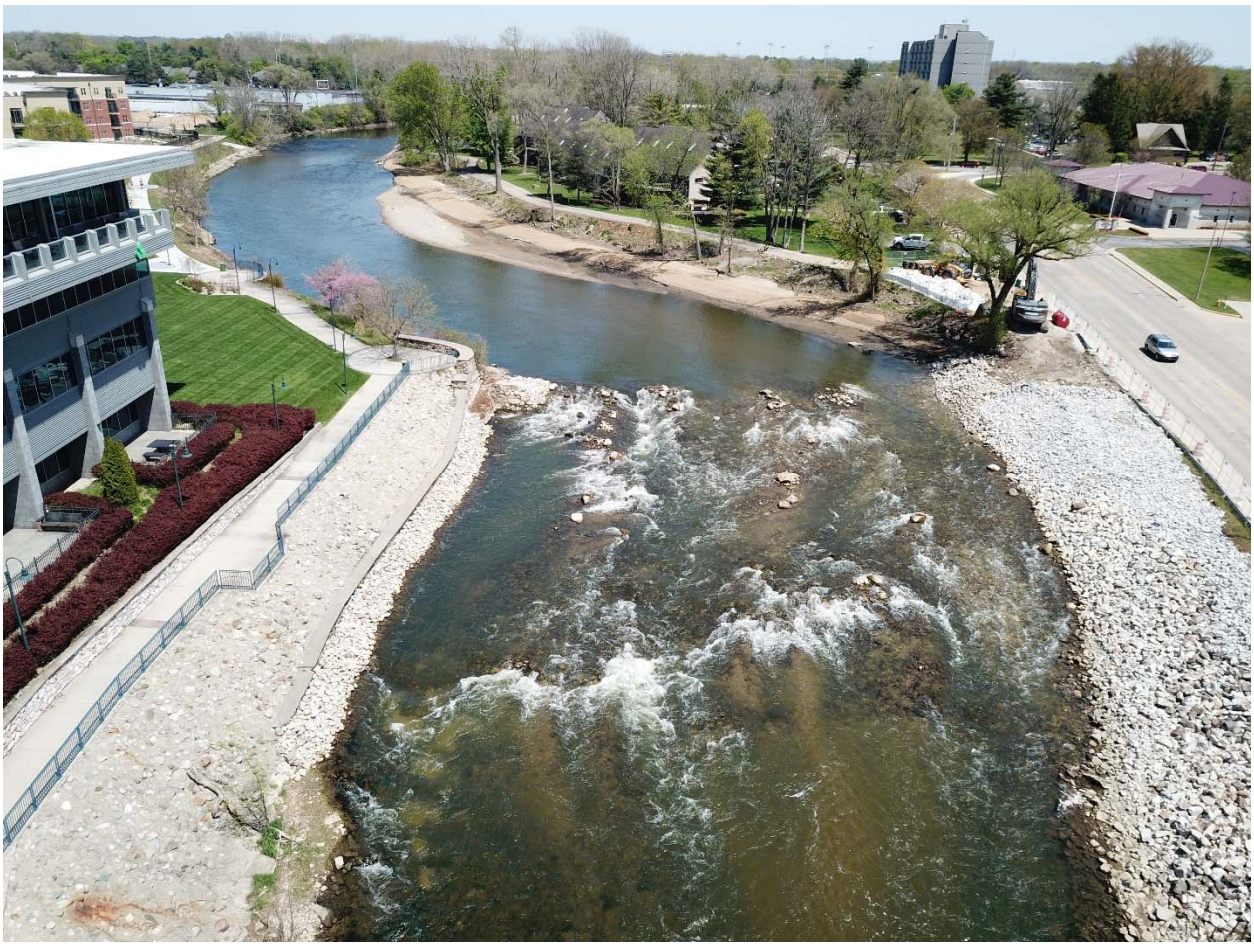
Elkhart River Dam Removal

City of Elkhart



Fish Community Monitoring

December, 2022

City of Elkhart
Public Works and Utilities

Introduction

In the winter and early spring of 2020, the U.S. Army Corps of Engineers, working with the City of Elkhart, removed the Elkhart River Dam in downtown Elkhart. This lowhead dam, located approximately 0.5 miles upstream of the Elkhart River confluence with the St. Joseph River was a major barrier to fish migration, preventing numerous lost species from recolonizing the Elkhart River. Removal of the Elkhart River Dam has resulted in opening up another 20 miles of the Elkhart River, not including tributaries.

Numerous pre-removal fish community surveys were conducted directly above and below the dam between 2000 and 2019 with major surveys in 2009, 2018 and 2019. These surveys revealed a significant disparity in species below versus above the dam (species lists are included in Attachement 1). Surveys conducted in 2018 and 2019 have been designated as pre-implementaiton surveys, while surveys conducted from 2020 to 2022 will provide post-implementation results.

Post-Implementation Surveys (2020 to 2022)

Electrofishing surveys were completed immediately below (Elkhart Avenue) and immediately above (Prairie Street) the former Elkhart River Dam in the years 2020, 2021, and 2022. Each year, surveys were completed at 3 additional stations (9 total from 2020 to 2022) upstream of the former dam that are part of a long-term monitoring network designed by the City of Elkhart. All sites were surveyed twice during the summer months in each year to account for seasonal variablity in their respective fish communities. Additional investigative sampling events were completed upstream in the Goshen area to document new species recolonization.

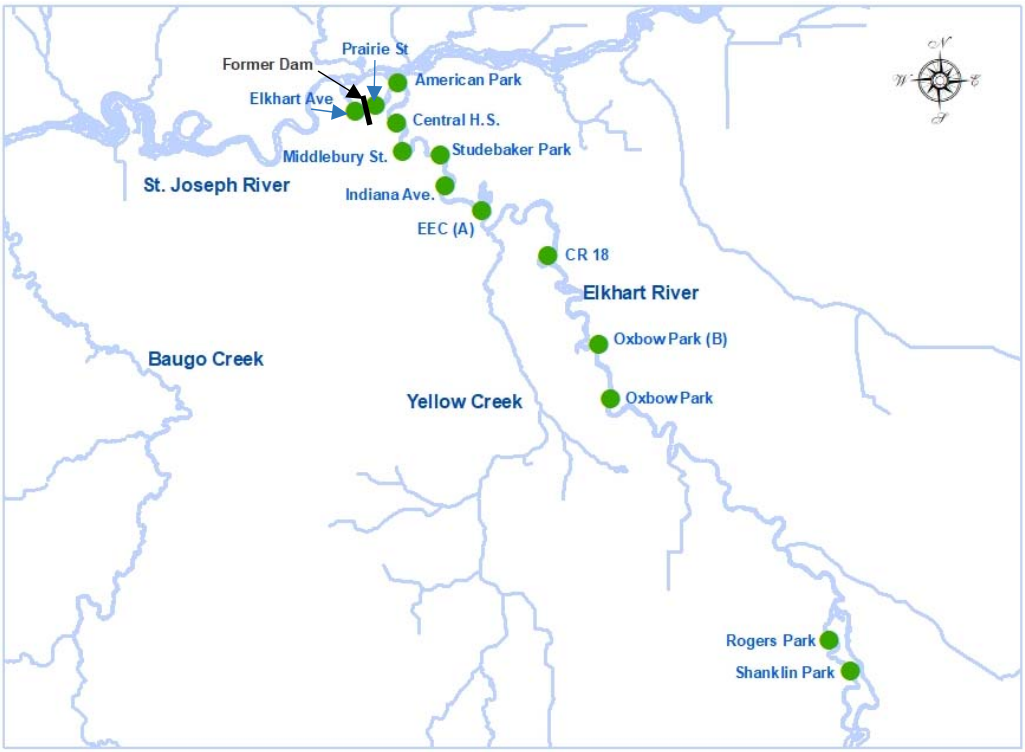


Figure 1: Elkhart River Monitoring sites 2020-2023

Species Records

Based on a review of the pre-removal monitoring data, numerous species were absent from the Elkhart River, but abundant below the dam or in the St. Joseph River. Those species include:

- Channel Catfish (*Ictalurus punctatus*)
- Greenside Darter (*Etheostoma blennioides*)
- Logperch (*Percina caprodes*)
- Longnose Gar (*Lepisosteus osseus*)
- Spotted Gar (*Lepisosteus oculatus*)
- Shorthead Redhorse (*Moxostoma macrolepidotum*)
- Silver Redhorse (*Moxostoma anisurum*)
- Black Redhorse (*Moxostoma duquesnei*)
- Quillback Carpsucker (*Capriodes cyprinus*)

A Longnose Gar collected upstream of the former dam site in 2020

Other species with very sparse records for the Elkhart River, but with relatively high abundance downstream of the former dam include:

- Muskellunge (*Esox Masquinongy*)
- River Redhorse (*Moxostoma carinatum*)
- Brown Bullhead (*Ameiurus nebulosus*)
- Black Bullhead (*Ameiurus melas*)
- Brook Silverside (*Labidesthes sicculus*)
- Bowfin (*Amia calva*)
- Mimic Shiner (*Notropis volcellus*)

A Logperch collected at shanklin Park in 2020, 18 miles upstream

Table 1: A list of 12 "new" species collected upstream in post-implementation surveys

Distance Upstream (miles)	0 to 1	1 to 3	3 to 5	5 to 10	10 to 15	15+
Mimic Shiner	X	X	X	X	X	X
Brook Silverside				X		
Greenside Darter	X					
Logperch	X	X	X	X	X	X
River Redhorse	X	X	X	X	X	X
Shorthead Redhorse	X	X	X	X	X	X
Silver Redhorse	X	X	X	X	X	X
Quillback	X					
Spotted Gar						X
Longnose Gar	X			X		
Channel Catfish	X		X		X	
Bowfin				X	X	

Mimic Shiner – This species was documented in low abundance upstream of the former dam prior to its removal. In 184 surveys completed prior to the dam removal between 1998 and 2019, only 51 individuals were documented by the City of Elkhart. In 27 post-implementation surveys, a total of 1270 individuals were collected. While this is a small minnow species (average size 2 to 3 inches), it rapidly recolonized the Elkhart River and was found in high abundance approximately 18 miles upstream following the dam removal.

Brook Silverside – This species was found in low abundance immediately below the dam and in low abundance in the St. Joseph River downstream of the Elkhart River prior to the dam removal. Prior to the dam removal (in 2009), only 1 individual was collected upstream of the dam. In 2022, 2 individuals were collected approximately 3.5 miles upstream of the dam. Given the dam removal, additional records of this species are expected upstream. However, this species is never expected to be in high abundance in the Elkhart River, given its preference of lentic habitats.

Greenside Darter - This species was found downstream of the dam (mostly in the St. Joseph River) prior to the removal of the dam. It appears that this species has been expanding and increasing in abundance in the St. Joseph River only in recent years. This species was found immediately upstream of the dam in post-implementation surveys but has yet to be found further upstream in the Elkhart River.

Logperch – This species was found in abundance below the dam prior to the removal but was not found upstream. Similar to Mimic Shiner, this species colonized the Elkhart River rapidly and was collected approximately 18 miles upstream within the first year of removal. This species was collected in almost all post-implementation surveys.

River Redhorse – This species was found in high abundance downstream of the dam but low abundance upstream of the dam prior its removal. In 184 surveys completed prior to the dam removal between 1998 and 2019, only 57 individuals were documented by the City of Elkhart (rate of 0.31 individuals per survey). In 27 post-implementation surveys, a total of 15 individuals were collected (rate of 0.56 individuals per survey). In a June 2021 survey approximately 10 miles upstream of the former dam, several were found in spawning condition (gravid females and males with nuptial tubercles) for the first time indicating active reproduction in the Elkhart River.

A breeding male river redhorse collected from the Elkhart River at Oxbow Park in 2021

Shorthead Redhorse - This species was found in high abundance downstream of the dam but was absent upstream of the dam prior its removal. Shorthead Redhorse demonstrated rapid recolonization and were collected in high abundance (405 individuals) upstream of the former dam between 2020 and 2022.

Silver Redhorse - This species was found in relatively high abundance downstream of the dam but was absent upstream of the dam prior its removal. This species was found as far as 10 miles upstream in surveys in 2021 and 2022 and a total of 26 individuals were collected upstream in post-implementation surveys.

Quillback – Only 1 individual of this species was collected upstream of the former dam in post implementation surveys and the 1 individual was collected within the first mile. This species was in relatively low abundance downstream of the former dam prior to implementation but is more abundant in the St. Joseph River downstream of the dam. Given its relatively low abundance below the former dam, it may take some time for this species to recolonize the Elkhart River. However, the Elkhart River may serve as an important spawning tributary for this species as is observed on Baugo Creek, another large St. Joseph River tributary that is in close proximity to the Elkhart River.

Spotted Gar – This species was collected in low abundance below the former dam prior and following implementation. Following removal, 2 individuals were collected approximately 17 miles upstream of the former dam. This species prefers highly vegetated backwaters and impounded sections of the St. Joseph River, and in 2022 both individuals were found in similar habitat (an oxbow backwater area) on the Elkhart River.

Longnose Gar – While this species was found in low abundance immediately below the dam prior to implementation, it is documented in high abundance in the St. Joseph River. In post implementation surveys, this species was collected approximately 10 miles upstream in 2020, and 4 individuals were collected approximately 17 miles upstream in 2022.

Channel Catfish – This species was found in relatively high abundance below the dam and in very low abundance above the dam (5 individuals between 1998 and 2019), prior to implementation. Following removal of the dam, this species was collected approximately 7 miles upstream of the dam in 2020 and approximately 17 miles upstream in 2022. A total of 9 individuals were collected upstream of the former dam in post implementation surveys.

Bowfin - This species was found in relatively high abundance below the dam and in low abundance above the dam, prior to implementation. In 184 surveys completed prior to the dam removal between 1998 and 2019, only 23 individuals were documented by the City of Elkhart. In 27 post-implementation surveys, a total of 15 individuals were collected.

A quillback collected from Prairie St. in 2021

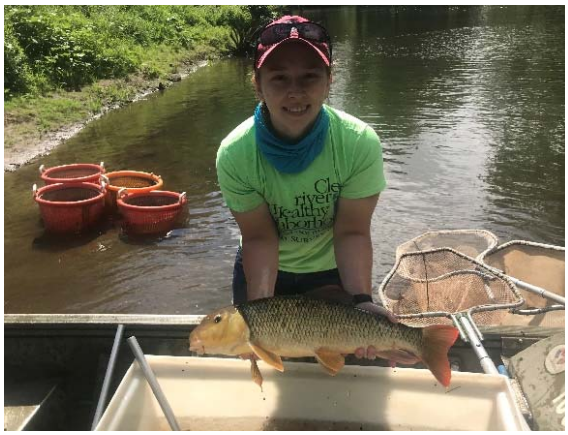
A bowfin collected from Indiana Ave. in 2022

In addition to the species listed above, removal of the dam will benefit approximately 50 additional species through population reconnection. Some noteworthy reconnections include:

- Greater Redhorse (*Moxostoma valenciennesi*) – State endangered species with numerous records above and below the former dam site.

- Northern Brook Lamprey (*Ichtyomyzon fossor*) – State species of special concern with sparse records above and below the dam site. Nine (9) suspected Northern Brook Lamprey ammocoetes (larval lamprey) were collected upstream of the former dam in post implementation surveys and 1 adult was collected in 2022 approximately 2.5 miles upstream.

- Longnose Dace (*Rhinichthys cataractae*) – State species of special concern with sparse records above the former dam site and 1 prior to the dam removal. This species is a riffle specialist and was found on the newly formed riffle upstream of the former dam in November 2020. An additional individual was collected approximately 2 miles upstream in 2022.



A Greater Redhorse collected from Shanklin Park in 2020

A Longnose Dace collected in 2020 on the newly emerged riffle

Recreational fisheries should also benefit from the removal of the dam. Smallmouth Bass (*Micropterus dolomieu*), Walleye (*Sander vitreus*), and Northern Pike (*Esox Lucius*) are all important game species in the Elkhart and St. Joseph Rivers whose populations have been isolated by the presence of the former dam. Our studies with age and growth of Smallmouth Bass indicate slow growth on the Elkhart but normal growth on the St. Joseph. Interactions between these formerly isolated populations will inevitably benefit genetic exchange. Post implementation monitoring suggests that Smallmouth Bass are migrating into the Elkhart from the St. Joseph. A tagged Smallmouth Bass was recaptured upstream of the former dam at American Park in late May, 2020. This fish was tagged in 2019 approximately 4 miles downstream on the St. Joseph River. Furthermore, 2 confirmed catches of Muskellunge by anglers have occurred below the Goshen Dam on the Elkhart River suggesting migration from the small St. Joseph River population.

Other species that are listed in Attachment 1, that may appear to be new species but are not considered priority species for this project, include Gizzard Shad (*Dorosoma cepedianum*), Brown Trout (*Salmo Trutta*), Silverjaw Minnow (*Ericymba buccata*), Central Stoneroller (*Campostoma anomalum*), and Warmouth (*Lepomis gulosus*). Gizzard Shad and Brown Trout are both non-native species that were

found upstream following the dam removal. Prior to the dam removal, Silverjaw Minnow and Central Stoneroller were collected sparsely upstream of the dam, but they were documented in abundance in the upstream tributaries. Warmouth have been found throughout the St. Joseph River Watershed, upstream and downstream of the former dam site.

Index Scores

Fish communities were evaluated using the Index of Biotic Integrity (IBI), Northern Indiana Till Plain Calibration, at the site immediately above (Prairie Street) and immediately below (Elkhart Avenue) the former dam site. IBI evaluations were also completed at 9 long-term monitoring sites located upstream of the former dam (American Park, Studebaker Park, CR 18, Oxbow Park, Oxbow Park (Below), EEC (Above), Central H.S., Indiana Ave., and Middlebury St.). In addition, habitat evaluations were also completed at these sites using the Qualitative Habitat Evaluation Index (QHEI).

IBI scores increased significantly at the Prairie St. site following removal of the dam (pre-impl. avg. = 47; post-impl. avg. = 53). Other fish community metrics including the # of species, the # of darter species, the # sensitive species, and the % of simple lithophils (fish that require coarse substrate for spawning) also improved significantly.

Table 2: Fish community and habitat scores for the sites immediately above and below the former dam

	Pre-Implementation			**Post-Implementation**			
Elkhart Ave. (Below Dam)	2018	2019	Average	2020	2021	2022	Average
IBI Score*	51	50	51	51	49	48	49
# Species	42	38	40	42	41	32	38
# Darters sp.	3	4	3.5	4	5	2	3.7
# Suckers sp.	7	6	6.5	6	6	4	5.3
# of Sensitive sp.	15	14	15	14	17	11	14
% Simple Lithophils*	18	18	18	16	7	14	12.3
QHEI	78	83	81	81	80	82	81
Prairie St. (Above Dam)	2018	2019	Average	2020	2021	2022	Average
IBI Score*	45	49	47	54	52	52	53
# Species	23	30	27	43	37	38	39
# Darters sp.	1	2	1.5	5	5	5	5
# Suckers sp.	5	5	5	7	7	7	7
# of Sensitive sp.	9	9	9	17	15	18	17
% Simple Lithophils*	22	20	21	34	24	31	30
QHEI	52	57	55	79	80	80	80

**IBI scores and % Simple Lithophils were averaged from the 2 sampling events. Species data are combined (not averaged) from the 2 sampling events.*

IBI scores for the Elkhart Ave. site were slightly lower following the dam removal (pre-impl. avg. = 51; post-impl. avg. = 49). Other metrics including the # of species, the # of sucker species, the # of sensitive species, and the % of simple lithophils also decreased slightly. While the habitat remained consistent below the dam (see QHEI scores), fish migration past the dam likely resulted in the slight drops in these fish community metrics.

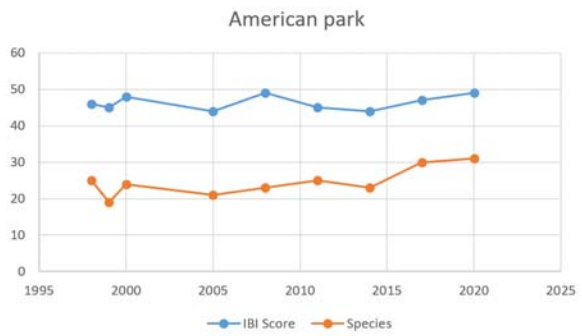
With the changes in stream elevation and flow, and the associated movement of substrates, the habitat (QHEI) scores improved significantly above the dam. Following the dam removal, a high gradient riffle with coarse cobble and boulders appeared approximately 0.1 miles upstream of the former dam. Riffle specialists like the Norther Hog Sucker (*Hypentelium Nigricans*) were abundant in this riffle. In addition to Longnose Dace and Greenside Darter, Blacknose Dace (*Rhinichthys atratulus)*, another riffle specialist, was found for this first time at the Prairie Street riffle in 2020. This feature and other natural features that were exposed from the dam removal were the reason for the increased QHEI score.

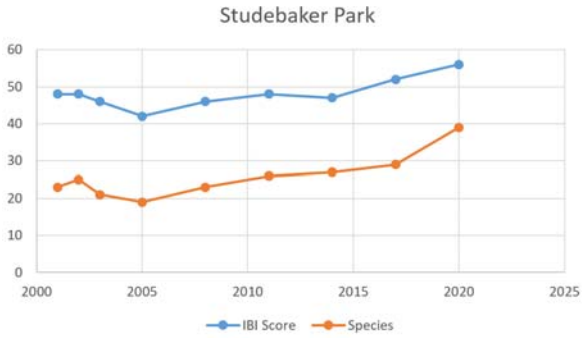
Three years of post-implementation monitoring provides a glimpse into potential future changes in the fish communities immediately above and below the dam. Results in 2020, the first year after the dam removal revealed a spike in species richness above the dam, which dropped off slightly in subsequent results from 2021 and 2022. The initial spike in 2020 was likely associated with fish communities mixing from two different habitat types and the initial surge in upstream migration from species below the dam. Over the course of the first three years, the river upstream of the former dam has continued to evolve as base sediments have shifted from over a 100 years of restriction. While the river seeks equilibrium in the coming years, the fish communities above and below the dam will likely continue to adjust.

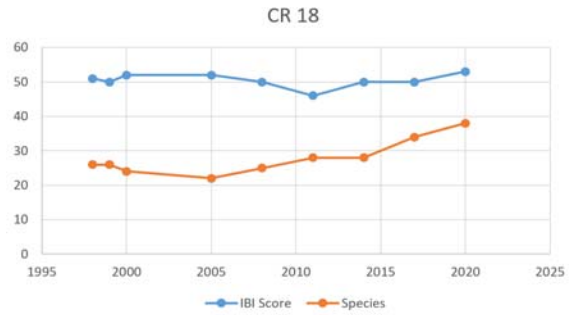
Long-term Monitoring Sites

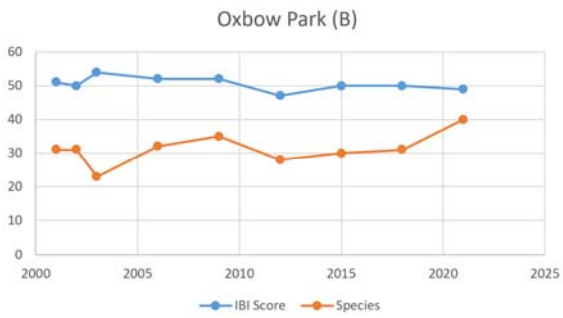
In post monitoring surveys from 2020-2022, species richness hit an all-time high at long-term monitoring sites (Figures 2-10). Prior to the removal of the dam, species richness was generally trending upwards at most of these sites, but in several cases a significant increase occurred following the dam removal. For example, at the Studebaker Park site (approximately 3 miles upstream), species richness increased from 29 in 2017 to 39 in 2020. An approximate 10 species increase was also observed at the EEC (A) site (approximately 4 miles upstream) and at the Oxbow Park (B) site (approximately 10 miles upstream). Modest increases in species richness 4 to 5 species were observed at all other sites, with the exception of the American Park site (approximately 1 miles upstream), where richness increased by only 1 species.

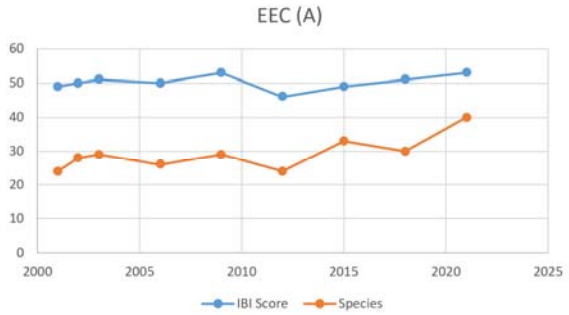
All-time high IBI scores were recorded at several sites on the Elkhart River following the removal of the dam. The Studebaker Park site had particularly impressive numbers in 2020, likely attributed to the dam removal, as did the Middlebury Street site (approximately 2 miles upstream) in 2022. All other long-term monitoring sites had scores either close to or slightly above their all-time high IBI scores, with the exception of the Oxbow (B) site, which has had relatively stagnant scores since 2013.

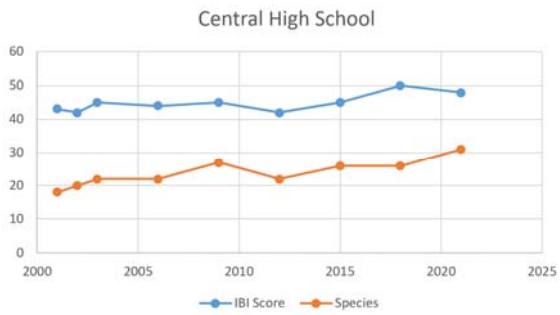


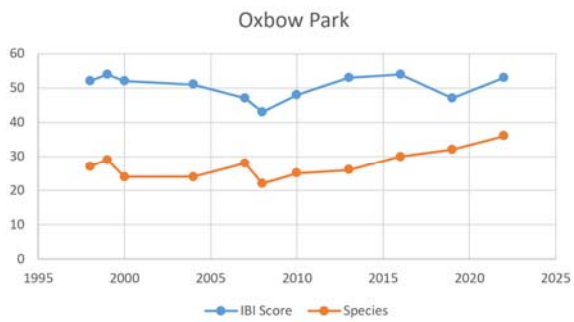


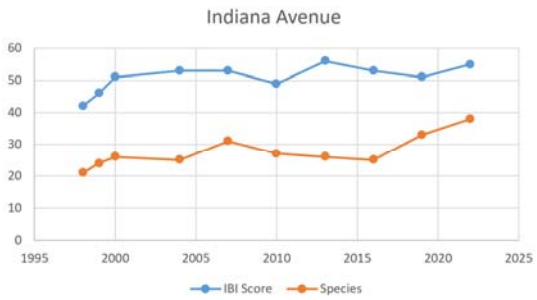


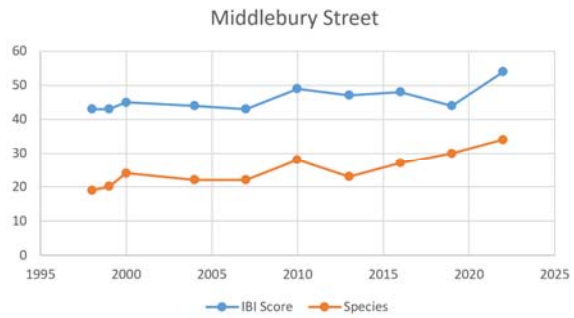












Figures 2-10: IBI and Species Richness at long-term monitoring sites on the Elkhart River.

Attachment 1 – Fish Species Lists

Common Name	Downstream Site (Pre-Removal)	Upstream Site (Pre-Removal)	Downstream (Post-Removal)	Upstream (Post-Removal)
American Brook Lamprey		X		X
Banded Killifish			X	
Black Bullhead	X		X	
Black Crappie	X	X	X	
Black Redhorse			X	
Blacknose Dace				X
Blackside Darter	X	X	X	X
Bluegill	X	X	X	X
Bluntnose Minnow	X	X	X	X
Bowfin	X	X	X	
Brook Silverside	X	X	X	
Brown Bullhead			X	
Brown Trout			X	X
Central Mudminnow			X	
Channel Catfish	X		X	X
Chestnut Lamprey	X	X	X	X
Common Carp	X	X	X	X
Common Shiner	X	X	X	X
Creek Chub	X			X
Fathead Minnow			X	
Gizzard Shad	X		X	X
Golden Redhorse	X	X	X	X
Golden Shiner	X			
Grass Pickerel		X	X	X
Greater Redhorse	X	X		X
Green Sunfish	X	X	X	X
Greenside Darter			X	X
Hornyhead Chub	X	X	X	X
Hybrid Sunfish	X	X	X	X
Johnny Darter	X	X	X	X
Largemouth Bass	X	X	X	X
Logperch	X		X	X
Longear Sunfish	X	X	X	X
Longnose Gar	X		X	X
Longnose Dace	X		X	X
Mimic Shiner	X		X	X
Muskellunge	X			

Common Name	Downstream Site (Pre-Removal)	Upstream Site (Pre-Removal)	Downstream (Post-Removal)	Upstream (Post-Removal)
Northern Brook Lamprey				X
Northern Hog Sucker	X	X	X	X
Northern Pike	X	X	X	X
Pirate Perch		X	X	
Pumpkinseed	X	X	X	X
Quillback	X		X	X
Rainbow Darter	X	X	X	X
Rainbow Trout	X			
Redear Sunfish	X	X	X	X
River Redhorse	X	X	X	X
Rock Bass	X	X	X	X
Rosyface Shiner	X	X	X	X
Sand Shiner	X	X	X	X
Shorthead Redhorse	X		X	X
Silver Lamprey	X			X
Silver Redhorse	X		X	X
Silverjaw Minnow			X	X
Smallmouth Bass	X	X	X	X
Spotfin Shiner	X	X	X	X
Spotted Gar	X		X	
Spotted Sucker	X	X	X	X
Stonecat Madtom			X	X
Stoneroller, Central	X			X
Striped Shiner	X	X	X	X
Walleye	X	X	X	X
Warmouth			X	X
White Sucker	X	X	X	X
Yellow Bullhead	X	X	X	X
Yellow Perch			X	

Attachment 2 – Pictures

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<tr><td>EEC (A) – Longnose Gar</td><td>Prairie Street - Greenside Darter</td></tr>
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<tr><td>Prairie Street - Channel Catfish</td><td>Prairie Street – Brown Trout</td></tr>
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<tr><td>Middlebury St. – Silver Redhorse</td><td>EEC (A) – Silver Redhorse</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Middlebury St. – Shorthead Redhorse</td><td>Middlebury Street – River Redhorse</td></tr>
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Oxbow Park – Juvenile Greater Redhorse	CR 18 – River Redhorse
	
Rogers Park (B) Goshen - Channel Catfish	CR 18 - Logperch
	
Rogers Park (B) Goshen – Spotted Gar	Shanklin Park Goshen - Logperch
	
Shanklin Park Goshen – Shorthead Redhorse	Rogers Park (B) Goshen – Longnose Gar