

Appendix A

Index of Biotic Integrity metrics

Index of Biotic Integrity metrics used to evaluate headwater stream (<20 square miles drainage area) sites in the St. Joseph River drainage:

1. Total number of species
2. Number of darter/madtom/sculpin species
3. % Headwater species
4. Number of minnow species
5. Number of sensitive species
6. % Tolerant
7. % Omnivores
8. % Insectivores
9. % Pioneer species (individuals)
10. Number of fish collected
11. % Simple lithophils
12. % DELT anomalies

Index of Biotic Integrity metrics used to evaluate wadeable stream (>20-<1,000 square miles drainage area) sites in the St. Joseph River drainage:

1. Total number of species
2. Number of darter species
3. Number of sunfish species
4. Number of sucker species
5. Number of sensitive species
6. % Tolerant
7. % Omnivores
8. % Insectivores
9. % Carnivores
10. Number of fish collected
11. % Simple lithophils
12. % DELT anomalies

Appendix B

Fish tissue preparation and results

Materials needed:

- Reynolds aluminum foil
- freezer wrap
- deionized (DI) water
- 1/2 gallon, 1 gallon, and jumbo size freezer bags w/write-on labels
- skinners
- stainless steel fillet knives
- knife sharpener
- scalars
- ice
- cooler

A group of three fish per species was selected based on size. In every case but one, the smallest fish in a group was greater than or equal to 90% of the length of the largest fish in that group. In the one instance the smallest fish was greater than 75% of the length of the largest fish as called for in the "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory"(1993). The largest fish or fish that fell into a length range for species on the advisory were selected. The fish were kept as close in size as possible within a group because the tissue from the three fish in each group was composited (mixed together) before the analyses were completed.

All of the tissue was in the form of boneless fillets taken from the fish. All of the fish, except for a few carp and redhorse groups, had skin-on fillets taken. The few exceptions had skin-on fillets taken from one side of each fish and skin-off fillets taken from the opposite side. These skin-on composites were analyzed separate from the skin-off composites to note the differences that may occur due to the different preparations.

Before the tissue was removed, the fillet knives, scalars and skinners were cleaned and rinsed with DI water, and freezer wrap was placed where the fish were to be processed. The knives, scalars and skinners were washed in river water and rinsed with DI water after each species was processed and new freezer wrap was placed before another species was processed. For skin-on samples, the scales were removed before the fillet was taken. For skin-off samples, the skin was scored around the edge of the fillet and then removed before the fillet was taken. It was important to be consistent with where the cut of the fillet ended and to not include any of the body cavity or viscera. Once the fillets were removed, they were rinsed in river water and then rinsed with DI water before being placed on aluminum foil. The foil was large enough to hold the three fillets for each species at a site. When all three fillets were placed on the foil, it was then wrapped and placed in a labeled freezer bag and placed on ice in a cooler. The fish tissue was placed in a freezer upon returning to the lab, and kept frozen until sent to the contract lab for analyses.

Appendix B

Tissue results and comparison.

Stream	Species	Station	Length Range (PW&U)			Advisory Length Range (State)	Mercury Group (PW&U)			Advisory Mercury Group (State)	PCB Group (PW&U)			Advisory PCB Group (State)	
			1998	1999	2000		1998	1999	2000		1998	1999	2000		
Elkhart River															
Rock Bass															
		Hively Avenue (CR 18)	7.0-7.3	7.9-8.7	7.4-8.2	7-9	1	1	NA	2	2	2	2	1	3
		Indiana Avenue	6.9-7.3	7.3-7.9	7.1-7.4	7-9	1	1	NA	2	1	1	2	2	3
		Middlebury Street	7.2-7.6	7.2-8.0	7.7-7.9	7-9	1	1	NA	2	1	2	1	3	3
Smallmouth Bass															
		Hively Avenue (CR 18)	15.0-15.6	11.1-11.9	5.6-5.9	5-6	2	1	1	1	2	2	2	2	3
		Indiana Avenue	11.9-14.0	14.4-14.8	5.7-6.1	5-6	2	2	1	1	2	2	2	2	3
		Middlebury Street	15.6-16.7	12.4-13.4	5.9-6.0	5-6	2	2	1	1	2	1	2	2	3
White Sucker															
		Hively Avenue (CR 18)	15.0-15.6	14.3-15.2	NS	13+	1	1	NS	1	2	2	2	NS	4
		Indiana Avenue	15.2-15.6	13.5-14.4	NS	13+	1	1	NS	1	2	2	2	NS	4
		Middlebury Street	14.1-14.7	15.2-16.1	14.2-14.4 15.0-15.2	13+	2	2	1	1	2	2	2	NA	4
St. Joseph River															
Channel Catfish															
		Jackson Street	16.3-17.7	16.1-16.6	NS	<20	1	1	NS	1	2	2	2	NS	1
		SR 15 (Bristol)	NS	NS	27.6-28.6	26+	NS	NS	2	1	NS	NS	3	5	5
Common Carp															
		Six-Span (CR 17)	31.1-32.1	26.6-27.4	NS	25+	1-2	2	NS	5	2	3	3	NS	5
		Bulldog Crossing (CR 13)	27.6-29.5	25.1-27.6	NS	25+	2	2	NS	5	3	3	3	NS	5
		Jackson Boulevard	25.6-26.1	25.2-27.8	NS	25+	1	1	NS	5	3	3	1-3	NS	5
		Nappanee Street	26.2-27.1	25.7-28.1	25.1-26.3	25+	1	1	1	5	3	3	3-4	3	5
Golden Redhorse															
		Six-Span (CR 17)	15.6-15.9	16.7-16.9	NS	13-25	1	2	NS	1	1	1	1	NS	3
		Bulldog Crossing (CR 13)	16.1-16.8	16.2-17.0	16.2-17.0	13-25	1	2	2	1	1	1	1	1	3
		Nappanee Street	15.2-15.7	14.7-14.9	14.9-16.1	13-25	1	1	1	1	2	2	2	2	3
Largemouth Bass															
		Six-Span (CR 17)	12.9-13.2	13.2-13.7	NS	12+	2	2	NS	3	1	1	1	NS	1

Appendix B

Stream	Species	Station	Length Range (PW&U)			Advisory Length Range (State)	Mercury Group (PW&U)			Advisory Mercury Group (State)	PCB Group (PW&U)			Advisory PCB Group (State)
			1998	1999	2000		1998	1999	2000		1998	1999	2000	
St. Joseph River (Continued)														
Shorthead Redhorse														
		Jackson Boulevard	15.5-16.9	16.0-16.6	15.0-15.7 16.4-16.9	14-17	1	1	NA	2	2	3	3	3
Smallmouth Bass														
		Bulldog Crossing (CR 13)	10.7-10.8	10.4-11.1	10.0-10.3 11.0-11.7	9-13	1	1	NA	2	1	3	1	1
		Jackson Boulevard	10.0-10.2	10.9-11.1	NS	9-13	1	1	NS	2	2	2	NS	1
		Nappanee Street	11.2-11.6	10.7-10.8	10.3-10.8	9-13	2	1	1	2	1	1	NA	1
Walleye														
		Miscellaneous Sites	NS	14.8-15.6	NS	<16	NS	2	NS	1	NS	2	NS	1
		Miscellaneous Sites	NS	NS	17.4-18.7	17+	NS	NS	2	4	NS	NS	2	1

NS - No sample collected

NA - No analysis performed

Appendix C

Location and species of fish caught at all sites in Elkhart County, 2000

Appendix C

Stream Site Number	St. Joseph River												
	1		2		3		4		5		6		7
	1st Pass	2nd Pass	1st Pass	2nd Pass	Day	Night	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
Chestnut Lamprey	X	X	X	X					X	X			
American Brook Lamprey								X					
Longnose Gar	X		X				X		X	X	X		
Bowfin	X	X	X	X		X					X	X	
Rainbow Trout											X		
Grass Pickerel		X						X					
Northern Pike		X		X	X	X						X	
Common Carp	X	X	X	X	X	X	X	X	X	X	X	X	X
Rosyface Shiner			X				X	X			X		
Striped Shiner				X			X				X		
Spottail Shiner					X								X
Steelcolor Shiner				X									
Spotfin Shiner	X	X	X	X			X	X	X	X	X	X	X
Mimic Shiner	X	X	X	X			X	X	X	X	X	X	X
Bluntnose Minnow	X	X	X	X	X			X	X		X	X	X
Quillback							X		X	X	X	X	
Silver Redhorse	X		X	X	X	X	X	X	X	X	X	X	X
Black Redhorse	X		X	X			X	X	X		X		
Golden Redhorse	X	X	X	X	X	X	X	X	X	X	X	X	X
Shorthead Redhorse	X	X	X	X	X	X	X	X	X	X	X	X	X
Greater Redhorse								X		X		X	
River Redhorse			X	X			X	X	X	X	X	X	
Northern Hog Sucker	X	X	X	X			X	X	X	X	X		
White Sucker	X	X			X		X				X	X	X
Spotted Sucker	X	X	X		X	X					X	X	X
Channel Catfish	X	X			X		X	X		X		X	
Yellow Bullhead	X	X		X	X	X		X	X	X		X	
Brown Bullhead	X	X											X
Brook Silverside					X						X	X	
Black Crappie					X					X	X	X	X
Rock Bass	X	X	X	X	X	X	X	X	X	X	X	X	X
Smallmouth Bass	X	X	X	X	X	X	X	X	X	X	X	X	X
Largemouth Bass	X	X	X	X	X	X		X	X	X	X	X	X
Green Sunfish					X			X			X		
Hybrid Sunfish			X		X	X	X			X			
Bluegill	X	X	X	X	X	X	X	X	X	X	X	X	X
Longear Sunfish	X		X	X	X			X	X	X	X	X	X
Redear Sunfish										X	X		
Pumpkinseed			X	X	X	X			X	X		X	
Walleye	X	X	X		X	X	X	X	X	X	X	X	
Yellow Perch	X	X	X	X		X						X	
Blackside Darter		X	X					X					
Logperch	X	X		X		X	X	X	X	X	X	X	
Johnny Darter		X											
Greenside Darter							X						
Rainbow Darter							X			X			X

Appendix C

Stream	Elkhart River											
	8	9		10		11		12		13		14
		1st Pass	2nd Pass									
Chestnut Lamprey	X	X		X	X	X	X			X		
American Brook Lamprey				X		X	X	X				
Bowfin				X	X							
Grass Pickerel				X	X		X	X	X			X
Northern Pike	X		X	X	X						X	
Hornyhead Chub	X	X	X	X	X	X	X	X	X			
Creek Chub		X						X				
Rosyface Shiner	X	X	X	X	X	X	X	X	X	X	X	X
Redfin Shiner												
Striped Shiner	X	X	X	X	X	X	X	X	X	X	X	X
Common Shiner										X		
Steelcolor Shiner								X				
Spotfin Shiner	X	X	X	X	X	X	X		X	X	X	X
Sand Shiner								X			X	
Mimic Shiner	X											
Silverjaw Minnow								X				
Bluntnose Minnow	X	X	X	X	X	X	X	X	X	X	X	
Black Redhorse				X								
Golden Redhorse	X	X	X	X	X	X	X	X	X	X	X	X
Shorthead Redhorse											X	
Greater Redhorse	X	X	X	X						X		
River Redhorse				X		X		X				
Northern Hog Sucker	X	X	X	X	X	X	X	X	X	X	X	X
White Sucker	X	X	X	X	X	X	X	X	X	X	X	X
Spotted Sucker	X	X	X	X	X	X			X	X	X	X
Channel Catfish											X	
Yellow Bullhead				X	X	X	X		X	X	X	
Black Bullhead	X											
Stonecat			X									
White Crappie	X											
Black Crappie		X		X	X		X		X	X		X
Rock Bass	X	X	X	X	X	X	X	X	X	X	X	X
Smallmouth Bass	X	X	X	X	X	X	X	X	X	X	X	X
Largemouth Bass	X	X	X	X	X	X	X	X		X	X	X
Green Sunfish	X	X		X			X		X	X	X	
Hybrid Sunfish	X		X			X			X			X
Bluegill	X	X	X	X	X	X	X	X	X	X	X	X
Longear Sunfish	X	X	X	X	X	X				X		X
Redear Sunfish							X				X	X
Pumpkinseed		X			X	X					X	X
Blackside Darter		X	X	X		X	X	X	X			

Appendix C

Stream	Christiana Creek				Yellow Creek				Baugo Creek		Cobus Creek			Manning Ditch	
	15		16		17		18		19	20	21	22	23	24	25
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass				1st Pass	2nd Pass		
Chestnut Lamprey	X														
American Brook Lamprey	X	X										X	X		
Longnose Gar	X														
Bowfin	X	X													
Brown Trout											X	X	X	X	
Central Mudminnow											X	X	X		
Grass Pickerel		X	X	X					X	X	X			X	
Common Carp	X			X					X						
Hornyhead Chub	X	X			X	X	X	X							
River Chub	X	X													
Creek Chub					X	X	X	X	X	X	X	X	X	X	X
Blacknose Dace					X	X		X		X	X	X	X		
Longnose Dace										X					
Striped Shiner	X	X		X	X	X	X	X	X	X					
Common Shiner											X				
Spotfin Shiner									X	X					
Sand Shiner									X	X					
Mimic Shiner						X									
Silverjaw Minnow					X	X			X	X					
Fathead Minnow					X	X			X						
Bluntnose Minnow	X	X	X		X	X	X	X	X	X				X	
Stoneroller					X	X		X	X	X					
Silver Redhorse	X			X											
Black Redhorse				X											
Golden Redhorse	X		X	X					X	X					
Northern Hog Sucker	X	X	X	X											
White Sucker	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Lake Chubsucker	X														
Channel Catfish									X						
Yellow Bullhead	X	X	X	X		X			X		X	X			
Brown Bullhead					X										
Stonecat		X		X						X					
Tadpole Madtom	X		X												
Black Crappie								X							
Rock Bass	X	X	X	X					X	X					
Smallmouth Bass	X	X	X	X			X	X		X					
Largemouth Bass	X	X		X		X		X	X	X		X			
Warmouth						X									
Green Sunfish			X		X	X	X	X	X	X	X				
Bluegill				X	X	X		X	X						
Redear Sunfish										X					
Pumpkinseed							X		X						
Blackside Darter									X						
Logperch		X		X						X					
Johnny Darter					X	X	X	X	X	X					
Rainbow Darter	X	X	X	X						X					
Orangethroat Darter	X	X		X											
Mottled Sculpin												X	X		

Appendix C

Stream	Lily Creek			Puterbaugh Creek		Pine Creek			Washington Twnshp. Ditch	Trout Creek		Little Elkhart River		
	26		27	28		29	30	31		32		33	34	
	1st Pass	2nd Pass		1st Pass	2nd Pass	1st Pass	2nd Pass			1st Pass	2nd Pass	1st Pass	2nd Pass	
Chestnut Lamprey												X		X
American Brook Lamprey												X	X	
Bowfin										X	X			
Brown Trout									X			X	X	X
Rainbow Trout												X	X	X
Central Mudminnow	X				X	X		X	X			X	X	
Grass Pickerel	X	X	X	X	X		X		X		X			
Common Carp														X
Golden Shiner		X												
Hornyhead Chub										X			X	X
Creek Chub	X	X	X	X	X	X	X	X	X	X		X	X	X
Blacknose Dace	X	X				X	X	X				X	X	X
Striped Shiner										X	X	X	X	X
Spotfin Shiner										X				
Sand Shiner		X												
Mimic Shiner	X		X							X				
Fathead Minnow														X
Bluntnose Minnow		X								X			X	X
Stoneroller	X	X	X	X	X								X	X
Golden Redhorse														X
Shorthead Redhorse											X			
Northern Hog Sucker										X	X	X	X	X
White Sucker	X	X	X	X	X	X	X	X	X		X	X	X	X
Spotted Sucker											X			
Yellow Bullhead	X		X							X	X			
Stonecat										X				
Tadpole Madtom										X	X			
Blackstripe Topminnow											X			
Rock Bass										X	X			
Smallmouth Bass											X			
Largemouth Bass							X			X	X	X	X	X
Warmouth												X		
Green Sunfish	X	X	X	X	X								X	X
Hybrid Sunfish	X		X		X						X			
Bluegill	X	X	X		X					X	X	X	X	X
Longear Sunfish										X				
Redear Sunfish				X							X			
Pumpkinseed				X							X			X
Walleye						X								
Yellow Perch			X								X			X
Logperch				X						X	X			
Johnny Darter	X	X		X	X	X	X	X				X	X	X
Greenside Darter										X				
Rainbow Darter				X	X				X	X	X			
Orangethroat Darter					X					X				
Mottled Sculpin				X	X	X	X	X	X			X	X	X

APPENDICES