APPENDIX D

FISH COMMUNITY MONITORING ANNUAL REPORTS

Elkhart Public Works & Utilities
Fish Community Monitoring

Annual Report
2000

City of Elkhart
The city with a heart

David L. Miller, Mayor

ANNUAL REPORT

Fish Community Monitoring on the St. Joseph and Elkhart Rivers and Selected Tributaries in Elkhart County, 2000.

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INTRODUCTION

For many years municipalities such as Elkhart have been required, through their NPDES (National Pollutant Discharge Elimination System) permits, to monitor chemical and microbiological levels of the rivers and streams to which they have any regulated discharges. This is done in an effort to protect the public and the aquatic communities that inhabit these waters, to determine the water quality in these areas, and to document the chemical and microbial contributions these discharges make to these streams. While conventional monitoring is good at identifying the chemical and microbial components of the water being tested and may help protect the public, it provides little information about the condition of the aquatic communities that it is also intended to protect. Alone, chemical and microbial monitoring is not an effective indicator of aquatic community health and provides limited insight to overall water quality.

To get a better idea of the impacts discharges may have on a stream, or what impact various land uses have in a stream's watershed, a two-tiered sampling approach has been found to be most effective in monitoring and determining water quality in aquatic systems and protecting aquatic communities (Craddock 1990, Ohio EPA 1988). These approaches use conventional monitoring coupled with biological monitoring, sampling of the actual aquatic communities. It is important to remember that conventional monitoring can only reveal the chemical and microbial levels of the water at the time the sample is collected. The sporadic presence of a biologically harmful substance could easily go undetected by conventional monitoring alone. Since the aquatic communities are present 24 hours a day, seven days a week, they are the overall product of the chemical and physical interactions in these aquatic systems and, hence, are the best indicators of the water quality in a given area. The drawback to biological monitoring, however, is it merely acts as a "red flag" when there is a problem. Since conventional monitoring can identify any problem chemical(s) and help pinpoint sources of contamination, it is best to use both monitoring strategies to provide the greatest amount of protection for the public and aquatic communities.

With this knowledge, the City of Elkhart began the second step in its monitoring activities by sampling the fish communities of the St. Joseph and Elkhart Rivers and their tributaries in and around Elkhart during the summer of 1998. In 1999 and 2000, core (Index) stations were resampled in an effort to establish baseline information that will allow the City to document the condition of the fish communities over time. This baseline of information will also reveal what impact an urban environment like Elkhart has on the rivers and streams that flow through it, and should identify any problem areas. The tool that will be used to assess the water quality using the fish community information is the Index of Biotic Integrity (IBI) as modified by Thomas Simon (1997). This index was developed by James Karr (1981), and is most useful in translating complex fish community information into a more understandable format for non-biologists. In simplest terms, the IBI acts as a biological indicator much like the DOW Industrial Average acts as an economic indicator (Karr 1996) and it provides a method to track the trends in fish community condition over time. It is comprised of three broad categories (species composition, trophic composition, and fish condition) which are broken down into 12 smaller categories known as metrics (Appendix A) to assess fish communities. These metrics are each given a score of 1 (low), 3, or 5 (high), and the total score for a site is in the range of 12 to 60. These scores can then be graphed and placed into one of five categories which describes the overall condition of the fish communities. Since it is assumed that the condition of the fish communities is a reflection of the water quality in a given area, Elkhart will be able to effectively track water quality conditions over time.

In addition to determining the water quality in a number of streams, sampling was also conducted to determine the overall diversity of the fish species in the Elkhart area. A fish tagging program that included smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*) and walleye (*Stizostedion vitreum*) that were collected during biological monitoring activities was also continued. This tagging effort will assist the Indiana Department of Natural Resources (IDNR) in determining the movement patterns of walleye and alert fishermen to the City's monitoring activities. Scale samples were also taken from all walleye, smallmouth and largemouth bass over 75 mm in length for age and growth analysis. The scale data will be made available as an additional report at a later date. Finally, tissue from eight species of

fish was sampled and analyzed for mercury and PCB (polychlorinated biphenyl) content. This information was added to the existing tissue data that Elkhart has collected to compare to the state's fish consumption advisory for the St. Joseph and Elkhart Rivers. Presently several species are on this advisory in the Elkhart area (Table 1) and the City wants to verify the state's findings and contribute information to the existing state database so an accurate and thorough advisory can be issued.

Table 1: Fish consumption information taken from the 2000 Indiana Fish Consumption Advisory.

Location	Species	Fish Size (inches)	Contaminant	Group
Elkhart River	Rock Bass	7-9	Hg, PCB	3
		9+	Hg, PCB	4
	Smallmouth Bass	5-6	PCB	3
	White Sucker	8-13	PCB	3
		13+	PCB	4
St. Joseph River	Black Redhorse	13-17	Hg	2
		17+	Hg	3
	Channel Catfish	20-24	PCB	3
		25-26	PCB	4
		26+	PCB	5
	Golden Redhorse	13-25	PCB	3
		25+	PCB	4
	Largemouth Bass	11-12	Hg	2
		12+	Hg	3
	Rock Bass	7-9	PCB	3
		9+	PCB	4
	Shorthead Redhorse	14-17	Hg, PCB	3
		17+	Hg, PCB	4
	Smallmouth Bass	9-13	Hg	2
		13+	Hg	3
	Walleye	16-17	Hg	3
		17+	Hg	4

Hg = Mercury
PCB = PCBs
Group 2 = 1 meal/week
Group 3 = 1 meal/month
Group 4 = 1 meal/2 months
Group 5 = DO NOT EAT
(Special restrictions apply to women and children. See advisory.)

METHODS

In an effort to establish a baseline of information for future comparison, fish community information was collected at select sites each of the last three summers (1998-2000). The sampling efforts of 2000 marked the third and last annual sampling at the core sites visited by Elkhart. This sampling continued to identify the majority of fish species present and to determine water quality levels in the rivers and streams around Elkhart. Stream sites were again sampled in one of two ways. Investigative sites were sampled only once and all fish collected at these sites were identified to species, the largest and smallest of each species were measured to the nearest millimeter (mm), the fish were counted, and then released. Index sites, on the other hand, were sampled twice at five-week intervals, and the length of the sample area was dependent on the stream's width. The length of these sites was 15 times the stream's width with a minimum length of 50 meters and a maximum length of 500 meters. Fish collected at index sites were studied more extensively. These fish were also identified to species and then processed in one of two ways. First, game fish (smallmouth bass, rock bass, bluegill, etc.) were measured by length to the nearest millimeter, individually weighed to the nearest gram (g), and then released. Non-game fish (suckers, darters, minnows, etc.) were counted, the largest and smallest of each species were measured to the nearest millimeter, species were mass weighed to the nearest gram, and then released. If a specimen of a species had not been previously retained from a site for the Public Works & Utilities specimen museum, then a single specimen of the smaller species was retained and larger specimens were photographed. This practice allows for the verification of the field and lab identifications if needed.

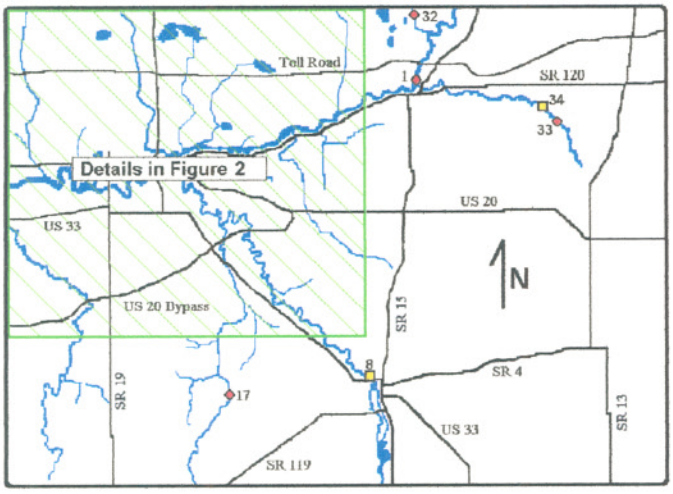
In 2000, the 20 index sites and 3 of the investigative sampled in 1998 and 1999 were resampled. In addition, eleven new investigative sites were also sampled (Figures 1 & 2 & Table 2). This continued Elkhart's sampling strategy of surveying the

Table 2: Sites sampled, the method used to sample each, and their IBI score (Index sites only).

Site Number	Site Description	Type of Site (Index/Investigative)	Method	IBI Scores			
				1998	1999	2000	Average
1	State Road 15 St. Joseph River	Index	Boat	53	57	51	**54**
2	County Road 17 St. Joseph River	Index	Boat	53	52	46	**50**
3	Mouth of Lily Creek St. Joseph River	Investigative	Boat				
4	Sherman Street St. Joseph River	Index	Boat	46	49	49	**48**
5	Bridge Street St. Joseph River	Index	Boat	48	50	48	**49**
6	Nappanee Street St. Joseph River	Index	Boat	48	48	48	**48**
7	Ash Road St. Joseph River	Investigative	Boat				
8	Rogers Park (below) Elkhart River	Investigative	Boat				
9	Oxbow Park Elkhart River	Index	Boat	52	54	53	**53**
10	County Road 18 Elkhart River	Index	Boat	52	52	52	**52**
11	Indiana Avenue Elkhart River	Index	Boat	45	47	51	**48**
12	Middlebury Street Elkhart River	Index	Boat	45	44	47	**45**
13	American Park Elkhart River	Index	Boat	48	45	48	**47**
14	Prairie Street Elkhart River	Investigative	Boat				
15	County Road 4 Christiana Creek	Index	Tote Barge	45	47	53	**48**
16	Willowdale Park Christiana Creek	Index	Tote Barge	46	46	41	**44**
17	County Road 32 Yellow Creek	Index	Tote Barge	36	34	37	**36**
18	US 20 Bypass Yellow Creek	Index	Tote Barge	44	43	29	**39**
19	County Road 28 Baugo Creek	Investigative	Tote Barge				
20	County Road 3 (N) Baugo Creek	Investigative	Tote Barge				
21*	County Road 10 Cobus Creek	Investigative	Tote Barge				
22*	County Road 8 Cobus Creek	Index	Tote Barge	34	28	29	**30**
23*	County Road 12 Cobus Creek	Investigative	Tote Barge				
24	Weaver Parkway Manning Ditch	Investigative	Back Pack				
25	County Road 12 Manning Ditch	Investigative	Back Pack				
26	Reckell Avenue Lily Creek	Index	Tote Barge	Not Sampled	32	38	
27	Bristol Street Lily Creek	Investigative	Tote Barge				
28*	County Road 8 Puterbaugh Creek	Index	Tote Barge	38	41	37	**39**
29*	US 20 Bypass Pine Creek	Index	Tote Barge	31	35	29	**32**
30*	County Road 17 Pine Creek	Investigative	Tote Barge				
31*	County Road 6 Washington Township Ditch	Investigative	Back Pack				
32	County Road 2 Trout Creek	Index	Tote Barge	Not Sampled	51	50	
33*	County Road 10 Little Elkhart River	Index	Tote Barge	Not Sampled	43	38	
34*	County Road 35 Little Elkhart River	Investigative	Tote Barge				

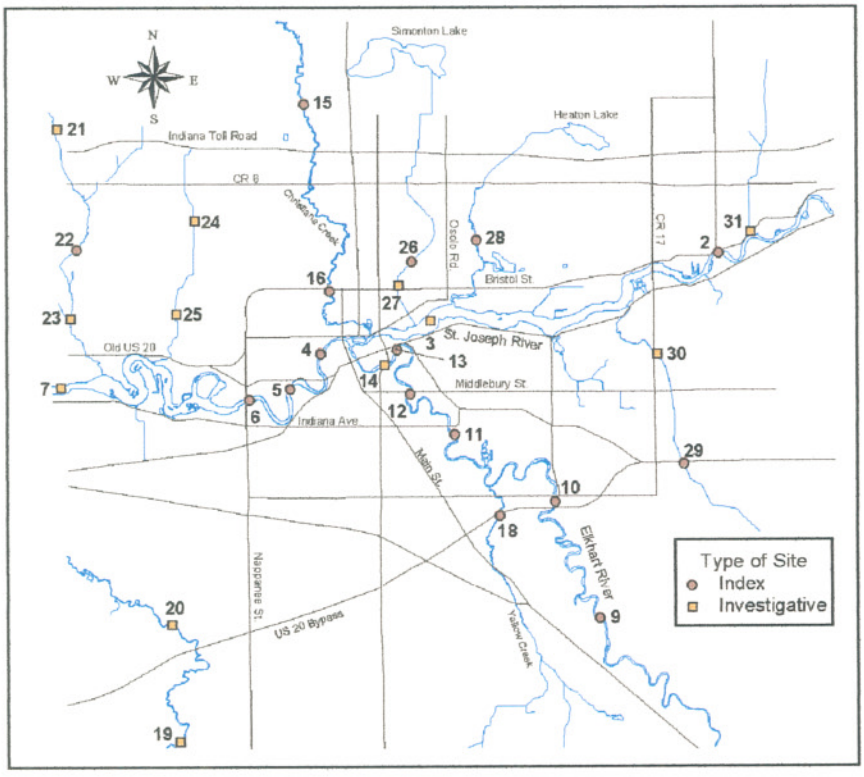
* - Denotes a cool/cold water stream

Figure 1: Fish sampling sites in Elkhart County, 2000.



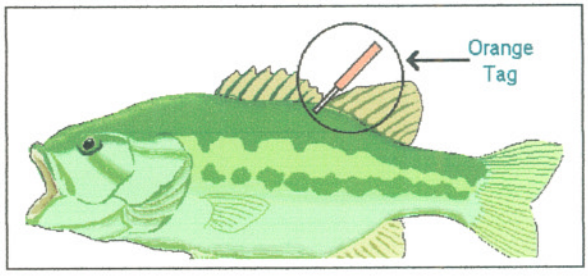
maximum number of streams and sites in the limited amount of time available for sampling. Investigative sites were generally sampled for a shorter distance (less than 15 times the stream width) and game fish other than bass and walleye that were individually measured at index sites were not weighed at these sites. These two differences in sampling and processing allowed for two investigative sites to be sampled in a day versus one index site.

Figure 2: Fish sampling sites in and around Elkhart, IN, 2000.



All sites were sampled utilizing either backpack, tote barge, or boat mounted electrofishing gear. The type of equipment used depended on the depth of the stream. For the smallest streams that would not accommodate the tote barge equipment, the battery powered backpack unit was used. If the stream was larger and wadeable for at least 80-90% of the area to be sampled, the tote barge equipment was used. All other areas were sampled utilizing the boat equipment. Power output of the three types of equipment varied. The backpack output was 0.5-1.5 amperes, the tote barge was 4-6 amperes, and the boat was 8-16 amperes.

Figure 3: Location of tag on fish.



Smallmouth bass greater than 10 inches, walleye greater than 12 inches and largemouth bass greater than 16 inches in length also had an anchor tag applied under the left anterior edge of the dorsal fin (Figure 3). This tag was orange or yellow in color and contained Elkhart Public Works & Utilities' phone number and a unique tag number. In addition to being tagged, the left pelvic fin of these fish was clipped to alert Public Works personnel to fish that had been tagged, but had shed the tag. The biggest advantage of this tagging study is its ability to reveal important movement patterns of these fish and help the IDNR in its walleye stocking efforts on the St. Joseph River. If the success of this stocking program continues

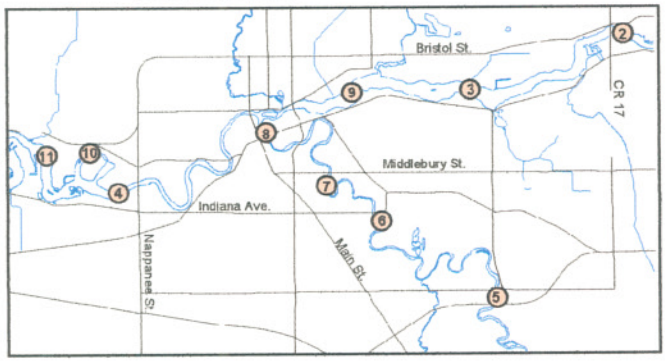
and grows, it could provide the Elkhart economy with additional revenue from non-local sport fishermen pursuing walleye in the Elkhart area.

Lastly, tissue in the form of fillets, was collected from common carp (*Cyprinus carpio*), smallmouth bass, rock bass (*Ambloplites rupestris*), walleye, channel catfish (*Ictalurus punctatus*), golden redhorse (*Moxostoma erythrurum*), shorthead redhorse (*M. macrolepidotum*), and white sucker (*Catostomus commersoni*) from July through October. The tissue samples were collected from four sites on the Elkhart River and six sites on the St. Joseph River (Table 3 & Figure 4). Due to the presence of an impassable dam just upstream of the Jackson Boulevard site on the Elkhart River, the tissue

Table 3: Fish tissue sites.

Site Number	River	Station
1	St. Joseph	Bristol (not on this map, same as Site 1 in Figure 1)
2	St. Joseph	Six-Span (CR 17)
3	St. Joseph	Bulldog Crossing (CR13)
4	St. Joseph	Below Nappanee St.
5	Elkhart	Hively Ave. (CR 18)
6	Elkhart	Indiana Ave.
7	Elkhart	Middlebury St.
8	Elkhart	Jackson Blvd.
9	St. Joseph	Martin's Landing
10	St. Joseph	Lexington Landing
11	St. Joseph	Oak Manor

Figure 4: Location of fish tissue sites on the St. Joseph and Elkhart Rivers.



samples collected from this area were once again treated as if the fish were from the St. Joseph River. Also, due to the difficulty of collecting three walleye of the same size from any given site, the tissue sample for these fish was collected at three different locations. Each tissue sample sent in for analysis was a composite of tissue from three fish of the same species at the given site or area (except as noted above). The samples were collected following the procedures in Appendix B (this report) and Appendix III in "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory" (1993).

RESULTS & DISCUSSION

In 2000, Elkhart collected 18,061 fish from the index and investigative sites that were sampled. These fish represented 66 species and 14 families (Tables 4 & 5). No additional species were found, leaving the species count for Elkhart County at 76. Greater redhorse (*Moxostoma valenciennesi* - state endangered) and river redhorse (*Moxostoma carinatum* - species of special concern) also continued to be represented in the samples. The top three species collected were mimic shiner (*Notropis volucellus*), white sucker, and smallmouth bass while the top three families represented were Cyprinidae (minnows and shiners), Catostomidae (suckers and redhorse), and Centrarchidae (sunfish and black bass). A summary of the species collected at each site is presented in Appendix C.

INDICES

The IBI scores ranged from a low of 29 (poor) at sites 18, 22 and 29 to a high of 53 (good) at sites 9 and 15 (Table 2). A longitudinal comparison of the 1998, 1999, and 2000 scores for the St. Joseph and Elkhart Rivers and Christiana and Yellow Creeks is presented in Graphs 1-3. It is important to remember that the IBI scores for the St. Joseph River (drainage basin >2,000 square miles) are only approximate because the metrics that were used were developed for rivers and streams in this area that have a drainage basin <1,000 square miles. When

Table 4: Summary of species captured at index sites.

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Mimic Shiner	1,956	13.82	2,445	5.39	0.10
Striped Shiner	1,329	9.39	19,482	42.91	0.83
Smallmouth Bass	1,162	8.21	182,968	403.01	7.76
White Sucker	1,127	7.96	174,294	383.91	7.39
Creek Chub	987	6.97	14,196	31.27	0.60
Golden Redhorse	956	6.76	575,956	1,268.63	24.43
Bluegill	923	6.52	28,305	62.35	1.20
Bluntnose Minnow	576	4.07	1,288	2.84	0.05
Rock Bass	575	4.06	47,661	104.98	2.02
Blacknose Dace	567	4.01	1,861	4.10	0.08
Spotfin Shiner	519	3.67	1,775	3.91	0.08
Northern Hog Sucker	494	3.49	106,148	233.81	4.50
Hornyhead Chub	400	2.83	8,650	19.05	0.37
Shorthead Redhorse	235	1.66	148,146	326.31	6.28
Mottled Sculpin	228	1.61	1,385	3.05	0.06
Stoneroller	180	1.27	1,587	3.50	0.07
Logperch	180	1.27	1,434	3.16	0.06
Johnny Darter	178	1.26	281	0.62	0.01
Rosyface Shiner	119	0.84	277	0.61	0.01
Silverjaw Minnow	111	0.78	207	0.46	0.01
River Redhorse	109	0.77	236,265	520.41	10.02
Largemouth Bass	106	0.75	21,385	47.10	0.91
Rainbow Darter	97	0.69	164	0.36	0.01
Common Carp	83	0.59	340,500	750.00	14.44
Yellow Bullhead	81	0.57	6,431	14.17	0.27
Quillback	71	0.50	105,433	232.23	4.47
Green Sunfish	68	0.48	1,846	4.07	0.08
Longear Sunfish	65	0.46	2,367	5.21	0.10
Walleye	64	0.45	14,207	31.29	0.60
Silver Redhorse	57	0.40	100,475	221.31	4.26
Spotted Sucker	54	0.38	19,782	43.57	0.84
Chestnut Lamprey	52	0.37	764	1.68	0.03
Brown Trout	42	0.30	4,758	10.48	0.20
Bowfin	32	0.23	45,869	101.03	1.95
Orangethroat Darter	29	0.20	31	0.07	0.00
Black Redhorse	28	0.20	19,853	43.73	0.84
Channel Catfish	26	0.18	52,955	116.64	2.25
Pumpkinseed	25	0.18	861	1.90	0.04
Blackside Darter	22	0.16	95	0.21	0.00
American Brook Lamprey	21	0.15	135	0.30	0.01
Grass Pickerel	19	0.13	727	1.60	0.03
Greater Redhorse	18	0.13	40,350	88.88	1.71
Black Crappie	18	0.13	2,794	6.15	0.12
Hybrid Sunfish	18	0.13	1,392	3.07	0.06
Tadpole Madtom	16	0.11	52	0.11	0.00
Stonecat	14	0.10	148	0.33	0.01
Yellow Perch	12	0.08	305	0.67	0.01
Steelcolor Shiner	12	0.08	38	0.08	0.00
Central Mudminnow	11	0.08	79	0.17	0.00
Brown Bullhead	9	0.06	3,822	8.42	0.16
Redear Sunfish	9	0.06	264	0.58	0.01
Sand Shiner	9	0.06	16	0.04	0.00
Northern Pike	8	0.06	8,152	17.96	0.35
Longnose Gar	8	0.06	4,438	9.78	0.19
Fathead Minnow	8	0.06	21	0.05	0.00
Rainbow Trout	7	0.05	2,366	5.21	0.10
River Chub	6	0.04	218	0.48	0.01
Warmouth	4	0.03	120	0.26	0.01
Brook Silverside	3	0.02	10	0.02	0.00
Common Shiner	3	0.02	8	0.02	0.00
Greenside Darter	2	0.01	11	0.02	0.00

Table 4 (cont.)

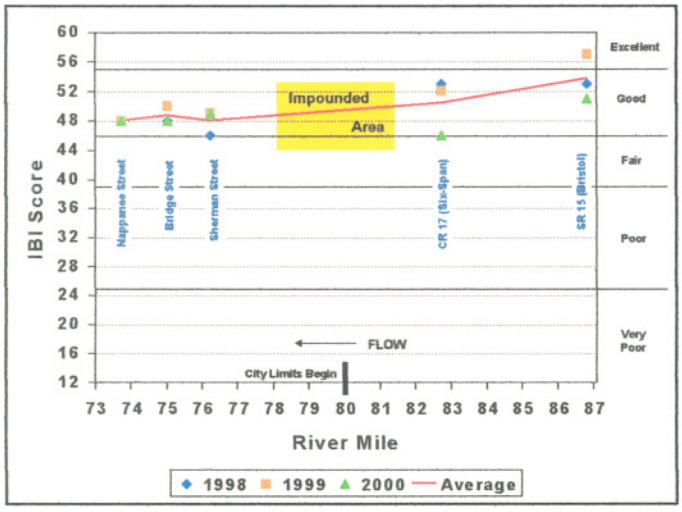
Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Lake Chubsucker	1	0.01	12	0.03	0.00
Blackstripe Topminnow	1	0.01	3	0.01	0.00
Golden Shiner	1	0.01	1	0.00	0.00
Total	14,151	100.00	2,357,869	5,193.54	100.00

Table 5: Summary of species captured at investigative sites.

Common Name	Total Number	% by Number
White Sucker	479	12.25
Creek Chub	411	10.51
Golden Redhorse	372	9.51
Bluegill	320	8.18
Smallmouth Bass	317	8.11
Bluntnose Minnow	264	6.75
Mimic Shiner	217	5.55
Blacknose Dace	166	4.25
Stoneroller	155	3.96
Rock Bass	119	3.04
Striped Shiner	111	2.84
Silverjaw Minnow	88	2.25
Spotfin Shiner	88	2.25
Sand Shiner	81	2.07
Johnny Darter	77	1.97
Brown Trout	74	1.89
Mottled Sculpin	72	1.84
Green Sunfish	65	1.66
Spotted Sucker	65	1.66
Common Carp	42	1.07
Northern Hog Sucker	42	1.07
Largemouth Bass	41	1.05
Longear Sunfish	32	0.82
Spottail Shiner	20	0.51
Silver Redhorse	16	0.41
Walleye	16	0.41
Central Mudminnow	15	0.38
Grass Pickerel	15	0.38
Pumpkinseed	13	0.33
Chestnut Lamprey	11	0.28
Hybrid Sunfish	11	0.28
Yellow Bullhead	11	0.28
Shorthead Redhorse	9	0.23
Logperch	8	0.20
Greater Redhorse	7	0.18
Hornyhead Chub	7	0.18
Rainbow Darter	7	0.18
Redear Sunfish	7	0.18
Black Crappie	6	0.15
Rosyface Shiner	5	0.13
Yellow Perch	5	0.13
White Crappie	4	0.10
Channel Catfish	3	0.08
Northern Pike	3	0.08
Bowfin	2	0.05
Fathead Minnow	2	0.05
Rainbow Trout	2	0.05
American Brook Lamprey	1	0.03
Black Bullhead	1	0.03
Blackside Darter	1	0.03
Brook Silverside	1	0.03
Brown Bullhead	1	0.03
Longnose Dace	1	0.03
Stonecat	1	0.03
TOTAL	3,910	100.00

metrics are developed for the St. Joseph River, all previously collected information will be used to recalculate a more accurate IBI score. Index sites also could not be established in the impounded area of the St. Joseph River because the metrics were developed for flowing waters. The make-up of the fish community is greatly different in impounded areas due to the differences in habitats that are available.

Graph 1: IBI scores for the St. Joseph River, Elkhart County, 1998-2000.



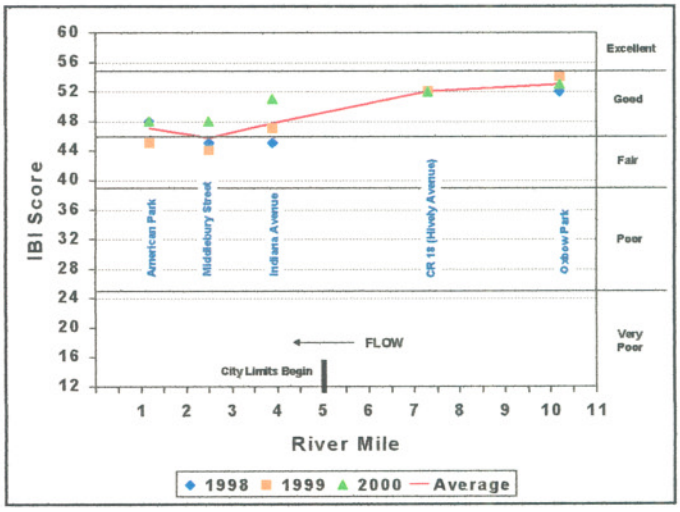
Year-to-year IBI score fluctuations of 4-8 points are not unusual and are attributed to the natural variability of biological communities. The fluctuations in IBI scores for most of the sites sampled on the rivers and streams reflected this natural variability, except for the Yellow Creek US 20 Bypass site. A dramatic decrease in IBI scores (14 points) at this site indicated additional water chemistry monitoring in this area will be necessary to try to identify the cause.

The trend of higher IBI scores upstream of Elkhart versus downstream on the St. Joseph River is reflected in the average scores for those sites for 1998-2000 (Graph 1). This trend is normal and, for now, expected. The multitude of impacts (ie. bridges, street run-off, combined sewer overflows, seawalls, lawn fertilizers, etc.) that are found in an urban area like Elkhart creates this trend in IBI scores. As improvements are made in adjacent land-use practices by all people, and new technologies allow for cleaner effluents from all sources, this trend will ideally become less exaggerated in time. With all of the disturbances and impacts that this river receives, however, the condition of the fish community as reflected by the IBI scores remains above average for an urban area the size of Elkhart.

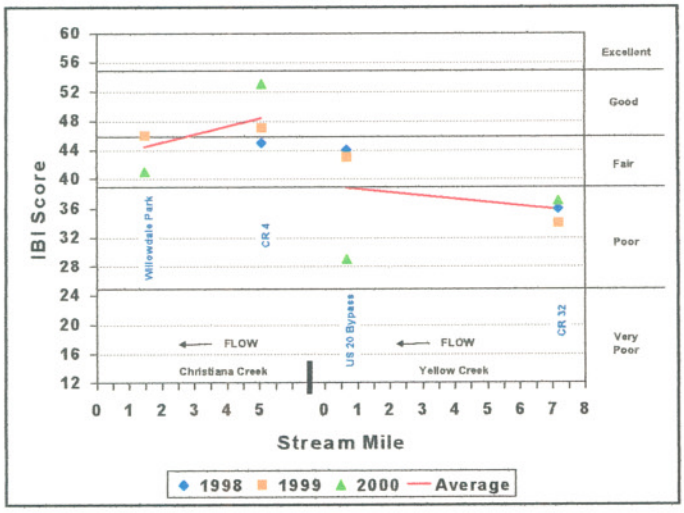
The trend of the Elkhart River IBI scores closely followed that of the St. Joseph River (Graph 2). The average of the scores from 1998-2000 was higher at the sites above Elkhart versus the sites within Elkhart. The IBI scores and the trends for both the Elkhart and St. Joseph Rivers do not reflect that the fish communities are in trouble, but do reveal that there is room for improvement for these communities through advances in technology and better stewardship activities.

Yellow Creek (tributary of the Elkhart River) and Christiana Creek (tributary of the St. Joseph River) were two of the largest tributaries sampled and each had two index sites. The County Road 32 site on Yellow Creek continued to reflect the poor water quality (Graph 3) that is common in streams impacted by agricultural runoff and stream channel modifications (ie. snagging and dredging). This site and the area upstream of it have tall, steep slopes, very little

Graph 2: IBI scores for the Elkhart River, Elkhart County, 1998-2000.



Graph 3: IBI scores for Christiana and Yellow Creeks, Elkhart County, 1998-2000.



overhanging vegetation, and no significant buffer zones (unmowed grassy areas). These characteristics contribute to the high amount of sediments this stream moves after a hard rain, and decreases the amount and types of habitats available to fish. The US 20 Bypass site previously revealed how a fish community could recover from most impacts if left undisturbed. This site and the immediate areas up and downstream have a great deal of overhead canopy and buffer strips and the stream channel has not been modified. All of these stream characteristics allow for a more diversified fish assemblage due to an increase in the amounts and types of habitats available. In 2000, however, the IBI scores at this site dropped dramatically revealing an impact by an unknown source. The habitat of this area had not changed, so the source is assumed to be a water contaminant. Water sample sites will be established upstream and within the fish sampling site to try to identify this contaminant and its source.

Christiana Creek flows through less agricultural land, but more residential areas than Yellow Creek. This trade-off has problems of its own, however. The presence of seawalls and septic systems, absence of buffer zones, and application of lawn fertilizers up to the stream's edge negatively impact this stream. The residential development along this stream could greatly decrease the effects of these impacts by simply building fewer or no seawalls, leaving more buffer zones, dealing with problem or failing septic systems, and using little or no lawn chemicals near the stream's edge. The IBI scores reveal good biological integrity in the upper reaches with only a slight decrease as the stream enters the city.

The IBI scores for the six remaining streams that had an index site are displayed in Graph 4. The Little Elkhart River, Lily Creek and Trout Creek were not sampled in 1998 so no average scores were calculated for these sites.

Puterbaugh, Pine and Cobus Creeks as well as the Little Elkhart River all had a good variety of habitats available. The water temperature these streams maintain, however, classify them as cool/cold water streams and this is their biggest limiting factor. This is important to know because the IBI was developed and modified for use on warmwater streams. Cool/cold water streams tend to have fewer species and not as many fish as warmwater streams. When the IBI is used to assess cool/cold water streams, it generally scores them lower. To have the best understanding of the integrity of these stream resources, the IBI metrics would need

Graph 4: IBI scores for various streams, Elkhart County, 1998-2000.

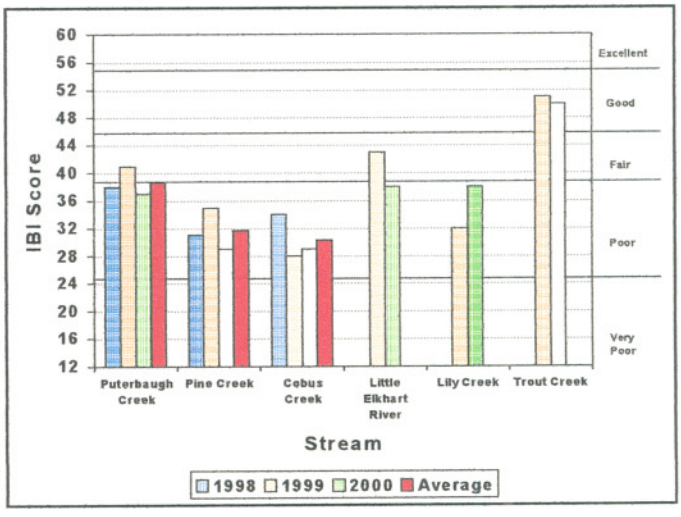


Table 6: Summary of tagged and recaptured fish.

Species	Number Tagged			Recaptures (fishermen)			Recaptures PW&U			# of Fish Represented		
	1998	1999	2000	1998	1999	2000	1998	1999	2000	1998	1999	2000
Smallmouth Bass	246	321	361	8	12	25	5	30	49	12	41	67
Walleye	38	41	40	4	4	8	0	0	3	4	4	10
Largemouth Bass	NA	17	20	NA	0	1	NA	0	3	NA	0	3

to be modified for scoring these types of streams. For now, the present IBI modification will suffice to reveal any drastic changes over time until the cool/cold-water metrics can be completed.

Lily Creek and Trout Creek are warm-water streams that both drain lakes, but are maintained quite differently. Lily Creek is a regulated drain that has recently (1997) been dredged. This dredging activity was done in an effort to decrease flooding impacts to neighboring landowners. Streams of this type may never support a biologically diverse fish community, but that is to be expected due to the main function (agricultural drainage) of the stream. Trout Creek, however, is a naturally flowing stream that has not been impacted by dredging activities. The IBI scores for both sites (Table 2, Figure 4) quickly reveal that streams with few or no disturbances support a more diverse fish community.

TAGGING & MOVEMENT

For 2000, a total of 421 fish were tagged (Table 6) and 80 fish were recaptured in 89 events. Almost twice as many recaptures were recorded for both fishermen and Public Works as compared to 1999. This is an excellent reflection of the sampling technique utilized by Public Works and cooperation of fishermen. Since 1998, 141 fish have been recaptured in 152 events, which reflects a recapture rate of 13.0% for all fish tagged to date. This recapture rate is good and reflects a slight increase in fishermen reporting recaptures, and a large increase in the number of smallmouth bass recaptured by Public Works.

Of the 89 recapture events this year, only 17 revealed any type of fish movement (Table 7). Eleven of these movements were in an upstream direction, while the remaining six were in a downstream direction. Walleye were once again the most active in terms of relocating (8 out of 11 recaptures moved), while smallmouth bass tended to stay in the area of their initial capture (only 8 out of 74 recaptures moved). Five walleye moved an average of 5.1 miles upstream and three averaged 7.5 miles in a downstream direction. Five smallmouth bass also moved upstream an average of 4.8 miles and three moved downstream an average of 5.2 miles.

Table 7: Summary of movement of recaptured fish, 2000.

Direction Moved	Smallmouth Bass	Walleye	Largemouth Bass
No Movement	66	3	3
Upstream	5	5	1
Downstream	3	3	0

While the number of fish movements that were observed stayed about the same as in 1999, the pattern was completely different. Walleye moved both upstream and downstream, and were not just recaptured below dams. Likewise, the smallmouth bass that were recaptured had moved to completely different areas, not just back to their original capture zones.

FISH TISSUE

The fish tissue results from 1998 and 1999 found that modifications of the fish consumption advisory (FCA) were warranted in Elkhart County. In 2000, tissue samples were collected to help clarify 1998 and 1999 results and to add data to the walleye and channel catfish information that had been previously collected. Detailed results can be found in Appendix B.

Smallmouth bass from the Elkhart River that were within the size range of the FCA (5-6 inches) were tissue sampled for the first time by Public Works in 2000. The lab results revealed that these fish had group 1 mercury levels and group 2 PCB levels. These results for PCBs are lower than the state's previous findings. PCB levels in rock bass tissue from the Elkhart River continued to fluctuate. Each of the three sampling locations has now had rock bass tissue with PCB levels that fell within the group 1 or 2 advisory. While these results have varied slightly over the last three years, they still reveal PCB levels lower than previously reported by the state. The results for the white sucker tissue also varied, but revealed group 1 or 2 mercury levels and group 2 PCB levels.

Tissue sampling on the St. Joseph River focused on collecting larger channel catfish and walleye, and collecting additional tissue samples of golden redhorse, common carp, shorthead redhorse, and smallmouth bass to confirm previous results from certain sampling locations. These results indicate walleye 14 to 19 inches have group 2 mercury and PCB levels, and channel catfish over 26 inches have group 2 mercury levels and group 3 PCB levels. The results for these two species will have to be confirmed in the coming years. Golden redhorse tissue continued to fall within the group 2 mercury level above Elkhart and group 2 PCB levels below town. These results would still place golden redhorse in a lower advisory group than they are presently in. Mercury and PCB results for carp continued to be lower than the state's findings, however carp tissue results for mercury have a similar pattern to the golden redhorse, higher above town than below town. Shorthead redhorse tissue results confirm the state's findings, and smallmouth bass results continued to vary. While smallmouth bass tissue results for mercury have revealed mostly group 1 levels, PCB results have varied from group 1 to group 3 levels showing a need for additional information.

CONCLUSION

After three years of conducting biological monitoring on the Elkhart and St. Joseph Rivers and their tributaries in Elkhart County, it has become apparent how important annual sampling is to accurately assess these rivers and streams and how useful annual sampling is in establishing a baseline for future comparisons. The IBI scores on the Elkhart and St. Joseph Rivers have fluctuated from year to year, however it is easy to see that these fluctuations are due to the natural variability of biological communities. While these IBI scores are reflective of good biological integrity, Graphs 1 and 2 point out that improvements could still be made. The fish communities of Christiana and Trout Creeks continue to exhibit good water quality, while Puterbaugh Creek and the Little Elkhart River have poor to fair water quality. An unknown impact has affected the fish community on the lower segment of Yellow Creek. This impact was noticed through a significant decrease in IBI scores at this site, and will be investigated further. Pine, Cobus and Lily Creeks continue to have poor water quality. The lower water quality of Lily and Yellow Creeks may be due to their primary use as agricultural drainage. The fish communities that were found may be the best that this type of stream can support. The fish communities found at the cool/cold-water streams (Puterbaugh, Pine and Cobus

Creeks and the Little Elkhart River) indicate lower water quality as determined by warmwater stream standards. Once the IBI metrics are developed and calibrated for the cool/cold-water streams in this area, a more accurate assessment will be available.

In Elkhart's third year of sampling, over 400 fish were tagged and 89 recaptures were recorded. While the number of recaptures drastically increased over previous years, the number of fish that actually moved remained about the same. Smallmouth bass moved very little (only 8 of 74), while 8 of 11 walleye moved either upstream or downstream. This information confirmed the walleye in this area are very mobile while the smallmouth bass tended to stay within very defined areas. This movement information, as well as the fish community information that is gathered, is helping the IDNR assess its stocking strategy for walleye. Elkhart looks forward to the continued stocking of walleye and the associated economic benefits for the city. The increased reporting of recaptured fish by fishermen has also given Elkhart the opportunity to inform more people of Elkhart's efforts to understand and protect its aquatic resources.

Fish tissue sampling results continued to support the need for modifications to the fish consumption advisory for Elkhart County. Additional data will be collected in 2001 for smaller smallmouth bass in the Elkhart River and larger walleye and channel catfish in the St. Joseph River to provide the best possible information on the status of PCB and mercury levels in these fish. Elkhart will also continue to provide its citizens with the most accurate information on PCB and mercury levels in the local fish populations.

In 2001, the City of Elkhart will continue its stewardship role in helping to preserve and protect the aquatic resources in this area as well as those in St. Joseph County. Beginning in the summer of 2001, the City of South Bend has contracted Elkhart to assist them in data collection and understanding the fish communities and conditions of their aquatic resources. This joint effort will bring these two cities closer to truly understanding the health of the St. Joseph River as a watershed in Indiana. Both cities wish to protect and enhance their valuable aquatic resources for the future.

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