

# ELKHART-SOUTH BEND AQUATIC COMMUNITY MONITORING



## ANNUAL REPORT 2018



*City of Elkhart*  
Public Works & Utilities

**Tim Neese, Mayor**

Clean  
river  
Healthy  
neighborhoods



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ELKHART ■ SOUTH BEND

Cover Photo: Joshua Schwalm with a big river redhorse at the Elkhart Environmental Center on the Elkhart River

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# AQUATIC COMMUNITY MONITORING ON THE ST. JOSEPH RIVER AND SEVERAL TRIBUTARIES, ELKHART & ST. JOSEPH COUNTIES: 2018 ANNUAL REPORT



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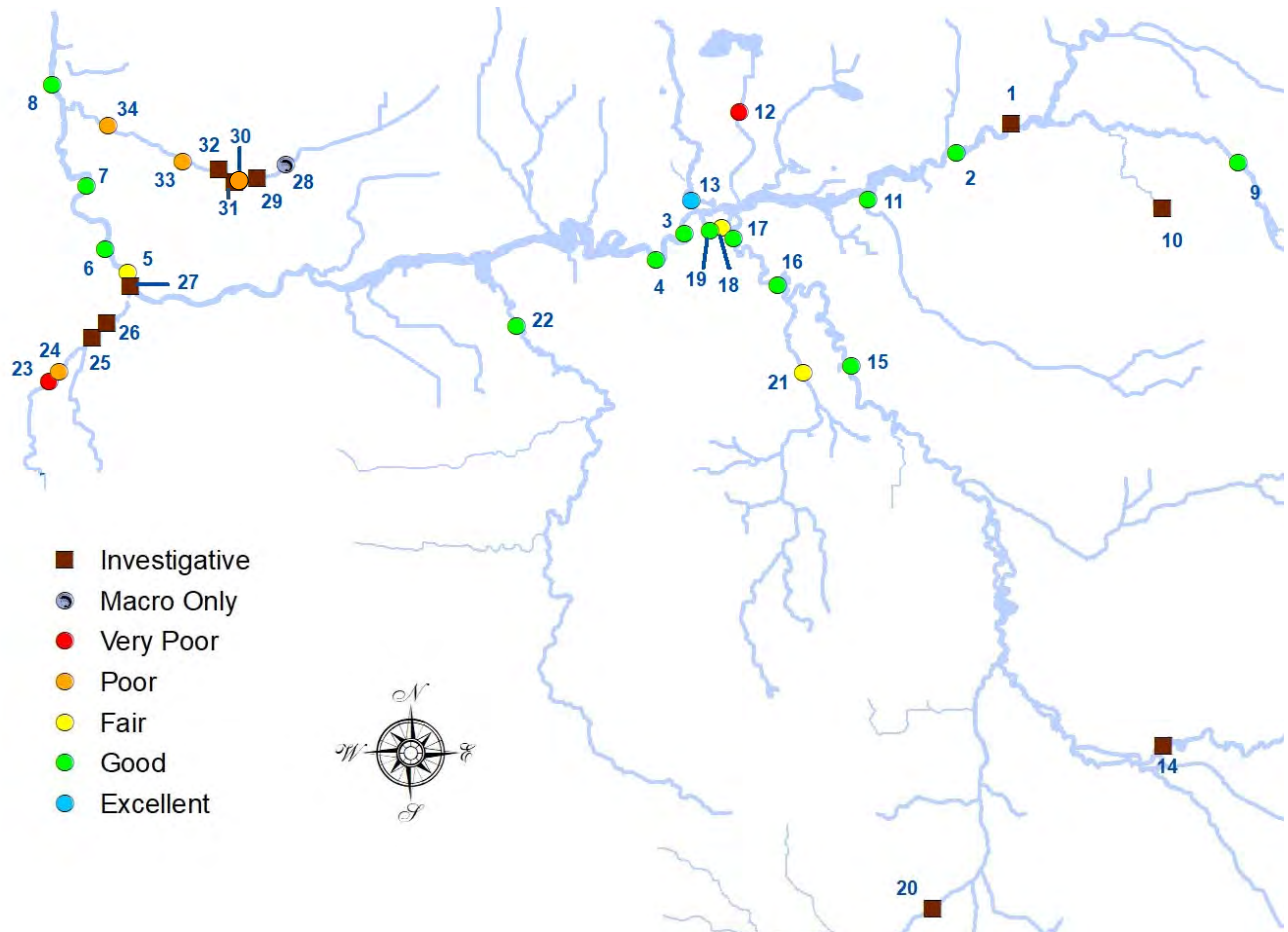
Aquatic Biologist

## **INTRODUCTION**

For many years, the Cities of South Bend and Elkhart have collected surface water samples from our local rivers to evaluate pollutant concentrations. In 1998, the City of Elkhart initiated biological community monitoring to compliment chemical and microbial sampling and to establish a long-term stream monitoring program. The City of South Bend joined forces with Elkhart in 2001, and since then both communities have gathered a great deal of information on the health of our local waterways.

On an average day, 2 billion gallons of water flow through the St. Joseph River in Elkhart and St. Joseph Counties. During the record flood of 2018, the river increased to 6 times its regular volume, with 12 billion gallons of water moving through the St. Joseph River Valley. While residents and neighborhoods were impacted, the river itself underwent some changes through significant movement and redepositing of sediment. Following the record flood of 2018, we entered the sampling season with cautious curiosity about potential impacts to biological communities in the river. Our sampling efforts in 2018 showed little impact, with good numbers of juvenile and adult fish, and healthy macroinvertebrate communities.

**Figure 2: Fish sampling sites in Elkhart and St. Joseph Counties and associated fish community conditions for 2018 (see Table 15 for site information)**



In 2018, the cities of Elkhart and South Bend, through the Aquatic Community Monitoring Program (Aquatics Program), continued to monitor local fish and macroinvertebrate communities in area rivers and streams. The information gathered was integrated into an overall water quality program for each City. While the cities measure the chemical and microbial composition of local stream water, the additional biological data provides a more accurate representation of the overall health of each stream. The way that biological communities are assembled can change as a result of a disturbance, such as a chemical spill or alteration of habitat. Chemical and microbial testing, while very important in pinpointing contaminants, is simply a snapshot of current conditions. In many cases, having both sets of data can help determine the cause and effect of disturbances to our local streams.

During the first 6 years (1998-2003), the Aquatics Program established core fish sampling sites on the St. Joseph River and many of its primary tributaries in the Elkhart area. For 3 consecutive years, data were collected from these sites and a baseline was established for each stream. Baseline data are now used to compare with current monitoring results to determine if impairments or enhancements are taking place in Elkhart area streams.

In 2001, the City of South Bend combined forces with the Aquatic Community Monitoring 2018

Aquatics Program, establishing a unique biological monitoring partnership between municipalities. As with the Elkhart area, core sampling sites were determined and similar baselines were established for South Bend over a 6 year period (2001-2006).

Other sampling efforts have been conducted in both



**A northern sunfish collected from the Elkhart River.**

Elkhart and St. Joseph Counties, offering a comprehensive view of stream conditions for the entire section of the St. Joseph River in Indiana. From 2007 to 2009, baseline monitoring was completed in the Mishawaka section of the St. Joseph River. Baseline monitoring was also conducted in the Goshen area of the Elkhart River in a partnership with the Elkhart River Restoration Association. Additionally, in 2016 baseline monitoring was conducted on numerous sites in the Cobus Creek Watershed to support a watershed study being conducted by the St. Joseph River Basin Commission (this study is available on the St. Joseph River Basin Commission's website: <http://www.sjrbc.com/>). While monitoring will not continue in these areas, the baseline data that were gathered will serve as an important reference for future biological comparisons.

In 2018, the Aquatics Program also collaborated with Indiana University—South Bend to conduct aquatic plant surveys on the St. Joseph River. These surveys were investigative in nature, but were conducted to obtain a better understanding of all aquatic life in the St. Joseph River.

The Aquatics Program consists of more than just traversing through local streams collecting fish data. A considerable portion of the Program is education. The biologist travels to local schools and watershed stakeholder group meetings, giving presentations and demonstrations, in an effort to increase awareness about the health of our local streams, and how it affects our quality of life. In 2018

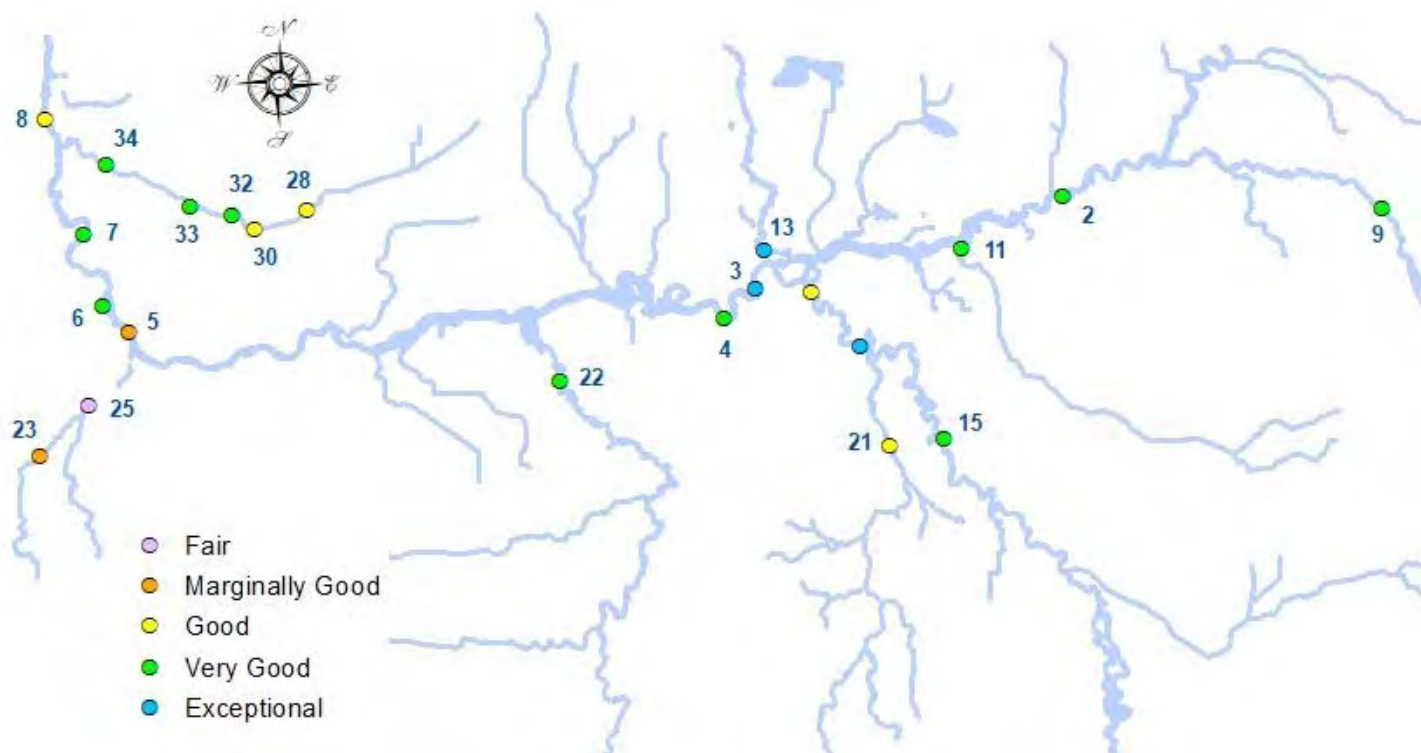
**Aquatics Program Intern, Joshua Schwalm teaches a group of Cub Scouts about a snapping turtle from the Elkhart River.**



alone, the Aquatics Program reached almost 5,000 Michiana residents through public presentations and demonstrations.

### Indices

The Index of Biotic Integrity (IBI) is the system that is used to assess local fish communities. The IBI was developed by Dr. James Karr in 1981 as a tool for assessing water/stream quality based on the fish communities that are



**Figure 3: Macroinvertebrate sampling sites and associated condition for 2018 (see Table 14 for site information)**

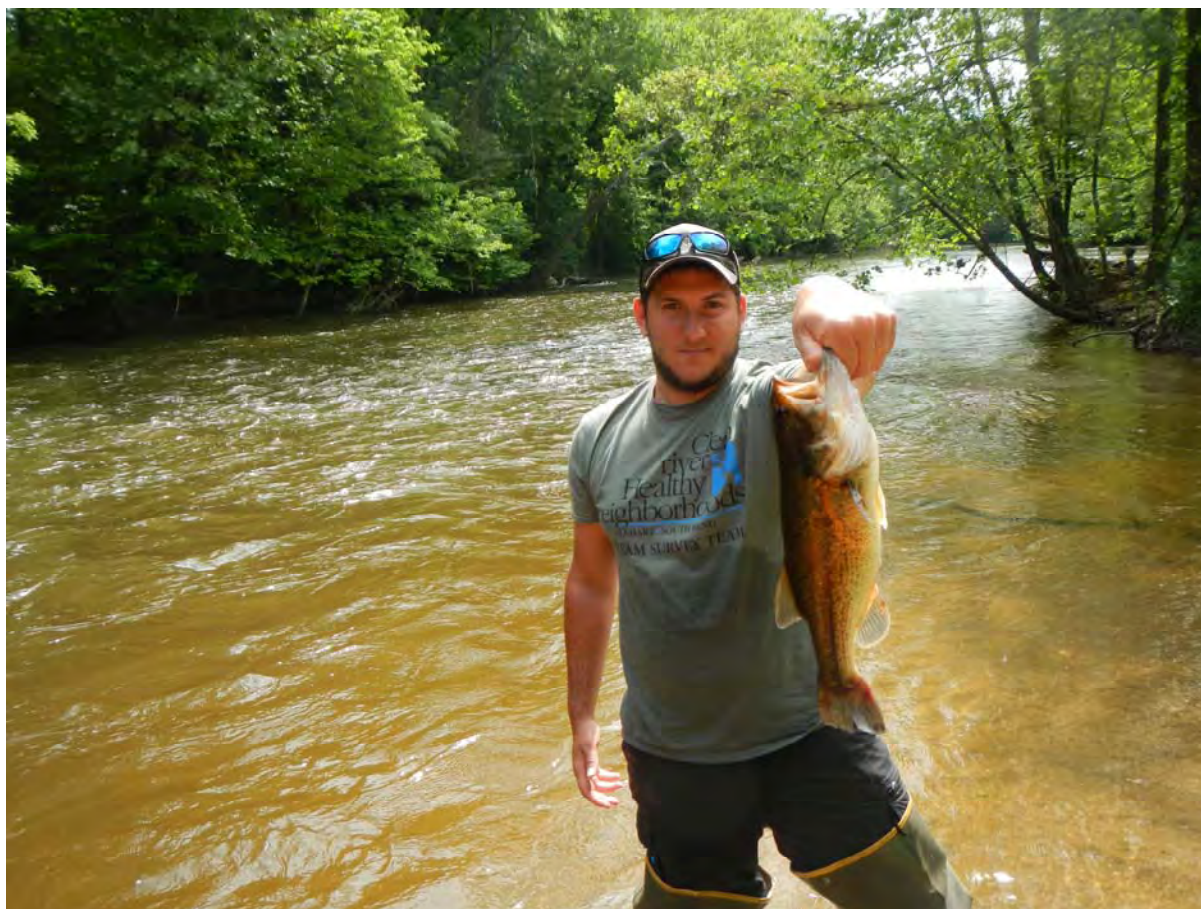
present. The IBI was modified by Dr. Thomas Simon in 1997 for use in the St. Joseph River Watershed. The IBI is a great tool in that complex biological information can be analyzed to provide measurements of stream quality for non-biologists and members of the general public. The IBI is comprised of 3 broad categories (species composition, trophic composition, and fish condition) which are broken down into 12 smaller categories, known as metrics (see Appendix A). These metrics are given a score based on their similarity to least impacted (reference) sites. One of 3 scores can be given for each metric: 1 (not similar to reference conditions), 3 (somewhat similar to reference conditions), or 5 (very similar to reference conditions). In general, the total score for a site will range from 12 to 60, but in an instance where no fish are present at a site, a score of 0 is given. These scores can then be graphed and placed into 1 to 5 classifications (very poor, poor, fair, good, or excellent), which describes the overall condition of the fish community being monitored.

Biologists recognize that fish community condition is a product of the water quality and the habitat that is available in any given area. Since 2003, the Aquatics Program has been assessing available habitat at all sampling loca-

tions using the Qualitative Habitat Evaluation Index (QHEI) (Rankin 1989). This index is similar to the IBI in its structure. It has 6 broad categories which are broken down into 21 smaller categories or metrics (Appendix A). This index will have a final score of 0 to 100 and the scores will be classified as excellent, good, fair-good, poor, and very poor. This assessment will help determine to what extent the IBI scores are being affected by habitat. It may also show specific habitat degradation issues that need to be addressed.

Fish are not the only aquatic organisms that can be monitored to determine overall health of rivers and streams. Through a sub-contract with the Midwest Biodiversity Institute (MBI, Columbus, Ohio), the Aquatics Program is also monitoring benthic (bottom dwelling) macroinvertebrates (visible animals without backbones). Twenty-two (22) sites were sampled in 2018 and results were compared to their respective baseline values or the value from the previous sampling event. The macroinvertebrate communities are assessed with the Invertebrate Community Index (ICI) developed by the Ohio Environmental Protection Agency (EPA) (Ohio EPA 1987). This index is broken down into 10 metrics (Appendix A). Like

**Joshua holding a largemouth bass at Oxbow Park on the Elkhart River. The location on the Elkhart River behind Joshua is where the old oxbow channel (where the park gets its name) was likely cut out of the river. This location has a high gradient riffle with lots of boulders and large cobble rocks making it one of the highest quality riffle habitats in the Elkhart area**





the IBI metrics, the ICI metrics are given a score based on their similarity to relatively undisturbed sites; 6 (comparable to exceptional community), 4 (comparable to typical community), 2 (slightly different from the typical community), or 1 (very different from the typical community). The site scores range from 0 to 60 and are classified similar to IBI scores. This combination of fish, habitat, macroinvertebrate, and chemical monitoring provides the cities of Elkhart and South Bend with the most comprehensive view of stream health.

The Indiana Department of Environmental Management (IDEM) has established guidelines to determine if a body of water is impaired or if its condition is supportive of aquatic life for the IBI and QHEI (IDEM 2015). The ICI is not an index used by IDEM, however, similar guidelines have been established by OHIO EPA for a nearby region, and those values are being used with the Elkhart and St. Joseph County data. Values of 36 or higher for IBI and ICI scores are indicators of a stream with the ability to support aquatic life. IDEM refers to streams with a score of 36 or higher, as those that are “attaining” aquatic life standards. QHEI scores of 51 or greater indicate that enough quality habitat is available to support aquatic communities.

In addition to performing water quality monitoring in the St. Joseph River basin, fish collections are conducted to determine the overall species diversity throughout the watershed. Walleye (*Sander vitreus*) and smallmouth bass (*Micropterus dolomieu*) populations are monitored from previous tagging events in cooperation with the Indiana Department of Natural Resources (IDNR). Tissue from 10 fish species was collected and analyzed for mercury and polychlorinated biphenyl (PCB) content. Current Indiana Fish Consumption Advisory data for the State of Indiana (Tables 10-13) include many species from the Indiana portion of the St. Joseph River Water-

shed. The cities involved in the Program believe it is vital to continually provide local citizens with the most updated and comprehensive information on local fish consumption.

## Methods

For the past 20 years, the Aquatics staff has used 2 collection protocols (investigative sampling and index sampling) to quickly catalog the major fish species and to quantify stream quality in the St. Joseph River Watershed. Investigative sites are sampled once during the season and the fish collected at these sites are identified to species, the largest and smallest specimens are measured to the nearest millimeter (mm), and all fish are counted and then released. Index sites are sampled twice during the season, with a minimum 5 week “rest” period between sampling events. Individual species maximum and minimum lengths are recorded, all fish are counted, and game fish are weighed and measured individually, while most non-game fish are mass weighed. Individual length and weight data are also collected for some of the important species like greater redhorse.

The length of stream sampled at an index site is dependent on the wetted width of the stream. The length of sites is 15 times this width, with a minimum of 50 meters and a maximum of 500 meters. Differences in sampling and processing (Foy 2004) have allowed multiple investigative sites to be sampled in a day versus 1 or 2 index sites. Every species collected at each site is verified either by retaining and preserving a small specimen for the Public Works & Utilities voucher museum or by photographing a large specimen. This practice allows for the verification of the field and lab identifications if needed.



**A big striped shiner collected from Pine Creek in Elkhart County**

**Figure 4: Hester-Dendy sampler placed into the stream bed**



In 2018, 9 index and 6 investigative sites were sampled in St. Joseph County and 14 index and 4 investigative sites were sampled in Elkhart County. IBI scores were calculated for each of the index sites and an average from the 2 visits was obtained to give the final score.

Fish were collected using either boat mounted, tote barge, or backpack electrofishing equipment. The type of gear used depended on the size of the stream. The St. Joseph and Elkhart Rivers were sampled with the boat. Smaller, wadeable streams were sampled with the tote barge, unless the stream was extremely small and shallow, in which case, the backpack was used. Power output from the 3 devices differed. The boat output was 8-16 amperes, the tote barge was 4-6 amperes, and the backpack was 0.5-1.5 amperes.

During each fish sampling event, stream habitat information was methodically collected using the QHEI as developed by Ohio EPA (Rankin 1989). Given that each index site was sampled twice, scores were averaged to give a final score (Table 15).

In late June 2018, Aquatics personnel placed Hester-Dendy samplers (artificial substrates used to collect small aquatic organisms) (Figure 4) at 22 sites (Table 2 and Figure 3) following Ohio EPA macroinvertebrate sampling procedures (Ohio EPA 1987, 1989). Of the 22 samplers that were set, 20 were placed at fish index sites, while 2

were placed at sites where macroinvertebrate data is most important. The data gathered from the samplers is considered a quantitative sample where species are identified and specimens are counted. This information was then used to calculate ICI scores for each site. Qualitative sampling also took place at each site with the use of a kick net through all available habitat near the location of the sampler. This extra sampling is used to capture additional species as well as provide information to make an estimate of stream health in the case where an ICI score can not be calculated due to the loss or vandalism of a sampler.

Fish tissue in the form of fillets was collected from bluegill (*Lepomis macrochirus*), common carp (*Cyprinus carpio*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), northern pike (*Esox Lucius*), and black crappie (*Pomoxis nigromaculatus*). Collection locations for fish tissue samples are presented in Table 3. Each tissue sample sent in for laboratory analysis (Pace Analytical, Green Bay, WI) was a composite of fillets from 3 fish of the same species from the sample reach. The shortest specimen was within 90% of the length of the longest specimen. The samples were collected following the procedures in Appendix B (this report) and in "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory", Appendix III (1993).

Long-term index monitoring consists of rotational sampling of stream stations. Each station is visited at least once every 3 years to gather biological and chemical data and to compare against previous sampling results, and baseline data.

## Results and Discussion

During the summer of 2018, a total of 21,089 fish, representing 19 families and 65 species, were collected in Elkhart County. In St. Joseph County, 6,781 fish, repre-

**Table 2: Macroinvertebrate Sampling Sites, 2018**

<u>Site Number</u>	<u>Stream</u>	<u>Location</u>	<u>Site Number</u>	<u>Stream</u>	<u>Location</u>
2	St. Joseph River	Nibbyville (A)	16	Elkhart River	EEC (A)
3	St. Joseph River	Lexington Ave	17	Elkhart River	Central High School
4	St. Joseph River	McNaughton Park	21	Yellow Creek	Concord High School
5	St. Joseph River	Jefferson Blvd	22	Baugo Creek	Restoration Site (B)
6	St. Joseph River	LaSalle Street	23	Bowman Creek	Gertrude Street
7	St. Joseph River	Keller Park	25	Bowman Creek	Green Tech Drive
8	St. Joseph River	Brick Road	28	Juday Creek	Holy Cross Pkwy
9	Little Elkhart River	CR 35	30	Juday Creek	Grape Road
11	Pine Creek	SR 120	32	Juday Creek	Driftwood
13	Christiana Creek	North Main Wellfield	33	Juday Creek	Ponader Park
15	Elkhart River	Oxbow (B)	34	Juday Creek	Myrtle Street

**Table 3: Location of fish tissue collection sites on the St. Joseph River for 2018**

<u>County</u>	<u>Location</u>
Elkhart	Nibbyville (A)
Elkhart	Six Span
Elkhart	McNaughton Park
St. Joseph	Jefferson Blvd
St. Joseph	Keller Park
St. Joseph	Brick Road

senting 17 families and 55 species were collected. In total, 66 different species were captured from the 2 counties.

Longear sunfish (*Lepomis megalotis*), bluegill (*Lepomis macrochirus*), and rock bass (*Ambloplites rupestris*) were the most abundant species collected in St. Joseph County, while spotfin shiner (*Cyprinella spiloptera*), bluegill (*Lepomis macrochirus*), and striped shiner (*Luxilus chrysocephalus*) were the most abundant in Elkhart County. For more detailed information on the number and types of fish species collected, see Appendix C.

### Indices

Fish community conditions at the index sites ranged from very poor (20) at Gertrude Street on Bowman Creek to excellent (55) at North Main Wellfield on Christiana Creek. Macroinvertebrate community scores ranged from fair (26) at Green Tech Drive on Bowman Creek to exceptional (56) at Lexington Avenue on the St. Joseph River. Habitat

#### Fish Community Metrics Explained

- % Simple Lithophils—Fish that are simple lithophilic spawners are those that don't protect their nest and young. They require high quality, coarse substrate for reproduction. An increase in the % of simple lithophils at a site suggests an improvement. Sucker species are simple lithophils.
- % Tolerant Species—Tolerant species are those that can survive in areas with degraded habitat or water quality. A decrease in the % of tolerant species collected suggests an improvement at a site.
- % Omnivores—Omnivorous fish are generally those that are adaptable and usually tolerant. A decrease in the % of omnivores suggests an improvement at a site.

quality ranged from poor (34) at Park Six Drive on Lily Creek to excellent (96) at County Road 35 on the Little Elkhart River.

#### *St. Joseph River*

Fish, macroinvertebrate, and habitat index scores for the entire Indiana portion of the St. Joseph River are displayed in Table 4. Previous index scores are also included.

In 2017, the Aquatics Program completed the 20th year of monitoring the St. Joseph River. IBI scores suggest minor increases in fish community integrity within the St. Joseph River over the 20 years of sampling, however, IBI scores were already high for the St. Joseph River when baseline data were collected. Given that 20 years of sampling has been conducted, a more rigorous and sensitive analysis of fish community data has been performed to evaluate subtle changes overtime. Data from this analysis are summarized herein and can be found in more detail in Appendix G.

In 2018, IBI scores at sites in the Elkhart County section of the St. Joseph River all fell within the very good range. The scores at Nibbyville (A) and Lexington Avenue were very similar to baseline scores, while the score at McNaughton Park was significantly higher than the baseline. IBI results from the past 3 rounds of sampling at this



**Joshua with a pair of big smallmouth bass from the Jefferson Boulevard site in South Bend.**

**Table 4. Index scores for St. Joseph River sites, Elkhart and St. Joseph Counties**

Station	County	River Mile	Fish IBI Scores				2018 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2012	2015	2018		Baseline/ Previous Score	2018
Nibbyville (A)	Elkhart	83.7	52	56	53	51	85	44	50
Lexington Avenue	Elkhart	75.7	52	54	50	52	83	52	56
McNaughton Park	Elkhart	74.4	46	48	53	51	59	36	44
Jefferson Blvd.	St. Joseph	57.9	44	40	41	42	58	40	32
LaSalle	St. Joseph	57.2	46	48	48	51	86	41	50
Keller Park	St. Joseph	54.9	50	54	47	54	80	VG*	50
Brick Road	St. Joseph	51.7	46	49	47	53	92	43	42

VG\* - denotes a rating of "Very Good" for this site based on the macroinvertebrates present with HD sampler lost

Fish Community Metrics Explained (continued)

- The # of species is a powerful basic metric for evaluating the health of an ecosystem. Higher species diversity reflects superior water quality and a higher diversity of habitats to support more species.
- # of sensitive species—sensitive species are those that cannot tolerate degraded water quality or habitat. Having a high number of sensitive species is a positive indication of stream health.
- % Insectivores—insectivores are generally considered a sensitive group of fish. Their presence in high numbers suggests that there is an abundance of insects present in the stream as a forage base.

site (2012-2018) suggest that the fish community is improving. Furthermore, the analysis of individual metrics for this site indicates that species diversity and other positive metrics are increasing at this site.

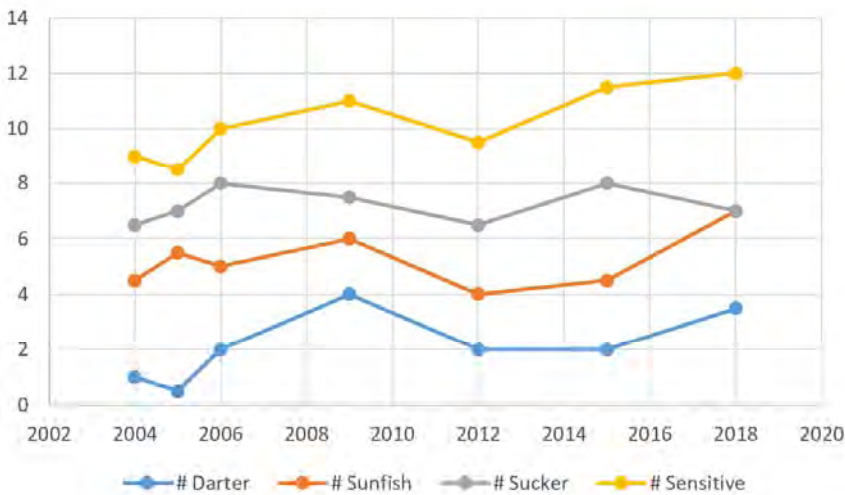
The metric analysis results correspond with results reported last year for the St. Joseph River. The percent of simple lithophilic fish metric has decreased significantly at most sites on the St. Joseph River in both counties. The number of sucker species has also decreased at some sites (sucker species are simple lithophils). While this does present a slight concern, it may just be a cyclic phenomenon and suckers will rebound in the future. The simple lithophilic metric is also skewed to a certain extent due to the significant increase in abundance of sunfish which are nest makers and not simple lithophils.

Macroinvertebrate scores for the Elkhart County section of the St. Joseph River were all up significantly since the previous sampling event in 2015 (Table 4). Although the score at McNaughton Park was up, it is still low relative to other St. Joseph River sites in Elkhart County. McNaughton Park is located on the upstream edge of an impoundment, which appears to have an influence on the quality of the macroinvertebrates at this site (Deegan, 2016)

IBI scores for the St. Joseph River in South Bend were very good with the exception of the Jefferson Boulevard site which had a score similar to its baseline value (Table 4). The Jefferson Boulevard site is located directly upstream of the South Bend Dam, which changes the habitat in the river and negatively affects the fish community, thus resulting in lower IBI scores (Deegan et al., 2017). The other sites in St. Joseph County scored well above their respective baseline values. The Brick Road site on the downstream end of South Bend had a particularly impressive score of 53, which is much higher than the baseline value of 46. This site has also had several positive changes in individual metrics since the inception of monitoring. The number of species has increased at this site over the years and the number of several important groups of fish, such as the darters and sensitive species, has increased (Figure 5). These positive trends have also been observed at the Darden Road site which is located in close proximity on the downstream side of South Bend.

Macroinvertebrate community scores for the South Bend section of the St. Joseph River also appear to demonstrate improved or similar results from previous monitoring

**Figure 5: Changes in IBI metrics at Brick Road on the St. Joseph River**



**A young red eared slider collected close to Darden Road in South Bend**



events. The one exception is at Jefferson Boulevard where the score dropped from 40 to 32. This does not present much of a concern, however, as its understood that the impoundment habitat created by South Bend Dam has a significant influence on the biological communities at this location.

Long-term trends for the St. Joseph River and tributaries show a startling increase in the total abundance of fish at most sites in the watershed. This increase does affect IBI scores (sometimes negatively) as it can influence IBI metrics that are based on proportions. We are interpreting these results cautiously at this time because it may be a reflection of a major ecosystem change within local waterways due to a change in an environmental variable. One potential explanation is that nutrient input (fertilizer runoff) is causing an increase ecosystem productivity. On the other hand, this increase in abundance may reflect a posi-

tive change as a result of better conditions for fish reproduction over past few years. Future monitoring results may shed more light on this issue.

*Elkhart River*

IBI Scores for the Elkhart River were similar to baseline scores for the Oxbow Park and Elkhart Environmental Center (EEC) (A) sites (Table 5). The score at Central High School was up significantly. IBI scores do not reflect much change at the EEC (A) site. However, individual metrics suggest positive changes, with an increase in the number of species and a decrease in tolerant fish and omnivores. These metric changes have also occurred at the Central High School site (see Appendix G).

Macroinvertebrate community scores were relatively similar to previous scores at Oxbow Park (B), but up signifi-

**Table 5: Index scores for Elkhart River sites, in Elkhart County**

Station	River Mile	Fish IBI Scores				2018 Habitat Scores	(ICI) Macroinvertebrate Scores	
		Baseline	2012	2015	2018		2015	2018
Oxbow Park (B)	10.2	52	47	50	50	90	46	44
EEC (A)	4.6	50	46	49	51	77	42	54
Central High School	2.1	43	42	45	50	78	44	38
Prairie Street	0.8				45	52		
Elkhart Ave	0.5				51	78		

**Table 6: Index scores for Bowman Creek and Juday Creek sites, St. Joseph County**

Stream	Station	Stream Mile	Fish IBI Scores (Coolwater IBI Scores)					2018 Habitat Scores
			Baseline	2012	2015	2017	2018	
Bowman Creek	Gertrude Street	3.4				19	20	61
Bowman Creek	Chippewa Avenue	3.0	13	25	25		25	74
Juday Creek	Grape Road	5.3	29 (31)	32 (36)	26 (33)		30 (36)	65
Juday Creek	Ponader Park	3.7				31 (31)	32 (30)	53
Juday Creek	Myrtle Street	1.7	21 (24)	24 (30)	24 (26)		30 (30)	52

cantly at the EEC (A) site. The score at Elkhart Central High School, however, was down significantly from the previous score. These results somewhat conflict with the fish community scores, but they illustrate the importance of sampling both fish and macroinvertebrates. Fish communities offer a better picture of the long-term health of a stream, whereas, macroinvertebrates are more indicative of a short-term disturbance.

*Bowman Creek*

The IBI score at Bowman Creek at Chippewa Avenue was 25, which is the same as the result from the last two sam-

pling seasons in 2012 and 2015. Although this score reflects an impaired fish community, it is significantly higher than the baseline value. Habitat changes occurred at this site following initial baseline sampling, which have had a very positive impact on the fish community.

The Aquatics Program initiated baseline sampling at Gertrude Street in 2017 and performed the second round of sampling in 2018. The 2018 IBI score of 20 was up slightly from 2017, and is indicative of an impaired stream. Macroinvertebrate scores were much higher (scoring 34 over the past 2 years), but still considered impaired. While Bowman Creek, upstream of the City of South Bend, has relatively good stream habitat, the biological communities

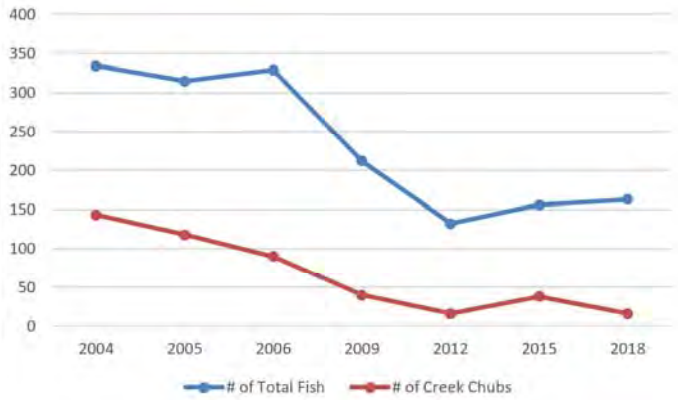
**Table 7: Macroinvertebrate Scores for additional Bowman and Juday Creek Sites**

Stream	Station	Stream Mile	2012	2015	2016	2017	2018
Bowman Creek	Gertrude Street	3.4				34	34
Bowman Creek	Green Tech Drive	2.0		30			26
Juday Creek	Holy Cross Pkwy	6.6			44	44	38
Juday Creek	Grape Road	5.3	20	40			40
Juday Creek	Driftwood Dr.	4.6			38	44	44
Juday Creek	Ponader Park	3.7					48
Juday Creek	Myrtle Street	1.7	50	50			46



**Pictured right: A Dobson fly larvae, also known as a hellgrammite, collected from the North Main Wellfield on Christiana Creek. Although they are very large, rather creepy looking macroinvertebrate, hellgrammites are very sensitive animals and indicators of a high quality stream. They are found in high abundance in Christiana Creek, and the Aquatics Program occasionally collects them from other local streams.**

**Figure 6: The number of creek chubs at Grape Road on Juday Creek (2004-2018)**



are reflective of a stream that is in poor condition and suffers from water quality issues.

*Juday Creek*

The IBI scores for Juday Creek do not indicate much change at Grape Road and Myrtle Street, however, we have argued previously that the IBI in its current form may not be the most appropriate tool for evaluating Juday Creek and other local coolwater streams. As such, the Aquatics Program is putting more of a focus on macroinvertebrate communities in Juday Creek. Furthermore, individual IBI metrics also appear to provide some meaningful data for analyzing changes overtime in Juday Creek.

IBI metrics do not show much change in the fish communities at Myrtle Street and Grape Road, with the exception in the significant reduction in abundance of fish at both sites. While fish abundance in most streams across the St. Joseph River Watershed appears to be increasing, the opposite is occurring in Juday Creek. The drop in fish abundance, however, does not appear to present much of a concern for either site, as the it appears to be correlated to a drop in the abundance of creek chubs, a very tolerant species (Figure 6).

Macroinvertebrate community scores at long-term monitoring sites (Grape Road and Myrtle Street) demonstrate a much different picture of the health of this stream. Both sites scored well above state standards for water quality. The score at Grape Road (40) was the same as when the site was last sampled. The score at Myrtle Street was down from when this site was last sampled, but still in the "Very Good" range. Macroinvertebrates were also sampled at Holy Cross Parkway and Driftwood Drive for the third consecutive year to establish a baseline at these sites for future comparisons. Established baseline scores for both sites are 42.



Skye with a beautiful greater redhorse from the St. Joseph River in Elkhart County

Yellow Creek

Yellow Creek at Concord High School has improved slightly since the completion of baseline monitoring (Table 8). The score in 2018 was 36, which is just above the line for being considered an impaired fish community. The macroinvertebrate score in 2018 (40) was up significantly from when this site was last sampled, but close to the score of 42 it received in 2012. In 2016, much of the riparian vegetation adjacent to this site was removed. Although this did not appear to impact the biological communities at this site, it is yet another disturbance to a stream that needs all the help it can get.

*Yellow Creek*

**Table 8: Index scores for Yellow Creek and Pine Creek, Elkhart County**

Stream	Station	River Mile	Fish IBI Scores				2018 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2012	2015	2018		2015	2018
Yellow Creek	Concord High School	2.2	34	36	34	36	63	32	40
Pine Creek	State Road 120	0.2	40	46	45	52	84	42	50
Lily Creek	Park Six Drive	2.7	15	6	6	15	34		

**Table 9: Index scores for sites on the Little Elkhart, Christiana Creek and Baugo Creek, Elkhart County**

Stream	Station	River Mile	Fish IBI Scores				2018 Habitat Scores	Macroinvertebrate scores (ICI)	
			Base-line	2012	2015	2018		2015	2018
Little Elkhart River	CR 35	6.5	43	45	46	51	96	48	52
Christiana Creek	North Main Wellfield	0.7	48	51	57	55	84	50	54
Baugo Creek	Restoration (B) Site	1.4	43	46	48	48	86	F*	44

\*F—denotes a rating of “Fair” for this site based on the macroinvertebrates present

*Pine Creek*

Due to loss of site access at SR 120 in 2018, the boundaries of this site were moved upstream to the adjacent property (see site location map in Appendix F). While some stream characteristics are different at the new location, habitat is very similar, and the fish community should be very similar at both locations. We will continue to use the new monitoring location to compare to previous sample events, but will note that it is not the exact same site.

Pine Creek at SR 120 has improved significantly since the initiation of baseline monitoring. The 2018 score of 52 was one of the highest IBI scores for any site, and is significantly higher than the baseline value of 40. Pine Creek does suffer from impairment in most locations given that it has been converted into a drainage ditch for much of its length. However, at the SR 120 location, it has very good habitat to support a high quality fish community. The macroinvertebrate community also scored very high (50) in 2018, improving significantly from when the site was previously sampled in 2015.

**Daragh with a little longnose gar at Darden Road in South Bend.**



*Lily Creek*

Of the streams monitored by the Aquatics Program in Elkhart County, Lily Creek has the most impaired fish communities (Table 8). Lily Creek enters the St. Joseph River just above the Johnson Street Dam. It has been known to run dry during warm summer months, which appears to be the main limitation on aquatic life in the creek. Lily Creek drains Simonton Lake and it is likely that the lake control on Simonton limits the amount of water that should be naturally drained into this creek.

*Little Elkhart River*

The fish community at the Little Elkhart River CR 35 site scored very well (51) in 2018, up significantly from the baseline score of 43. In addition, numerous IBI metrics including the number of species, the number of sensitive species, the number of darter species, the number of sunfish species, the percent of tolerant fish, the percent of insectivores, and the percent of carnivores, have improved since the inception of monitoring at this site. The macroinvertebrate community score (52) was also very high, up from when the site was last sampled in 2015.

*Christiana Creek*

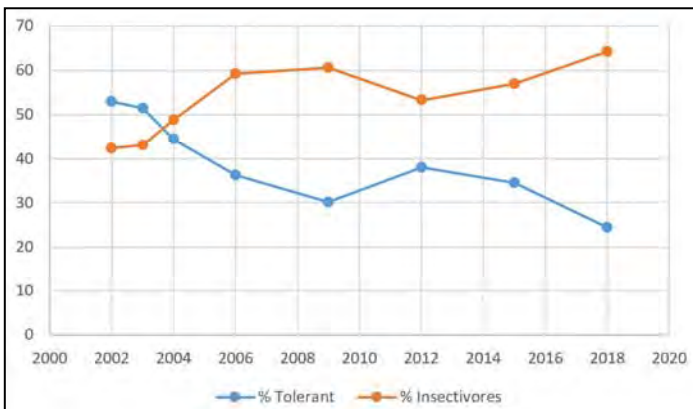
Christiana Creek at North Main Wellfield had a very high IBI score in 2017, although the IBI scores at this site have been very high for the past decade (Table 9). This site has seen substantial improvement since the inception of monitoring as indicated by fish species diversity which has increased significantly. The macroinvertebrate community is also thriving at this site, as indicated by the impressive score of 54 it received in 2018. Dobsonfly larvae, which are large, very sensitive, aquatic insects, are also found in abundance at this site.

*Baugo Creek*

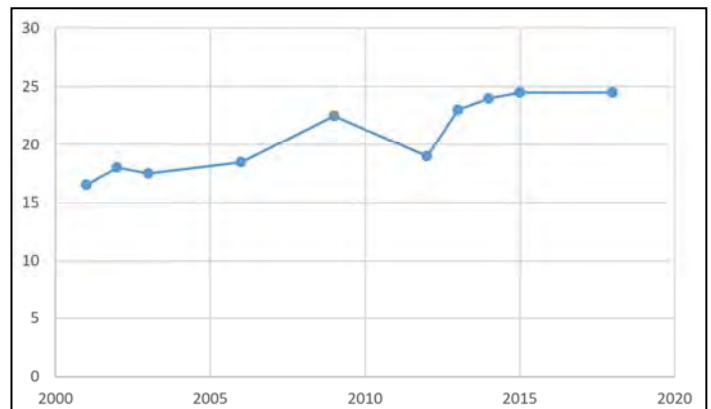
The IBI scores for the Restoration (B) site on Baugo Creek was 48 which is the same as the last time as it was sampled and up significantly from the baseline value. This site



**Figure 7: Changes in the percent of tolerant individuals and insectivores at CR 35 on the Little Elkhart River**



**Figure 8: Changes in the number of species collected at North Main Wellfield on Christiana Creek**



was initially sampled to gauge the benefits of instream restoration work that was completed by the Elkhart County Drainage Board. Based on IBI scores, the restoration may have benefited the fish communities at this site. The 2018 macroinvertebrate community score fell in the “Good” range suggesting an improvement from 2015 when this site fell in the “Fair” range.

### Fish Tissue

In 2018, tissue was collected from fish in both Elkhart and St. Joseph Counties. Collections were based on the current Fish Consumption Advisory (FCA) for area streams and potential data gaps within the FCA. The FCA provides guidance on the rate of consumption of local wild fishes (Tables 10-13) based on the concentration of polychlorin-



**Nate, Josh, and Kyle pose with big channel catfish at Keller Park in South Bend**

ated biphenyl (PCB) or mercury (Hg) concentrations in their tissue. It should be noted that the State FCA has more restrictive guidance for individuals that are considered to be part of the "sensitive population." Females under the age of 50 and males under the age of 18 are considered to be part of the sensitive population. For more information on local fish consumption, visit the Indiana State Department of Health's (DOH) website (<http://www.in.gov/isdh/23650.htm>). In 2019, the DOH released a new interactive web map that features easily accessible fish consumption information for the St. Joseph River Watershed.

Many variables play a role in contaminant concentrations in fish. In general, larger fish will tend to have higher concentrations of contaminants in their tissue. Concentrations of contaminants can vary from one fish to another, so the methodology for collecting tissue samples requires collecting three fish and compositing all fish into one sample. Because of variability in concentrations, gathering multiple samples of the same species over the course of several years can provide a more accurate understanding of pollutant concentrations. The State of Indiana employs this idea and will average the concentrations of multiple samples to provide a more accurate representation of pollutant concentrations for that species. Given the high frequency in which samples are collected by the Aquatics Program, through collaboration with the State of Indiana, the FCA for the St. Joseph River is one of the most accurate of any waterbody in the State.

In 2018, 10 fish tissue samples were collected by the Aquatics Program. Tissue samples were collected for 8 species. Multiple samples of the same species were collected in different stretches of the St. Joseph River.



**Daragh with a coho salmon from Keller Park in South Bend**

Mercury was detected in trace amounts in all tissue samples. In the years of collecting tissue samples from the St. Joseph River Watershed, the Aquatics Program has rarely encountered high concentrations of mercury in fish tissue. PCBs, on the other hand are found in relatively high concentrations in some fish species in the St. Joseph River and PCBs generally drive the guidance for fish consumption for the St. Joseph River.

The following narrative describes results of the Aquatics Program's fish tissue collections from Elkhart and St. Joseph Counties in 2018 based on the concentration of PCBs and Hg:

Common Carp (average size 23.2 inches) were collected from the St. Joseph River at McNaughton Park. The last time common carp were sampled from this section of river was in 2003. The concentration of Hg from this sample was relatively low, however, PCB concentrations were relatively high. Based on PCB concentrations, the guidance for eating common carp from this section is one meal per month for common carp up to 23 inches, and one meal every 2 months for carp greater than 23 inches.

Largemouth Bass were collected from below the Johnson Street Dam (average size 11.2 inches) and above the Johnson Street Dam (average size 11.4



**Josh with a walleye from LaSalle Ave. in South Bend**

**Table 10: Fish Consumption Advisory (Elkhart County)**

Species	Fish Size (inches)	Contaminant	Consumption Guidance	<u>Sensitive Population Guidance</u>
Bluegill and other Sunfish	ALL	Hg	Unrestricted	1 meal/week
Bullhead Catfish	ALL	Hg	Unrestricted	1 meal/week
Channel Catfish	ALL	PCBs	1 meal/month	1 meal/month
Common Carp	ALL	PCBs/Hg	1 meal/month	1 meal/month
Crappie	All	Hg	Unrestricted	1 meal/week
Largemouth Bass	Up to 16	Hg	1 meal/week	1 meal/week
Largemouth Bass	16+	Hg	1 meal/week	1 meal/month
Northern Pike	Up to 30	Hg	1 meal/week	1 meal/week
Northern Pike	30+	Hg	1 meal/week	1 meal/month
Redhorse	ALL	PCBs/Hg	1 meal/week	1 meal/week
Rock Bass	ALL	Hg	Unrestricted	1 meal/week
Smallmouth Bass	ALL	Hg	1 meal/week	1 meal/week
Walleye	ALL	PCBs/Hg	1 meal/week	1 meal/month
White Sucker	ALL	Hg	Unrestricted	1 meal/week

**Table 11: Fish Consumption Advisory (St. Joseph County—Baugo Bay to Twin Branch Dam)**

Species	Fish Size (inches)	Contaminant	Consumption Guidance	<u>Sensitive Population Guidance</u>
Bluegill and other Sunfish	ALL	Hg	Unrestricted	1 meal/week
Bullhead Catfish	ALL	Hg	1 meal/week	1 meal/week
Channel Catfish	ALL	PCBs	1 meal/month	1 meal/month
Common Carp	ALL	PCBs/Hg	1 meal/2 months	1 meal/2 months
Crappie	ALL	Hg	1 meal/week	1 meal/week
Largemouth Bass	ALL	PCBs	1 meal/week	1 meal/week
<i>*Northern Pike</i>	Up to 30	Hg	1 meal/week	1 meal/week
	30+	PCBs/Hg	1 meal/week	1 meal/month
Redhorse	ALL	PCBs/Hg	1 meal/week	1 meal/week
Rock Bass	ALL	Hg	Unrestricted	1 meal/week
<i>*Smallmouth Bass</i>	ALL	Hg	1 meal/week	1 meal/week
Spotted Sucker	Up to 16		Unrestricted	Unrestricted
	16+	Hg	Unrestricted	1 meal/week
<i>*Walleye</i>	ALL	PCBs/Hg	1 meal/week	1 meal/month
White Sucker	ALL	Hg	Unrestricted	1 meal/week

*\*Elkhart County data are included as this section of river is free flowing into Elkhart County*  
**Sensitive Population**— Females under the age of 50 and males under the age of 18  
**1 Meal**—8oz. For adults, 3oz. for children ages 3 to 6

**Table 12: Fish Consumption Advisory (St. Joseph County—Twin Branch Dam to State Line)**

Species	Fish Size (inches)	Contaminant	Consumption Guidance	<i>Sensitive Population Guidance</i>
Bluegill and other Sunfish	ALL	PCBs	1 meal/month	1 meal/month
Bullhead Catfish	ALL	PCBs/Hg	1 meal/week	1 meal/week
Channel Catfish	ALL	PCBs	Do Not Eat	Do Not Eat
Common Carp	ALL	PCBs	Do Not Eat	Do Not Eat
Largemouth Bass	ALL	PCBs/Hg	1 meal/week	1 meal/week
Northern Pike	Up to 34	PCBs	1 meal/week	1 meal/week
	34+	PCBs	1 meal/month	1 meal/month
Quilback Carpsucker		PCBs/Hg	1 meal/month	1 meal/month
Redhorse	ALL	PCBs	1 meal/2 months	1 meal/2 months
Rock Bass	ALL	PCBs/Hg	1 meal/week	1 meal/week
Smallmouth Bass	ALL	PCBs	1 meal/month	1 meal/month
Steelhead	Up to 25	PCBs	1 meal/week	1 meal/week
	25-33	PCBs	1 meal/month	1 meal/month
	33+	PCBs	1 meal/2 months	1 meal/2 months
Walleye	ALL	PCBs	1 meal/month	1 meal/month

**Table 13: Fish Consumption Advisory (Elkhart River)**

Species	Fish Size (inches)	Contaminant	Consumption Guidance	<i>Sensitive Population Guidance</i>
<i>*Bluegill and other Sunfish</i>	ALL		Unrestricted	1 meal/week
<i>*Bullhead Catfish</i>	ALL		Unrestricted	1 meal/week
Channel Catfish	ALL	PCBs	1 meal/month	1 meal/month
Northern Pike	Up to 23	Hg	Unrestricted	1 meal/week
Northern Pike	23+	PCBs/Hg	1 meal/week	1 meal/week
Northern Hogsucker	ALL	Hg	Unrestricted	1 meal/week
Redhorse	All	Hg	1 meal/week	1 meal/month
Rock Bass	Up to 6		Unrestricted	Unrestricted
Rock Bass	6 to 7	Hg	Unrestricted	1 meal/week
Rock Bass	7+	Hg	1 meal/week	1 meal/week
Smallmouth Bass	Up to 20	Hg	1 meal/week	1 meal/month
Smallmouth Bass	20+	Hg	1 meal/month	1 meal/month
Walleye	Up to 18	PCBs	Unrestricted	1 meal/week
Walleye	18+	PCBs	1 meal/week	1 meal/week
White Sucker	Up to 16	Hg	1 meal/week	1 meal/week
White Sucker	16+	Hg	1 meal/week	1 meal/month

*\*Tissue Samples for Bluegill, other sunfish and bullhead catfish are not covered in the FCA for the Elkhart River. Data presented are Indiana’s general safe fish consumption guidelines*



**Josh with a big river redhorse from LaSalle Ave. in downtown South Bend**

inches) in 2018. Largemouth bass in this size range had not previously been sampled by the Aquatics Program. The State of Indiana recently changed the harvestable size range of largemouth and smallmouth bass for rivers in Indiana, where fish that are smaller than 12 inches can now be kept by anglers. Based on results for Hg, guidance for 11 inch largemouth from the section of river above the Johnson Street Dam is no restrictions for the general population and one meal per week for the sensitive population. Based on Hg and PCB concentrations, consumption of largemouth in the same size range below the dam is one meal per week for both the general and sensitive populations.

Bluegill (average size 8.4 inches) were collected from Keller Park on the St. Joseph River. Based on concentrations of PCBs, guidance for bluegill in this size range is 1 meal per week for both the general and sensitive populations. Bluegill were also collected below the South Bend Dam in 2014 and 2017. Contaminant concentrations in recent years have been much lower than results that have been observed in the past in South Bend. In addition, a bluegill sample was also collected below the Twin Branch Dam in 2016 and 2017 for fish that are approximately 7 inches long. Samples from both years yielded very low concentrations of PCBs and Hg. The current FCA guidance for bluegill in South Bend is one meal every month. This guidance may become more liberal in the future given the results from the South Bend area in recent years.

Steelhead (average size 28.1 inches) were collected from Keller Park on the St. Joseph River. Steelhead are routinely sampled by the Aquatics Program due to this spe-

cies being heavily harvested for consumption. Results from 2018 and previous years appear to correspond well with the current guidance in the FCA which offers different guidance for different size ranges of steelhead (Table 12).

Smallmouth bass were collected from the St. Joseph River in Elkhart at the Six-Span Bridge site and at Jefferson Boulevard in South Bend. Respective average lengths were 11.3 and 11.6 inches. Based on the results, guidance for 11 inch smallmouth bass from the Elkhart section would be no restrictions for the general population and one meal per week for the sensitive population. Guidance for the South Bend section would be one meal per week for both the general and sensitive populations. This guidance is less restrictive than the current guidance in the FCA (Table 12).

Northern Pike (average length 25.6) were collected from Keller Park on the St. Joseph River. Based on PCB concentrations, guidance for northern pike in this size range would be 1 meal per month, which is more restrictive than the current FCA (Table 12).

Coho salmon in the 24.8 inch size range were collected at Keller Park in 2018 for the first time. Based on PCB concentrations, guidance for this species would be 1 meal per month. Currently, there is no specific guidance for coho salmon for the St. Joseph River.

Black Crappie (average size 10 inches) were collected from the Six Span Bridge site on the St. Joseph River. Based on low concentrations of Hg and PCBs, guidance for this species is no restrictions for the general population and one meal per week for the sensitive population.

### **Aquatic Plant Surveys**

In 2017 and 2018, the Aquatics Program conducted several aquatic plant community surveys on the St. Joseph and Elkhart Rivers. These surveys were conducted in collaboration with Dr. Andrew Schnabel and his students from Indiana University-South Bend. The surveys in 2017 were very basic, just focusing on inventorying and documenting plant species on the St. Joseph River. The surveys in 2018 were conducted more strategically and incorporated fish and macroinvertebrate studies to evaluate relationships between plant and animal communities in the St. Joseph and Elkhart Rivers. Five (5) sites were selected; 3 sites on the Elkhart River in Elkhart County and 2 sites on

**Table 14: Plant species and associated macroinvertebrate and fish indices**

Common Name	Elkhart River Oxbow Park	Elkhart River Rogers Park Above	Elkhart River Rogers Park Below	St. Joseph River Darden Road	St. Joseph River Riverside Drive
American Pondweed <i>Potamogeton nodosus</i>	X	X	X	X	X
Sago Pondweed <i>Stuckenia pectinata</i>	X		X	X	X
Small Pondweed <i>Potamogeton pusillus</i>	X	X		X	X
Curlyleaf Pondweed <i>Potamogeton crispus*</i>	X	X	X		X
Leafy Pondweed <i>Potamogeton foliosus</i>					X
Unidentified Pondweed <i>Potamogeton sp.</i>					X
Coontail <i>Ceratophyllum demersum</i>	X	X		X	X
American Elodea <i>Elodea canadensis</i>					X
Bushy Naiad <i>Najas gracillima</i>					X
Common Arrowhead <i>Sagittaria latifolia</i>	X				
Arum-leaved Arrowhead <i>Sagittaria cuneata</i>	X				
Eelgrass <i>Vallisneria americana</i>	X	X			X
Cabomba <i>Cabomba caroliniana*</i>					X
Wild Rice <i>Zizania palustris</i>	X	X			
Water Lily <i>Nymphaea odorata</i>				X	X
Duckweed <i>Lemna minor</i>	X	X	X	X	X
Eurasian watermilfoil <i>Myriophyllum spicatum*</i>		X			X
Antifever fontinalis moss <i>Fontinalis antipyretica</i>	X	X	X		
Habitat QHEI Score	92	54	82	86	57
Macroinvertebrates HBI Score	5.36	6.57	5.07	4.74	6.45
Fish					
Avg # of species/transect	7.5	8.33	3.5	10	
Avg # of Fish/transect	28.33	48.33	5.5	43	
# of Tolerant Fish/transect	0.33	17.33	0	2.6	
% of Tol. Fish/transect	1.08	35.56	0	6.4	
# of Sensitive Fish/transect	17	3.33	3.5	9	
% of Sens. Fish/transect	56.67	6.84	66.07	23.14	

\*Denotes a non-native plant species



**Steven Swanson (IUSB Biology Student) and Kyle hold a seine used to collect fish from a bed of American pondweed**

the St. Joseph River in South Bend. These sites were selected based on ease of access, but were also based on the abundance of plants. The window for collecting plants in our waterways can vary based on many variables, and in 2018 plant communities did not fully mature until late July given the movement of bed sediments during the record flood in early 2018. A list of the plant species identified as part of these surveys are presented in Table 14.

During the initial surveys in 2017, it was determined that there are two predominant plant species in the Elkhart and St. Joseph Rivers: American pondweed (*Potamogeton nodosus*) and sago pondweed (*Stuckenia pectinata*). In the late summer, these two species can co-exist in dense beds in shallow riffles and runs on both rivers. Given that both species occur on riffles, they appear to tolerate current more so than other plant species listed in Table 14. Antifer fontinalis moss (*Fontinalis antipyretica*), also appears to be very common in both rivers in riffle and run habitat, but it is less conspicuous given its small size and benthic (bottom dwelling) nature. Duckweed (*Lemna minor*) and eelgrass (*Vallisneria americana*) also appear to be ubiquitous in the two rivers and both can be found in riffle and run habitat. Other common native plants that occur along the fringes of both rivers or in backwater areas include submergent plants coontail (*Ceratophyllum demersum*), American elodea (*Elodea canadensis*) and several other pondweeds (*Potamogeton sp.*) The most common emergent plant found in both rivers appears to be arrowhead (*Sagittaria sp.*), but wild rice (*Zizania palustris*) and water lily (*Nymphaea odorata*) can also be found along the fringes in slow moving water. Three non-native sub-

mergent plants including curlyleaf pondweed (*Potamogeton crispus*), cabomba (*Cabomba caroliniana*) and Eurasian watermilfoil (*Myriophyllum spicatum*) are present, although we only found cabomba on the St. Joseph River. All three species appear to flourish in areas with little or no current, but curlyleaf pondweed is present in low abundance in beds with other pondweeds in the current.

The 2018 plant surveys were conducted in 50 meter linear transects. Plant samples were grabbed using a rake at 3 random points along each transect. Macroinvertebrates were collected from plants within and immediately adjacent to each random plant sample with 4 vigorous scoops of a D-net. The goal was to dislodge and gather any macroinvertebrates occupying the plants. Plant species from each random sample were identified, while macroinvertebrate samples collected along each transect were composited. A subsample of the macroinvertebrate sample was obtained using a timed 15 minute pick. Fish were also collected along each transect using a 15 foot seine and a backpack electrofisher. Fish were not collected at Riverside Drive due to time constraints.

At this time we are just presenting plant frequency data, although additional analysis may be used on these data in the future to determine the abundance of these species. Habitat surveys using the QHEI were also performed at each site. Due to time constraints, macroinvertebrates were only identified to the family level, and the Hilsenhoff Biotic Index (HBI) was used to evaluate macroinvertebrate communities (Hilsenhoff, 1988). The HBI uses a scoring system from 0-10 with a low score being good and a high score being bad. For example, a score of 0 would be considered an excellent macroinvertebrate community and a score of 10 would be considered highly impaired. For fish species, simple metrics including the number of species, and the number of sensitive and tolerant species were evaluated. Results from the various biological communities are presented in Table 14.

Of the 5 sites that were sampled, 2 of the sites (Elkhart River—Rogers Park Above and St. Joseph River—Riverside Drive) had the lowest QHEI scores. Rogers Park Above is located on a backwater channel that connects water discharging from the Goshen Millrace to the Elkhart River. The Riverside Drive site is located in the impoundment of the South Bend Dam. Both sites have much slower flow characteristics relative to the other sites resulting in the degraded stream habitat. In addition to the lower QHEI

Table 15: Sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2018

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores	ICI Scores	QHEI Scores
						2018	2018	2018
St. Joseph River	Shore Manor Drive	1	Investigative	Elkhart	Boat			87
	Nibbyville (A)	2	Index	Elkhart	Boat	51	50	85
	Lexington Avenue	3	Index	Elkhart	Boat	52	56	83
	McNaughton Park	4	Index	Elkhart	Boat	51	44	59
	Jefferson Blvd	5	Index	St. Joseph	Boat	42	32	58
	LaSalle Ave	6	Index	St. Joseph	Boat	51	50	86
	Keller Park	7	Index	St. Joseph	Boat	54	50	80
	Brick Road	8	Index	St. Joseph	Boat	53	42	92
Little Elkhart River*	CR 35	9	Index	Elkhart	Tote Barge	51	52	96
York TWP Ditch	CR 12	10	Investigative	Elkhart	Back Pack			52
Pine Creek*	SR 120	11	Index	Elkhart	Tote Barge	52	50	84
Lily Creek	Park Six Drive	12	Index	Elkhart	Back Pack	15		34
Christiana Creek	NMWF	13	Index	Elkhart	Tote Barge	55	54	84
Elkhart River	Benton (US 33)	14	Investigative	Elkhart	Boat			74
	Oxbow Park (B)	15	Index	Elkhart	Boat	50	44	90
	EEC (A)	16	Index	Elkhart	Boat	51	54	77
	Central High School	17	Index	Elkhart	Boat	50	38	78
	Prairie Street	18	Index	Elkhart	Boat	45		52
	Elkhart Ave	19	Index	Elkhart	Boat	51		78
Turkey Creek	US 6	20	Investigative	Elkhart	Tote Barge			66
Yellow Creek	Concord High School	21	Index	Elkhart	Tote Barge	36	40	63
Baugo Creek	Restoration Site (B)	22	Index	Elkhart	Tote Barge	48	44	86
Bowman Creek	Gertrude Street	23	Index	St. Joseph	Back Pack	20	34	61
	Chippewa Ave	24	Index	St. Joseph	Back Pack	25		74
	Green Tech Drive	25	Investigative fish & Macroinvertebrate	St. Joseph	Back Pack		26	52
	St. Joseph Street	26	Investigative	St. Joseph	Back Pack			45
	St. Joseph River Mouth	27	Investigative	St. Joseph	Back Pack			38



**Table 15: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2018  
(continued)**

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores	ICI Scores	QHEI Scores
						2018	2018	2018
Juday Creek*	Holy Cross Pkwy	28	Macroinvertebrate Only	St. Joseph			38	
	Edison Lakes Pkwy	29	Investigative	St. Joseph	Back Pack			44
	Grape Road	30	Index	St. Joseph	Tote Barge	<u>30</u> (36)	40	65
	Tanglewood Court	31	Investigative	St. Joseph	Tote Barge			61
	Driftwood Drive	32	Investigative	St. Joseph	Back Pack		44	59
	Ponader Park	33	Index	St. Joseph	Tote Barge	<u>32</u> (30)	48	53
	Myrtle Street	34	Index	St. Joseph	Tote Barge	<u>30</u> (30)	46	52

\* denotes a cool/cold water stream

Underlined values are indicative of stream impairment

Coolwater scores are in (parenthesis) Juday Creek and Cobus Creek were analyzed using coolwater methods

score, both sites had the worst HBI score. While fish were not sampled at Riverside Drive, Rogers Park Above had the highest proportion of tolerant fish and the lowest proportion of sensitive fish. Lastly, these two sites with degraded habitat also had the highest frequency of non-native plants species. Plant species diversity was highest at the Riverside Drive site, suggesting that most plant species prefer low current habitat.

Another interesting finding from this work was on the main section of the Elkhart River below Rogers Park—the Rogers Park (B) site. This site is located in an urban section of the Elkhart River that has limited fringe habitat relative to the Oxbow Park site and the Darden Road site and the lowest plant species diversity of any site sampled. The predominant plant species at this site were American pondweed and sago pondweed. Fish species diversity and abundance was lowest at this site, suggesting a connection between plant species diversity and fish species diversity. While the fish species diversity was highest at Darden Road, this can be explained by it being a higher order stream. The biggest difference between the Oxbow Park site and the Rogers Park (B) site are adjacent land uses and the quality of the riparian habitat. At Oxbow Park, much of the adjacent land is woodland which promotes natural fringe habitat for aquatic plants to grow. The land uses adjacent to Rogers Park on the other hand are highly urbanized, with more disturbed fringe habitat.

### Conclusion

Long-term biological monitoring by the cities of Elkhart

and South Bend is starting to provide a more thorough understanding of the health of our rivers and streams. Along with our rivers and streams, the Elkhart-South Bend Aquatics Program also continues to evolve by sampling more locations within the watershed, expanding our macroinvertebrate sampling program, sampling plant communities and changing our techniques slightly to fill data gaps. Beginning in 2017 we started to apply more in-depth analyses of fish community data. In Juday Creek and other coolwater streams, more of an emphasis is now placed on macroinvertebrate monitoring.

When the Aquatics Program initiated monitoring in the St. Joseph River in 1998, IBI scores indicated that the river had good to excellent fish communities. IBI scores for the St. Joseph River have not shown much change in the past 20 years. However, a review of individual metrics, suggest that changes are occurring within the fish communities in the St. Joseph River. The Elkhart County section of the St. Joseph River has seen modest changes, however, greater improvements in the fish community are being observed in the South Bend section, particularly on the stretch of river downstream of South Bend.

Metric data also show some long-term changes in fish communities in the St. Joseph River tributaries. Minor improvements are being observed at sites on the Elkhart River and at County Road 35 on the Little Elkhart River. Christiana Creek at North Main Wellfield continues to be one of the highest quality sites in the watershed.

Long-term trends for the St. Joseph River and tributaries show a startling increase in the total abundance of fish at



**Daragh with a brown trout from Juday Creek**

most sites in the watershed. This increase does affect IBI scores (sometimes negatively) as it can influence IBI metrics that are based on proportions. In addition, the abundance of sucker species appears to have declined over time, while the abundance of sunfish species has increased. We are interpreting these results cautiously at this time because it may be a reflection of a major ecosystem change within local waterways due to a change in an environmental variable. One potential explanation is that nutrient input (fertilizer run-off) is causing an increase ecosystem productivity. On the other hand, the increase in total abundance may reflect a positive change as a result of better conditions for fish reproduction over the past few years. Future monitoring results may shed more light on this issue.

Data collected from 2018 do not reflect any major im-



**A young brown bullhead from Pine Creek**

pacts to the biological communities in the St. Joseph River watershed following the major flood that occurred in February of 2018. The flood did move a lot of sediment in local waterways, creating new sand and gravel bars and deep pools. With the sensitive nature of juvenile fish and macroinvertebrates, we were concerned that they would be most impacted. However, there was no apparent impact to both groups of animals.

## Acknowledgements

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**Joshua with a northern hogsucker from LaSalle Ave on the St. Joseph River**

# APPENDICES

# Appendix A

## Metrics for Biological Indices

The Northern Indiana Till Plain 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. Percent headwater species
4. Number of minnow species
5. Number of sensitive species
6. Percent tolerant
7. Percent omnivores
8. Percent insectivores
9. Percent pioneer species (individuals)
10. Number of fish collected
11. Percent simple lithophils
12. Percent DELT anomalies

The Northern Indiana Till Plain 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. Percent tolerant
7. Percent omnivores
8. Percent insectivores
9. Percent carnivores
10. Number of fish collected
11. Percent simple lithophils
12. Percent DELT anomalies

Invertebrate Community Index categories and metrics used to evaluate sites in the St. Joseph River drainage:

1. Total number of taxa
2. Total number of mayfly taxa
3. Total number of caddisfly taxa
4. Total number of dipteran taxa
5. Percent mayfly composition
6. Percent caddisfly composition
7. Percent tribe Tanytarsini midge composition
8. Percent other dipteran and non-insect composition
9. Percent tolerant organisms
10. Total number of qualitative EPT (mayflies, stoneflies and caddisflies) taxa

Qualitative Habitat Evaluation Index categories and metrics used to evaluate sites in the St. Joseph River drainage:

1. Substrate
  - type
  - number of types present
  - origin
  - silt cover
  - extent of embeddedness
  
2. Instream Cover
  - type
  - amount
  
3. Channel Morphology
  - sinuosity
  - development
  - channelization
  - stability
  
4. Riparian Zone and Bank Erosion
  - riparian width
  - floodplain quality
  - bank erosion
  
5. Pool/Glide and Riffle/Run Quality
  - maximum pool depth
  - pool/riffle morphology
  - pool/riffle/run current velocity
  - riffle/run depth
  - riffle/run substrate
  - riffle/run embeddedness
  
6. Gradient

The Coolwater Index of Biotic Integrity metrics used to evaluate sites in Indiana with less than or equal to 100 square miles drainage area:

1. Number of Native Species
2. Number of darter/madtom/sculpin species
3. Percent headwater species
4. Percent coolwater species
5. Percent sensitive and intolerant Species
6. Percent tolerant
7. Percent detritivore
8. Percent invertivore
9. Percent pioneer species
10. Number of fish collected (minus tolerant individuals)
11. Percent simple lithophils
12. Percent DELT anomalies

The Coolwater Index of Biotic Integrity metrics used to evaluate sites in Indiana with greater than 100 square miles drainage area:

1. Number of Native Species
2. Number of darter/madtom/sculpin species
3. Percent catostomidae (sucker family)
4. Percent coolwater species
5. Percent sensitive and intolerant Species
6. Percent tolerant
7. Percent detritivore
8. Percent invertivore
9. Percent carnivore
10. Number of fish collected (minus tolerant individuals)
11. Percent simple lithophils
12. Percent 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. The smallest fish in each group was greater than or equal to 90% of the length of the largest fish in that group. 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 had skin-on fillets taken. 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. 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.

## Fish Tissue Results, Aquatics Program 2018

Station	Species	Length Range (in)	PCB Group General Population	Hg Group General Population	PCB Group Sensitive Population	Hg Group Sensitive Population
St. Joseph River McNaughton Park	Common Carp	23-23.4	3	1	3	2
St. Joseph River Nibbyville (A)	Largemouth Bass	11.1-11.5	1	1	1	2
St. Joseph River McNaughton Park	Largemouth Bass	11.3-11.7	2	2	2	2
St. Joseph River Keller Park (A)	Bluegill	8.3-8.7	2	1	2	2
St. Joseph River Brick Road	Steelhead	27.6-28.9	3	1	3	2
St. Joseph River Jefferson Blvd	Smallmouth Bass	11.3-11.8	2	1	2	2
St. Joseph River Keller Park	Northern Pike	24.5-26.5	3	1	3	2
St. Joseph River Keller Park	Coho Salmon	24.0-25.4	3	1	3	2
St. Joseph River Six Span	Smallmouth Bass	10.8-11.9	1	1	2	2
St. Joseph River Six Span	Black Crappie	9.6-10.3	1	1	2	2

**Sensitive Population**— Females under the age of 50 and males under the age of 18

**1 Meal**—8oz. For adults, 3oz. for children ages 3 to 6

**Group 1**—No restrictions

**Group 2**—1 Meal/week

**Group 3**—1 meal/month

**Group 4**—1 meal/2 months

**Group 5**—Do Not Eat

# Appendix C

Summary of fish collected by county, 2018

Summary of species captured at index sites in Elkhart County, 2018

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Spotfin Shiner	2,021	10.25	4,456	9.82	0.30
Bluegill	1,638	8.31	49,334	108.76	3.30
Striped Shiner	1,620	8.22	20,394	44.96	1.36
Rock Bass	1,490	7.56	89,769	197.91	6.00
Sand Shiner	1,248	6.33	1,695	3.74	0.11
Mimic Shiner	1,207	6.12	1,840	4.06	0.12
Longear Sunfish	924	4.69	19,087	42.08	1.28
Rainbow Darter	920	4.67	1,196	2.64	0.08
Smallmouth Bass	866	4.39	102,763	226.55	6.87
Bluntnose Minnow	838	4.25	2,096	4.62	0.14
Golden Redhorse	793	4.02	414,446	913.70	27.69
Johnny Darter	744	3.77	717	1.58	0.05
White Sucker	619	3.14	109,508	241.42	7.32
Stoneroller, Central	442	2.24	3,634	8.01	0.24
Rosyface Shiner	401	2.03	922	2.03	0.06
Blacknose Dace	362	1.84	1,009	2.22	0.07
Logperch	357	1.81	2,271	5.01	0.15
Green Sunfish	348	1.76	5,448	12.01	0.36
Creek Chub	334	1.69	5,266	11.61	0.35
Largemouth Bass	321	1.63	48,489	106.90	3.24
Northern Hog Sucker	273	1.38	54,972	121.19	3.67
Hornyhead Chub	242	1.23	4,612	10.17	0.31
Shorthead Redhorse	212	1.08	127,331	280.72	8.51
Mottled Sculpin	187	0.95	977	2.15	0.07
Blackside Darter	144	0.73	393	0.87	0.03
Common Shiner	126	0.64	1,576	3.47	0.11
Central Mudminnow	124	0.63	820	1.81	0.05
Chestnut Lamprey	98	0.50	872	1.92	0.06
American Brook Lamprey	82	0.42	633	1.40	0.04
Silverjaw Minnow	77	0.39	103	0.23	0.01
Common Carp	74	0.38	203,202	447.98	13.58
Redear Sunfish	66	0.33	7,958	17.54	0.53
Longnose Dace	56	0.28	219	0.48	0.01
Walleye	55	0.28	23,521	51.85	1.57
Greenside Darter	41	0.21	106	0.23	0.01
Silver Redhorse	40	0.20	48,811	107.61	3.26
Gizzard Shad	36	0.18	11,520	25.40	0.77
Spotted Sucker	31	0.16	5,253	11.58	0.35
Northern Pike	27	0.14	19,166	42.25	1.28
Grass Pickerel	23	0.12	505	1.11	0.03
Pumpkinseed	21	0.11	541	1.19	0.04

Summary of species captured at index sites in Elkhart County, 2018 (continued)

COMMON NAME	Total Number	% By Number	Total Weight (g)	Total Weight (lbs.)	% By Weight
Black Crappie	20	0.10	2,056	4.53	0.14
River Redhorse	19	0.10	55,800	123.02	3.73
Yellow Bullhead	18	0.09	1,608	3.55	0.11
Brown Trout	16	0.08	5,181	11.42	0.35
Hybrid Sunfish	12	0.06	383	0.84	0.03
Golden Shiner	12	0.06	91	0.20	0.01
Brown Bullhead	10	0.05	3,588	7.91	0.24
Brook Stickleback	10	0.05	18	0.04	0.00
Bowfin	8	0.04	6,605	14.56	0.44
Quillback	8	0.04	3,805	8.39	0.25
Pirate Perch	8	0.04	77	0.17	0.01
Banded Killifish	6	0.03	9	0.02	0.00
Greater Redhorse	5	0.03	8,146	17.96	0.54
Yellow Perch	5	0.03	49	0.11	0.00
Brook Silverside	5	0.03	6	0.01	0.00
Rainbow Trout	4	0.02	1,415	3.12	0.09
Longnose Gar	4	0.02	1,107	2.44	0.07
Warmouth	4	0.02	106	0.23	0.01
Fathead Minnow	4	0.02	10	0.02	0.00
Stonecat	3	0.02	131	0.29	0.01
Black Bullhead	3	0.02	129	0.28	0.01
Channel Catfish	2	0.01	7,800	17.20	0.52
Spotted Gar	1	0.01	643	1.42	0.04
Black Redhorse	1	0.01	400	0.88	0.03
Tadpole Madtom	1	0.01	14	0.03	0.001
<b>Total</b>	<b>19,717</b>	<b>100</b>	<b>1496,608</b>	<b>3,299.46</b>	<b>100</b>

Index Sites	19,717
Investigative Sites	1,372
<b>Elkhart County Total</b>	<b>21,089</b>

Summary of species captured at investigative sites in Elkhart County, 2018

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Golden Redhorse	188	13.70	120,594	265.86	57.30
Rock Bass	150	10.93	7,879	17.37	3.74
Striped Shiner	129	9.40	764	1.68	0.36
Longear Sunfish	113	8.24	2,822	6.22	1.34
Bluegill	112	8.16	2,830	6.24	1.34
Smallmouth Bass	71	5.17	12,932	28.51	6.14
Green Sunfish	71	5.17	1,801	3.97	0.86
Creek Chub	62	4.52	73	0.16	0.03
Johnny Darter	57	4.15	78	0.17	0.04
Bluntnose Minnow	44	3.21	140	0.31	0.07
Spotfin Shiner	43	3.13	156	0.34	0.07
Logperch	41	2.99	398	0.88	0.19
Shorthead Redhorse	36	2.62	24,800	54.67	11.78
Northern Hog Sucker	28	2.04	9,899	21.82	4.70
Largemouth Bass	26	1.90	1,248	2.75	0.59
Mimic Shiner	25	1.82	50	0.11	0.02
Central Mudminnow	24	1.75	98	0.22	0.05
Blackside Darter	22	1.60	59	0.13	0.03
Hornyhead Chub	21	1.53	529	1.17	0.25
Grass Pickerel	17	1.24	525	1.16	0.25
Rainbow Darter	14	1.02	30	0.07	0.01
Pirate Perch	10	0.73	80	0.18	0.04
White Sucker	9	0.66	1,413	3.12	0.67
Blacknose Dace	9	0.66	28	0.06	0.01
Yellow Bullhead	7	0.51	459	1.01	0.22
Rosyface Shiner	7	0.51	21	0.05	0.01
Walleye	6	0.44	5,690	12.54	2.70
American Brook Lamprey	6	0.44	27	0.06	0.01
Blackstripe Topminnow	5	0.36	10	0.02	0.00
Black Crappie	4	0.29	265	0.58	0.13
Common Carp	2	0.15	10,200	22.49	4.85
Northern Pike	2	0.15	1,341	2.96	0.64
Tadpole Madtom	2	0.15	16	0.04	0.01
Sand Shiner	2	0.15	2	0.00	0.00
Channel Catfish	1	0.07	2,900	6.39	1.38
Spotted Sucker	1	0.07	200	0.44	0.10
Black Bullhead	1	0.07	85	0.19	0.04
Yellow Perch	1	0.07	18	0.04	0.01
Golden Shiner	1	0.07	4	0.01	0.002
Stoneroller, Central	1	0.07	1	0.00	0.0005
River Redhorse	1	0.07	0	0.00	0.000000
<b>Totals</b>	<b>1,372</b>	<b>100</b>	<b>210,465</b>	<b>464</b>	<b>100</b>



Summary of species captured at index sites in St. Joseph County, 2018

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Longear Sunfish	975	16.38	23,582	51.99	3.34
Bluegill	761	12.79	18,352	40.46	2.60
Rock Bass	716	12.03	43,841	96.65	6.21
Smallmouth Bass	579	9.73	81,761	180.25	11.59
Creek Chub	573	9.63	7,043	15.53	1.00
Mimic Shiner	283	4.76	301	0.66	0.04
Golden Redhorse	233	3.92	198,528	437.68	28.14
Mottled Sculpin	188	3.16	1,102	2.43	0.16
Johnny Darter	180	3.02	169	0.37	0.02
Spotfin Shiner	173	2.91	460	1.01	0.07
Green Sunfish	170	2.86	2,284	5.04	0.32
Bluntnose Minnow	139	2.34	308	0.68	0.04
Blacknose Dace	112	1.88	397	0.88	0.06
Black Redhorse	87	1.46	64,468	142.13	9.14
Shorthead Redhorse	75	1.26	55,822	123.07	7.91
White Sucker	75	1.26	16,507	36.39	2.34
Northern Hog Sucker	56	0.94	22,033	48.57	3.12
Largemouth Bass	50	0.84	4,568	10.07	0.65
Spotted Sucker	48	0.81	25,222	55.60	3.58
Redear Sunfish	48	0.81	2,079	4.58	0.29
Central Mudminnow	44	0.74	131	0.29	0.02
Pumpkinseed	39	0.66	1,042	2.30	0.15
Blackside Darter	33	0.55	65	0.14	0.01
Greenside Darter	31	0.52	111	0.24	0.02
Walleye	29	0.49	16,974	37.42	2.41
Gizzard Shad	26	0.44	4,606	10.15	0.65
Yellow Bullhead	25	0.42	3,861	8.51	0.55
Logperch	25	0.42	140	0.31	0.02
Quillback	22	0.37	32,900	72.53	4.66
Sand Shiner	21	0.35	34	0.07	0.00
Longnose Gar	14	0.24	8,665	19.10	1.23
Spottail Shiner	14	0.24	54	0.12	0.01
Rainbow Darter	12	0.20	17	0.04	0.00
Banded Killifish	11	0.18	33	0.07	0.00
Brown Trout	10	0.17	7,489	16.51	1.06
Northern Pike	9	0.15	15,020	33.11	2.13
Hybrid Sunfish	8	0.13	198	0.44	0.03
Golden Shiner	7	0.12	17	0.04	0.002
Rainbow Trout	6	0.10	3,935	8.68	0.56
Striped Shiner	6	0.10	91	0.20	0.01
Channel Catfish	4	0.07	16,200	35.71	2.30
Brown Bullhead	4	0.07	1,969	4.34	0.28
Chestnut Lamprey	4	0.07	24	0.05	0.00



Summary of species captured at index sites in St. Joseph County, 2018 (continued)

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Spotted Gar	3	0.05	1,700	3.75	0.24
Black Crappie	3	0.05	498	1.10	0.07
Black Bullhead	3	0.05	404	0.89	0.06
Warmouth	3	0.05	98	0.22	0.01
Common Carp	2	0.03	7,400	16.31	1.05
River Redhorse	2	0.03	7,300	16.09	1.03
Bowfin	2	0.03	2,276	5.02	0.32
Brook Silverside	2	0.03	3	0.01	0.0004
Silver Redhorse	1	0.02	3,300	7.28	0.47
Stonecat	1	0.02	54	0.12	0.01
YOY Suckers (Unid.)	1	0.02	3	0.01	0.0004
Grass Pickerel	1	0.02	3	0.01	0.0004
Fathead Minnow	1	0.02	2	0.00	0.0003
Stoneroller, Central	1	0.02	2	0.00	0.0003
<b>Total</b>	<b>5,951</b>	<b>100</b>	<b>705,446</b>	<b>1,555.24</b>	<b>100</b>

Summary of species captured at investigative sites in St. Joseph County, 2018

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Creek Chub	505	60.84	1,618	3.57	0.18
White Sucker	69	8.31	3,568	7.87	0.40
Green Sunfish	59	7.11	783	1.73	0.09
Mottled Sculpin	56	6.75	319	0.70	0.04
Blacknose Dace	48	5.78	262	0.58	0.03
Johnny Darter	32	3.86	45	0.10	0.01
Golden Shiner	17	2.05	18	0.04	0.00
Largemouth Bass	16	1.93	324	0.71	0.04
Rainbow Trout	5	0.60	337	0.74	0.04
Black Bullhead	4	0.48	10	0.02	0.001
Stoneroller, Central	4	0.48	5	0.01	0.001
Hybrid Sunfish	3	0.36	87	0.19	0.01
Longear Sunfish	2	0.24	8	0.02	0.001
Rainbow Darter	2	0.24	2	0.004	0.0002
Hybrid Minnow	2	0.24	2	0.004	0.0002
Brown Trout	1	0.12	1,404	3.10	0.16
Central Mudminnow	1	0.12	8	0.02	0.001
Striped Shiner	1	0.12	8	0.02	0.001
Bluegill	1	0.12	2	0.004	0.0002
Fathead Minnow	1	0.12	1	0.002	0.0001
Smallmouth Bass	1	0.12	1	0.002	0.0001
<b>Total</b>	<b>830</b>	<b>100</b>	<b>8,812</b>	<b>19.43</b>	<b>1</b>

Index Sites	5,951
Investigative Sites	830
<b>St. Joseph County Total</b>	<b>6,781</b>



# Appendix D

Summary of fish collected by site, 2018  
(Reference Table 1 for site numbers and locations)

Stream	St. Joseph River, Elkhart County, 2018						
Site	Shore Manor Drive	Nibbyville (A)		Lexington Ave		McNaughton Park	
		1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey			X		X		
#Banded Killifish				X			
Black Crappie	X		X	X	X	X	
~Black Redhorse				X			
Blackside Darter	X	X	X	X	X	X	X
Bluegill	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X
#Bowfin		X					
~Brook Silverside					X		
#Channel Catfish	X						
Chestnut Lamprey		X	X	X	X	X	
#Common Carp		X	X	X	X	X	X
#Gizzard Shad				X	X	X	X
~Golden Redhorse	X	X	X	X	X	X	X
Grass Pickerel			X		X		
~Greater Redhorse				X		X	
#Green Sunfish	X	X	X	X	X	X	X
~Greenside Darter			X		X		
~Hornyhead Chub	X	X			X		
Hybrid Sunfish			X	X		X	X
Johnny Darter	X	X	X		X		
Largemouth Bass	X	X	X	X	X	X	X
~Logperch	X		X	X	X	X	X
~Longear Sunfish	X	X	X	X	X	X	X
Longnose Gar		X	X				X
~Mimic Shiner	X	X	X	X	X	X	X
~Northern Hog Sucker	X	X	X	X	X		X
Northern Pike	X		X		X	X	X
Pirate Perch			X				
Pumpkinseed		X			X	X	
#Quillback				X			X
~Rainbow Darter	X		X		X	X	
Redear Sunfish		X	X	X	X		
~River Redhorse	X	X		X	X	X	X
~Rock Bass	X	X	X	X	X	X	
~Rosyface Shiner			X	X	X		X
~Sand Shiner				X	X		X
~Shorthead Redhorse	X	X	X	X	X	X	X
~Silver Redhorse		X	X	X	X	X	X

Stream	St. Joseph River, Elkhart County, 2018						
Site	Shore Manor Drive	Nibbyville (A)		Lexington Ave		McNaughton Park	
		1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~Smallmouth Bass	X	X	X	X	X	X	X
~Spotfin Shiner	X	X	X	X	X	X	X
Spotted Sucker		X	X				
Stoneroller, Central				X	X		
Striped Shiner	X	X	X		X	X	X
Walleye	X	X		X	X	X	X
#White Sucker		X	X	X	X	X	X
#Yellow Bullhead	X		X	X	X		
Yellow Perch	X		X				

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Stream	St. Joseph River, St. Joseph County, 2018							
Site	Jefferson Blvd		LaSalle Ave		Keller Park		Brick Road	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
#Banded Killifish							X	X
Black Crappie			X			X		
~Black Redhorse			X	X	X	X	X	X
Blackside Darter		X	X	X		X		X
Bluegill	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X	X
#Bowfin		X				X		
~Brook Silverside								X
#Brown Bullhead	X	X						
#Channel Catfish					X	X		
Chestnut Lamprey				X	X	X	X	
#Common Carp					X	X		
#Creek Chub		X		X				X
Gizzard Shad	X	X	X					
~Golden Redhorse	X	X	X	X	X	X	X	X
~Golden Shiner					X			X
#Green Sunfish	X	X	X	X	X		X	X
~Greenside Darter		X		X	X	X		X
Hybrid Sunfish			X		X			X
Johnny Darter		X		X			X	X
Largemouth Bass	X	X	X		X	X	X	X
~Logperch		X		X	X	X		X
~Longear Sunfish	X	X	X	X	X	X	X	X
Longnose Gar			X	X	X		X	X
~Mimic Shiner		X	X	X	X	X	X	X
~Northern Hog Sucker			X	X	X	X	X	X
Northern Pike			X		X	X	X	X
Pumpkinseed	X	X		X	X	X	X	X
#Quillback	X		X			X	X	
~Rainbow Darter		X		X	X	X	X	X
Rainbow Trout			X					
Redear Sunfish	X		X	X		X	X	X
~River Redhorse				X	X			
~Rock Bass	X	X	X	X	X	X	X	X
~Sand Shiner				X				X
~Shorthead Redhorse			X	X	X	X	X	X
~Silver Redhorse							X	
~Smallmouth Bass	X	X	X	X	X	X	X	X

Stream	St. Joseph River, St. Joseph County, 2018							
Site	Jefferson Blvd		LaSalle Ave		Keller Park		Brick Road	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
Spotfin Shiner	X	X	X	X	X	X	X	X
Spottail Shiner		X		X				X
Spotted Gar			X			X		
Spotted Sucker	X	X			X		X	X
~Stonecat							X	
Stoneroller, Central				X				
Striped Shiner		X	X	X				X
Walleye		X	X	X		X	X	X
Warmouth						X	X	X
#White Sucker		X	X		X	X	X	X
#Yellow Bullhead	X	X		X		X	X	X
YOY Suckers (Unid.)		X						

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**Tributaries to the St. Joseph River, Elkhart County, 2018**

Stream	Elkhart River										
	Benton (US 33)	Oxbow (B)		EEC (A)		Central H.S.		Prairie Ave.		Elkhart Ave.	
		1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey		X	X	X	X	X	X	X			
Black Crappie				X	X						X
#Black Bullhead										X	
Black Crappie											
Blackside Darter	X		X	X	X		X			X	X
Blackstripe Topminnow	X										
Bluegill		X	X	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X	X		X	X
Bowfin										X	X
~Brook Silverside										X	
#Brown Bullhead										X	X
#Central Mudminnow			X				X				
#Channel Catfish											X
Chestnut Lamprey		X	X	X	X	X	X	X	X	X	
#Common Carp	X		X							X	X
Common Shiner											X
Gizzard Shad										X	X
#Creek Chub		X	X								
~Golden Redhorse	X	X	X	X	X	X	X	X	X	X	X
#Golden Shiner	X			X							
Grass Pickerel	X		X		X				X		
~Greater Redhorse								X			
#Green Sunfish	X	X	X		X	X	X	X	X	X	X
~Hornyhead Chub	X	X	X	X	X	X	X				X
Hybrid Sunfish											X
Johnny Darter			X	X	X		X	X			
Largemouth Bass	X	X	X	X	X	X	X	X	X	X	X
~Logperch											X
~Longear Sunfish	X	X		X	X	X	X	X	X	X	X
~Mimic Shiner						X	X			X	
~Northern Hog Sucker	X	X	X	X	X	X	X	X	X	X	X
Northern Pike			X	X		X		X	X	X	X
Pirate Perch	X	X			X						
Pumpkinseed						X	X		X	X	X
~Rainbow Darter		X	X	X	X		X				X
Rainbow Trout										X	
Redear Sunfish				X	X	X		X	X		X
~River Redhorse					X					X	
~Rock Bass	X	X	X	X	X	X	X	X	X	X	X
~Rosyface Shiner	X	X	X	X	X	X	X	X	X	X	X



Tributaries to the St. Joseph River, Elkhart County, 2018											
Stream	Elkhart River										
Site	Benton (US 33)	Oxbow (B)		EEC (A)		Central H.S.		Prairie Ave.		Elkhart Ave.	
		1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~Sand Shiner		X	X	X	X	X	X	X		X	X
~Shorthead Redhorse										X	X
~Silver Redhorse										X	X
~Smallmouth Bass	X	X	X	X	X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X	X	X	X	X
Spotted Gar										X	
Spotted Sucker	X	X	X	X	X				X	X	
~Stonecat		X		X						X	
Stoneroller, Central		X									X
Striped Shiner	X	X	X	X	X	X	X	X	X	X	X
Tadpole Madtom			X								
Walleye			X							X	X
#White Sucker	X	X	X	X	X	X	X	X	X	X	X
#Yellow Bullhead					X	X	X			X	X

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**Tributaries to the St. Joseph River, St. Joseph County, 2018**

Stream	Bowman Creek						
	Getrude		Chippewa		Green Tech Drive	St. Joseph St.	Lincolnway
	1st Pass	2nd Pass	1st Pass	2nd Pass			
#Black Bullhead	X						
Bluegill	X		X	X	X		
#Central Mudminnow		X					
#Creek Chub	X	X	X	X	X	X	X
#Grass Pickerel		X					
#Green Sunfish	X	X	X	X	X	X	X
Hybrid Sunfish			X		X		X
Johnny Darter							X
Largemouth Bass					X	X	
~Longear Sunfish							X
~Rainbow Darter							X
Rainbow Trout							X
~Smallmouth Bass							X
Stoneroller, Central							X
Striped Shiner							X
#White Sucker							X

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Tributaries to the St. Joseph River, St. Joseph County, 2018									
Stream	Juday Creek								
Site	Edison Lakes	Grape Road		Tanglewood	Driftwood	Ponader Park		Myrtle Street	
		1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
#Black Bullhead	X		X	X					
#Blacknose Dace	X	X	X	X	X	X	X		X
Bluegill							X		
Brown Trout		X	X	X					
#Central Mudminnow		X	X	X		X	X	X	
#Creek Chub	X	X	X	X	X	X	X	X	X
#Fathead Minnow	X								X
#Golden Shiner	X		X	X					
#Green Sunfish	X	X	X	X	X	X	X	X	X
Hybrid Minnow	X								
Hybrid Sunfish							X		
Johnny Darter	X	X	X	X	X	X	X	X	X
Largemouth Bass		X							X
Mottled Sculpin	X	X	X	X	X	X	X	X	X
Rainbow Trout						X		X	X
~Rock Bass						X	X	X	X
~Smallmouth Bass						X			
#White Sucker	X	X	X	X	X	X	X	X	X

Tributaries to the St. Joseph River, Elkhart County, 2018						
Stream	Little Elkhart		Pine Creek		Christiana Creek	
Site	CR 35		SR 120		NMWF	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey		X				
#Black Bullhead			X			
#Blacknose Dace	X	X				
Blackside Darter	X	X	X	X	X	X
Bluegill	X	X	X	X	X	X
#Bluntnose Minnow		X	X	X	X	X
Bowfin				X		
#Brown Bullhead				X	X	
Brown Trout	X	X				
#Central Mudminnow	X	X	X			
Chestnut Lamprey	X	X			X	X
#Common Carp						X
Common Shiner		X				
#Creek Chub	X	X	X	X	X	X
~Golden Redhorse	X				X	X
Grass Pickerel	X	X	X			
#Green Sunfish	X	X	X	X	X	
~Hornyhead Chub			X	X	X	X
Hybrid Sunfish			X	X		
Johnny Darter	X	X	X	X		
Largemouth Bass	X	X			X	X
~Loggerperch	X	X	X	X	X	X
~Longear Sunfish						X
Mottled Sculpin	X	X	X	X		
~Northern Hog Sucker	X	X			X	X
Northern Pike					X	
Pumpkinseed			X		X	X
~Rainbow Darter	X	X	X	X	X	X
Rainbow Trout	X	X				
~Rock Bass			X	X	X	X
~Shorthead Redhorse	X	X	X		X	X
~Silver Redhorse					X	X
~Smallmouth Bass	X	X		X	X	X
Spotfin Shiner					X	X
~Stonecat						X
Stoneroller, Central		X	X	X	X	X
Striped Shiner	X	X	X	X	X	X
Walleye					X	X

Tributaries to the St. Joseph River, Elkhart County, 2018						
Stream	Little Elkhart		Pine Creek		Christiana Creek	
Site	CR 35		SR 120		NMWF	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
Warmouth		X				
#White Sucker	X	X	X		X	X
#Yellow Bullhead				X		X

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**Tributaries to the St. Joseph River, Elkhart County, 2018**

Stream	York Twp Ditch	Lily Creek		Turkey Creek	Yellow Creek		Baugo Creek	
	CR 12	Park 6 Drive		US Hwy 6	Concord H.S.		Restoration (B)	
		1st Pass	2nd Pass	1st Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey				X				
#Banded Killifish							X	X
#Black Bullhead				X				
Black Crappie								X
#Blacknose Dace	X			X	X	X	X	X
Blackside Darter				X			X	X
Blackstripe Topminnow				X				
Bluegill		X		X	X	X	X	X
#Bluntnose Minnow		X		X	X	X	X	X
Bowfin			X					
Brook Stickleback					X			
#Central Mudminnow	X			X	X	X		
Chestnut Lamprey					X	X		
Common Shiner						X		X
#Creek Chub	X	X		X	X	X	X	X
#Fathead Minnow					X	X		
~Golden Redhorse				X			X	X
#Golden Shiner					X	X		
Grass Pickerel				X	X			
#Green Sunfish	X	X	X	X	X	X	X	X
~Greenside Darter							X	X
~Hornyhead Chub				X	X	X		
Hybrid Sunfish							X	
Johnny Darter				X	X	X	X	X
Largemouth Bass	X		X	X	X	X	X	X
~Logperch							X	X
~Longear Sunfish				X			X	X
~Longnose Dace							X	X
~Mimic Shiner				X				
~Northern Hog Sucker				X				
Pirate Perch				X		X		
Pumpkinseed							X	
#Quillback								X
~Rainbow Darter				X	X	X	X	X
~Rock Bass				X			X	X
~Sand Shiner				X			X	X

**Tributaries to the St. Joseph River, Elkhart County, 2018**

Stream	York Twp Ditch	Lily Creek		Turkey Creek	Yellow Creek		Baugo Creek	
Site	CR 12	Park 6 Drive		US Hwy 6	Concord H.S.		Restoration (B)	
		1st Pass	2nd Pass	1st Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~Silver Redhorse							X	X
Silverjaw Minnow						X	X	X
~Smallmouth Bass				X			X	X
Spotfin Shiner							X	X
Stoneroller, Central				X	X	X	X	X
Striped Shiner				X	X		X	X
Tadpole Madtom				X				
Walleye							X	X
#White Sucker				X	X	X	X	X
#Yellow Bullhead				X				
Yellow Perch		X	X					

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# Appendix E

## Summary of macroinvertebrates (insects) collected by site, 2018

Macroinvertebrates were collected in two ways to calculate the Invertebrate Community Index (ICI). The first method employed a sampling device known as a Hester-Dendy multi-plate sampler (HD sampler). Macroinvertebrates collected using this method were identified and counted (Quantitative column in the following tables). The second method was a sweep with a net of all the available habitat types in the area of the Hester-Dendy in an effort to identify other macroinvertebrates in the stream that may not colonize the HD samplers. Macroinvertebrates collected in this way were identified and simply counted as being present (Qualitative column).

## SJR Nibbyville (A)

Date Collected: 8/22/18 Site #: 2

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	83	+	F	Petrophila sp	9		MI
Nemertea	8		F	Dineutus sp	5	+	F
Hyalella azteca	0	+	F	Peltodytes sp	0	+	MT
Gammarus fasciatus	0	+	F	Psephenus herricki	0	+	MI
Plauditus dubius or P. virilis	50	+	I	Scirtidae	0	+	F
Baetis flavistriga	1		F	Macronychus glabratus	17	+	F
Baetis intercalaris	152		F	Stenelmis sp	0	+	F
Labiobaetis propinquus	0	+	MI	Anopheles sp	0	+	F
Isonychia sp	261		MI	Ablabesmyia sp	0	+	
Leucrocuta sp	7	+	MI	Nilotanypus fimbriatus	8		F
Stenacron sp	7	+	F	Pentaneura inconspicua	23		F
Maccaffertium exiguum	414	+	MI	Thienemannimyia group	4		F
Maccaffertium mediopunctatum	48		MI	Corynoneura lobata	8		F
Maccaffertium pulchellum	75	+	MI	Cricotopus (C.) sp	0	+	F
Maccaffertium terminatum	41	+	MI	Cricotopus (C.) bicinctus	73		T
Teloganopsis deficiens	18		I	Tvetenia discoloripes group	4		MI
Tricorythodes sp	607	+	MI	Cryptochironomus sp	0	+	F
Anthopotamus sp	0	+	MI	Cryptotendipes pseudotener	0	+	F
Coenagrionidae	0	+	T	Dicrotendipes neomodestus	154	+	F
Argia sp	2	+	F	Polypedilum (U.) flavum	38		F
Pteronarcys sp	1	+	MI	Polypedilum (P.) fallax group	8	+	F
Acroneuria internata	1		MI	Polypedilum (P.) illinoense	0	+	T
				Polypedilum (T.) halterale			
Paragnetina sp	8		MI	group	0	+	MT
Agnetina capitata complex	2		MI	Rheotanytarsus sp	27		F
Chimarra obscura	61		MI	Tanytarsus sepp	8	+	F
Neureclipsis sp	30		MI	Sciomyzidae	0	+	MT
Polycentropus sp	17	+	MI	Hydrobiidae	0	+	F
Cheumatopsyche sp	839	+	F	Elimia sp	2	+	MI
Ceratopsyche morosa group	0	+	MI	Physella sp	0	+	T
Hydropsyche phalerata	94		MI	Planorbella (P.) pilsbryi	0	+	T
Hydropsyche venularis	1		MI	Ferrissia sp	2	+	F
Macrostemum zebratum	9		I	Corbicula fluminea	0	+	F
Hydroptila sp	159		F	Dreissena polymorpha	0	+	F
Brachycentrus numerosus	12		MI	No. of Quantitative Taxa:	45		
Neophylax sp	0	+	MI	No. of Qualitative Taxa:	47		
Pycnopsyche sp	0	+	MI	Total Taxa:	73		
Lepidostoma sp	0	+	MI	No. of Organisms	3400		
Ceraclea sp	0	+	MI	Qualitative EPT:	18		
Oecetis sp	2		F	<b>ICI:</b>	<b>50</b>		
Triaenodes sp	0	+	MI				

SJR Lexington Ave

Date Collected: 8/23/18 Site #: 3

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F	Neophylax sp	0	+	MI
Turbellaria	112	+	F	Nectopsyche diarina	0	+	MI
Nemertea	4		F	Oecetis persimilis	2		MI
Oligochaeta	0	+	T	Peltodytes sp	0	+	MT
Placobdella ornata	0	+	MT	Macronychus glabratus	10	+	F
Caecidotea sp	0	+	T	Stenelmis sp	5	+	F
Gammarus fasciatus	0	+	F	Ceratopogonidae	0	+	T
Hydrachnidia	0	+	F	Ablabesmyia sp	7		
Plauditus dubius or P. virilis	14	+	I	Ablabesmyia janta	7		F
Baetis intercalaris	18	+	F	Nilotanypus fimbriatus	4		F
Labiobaetis propinquus	0	+	MI	Corynoneura lobata	4		F
Isonychia sp	94	+	MI	Cricotopus (C.) bicinctus	15	+	T
Leucrocuta sp	0	+	MI	Cricotopus (L.) sylvestris group	0	+	T
Stenacron sp	99	+	F	Thienemanniella lobapodema	0	+	F
Maccaffertium exiguum	63	+	MI	Cryptochironomus sp	0	+	F
Maccaffertium mediopunctatum	45	+	MI	Dicrotendipes neomodestus	37	+	F
Maccaffertium pulchellum	25		MI	Phaenopsectra obediens gp	15		F
Maccaffertium terminatum	43	+	MI	Polypedilum (Uresipedilum) flavum	37	+	F
Teloganopsis deficiens	13		I	Polypedilum (P.) illinoense	0	+	T
Tricorythodes sp	38	+	MI	Polypedilum (T.) halterale group	0	+	MT
Caenis sp	10		F	Tribelos fuscicorne	7		F
Hexagenia sp	0	+	F	Cladotanytarsus mancus gp.	0	+	F
Coenagrionidae	0	+	T	Rheotanytarsus sp	498	+	F
Argia sp	0	+	F	Tanytarsus sepp	37	+	F
Pteronarcys sp	0	+	MI	Hemerodromia sp	2		F
Acroneuria carolinensis	0	+	MI	Elimia sp	34	+	MI
Agetina capitata complex	3	+	MI	Ferrissia sp	4	+	F
Neoplea sp	0	+	F	Corbicula fluminea	2	+	F
Sialis sp	0	+	MT	Dreissena polymorpha	0	+	F
Chimarra obscura	26	+	MI	Elliptio dilatata	0	+	MI
Neureclipsis sp	2	+	MI	Lampsilis radiata luteola	0	+	MI
Polycentropus sp	7	+	MI				
Cheumatopsyche sp	268	+	F	No. of Quantitative Taxa:	44		
Ceratopsyche morosa group	2		MI	No. of Qualitative Taxa:	56		
Hydropsyche aerata	35		MI	Total Taxa:	72		
Hydropsyche phalerata	4	+	MI	No. of Organisms	1744		
Hydropsyche venularis	16		MI	Qualitative EPT:	24		
Macrostemum zebratum	58	+	I	ICI:	56		
Glossosomatidae	6	+	MI				
Hydroptila sp	9		F				
Brachycentrus numerosus	3	+	MI				

## SJR McNaughton Park

Date Collected: 8/23/18 Site #: 4

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F				
Turbellaria	3	+	F	Stenochironomus sp	8	+	F
Urnatella gracilis	1		MI	Rheotanytarsus sp	306		F
Oligochaeta	4	+	T	Hemerodromia sp	2		F
Helobdella stagnalis	0	+	T	Elimia sp	0	+	MI
Caecidotea sp	0	+	T	Physella sp	0	+	T
Gammarus fasciatus	5		F	Ferrissia sp	1	+	F
Gammarus fasciatus	0	+	F	Corbicula fluminea	0	+	F
Orconectes (P.) rusticus	0	+	F	Dreissena polymorpha	0	+	F
Hydrachnidia	0	+	F				
Baetis intercalaris	1		F				
Isonychia sp	50		MI				
Stenacron sp	40	+	F				
Maccaffertium exiguum	61	+	MI				
Maccaffertium mediopunctatum	12		MI				
Maccaffertium pulchellum	33		MI				
Maccaffertium vicarium	3		MI	No. of Quantitative Taxa:	30		
Teloganopsis deficiens	6		I	No. of Qualitative Taxa:	28		
Tricorythodes sp	69	+	MI	Total Taxa:	48		
Cyrnellus fraternus	8		F	No. of Organisms	1191		
Polycentropus sp	1		MI	Qualitative EPT:	7		
Cheumatopsyche sp	245	+	F	<b>ICI:</b>	<b>44</b>		
Hydropsyche aerata	6		MI				
Macrostemum zebratum	2		I				
Brachycentrus numerosus	0	+	MI				
Pycnopsyche sp	0	+	MI				
Nectopsyche diarina	0	+	MI				
Oecetis sp	1		F				
Psephenus herricki	0	+	MI				
Macronychus glabratus	1	+	F				
Stenelmis sp	0	+	F				
Tanypodinae	8						
Ablabesmyia janta	0	+	F				
Ablabesmyia mallochi	0	+	F				
Labrundinia pilosella	4		F				
Corynoneura lobata	8		F				
Thienemanniella lobapodema	4		F				
Dicrotendipes neomodestus	188	+	F				
Polypedilum (U.) flavum	110		F				
Polypedilum (T.) halterale gp.	0	+	MT				

SJR Jefferson Blvd

Date Collected: 8/29/18 Site #: 5

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	14		F	Polypedilum (P.) illinoense	5	+	T
Turbellaria	27		F	Tribelos fuscicorne	3		F
Oligochaeta	10	+	T	Tribelos jucundum	1		MT
Caecidotea sp	0	+	T	Rheotanytarsus pellucidus	1		MI
Gammarus fasciatus	53	+	F	Rheotanytarsus sp	13		F
Orconectes sp	1	+	F	Tanytarsus glabrescens gp. sp 7	1		F
Labiobaetis propinquus	0	+	MI	Tanytarsus sepp	1		F
Isonychia sp	10		MI	Hemerodromia sp	1		F
Stenacron sp	255	+	F	Hydrobiidae	0	+	F
Maccaffertium pulchellum	36		MI	Elimia sp	108		MI
Tricorythodes sp	74	+	MI	Physella sp	15	+	T
Coenagrionidae	1	+	T	Gyraulus sp	1	+	MT
Argia sp	0	+	F	Planorbella (Pierosoma) pilsbryi	0	+	T
Anax sp	0	+	MT	Corbicula fluminea	1	+	F
Boyeria vinosa	1		F				
Cyrnellus fraternus	2		F	No. of Quantitative Taxa:	47		
Polycentropus sp	7		MI	No. of Qualitative Taxa:	22		
Cheumatopsyche sp	34		F	Total Taxa:	55		
Hydropsyche aerata	5		MI	No. of Organisms	853		
Hydropsyche venularis	2		MI	Qualitative EPT:	5		
Hydroptila sp	46		F	<b>ICI:</b>	<b>32</b>		
Pycnopsyche sp	0	+	MI				
Mystacides sp	3		MI				
Oecetis persimilis	1	+	MI				
Peltodytes sp	0	+	MT				
Helichus sp	1		F				
Macronychus glabratus	36	+	F				
Stenelmis sp	18	+	F				
Ablabesmyia janta	37		F				
Ablabesmyia mallochi	1		F				
Labrundinia pilosella	1		F				
Thienemannimyia group	1		F				
Cricotopus (C.) bicinctus	2		T				
Cricotopus (C.) or Orthocladius (O.) sp	1						
Tvetenia bavarica group	1		MI				
Dicrotendipes neomodestus	9	+	F				
Glyptotendipes (G.) sp	1		MT				
Microtendipes pedellus group	1		F				
P. albimanus or P. duplicatus	2		F				
Polypedilum sp	2						
Polypedilum (Uresipedilum) flavum	6		F				

SJR LaSalle Ave

Date Collected: 9/5/18 Site #: 6

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	728	+	F	Stenelmis sp	0	+	F
Caecidotea sp	0	+	T	Simulium sp	57	+	F
Gammarus sp	0	+	F	Hayesomyia s. or Thienemannimyia n.	18		F
Hydrachnidia	16		F	Cricotopus (C.) bicinctus	7		T
Plauditus dubius or P. virilis	0	+	I	Tvetenia discoloripes group	89	+	MI
Baetis flavistriga	0	+	F	Chironomus (C.) sp	0	+	MT
Baetis intercalaris	558	+	F	Cryptochironomus sp	0	+	F
Labiobaetis propinquus	0	+	MI	Dicrotendipes neomodestus	0	+	F
Proclleon viridoculare	0	+	MI	Polypedilum (U.) flavum	68		F
Isonychia sp	293	+	MI	Stictochironomus sp	0	+	F
Leucrocuta sp	7	+	MI	Rheotanytarsus sp	122		F
Stenacron sp	30	+	F	Hemerodromia sp	74		F
Maccaffertium exiguum	209	+	MI	Elimia sp	20	+	MI
Maccaffertium mediopunctatum	13		MI	Gyraulus sp	0	+	MT
Maccaffertium pulchellum	30		MI	Corbicula fluminea	8	+	F
Maccaffertium terminatum	20		MI	No. of Quantitative Taxa:	32		
Teloganopsis deficiens	83		I	No. of Qualitative Taxa:	34		
Tricorythodes sp	138	+	MI	Total Taxa:	50		
Caenis sp	0	+	F	No. of Organisms	5762		
Baetisca sp	0	+	MI	Qualitative EPT:	17		
Hetaerina sp	1	+	F	<b>ICI:</b>	<b>50</b>		
Coenagrionidae	0	+	T				
Argia sp	0	+	F				
Chimarra obscura	122		MI				
Cheumatopsyche sp	1724	+	F				
Hydropsyche aerata	53		MI				
Hydropsyche orris	160		MI				
Hydropsyche phalerata	260	+	MI				
Hydropsyche simulans	9		MI				
Hydropsyche venularis	0	+	MI				
Macrostemum zebratum	476	+	I				
Hydroptila sp	359		F				
Brachycentrus numerosus	1		MI				
Pycnopsyche sp	0	+	MI				
Macronychus glabratus	9	+	F				

SJR Keller Park

Date Collected: 9/5/18 Site #: 7

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	706	+	F	Simulium sp	50	+	F
Oligochaeta	0	+	T	Hayesomyia s. or Thienemannimyia n.	14		F
Caecidotea sp	0	+	T	Cricotopus (C.) bicinctus	41		T
Gammarus fasciatus	1	+	F	Tvetenia discoloripes group	151		MI
Hydrachnidia	0	+	F	Polypedilum (Uresipedilum) flavum	376	+	F
Plauditus dubius or P. virilis	61	+	I	Polypedilum (P.) illinoense	0	+	T
Baetis flavistriga	2	+	F	Rheotanytarsus sp	82		F
Baetis intercalaris	594	+	F	Hemerodromia sp	17		F
Labiobaetis propinquus	0	+	MI	Hydrobiidae	0	+	F
Iswaeon anoka	0	+	MI	Elimia sp	1	+	MI
Isonychia sp	549	+	MI	Physella sp	0	+	T
Stenacron sp	16	+	F	Planorbella (Pierosoma) pilsbryi	0	+	T
Maccaffertium exiguum	163	+	MI	Corbicula fluminea	0	+	F
Maccaffertium pulchellum	81		MI	Lampsilis radiata luteola	0	+	MI
Maccaffertium vicarium	114		MI				
Teloganopsis deficiens	51		I	No. of Quantitative Taxa:	34		
Tricorythodes sp	116	+	MI	No. of Qualitative Taxa:	37		
Coenagrionidae	0	+	T	Total Taxa:	54		
Argia sp	0	+	F	No. of Organisms	6395		
Gomphus sp	0	+	F	Qualitative EPT:	15		
Agnetina capitata complex	1		MI	<b>ICI:</b>	<b>50</b>		
Chimarra obscura	183		MI				
Neureclipsis sp	1		MI				
Cheumatopsyche sp	1746		F				
Hydropsyche aerata	41		MI				
Hydropsyche orris	5		MI				
Hydropsyche phalerata	468	+	MI				
Hydropsyche simulans	38		MI				
Macrostemum zebratum	583	+	I				
Hydroptila sp	131	+	F				
Brachycentrus numerosus	1	+	MI				
Lepidostoma sp	2		MI				
Nectopsyche exquisita	0	+	MI				
Oecetis sp	1		F				
Triaenodes sp	0	+	MI				
Psephenus herricki	0	+	MI				
Dubiraphia bivittata	0	+	F				
Dubiraphia vittata group	0	+	F				
Macronychus glabratus	8	+	F				
Stenelmis sp	0	+	F				

SJR Brick Road

Date Collected: 9/10/18 Site #: 8

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F	Hayesomyia s. or Thienemannimyia n.	3		F
Turbellaria	58	+	F	Cricotopus (C.) bicinctus	21		T
Nemertea	8		F	Cricotopus (C.) trifascia	1		F
Oligochaeta	2	+	T	Tvetenia discoloripes group	1		MI
Placobdella sp	1		MT	Chironomus (C.) sp	0	+	MT
Caecidotea sp	0	+	T	Dicrotendipes neomodestus	6	+	F
Crangonyx sp	0	+	MT	Polypedilum (Uresipedilum) flavum	42		F
Gammarus fasciatus	16		F	Rheotanytarsus sp	30		F
Plauditus dubius or P. virilis	45	+	I	Hemerodromia sp	6		F
Baetis intercalaris	51	+	F	Hydrobiidae	0	+	F
Isonychia sp	13	+	MI	Elimia sp	3	+	MI
Leucrocuta sp	0	+	MI	Planorbella (P.) pilsbryi	0	+	T
Stenacron sp	11	+	F	Corbicula fluminea	0	+	F
Maccaffertium sp	0	+	MI	No. of Quantitative Taxa:	37		
Maccaffertium exiguum	48		MI	No. of Qualitative Taxa:	29		
Maccaffertium m. integrum	2		MI	Total Taxa:	51		
Maccaffertium pulchellum	29		MI	No. of Organisms	737		
Maccaffertium terminatum	29		MI	Qualitative EPT:	12		
Teloganopsis deficiens	3		I	<b>ICI:</b>	<b>42</b>		
Tricorythodes sp	78	+	MI				
Calopterygidae	0	+	F				
Hetaerina sp	5		F				
Coenagrionidae	0	+	T				
Argia sp	0	+	F				
Agnetina capitata complex	1		MI				
Neureclipsis sp	2		MI				
Polycentropus sp	4		MI				
Cheumatopsyche sp	103	+	F				
Hydropsyche phalerata	31	+	MI				
Macrostemum zebratum	12	+	I				
Hydroptila sp	19		F				
Brachycentrus numerosus	56	+	MI				
Pycnopsyche sp	0	+	MI				
Oecetis sp	1		F				
Ancyronyx variegata	0	+	F				
Macronychus glabratus	43	+	F				
Stenelmis sp	2	+	F				
Ablabesmyia janta	1		F				



Little Elkhart River CR 35

Date Collected: 8/22/18 Site #: 9

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	4		F	Conchapelopia sp	16	+	F
Turbellaria	8	+	F	Pentaneura inconspicua	5		F
Oligochaeta	16		T	Diamesa sp	0	+	F
Lirceus sp	0	+	MT	Pagastia orthogonia	0	+	F
Gammarus sp	16	+	F	Brillia flavifrons group	0	+	F
Orconectes (P.) rusticus	0	+	F	Corynoneura lobata	9		F
Hydrachnidia	0	+	F	Cricotopus (C.) bicinctus	5	+	T
Baetis tricaudatus	1		MI	Cricotopus (C.) trifascia	0	+	F
Baetis flavistriga	65	+	F	Eukiefferiella devonica group	5		F
Baetis intercalaris	21		F	Parametriocnemus sp	120		F
Iswaeon anoka	1	+	MI	Rheocricotopus (P.) robacki	5		F
Heptagenia sp	1			Thienemanniella similis	5		MI
Maccaffertium exiguum	15		MI	Thienemanniella xena	58		F
Maccaffertium terminatum	34		MI	Cryptochironomus sp	0	+	F
Maccaffertium vicarium	49	+	MI	Microtendipes pedellus group	5		F
Teloganopsis deficiens	1		I	Paratendipes albimanus or P. duplicatus	0	+	F
Anthopotamus sp	0	+	MI	Polypedilum (U.) flavum	42		F
Calopterygidae	0	+	F	Polypedilum (P.) fallax group	10		F
Boyeria vinosa	0	+	F	Polypedilum (P.) illinoense	0	+	T
Gomphus sp	0	+	F	Paratanytarsus sp	10		F
Pteronarcys sp	0	+	MI	Rheotanytarsus pellucidus	42		MI
Paragnetina sp	0	+	MI	Rheotanytarsus sp	272		F
Cheumatopsyche sp	113	+	F	Tanytarsus glabrescens grp. sp 7	5		F
Ceratopsyche morosa gp	51	+	MI	Hemerodromia sp	5		F
Ceratopsyche sparna	121	+	F	Elimia sp	1	+	MI
Hydropsyche depravata gp	3		F	Ferrissia sp	2		F
Glossosoma sp	0	+	MI	Sphaerium sp	0	+	F
Hydroptila sp	10		F	No. of Quantitative Taxa: 43			
Brachycentrus numerosus	9	+	MI	No. of Qualitative Taxa: 38			
Neophylax sp	0	+	MI	Total Taxa: 66			
Pycnopsyche sp	1	+	MI	No. of Organisms 1199			
Lepidostoma sp	1		MI	Qualitative EPT: 15			
Helicopsyche borealis	0	+	MI	<b>ICI: 52</b>			
Leptoceridae	0	+					
Macronychus glabratus	26		F				
Optioservus sp	0	+	MI				
Stenelmis sp	0	+	F				
Antocha sp	5	+	MI				
Simulium sp	5	+	F				

Pine Creek SR 120

Date Collected: 8/21/18 Site #: 11

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	8	+	F	Parametricnemus sp	49		F
Oligochaeta	28	+	T	Paratrichocladus sp	49		MI
Caecidotea sp	0	+	T	Rheocricotopus (P.) robacki	78	+	F
Crangonyx sp	0	+	MT	Thienemanniella xena	44		F
Gammarus sp	31	+	F	Tvetenia bavarica group	39		MI
Gammarus pseudolimnaeus	0	+	F	Tvetenia discoloripes group	10		MI
Orconectes sp	0	+	F	Paratendipes a. or P. duplicatus	0	+	F
Hydrachnidia	4	+	F	Phaenopsectra obediens group	0	+	F
Baetis tricaudatus	50	+	MI	Polypedilum (U.) aviceps	254	+	MI
Baetis flavistriga	36	+	F	Polypedilum (U.) flavum	29		F
Stenacron sp	3	+	F	Polypedilum (P.) fallax group	10		F
Maccaffertium mediopunctatum	2	+	MI	Polypedilum (T.) scalaenum grp	10		F
Maccaffertium vicarium	15	+	MI	Paratanytarsus sp	20	+	F
Lype diversa	15		MI	Rheotanytarsus pellucidus	127		MI
Polycentropus sp	1		MI	Rheotanytarsus sp	293		F
Cheumatopsyche sp	106	+	F	Tanytarsus sp	10		F
Ceratopsyche morosa grp	27		MI	Tabanidae	1		F
Ceratopsyche sparna	152	+	F	Empididae	2		F
Hydropsyche depravata grp	77		F	Physella sp	0	+	T
Glossosoma sp	0	+	MI	No. of Quantitative Taxa:			42
Hydroptila sp	21		F	No. of Qualitative Taxa:			36
Brachycentrus numerosus	4	+	MI	Total Taxa:			59
Pycnopsyche sp	0	+	MI	No. of Organisms			1704
Nectopsyche diarina	0	+	MI	Qualitative EPT:			12
Trienodes sp	0	+	MI	<b>ICI:</b>			<b>50</b>
Hydrobius sp	0	+	F				
Sperchopsis tessellata	0	+	F				
Dubiraphia quadrinotata	0	+	F				
Macronychus glabratus	9		F				
Optioservus sp	2	+	MI				
Antocha sp	5	+	MI				
Tipula abdominalis	0	+	F				
Simulium sp	4	+	F				
Conchapelopia sp	29		F				
Pagastia orthogonia	0	+	F				
Brillia flavifrons group	10	+	F				
Cardiocladius obscurus	0	+	MI				
Cricotopus (C.) sp	20		F				
Cricotopus (C.) bicinctus	10		T				
Cricotopus (C.) tremulus grp	10		MT				

Christiana Creek North Main Wellfield

Date Collected: 8/20/18 Site #: 13

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.											
Turbellaria	2	+	F	Optioservus sp	1	+	MI											
Nemertea	5		F	Stenelmis sp	6	+	F											
Oligochaeta	8		T	Simulium sp	4	+	F											
Gammarus fasciatus	12	+	F	Tanypodinae	1													
Hydrachnidia	0	+	F	Conchapelopia sp	2		F											
Plauditus dubius or P. virilis	4		I	Nilotanypus fimbriatus	5		F											
Baetis flavistriga	17	+	F	Orthocladiinae	1													
Baetis intercalaris	138	+	F	Cardiocladius obscurus	13	+	MI											
Labiobaetis propinquus	0	+	MI	Cricotopus (C.) sp	5		F											
Iswaeon anoka	17	+	MI	Cricotopus (C.) bicinctus	3		T											
Isonychia sp	8	+	MI	Parametriocnemus sp	1		F											
Nixe sp	0	+	MI	Rheocricotopus (P.) robacki	2		F											
Stenacron sp	0	+	F	Thienemanniella taurocapita	7		MI											
Maccaffertium exiguum	173	+	MI	Tvetenia discoloripes group	9		MI											
Maccaffertium mediopunctatum	84	+	MI	Microtendipes "caelum"	1	+	MI											
Maccaffertium terminatum	28		MI	Polypedilum (U.) aviceps	0	+	MI											
Teloganopsis deficiens	33	+	I	Polypedilum (U.) flavum	17	+	F											
Tricorythodes sp	1	+	MI	Stenochironomus sp	1		F											
Hetaerina sp	2	+	F	Rheotanytarsus pellucidus	1		MI											
Acroneuria internata	1	+	MI	Rheotanytarsus sp	28		F											
Corydalus cornutus	5	+	MI	Hemerodromia sp	4		F											
Chimarra obscura	326	+	MI	Elimia sp	0	+	MI											
Neureclipsis sp	0	+	MI	Ferrissia sp	13		F											
Cheumatopsyche sp	112	+	F	Corbicula fluminea	0	+	F											
Hydropsyche sp or Ceratopsyche sp	0	+																
Ceratopsyche morosa group	2		MI	<table border="1"> <tr> <td>No. of Quantitative Taxa:</td> <td>52</td> </tr> <tr> <td>No. of Qualitative Taxa:</td> <td>39</td> </tr> <tr> <td>Total Taxa:</td> <td>65</td> </tr> <tr> <td>No. of Organisms</td> <td>1254</td> </tr> <tr> <td>Qualitative EPT:</td> <td>22</td> </tr> <tr> <td><b>ICI:</b></td> <td><b>54</b></td> </tr> </table>			No. of Quantitative Taxa:	52	No. of Qualitative Taxa:	39	Total Taxa:	65	No. of Organisms	1254	Qualitative EPT:	22	<b>ICI:</b>	<b>54</b>
No. of Quantitative Taxa:	52																	
No. of Qualitative Taxa:	39																	
Total Taxa:	65																	
No. of Organisms	1254																	
Qualitative EPT:	22																	
<b>ICI:</b>	<b>54</b>																	
Ceratopsyche sparna	41		F															
Hydropsyche depravata grp.	61		F															
Hydropsyche phalerata	24	+	MI															
Macrostemum zebratum	2		I															
Hydroptila sp	10		F															
Brachycentrus numerosus	2	+	MI															
Neophylax sp	0	+	MI															
Pycnopsyche sp	0	+	MI															
Helicopsyche borealis	0	+	MI															
Nectopsyche diarina	0	+	MI															
Petrophila sp	1		MI															
Dineutus sp	1	+	F															
Psephenus herricki	1	+	MI															
Macronychus glabratus	4	+	F															
Microcyloepus pusillus	4		MI															

Elkhart River Oxbow (B)

Date Collected: 8/27/18 Site #: 15

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	1		F	Thienemanniella xena	3		F
Oligochaeta	14	+	T	Tvetenia discoloripes group	31		MI
Caecidotea sp	0	+	T	Cryptotendipes pseudotener	0	+	F
Gammarus sp	0	+	F	Microtendipes "caelum"	0	+	MI
Hydrachnidia	0	+	F	Microtendipes pedellus grp.	0	+	F
Baetis flavistriga	0	+	F	Phaenopsectra obediens grp	0	+	F
Baetis intercalaris	19	+	F	Polypedilum (U.) flavum	0	+	F
Iswaeon anoka	0	+	MI	Polypedilum (P.) fallax group	5		F
Isonychia sp	4		MI	Polypedilum (P.) illinoense	5	+	T
Stenacron sp	1	+	F	Stenochironomus sp	3		F
Maccaffertium exiguum	52	+	MI	Rheotanytarsus sp	161	+	F
Maccaffertium mediopunctatum	4	+	MI	Chrysops sp	0	+	F
Maccaffertium pulchellum	4		MI	Hemerodromia sp	4		F
Maccaffertium terminatum	29	+	MI	Elimia sp	2	+	MI
Tricorythodes sp	1	+	MI	Corbicula fluminea	0	+	F
Coenagrionidae	0	+	T				
Argia sp	0	+	F				
Paragnetina sp	4		MI				
Agneta capitata complex	1	+	MI				
Lype diversa	1		MI				
Cheumatopsyche sp	21	+	F				
Ceratopsyche morosa group	62	+	MI				
Ceratopsyche sparna	31		F				
Hydropsyche depravata group	1		F				
Brachycentrus numerosus	1	+	MI				
Pycnopsyche sp	0	+	MI				
Lepidostoma sp	1		MI				
Nectopsyche diarina	0	+	MI				
Psephenus herricki	0	+	MI				
Scirtidae	0	+	F				
Ancyronyx variegata	0	+	F				
Macronychus glabratus	14		F				
Microcyloopus pusillus	0	+	MI				
Optioservus sp	0	+	MI				
Stenelmis sp	0	+	F				
Antocha sp	0	+	MI				
Simulium sp	4		F				
Ablabesmyia mallochi	0	+	F				
Conchapelopia sp	3		F				
Meropelopia sp	0	+	F				
Rheocricotopus (P.) robacki	3		F				

No. of Quantitative Taxa:	31
No. of Qualitative Taxa:	39
Total Taxa:	56
No. of Organisms	490
Qualitative EPT:	14
<b>ICI:</b>	<b>44</b>

Elkhart River EEC (A)

Date Collected: 8/24/18 Site #: 16

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F	Helicopsyche borealis	0	+	MI
Turbellaria	5	+	F	Nectopsyche diarina	0	+	MI
Nemertea	4		F	Psephenus herricki	0	+	MI
Oligochaeta	2		T	Cyphon sp	0	+	MT
Helobdella stagnalis	0	+	T	Ancyronyx variegata	0	+	F
Caecidotea sp	0	+	T	Dubiraphia vittata group	0	+	F
Gammarus sp	1	+	F	Macronychus glabratus	29	+	F
Orconectes (P.) rusticus	0	+	F	Optioservus sp	0	+	MI
Hydrachnidia	0	+	F	Stenelmis sp	0	+	F
Baetis flavistriga	7	+	F	Antocha sp	2		MI
Baetis intercalaris	145	+	F	Tipula sp	1		F
Iswaeon anoka	0	+	MI	Simulium sp	5	+	F
Isonychia sp	20	+	MI	Clinotanypus pinguis	0	+	MT
Leucrocuta sp	1	+	MI	Meropelopia sp	8		F
Stenacron sp	2	+	F	Tanypus neopunctipennis	0	+	T
Maccaffertium exiguum	40	+	MI	Rheocricotopus (P.) robacki	16		F
Maccaffertium mediopunctatum	18	+	MI	Tvetenia discoloripes group	41		MI
Maccaffertium terminatum	15		MI	Dicrotendipes neomodestus	4		F
Teloganopsis deficiens	7		I	Microtendipes "caelum"	4	+	MI
Tricorythodes sp	4	+	MI	Polypedilum (U.) flavum	32	+	F
Calopteryx sp	0	+	F	Polypedilum (P.) fallax group	4		F
Coenagrionidae	0	+	T	Rheotanytarsus pellucidus	4		MI
Argia sp	0	+	F	Rheotanytarsus sp	249	+	F
Boyeria vinosa	0	+	F	Tanytarsus sp	0	+	F
Gomphus sp	0	+	F	Hemerodromia sp	12		F
Macromia sp	0	+	MI	Hydrobiidae	0	+	F
Pteronarcys sp	0	+	MI	Elimia sp	5	+	MI
Paragnetina sp	0	+	MI	Physella sp	0	+	T
Agnetina capitata complex	3	+	MI	Ferrissia sp	3	+	F
Neoplea sp	0	+	F	Corbicula fluminea	5	+	F
Polycentropus sp	0	+	MI	No. of Quantitative Taxa: 39			
Cheumatopsyche sp	54	+	F	No. of Qualitative Taxa: 54			
Ceratopsyche morosa group	149	+	MI	Total Taxa: 69			
Ceratopsyche sparna	100	+	F	No. of Organisms 1045			
Hydropsyche depravata group	22	+	F	Qualitative EPT: 21			
Hydropsyche phalerata	6		MI	<b>ICI: 54</b>			
Hydroptila sp	2		F				
Brachycentrus numerosus	14	+	MI				
Pycnopsyche sp	0	+	MI				

Elkhart River Elkhart Central High School

Date Collected: 8/24/18 Site #: 17

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	4		F	Dubiraphia vittata group	0	+	F
Turbellaria	106	+	F	Macronychus glabratus	21	+	F
Oligochaeta	6	+	T	Optioservus sp	0	+	MI
Caecidotea sp	1	+	T	Stenelmis sp	3	+	F
Gammarus sp	96	+	F	Tanypodinae	3		
Hydrachnidia	0	+	F	Ablabesmyia janta	0	+	F
Plauditus dubius or P. virilis	0	+	I	Meropelopia sp	6		F
Baetis flavistriga	3	+	F	Nilotanytus fimbriatus	10		F
Baetis intercalaris	15		F	Corynoneura lobata	16		F
Iswaeon anoka	0	+	MI	Cricotopus sp	2		F
Isonychia sp	34		MI	Chironomus (C.) decorus group	0	+	T
Leucrocota sp	2	+	MI	Cryptotendipes pseudotener	0	+	F
Stenacron sp	137	+	F	Dicrotendipes neomodestus	149	+	F
Maccaffertium exiguum	41		MI	Microtendipes "caelum"	22		MI
Maccaffertium mediopunctatum	32	+	MI	Microtendipes pedellus group	28	+	F
Maccaffertium pulchellum	4		MI	Paratendipes a. or P. duplicatus	0	+	F
Maccaffertium terminatum	24	+	MI	Polypedilum (Uresipedilum) flavum	25	+	F
Tricorythodes sp	189	+	MI	Polypedilum (P.) fallax group	6		F
Coenagrionidae	0	+	T	Polypedilum (P.) illinoense	3	+	T
Argia sp	16	+	F	Polypedilum (T.) scalaenum group	0	+	F
Acroneuria carolinensis	1		MI	Cladotanytarsus vanderwulpi grp sp 5	0	+	MI
Agnetina capitata complex	3		MI	Rheotanytarsus pellucidus	6		MI
Lype diversa	4		MI	Rheotanytarsus sp	8		F
Nyctiophylax sp	2		MI	Tanytarsus glabrescens group sp 7	0	+	F
Polycentropus sp	1	+	MI	Tanytarsus sepp	6	+	F
Cheumatopsyche sp	54		F	Hemerodromia sp	4	+	F
Ceratopsyche morosa group	8		MI	Elimia sp	50	+	MI
Ceratopsyche sparna	7		F	Physella sp	2		T
Hydropsyche phalerata	1		MI	Ferrissia sp	65		F
Hydroptila sp	78		F	Corbicula fluminea	0	+	F
Brachycentrus numerosus	13		MI	Sphaerium sp	0	+	F
Neophylax sp	0	+	MI	Lampsilis radiata luteola	0	+	MI
Pycnopsyche sp	0	+	MI	No. of Quantitative Taxa:	52		
Lepidostoma sp	4		MI	No. of Qualitative Taxa:	41		
Leptoceridae	1			Total Taxa:	71		
Nectopsyche diarina	1	+	MI	No. of Organisms	1327		
Petrophila sp	3		MI	Qualitative EPT:	12		
Dubiraphia bivittata	1		F	<b>ICI:</b>	<b>38</b>		
Dubiraphia quadrinotata	0	+	F				

Yellow Creek Concord High School

Date Collected: 8/27/18 Site #: 21

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	168		F	Cryptochironomus sp	0	+	F
Turbellaria	206	+	F	Dicrotendipes neomodestus	162	+	F
Oligochaeta	112	+	T	Microtendipes "caelum"	20	+	MI
Caecidotea sp	4	+	T	Microtendipes pedellus group	364	+	F
Gammarus sp	266	+	F	Paralauterborniella nigrohalteralis	0	+	F
Hydrachnidia	32	+	F	Paratendipes albimanus or P. duplicatus	0	+	F
Acerpenna pygmaea	8	+	MI	Phaenopsectra obediens group	0	+	F
Baetis tricaudatus	0	+	MI	Polypedilum (Uresipedilum) flavum	283		F
Baetis flavistriga	29	+	F	Polypedilum (P.) fallax group	40		F
Callibaetis sp	0	+	MT	Polypedilum (P.) illinoense	0	+	T
Stenacron sp	98	+	F	Polypedilum (T.) scalaenum group	0	+	F
Calopteryx sp	2	+	F	Stictochironomus sp	0	+	F
Coenagrionidae	0	+	T	Cladotanytarsus mancus group	0	+	F
Trichocorixa sp	0	+	MT	Cladotanytarsus vanderwulpi group	0	+	
Cheumatopsyche sp	149	+	F	Cladotanytarsus vanderwulpi grp sp 3	0	+	MI
Ceratopsyche morosa grp	258	+	MI	Cladotanytarsus vanderwulpi grp sp 4	0	+	MI
Hydropsyche depravata grp	23	+	F	Paratanytarsus sp	243		F
Hydroptilidae	8		F	Rheotanytarsus sp	81		F
Leptoceridae	8			Tanytarsus sp	40	+	F
Ancyronyx variegata	1		F	Tanytarsus glabrescens group sp 7	182		F
Macronychus glabratus	10		F	Tanytarsus sepp	20		F
Optioservus sp	0	+	MI	Hemerodromia sp	8		F
Optioservus sp	2		MI	Physella sp	17	+	T
Stenelmis sp	1	+	F	Helisoma anceps anceps	0	+	F
Antocha sp	1		MI	Ferrissia sp	72		F
Simulium sp	0	+	F	Sphaerium sp	0	+	F
Ablabesmyia simpsoni	0	+	F				
Conchapelopia sp	61	+	F				
Nilotanypus fimbriatus	20		F				
Pentaneura inconspicua	61	+	F				
Procladius (Holotanypus) sp	0	+	MT				
Corynoneura lobata	20		F				
Cricotopus (C.) sp	0	+	F				
Cricotopus (C.) bicinctus	20	+	T				
Cricotopus (C.) tremulus grp	121		MT				
Paratrichocladius sp	81		MI				
Rheocricotopus (P.) robacki	20		F				
Chironomus (C.) decorus grp	0	+	T				

No. of Quantitative Taxa:	41
No. of Qualitative Taxa:	44
Total Taxa:	64
No. of Organisms	3322
Qualitative EPT:	8
<b>ICI:</b>	<b>40</b>

Baugo Creek Restoration (B)

Date Collected: 8/21/18 Site #: 22

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.											
Hydra sp	16		F	Thienemanniella lobapodema	14		F											
Turbellaria	0	+	F	Tvetenia bavarica group	0	+	MI											
Nemertea	0	+	F	Cryptochironomus sp	0	+	F											
Plumatella sp	2		F	Dicrotendipes neomodestus	101		F											
Caecidotea sp	1	+	T	Microtendipes "caelum"	29	+	MI											
Gammarus sp	0	+	F	Microtendipes pedellus group	14		F											
Orconectes (P.) rusticus	0	+	F	Paratendipes albimanus or P. duplicatus	0	+	F											
Hydrachnidia	0	+	F	Polypedilum (Uresipedilum) aviceps	14		MI											
Baetis flavistriga	124	+	F	Polypedilum (Uresipedilum) flavum	58		F											
Baetis intercalaris	17	+	F	Polypedilum (P.) fallax group	72		F											
Labiobaetis propinquus	0	+	MI	Polypedilum (P.) illinoense	0	+	T											
Isxaeon anoka	0	+	MI	Polypedilum (P.) laetum group	0	+	MI											
Stenacron sp	1	+	F	Polypedilum (T.) scalaenum group	14		F											
Maccaffertium exiguum	1	+	MI	Cladotanytarsus mancus group	0	+	F											
Stenonema femoratum	0	+	F	Paratanytarsus sp	29		F											
Tricorythodes sp	0	+	MI	Rheotanytarsus pellucidus	14		MI											
Calopteryx sp	10	+	F	Rheotanytarsus sp	532		F											
Argia sp	1	+	F	Tanytarsus sp	29	+	F											
Boyeria vinosa	0	+	F	Tanytarsus glabrescens group sp 4	29		F											
Cheumatopsyche sp	113	+	F	Tanytarsus sepp	58		F											
Ceratopsyche morosa group	607	+	MI	Stratiomys sp	0	+	MT											
Hydroptilidae	2		F	Hemerodromia sp	24		F											
Ancyronyx variegata	11	+	F	Physella sp	0	+	T											
Macronychus glabratus	1		F	<table border="1"> <tr> <td>No. of Quantitative Taxa:</td> <td>40</td> </tr> <tr> <td>No. of Qualitative Taxa:</td> <td>37</td> </tr> <tr> <td>Total Taxa:</td> <td>62</td> </tr> <tr> <td>No. of Organisms</td> <td>2332</td> </tr> <tr> <td>Qualitative EPT:</td> <td>10</td> </tr> <tr> <td><b>ICI:</b></td> <td><b>44</b></td> </tr> </table>			No. of Quantitative Taxa:	40	No. of Qualitative Taxa:	37	Total Taxa:	62	No. of Organisms	2332	Qualitative EPT:	10	<b>ICI:</b>	<b>44</b>
No. of Quantitative Taxa:	40																	
No. of Qualitative Taxa:	37																	
Total Taxa:	62																	
No. of Organisms	2332																	
Qualitative EPT:	10																	
<b>ICI:</b>	<b>44</b>																	
Stenelmis sp	17	+	F															
Antocha sp	33	+	MI															
Tipula sp	0	+	F															
Anopheles sp	0	+	F															
Simulium sp	0	+	F															
Conchapelopia sp	43		F															
Hayesomyia senata or T. norena	14	+	F															
Nilotanypus fimbriatus	43		F															
Procladius (Holotanypus) sp	0	+	MT															
Corynoneura lobata	29		F															
Cricotopus (C.) or Orthocladius (O.) sp	29																	
Nanocladius (N.) c.or N. (N.)	14		F															
Nanocladius (N.) spinipennis	29		F															
Rheocricotopus (Psilocricotopus)	129		F															
Thienemanniella sp	14																	



## Bowman Creek Gertrude Street

Date Collected: 8/29/18 Site #: 23

Taxa Name	Quantitative	Qualitative	Tol.													
Erpobdella microstoma	0	+	MT													
Caecidotea sp	0	+	T													
Gammarus sp	71	+	F													
Hydrachnidia	0	+	F													
Baetis tricaudatus	5	+	MI													
Baetis flavistriga	2		F	<table border="1"> <tr> <td>No. of Quantitative Taxa:</td> <td>26</td> </tr> <tr> <td>No. of Qualitative Taxa:</td> <td>19</td> </tr> <tr> <td>Total Taxa:</td> <td>37</td> </tr> <tr> <td>No. of Organisms</td> <td>636</td> </tr> <tr> <td>Qualitative EPT:</td> <td>3</td> </tr> <tr> <td><b>ICI:</b></td> <td><b>34</b></td> </tr> </table>	No. of Quantitative Taxa:	26	No. of Qualitative Taxa:	19	Total Taxa:	37	No. of Organisms	636	Qualitative EPT:	3	<b>ICI:</b>	<b>34</b>
No. of Quantitative Taxa:	26															
No. of Qualitative Taxa:	19															
Total Taxa:	37															
No. of Organisms	636															
Qualitative EPT:	3															
<b>ICI:</b>	<b>34</b>															
Calopteryx sp	9	+	F													
Aeshnidae	4															
Boyeria vinosa	0	+	F													
Cheumatopsyche sp	49	+	F													
Hydropsyche depravata group	24	+	F													
Macronychus glabratus	17		F													
Optioservus sp	9		MI													
Stenelmis sp	0	+	F													
Limonia sp	0	+	F													
Simulium sp	0	+	F													
Conchapelopia sp	24		F													
Helopelopia sp	4		F													
Corynoneura lobata	4		F													
Cricotopus (C.) sp	20		F													
Limnophyes sp	8		T													
Nanocladius (N.) spiniplenus	4		F													
Rheocricotopus (Psilocricotopus) robacki	4		F													
Tvetenia bavarica group	24		MI													
Microtendipes pedellus group	4	+	F													
Polypedilum (Uresipedilum) aviceps	116	+	MI													
Polypedilum (Uresipedilum) flavum	12		F													
Polypedilum (P.) fallax group	4		F													
Polypedilum (P.) illinoense	12		T													
Stictochironomus sp	0	+	F													
Cladotanytarsus vanderwulpi group sp 4	0	+	MI													
Paratanytarsus sp	4	+	F													
Rheotanytarsus sp	168		F													
Neoplasta sp	16		MI													
Physella sp	0	+	T													
Ferrissia sp	18		F													
Sphaerium sp	0	+	F													

## Bowman Creek Green Tech Drive

Date Collected: 8/29/18 Site #: 25

Taxa Name	Quantitative	Qualitative	Tol.	
Spongillidae	0	+	F	
Hydra sp	7809	+	F	
Turbellaria	952	+	F	
Nemertea	16		F	
Plumatella sp	2		F	
Oligochaeta	0	+	T	
Helobdella stagnalis	0	+	T	
Helobdella papillata	2		MT	No. of Quantitative Taxa: 26
Caecidotea sp	0	+	T	No. of Qualitative Taxa: 30
Hyalella azteca	16	+	F	Total Taxa: 42
Crangonyx sp	24	+	MT	No. of Organisms 11670
Gammarus sp	0	+	F	Qualitative EPT: 4
Hydrachnidia	0	+	F	<b>ICI: 26</b>
Caenis sp	0	+	F	
Calopteryx sp	0	+	F	
Coenagrionidae	1	+	T	
Boyeria vinosa	0	+	F	
Epitheca (Tetragoneuria) sp	1	+	MT	
Erythemis simplicicollis	0	+	MT	
Chimarra obscura	36	+	MI	
Cheumatopsyche sp	97	+	F	
Hydropsyche depravata group	197	+	F	
Macronychus glabratus	26		F	
Optioservus sp	0	+	MI	
Stenelmis sp	0	+	F	
Anopheles sp	0	+	F	
Clinotanypus pinguis	0	+	MT	
Conchapelopia sp	580		F	
Helopelopia sp	580	+	F	
Procladius (Holotanypus) sp	0	+	MT	
Nanocladius (N.) crassicornus or N. (N.) "rectinervis"	28	+	F	
Parachironomus sp	83		MT	
Parachironomus frequens	276		F	
Phaenopsectra flavipes	28		MT	
Polypedilum (Uresipedilum) aviceps	221	+	MI	
Polypedilum (Uresipedilum) flavum	525	+	F	
Polypedilum (P.) fallax group	28		F	
Hemerodromia sp	32		F	
Physella sp	104	+	T	
Planorbella (Pierosoma) pilsbryi	4		T	
Planorbella (Pierosoma) trivolvis	2		MT	
Sphaerium sp	0	+	F	

Juday Creek Holy Cross Parkway

Date Collected: 9/4/18 Site #: 28

Taxa Name	Quantitative	Qualitative	Tol.	
Turbellaria	1		F	
Oligochaeta	24	+	T	
Gammarus sp	11	+	F	
Hydrachnidia	0	+	F	No. of Quantitative Taxa: 16
Baetis tricaudatus	0	+	MI	No. of Qualitative Taxa: 26
Labiobaetis frondalis	0	+	MI	Total Taxa: 34
Stenacron sp	33	+	F	No. of Organisms 5578
Hetaerina sp	1		F	Qualitative EPT: 6
Boyeria vinosa	0	+	F	<b>ICI: 38</b>
Neoplea sp	0	+	F	
Cheumatopsyche sp	826	+	F	
Ceratopsyche morosa group	21		MI	
Hydropsyche depravata group	164	+	F	
Brachycentrus numerosus	0	+	MI	
Berosus sp	0	+	MT	
Macronychus glabratus	0	+	F	
Tipula sp	0	+	F	
Simulium sp	0	+	F	
Conchapelopia sp	120		F	
Meropelopia sp	0	+	F	
Pentaneura inconspicua	0	+	F	
Cricotopus (C.) bicinctus	0	+	T	
Cricotopus (C.) or Orthocladius (O.) sp	0	+		
Parametrioctenemus sp	120		F	
Tvetenia bavarica group	240		MI	
Microtendipes "caelum"	0	+	MI	
Polypedilum (Uresipedilum) aviceps	420	+	MI	
Polypedilum (Uresipedilum) flavum	60	+	F	
Polypedilum (P.) fallax group	60		F	
Saetheria tylus	0	+	F	
Cladotanytarsus vanderwulpi group sp 3	0	+	MI	
Rheotanytarsus sp	3417	+	F	
Tanytarsus sp	60		F	
Physella sp	0	+	T	

Juday Creek Grape Road

Date Collected: 9/4/18 Site #: 30

Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	24		F
Turbellaria	0	+	F
Oligochaeta	0	+	T
Caecidotea sp	1		T
Gammarus sp	35	+	F
Orconectes sp	0	+	F
Hydrachnidia	0	+	F
Baetis tricaudatus	14	+	MI
Baetis flavistriga	0	+	F
Labiobaetis frondalis	0	+	MI
Baetis intercalaris	2	+	F
Stenacron sp	42	+	F
Caenis sp	0	+	F
Calopteryx sp	0	+	F
Cheumatopsyche sp	788	+	F
Hydropsyche depravata group	218	+	F
Trienodes ignitus	0	+	MI
Gyrinus sp	0	+	F
Dubiraphia quadrinotata	0	+	F
Simulium sp	3	+	F
Conchapelopia sp	57		F
Nilotanypus fimbriatus	57		F
Parametriocnemus sp	57	+	F
Rheocricotopus (Psilocricotopus) robacki	228		F
Tvetenia bavarica group	171		MI
Microtendipes pedellus group	57		F
Paralauterborniella nigrohalteralis	0	+	F
Paratendipes albimanus or P. duplicatus	0	+	F
Polypedilum (Uresipedilum) aviceps	341	+	MI
Polypedilum (Uresipedilum) flavum	57		F
Polypedilum (P.) illinoense	0	+	T
Polypedilum (Tripodura) scalaenum group	0	+	F
Rheotanytarsus sp	3415		F
Tanytarsus sp	57		F
Myxosargus sp	0	+	MT
Neoplasta sp	33		MI
Hemerodromia sp	16		F

No. of Quantitative Taxa:	21
No. of Qualitative Taxa:	25
Total Taxa:	37
No. of Organisms	5673
Qualitative EPT:	9
<b>ICI:</b>	<b>40</b>

Juday Creek Driftwood

Date Collected: 9/11/18 Site #: 32

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F	Cladotanytarsus mancus group	0	+	F
Hydra sp	8		F	Paratanytarsus sp	0	+	F
Turbellaria	76	+	F	Rheotanytarsus sp	3038	+	F
Nemertea	8		F	Tanytarsus sp	58		F
Oligochaeta	60	+	T	Empididae	12		F
Crangonyx sp	0	+	MT	Hemerodromia sp	16		F
Gammarus sp	116	+	F	Physella sp	3		T
Hydrachnidia	0	+	F	Gyraulus sp	0	+	MT
Baetis tricaudatus	11	+	MI	Planorbella (Pierosoma) trivolvis	0	+	MT
Baetis intercalaris	4	+	F	Ferrissia sp	11	+	F
Stenacron sp	12	+	F	Corbicula fluminea	0	+	F
Maccaffertium vicarium	0	+	MI				
Tricorythodes sp	0	+	MI				
Caenis sp	0	+	F				
Calopteryx sp	0	+	F				
Lype diversa	10		MI				
Polycentropus sp	1		MI	No. of Quantitative Taxa:	34		
Cheumatopsyche sp	548	+	F	No. of Qualitative Taxa:	39		
Ceratopsyche morosa group	132		MI	Total Taxa:	52		
Hydropsyche depravata group	107	+	F	No. of Organisms	6185		
Hydroptila sp	2	+	F	Qualitative EPT:	11		
Mystacides sp	17	+	MI	<b>ICI:</b>	<b>44</b>		
Nectopsyche diarina	0	+	MI				
Macronychus glabratus	5	+	F				
Tipula sp	2	+	F				
Conchapelopia sp	234	+	F				
Helopelopia sp	58		F				
Meropelopia sp	117		F				
Cricotopus (C.) sp	58	+	F				
Cricotopus (C.) bicinctus	58	+	T				
Parametriocnemus sp	292		F				
Rheocricotopus (Psilocricotopus) robacki	351	+	F				
Tvetenia bavarica group	58		MI				
Cryptochironomus sp	0	+	F				
Dicrotendipes neomodestus	234	+	F				
Microtendipes "caelum"	234	+	MI				
Paratendipes albimanus or P. duplicatus	0	+	F				
Polypedilum (Uresipedilum) flavum	234	+	F				
Polypedilum (P.) fallax group	0	+	F				
Polypedilum (P.) illinoense	0	+	T				
Polypedilum (Tripodura) scalaenum grp	0	+	F				

Juday Creek Ponader Park

Date Collected: 9/10/18 Site #: 33

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	1	+	F	Procladius (Holotanypus) sp	0	+	MT
Urnatella gracilis	1		MI	Cricotopus (C.) bicinctus	62		T
Oligochaeta	81		T	Parametriocnemus sp	187		F
Crangonyx sp	0	+	MT	Rheocricotopus (P.) robacki	1311	+	F
Gammarus sp	8	+	F	Tvetenia bavarica group	312		MI
Hydrachnidia	8	+	F	Dicrotendipes sp	62		F
Baetis tricaudatus	0	+	MI	Microtendipes "caelum"	312		MI
Baetis flavistriga	0	+	F	Phaenopsectra obediens grp	62	+	F
Baetis intercalaris	56	+	F	Polypedilum (U.) aviceps	62	+	MI
Iswaeon anoka	0	+	MI	Polypedilum (U.) flavum	624	+	F
Stenacron sp	14	+	F	Polypedilum (P.) illinoense	0	+	T
Maccaffertium exiguum	10	+	MI	Paratanytarsus sp	125		F
Tricorythodes sp	4	+	MI	Rheotanytarsus pellucidus	62	+	MI
Caenis sp	1		F	Rheotanytarsus sp	2809	+	F
Ephemera sp	1		MI	Tanytarsus sp	62	+	F
Calopterygidae	33		F	Empididae	10		F
Calopteryx sp	0	+	F	Hemerodromia sp	1		F
Aeshna sp	0	+	MT	Physella sp	0	+	T
Boyeria vinosa	1		F	Planorbella (P.) trivolvis	0	+	MT
Neurocordulia sp	0	+	F	Ferrissia sp	0	+	F
Belostoma sp	0	+	T	Corbicula fluminea	1	+	F
Sialis sp	0	+	MT	No. of Quantitative Taxa: 41			
Polycentropus sp	3		MI	No. of Qualitative Taxa: 41			
Cheumatopsyche sp	841	+	F	Total Taxa: 62			
Ceratopsyche morosa grp	366	+	MI	No. of Organisms 8535			
Ceratopsyche sparna	3		F	Qualitative EPT: 11			
Hydropsyche depravata grp	701	+	F	<b>ICI: 48</b>			
Hydroptilidae	11		F				
Brachycentrus numerosus	1		MI				
Leptoceridae	2						
Nectopsyche diarina	1	+	MI				
Oecetis sp	3		F				
Peltodytes sp	0	+	MT				
Dubiraphia sp	0	+	F				
Macronychus glabratus	8	+	F				
Optioservus sp	0	+	MI				
Stenelmis sp	0	+	F				
Antocha sp	0	+	MI				
Dixella sp	0	+	F				
Anopheles sp	0	+	F				
Conchapelopia sp	312		F				

Juday Creek Myrtle Street

Date Collected: 9/10/18 Site #: 34

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	84	+	F
Gammarus sp	2	+	F
Hydrachnidia	1		F
Baetis tricaudatus	14	+	MI
Baetis flavistriga	29	+	F
Baetis intercalaris	7	+	F
Iswaeon anoka	3	+	MI
Stenacron sp	48	+	F
Maccaffertium exiguum	22	+	MI
Maccaffertium terminatum	43	+	MI
Maccaffertium vicarium	43	+	MI
Calopteryx sp	1	+	F
Boyeria vinosa	0	+	F
Lype diversa	5		MI
Cheumatopsyche sp	587	+	F
Ceratopsyche morosa group	408	+	MI
Ceratopsyche sparna	31	+	F
Hydropsyche depravata group	20	+	F
Brachycentrus numerosus	0	+	MI
Brachycentrus numerosus	7		MI
Pycnopsyche sp	1		MI
Oecetis persimilis	3		MI
Sperchopsis tessellata	0	+	F
Macronychus glabratus	25	+	F
Optioservus sp	1		MI
Stenelmis sp	12	+	F
Simulium sp	253	+	F
Conchapelopia sp	98		F
Corynoneura lobata	16		F
Parametricnemus sp	262		F
Rheocricotopus (Psilocricotopus) robacki	33		F
Thienemanniella xena	49		F
Tvetenia bavarica group	131		MI
Tvetenia discoloripes group	82		MI
Microtendipes "caelum"	33		MI
Paralauterborniella nigrohalteralis	0	+	F
Polypedilum (Uresipedilum) flavum	66		F
Polypedilum (P.) illinoense	0	+	T
Rheotanytarsus sp	902		F
Tanytarsus sp	0	+	F
Empididae	9		F
Hemerodromia sp	9		F
Laevapex fuscus	10		MT
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	37
No. of Qualitative Taxa:	25
Total Taxa:	44
No. of Organisms	3350
Qualitative EPT:	13
<b>ICI:</b>	<b>46</b>





# Appendix F

## Aerial Site Location Maps



Site #1: St. Joseph River Shore  
Manor Drive



Site #2: St. Joseph River Nibbyville (A)



Site #3: St. Joseph River Lexington Avenue



Site #4: St. Joseph River McNaughton Park



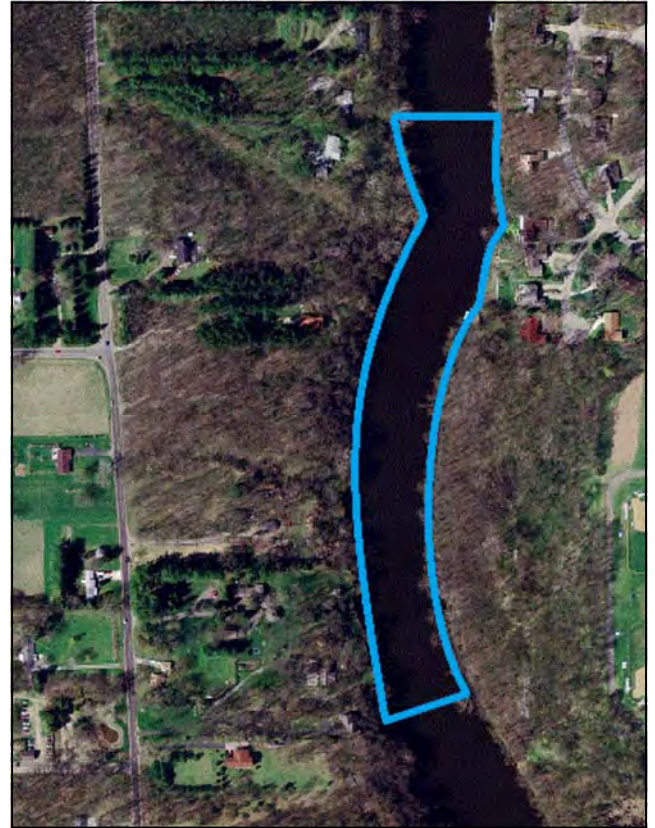
Site #5: St. Joseph River Jefferson Blvd.



Site #6: St. Joseph River LaSalle Avenue



Site #7: St. Joseph River Keller Park



Site #8: St. Joseph River Brick Road

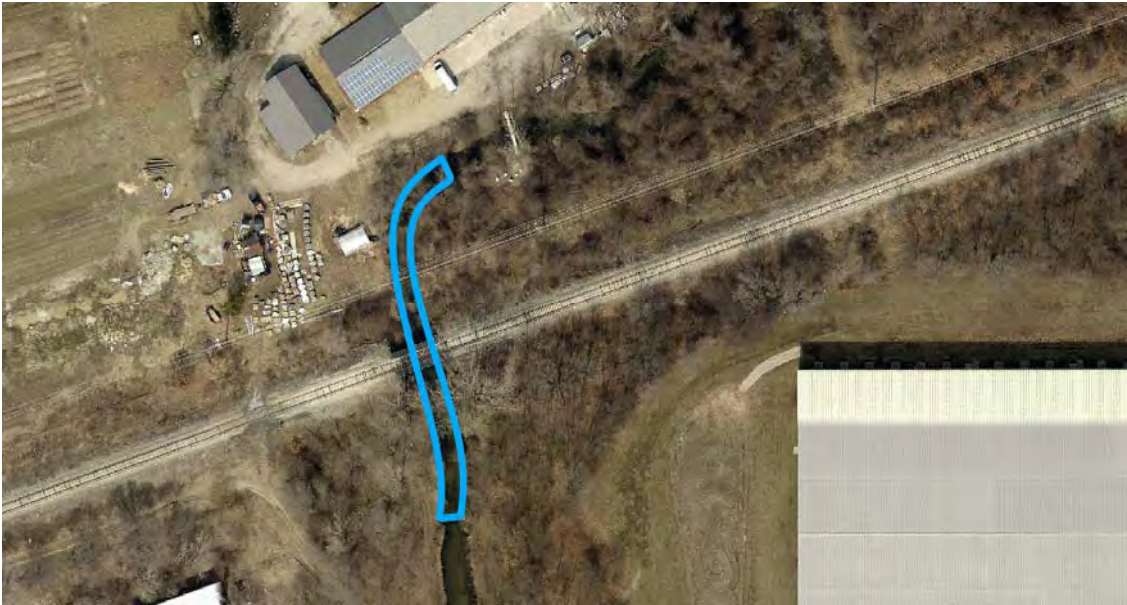


Site #9: Little Elkhart River County Road 35



Site #10: York TWP  
Ditch CR 12

Site #11: Pine Creek SR 120



Site #12: Lily Creek Park Six Drive

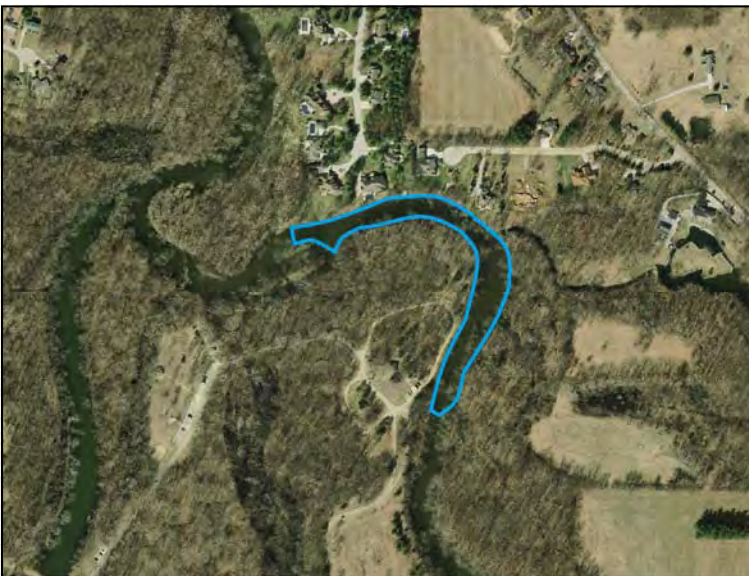


Site #13: Christiana Creek NMWF

Site #14: Elkhart River Benton (US 33)



Benton Dam



Site #15: Elkhart River Oxbow (B)



Site #16: Elkhart River EEC (A)



Site #17: Elkhart River Central H.S.



Site #19: Elkhart River Elkhart Avenue

Elkhart River Dam

Site #18: Elkhart River Prairie Avenue



Site #20: Turkey Creek US 6

Site #21: Yellow Creek Concord H.S.



Site #22: Baugo Restoration (B)

Site #23: Bowman Creek Gertrude Street







Site #24: Bowman Creek Chippewa Avenue

Site #25: Bowman Creek Green Tech Drive



Site #26: Bowman Creek St. Joseph Street

Site #27: Bowman Creek St. Joseph River Mouth





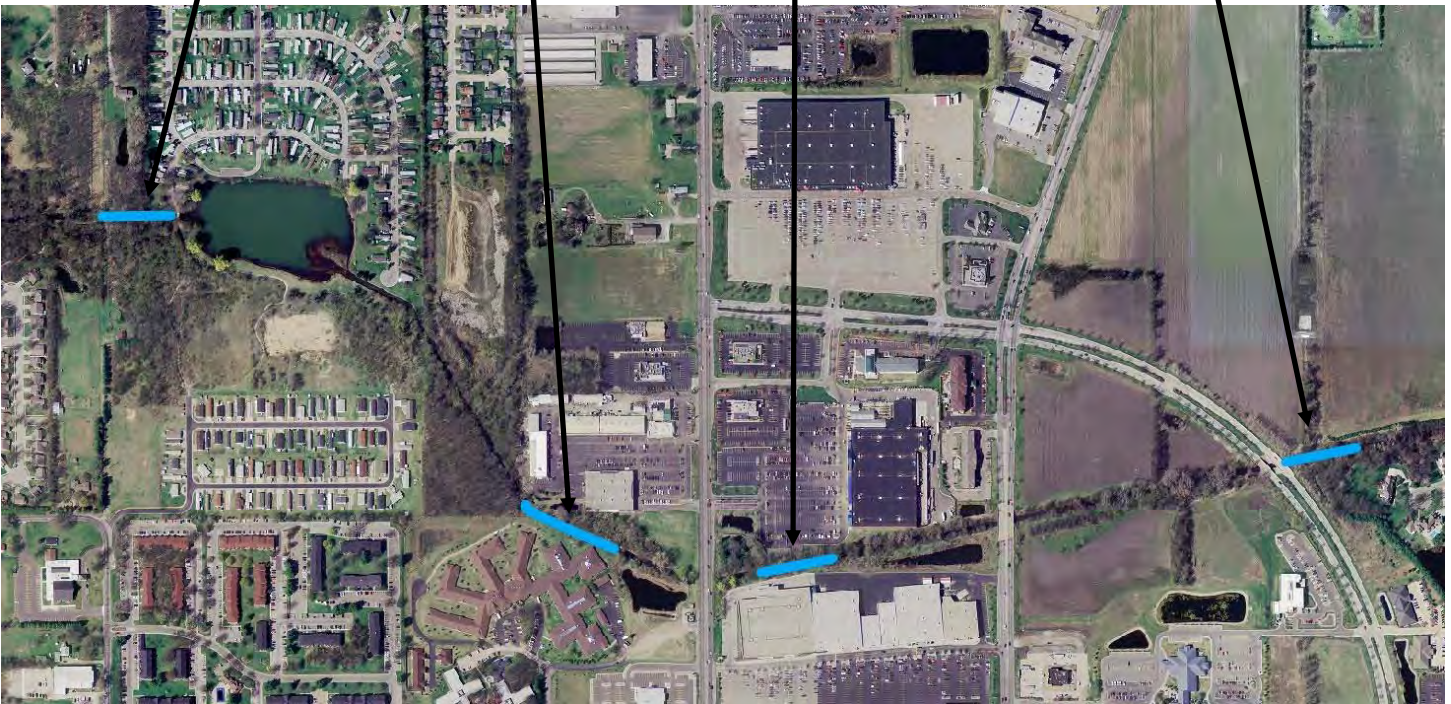
Site #28: Juday Creek Holy Cross Pkwy  
Macroinvertebrate Sampler Location

Site #31: Juday Creek Tanglewood Ct.

Site #29: Juday Creek Edison Lakes Pkwy

Site #32: Juday Creek Driftwood Dr.

Site #30: Juday Creek Grape Road





Site #33: Juday Creek Ponader Park

Site #34 Juday Creek Myrtle Street



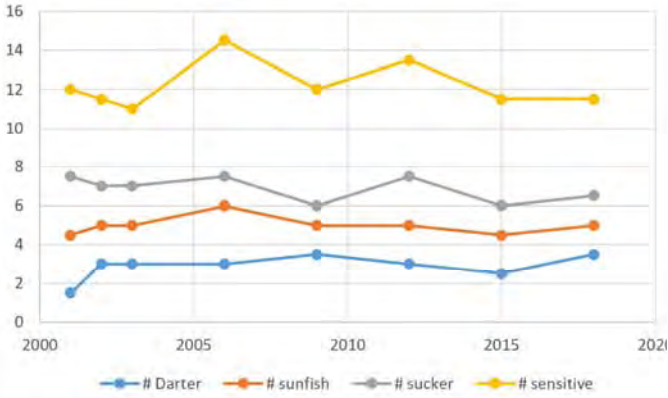


# Appendix G

## In-depth Metric Analysis

The following is an analysis of metrics contained within the IBI comparing scores since the inception of monitoring on the St. Joseph River and its tributaries. Graphs along with very brief interpretations will be presented for individual sites.

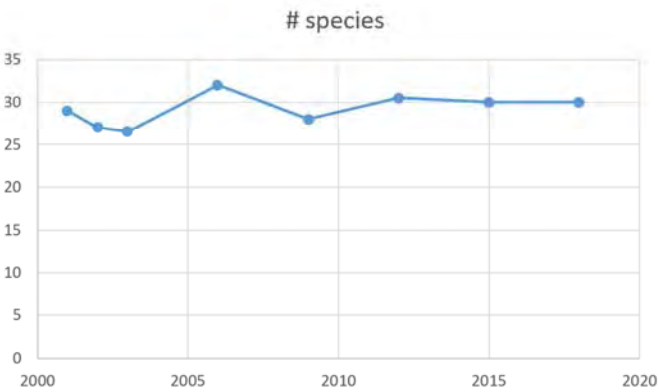
## Site 2: St. Joseph River—Nibbyville (A)



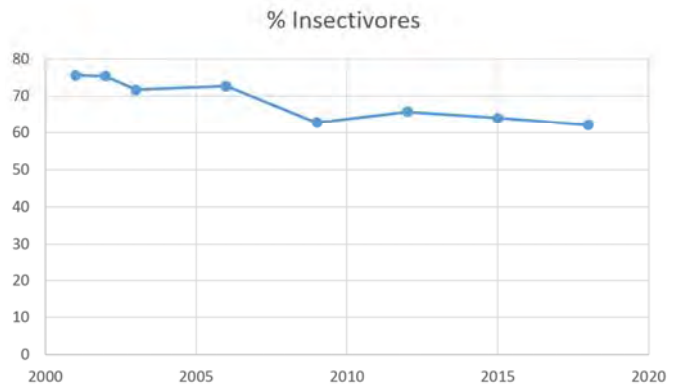
Since the inception of monitoring at this site, the number of sensitive species has stayed relatively similar. The number of sucker species has decreased slightly, the number of darters has increased slightly and the number of sunfish has stayed relatively similar.



Since the inception of monitoring, the percent of tolerant individuals and omnivores has fluctuated. However the percent of both metrics has remained very low over time.



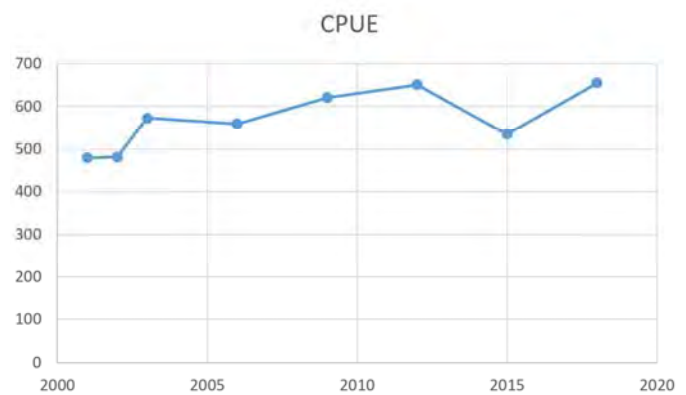
Since the inception of monitoring, the number of species has varied slightly and has not increased or decreased over time.



Since the inception of monitoring, the percent of insectivore fish has decreased from approximately 75% to just over 60%.



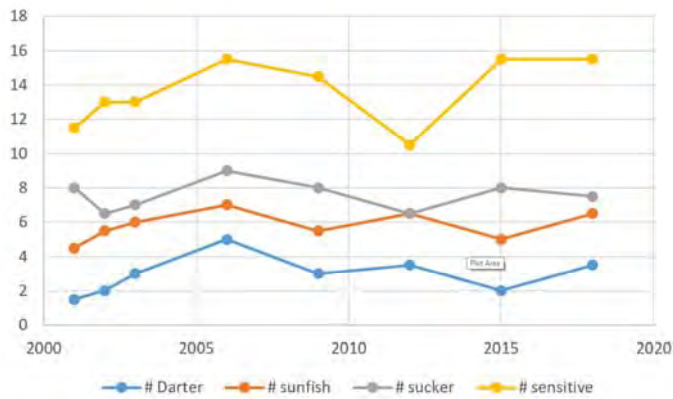
Since the inception of monitoring the percent of simple lithophilic spawners has increased slightly although this metric has fluctuated.



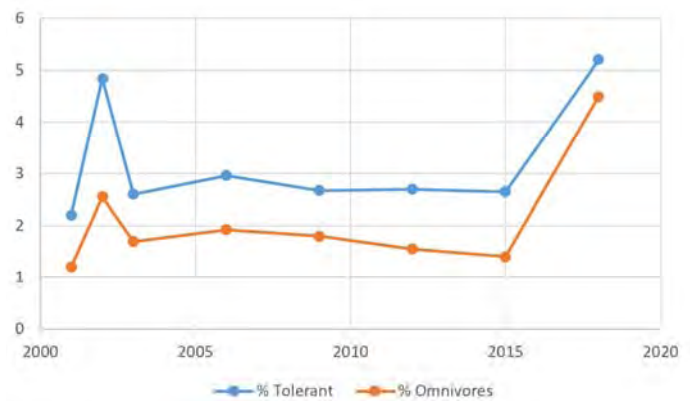
The total number of fish collected (CPUE) has increased gradually since the inception of monitoring with minor fluctuations.

*\*Note that the % of tolerant individuals and omnivores are generally related. As one increases or decreases over the years, the other will follow the same pattern. In general, omnivores are tolerant species; hence the relationship.*

## Site 3: St. Joseph River—Lexington Ave

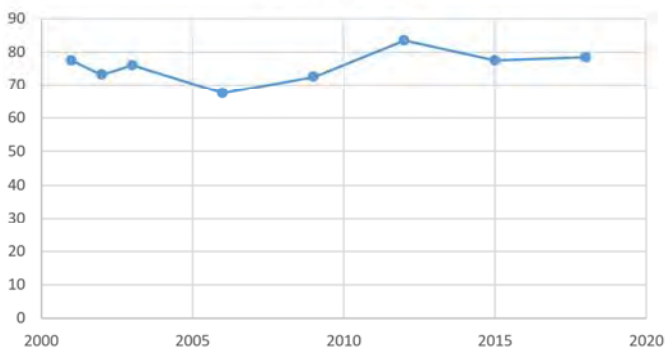


Since the inception of monitoring, the number of darters, sunfish, and suckers metrics have remained relatively similar. The number of sensitive species has fluctuated considerably but has remained high (15 species) from 2015 to 2018.



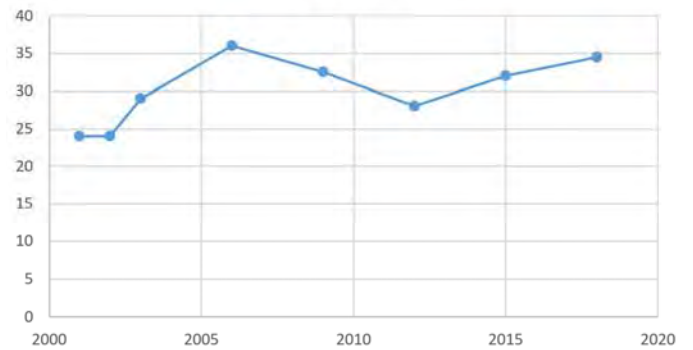
In 2018, the percent of tolerant individuals and omnivores were the highest they have been since the inception of monitoring. However, these metrics have always been extremely low at this site (5% or less).

% Insectivores



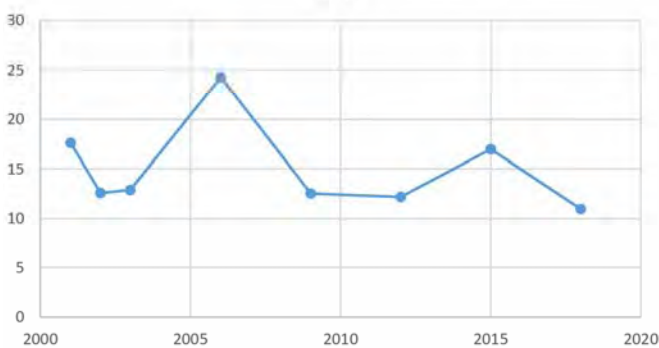
The percent of insectivores fish has remained relatively similar at this site over time and has always been very high.

# species



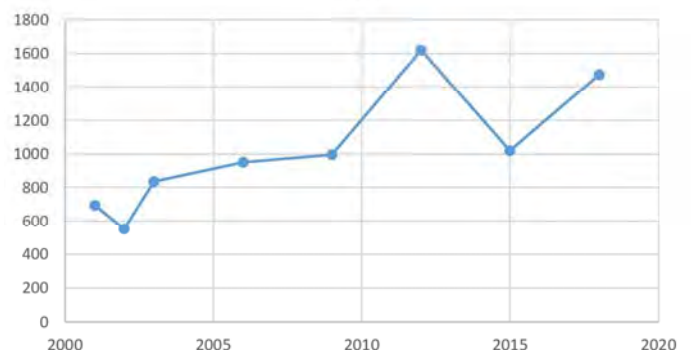
Since the inception of monitoring, the number of species has fluctuated but there has been a general increase by about 5 to 10 species.

% SL



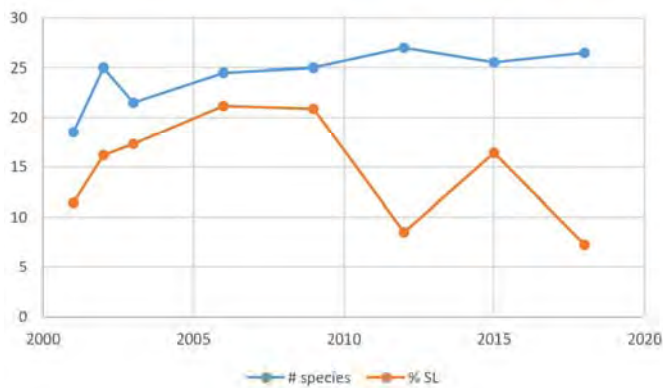
The percent of simple lithophilic spawners has fluctuated over time, but has remained relatively similar.

CPUE

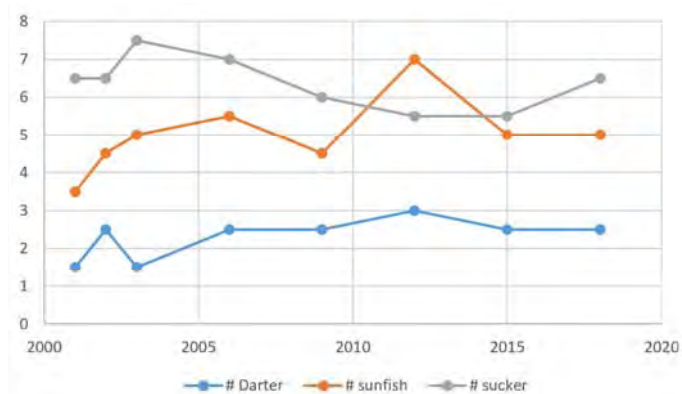


The total number of fish collected (CPUE) has increased substantially since the inception of monitoring.

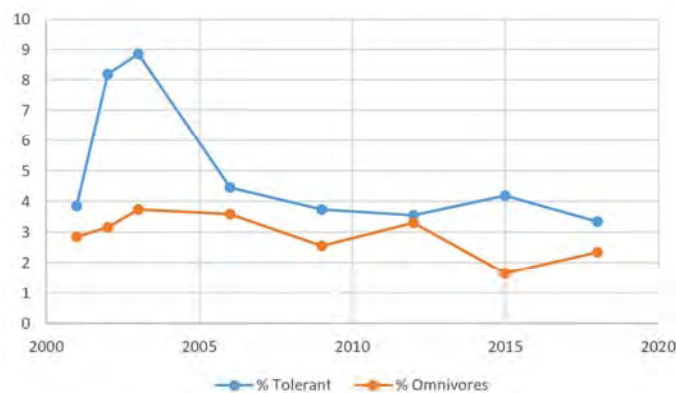
## Site 4: St. Joseph River—McNaughton Park



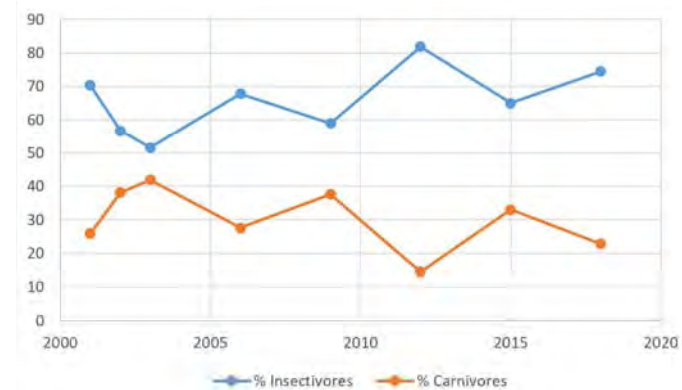
The number of species has increased gradually since the inception of monitoring and has been consistently over 25 in the past several years. The percent of simple lithophilic spawners initially increased but this metric hit its lowest point in 2018.



The number of darter and sunfish species have increased since the inception of monitoring, while the number of sucker species appears to have gradually declined with a slight rebound in 2018.

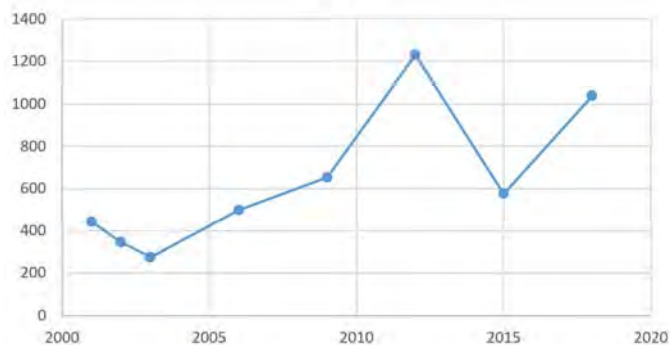


Despite a spike in the percentage of tolerant individuals, this metric along with the percent of omnivores has remained very low since the inception of monitoring.



The percentage of carnivores and insectivores have fluctuated over the years, although carnivores appear to be slightly trending down while insectivores appear to be slightly trending up. It is pretty evident based on this graph that these two metrics have a strong negative relationship. This means as one increases the other decreases.

CPUE

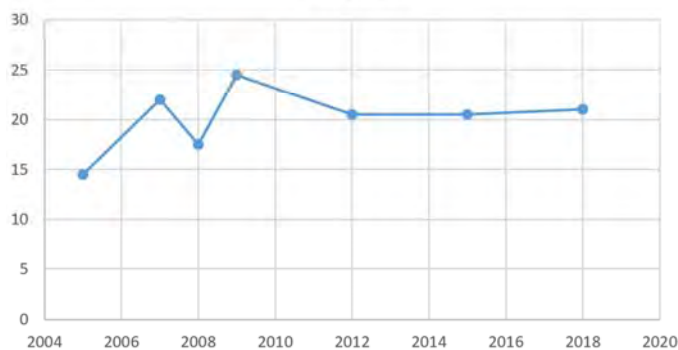


The total number of fish collected (CPUE) has increased significantly since the inception of monitoring.

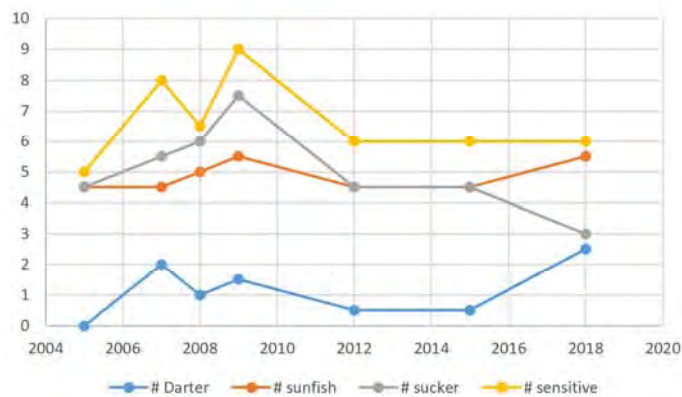


## Site 5: St. Joseph River—Jefferson Blvd

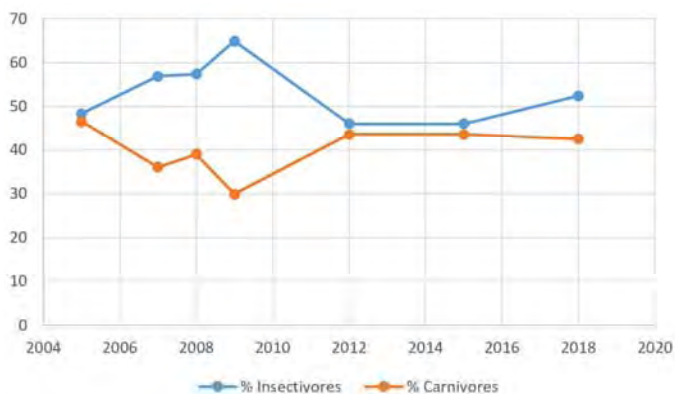
# species



Since the inception of monitoring, the number of species has increased slightly, although the number at this site has remained relatively low compared to most other sites on the St. Joseph River.



Since the inception of monitoring, the number of darters and sunfish have increased slightly and the number of suckers has decreased. In the late 2000s the number of sensitive species increased considerably, however that metric has since lowered closer to original numbers.

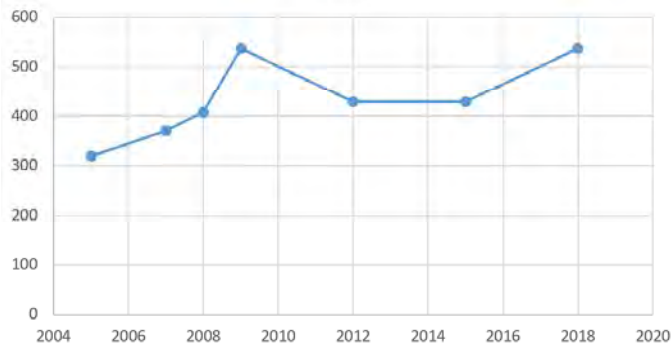


The percent of carnivores and insectivores has been relatively similar over the years. Both metrics appear to occupy close to 50 percent of the population. Note the strong negative relationship between both metrics.



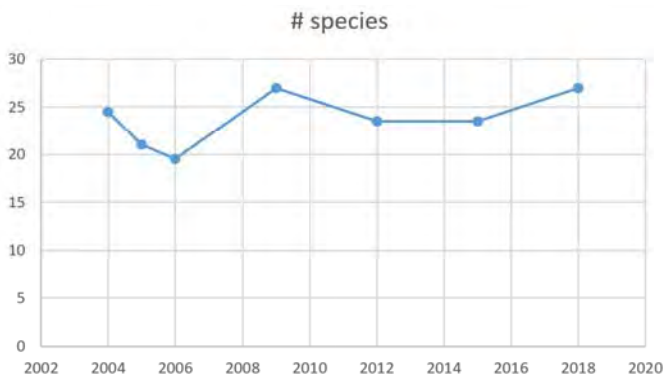
Since the inception of monitoring, the percent of tolerant individuals and omnivores has fluctuated. Both metrics have been very low (15% or less) over the years.

CPUE

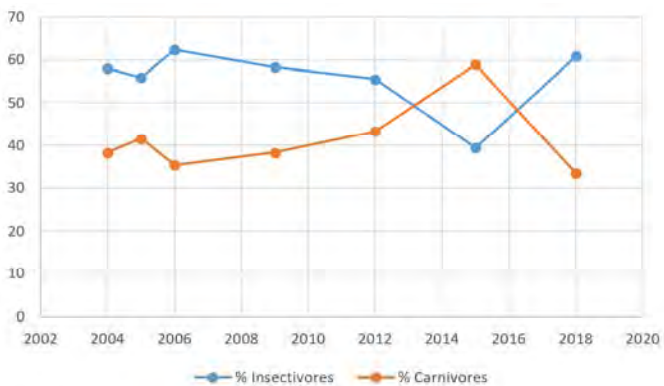


The total number of fish collected (CPUE) has increased significantly since the inception of monitoring.

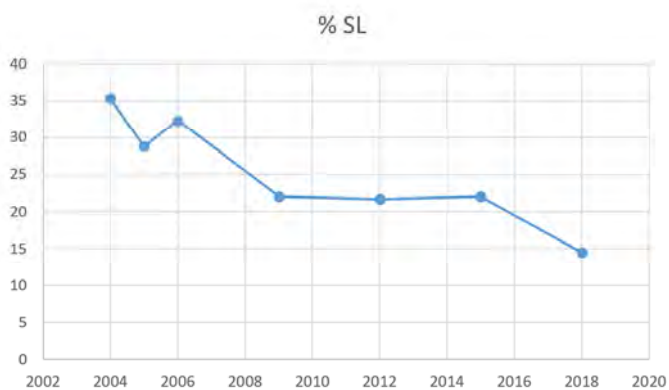
## Site 6: St. Joseph River—LaSalle Ave.



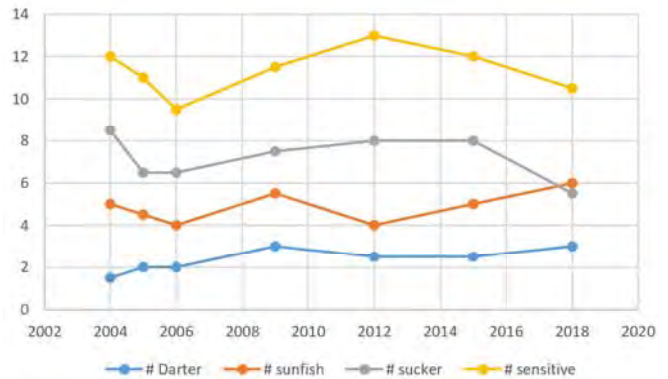
The number of species dropped in the first few years of monitoring to 20 species, but has rebounded and been consistently close to 25 in the past several years of monitoring.



The percent of carnivores and insectivores has been relatively similar over the years. Both metrics appear to occupy close to 50 percent of the population. Note the strong negative relationship between both metrics.



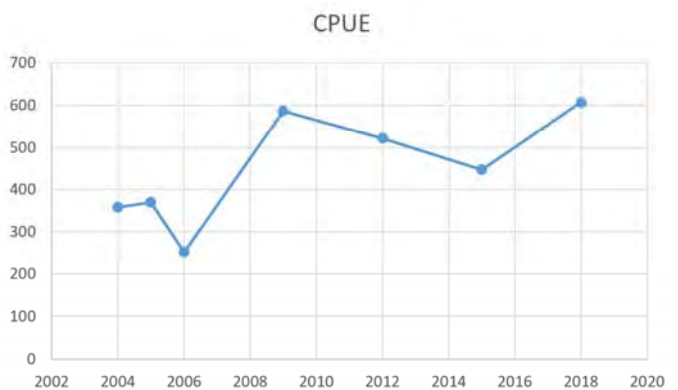
The percent of simple lithophilic spawners has decreased substantially at this site since the inception of monitoring



The number of darters and sunfish species has increased slightly since the inception of monitoring. The number of sucker species has declined slightly, and the number of sensitive species has fluctuated slightly.

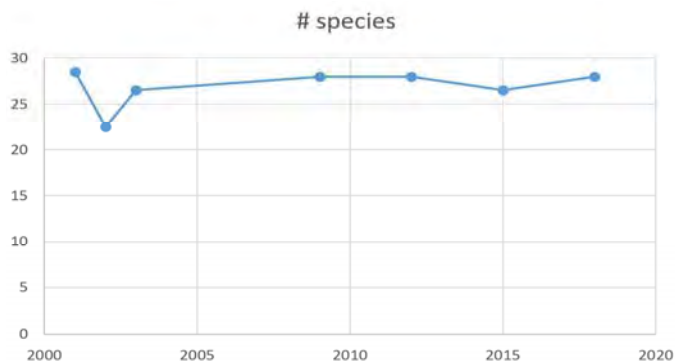


The percent of tolerant individuals and omnivores has fluctuated at this site, but these metrics have always been very low (less than 10%)

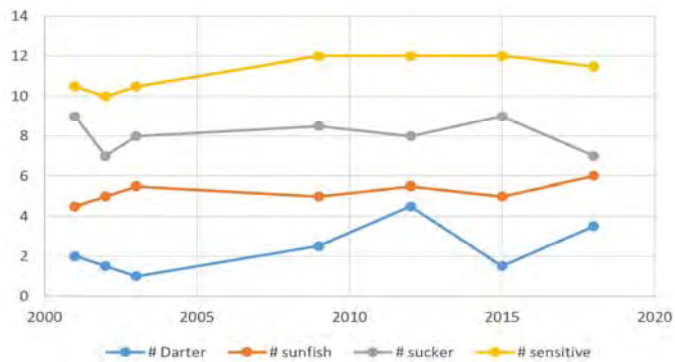


The total number of fish collected (CPUE) has increased significantly since the inception of monitoring.

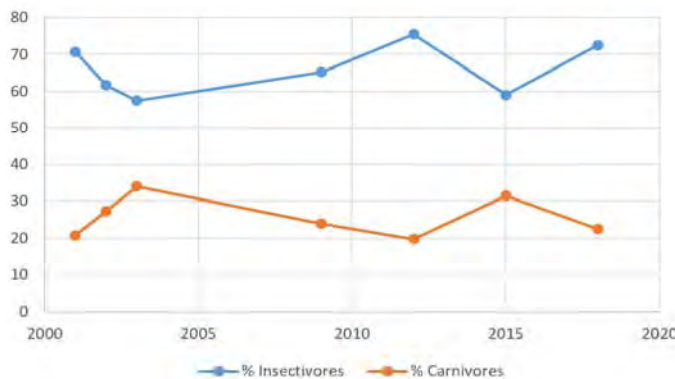
## Site 8: St. Joseph River—Keller Park



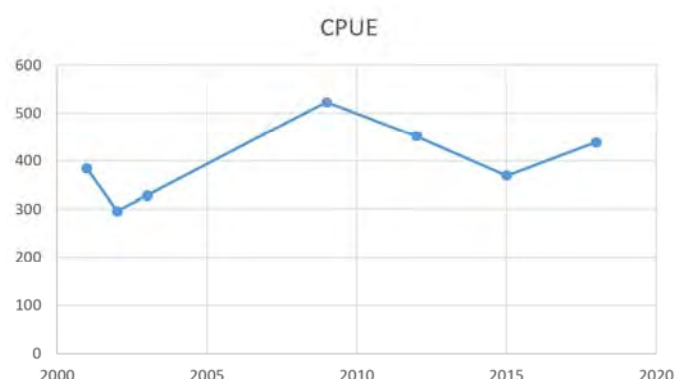
The number of species at this site has been very consistent with one minor deviation in the early 2000s.



The number of sensitive species and sunfish has increased slightly since the inception of monitoring, while the number of darters and suckers has been relatively inconsistent.



The percent of insectivores and carnivores have remained relatively similar over the years with minor fluctuations.

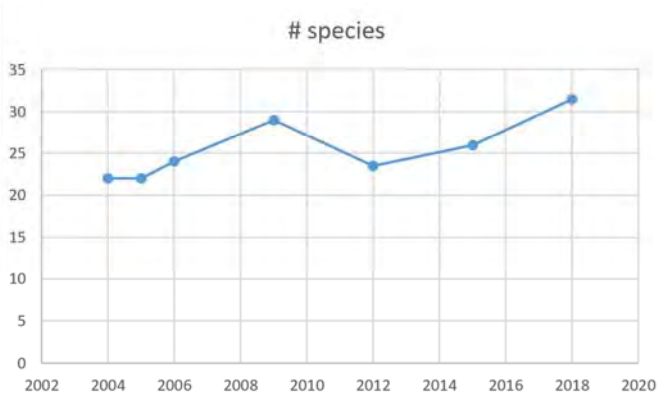


The total number of fish collected (CPUE) has fluctuated to a certain extent, but has not increased like other sites on the St. Joseph River.

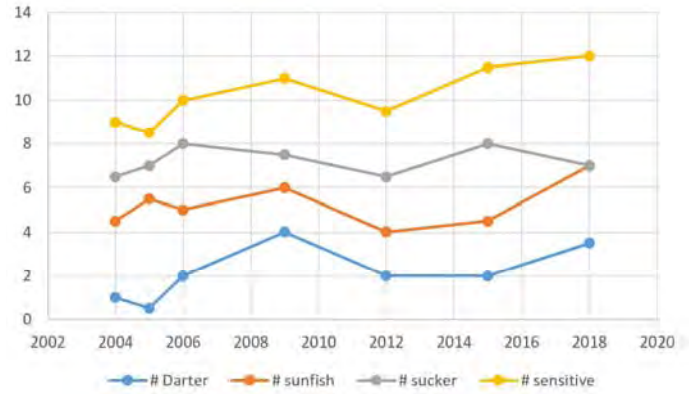


While the percent of simple lithophilic spawners has fluctuated to a certain extent there appears to be a general decline over time for this group of fish.

## Site 8: St. Joseph River—Brick Road



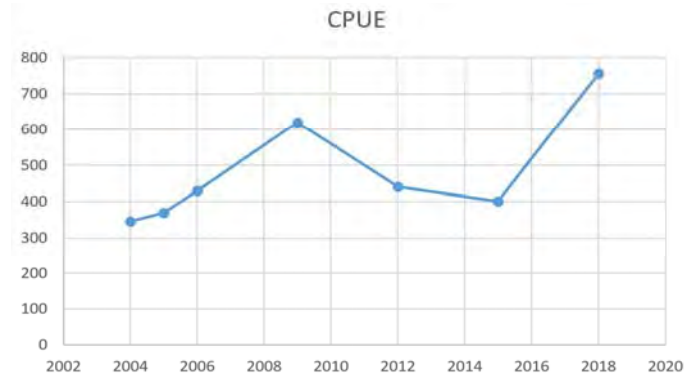
The number of species at this site has increased since the inception of monitoring.



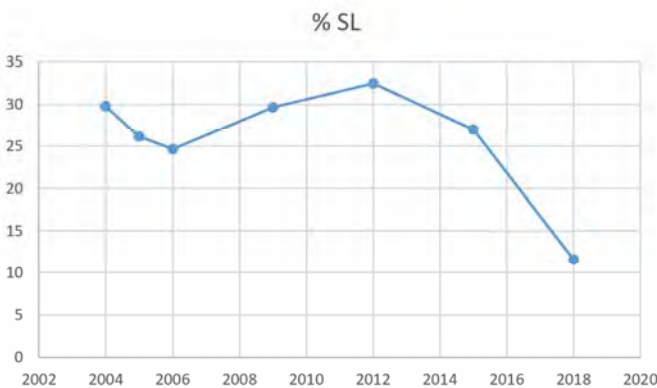
The number of darters, sunfish, and sensitive species has increased at this site since the inception of monitoring, while the number of sucker species has remained relatively similar over time.



The percent of tolerant individuals and omnivores increased slightly in 2015, but these two metrics have been very low since the inception of monitoring.



The total number of fish collected (CPUE) has increased since the inception of monitoring, however fluctuations have occurred and this number may retract in future monitoring events.

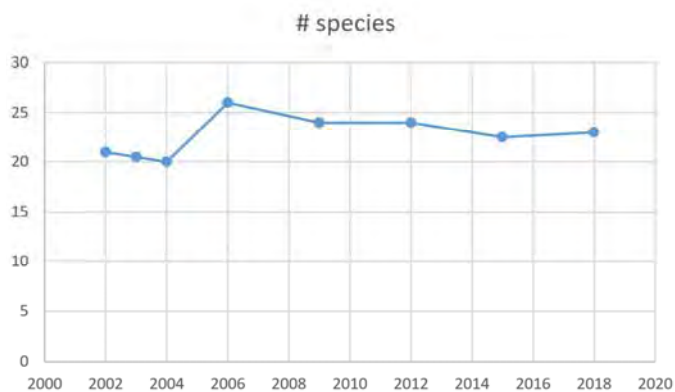


The percent of simple lithophilic spawning fish has decreased substantially since the inception of monitoring. A huge decrease occurred in 2018 relative to previous years. Similar to the increase in CPUE, future monitoring events may result in this percentage moving back towards levels seen previously.

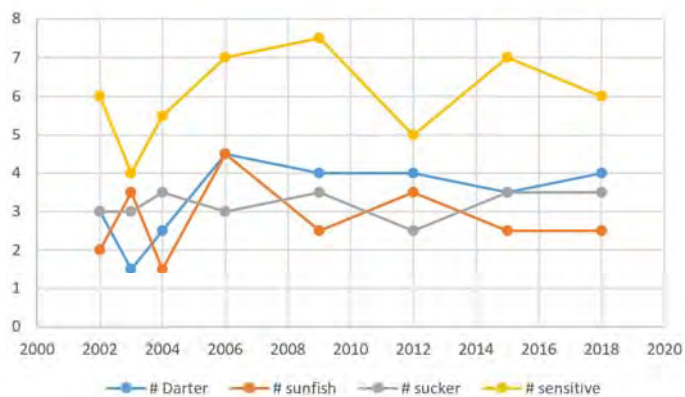


The percent of insectivores and carnivores have remained relatively similar over time. As with other metrics, there appears to have been a significant change in the percent of insectivores in 2018.

## Site 9: Little Elkhart River—County Road 35



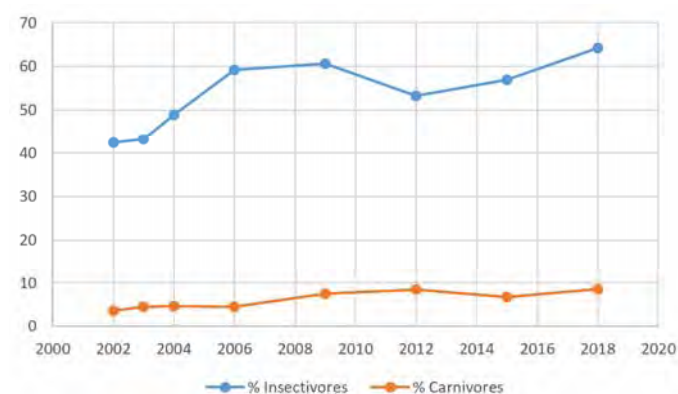
The number of species at this site increased substantially in 2006 (from approximately 21 species to approximately 25) and has remained close to 25 species since that time.



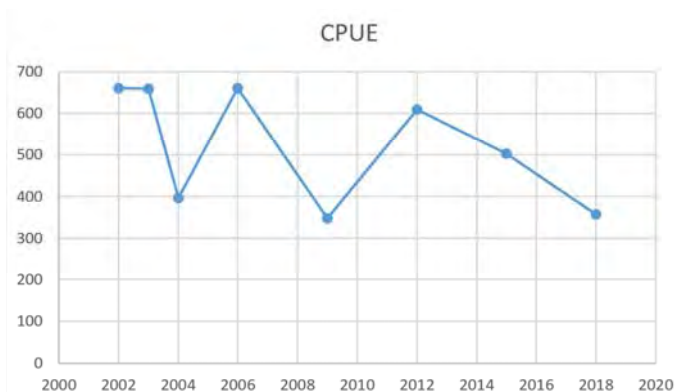
The number of sensitive species, sunfish, and suckers has fluctuated to a certain extent since the inception of monitoring. The number of darters, however, increased to approximately 4 species in 2006 and has remained similar to that number since.



The percent of tolerant individuals has decreased substantially since the inception of monitoring, while the percent of omnivores has remained relatively similar over time.

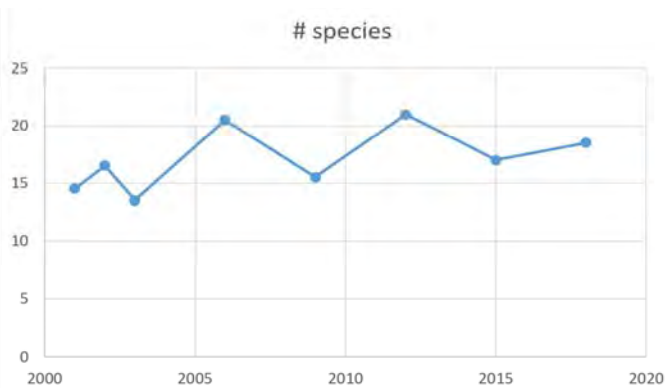


The percent of insectivores has increased substantially since the inception of monitoring, while the percent of carnivores has also increased. The percent of carnivores has always been very low at this site (less than 10%).

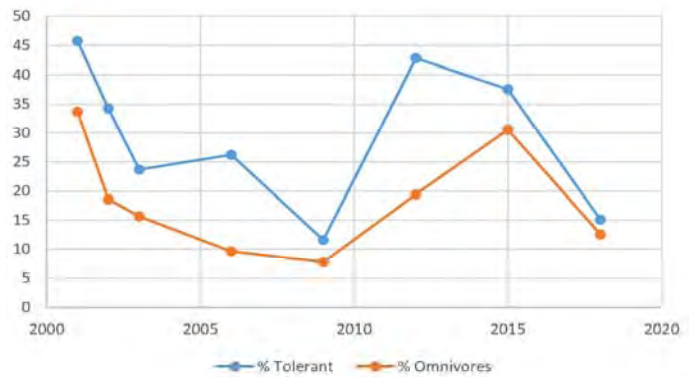


The total number of fish collected (CPUE) has fluctuated significantly since the inception of monitoring.

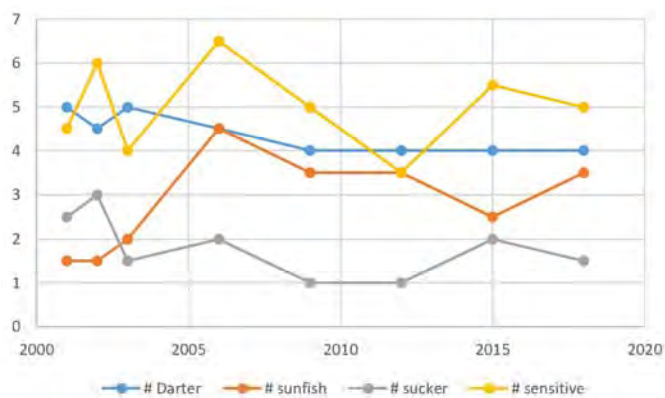
## Site 11: Pine Creek—SR 120 Resident



The number of species has fluctuated at this site, but there appears to be a slight trending increase in the number of species.



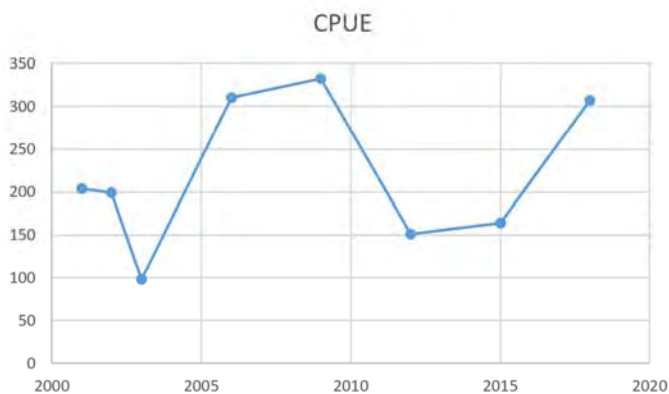
The percent of tolerant species and omnivores has fluctuated greatly at this site since the inception of monitoring with 2018 being a positive year (low percentage) for both metrics).



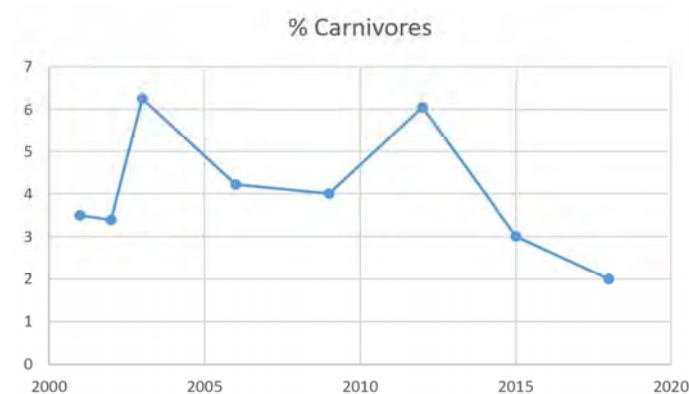
The number of sunfish species has increased since the inception of monitoring at this site, while the number of darters and suckers has decreased slightly. The number of sensitive species has fluctuated slightly but has generally stayed the same over time.



The percent of simple lithophilic spawning fish and insectivores fish has fluctuated slightly but these metrics have remained relatively similar over time

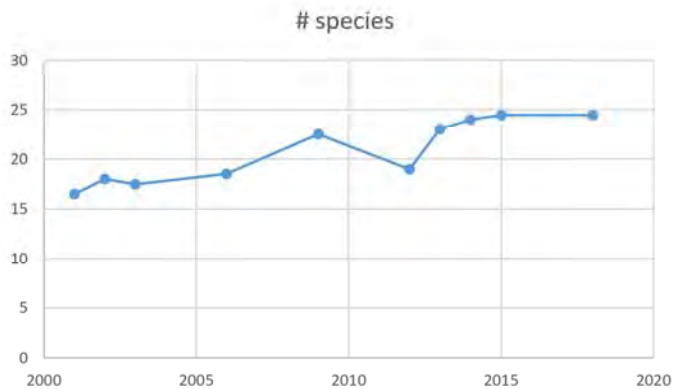


The total number of fish collected (CPUE) has fluctuated significantly over the years.

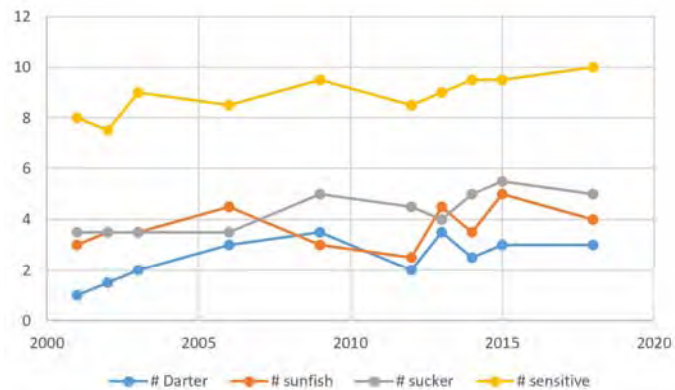


The percent of carnivores has always been very low at this site and hit its lowest point in 2018.

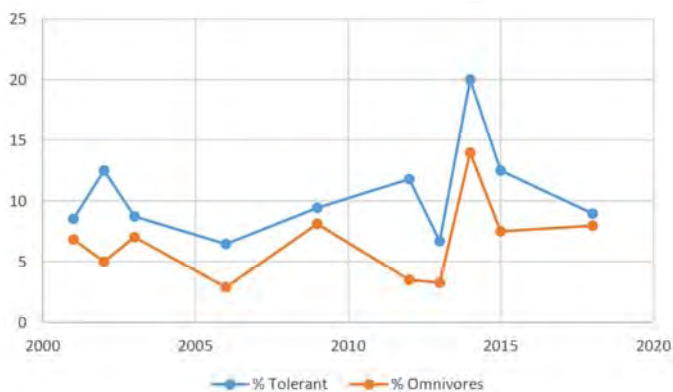
## Site 13: Christiana Creek—NMWF (North Main Wellfield)



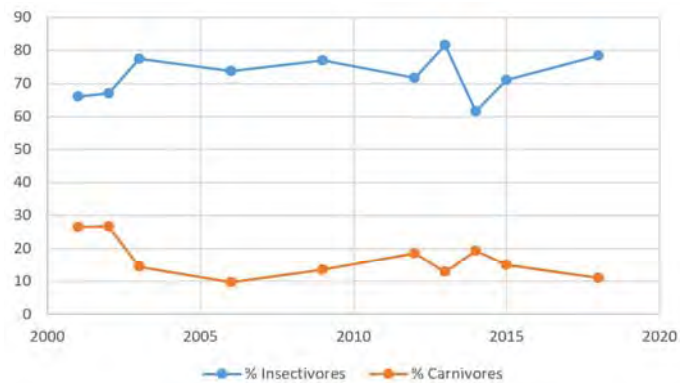
The number of fish collected at this has increased in a gradual fashion since the inception of monitoring, however, the change has been substantial (approximately 16 species in 2001 to approximately 25 species in 2018).



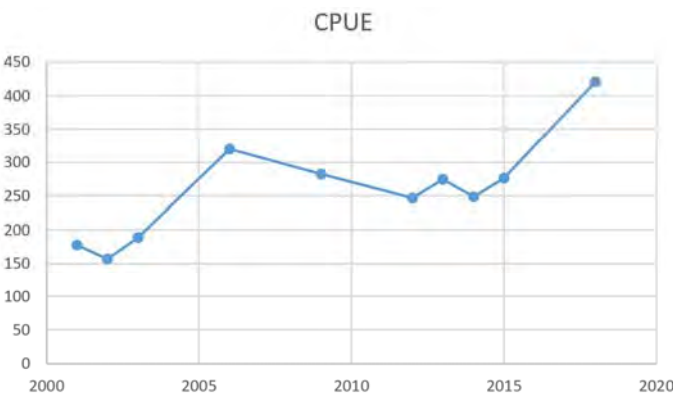
The number of sensitive species, darters, and suckers has increased since the inception of monitoring while the number of sunfish has stayed relatively the same.



The percent of tolerant individuals and omnivores has fluctuated slightly over the years, but both metrics have always been very low for this site.

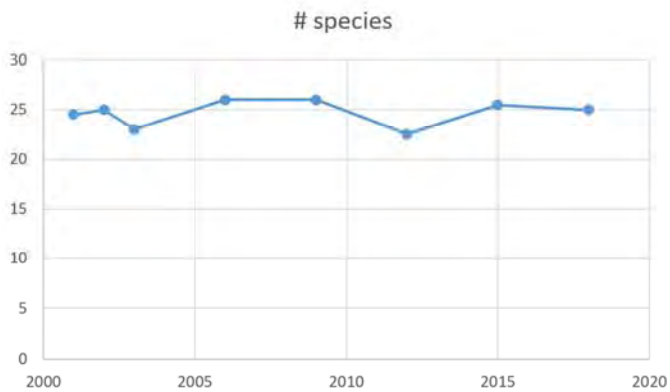


The percent of carnivores has decreased significantly since the inception of monitoring while the percent of insectivores has fluctuated slightly but remained relatively similar.



The total number of fish collected (CPUE) has increased significantly since the inception of monitoring.

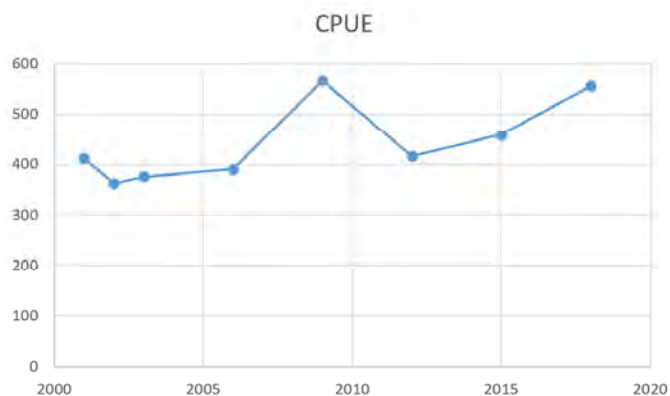
## Site 15: Elkhart River—Oxbow Park (B)



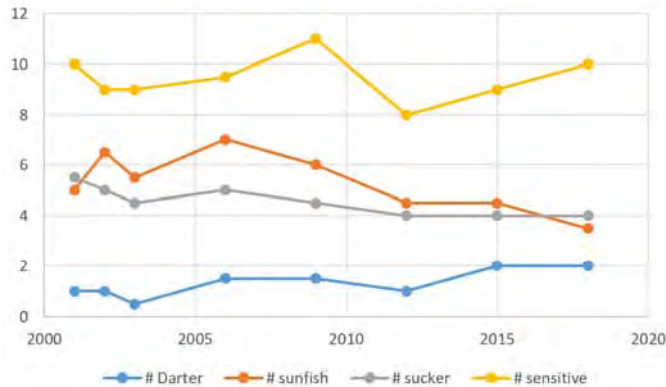
The number of species collected (approximately 25) has remained the same since the inception of monitoring at this site. This number of fish (25) is relatively high for the Elkhart River suggesting that this site has been in good condition for a long time.



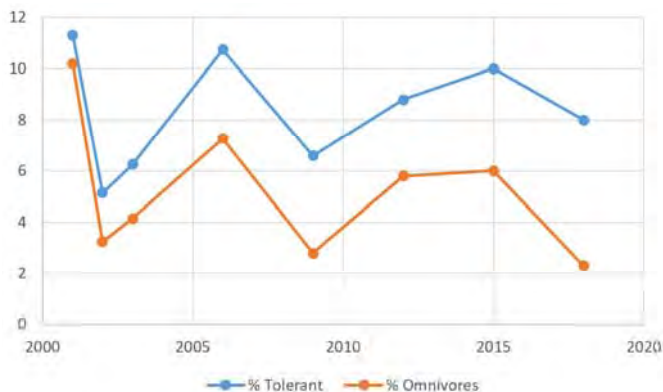
The percent of carnivores and insectivores has fluctuated since the inception of monitoring with a significant increase in insectivores in 2018 and a significant decrease in carnivores.



The total number of fish collected (CPUE) has increased significantly since the inception of monitoring.



The number of darters has increased slightly at this site, while the numbers of suckers and sunfish have decreased slightly. The number of sensitive species has remained the same with minor fluctuations over time.



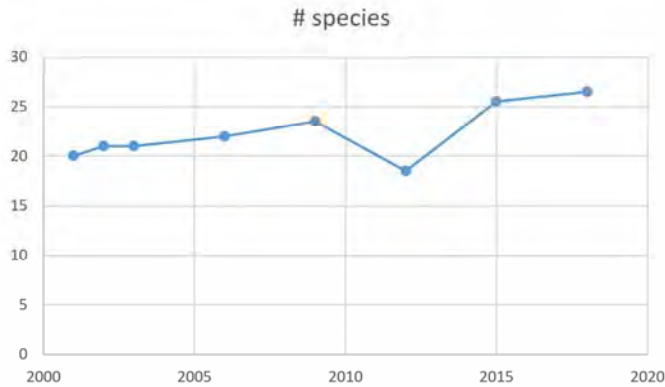
The percent of tolerant individuals and omnivores has fluctuated since the inception of monitoring but both metrics have always been very low (less than 12%).



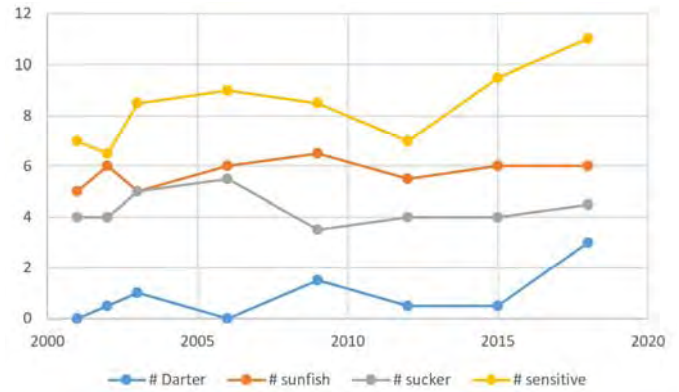
The percent of simple lithophils remained close to 45 for the first 10 years of monitoring but increased substantially starting in 2015.



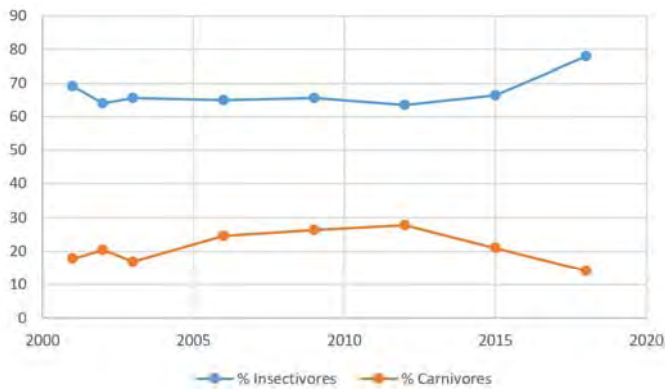
## Site 16: Elkhart River—Elkhart Environmental Center (EEC) (A)



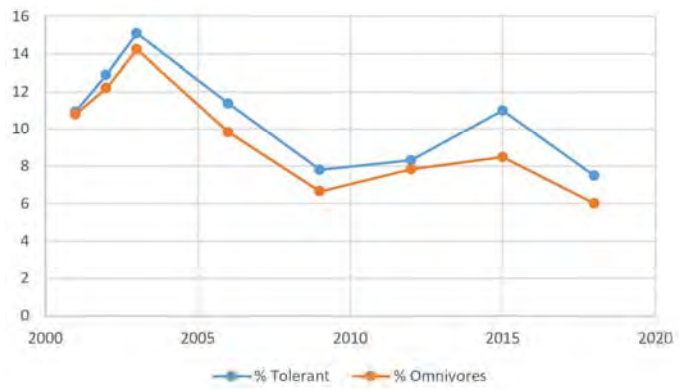
The number of species has gradually increased from 20 to 26 over time with a minor drop in occurring in 2012.



The number of darters and sensitive species increased in 2018 beyond numbers seen previously. The number of sunfish and suckers have remained the same.



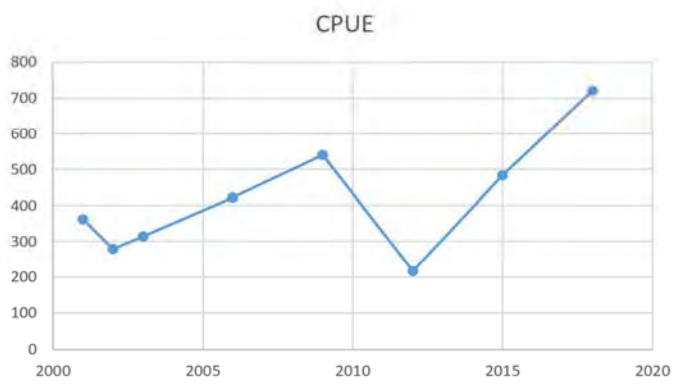
The numbers of carnivores and insectivores have remained relatively similar over time with carnivores slightly decreasing in 2018 and insectivores slightly increasing.



The percent of tolerant individuals and omnivores has decreased slightly over time, however, these metrics have always been low (less than 16%) at this site.

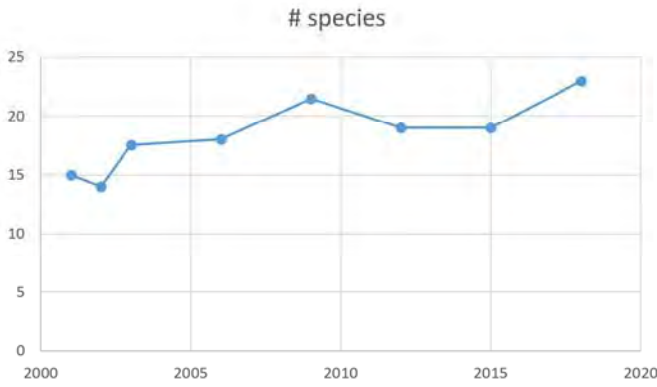


The percent of simple lithophilic spawning fish has decreased over time at this site.

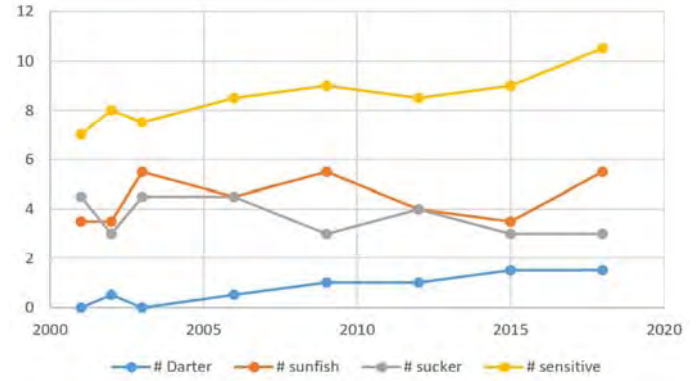


The total number of fish collected (CPUE) has increased over time with a major increase occurring in 2018.

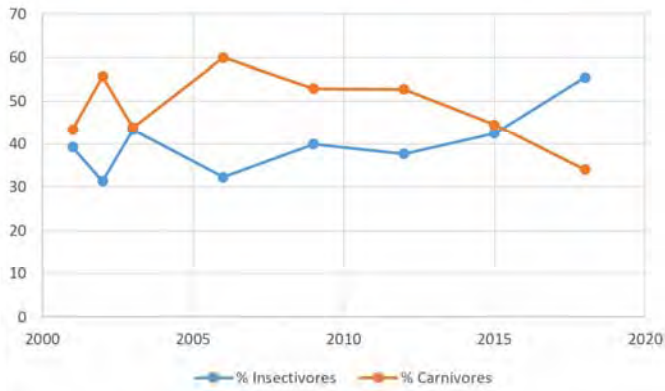
# Site 17: Elkhart River—Central High School



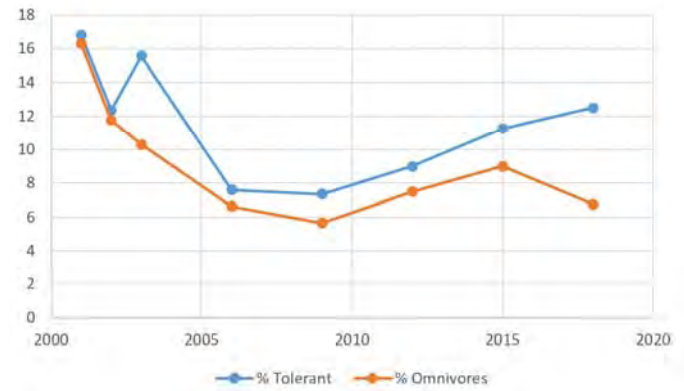
The number of species has increased at this site with a significant jump in 2018.



The number of darters and sensitive species has increased at this site, while the number of suckers has gradually decreased and the number of sunfish has remained relatively similar.



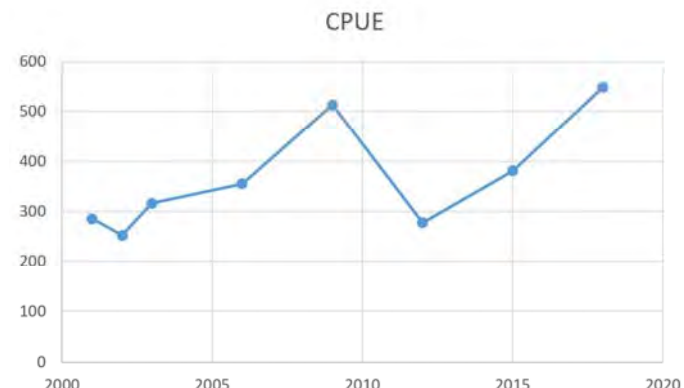
The number of insectivores and carnivores has remained relatively similar since the inception of monitoring with some fluctuations occurring.



The percent of tolerant individuals and omnivores has generally decreased since the inception of monitoring, although the percent of tolerant individuals is trending upwards. Regardless, both metrics have been low (less than 18%) since the inception of monitoring.

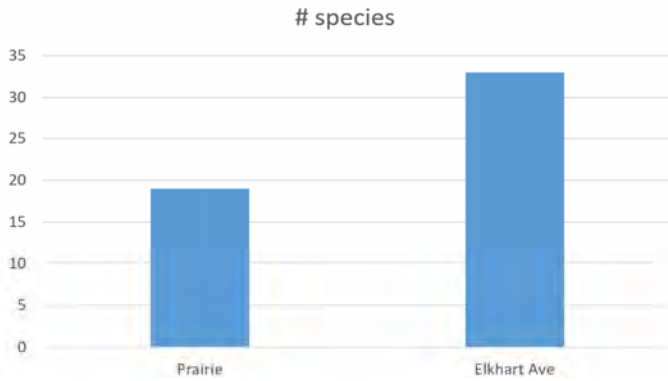


The percent of simple lithophilic spawners has decreased since the inception of monitoring.

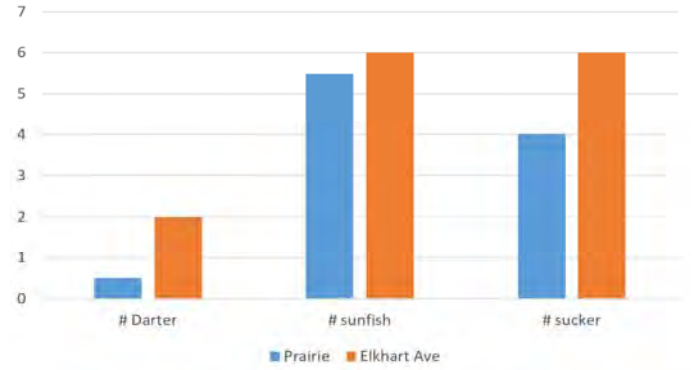


The total number of fish collected has fluctuated since the inception of monitoring with a general increase occurring.

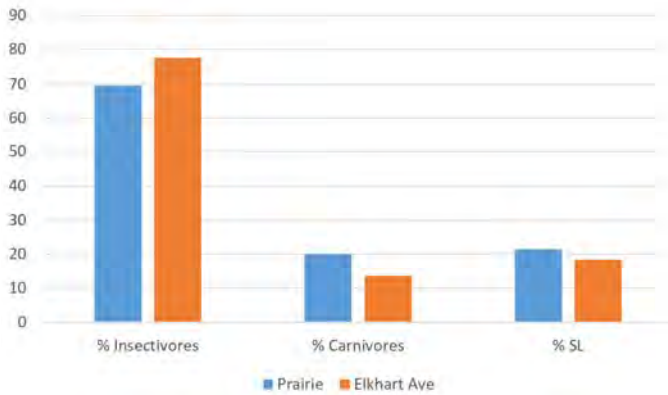
## Site 17 & 18: Elkhart River—Prairie and Elkhart River Comparison



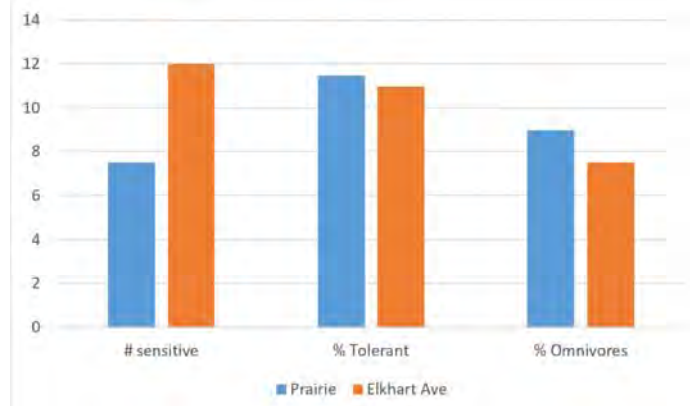
Two sites were sampled in 2018 to assess the impact of the Elkhart River dam on fish communities in the Elkhart River. As expected, the Elkhart Avenue site (below the dam) had a significantly higher number of species than the Prairie Street site (above the dam).



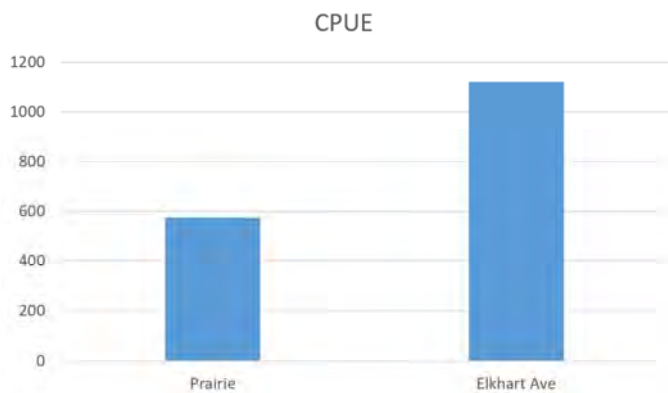
The number of darter, sunfish, and sucker species were all higher at the Elkhart Avenue site.



The percent of insectivores fish was slightly higher at the Elkhart Avenue site, although the percentage of carnivores and simple lithophilic spawning fish was slightly lower at the Elkhart Avenue site.

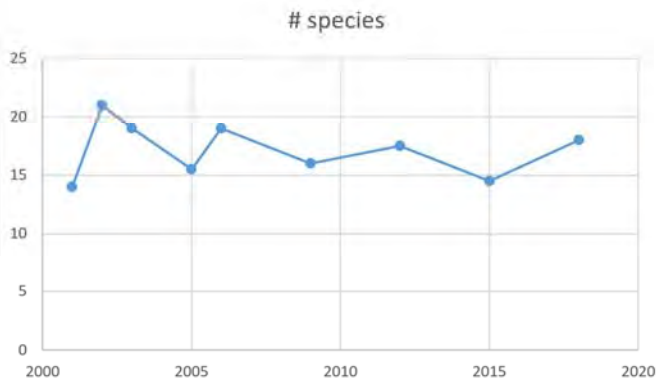


The number of sensitive species was significantly higher at the Elkhart Avenue site, while the percent of tolerant individuals and omnivores was slightly lower.

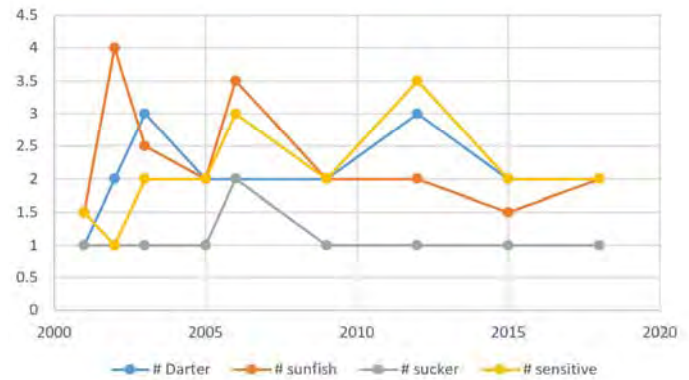


The total number of fish collected was much higher at the Elkhart Avenue site than the Prairie Street site.

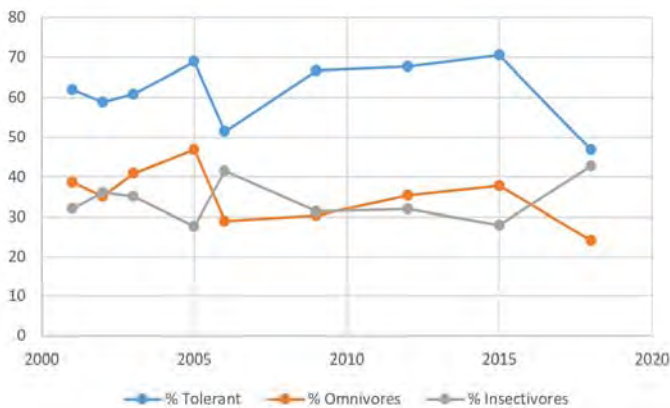
## Site 21: Yellow Creek—Concord High School



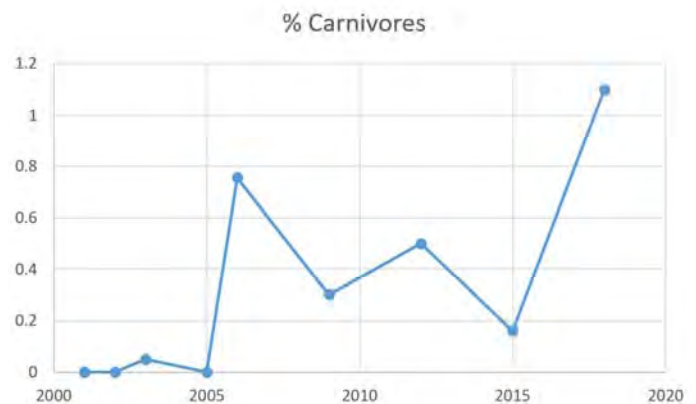
The total number of species has fluctuated over the years but is relatively similar to what it was when monitoring was initiated at this site.



The number of sucker and sunfish species have remained similar since the inception of monitoring, while the number of sensitive species and darters has increased slightly.



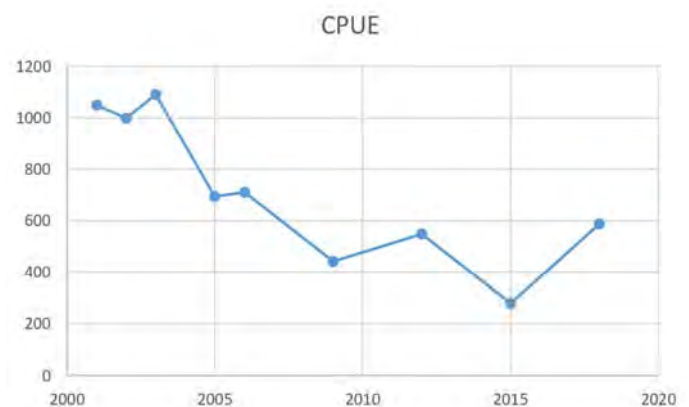
The percent of insectivores, tolerant individuals, and carnivores has fluctuated over the years with insectivores slightly increasing in 2018 and tolerant individuals and insectivores decreasing.



The percent of carnivores has always been extremely low at this site.

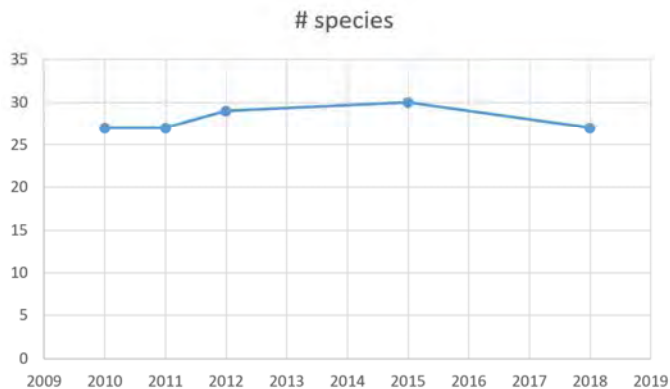


The percent of simple lithophils has decreased significantly at this site since the inception of monitoring.

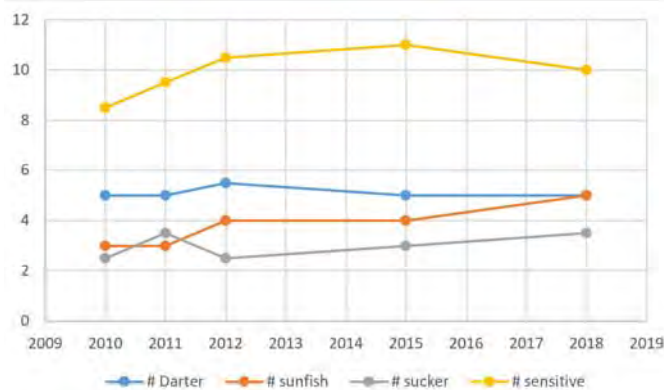


The total number of fish collected (CPUE) has decreased significantly at this site since the inception of monitoring.

## Site 22: Baugo Creek—Restoration (B)



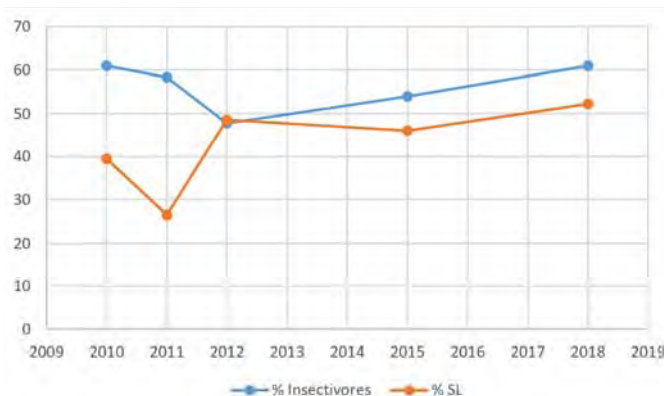
The number of species at this site has been consistent since the inception of monitoring.



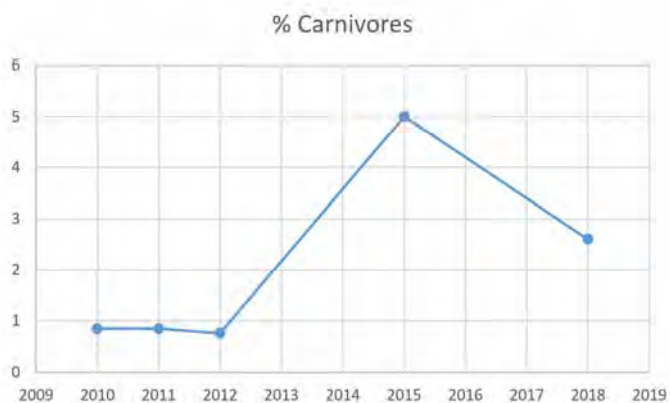
There has been a slight increase in the number of sensitive species and sunfish, while the number of darters and suckers has remained relatively similar over time.



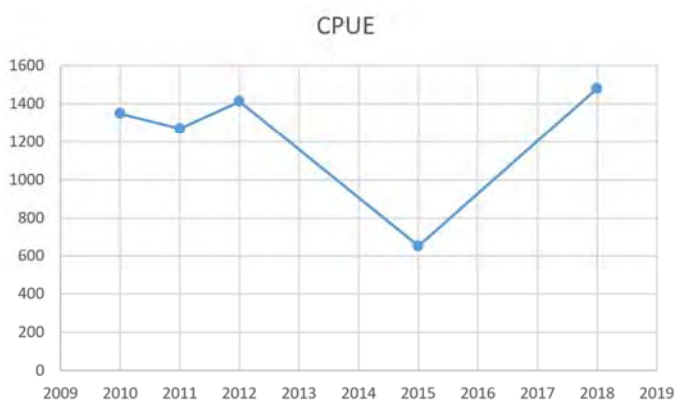
The percent of tolerant individuals and omnivores has fluctuated since the inception of monitoring.



The percent of simple lithophils and insectivores metrics have both been close to 50 percent since the inception of monitoring, although the population was only comprised of approximately 25% of simple lithophils in 2011.

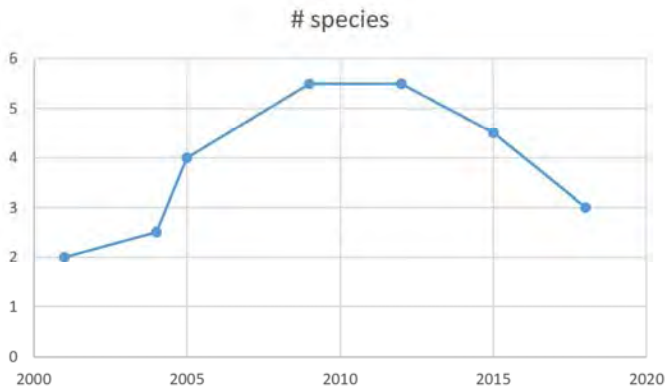


There was a slight rise in the percent of carnivores at this site, but this metric has always been very low (less than 5%).

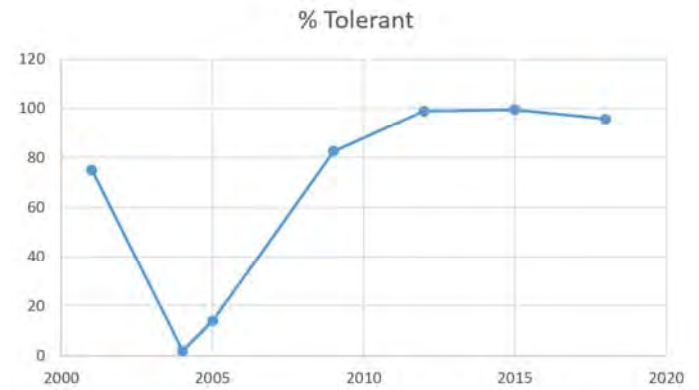


Despite a significant drop in the total number of fish collected in 2015, this number has stayed relatively similar in the past 8 years.

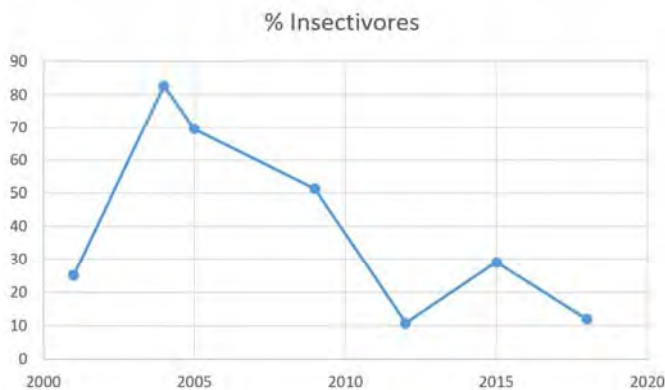
## Site 24: Bowman Creek—Chippewa Ave



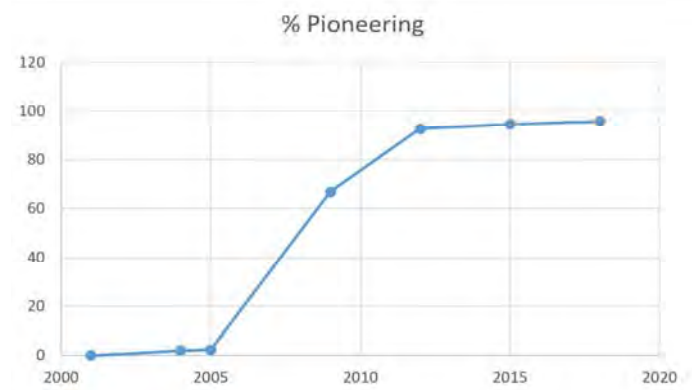
The total number of species rose at this site in the mid-2000s but this metric appears to be trending back towards the level seen during the first few years of sampling.



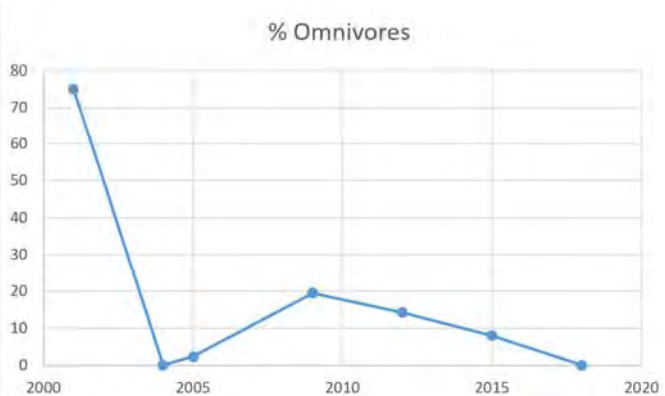
The percent of tolerant individuals has increased in recent years and has been close to 100% since 2007.



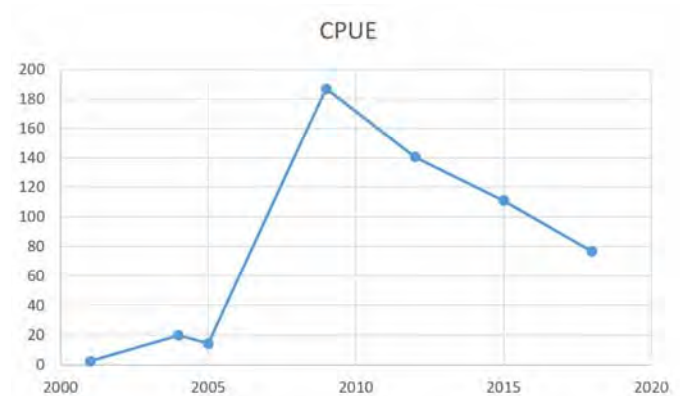
The percent of insectivores rose significantly in the first few years of sampling, but it has since plummeted.



The percent of pioneering species has risen significantly in recent years.

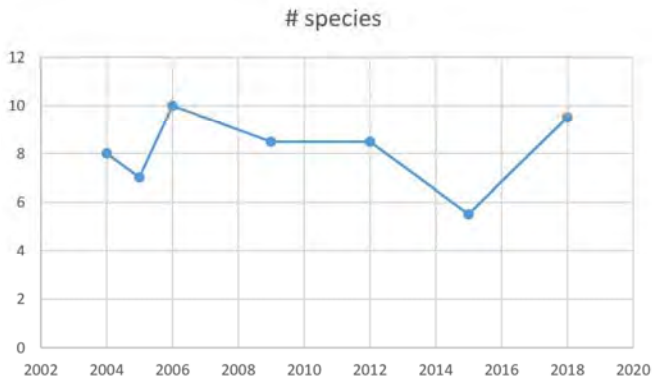


The percent of omnivores was very high in the first sampling season, but it has dropped and stayed very low since.

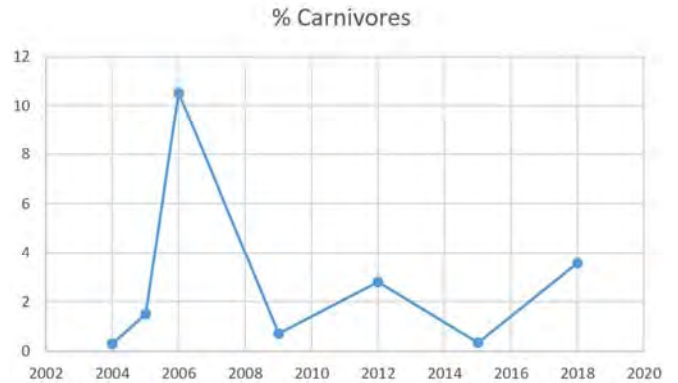


The total number of fish (CPUE) collected was very low in the first few years of sampling but it increased in 2007 and has remained high since.

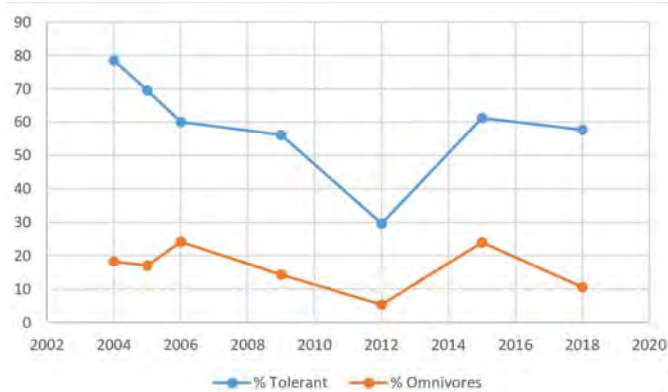
# Site 30: Juday Creek—Grape Road



The number of species at this site has fluctuated since the inception of monitoring.



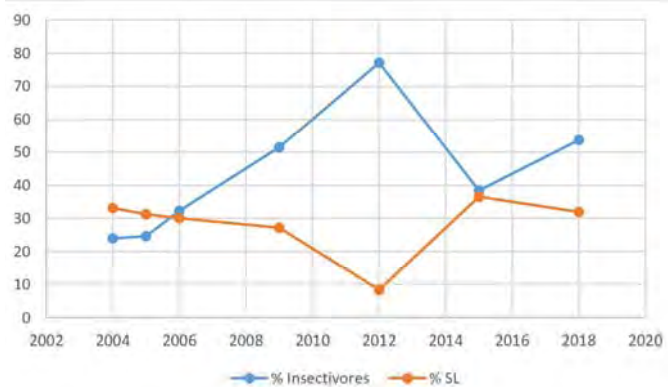
The percent of carnivores at this site has always been very low, with the exception of a minor spike above 10% in 2006.



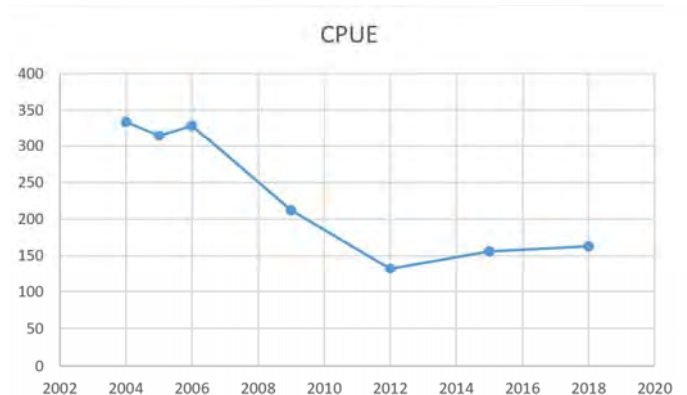
The percent of tolerant individuals and omnivores has decreased slightly since the inception of monitoring.



The number of darters, suckers and sensitive species have remained consistent at this site (darter data are covered up), while the number of sunfish species has decreased.

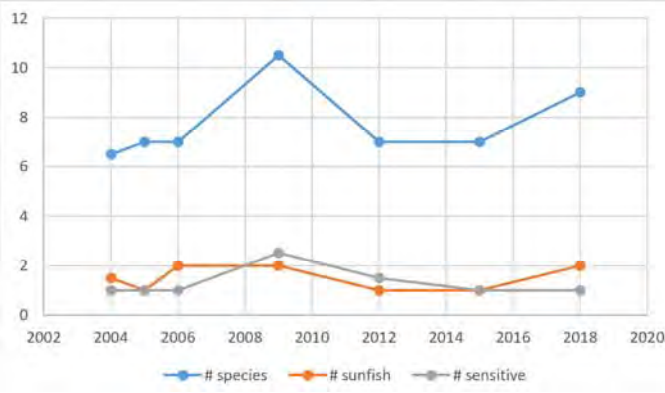


The percent of insectivores has increased at this site, while the percent of simple lithophilic spawning fish has remained relatively similar.

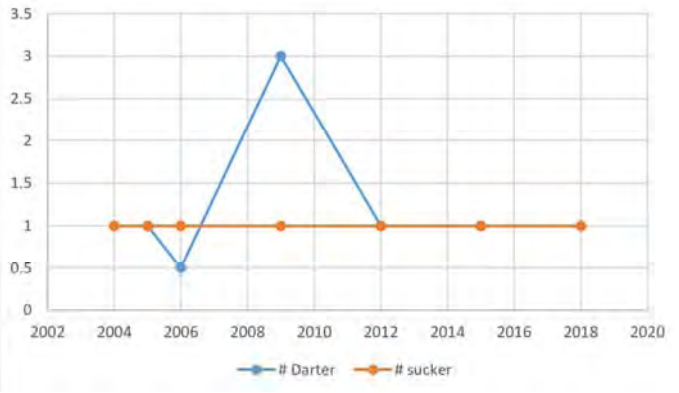


The total number of fish collected (CPUE) has dropped significantly since the inception of monitoring.

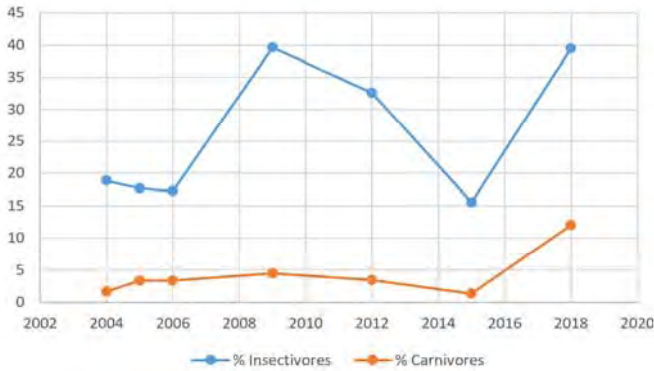
## Site 31: Juday Creek—Myrtle Street



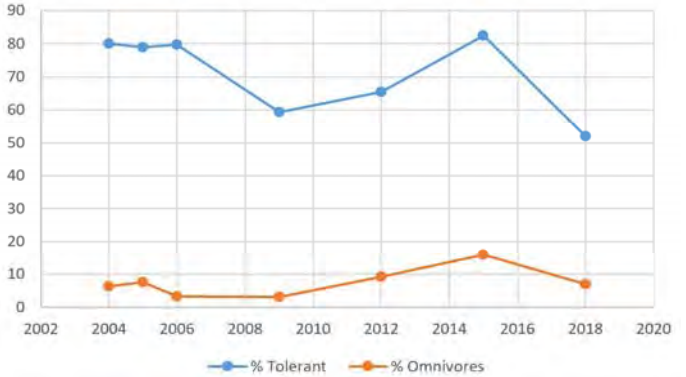
The number of species at this site has fluctuated but has increased slightly since the inception of monitoring. The number of sensitive species and sunfish has always been very low at this site.



The number of darters at this site increased in the late 2000s, but since that time only one species has been found. Only one sucker species (white sucker) has been found at this site since the inception of monitoring.



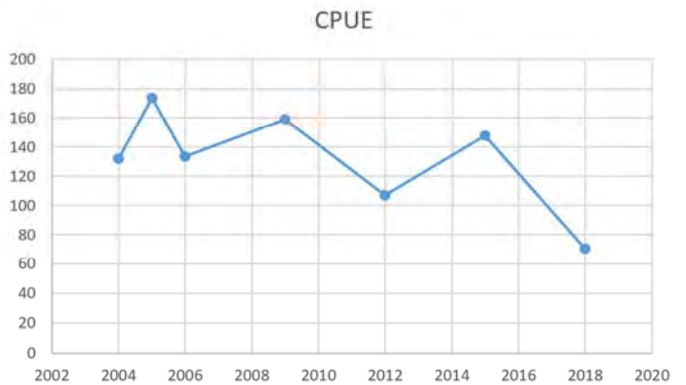
The percent of insectivores has fluctuated over the years of monitoring at this site, while the percent of carnivores has always been low, but increased significantly in 2018.



The percent of tolerant species has fluctuated at this site over the years, but did drop significantly in 2018. The percent of omnivores has had some minor fluctuations over the years, but has always been low.



The percent of simple lithophils has fluctuated over the years but has always been low at this site.



The total number of fish collected (CPUE) has fluctuated over the years, but hit its lowest point in 2018.



