #2

Dear John:

Enclosed please find three copies of the 2002 Annual Interim Monitoring Report for the Sheboygan River and Harbor site. If you have any questions, or want to discuss the information presented in the report, please contact me at your convenience.

Sincerely,

BLASLAND, BOUCK & LEE, INC.

David W. Hohreiter, Ph.D.  
Principal Scientist

LDA/amm  
Enclosures

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# REPORT

*2002 Interim  
Monitoring Program Annual Report  
Sheboygan River and Harbor*

**Prepared by BBL, Inc. on Behalf of  
Tecumseh Products Company**

**April 2003**

REPORT

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**April 2003**

**BBL**<sup>®</sup>  
BLASLAND, BOUCK & LEE, INC.  
*engineers & scientists*

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# 1. Introduction

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This report describes the resident fish monitoring and the caged fish study completed as part of the Interim Monitoring Program (IMP) for the Sheboygan River and Harbor (the Site). These activities were completed in accordance with the IMP Work Plan/QAPP (BBL, 1996), which was developed in consultation with the U.S. Environmental Protection Agency (USEPA) and Wisconsin Department of Natural Resources (WDNR).

The stated objectives of the IMP are to:

1. provide data to evaluate the effectiveness of remediation;
2. generate data to allow for periodic re-evaluation of potential human exposure and associated risks; and
3. establish baseline data to be used in conjunction with the data from the long-term monitoring program that will be established following implementation of the selected remedy to evaluate the overall effectiveness of remediation.

A description of the IMP biota sampling activities completed in 2002 and a summary of the results are presented in the following sections.

## 2. Resident Fish Monitoring

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### 2.1 Field Sampling Activities

Consistent with previous IMP sampling efforts, resident fish were collected in 2002 from three reaches of the Sheboygan River, specifically: 1) in the vicinity of Rochester Park, 2) between Kohler's River Bend Dam and Waelderhaus Dam, and 3) in the vicinity of Kiwanis Park. Target species for each reach were twelve smallmouth bass (*Micropterus dolomieu*) and twenty-five composite samples (n = 2 fish per composite) of juvenile white suckers (*Catostomus commersoni*). All samples were analyzed for PCBs using USEPA Method 8082. Analytical results are presented in the attached tables.

Complete samples of adult smallmouth bass and juvenile white suckers were collected from each location using electrofishing equipment on September 9 through September 11, 2002. A summary of smallmouth bass and juvenile white sucker analytical data is presented in the following sections.

### 2.2 Analytical Results

#### *Smallmouth Bass*

The 2002 smallmouth bass PCB data are presented in Tables 1 and 2. The mean total PCB concentration in Rochester Park smallmouth bass (2.2 mg/kg) is similar to concentrations reported in 2001 (2.1 mg/kg) and is lower than concentrations reported in any of the previous Alternative Specific Remedial Investigation (ASRI) or IMP sampling events, and is statistically significantly lower than concentrations reported in 1991 (10.3 mg/kg), 1995 (9.6 mg/kg) and 1998 (10.7 mg/kg) (ANOVA, Scheffe,  $p < 0.05$ ). The mean total PCB concentration in 2002 smallmouth bass from between the Kohler dams (1.1 mg/kg) is the same as the mean total PCB concentration reported in 2001 (1.1 mg/kg), and is the same or lower than concentrations previously reported for ASRI and IMP sampling events at this location. Similarly, the 2002 Kiwanis Park smallmouth bass mean total PCB concentration (0.82 mg/kg) is lower than concentrations reported in any of the previous ASRI and IMP sampling events, and is statistically significantly lower than mean total PCB concentrations reported from the early to mid-1990s (1991 through 1996) (ANOVA, Scheffe,  $p < 0.05$ ). Smallmouth bass lipid-normalized PCB data generally follow the same trend as described for total PCBs (wet-weight).

Figures 1 (A, B and C) and 2 (A, B, and C) graphically depict temporal trends in smallmouth bass mean total PCB and mean lipid-normalized PCB concentrations, respectively. Smallmouth bass collected in the vicinity of Rochester Park show an apparent decreasing temporal trend in total PCB and lipid-normalized PCB concentrations from 1998 onward (Figure 1A). Figures 1B and 1C show an apparent overall decreasing trend in smallmouth bass total PCB concentrations between the Kohler dams and in the vicinity of Kiwanis Park.

#### *White Sucker*

White sucker PCB data are presented in Tables 3 and 4. The mean total PCB concentration in 2002 white suckers collected from Rochester Park (2.7 mg/kg) is statistically significantly lower than concentrations reported in 2001 (18.3 mg/kg) and in any of the previous IMP sampling events (ANOVA, Scheffe,  $p < 0.05$ ). The mean total PCB concentration in white suckers from between the Kohler dams (1.9 mg/kg) is lower than concentrations reported in 2001 (3.4 mg/kg), and is statistically significantly lower than concentrations reported in any of the previous years (ANOVA, Scheffe,  $p < 0.05$ ). For Kiwanis Park white suckers, the 2002 mean total

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PCB concentration (1.4 mg/kg) is statistically significantly lower than concentrations reported during the first two years of the IMP (1994 and 1995), and in 2000 (ANOVA, Scheffe,  $p < 0.05$ ). White sucker lipid-normalized PCB concentrations follow the same general trend as described for total PCBs (wet-weight).

Temporal trends in juvenile white sucker PCB concentrations are graphically presented in Figures 3 (A, B and C) and 4 (A, B and C). Figures 3A and 4A show no apparent overall trend in mean total PCB and mean lipid-normalized PCB concentrations in white suckers collected from the vicinity of Rochester Park. However, concentrations reported from this location in 2002 are lower than concentrations reported in any of the previous IMP sampling events. Figures 3B and 3C may indicate an apparent decreasing trend in mean total PCB concentrations in white suckers collected between the Kohler dams and in the vicinity of Kiwanis Park.

## 3. Caged Fish Study

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### 3.1 Field Sampling Activities

The IMP caged fish studies were conducted as described in the IMP Work Plan (BBL, 1996). The caged fish studies are designed to provide a relative indicator of PCB availability. These study results do not provide information that is directly useful for evaluating potential risks to human health.

The 2002 caged fish studies were consistent with previous IMP caged fish studies and included the following five monitoring locations.

1. A background location above Sheboygan Falls dam corresponding to water-column monitoring location W-1 (IMP Station 1).
2. Immediately downstream of sediment area 19 and near water-column monitoring location W-13B (IMP Station 2).
3. Immediately upstream of River Bend Dam near water-column monitoring location W-3, and immediately downstream of sediment areas 28 and 31 (IMP Station 3).
4. Immediately upstream of Waelderhaus Dam, near water-column monitoring location W-4, and immediately downstream of sediment areas 45 and 46 (IMP Station 4).
5. In the vicinity of the I-43 bridge and the USGS gaging station, near water-column monitoring location W-5 (IMP Station 5).

Fish cages (two cages per location) were placed in the River on September 25, 2002. Each cage contained approximately 250 fathead minnows (*Pimephales promelas*). Prior to placing minnows into cages, two pre-exposure minnow samples were obtained and submitted to EnChem Laboratory, Madison, Wisconsin for analyses of PCB/lipid content to confirm that the study fish had non-detectable PCB concentrations.

Three-week exposure samples were obtained on October 15, 2002, and 6-week exposure samples were taken on November 6, 2002. During each sampling event, two composite samples were obtained from each cage, for a total of four samples per sampling station.

### 3.2 Analytical Results

The results of PCB and lipid analyses for the 2002 caged fish study are presented in Table 5. Total mean PCB concentrations at the four non-background locations (Stations 2 to 5) ranged from 0.45 mg/kg to 0.50 mg/kg for the 3-week samples, and mean lipid-normalized concentrations ranged from 23 to 28 mg/kg lipid. Total mean PCB concentrations at the four non-background locations for the 6-week samples ranged from 0.39 mg/kg to 0.51 mg/kg, and mean lipid-normalized concentrations ranged from 30 mg/kg to 36 mg/kg lipid.

Table 6 presents a summary of all the 6-week caged fish results, including historic ASRI data for IMP Stations 1 and 2. For all stations (with the exception of the upstream background location, Station 1) the 2002 6-week total mean PCB concentrations are lower than concentrations reported for ASRI and IMP sampling events from 1994



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to 2000, and are the same or lower than concentrations reported in 2001. At Station 2 (the only non-background caged fish location continually monitored since 1989), the 2002 total mean PCB concentration is significantly less than the 1989 baseline concentration and total mean PCB concentrations reported from 1995 through 1999 (ANOVA, Scheffe,  $p < 0.05$ ). At Stations 3 and 4, mean total PCB concentrations reported in 2002 caged fish are similar to concentrations reported in 2001, but are generally statistically significantly lower than concentrations reported in years prior to 2000 (ANOVA, Scheffe,  $p < 0.05$ ). At Station 5, the 2002 6-week caged fish total mean PCB concentration (0.51 mg/kg) is statistically significantly lower than concentrations reported in 1994 through 2000 (ANOVA, Scheffe,  $p < 0.05$ ), and is similar to total mean PCB concentrations reported in 2001 (0.58 mg/kg). Lipid-normalized PCB concentrations follow the same general trend as total PCBs (wet-weight).

Figures 5 (A, B, C, and D) and 6 (A, B, C, and D) graphically depict temporal trends in caged fish mean total PCB and lipid-normalized PCB concentrations. These figures show an apparent decreasing trend in mean total PCB and mean lipid-normalized concentrations from Stations 2 through 5 from 1999 onward.

## 4. Conclusions

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The mean total PCB concentrations reported for the 2002 IMP resident and caged fish studies are similar to PCB concentrations reported for the 2001 IMP sampling event. Specifically, the 2002 smallmouth bass mean total PCB concentrations are similar to concentrations reported in 2001 and are the lowest smallmouth bass concentrations reported to date. The 2002 white sucker PCB concentrations are also similar to the concentrations reported in 2001, with the exception of the mean total PCB concentration reported in white suckers from Rochester Park (2.7 mg/kg), which is statistically significantly lower than the mean concentration reported in 2001 (18.3 mg/kg). Caged fish mean total PCB concentrations are also similar to concentrations reported in 2001 and are among the lowest caged fish PCB concentrations reported to date.

TABLE 1

SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM

## 2002 SMALLMOUTH BASS MONITORING RESULTS (1)

Collection Dates: September 9-11, 2002

Sample	Length (cm)	Weight (g)	Lipid (%)	Total PCB (2) Method 8082 (mg/kg)	Lipid-Normalized PCB (2) (mg/kg-lipid)
<b>ROCHESTER PARK</b>					
FB-416	31.3	600	0.72	2.2	306
FB-417	25.5	260	0.33	2.2	667
FB-418	23.5	210	0.39	2.8	718
FB-419	26.0	310	1.02	3.3	324
FB-420	25.2	270	0.66	3.3	500
FB-421	28.6	430	0.62	1.5	242
FB-422	30.2	460	0.64	1.2	188
FB-423	32.5	590	0.43	1.7	395
FB-424	33.0	800	0.66	1.0	152
FB-425	35.6	830	0.71	1.8	254
FB-426	36.9	900	0.60	2.9	483
FB-427	38.9	1000	1.16	2.9	250
Mean (3)	30.6	555	0.66	2.2	373
Standard Deviation	5.0	274	0.24	0.8	184
<b>BETWEEN KOHLER DAMS</b>					
FB-440	23.9	250	0.64	2.0	313
FB-441	24.4	250	0.60	0.95	158
FB-442	25.3	370	0.60	0.62	103
FB-443	25.2	300	0.39	0.98	251
FB-444	26.0	390	1.03	1.2	117
FB-445	28.4	400	0.48	0.67	140
FB-446	28.2	430	0.64	0.81	127
FB-447	28.9	430	0.75	1.7	227
FB-448	30.2	530	0.91	1.3	143
FB-449	31.2	560	0.65	0.74	114
FB-450	32.1	590	0.67	0.72	107
FB-451	40.9	1100	0.77	1.1	143
Mean (3)	28.7	467	0.68	1.1	162
Standard Deviation	4.7	228	0.17	0.43	66
<b>KIWANIS PARK</b>					
FB-428	32.0	560	0.48	0.85	177
FB-429	31.7	630	0.69	0.99	143
FB-430	30.0	490	0.42	0.53	126
FB-431	34.5	850	0.53	1.0	189
FB-432	33.5	650	0.48	0.94	196
FB-433	35.7	870	0.60	0.64	107
FB-434	32.0	650	0.52	0.88	169
FB-435	28.0	420	0.70	0.97	139
FB-436	27.7	400	0.62	0.76	123
FB-437	31.1	630	0.68	0.65	96
FB-438	32.0	580	0.42	0.93	221
FB-439	29.4	500	0.57	0.72	126
Mean (3)	31.5	603	0.56	0.82	151
Standard Deviation	2.4	147	0.10	0.16	39

## Notes:

(1) Smallmouth bass samples prepared as skin-on, scales-off fillet.

(2) PCB concentrations reported on a wet-weight basis.

(3) Arithmetic mean.

g = grams

cm = centimeters

mg/kg = milligrams per kilogram

mg/kg-lipid = (total PCB/lipid)\*100

ND = Non-detect

TABLE 2  
SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM

SUMMARY OF SMALLMOUTH BASS MONITORING RESULTS (1,2,3)  
(1990 - 1996, 1998 - 2002)

Location/Species	Year	Mean Total PCB (mg/kg) (4)	Mean Lipid-Normalized PCB (mg/kg-lipid) (4)
Rochester Park	1990	6.2 (ab)	916 (ab)
	1991	10.3 (a)	969 (ab)
	1992	6.3 (ab)	600 (ab)
	1993	4.6 (ab)	450 (ab)
	1994	7.5 (ab)	875 (ab)
	1995	9.6 (a)	854 (ab)
	1996	3.4 (ab)	341 (b)
	1998	10.7 (a)	1294 (a)
	1999	7.6 (ab)	1153 (ab)
	2000	7.1 (ab)	674 (ab)
	2001	2.1 (b)	333 (b)
	2002	2.2 (b)	365 (ab)
Between Kohler Dams	1990	4.7 (abc)	571 (ab)
	1991	7.3 (a)	848 (a)
	1992	5.2 (ab)	417 (ab)
	1993	5.4 (ab)	562 (ab)
	1994	5.6 (ab)	523 (ab)
	1995	3.6 (abc)	335 (bcd)
	1996	3.9 (abc)	361 (abcd)
	1998	3.1 (bcd)	416 (abc)
	1999	2 (cd)	322 (bcd)
	2000	4.2 (abc)	459 (ab)
	2001	1.1 (d)	152 (d)
	2002	1.1 (d)	154 (cd)
Kiwanis Park	1990	2.3 (abcde)	217 (bc)
	1991	3.7 (ac)	355 (ab)
	1992	2.4 (acd)	283 (b)
	1993	3 (c)	733 (a)
	1994	2.5 (acd)	219 (bc)
	1995	2 (abcd)	163 (bc)
	1996	2.3 (acd)	249 (bc)
	1998	1.9 (abcde)	186 (bc)
	1999	2 (abcde)	248 (bc)
	2000	1.3 (bde)	146 (bc)
	2001	0.84 (be)	85 (c)
	2002	0.82 (e)	151 (bc)

Notes:

(1) Smallmouth bass samples prepared as skin-on, scales-off filets.

(2) Arithmetic Mean.

(3) Samples were not collected in 1997. Scientific Collectors Permit Application was not approved.

(4) PCB concentrations reported on a wet-weight basis.

mg/kg-lipid = (total PCB/lipid)\*100

The letters in parentheses denoting statistical differences (for each analysis) apply to the data presented in each column for each location. Within each location, means with different letters are significantly different (ANOVA, Scheffe, 95% Confidence).

TABLE 3

SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM

2002 WHITE SUCKER MONITORING RESULTS (1)

Collection Dates: September 9 - 11, 2002

Sample	Length #1 (cm)	Length #2 (cm)	Length #3 (cm)	Weight #1 (g)	Weight #2 (g)	Weight #3 (g)	Total Sample Weight (g)	Lipid (%)	Total PCB (2) Method 8082 (mg/kg)	Lipid-Normalized PCB (2) (mg/kg-lipid)
ROCHESTER PARK										
FK-393	7.0	7.7	NA	3.4	4.2	NA	7.6	1.22	2.6	213
FK-394	7.6	7.6	NA	4.5	4.4	NA	8.9	1.41	3.2	227
FK-395	7.9	8.3	NA	5.0	5.9	NA	10.9	1.86	3.2	172
FK-396	6.9	7.5	NA	3.6	3.9	NA	7.5	1.09	3.9	358
FK-397	10.2	10.2	NA	11.1	11.5	NA	22.6	1.22	4.1	336
FK-398	9.0	8.9	NA	7.1	7.6	NA	14.7	1.63	1.2	74
FK-399	7.9	8.7	NA	5.0	6.8	NA	11.8	1.21	3.8	314
FK-400	8.1	8.3	NA	5.5	5.9	NA	11.4	1.12	1.4	125
FK-401	9.0	8.4	NA	6.7	5.9	NA	12.6	1.13	1.9	168
FK-402	7.9	8.1	NA	4.6	5.4	NA	10.0	0.93	3.4	366
FK-403	9.0	8.3	NA	7.6	6.2	NA	13.8	1.35	2.5	185
FK-404	6.9	7.6	NA	3.5	4.4	NA	7.9	0.93	3.8	409
FK-405	8.0	8.0	NA	5.3	5.4	NA	10.7	1.84	1.6	87
FK-406	9.5	8.9	NA	9.0	7.0	NA	16.0	1.56	1.8	115
FK-407	8.6	8.5	NA	7.1	6.2	NA	13.3	2.08	4.4	212
FK-408	7.5	7.2	NA	4.1	4.1	NA	8.2	1.33	3.9	293
FK-409	7.0	7.7	NA	3.5	4.7	NA	8.2	1.01	2.1	208
FK-410	7.8	7.7	NA	4.7	4.9	NA	9.6	1.18	3.2	271
FK-411	9.1	9.6	NA	8.8	9.2	NA	18.0	1.47	1.7	116
FK-412	10.4	10	NA	11.8	11.3	NA	23.1	1.24	2.1	169
FK-413	10.5	9.8	NA	12	10.2	NA	22.2	1.61	1.6	99
FK-414	8.7	8.3	NA	7.6	6.1	NA	13.7	1.23	1.5	122
FK-415	6.2	7.1	5.8	2.6	3.8	1.9	6.4	1.57	2.9	185
FK-416	6.5	6.5	6.7	2.3	2.7	3.1	5.0	0.90	2.2	244
FK-417	6.6	6.8	7.0	3.0	2.9	2.9	5.9	1.87	3.4	182
Mean (3)	8.2	8.2	6.5	6.0	6.0	2.6	12.0	1.36	2.7	210
Standard Deviation	1.2	1.0	0.6	2.8	2.4	0.6	5.1	0.32	1.0	94

TABLE 3

SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM2002 WHITE SUCKER MONITORING RESULTS (1)  
Collection Dates: September 9 - 11, 2002

Sample	Length #1 (cm)	Length #2 (cm)	Length #3 (cm)	Weight #1 (g)	Weight #2 (g)	Weight #3 (g)	Total Sample Weight (g)	Lipid (%)	Total PCB (2) Method 8082 (mg/kg)	Lipid-Normalized PCB (2) (mg/kg-lipid)
BETWEEN KOHLER DAMS										
FK-418	7.5	7.9	NA	4.3	4.8	NA	9.1	1.11	2.8	252
FK-419	7.7	7.9	NA	4.5	4.8	NA	9.3	1.15	2.0	174
FK-420	8.4	8.3	NA	5.8	5.7	NA	11.5	1.19	1.5	126
FK-421	8.2	8.4	NA	5.6	5.7	NA	11.3	1.46	1.9	130
FK-422	8.6	8.5	NA	6.1	6.3	NA	12.4	1.44	3.8	264
FK-423	9.1	8.6	NA	6.7	6.0	NA	12.7	1.01	1.6	158
FK-424	9.0	8.0	NA	7.5	6.6	NA	14.1	1.36	1.6	118
FK-425	8.1	7.5	NA	5.0	4.8	NA	9.8	1.85	2.9	157
FK-426	7.8	8.0	7.1	4.1	4.6	4.1	8.7	1.13	1.4	124
FK-427	8.1	8.4	NA	5.1	5.8	NA	10.9	1.43	1.4	98
FK-428	9.1	9.4	NA	7.5	7.6	NA	15.1	1.49	2.3	154
FK-429	7.5	7.6	7.7	4.2	4.4	4.3	8.6	0.97	1.1	113
FK-430	9.2	9.4	NA	6.9	7.4	NA	14.3	1.02	1.4	137
FK-431	9.1	9.8	NA	7.6	7.7	NA	15.3	0.89	1.8	202
FK-432	7.9	7.4	8.0	4.0	3.7	4.8	12.5	1.14	1.2	105
FK-433	7.9	7.6	NA	4.6	4.5	NA	9.1	0.97	1.5	155
FK-434	7.8	8.2	NA	4.4	5.4	NA	9.8	1.07	1.6	150
FK-435	8.9	9.4	NA	6.8	8.0	NA	14.8	0.90	2.1	233
FK-436	9.5	9.8	NA	8.4	10.0	NA	18.4	1.46	1.6	110
FK-437	9.9	10.5	NA	9.8	10.9	NA	20.7	1.33	1.7	128
FK-438	10.0	9.9	NA	10.2	8.8	NA	19.0	1.60	2.2	138
FK-439	12.0	11.0	NA	17.0	12.9	NA	29.9	1.19	1.2	101
FK-440	9.4	10.5	NA	10.2	11.4	NA	21.6	1.80	2.7	150
FK-441	9.2	9.4	NA	8.2	8.4	NA	16.6	1.39	2.0	144
FK-442	10.0	9.4	NA	8.8	7.7	NA	16.5	1.00	2.2	220
Mean (3)	8.8	8.8	7.6	6.9	7.0	4.4	14.1	1.25	1.9	154
Standard Deviation	1.0	1.0	0.5	2.9	2.4	0.4	5.0	0.27	0.6	47

TABLE 3

SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM2002 WHITE SUCKER MONITORING RESULTS (1)  
Collection Dates: September 9 - 11, 2002

Sample	Length #1 (cm)	Length #2 (cm)	Length #3 (cm)	Weight #1 (g)	Weight #2 (g)	Weight #3 (g)	Total Sample Weight (g)	Lipid (%)	Total PCB (2) Method 8082 (mg/kg)	Lipid-Normalized PCB (2) (mg/kg-lipid)
KIWANIS PARK										
FK-443	9.8	10.0	NA	9.4	10.5	NA	19.9	1.42	1.2	85
FK-444	9.2	8.9	NA	8.8	7.9	NA	16.7	1.83	1.5	82
FK-445	8.7	8.2	NA	7.2	5.9	NA	13.1	1.44	0.97	67
FK-446	8.9	9.3	NA	7.4	7.6	NA	15.0	1.07	1.1	103
FK-447	9.8	10.5	NA	8.7	10.5	NA	19.2	1.10	0.87	79
FK-448	9.5	8.2	NA	8.5	5.8	NA	14.3	1.76	1.1	63
FK-449	8.0	8.0	NA	4.8	4.7	NA	9.5	1.38	1.0	72
FK-450	8.6	8.1	NA	6.4	4.8	NA	11.2	1.09	1.1	101
FK-451	7.6	8.2	NA	4.4	4.8	NA	9.2	1.79	1.5	84
FK-452	7.4	8.0	NA	3.8	4.2	NA	8.0	1.82	1.9	104
FK-453	7.1	7.5	NA	3.3	4.4	NA	7.7	1.73	1.4	81
FK-454	8.0	8.3	NA	4.1	6.0	NA	10.1	1.81	2.0	110
FK-455	7.3	7.4	NA	3.3	3.6	NA	6.9	1.49	1.3	87
FK-456	6.9	6.9	NA	3.0	3.1	NA	6.1	1.33	1.3	98
FK-457	6.6	7.1	NA	2.6	3.6	NA	6.2	1.41	1.7	121
FK-458	6.0	6.5	NA	2.2	2.7	NA	2.2	1.37	1.3	95
FK-459	6.0	6.8	NA	2.1	3.3	NA	5.4	2.67	2.0	75
FK-460	6.8	7.5	NA	3.1	4.3	NA	7.4	1.51	1.6	106
FK-461	8.6	7.5	NA	5.6	4.1	NA	9.7	1.30	1.2	92
FK-462	15.2	14.6	NA	32	32	NA	64.0	1.57	1.1	70
FK-463	17.5	17.2	NA	54.4	56	NA	110.4	1.81	1.5	83
FK-464	16.6	16.9	NA	46.8	49.3	NA	96.1	1.62	1.3	80
FK-465	16.5	15.6	NA	49.8	39.7	NA	89.5	1.25	1.2	96
FK-466	15.1	15.8	NA	35.7	37.9	NA	73.6	1.52	2.6	171
FK-467	17.6	18.3	NA	51.8	63.2	NA	115.0	1.96	2.3	117
Mean (3)	10.0	10.1	NA	14.8	15.2	NA	29.9	1.56	1.4	93
Standard Deviation	3.9	3.8	NA	18.0	18.8	NA	36.7	0.34	0.4	22

TABLE 3

SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM

2002 WHITE SUCKER MONITORING RESULTS (1)

Collection Dates: September 9 - 11, 2002

Notes:

(1) White sucker samples prepared as whole-body composites consisting of two fish per composite sample. Some composite samples consist of three individuals for the purpose of meeting minimum sample mass requirements.

(2) PCB concentrations reported on a wet-weight basis.

(3) Arithmetic mean.

cm= centimeters

g= grams

mg/kg= milligrams per kilogram

mg/kg-lipid = (total PCB/lipid)\*100

NA= Not available



TABLE 4  
SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING RESULTS

SUMMARY OF WHITE SUCKER MONITORING RESULTS (1)  
(1994 - 1996, 1998 - 2002) (2)

Location	Year	Mean Total PCB (mg/kg) (3,4)	Mean Lipid-Normalized PCB (mg/kg-lipid) (3,4)
Rochester Park	1994	7.9 (b)	409 (b)
	1995	7.4 (b)	375 (b)
	1996	8.1 (b)	354 (b)
	1998	18.3 (a)	1091 (a)
	1999	NA	NA
	2000	8.4*	792*
	2001	18.3 (a)	1380 (a)
	2002	2.7 (c)	210 (c)
Between Kohler Dams	1994	8.7 (a)	437 (a)
	1995	6.2 (a)	330 (ab)
	1996	6.1*	242*
	1998	6.8 (a)	349 (a)
	1999	NA	NA
	2000	NA	NA
	2001	3.4 (b)	226 (b)
	2002	1.9 (c)	154 (b)
Kiwanis Park	1994	3.9 (a)	208 (a)
	1995	3.4 (a)	197 (a)
	1996	1.9 (bc)	74 (cd)
	1998	1.3 (d)	53 (c)
	1999	NA	NA
	2000	2.2 (b)	115 (b)
	2001	2.1 (bc)	119 (b)
	2002	1.4 (cd)	93 (c)

Notes:

(1) White sucker samples prepared as whole-body composites consisting of two fish per composite.

(2) Samples were not collected in 1997. Scientific Collectors Permit Application was not approved.

(3) Arithmetic Mean.

(4) PCB concentrations reported on a wet-weight basis.

$$\text{mg/kg-lipid} = (\text{total PCB/lipid}) \times 100$$

\* Only one composite sample collected. Sample is not included in the statistical analysis.

The letters in parentheses denoting statistical differences (for each analysis) apply to the data presented in each column for each location. Within each location, means with different letters are significantly different (ANOVA, Scheffe, 95% Confidence).

TABLE 5

SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM2002 CAGED FISH MONITORING RESULTS (1,2)  
(9/25/02-11/6/02)

Location	Cage No.	Lipid (%)	3-Week Exposure		6-Week Exposure		
			Total PCB (3) (mg/kg)	Lipid-Normalized PCB (3) (mg/kg-lipid)	Lipid (%)	Total PCB (3) (mg/kg)	Lipid-Normalized PCB (3) (mg/kg-lipid)
Station 1	1A	1.41	ND (< 0.050)	1.8	1.37	NA	NA
Upstream of Sheboygan Falls Dam (W-1)	1A	1.74	ND (< 0.050)	1.4	1.25	NA	NA
	1B	1.67	ND (< 0.050)	1.5	1.16	ND (< 0.050)	2.2
	1B	1.81	ND (< 0.050)	1.4	1.21	NA	NA
Arithmetic Mean		1.66	0.025	1.5	1.25	0.025	2.2
Standard Deviation		0.17	0.00	0.19	0.09	0.00	0.00
Station 2	2A	1.76	0.47	27	1.45	0.43	30
Downstream of ASRI capping/armoring and removal areas (W-13B)	2A	1.52	0.4	26	1.54	0.45	29
	2B	1.9	0.49	26	1.52	0.52	34
	2B	1.65	0.5	30	1.47	0.46	31
Arithmetic Mean		1.71	0.47	27	1.50	0.47	31
Standard Deviation		0.16	0.045	2.1	0.04	0.039	2.2
Station 3	3A	2.37	0.49	21	1.28	0.43	34
Upstream of Riverbend Dam (W-3)	3A	1.54	0.40	26	1.22	0.38	31
	3B	1.80	0.38	21	1.43	0.36	25
	3B	1.96	0.51	26	1.30	0.39	30
Arithmetic Mean		1.92	0.45	23	1.31	0.39	30
Standard Deviation		0.35	0.065	3.0	0.09	0.029	3.7
Station 4	4A	2.06	0.63	31	2.25	0.67	30
Upstream of Waelderhaus Dam (W-4)	4A	1.75	0.50	29	2.33	0.78	33
	4B	1.80	0.39	22	0.49	0.16	33
	4B	1.63	0.48	29	1.43	0.41	29
Arithmetic Mean		1.81	0.50	28	1.63	0.51	31
Standard Deviation		0.18	0.099	4.0	0.86	0.28	2.1
Station 5	5A	1.36	0.40	29	1.40	0.48	34
Downstream of USGS Gaging Station (W-5)	5A	1.68	0.49	29	1.13	0.44	39
	5B	1.64	0.44	27	1.43	0.50	35
	5B	1.76	0.49	28	1.50	0.54	36
Arithmetic Mean		1.61	0.46	28	1.37	0.49	36
Standard Deviation		0.17	0.044	1.2	0.16	0.042	2.2

## Notes:

- (1) Whole-body fathead minnow composite samples.  
(2) Two samples of the pre-exposure minnow population were collected and analyzed for PCBs. PCBs were not detected at levels above Aroclor-specific method detection limit (0.05 mg/kg). Lipid content of the samples was 3.40 % and 2.81 %.  
(3) PCB concentrations reported on a wet-weight basis.

$$\text{mg/kg-lipid} = (\text{total PCB/lipid}) * 100$$

Half the detection limit was used to calculate the arithmetic mean and standard deviation for concentrations reported below the analytical detection limit.

NA = not available. Data are not useable due to QC problems (surrogate recoveries were outside control limits for these samples).

TABLE 6

SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAMSUMMARY OF CAGED FISH MONITORING RESULTS (1)  
(6-Week Samples)

Location	YEAR	Mean	Mean	
		Total PCB (mg/kg) (2,3)	PCB/Lipid (mg/kg-lipid) (2,3)	
Station 1 (W-1) Upstream of Sheboygan Falls dam	Phase 1 (9/8/89)	< 0.02	< 1.1	
	Phase 2a (12/21/89)	< 0.035	< 1.5	
	Phase 2b (10/31/90)	< 0.1	< 10	
	Phase 3a (9/1/92)	< 0.03	< 1.2	
	Phase 3b (10/13/92)	< 0.02	< 1.3	
	Phase 4 (IMP) 1994	< 0.05	< 3.0	
	Phase 5 (IMP) 1995	< 0.05	< 1.7	
	Phase 6 (IMP) 1996	< 0.05	< 1.34	
	Phase 7 (IMP) 1997	0.025	1.2	
	Phase 8 (IMP) 1998	< 0.2	< 4.78	
	Phase 9 (IMP) 1999	< 0.05	< 1.8	
	Phase 10 (IMP) 2000	0.093	5.0	
Phase 11 (IMP) 2001	< 0.050	< 1.0		
Phase 12 (IMP) 2002	< 0.050	< 2.0		
Station 2 (W-13B) Downstream of ASRI capping/armoring and removal areas	Phase 1 (9/8/89)	8.4 (a)	690 (a)	
	Phase 2a (12/21/89)	2.0 (cdef)	104 (cd)	
	Phase 2b (10/31/90)	3.23 (abc)	300 (ab)	
	Phase 3a (9/1/92)	7.55 (ab)	222 (bc)	
	Phase 3b (10/13/92)	1.42 (def)	91 (cde)	
	Phase 4 (IMP) 1994	1.1 (efg)	67 (cd)	
	Phase 5 (IMP) 1995	2.2 (bcdef)	84 (cde)	
	Phase 6 (IMP) 1996	1.8 (cdef)	94 (cde)	
	Phase 7 (IMP) 1997	2.4 (bcde)	112 (cd)	
	Phase 8 (IMP) 1998	2.0 (cdef)	89 (cde)	
	Phase 9 (IMP) 1999	3.0 (bcd)	111 (cd)	
	Phase 10 (IMP) 2000	0.92 (fg)	42 (ef)	
Phase 11 (IMP) 2001	0.51 (g)	22 (f)		
Phase 12 (IMP) 2002	0.47 (g)	31 (f)		
Station 3 (W-3) Upstream of Riverbend dam	Phase 4 (IMP) 1994	1.4 (b)	89 (b)	
	Phase 5 (IMP) 1995	2.4 (a)	99 (ab)	
	Phase 6 (IMP) 1996	1.2 (bc)	68 (bc)	
	Phase 7 (IMP) 1997	1.7 (ab)	81 (bc)	
	Phase 8 (IMP) 1998	2.6 (a)	121 (a)	
	Phase 9 (IMP) 1999	2.5 (a)	95 (ab)	
	Phase 10 (IMP) 2000	0.93 (bc)	50 (cd)	
	Phase 11 (IMP) 2001	0.37 (c)	18 (d)	
	Phase 12 (IMP) 2002	0.39 (c)	30 (d)	
	Station 4 (W-4) Upstream of Waelderhaus dam	Phase 4 (IMP) 1994	1.6 (cd)	103 (b)
		Phase 5 (IMP) 1995	2.7 (ab)	98 (bc)
		Phase 6 (IMP) 1996	1.2 (de)	66 (bcd)
Phase 7 (IMP) 1997		2 (bc)	99 (bc)	
Phase 8 (IMP) 1998		3.3 (a)	163 (a)	
Phase 9 (IMP) 1999		2.5 (b)	94 (bc)	
Phase 10 (IMP) 2000		1.2 (de)	60 (cd)	
Phase 11 (IMP) 2001		0.58 (e)	27 (d)	
Phase 12 (IMP) 2002		0.51 (e)	31 (d)	
Station 5 (W-5) Downstream of USGS Gaging Station		Phase 4 (IMP) 1994	1.6 (cd)	83 (abc)
		Phase 5 (IMP) 1995	2.5 (ab)	102 (a)
		Phase 6 (IMP) 1996	1.8 (cd)	85 (abc)
	Phase 7 (IMP) 1997	1.3 (d)	68 (cd)	
	Phase 8 (IMP) 1998	3.0 (a)	97 (ab)	
	Phase 9 (IMP) 1999	2.1 (bc)	80 (bc)	
	Phase 10 (IMP) 2000	1.9 (bcd)	51 (de)	
	Phase 11 (IMP) 2001	0.58 (e)	25 (f)	
	Phase 12 (IMP) 2002	0.49 (e)	36 (ef)	

## Notes:

(1) Whole-body fathead minnow composite samples.

(2) Arithmetic Mean

(3) PCB concentrations reported on a wet-weight basis.

mg/kg-lipid = (total PCB/lipid)\*100

The letters in parentheses denoting statistical differences (for each analysis) apply to the data presented

in each column for each location. Within each location, means with different letters are statistically significantly different (ANOVA, Scheffe's, 95% Confidence.)

Phase 1 = pre ASRI activities.

Phase 2a, 2b = during ASRI activities (upstream of Station 2).

Phase 3a, 3b = post ASRI activities (work conducted upstream of Station 2 in November 1991).

Phase 4-9 = IMP (post-ARS) activities).

1994 6-week samples collected 10/26/94.

1995 6-week samples collected 11/1/95.

1996 6-week samples collected 11/6/96.

1997 6-week samples collected 10/30/97.

1998 6-week samples collected 11/4/98.

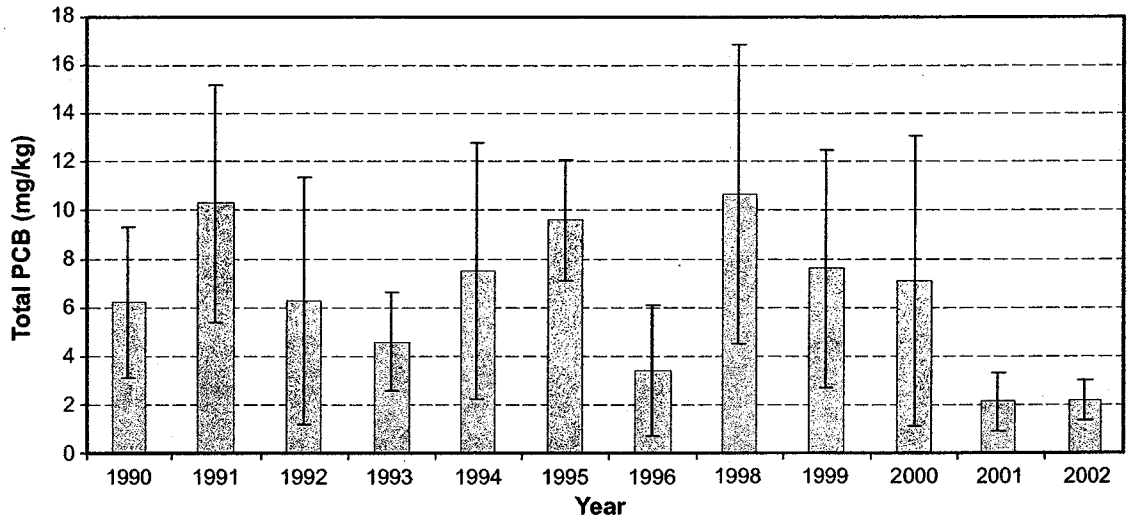
1999 6-week samples collected 11/4/99.

2000 6-week samples collected 11/1/00.

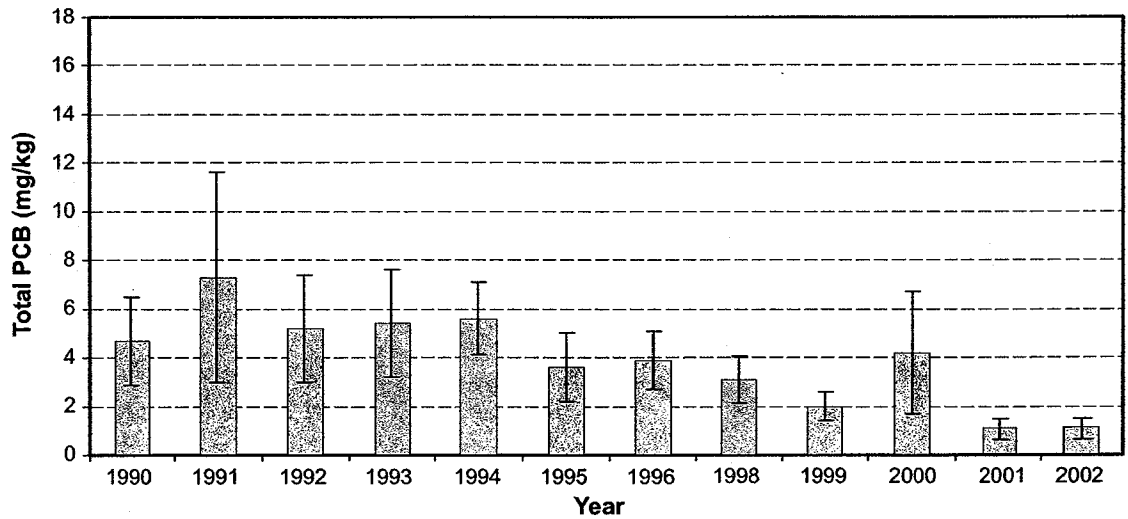
2001 6-week samples collected 11/07/01.

2002 6-week samples collected 11/06/02.

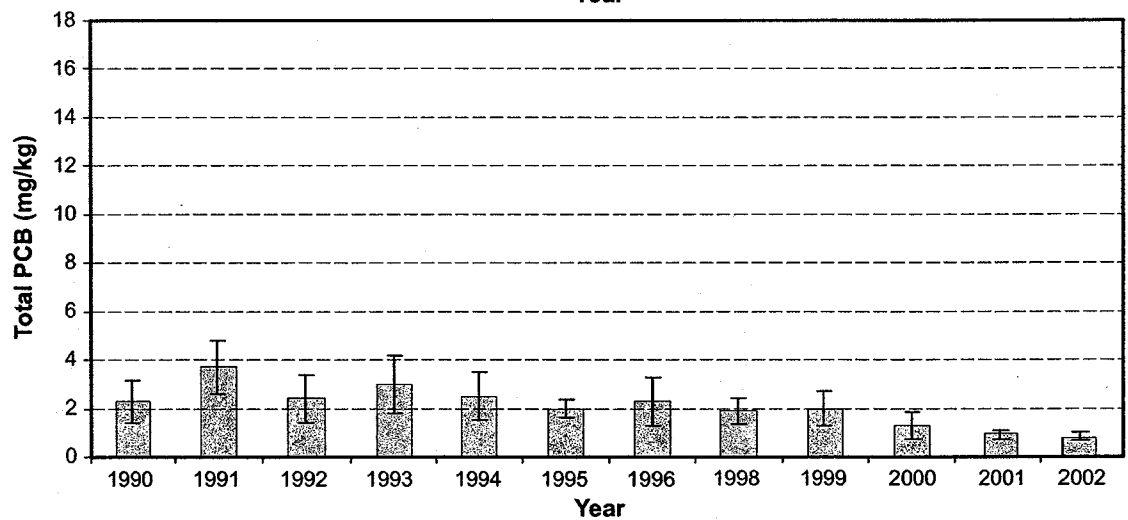
**FIGURE 1A**  
Vicinity of  
Rochester Park



**FIGURE 1B**  
Between the  
Kohler Dams



**FIGURE 1C**  
Vicinity of  
Kiwanis Park



I = Standard Deviation

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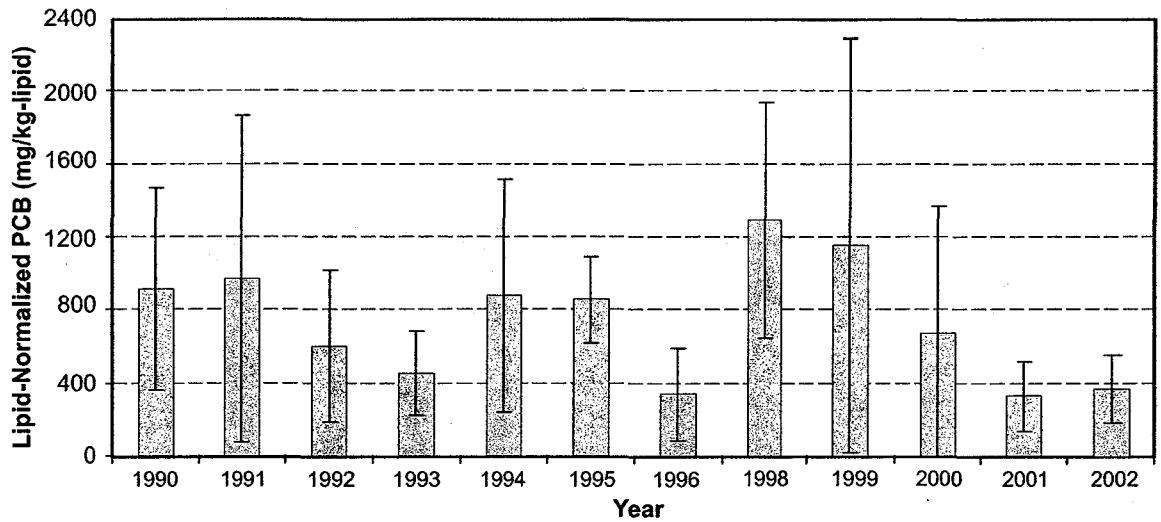
SMALLMOUTH BASS  
MEAN TOTAL PCB CONCENTRATIONS (MG/KG)  
(1990-1996, 1998-2002)

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FIGURE  
1

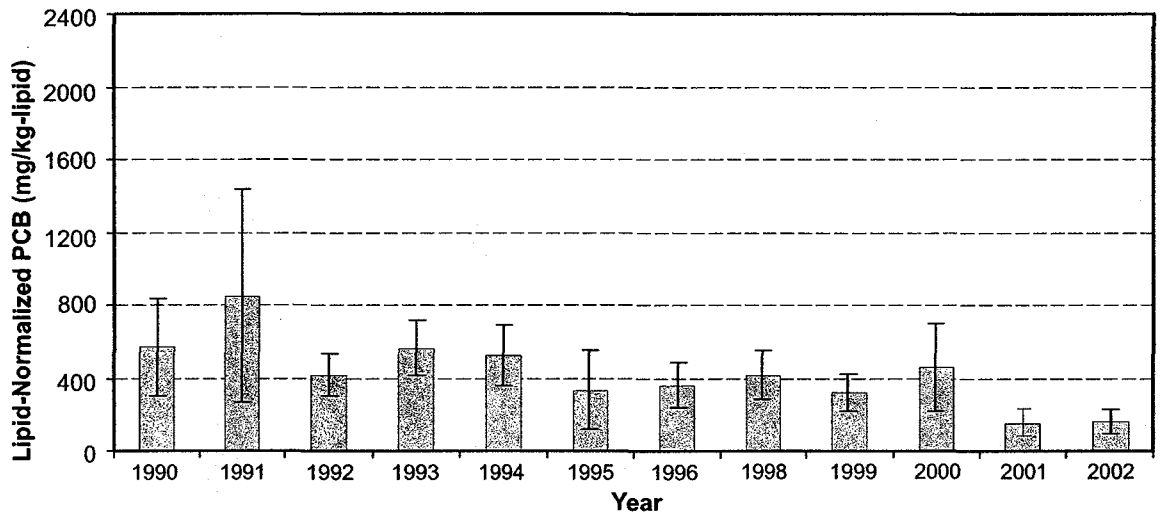
**FIGURE 2A**

Vicinity of Rochester Park



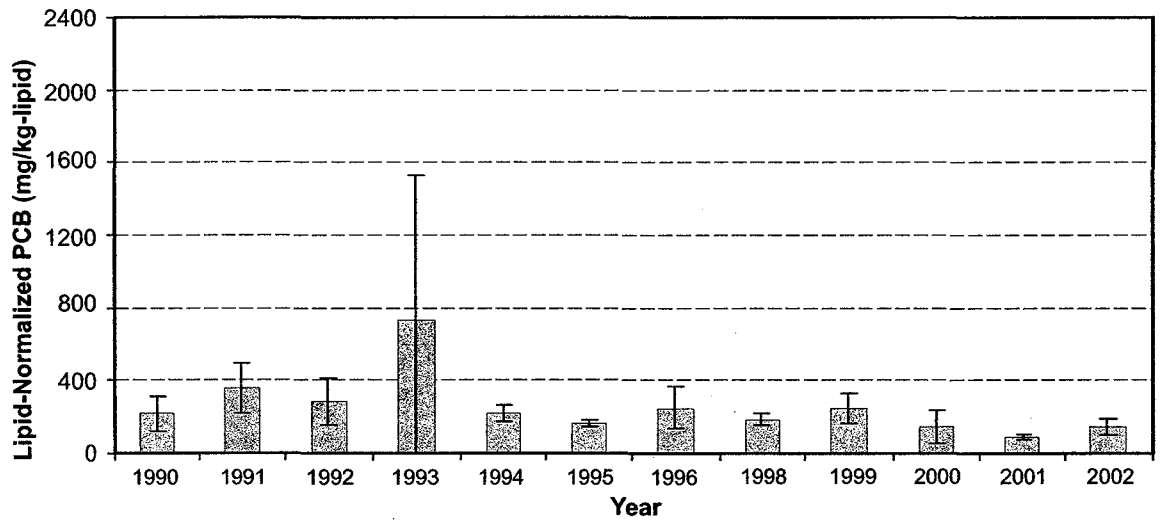
**FIGURE 2B**

Between the Kohler Dams



**FIGURE 2C**

Vicinity of Kiwanis Park



I = Standard Deviation

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INTERIM MONITORING PROGRAM

SMALLMOUTH BASS MEAN  
LIPID-NORMALIZED PCB CONCENTRATIONS  
(MG/KG-LIPID) (1990-1996, 1998-2002)

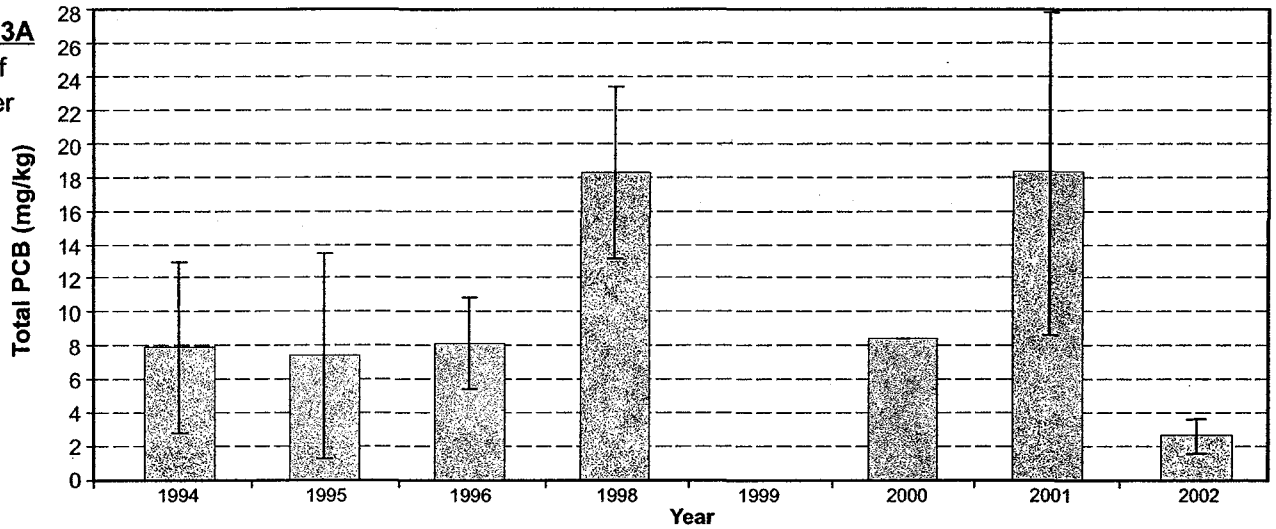
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FIGURE

2

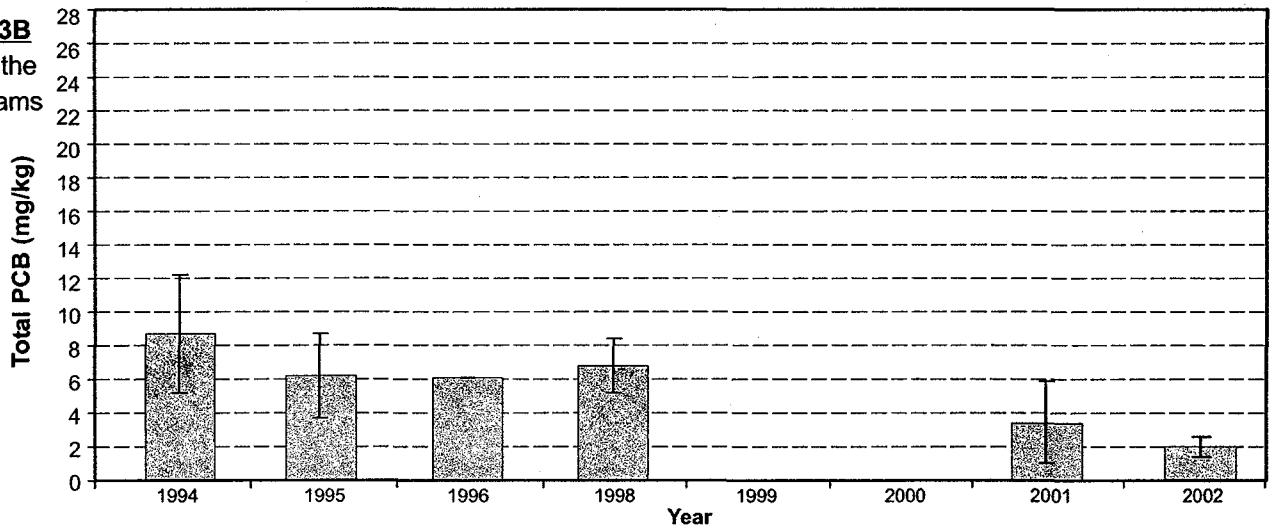
**FIGURE 3A**

Vicinity of Rochester Park



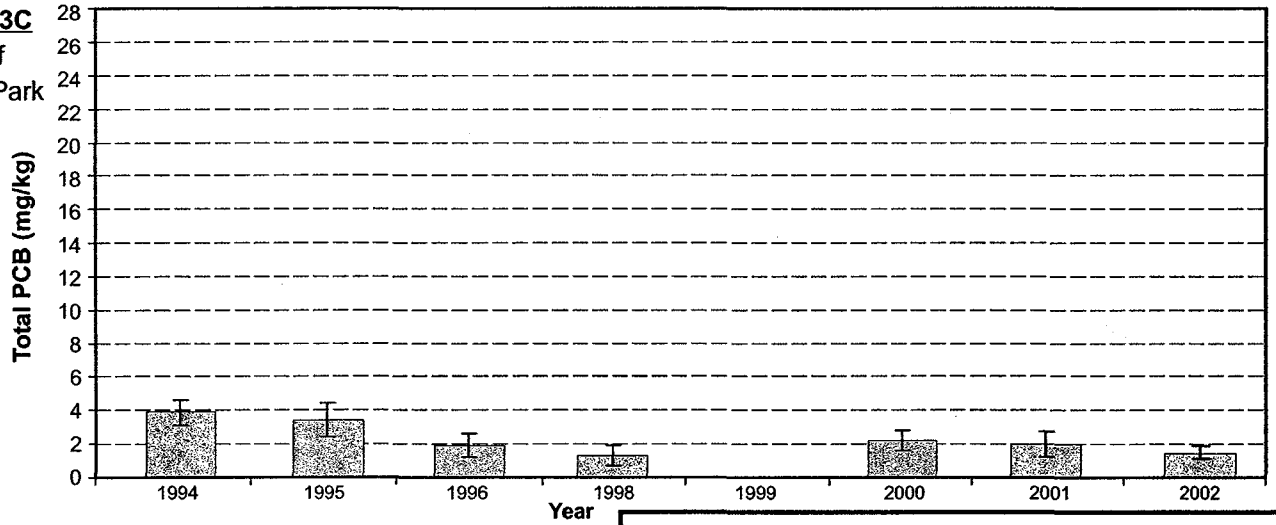
**FIGURE 3B**

Between the Kohler Dams



**FIGURE 3C**

Vicinity of Kiwanis Park



I = Standard Deviation

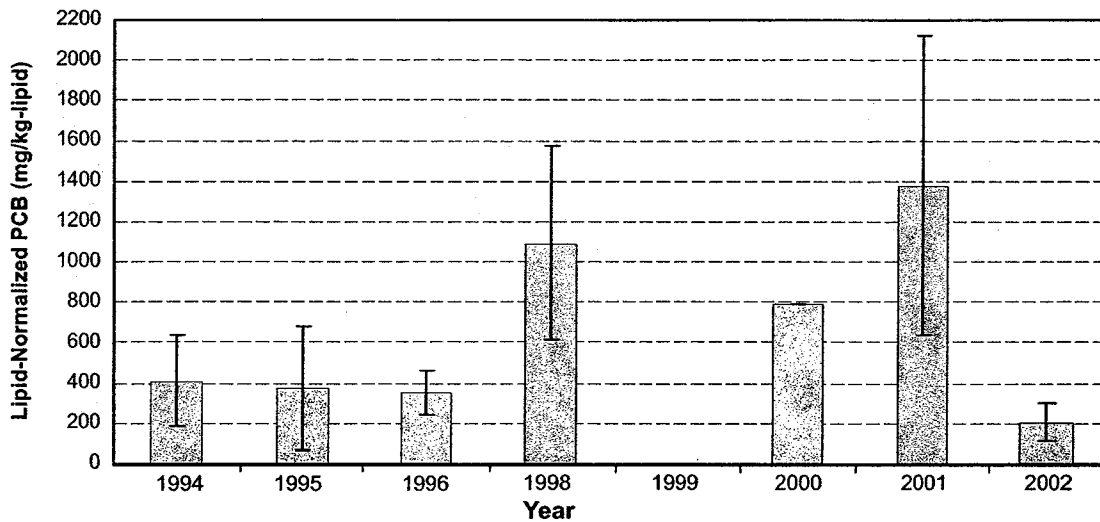
SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM

WHITE SUCKER  
MEAN TOTAL PCB CONCENTRATIONS (MG/KG)  
(1994-1996, 1998, 2000-2002)

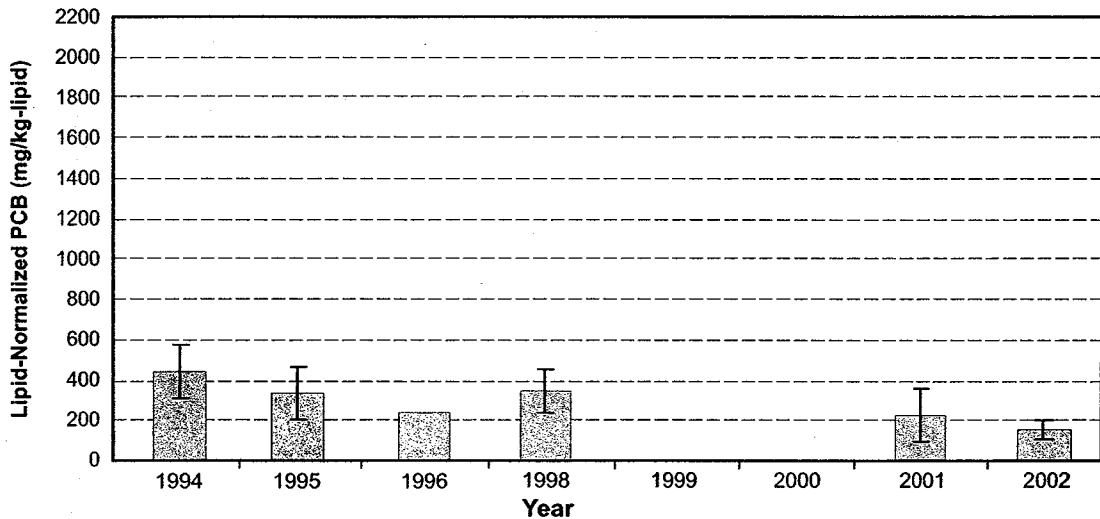
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FIGURE  
**3**

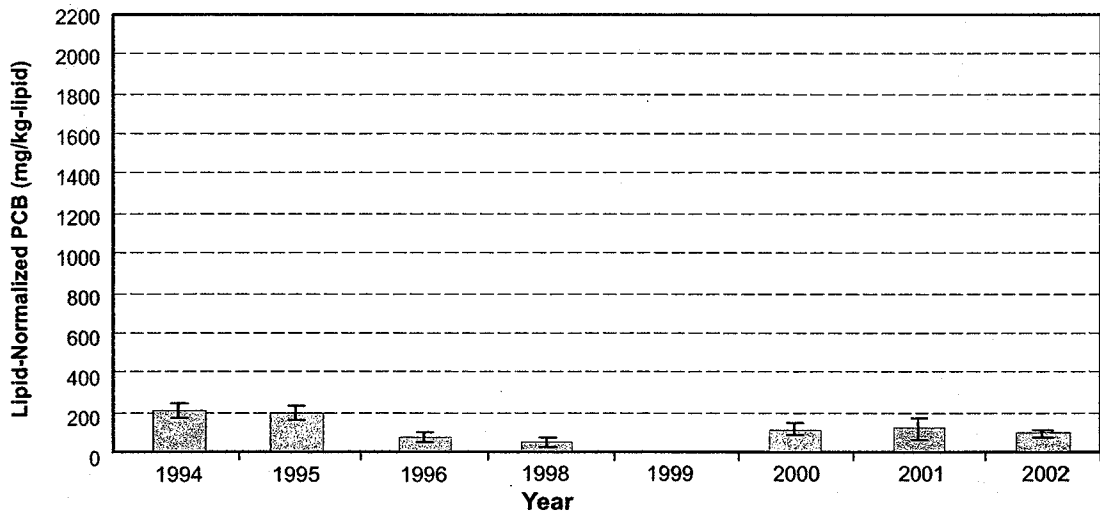
**FIGURE 4A**  
Vicinity of  
Rochester Park



**FIGURE 4B**  
Between the  
Kohler Dams



**FIGURE 4C**  
Vicinity of  
Kiwanis Park



I = Standard Deviation

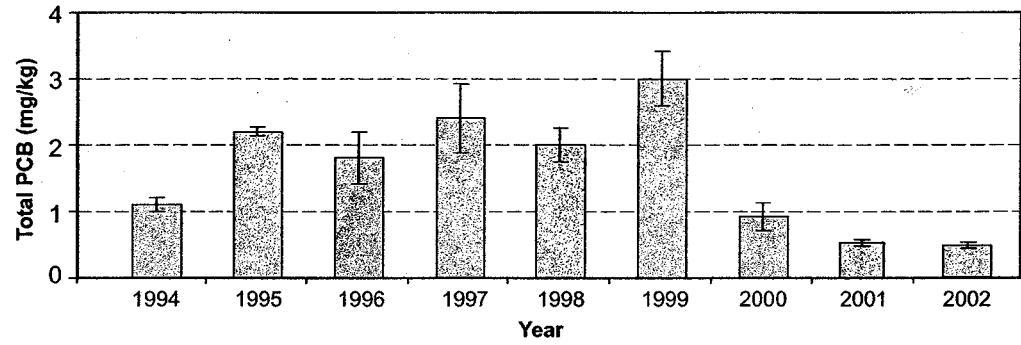
SHEBOYGAN RIVER AND HARBOR  
INTERIM MONITORING PROGRAM

WHITE SUCKER MEAN  
LIPID-NORMALIZED PCB CONCENTRATIONS  
(MG/KG-LIPID) (1990-1996, 1998, 2000-2002)

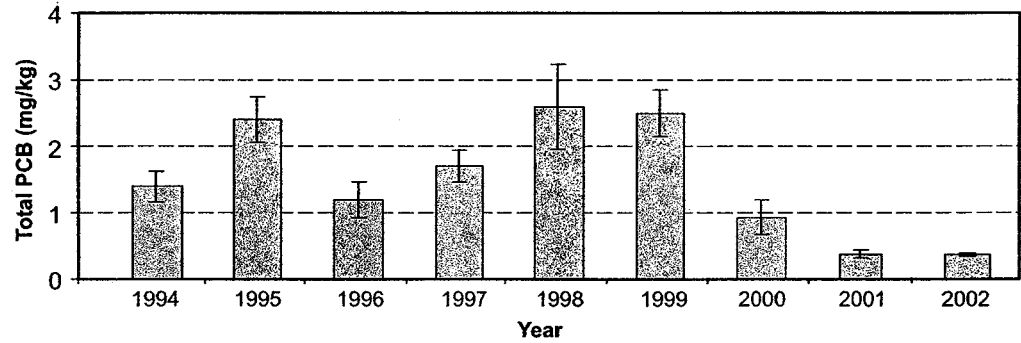
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FIGURE  
4

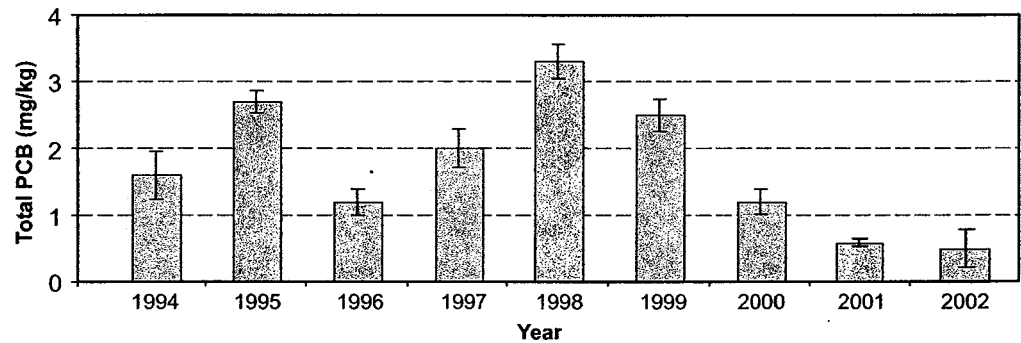
**FIGURE 5A**  
 Station 2 (W-13B)  
 Downstream of ASRI  
 Capped/Armoring  
 and Removal Areas



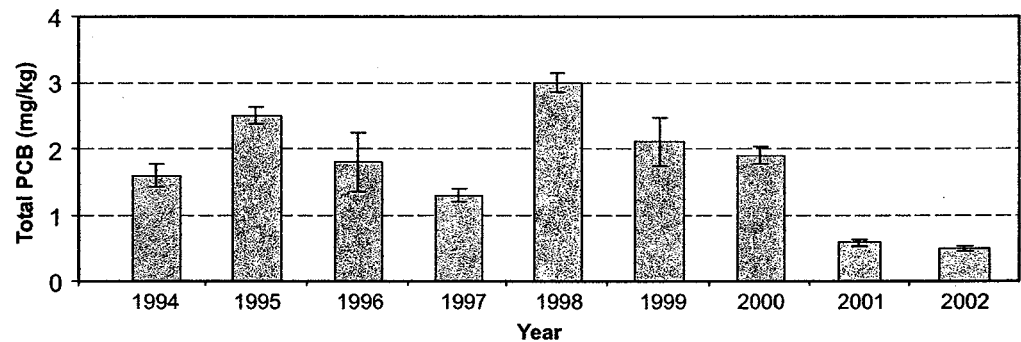
**FIGURE 5B**  
 Station 3 (W-3)  
 Upstream of River  
 Bend Dam



**FIGURE 5C**  
 Station 4 (W-4)  
 Upstream of  
 Waelderhaus Dam



**FIGURE 5D**  
 Station 5 (W-5)  
 Downstream of  
 USGS Gaging Station



I = Standard Deviation

SHEBOYGAN RIVER AND HARBOR  
 INTERIM MONITORING PROGRAM

CAGED FISH MEAN TOTAL PCB  
 CONCENTRATIONS (MG/KG)  
 (1994-2002)

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FIGURE  
**5**