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2017

City of Elkhart
Public Works & Utilities

Tim Neese, Mayor

Clean river Healthy neighborhoods

ELKHART ▪ SOUTH BEND

Cover Photo: A close up view of a greater redhorse from the St. Joseph River

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Aquatic Community Monitoring on the St. Joseph River and Several Tributaries, Elkhart & St. Joseph Counties: 2017 Annual Report

Figure 1: A beautiful rainbow darter collected from St. Pat's Drain in St. Pat's Park

Prepared by

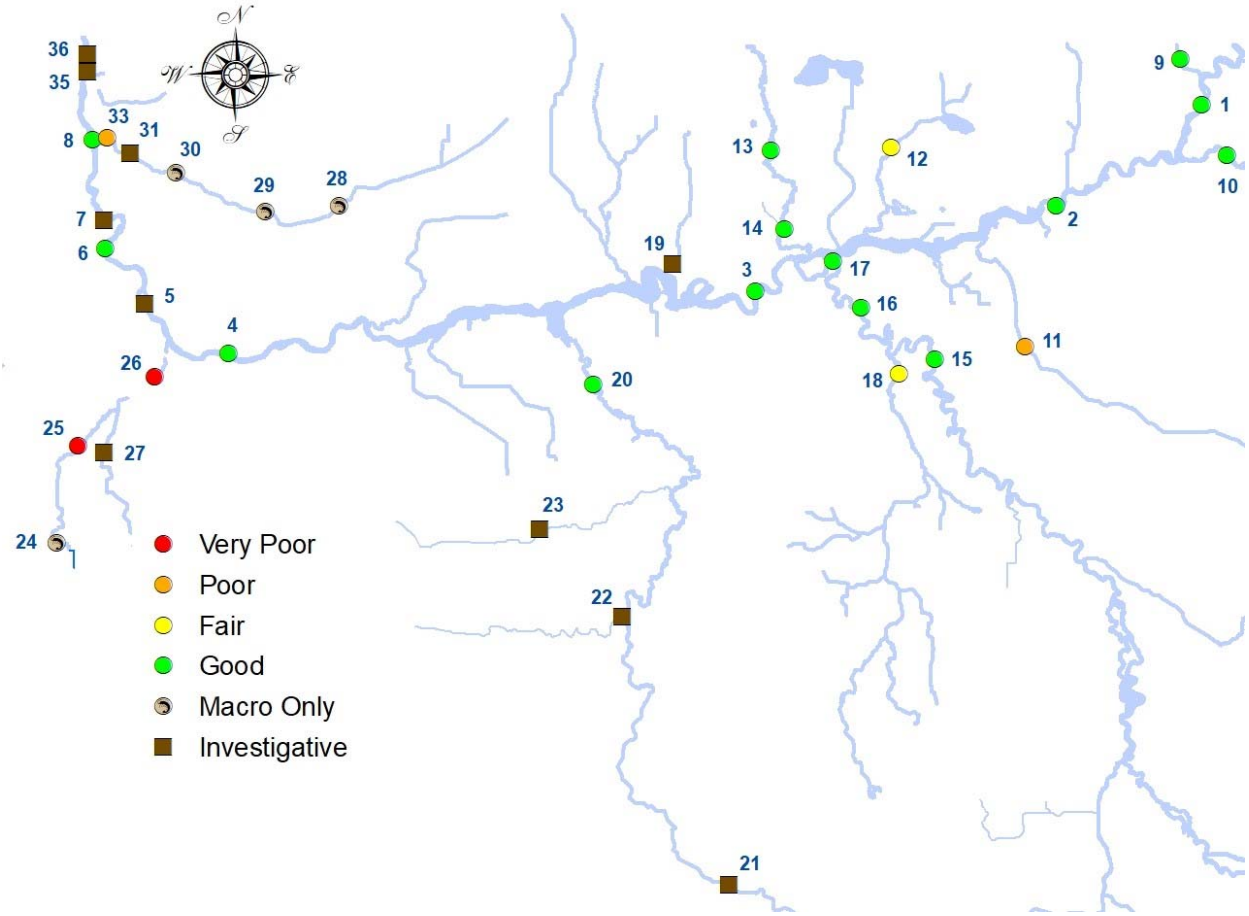
Daragh Deegan

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.

The year of 2017 marked the 20th anniversary of fish community monitoring on St. Joseph River. In the 20 year time span, 492,089 fish have passed through the nets, hands, and measuring equipment of our field monitoring team. Data collected from these fish have provided us with a highly robust dataset that can be used to evaluate trends in the health of area rivers and streams. Although this report provides traditional biological community health results, data evaluation encompasses the culmination of 20 years of monitoring while focusing on changes to the fish communities in the St. Joseph River Watershed.

Figure 2: Fish sampling sites in Elkhart and St. Joseph Counties and associated fish community conditions for 2017 (see Table 15 for site information)



In 2017, 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 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 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

A pretty little green sunfish collected from Christiana Creek in Elkhart

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.

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 2017 alone, the Aquatics Program reached almost 5,000 Michiana residents through public presentations and demonstrations.

Biologist Daragh Deegan with Elkhart Educational Foundation Summer Camper, Brennan. The Aquatics Program interacts with many student groups during the summer sampling season

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 present. The IBI was modified by Dr. Thomas Simon in 1997 for use in the St. Joseph River Watershed. The IBI is

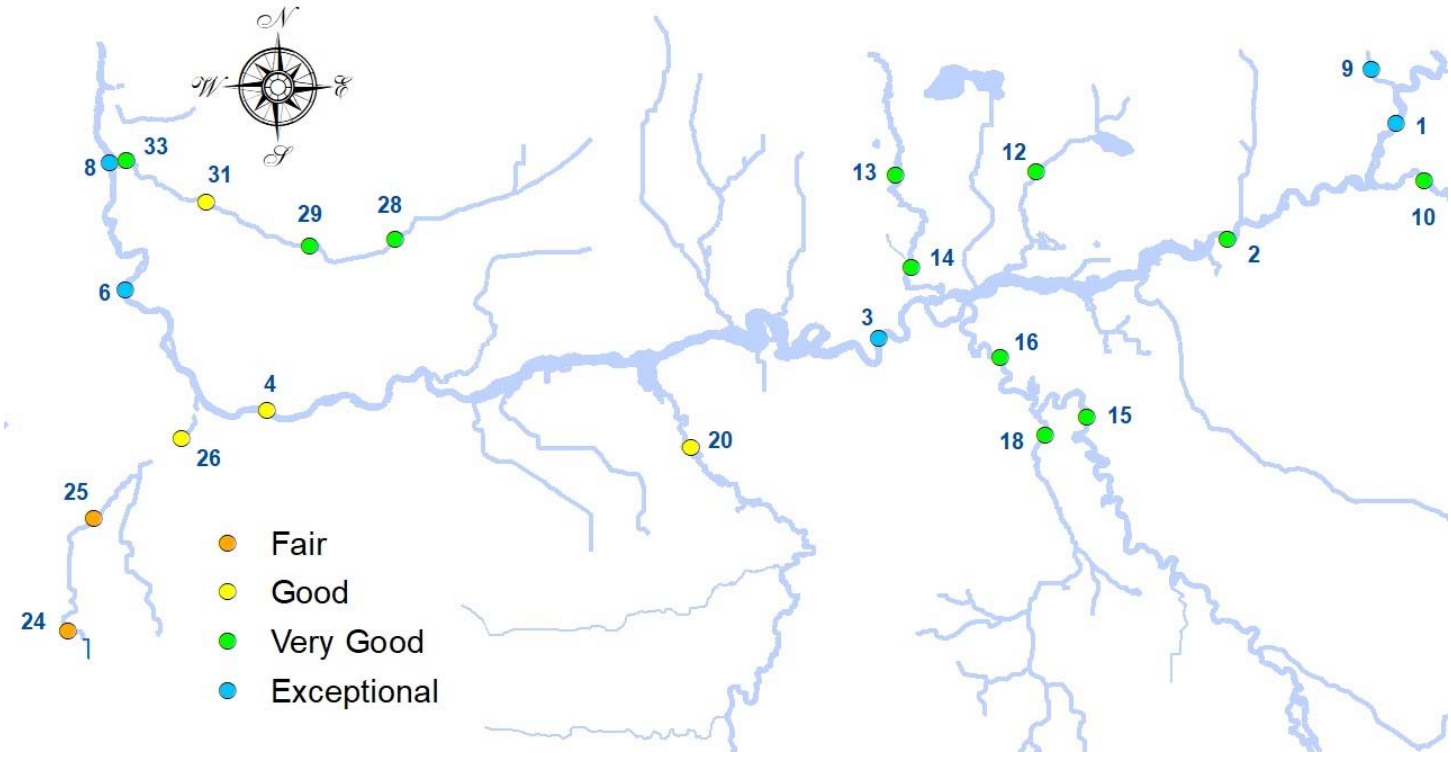


Figure 3: Macroinvertebrate sampling sites and associated condition for 2017 (see Table 15 for site information)

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 locations 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 2017 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 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

A greater redhorse (pictured left) was collected close to IU South Bend on the St. Joseph River. Striped shiner (pictured right) were the most abundant species collected by the program in 2017. The striped shiner is a male with bright pink coloration for the breeding season

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 11-14) include many species from the Indiana portion of the St. Joseph River Watershed. 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 and 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.

In 2017, 7 index and 7 investigative sites were sampled in St. Joseph County and 14 index and 2 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 2017, 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

A large chestnut lamprey collected from American Park on the Elkhart River. The chestnut lamprey is one of four lamprey species in the St. Joseph River. Although they have an unusual appearance, they are an important native fish.

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

procedures (Ohio EPA 1987, 1989). Of the 22 that were set, 18 were placed at fish index sites, while 4 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),* channel catfish *(Ictalurus punctatus),* shorthead redhorse *(Moxostoma macrolepidotum),* smallmouth bass *(Micropterus dolomieu),* steelhead *(Oncorhynchus mykiss), and* walleye (*Sander vitreus).* 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 2017, a total of 20,368 fish, representing 16 families and 69 species, were collected in Elkhart County. In St. Joseph County, 5,795 fish, representing 15 families and 54 species were collected. In total, 71 different species were captured from the 2 counties.

Striped shiner (*Luxilus chrysocephalus*), bluegill (Lepomis macrochirus), and rock bass (*Ambloplites rupestris*) were the most abundant species collected in Elkhart County, while creek chub (*Semotilus atromacatus*), longear sunfish (*Lepomis megalotis), and* rock bass (*Ambloplites rupestris*) were the most abundant in St. Joseph 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 (14) at Studebaker Golf Course on Bownman Creek to very good (52) at Studebaker Park on the Elkhart River. Macroinvertebrate community scores ranged from marginally good (34) at Locust Road (S) on Auten Ditch and Gertrude Street on Bowman Creek to exceptional (56) at Angela Boulevard on the St. Joseph River. Habitat quality ranged from poor (33) at CR 3 (Wakarusa) on Baugo Creek to excellent (89) at Izaak Walton League (A) on Juday Creek.

Table 2: Macroinvertebrate Sampling Sites, 2017

Site Number	Stream	Location	Site Number	Stream	Location
1	St. Joseph River	Toll Road (Bristol)	15	Elkhart River	CR 18
2	St. Joseph River	Six Span	16	Elkhart River	Studebaker Park
3	St. Joseph River	Bridge Street	18	Yellow Creek	US 20 Bypass
4	St. Joseph River	Ironwood Dr.	20	Baugo Creek	Restoration Site
6	St. Joseph River	Angela Blvd.	24	Auten Ditch	Locust Road (S)
8	St. Joseph River	Darden Road	25	Bowman Creek	Gertrude Ave.
9	Trout Creek	CR 2	26	Bowman Creek	Studebaker Golf Course
10	Little Elkhart River	SR 120	28	Juday Creek	Holy Cross Pkwy
12	Puterbaugh Creek	Reedy Drive	29	Juday Creek	Driftwood Dr.
13	Christiana Creek	CR 6	31	Juday Creek	Kintz
14	Christiana Creek	Willowdale Park	32	Juday Creek	Izaak Walton League

Table 3: Location of fish tissue collection sites for 2017

Site Number	Stream	Location
1	St. Joseph River	SR 15/Toll Road (Bristol)
2	St. Joseph River	Bridge Street
3	St. Joseph River	Twin Branch (B)
4	St. Joseph River	South Bend Dam (B)
5	St. Joseph River	Angela Blvd
6	St. Joseph River	Pinhook (B)
7	St. Joseph River	Darden Road

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.

This year (2017) marked 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 where collected. Given the 20th anniversary, 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 2017, IBI scores at sites in the Elkhart County section of the river all fell within the very good range and were very similar to baseline scores. While IBI scores do not really reflect much change in the 20 years of sampling in Elkhart County, analysis of individual metrics suggest modest improvements at some sites. For example; at the Toll Road site the number of species, the number of sensitive species, and the % of fish that are simple lithophils all increased; while the % of Tolerant species and the % of omnivores decreased. The Bridge Street site in Elkhart County also had positive changes in fish community health with increases in the number of all species and the number of sensitive species. However, some negative changes have also occurred at this site, with the % of insectivores decreasing and the percent of simple lithophils decreasing. At the Six Span site, the only metric that has increased positively is the number of species. Other metrics have remained relatively stable, except for the number of insectivores, which has decreased, and the % of tolerant and omnivorous fish, which have increased.

Macroinvertebrate (ICI) scores were all impressive in the Elkhart section of the St. Joseph River (Table 4). Respective scores of 48 and 50 at Six Span and Bridge Street were significantly higher than baseline scores. Macroinvertebrates were sampled for the first time at the Toll Road site producing an exceptional score of 52.

In 2017, fish IBI Scores for the St. Joseph River in St. Joseph County were much higher than the baseline score at Ironwood, but were the same as the baseline for Darden Road and Angela Boulevard. While the IBI scores remain the same at Angela, an increase in the number of carnivores and a decrease in the % of tolerant fish and omnivores suggest that this site has improved slightly over time. Ironwood on the other hand has improved significantly with increases in the number of darter species, sen-

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, course substrate for reproduction. An increase in the % of simple lithophils at a site suggests an improvement.
- % Tolerant Species—Tolerant species are those that can survive in areas with degraded habitat or water quality. An 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.

Geoff with a young carp from the St. Joseph River. Carp are a non-native species that are considered very tolerant.

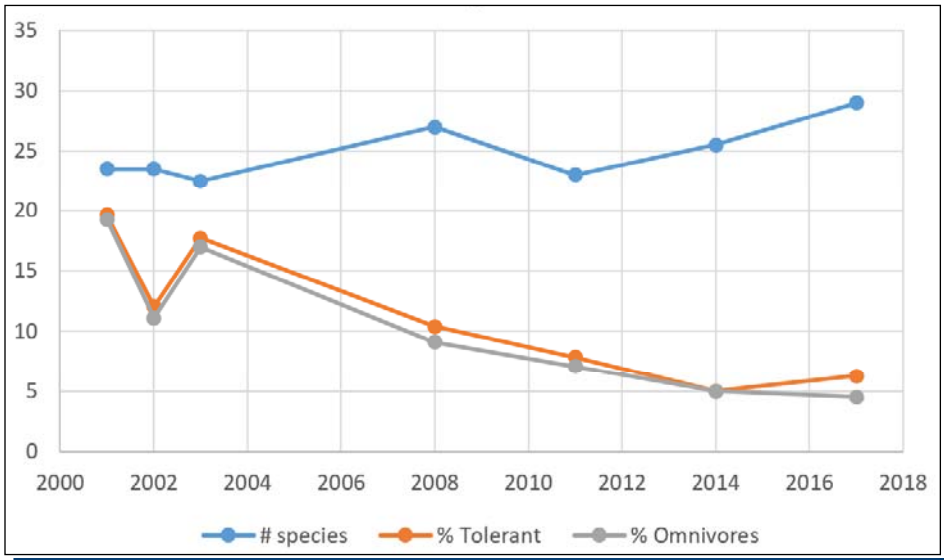
Table 4. Index scores for St. Joseph River sites, Elkhart and St. Joseph Counties

Station	County	River Mile	Fish IBI Scores				2017 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2011	2014	**2017**		Baseline/ Previous Score	**2017**
Toll Road (Bristol)	Elkhart	87.7	*50*	54	51	**50**	85		**52**
Six Span	Elkhart	82.7	*50*	51	52	**50**	83	40	**48**
Bridge Street	Elkhart	75	*49*	51	51	**51**	86	42	**50**
Ironwood Drive	Elkhart	59.9	*43*	49	44	**48**	63	30	**40**
Angela Blvd.	St. Joseph	55.6	*46*	51	47	**46**	85	54	**56**
Darden Road	St. Joseph	52.4	*50*	49	50	**50**	88	38	**50**

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.

Figure 5: IBI metrics for the Darden Road Site indicting improvements



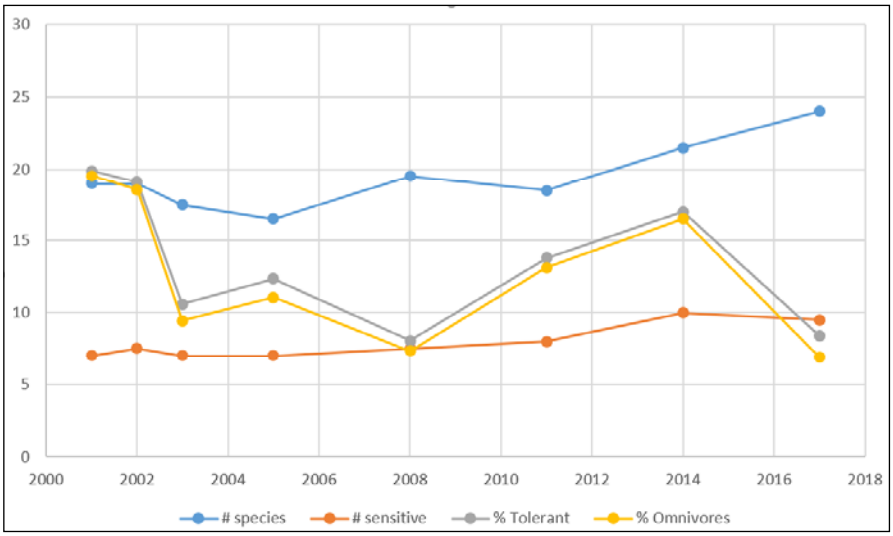
sitive species, and % of insectivores. There has also been a major decrease in the % of tolerant species and omnivores at Ironwood.

Darden Road has also seen major improvements in the fish community, with the % of insectivores and number of fish species increasing, and the % of tolerant fish and omnivores decreasing significantly (Figure 5). While IBI scores may not reflect improvements in the fish community in the St. Joseph River, these individual metric scores suggest some major improvements at Darden Road. Darden Road is particularly interesting given that it is located on the downstream side of South Bend City limits. Improvements in this section could be a reflection of South Bend's major reduction in combined sewer overflows.

Macroinvertebrate scores for 2017 were all up in the South Bend section of the St. Joseph River (Table 4). The Ironwood site was in the good range (40), well above the previous score at this site in 2014. The Angela Blvd. score of 56 was up slightly from the score it received in 2014, but was the highest macroinvertebrate score in the watershed in 2017. The score at Darden Road (50) was also up significantly from the baseline score of 38.

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

Figure 6: Changes in IBI metrics at the Elkhart River Studebaker Park Site signifying improvement



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, this increase in abundance may reflect a positive 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 sites at CR 18 and American Park. The score at Studebaker Park was up significantly. Although IBI scores haven't increased significantly at CR 18, a review of fish community metrics for this site suggest significant improvements in species diversity and decreases in the abundance of tolerant fish and omnivores. Metrics data for Studebaker Park also suggest major improvements at this site (Figure 6). Metric scores at American Park, on the other hand, show little signs of improvement. A major ecological limitation for this site, is the fact that it is located in the impoundment of the Elkhart River Dam (Deegan et al, 2017).

High School student volunteer, Josh with a goldern redhorse at Darden Road

Macroinvertebrate scores in 2017 were 48 for both Elkhart River sites. The score at CR 18 was much lower (40) in 2014, which was a cause for concern given that it had a score of 50 in 2011. Macroinvertebrate communities react quickly to stressors. Because the scores bounced back from 2014, it is apparent that a short term disturbance occurred in the Elkhart River between 2011 and 2014.

Bowman Creek

In 2017, the IBI score at Studebaker Golf Course on Bowman Creek was 14, which is up from its baseline value of 12 and significantly higher than the score of 6 it received in 2014 (Table 6). Bowman Creek suffers from significant urban modification. Much of the stream is ran underground, and it is known to run dry during the hot summer months. In addition to these limitations, the habitat at many locations including Studebaker Golf Course is very limited. This site received a QHEI habitat score of 47 in 2017, which is very low and considered degraded habitat.

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

Station	River Mile	Fish IBI Scores				2017 Habitat Scores	(ICI) Macroinvertebrate Scores	
		Baseline	2011	2014	**2017**		2014	**2017**
CR 18 (Hively Ave)	7.3	51	46	50	**50**	84	40	**48**
Studebaker Park (A)	3.4	47	48	47	**52**	83		**48**
American Park	1.2	46	45	44	**47**	84	40	

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

Stream	Station	Stream Mile	Fish IBI Scores (Coolwater IBI Scores)				2017 Habitat Scores
			Baseline	2011	2014	**2017**	
Bowman Creek	Gertrude Street	3.4				**19**	63
Bowman Creek	Studebaker Golf Course	1.1	12	16	6	**14**	47
Juday Creek	Ponader Park	3.7				**31 (31)**	70
Juday Creek	Izaak Walton League	0.5	27 (26)	22 (34)	27 (28)	**26 (33)**	81

The Aquatic Program also sampled Bowman Creek at Gertrude Street in 2017 and will do so in coming years to establish a baseline at this location. The habitat score at Gertrude Street was 63, promoting a relatively high IBI score for Bowman Creek of 19. This site has woodland along both of its banks which provide woody material for instream habitat and a more natural riparian area for filtering stormwater.

Bowman Creek was sampled for macroinvertebrates at both fish sampling locations in 2017 (Studebaker Golf Course and Gertrude Street). Studebaker Golf Course had an ICI score of 40, which is the highest biological index score ever recorded on Bowman Creek. This is great news for a stream that almost always has impaired fish and macroinvertebrate communities. As mentioned previously, habitat is a major limiting factor for aquatic life in this stream, however, as long as the flow is maintained in the creek, the water quality is good enough to support a diverse community of macroinvertebrates. The site at Gertrude Street was sampled for macroinvertebrates for the first time and had a promising ICI score of 34. Although this score reflects an impaired macroinvertebrate community, it is good for a stream that generally has very low biological index scores.

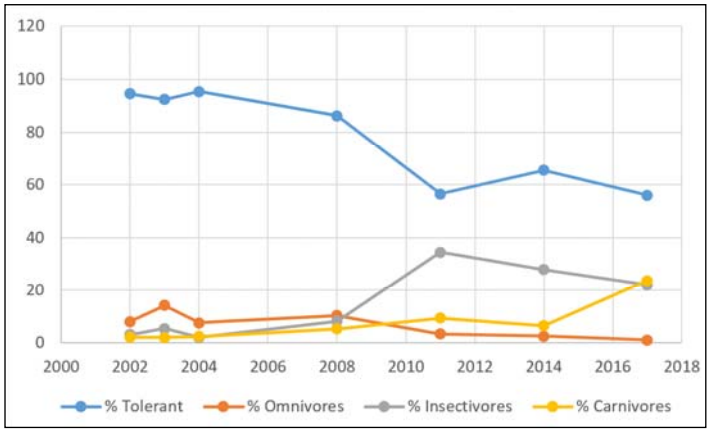
The macroinvertebrate community was also sampled on Auten Ditch in the headwaters of the Bowman Creek Watershed. This site was sampled for the third consecutive year to establish a baseline for future comparisons. The score in 2017 (34) was the highest in the 3 years of sampling.

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

Stream	Station	Stream Mile	ICI Macroinvertebrate Scores (**2017**)
Bowman Creek	Gertrude Street	3.4	**34**
Bowman Creek	Studebaker GC	1.1	**40**
Auten Ditch	Locust Road (S)	6	**34**
Juday Creek	Holy Cross Pkwy	6.6	**44**
Juday Creek	Driftwood Dr.	4.6	**44**
Juday Creek	Kintz Ave.	2.5	**38**
Juday Creek	Izaak Walton League	0.5	**42**

Aquatic Biologist Daragh Deegan with a white sucker. Being a species that can tolerate coolwater conditions, white suckers are abundant in Juday Creek

Figure 7: Changes in IBI metrics for Juday Creek at Izaak Walton League



One of many northern hogsuckers that were collected from area streams in 2018. Northern hogsuckers have a very unique characteristics that allow them to live in swift current

Juday Creek

The IBI score for Juday Creek do not indicate much change at the Izaak Walton League, 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 show some slight improvement at Izaak Walton League over the past 17 years. For example, the % of insectivores and carnivores has increased, while the % of tolerant individuals and omnivores has decreased. (Figure 7). Macroinvertebrate scores were down for both index sites (Kintz Avenue and the Izaak Walton League). The score at Kintz Avenue (38) was significantly lower in 2017 than the previous score of 48 in 2014. Although not as significant, the score at the Izaak Walton League was also down in 2017. These changes may be a reflection of a short term disturbance between 2014 and 2017. Macroinvertebrate integrity can fluctuate substantially from environmental variables. Macroinvertebrate scores will be closely monitored at these sites in the future.

Macroinvertebrates were also sampled at Holy Cross Parkway and Driftwood Drive for the second consecutive year. These sites will be sampled again in 2018 to establish a baseline for future comparisons. Both sites had ICI scores of 44, falling in the good to very good range.

Yellow Creek

The IBI score at the US 20 Bypass on Yellow Creek was 44 in 2017 (Table 8). This site underwent some major drainage modifications in the early 2000s which devastated the habitat and fish communities (Foy, 2004). Over the course of the past 10 years, the habitat at this site has recovered to a certain extent (the habitat score at this site was 80 in 2017). As a result, the fish communities appear to have bounced back to conditions observed before the major disturbance. The macroinvertebrate community score of 42 was slightly higher than the score of 40 in 2014. Macroinvertebrate scores, while not exceptional, appear to be stable; this is good for this stream, as it suffers from unstable flows and water quality problems (Deegan, 2017)

Pine Creek

Pine Creek at the U.S. 20 Bypass continues to have impaired fish communities (Table 8). This stream, while having relatively good habitat at the U.S. 20 Bypass, has been highly modified for drainage and is very unstable. Water levels, flow and the input of sediment and other pollutants will increase significantly in this stream following a rain event. A review of metric scores for this site indicate that several aspects of the fish community have gotten

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

Stream	Station	River Mile	Fish IBI Scores				2016 Habitat Scores	ICI Macroinvertebrate Scores (2017)
			Baseline	2011	2014	**2017**		
Yellow Creek	US 20 Bypass	0.6	39	36	40	**44**	80	42
Pine Creek	US 20 Bypass	3.0	31	28	28	**27**	73	

Table 9: Index scores for tributary streams in Elkhart County

Stream	Station	River Mile	Fish IBI Scores				2017 Habitat Scores	Macroinvertebrate scores (ICI)	
			Baseline	2011	2014	**2017**		2014	2017
Trout Creek	County Road 2	0.7	51	47	45	**49**	71		**50**
Puterbaugh Creek	Reedy Drive	2.3	37	39	40	**43**	67		**46**
Little Elkhart River	State Road 120	1.6	53	53	48	**50**	88	**48**	**46**
Baugo Creek	Restoration Site	1.8	43	43	41	**48**	81	**38**	**40**

worse in the past 20 years. For example, the number of darter species, and the % of simple lithophils and insectivores have decreased, while the % of tolerant individuals has increased.

Little Elkhart River

The Little Elkhart at SR 120 had an IBI score of 50, which is lower than the baseline, but up from the last time it was sampled in 2014 (Table 9). An evaluation of metrics suggest that this site has changed since the implementation of biological monitoring. The percentage of tolerant individuals and omnivores has increased at this site, while the percentage of insectivores has decreased. While these changes are not positive, they are subtle and do not present a huge concern at this time.

The Little Elkhart River at SR 120 has exceptional habitat (QHEI score 88), which is one of the best in the watershed.

Geoff with a nice channel catfish collected from the St. Joseph River upstream of Bristol

The river at this location is surrounded by a large woodland, and it offers a broad array of different types of substrate and habitat types. The macroinvertebrate score of 46 was down slightly from the score it received in 2011 (Table 9) and much lower than the score of 52 it received in 2008. Between some of the changes observed with fish community metrics and macroinvertebrate scores in recent years, it could be argued that this site has degraded slightly in recent years. Other Little Elkhart River sites sampled by the Aquatics Program, higher in the watershed, have not revealed much decline. This stream will be closely monitored to determine if negative changes persist in the long term.

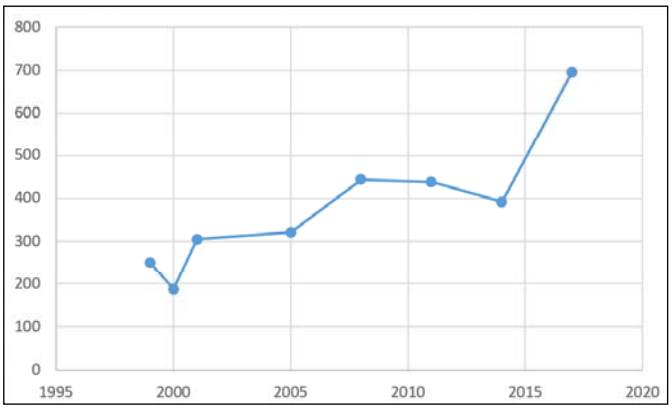
Trout Creek

Although the IBI score for this stream in 2017 was down slightly from the baseline, it was up significantly from the last time it was sampled in 2014. Trout Creek is believed to have excellent water quality as it leaves Long Lake in Michigan and drains toward the St. Joseph River. Bluegill are a highly abundant species in this stream and their dominant presence significantly influences the IBI scores it receives. Overall, metric scores have not changed much at this site over the past 20 years, although the total abundance of fish collected (mostly comprised of bluegill) has increased substantially (Figure 8). Macroinvertebrates were sampled for the first time in 2017, providing an ICI score of 50, which is in the exceptional range.

Puterbaugh Creek

Until 2017, Puterbaugh Creek at Reedy Drive has had relatively consistent IBI scores. In 2017, the IBI score increased substantially from the baseline (Table 9). A review of metric scores suggests that the fish communities have improved in the past 20 years (Figure 9). The % of insectivorous fish has increased, while the % of pioneering species has substantially decreased. In the first several years of sampling at this location, creek chub, a high tolerant pioneering species, was found in much higher abundance. Pioneering species are those that are often found in high

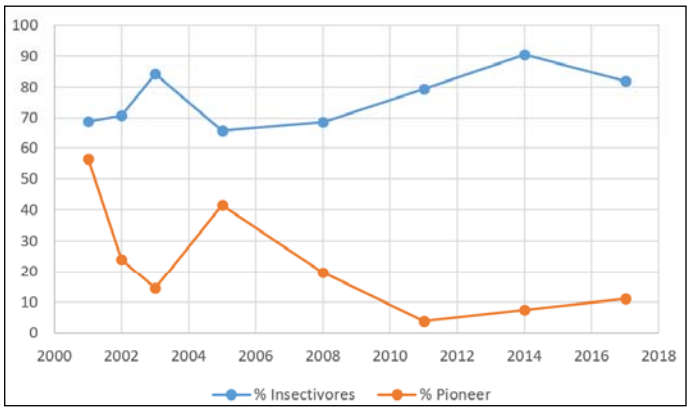
Figure 8: Total abundance of fish collected per sampling event at Trout Creek CR 2



abundance following a disturbance.

Puterbaugh Creek has an interesting mix of both warm and coolwater species. This creek has significant groundwater influences which help maintain cooler water temperatures. It drains Heaton Lake to the St. Joseph River and is also connected to East Lake in northeast Elkhart: all three bodies of water are likely sources for the warmwater species found in Puterbaugh Creek. Macroinvertebrates were sampled at this site for the first time in 2017, providing a very good score of 46.

Figure 9: Changes in IBI metrics for Puterbaugh Creek at Reedy Drive

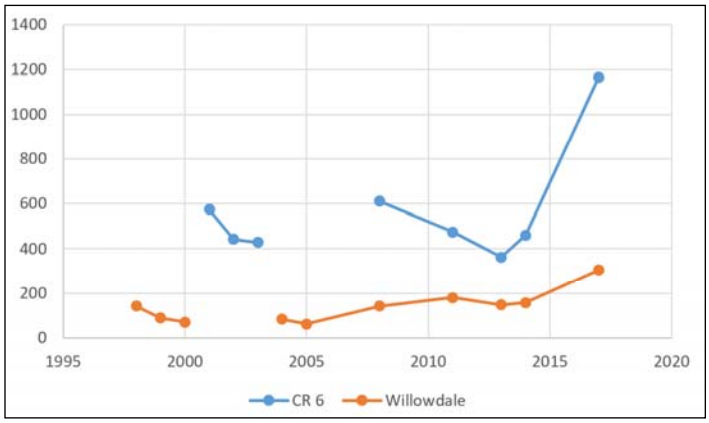


Baugo Creek

In 2017, Baugo Creek was sampled at the Restoration site for the second time since the completion of baseline monitoring in 2012. The IBI score in 2014 was slightly lower than the baseline but much higher at 48 in 2017. The Restoration site is a location where a significant amount of instream restoration work was completed in 2010 by the Elkhart County Drainage Board in an effort to help stabilize the stream. Several structures called "j hooks" were placed in the stream which have helped develop and stabilize the instream habitat. The habitat score was relatively high (81) for this site. The macroinverte-

A beautiful young bowfin collected from the St. Joseph River in Elkhart

Figure 10: Total abundance of fish collected at Christiana Creek sites



brate (ICI) score for this site was 42 in 2017, up significantly from 2014, but much lower than the initial score this site received in 2011. In 2011, the site was just underwent restoration and the macroinvertebrate community reacted quickly. However, ICI scores in the lower 40s seem more realistic of longterm conditions in this stream given some of the water quality and quantity issues that it has (Deegan, 2015).

Christiana Creek

The 2017 IBI score of 46 at CR 6 on Christiana Creek is discouraging (Table 10). This is the lowest score that has been recorded at this site and it is significantly below the baseline value of 50. Similar drops in score were also observed at CR 4 on Christiana Creek in 2016. On a positive note, individual metrics indicate that species diversity has increased at this site over the years. One major change in 2017, and likely the result of the low IBI score, is the substantial increase in the total abundance of fish collected. The number of fish collected per sampling event over the years has averaged about 600; in 2017 this number was 1,200 (Figure 10). Species that were collected in very high abundance in 2017 were striped shiner, northern hogsucker, and horneyhead chub. In addition to the decline observed in the fish community at CR 6, the macroinvertebrate score (44) was also down significantly from the 2014 score of 50.

The 2017 IBI score of 49 at Willowdale Park on Christiana Creek was significantly higher than the baseline, but down from previous sampling events in 2011 and 2014. This site had low IBI scores during baseline sampling due to the lack of fish being present at the site. Total fish abundance (Figure 10) and species diversity has increased considerably at this site over the years. The increase in fish abundance appears to be having the opposite affect on IBI scores at Willowdale Park than it does at CR 6, although the increase at CR 6 is drastically higher. Macroinvertebrates were sampled for the first time at Willowdale Park, providing a very good ICI score of 46.

Fish Tissue

In 2017, 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 11-14), based on the concentration of polychlorinated 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 website (http://www.in.gov/isdh/23650.htm).

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 representa-

Table 10: Index Scores for Christiana Creek, Elkhart County

Stream	Station	River Mile	Fish IBI Scores				2017 Habitat Scores	Macroinvertebrate scores (ICI)	
			Baseline	2011	2014	**2017**		2014	2017
Christiana Creek	County Road 6	4.0	50	52	50	**46**	83	50	**44**
Christiana Creek	Willowdale Park	1.4	38	56	50	**49**	81		**46**

Table 11: Fish Consumption Advisory (Elkhart County)

Species	Fish Size (inches)	Contaminant	Consumption Guidance	***Sensitive Population Guidance***
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	I 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 12: Fish Consumption Advisory (St. Joseph County—Baugo Bay to Twin Branch Dam)

Species	Fish Size (inches)	Contaminant	Consumption Guidance	***Sensitive Population Guidance***
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*
**Northern Pike*	Up to 30	Hg	1 meal/week	*1 meal/week*
	30+	PCBs/Hg	1 meal/week	*1 meal/month*
Redhorse	ALL	PCBs/Hg	I meal/week	*1 meal/week*
Rock Bass	ALL	Hg	Unrestricted	*1 meal/week*
**Smallmouth Bass*	ALL	Hg	1 meal/week	*1 meal/week*
Spotted Sucker	Up to 16		Unrestricted	*Unrestricted*
	16+	Hg	Unrestricted	*1 meal/week*
**Walleye*	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 13: Fish Consumption Advisory (St. Joseph County—Twin Branch Dam to State Line)

Species	Fish Size (inches)	Contaminant	Consumption Guidance	***Sensitive Population Guidance***
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	I 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	I meal/2 months	*1 meal/2 months*
Walleye	ALL	PCBs	1 meal/month	*1 meal/month*

tion 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 2017, 10 fish tissue samples were collected by the Aquatics Program. Tissue samples were collected for 6 species. Multiple samples of the same species were collected in different stretches of the St. Joseph River. In addition, some samples duplicating those from 2016 (same species, size and location), were collected to provide a more accurate representation for that species in the FCA.

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 represent more of a concern for human consumption.

The following narrative describes results of the Aquatics Program's fish tissue collections from Elkhart and St. Joseph Counties in 2017 based on the concentration of PCBs and Hg:

Walleye in the 20.6 to 22.3 size range were collected from the Bristol section of the St. Joseph River. Walleye tissue samples have not been sampled in this section since 2004 due to the suspension of stocking in this section in of river and subsequent reduction in walleye abundance. Michigan DNR reinstituted stocking of walleye above Bristol in 2012, and walleye are once again found in higher abundance. Samples from 2017 suggest that walleye in this section should be limited once per week for the general population and once per month for the sensitive population.

Walleye were also collected at Angela Boulevard in South Bend in the 20.2 to 21.4 inch size range. A sample in the same size range was collected for this species in 2016. The 2017 sample had higher concentrations of PCBs (guidance of 1 meal per month for the general population) compared to the 2016 sample (guidance of 1 meal per week). Repeating the sampling of this species in back to back years has been beneficial in gathering more accurate data for this species in the South Bend area.

Channel catfish in the 21.3 to 23.5 inch size range were collected from the Bristol section of the St. Joseph River in 2017. This species, in the same size range, was also sampled in 2016. Results over the 2 years were similar to the walleye samples from Bristol. The 2017 sample had higher concentrations of PCBs (guidance of 1 meal per month for the general population) compared to the 2016 sample (guidance of 1 meal per week).

Shorthead redhorse were collected below the South Bend Dam in 2017 in the 17.8 to 18.6 size range. A sample in a similar size range was also collected in 2014. The 2017 sample had slightly lower concentrations of PCBs than 2014. The consumption guidance from the 2014 sample

suggests that this species should not be consumed. Results in 2017 suggest that this species could be eaten once every 2 months for the general population but should not be eaten by the sensitive population. The state of Indiana is now grouping all redhorse species (shorthead, golden, black, river, greater, silver) in the fish consumption advisory because these species are difficult for anglers to differentiate. Given that the other species of redhorse tend to have much lower concentrations than shorthead redhorse, the current FCA guidance is one meal every two months for both the general and sensitive populations.

Shorthead redhorse were also collected below the Twin Branch Dam upstream of South Bend. The 2017 sample was collected for confirmation of results of the same sample collected in 2016. Both samples contained relatively low PCB concentrations, putting them in the guidance category of one meal per month for both the general and sensitive populations.

Bluegill were collected below the South Bend Dam in 2017 in the 8.0 to 8.4 inch size range. A sample of bluegill, slightly smaller (6.7 to 7.0 inches), was collected in 2014. Samples from both years yielded similar concentrations of PCBs and Hg, and were 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.

Geoff with a steelhead at the mouth of Juday Creek on the St. Joseph River

Steelhead were collected in the 26.9 to 27.2 inch size range in 2017 from Darden Road. A sample in a slightly

Table 14: Fish Consumption Advisory (Elkhart River)

Species	Fish Size (inches)	Contaminant	Consumption Guidance	***Sensitive Population Guidance***
**Bluegill and other Sunfish*	ALL		Unrestricted	1 meal/week
**Bullhead Catfish*	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

Table 15: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2017

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores 2016	ICI Scores 2016	QHEI Scores 2016
St. Joseph River	Toll Road (Bristol)	1	Index	Elkhart	Boat	50	52	85
	Six Span	2	Index	Elkhart	Boat	50	48	83
	Bridge Street	3	Index	Elkhart	Boat	51	50	86
	Ironwood Dr.	4	Index	St. Joseph	Boat	48	40	63
	South Bend Dam (Below—Night)	5	Investigative	St. Joseph	Boat			72
	Angela Blvd.	6	Index	St. Joseph	Boat	46	56	85
	Sherman Ave.	7	Investigative	St. Joseph	Boat			86
	Darden Road	8	Index	St. Joseph	Boat	50	50	88
Trout Creek	CR 2	9	Index	Elkhart	Tote Barge	49	50	71
Little Elkhart River*	SR 120	10	Index	Elkhart	Tote Barge	50	46	88
Pine Creek*	US 20 Bypass	11	Index	Elkhart	Tote Barge	27		73
Puterbaugh Creek*	Reedy Drive	12	Index	Elkhart	Tote Barge	43	46	67
Christiana Creek	CR 6	13	Index	Elkhart	Tote Barge	46	44	83
	Willowdale Park	14	Index	Elkhart	Tote Barge	49	46	81
Elkhart River	CR 18 (Hively Ave.)	15	Index	Elkhart	Boat	50	48	84
	Studebaker Park (A)	16	Index	Elkhart	Boat	52	48	83
	American Park	17	Index	Elkhart	Boat	47		64
Yellow Creek	US 20 Bypass	18	Index	Elkhart	Tote Barge	44	42	80
Osborn Manning Ditch	Lexington Park Drive	19	Investigative	Elkhart	Back Park			51
Baugo Creek	Restoration Site	20	Index	Elkhart	Tote Barge	48	40	81
	CR 3 (Wakarusa)	21	Investigative	Elkhart	Back Pack			33
Rogers Ditch	Beech Road	22	Investigative	St. Joseph	Back Pack			39
Grimes Ditch	Madison Road	23	Investigative	St. Joseph	Tote Barge			47
Auten Ditch	Locust Road (S)	24	Macroinvertebrate Only	St. Joseph			34	
Bowman Creek	Gertrude St.	25	Index	St. Joseph	Back Pack	19	34	63
	Studebaker Golf Course	26	Index	St. Joseph	Back Pack	14	40	47
Phillips Ditch	Ireland Road	27	Investigative	St. Joseph	Back Pack			40
Juday Creek*	Holy Cross Pkwy	28	Macroinvertebrate Only	St. Joseph			44	

Table 15: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2017 (continued)

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores 2016	ICI Scores 2016	QHEI Scores 2016
Juday Creek*	Driftwood Dr.	29	Macroinvertebrate Only	St. Joseph			44	
	Ponader Park	30	Index	St. Joseph	Tote Barge	31 (31)		70
	Kintz Ave.	31	Macroinvertebrate Only	St. Joseph			38	
	Cleveland Road	32	Investigative	St. Joseph	Tote Barge			78
	Izaak Walton League	33	Index	St. Joseph	Tote Barge/ Back Pack	26 (33)	42	81
	Izaak Walton League (Above)	34	Investigative	St. Joseph	Back Pack			89
Manion Drain	St. Pats Park	35	Investigative	St. Joseph	Back Pack			70
St. Pats Drain*	St. Pats Park	36	Investigative	St. Joseph	Back Pak			80

*** 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

smaller size range was collected in 2016. Results from 2016 yielded slightly lower concentrations of PCBs than those from 2017. The results from 2016 and 2017 appear to correspond well with the current guidance in the FCA which offers different guidance for different size ranges of steelhead. (Table 13).

Smallmouth bass samples in the 11.1 to 11.7 inch size range were collected from two locations on the St. Joseph River in 2017. Smallmouth bass collected at Bridge Street in Elkhart had PCB concentrations that would warrant consumption guidance of 1 meal every week. Fish collected from Darden Road in South Bend yielded concentrations that would warrant consumption guidance of 1 meal every month. In the past, the Aquatics Program collected smallmouth bass larger than 12 inches for tissue samples. However, in the past few years, the State of Indiana has implemented a slot limit for bass in rivers, which allows anglers to keep bass shorter than 12 inches and longer than 15 inches (fish in the slot between 12 and 15 inches cannot be harvested). Smallmouth bass smaller than 12 inches will continue to be targeted in future sampling efforts to ensure the FCA has the most relevant data for current harvesting regulations.

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, and changing our techniques slightly to fill data gaps. With 2017 marking the 20 year anniversary of the program, long-term trends were analyzed differently, with a focus on evaluating different aspects of the fish community. 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.

Metric data also show some long-term changes in fish communities in the St. Joseph River tributaries. Minor improvements are being observed at 2 sites on the Elkhart River. However, some potentially negative trends are occurring on the Little Elkhart River at State Road 120, Pine Creek at the US 20 Bypass, and CR 6 on Christiana Creek.

Metric data from other tributary streams sampled in 2017, such as Bowman Creek, Baugo Creek, and Juday Creek do not show much change. However, the macroinvertebrate score at Studebaker Golf Course on Bowman

Creek of 40 is the highest biological index score this stream has ever received and speaks to the potential for Bowman Creek to support aquatic life. Data from the site sampled on Yellow Creek at the US 20 Bypass is also promising, suggesting that the site has recovered from a major disturbance that occurred in the early 2000s.

Fish tissue sampling from 2017 also provided very useful data for the St. Joseph River Fish Consumption Advisory, making it one of the most thorough FCAs for any river in the State of Indiana.

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 run-off) is causing an increase ecosystem productivity. On the other hand, this increase in abundance may reflect a positive change as a result of better conditions for fish reproduction over past few years. Future monitoring results may shed more light on this issue.

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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
- scalers
- 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, scalers and skinners were cleaned and rinsed with DI water, and freezer wrap was placed where the fish were to be processed. The knives, scalers 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 2017

Station	Species	Length Range (in)	PCB Group General Population	Hg Group General Population	PCB Group Sensitive Population	Hg Group Sensitive Population
St. Joseph River Bristol	Walleye	20.6-22.3	1 meal/week	1 meal/week	1 meal/week	1 meal/month
St. Joseph River Bristol	Channel Catfish	21.3-23.5	1 meal/month	Unrestricted	1 meal/month	1 meal/week
St. Joseph River Below South Bend Dam	Shorthead Redhorse	17.8-18.6	1 meal/2 months	Unrestricted	1 meal/2 months	1 meal/week
St. Joseph River Below South Bend Dam	Bluegill	8.0-8.4	1 meal/week	Unrestricted	1 meal/week	1 meal/week
St. Joseph River Bridge Street	Smallmouth Bass	11.1-11.7	1 meal/week	Unrestricted	1 meal/week	1 meal/week
St. Joseph River Pinhook (B)	Smallmouth Bass	11.1-11.7	1 meal/month	Unrestricted	1 meal/month	1 meal/week
St. Joseph River Darden Road	Steelhead	26.9-27.2	1 meal/month	Unrestricted	1 meal/month	1 meal/week
St. Joseph River Angela	Walleye	20.2-21.4	1 meal/month	1 meal/week	1 meal/month	1 meal/week
St. Joseph River Below Twin Branch Dam	Bluegill	6.7-7.4	Unrestricted	Unrestricted	Unrestricted	Unrestricted
St. Joseph River Below Twin Branch Dam	Shorthead Redhorse	17.4-18.5	1 meal/month	Unrestricted	1 meal/month	1 meal/week

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*

Appendix C

Summary of fish collected by county, 2017

Summary of species captured at index sites in Elkhart County, 2017

COMMON NAME	Total Number	% By Number	Total Weight (g)	Total Weight (lbs.)	% By Weight
Striped Shiner	3,471	17.14	37,335	82.24	2.54
Bluegill	2,341	11.56	46,221	101.82	3.15
Rock Bass	1,541	7.61	102,084	224.88	6.96
Rainbow Darter	1,067	5.27	1,625	3.58	0.11
Hornyhead Chub	954	4.71	12,288	27.07	0.84
Golden Redhorse	896	4.42	393940	867.80	26.85
Mimic Shiner	895	4.42	1262	2.78	0.09
White Sucker	801	3.95	135,023	297.44	9.20
Smallmouth Bass	751	3.71	85,477	188.30	5.83
Bluntnose Minnow	723	3.57	1,892	4.17	0.13
Rosyface Shiner	667	3.29	1,298	2.86	0.09
Northern Hog Sucker	644	3.18	119,821	263.95	8.17
Creek Chub	599	2.96	10,749	23.68	0.73
Spotfin Shiner	599	2.96	2,590	5.71	0.18
Longear Sunfish	545	2.69	145,09	31.96	0.99
Johnny Darter	451	2.23	627	1.38	0.04
Sand Shiner	330	1.63	708	1.56	0.05
Logperch	319	1.57	2,956	6.51	0.20
Mottled Sculpin	294	1.45	1,120	2.47	0.08
Largemouth Bass	259	1.28	49,861	109.84	3.40
Common Shiner	213	1.05	1,824	4.02	0.12
Blacknose Dace	206	1.02	855	1.88	0.06
Green Sunfish	184	0.91	3,502	7.71	0.24
Blackside Darter	175	0.86	537	1.18	0.04
Shorthead Redhorse	171	0.84	114,895	253.10	7.83
Stoneroller, Central	166	0.82	1,767	3.89	0.12
Greater Redhorse	88	0.43	25,399	55.95	1.73
Central Mudminnow	72	0.36	304	0.67	0.02
Spotted Sucker	70	0.35	9,430	20.77	0.64
Chestnut Lamprey	70	0.35	603	1.33	0.04
Yellow Bullhead	66	0.33	5,518	12.16	0.38
Grass Pickerel	55	0.27	1,008	2.22	0.07
Pumpkinseed	52	0.26	704	1.55	0.05
River Chub	48	0.24	572	1.26	0.04
Black Crappie	42	0.21	2,904	6.40	0.20
Greenside Darter	42	0.21	128	0.28	0.01
Black Redhorse	38	0.19	21,950	48.35	1.50
River Redhorse	30	0.15	73,500	161.91	5.01
American Brook Lamprey	29	0.14	197	0.43	0.01
Blackstripe Topminnow	28	0.14	47	0.10	0.00
Common Carp	26	0.13	80,598	177.55	5.49

Summary of species captured at index sites in Elkhart County, 2017 (continued)

COMMON NAME	Total Number	% By Number	Total Weight (g)	Total Weight (lbs.)	% By Weight
Walleye	24	0.12	13,356	29.42	0.91
Silver Lamprey	24	0.12	102	0.22	0.01
Silver Redhorse	22	0.11	39,477	86.96	2.69
Northern Pike	19	0.09	13,566	29.88	0.92
Longnose Dace	17	0.08	99	0.22	0.01
Yellow Perch	16	0.08	377	0.83	0.03
Redear Sunfish	15	0.07	624	1.37	0.04
Pirate Perch	15	0.07	133	0.29	0.01
Brown Bullhead	12	0.06	6322	13.93	0.43
Bowfin	10	0.05	12,156	26.78	0.83
Hybrid Sunfish	8	0.04	122	0.27	0.01
Silverjaw Minnow	8	0.04	10	0.02	0.00
Banded Killifish	7	0.03	28	0.06	0.00
Brook Silverside	7	0.03	15	0.03	0.00
Channel Catfish	6	0.03	10,162	22.39	0.69
Brown Trout	6	0.03	837	1.84	0.06
Stonecat	4	0.02	107	0.24	0.01
Fathead Minnow	4	0.02	15	0.03	0.00
Longnose Gar	2	0.01	1,000	2.20	0.07
Warmouth	2	0.01	97	0.21	0.01
Tadpole Madtom	2	0.01	23	0.05	0.00
Spotted Gar	1	0.00	397	0.87	0.03
Rainbow Trout	1	0.00	353	0.78	0.02
Brook Trout	1	0.00	177	0.39	0.01
Goldfish	1	0.00	34	0.07	0.00
Gizzard Shad	1	0.00	8	0.02	0.00
Black Bullhead	1	0.00	1	0.00	0.00
Golden Shiner	1	0.00	1	0.00	0.00
Total	**20,255**	**100**	**1,467,227**	**3,232.12**	**100.00**

Summary of species captured at investigative sites in Elkhart County, 2017

COMMON NAME	Total Number	% By Number
Blacknose Dace	63	55.75
Rainbow Darter	18	15.93
Creek Chub	11	9.73
Striped Shiner	10	8.85
Grass Pickerel	6	5.31
White Sucker	2	1.77
Bluntnose Minnow	1	0.88
Green Sunfish	1	0.88
Johnny Darter	1	0.88
Total	**113**	**100**

Index Sites	20,255
Investigative Sites	113
Elkhart County Total	20,368

Summary of species captured at index sites in St. Joseph County, 2017

COMMON NAME	Total Number	% By Number	Total Weight (g)	Total Weight (lbs.)	% By Weight
Longear Sunfish	610	13.08	14,283	31.46	2.09
Rock Bass	599	12.84	42,404	93.41	6.21
Smallmouth Bass	585	12.54	79,553	175.25	11.65
Creek Chub	549	11.77	5,955	13.12	0.87
Bluegill	509	10.91	8,107	17.86	1.19
Golden Redhorse	225	4.82	178,350	392.88	26.11
Blacknose Dace	175	3.75	629	1.39	0.09
Green Sunfish	169	3.62	1,782	3.93	0.26
Spotfin Shiner	137	2.94	630	1.39	0.09
Mimic Shiner	132	2.83	207	0.46	0.03
Johnny Darter	121	2.59	185	0.41	0.03
White Sucker	92	1.97	27,887	61.43	4.08
Mottled Sculpin	91	1.95	575	1.27	0.08
Black Redhorse	87	1.86	60,841	134.03	8.91
Rainbow Darter	87	1.86	89	0.20	0.01
Rainbow Trout	81	1.74	30,056	66.21	4.40
Shorthead Redhorse	64	1.37	55,669	122.63	8.15
Bluntnose Minnow	47	1.01	112	0.25	0.02
Spotted Sucker	43	0.92	23,331	51.40	3.42
Yellow Bullhead	30	0.64	6,443	14.19	0.94
Northern Hog Sucker	28	0.60	10,476	23.08	1.53
Quillback	26	0.56	39,100	86.13	5.72
Walleye	26	0.56	32,072	70.65	4.70
Largemouth Bass	23	0.49	3,523	7.76	0.52
Banded Killifish	18	0.39	70	0.15	0.01
Common Carp	15	0.32	35,452	78.10	5.19
Logperch	12	0.26	187	0.41	0.03
Central Mudminnow	12	0.26	50	0.11	0.01
Pumpkinseed	8	0.17	355	0.78	0.05
Chestnut Lamprey	8	0.17	154	0.34	0.02
Blackside Darter	8	0.17	32	0.07	0.00
Longnose Gar	4	0.09	2,600	5.73	0.38
Northern Pike	4	0.09	1,668	3.67	0.24
Hybrid Sunfish	4	0.09	311	0.69	0.05
Redear Sunfish	4	0.09	171	0.38	0.03
Greater Redhorse	3	0.06	7,600	16.74	1.11
Brown Bullhead	3	0.06	1,199	2.64	0.18
Brown Trout	3	0.06	233	0.51	0.03
Warmouth	3	0.06	55	0.12	0.01
Golden Shiner	3	0.06	27	0.06	0.00
Silver Redhorse	2	0.04	5,800	12.78	0.85

Summary of species captured at index sites in St. Joseph County, 2017 (continued)

COMMON NAME	Total Number	% By Number	Total Weight (g)	Total Weight (lbs.)	% By Weight
River Redhorse	2	0.04	3,200	7.05	0.47
Gizzard Shad	2	0.04	529	1.17	0.08
Stonecat	2	0.04	54	0.12	0.01
Greenside Darter	2	0.04	5	0.01	0.00
Pirate Perch	2	0.04	3	0.01	0.00
Bowfin	1	0.02	785	1.73	0.11
Black Crappie	1	0.02	212	0.47	0.03
Silver Lamprey	1	0.02	8	0.02	0.00
Spottail Shiner	1	0.02	1	0.00	0.00
Channel Catfish	1	0.02	0	0.00	0.00
Total	**4,665**	**100**	**683,020**	**1,504.61**	**100.00**

Summary of species captured at investigative sites in St. Joseph County, 2017

COMMON NAME	Total Number	% By Number		COMMON NAME	Total Number	% By Number
Creek Chub	361	31.95		Shorthead Redhorse	11	0.97
Blacknose Dace	96	8.50		Northern Hog Sucker	11	0.97
Stoneroller, Central	80	7.08		Black Redhorse	9	0.80
Bluntnose Minnow	75	6.64		Rainbow Trout	8	0.71
Johnny Darter	72	6.37		Spotted Sucker	4	0.35
Spotfin Shiner	71	6.28		Walleye	4	0.35
Mottled Sculpin	56	4.96		Largemouth Bass	3	0.27
Golden Redhorse	44	3.89		Logperch	3	0.27
White Sucker	38	3.36		Striped Shiner	3	0.27
Bluegill	33	2.92		Stonecat	2	0.18
Green Sunfish	29	2.57		Channel Catfish	1	0.09
Smallmouth Bass	28	2.48		Hybrid Sunfish	1	0.09
Mimic Shiner	27	2.39		Chestnut Lamprey	1	0.09
Silverjaw Minnow	20	1.77		Rainbow Darter	1	0.09
Longear Sunfish	19	1.68		Blackside Darter	1	0.09
Rock Bass	18	1.59		**Total**	**1,130**	**100**

Index Sites	4,665
Investigative Sites	1,130
St. Joseph County Total	**5,795**

Appendix D

Summary of fish collected by site, 2017
(Reference Table 1 for site numbers and locations)

Stream	St. Joseph River, Elkhart County, 2017					
Site	Toll Road (Bristol)		Six Span		Bridge St	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
#Banded Killifish	X				X	
Black Crappie			X	X	X	X
~Black Redhorse	X	X	X	X	X	X
Blackside Darter	X	X	X	X	X	X
Bluegill	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X
Bowfin	X		X		X	
~Brook Silverside	X		X	X		X
#Brown Bullhead		X	X		X	
#Channel Catfish	X	X				
Chestnut Lamprey	X		X		X	X
#Common Carp	X	X	X	X	X	X
Common Shiner						X
#Gizzard Shad					X	
Golden Redhorse	X	X	X	X	X	X
Grass Pickerel	X	X				X
~Greater Redhorse	X	X			X	
#Green Sunfish	X		X		X	X
~Greenside Darter	X	X		X	X	X
~Hornyhead Chub	X	X		X		
#Hybrid Sunfish				X	X	
Johnny Darter	X	X		X		X
Largemouth Bass	X	X	X	X	X	X
~Logperch	X	X	X	X	X	X
~Longear Sunfish	X	X	X	X	X	X
#Longnose Gar					X	
~Mimic Shiner	X	X	X	X	X	X
~Northern Hog Sucker	X	X	X	X	X	X
Northern Pike	X	X		X		X
Pirate Perch						X
Pumpkinseed			X	X	X	X
~Rainbow Darter	X	X		X	X	
Redear Sunfish		X		X		X
~River Redhorse			X	X	X	X
~Rock Bass	X	X	X	X	X	X
~Rosyface Shiner	X	X	X	X	X	
~Sand Shiner	X				X	
~Shorthead Redhorse	X	X	X	X	X	X
Silver Lamprey	X			X	X	

Stream	St. Joseph River, Elkhart County, 2017					
Site	Toll Road (Bristol)		Six Span		Bridge Street	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~Silver Redhorse	X	X	X	X	X	X
~Smallmouth Bass	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X
Spotted Sucker		X	X	X	X	
Stoneroller, Central		X		X		
Striped Shiner	X	X	X	X	X	
Walleye	X	X		X	X	X
#White Sucker	X	X	X		X	X
#Yellow Bullhead	X	X	X	X		X
Yellow Perch		X	X	X		

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

Stream	St. Joseph River, St. Joseph County, 2017							
Site	Ironwood Dr.		South Bend Dam (B) - Night Shock	Angela Blvd.		Sherman Ave.	Darden Rd.	
	1st Pass	2nd Pass		1st Pass	2nd Pass		1st Pass	2nd Pass
#Banded Killifish	X	X			X		X	X
Black Crappie	X		X					
~Black Redhorse		X	X	X	X	X	X	X
Blackside Darter		X			X	X		X
Bluegill	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X		X	X	X	X	X
Bowfin				X				
~Brook Silverside			X					
#Brown Bullhead	X	X						
#Channel Catfish		X	X			X		
Chestnut Lamprey			X	X	X	X	X	X
#Common Carp	X	X	X					
#Creek Chub								X
#Gizzard Shad		X	X	X				
Golden Redhorse	X	X	X	X	X	X	X	X
#Golden Shiner				X				X
~Greater Redhorse		X		X			X	
#Green Sunfish	X	X	X	X	X	X	X	
~Greenside Darter					X			
#Hybrid Sunfish	X	X						
Johnny Darter		X			X		X	X
Largemouth Bass	X	X		X	X	X		X
~Logperch		X			X	X		
~Longear Sunfish	X	X	X	X	X	X	X	X
#Longnose Gar	X		X	X	X			
~Mimic Shiner	X	X	X	X	X	X	X	X
~Northern Hog Sucker	X			X	X	X	X	X
Northern Pike			X				X	X
Pirate Perch								X
Pumpkinseed	X	X					X	
#Quillback	X	X	X	X	X		X	X
~Rainbow Darter	X		X		X		X	X
Rainbow Trout	X			X		X	X	X
Redear Sunfish								X
~River Redhorse			X				X	
~Rock Bass	X	X	X	X	X	X	X	X
~Shorthead Redhorse	X	X	X	X	X	X	X	X
Silver Lamprey							X	

Stream	St. Joseph River, St. Joseph County, 2017							
Site	Ironwood Dr.		South Bend Dam (B)-Night Shock	Angela Blvd.		Sherman Ave.	Darden Rd.	
	1st Pass	2nd Pass		1st Pass	2nd Pass		1st Pass	2nd Pass
~Silver Redhorse	X		X				X	
~Smallmouth Bass	X	X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X	X
Spottail Shiner								X
Spotted Sucker	X	X			X	X	X	X
~Stonecat		X			X	X		
Walleye	X	X	X	X	X	X	X	X
Warmouth								X
#White Sucker	X	X					X	X
#Yellow Bullhead	X	X		X	X		X	X

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

Tributaries to the St. Joseph River, Elkhart County, 2017						
Stream	**Elkhart River**					
Site	**Hively Ave.**		**Studebaker Park**		**American Park**	
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
~American Brook Lamprey		X		X	X	X
Black Crappie	X	X	X	X		
Blackside Darter	X		X	X	X	X
Blackstripe Topminnow	X	X				
Bluegill	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X
Bowfin	X	X			X	
#Central Mudminnow	X	X				
Chestnut Lamprey	X	X	X		X	X
Common Shiner			X			X
#Creek Chub	X	X	X	X		
#Fathead Minnow	X					
~Golden Redhorse	X	X	X	X	X	X
Grass Pickerel		X				X
~Greater Redhorse					X	X
#Green Sunfish	X	X	X	X	X	X
~Hornyhead Chub	X	X	X	X	X	X
Johnny Darter	X	X	X	X	X	X
Largemouth Bass	X	X	X	X	X	X
~Longear Sunfish	X	X		X	X	X
~Mimic Shiner				X		X
~Northern Hog Sucker	X	X	X	X	X	X
Northern Pike	X	X				
Pirate Perch				X	X	X
Pumpkinseed		X	X		X	X
~Rainbow Darter	X	X	X	X		X
Redear Sunfish		X		X		
~River Redhorse			X			
~Rock Bass	X	X	X	X	X	X
~Rosyface Shiner	X	X	X	X	X	X
~Sand Shiner		X	X		X	X
Silver Lamprey					X	X
Silverjaw Minnow	X					
~Smallmouth Bass	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X
Spotted Sucker	X	X	X	X	X	X
Striped Shiner	X	X	X	X	X	X
Walleye		X				
#White Sucker	X	X	X	X	X	X
#Yellow Bullhead	X					X

Tributaries to the St. Joseph River, St. Joseph County, 2017							
Stream	**Rogers Ditch**	**Grimes Ditch**	**Bowman Creek**				**Phillips Ditch**
Site	**Beech Rd.**	**Madison Rd.**	**Studebaker G.C.**		**Gertrude**		**Ireland Rd.**
			1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	
#Blacknose Dace	X	X					
#Bluntnose Minnow	X	X					
#Central Mudminnow						X	
#Creek Chub	X	X	X	X	X	X	
#Green Sunfish	X	X	X		X	X	X
Johnny Darter	X	X					
Silverjaw Minnow	X	X					
Stoneroller, Central	X	X					
Striped Shiner	X						
#White Sucker	X	X					

Tributaries to the St. Joseph River, St. Joseph County, 2017								
Stream	**Juday Creek**						**St. Pats Stream**	**Kiefer Ditch**
Site	**Ponader Park**		**Izaak Walton**		**Izaak Walton (Above)**	**Cleveland Rd.**	**SJR Mouth**	**SJR Mouth**
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**				
#Banded Killifish							X	
#Blacknose Dace	X	X	X	X	X	X		X
Bluegill		X						
Brown Trout	X	X						
#Central Mudminnow	X	X					X	X
Common Carp	X							
#Creek Chub	X	X	X	X	X	X	X	X
#Green Sunfish	X	X		X		X	X	X
#Hybrid Sunfish		X				X		
Johnny Darter	X	X	X			X		
Mottled Sculpin	X	X	X	X	X	X		X
~Rainbow Darter						X	X	X
Rainbow Trout			X	X	X	X	X	X
~Rock Bass	X	X				X		
~Smallmouth Bass	X	X						
#White Sucker	X	X	X		X	X		X

~ - denotes a species that is SENSITIVE to environmental disturbances such as degraded water quality or habitat
# - denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

Tributaries to the St. Joseph River, Elkhart County, 2017								
Stream	**Trout Creek**		**Christiana Creek**				**Little Elkhart**	
Site	**CR 2**		**Willowdale**		**CR 6**		**SR 120**	
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
~American Brook Lamprey							X	
#Black Bullhead		X						
Black Crappie					X			
Blackside Darter							X	X
Blackstripe Topminnow		X			X	X		
Bluegill	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X	X
Brown Trout						X	X	X
#Central Mudminnow		X			X		X	X
#Channel Catfish						X		
Chestnut Lamprey			X		X	X	X	
Common Shiner								X
#Creek Chub	X			X	X	X	X	X
~Golden Redhorse	X		X	X	X	X	X	
#Goldfish					X			
Grass Pickerel		X		X			X	X
#Green Sunfish	X	X			X		X	X
~Greenside Darter	X							X
~Hornyhead Chub	X	X	X		X	X		X
#Hybrid Sunfish						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						
Mottled Sculpin							X	X
~Northern Hog Sucker	X	X	X	X	X	X	X	X
Northern Pike								X
~Rainbow Darter	X	X	X	X	X	X	X	X
Rainbow Trout							X	
Redear Sunfish	X	X						
~River Chub					X	X		
~Rock Bass	X	X	X	X	X	X	X	X
~Rosyface Shiner							X	X
~Shorthead Redhorse			X	X			X	X
Silver Lamprey			X	X		X		
~Silver Redhorse			X					
~Smallmouth Bass		X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X	
Spotted Gar		X						

Tributaries to the St. Joseph River, Elkhart County, 2017								
Stream	**Trout Creek**		**Christiana Creek**				**Little Elkhart**	
Site	**CR 2**		**Willowdale**		**CR 6**		**SR 120**	
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
Spotted Sucker		X						
~Stonecat					X	X		
Stoneroller, Central							X	
Striped Shiner	X	X	X	X	X	X	X	X
~Tadpole Madtom					X	X		
Warmouth					X	X		
#White Sucker		X	X	X	X	X	X	X
#Yellow Bullhead		X	X		X	X		
Yellow Perch	X	X						

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Tributaries to the St. Joseph River, Elkhart County, 2017										
Stream	**Pine Creek**		**Puterbaugh Creek**		**Yellow Creek**		**Osborn Manning Ditch**	**Baugo Creek**		
Site	**US 20 Bypass**		**Reedy Dr.**		**US 20 Bypass**		**Lexington Park Dr.**	**Restoration**		**CR 3 Wakarusa**
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**		**1st Pass**	**2nd Pass**	
~American Brook Lamprey	X		X							
#Black Bullhead										X
#Blacknose Dace	X	X			X	X	X	X	X	
Blackside Darter					X	X		X	X	
Bluegill		X	X	X	X	X		X	X	
#Bluntnose Minnow					X	X	X	X	X	
Brown Trout								X	X	
#Central Mudminnow	X	X	X	X				X		X
Chestnut Lamprey								X	X	
Common Shiner					X	X		X		X
#Creek Chub	X	X	X	X	X	X	X	X	X	X
#Fathead Minnow					X	X				
#Golden Shiner									X	
Grass Pickerel	X	X	X	X		X	X			
#Green Sunfish	X	X	X	X	X	X	X	X	X	X
~Greenside Darter								X	X	
~Hornyhead Chub					X	X				
#Hybrid Sunfish									X	
Johnny Darter			X	X	X	X	X	X	X	X
Largemouth Bass						X		X	X	
~Logperch								X	X	
~Longear Sunfish									X	
~Longnose Dace								X	X	
Mottled Sculpin	X	X	X	X						
~Northern Hog Sucker					X	X				
Northern Pike										X
Pumpkinseed								X	X	
~Rainbow Darter			X	X	X	X	X	X	X	
Redear Sunfish			X	X						
~Rock Bass								X	X	
~Rosyface Shiner					X	X				
~Sand Shiner								X	X	
~Shorthead Redhorse									X	
~Silver Redhorse									X	

Tributaries to the St. Joseph River, Elkhart County, 2017										
Stream	**Pine Creek**		**Puterbaugh Creek**		**Yellow Creek**		**Osborn Manning Ditch**	**Baugo Creek**		
Site	**US 20 Bypass**		**Reedy Dr.**		**US 20 Bypass**		**Lexington Park Dr.**	**Restoration**		**CR 3 Wakarusa**
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**		**1st Pass**	**2nd Pass**	
Silverjaw Minnow					X			X	X	
~Smallmouth Bass								X	X	
Spotfin Shiner								X		
Stoneroller, Central					X	X		X	X	X
Striped Shiner					X	X	X	X	X	X
Walleye								X	X	
#White Sucker	X	X	X		X	X	X	X	X	X
#Yellow Bullhead			X	X						

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Appendix E

Summary of macroinvertebrates (insects) collected by site, 2017

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).

St. Joseph River - Toll Road
Date Collected: 8/4/17 Site #:1

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	14	+	F	Ochrotrichia sp	6		MI
Nemertea	4		F	Brachycentrus numerosus	15		MI
Oligochaeta	0	+	T	Neophylax sp	0	+	MI
Placobdella ornata	0	+	MT	Pycnopsyche sp	0	+	MI
Caecidotea sp	0	+	T	Helicopsyche borealis	0	+	MI
Hyalella azteca	0	+	F	Triaenodes injustus	0	+	MI
Gammarus sp	0	+	F	Dineutus sp	1		F
Orconectes sp	0	+	F	Psephenus herricki	0	+	MI
Hydrachnidia	0	+	F	Scirtidae	0	+	F
Plauditus dubius or P. virilis	11		I	Macronychus glabratus	6	+	F
Baetis flavistriga	3		F	Stenelmis sp	0	+	F
Baetis intercalaris	59		F	Simulium sp	86		F
Iswaeon anoka	7	+	MI	Tanypodinae	0	+	
Callibaetis sp	0	+	MT	Nilotanypus fimbriatus	9		F
Isonychia sp	194	+	MI	Pentaneura inconspicua	1		F
Leucrocuta sp	0	+	MI	Corynoneura lobata	3		F
Stenacron sp	0	+	F	Cricotopus sp	1		F
Maccaffertium exiguum	136	+	MI	Cricotopus (C.) bicinctus	0	+	T
Maccaffertium mediopunctatum	31	+	MI	Nanocladius (N.) crassicornus or N. (N.) "rectinervis"	6		F
Maccaffertium pulchellum	31		MI	Rheocricotopus (Psilocricotopus) robacki	7		F
Maccaffertium terminatum	160	+	MI	Thienemanniella xena	5		F
Teloganopsis deficiens	15		I	Dicrotendipes neomodestus	0	+	F
Tricorythodes sp	17	+	MI	Glyptotendipes (G.) sp	6		MT
Caenis sp	4	+	F	Paralauterborniella nigrohal-teralis	0	+	F
Anthopotamus sp	0	+	MI	Polypedilum (Uresipedilum) fla-vum	17	+	F
Hexagenia sp	0	+	F	Stenochironomus sp	3		F
Calopteryx sp	0	+	F	Rheotanytarsus sp	124		F
Coenagrionidae	0	+	T	Hemerodromia sp	1		F
Argia sp	0	+	F	Elimia sp	3	+	MI
Pteronarcys sp	0	+	MI	Physella sp	0	+	T
Acroneuria abnormis	13		MI	Laevapex fuscus	9		MT
Neoperla clymene complex	0	+	I	Corbicula fluminea	0	+	F
Agnetina capitata complex	4		MI	Elliptio dilatata	0	+	MI
Sialis sp	0	+	MT	Villosa iris iris	0	+	MI
Corydalus cornutus	4		MI				
Neureclipsis sp	1		MI	No. of Quantitative Taxa:	43		
Cheumatopsyche sp	89	+	F	No. of Qualitative Taxa:	46		
Ceratopsyche sparna	2		F	Total Taxa:	76		
Hydropsyche depravata group	1		F	No. of Organisms	1145		
Hydropsyche phalerata	29	+	MI	Qualitative EPT:	20		
Macrostemum zebratum	1		I	**ICI:**	**52**		
Hydroptila sp	6		F				

St. Joseph River - Six Span
Date Collected: 8/4/17 Site #: 2

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	7	+	F
Gammarus sp	2	+	F
Hydrachnidia	0	+	F
Baetis flavistriga	1		F
Baetis intercalaris	25		F
Labiobaetis propinquus	0	+	MI
Iswaeon anoka	6	+	MI
Isonychia sp	77		MI
Leucrocuta sp	4		MI
Stenacron sp	44		F
Maccaffertium exiguum	66		MI
Maccaffertium mediopunctatum	31		MI
Maccaffertium pulchellum	66		MI
Maccaffertium terminatum	48	+	MI
Teloganopsis deficiens	49		I
Tricorythodes sp	191	+	MI
Caenis sp	7	+	F
Anthopotamus sp	0	+	MI
Pteronarcys sp	1	+	MI
Neoperla clymene complex	1		I
Neureclipsis sp	1		MI
Polycentropus sp	11		MI
Cheumatopsyche sp	127		F
Hydropsyche phalerata	3		MI
Hydroptila sp	23		F
Ithytrichia sp	2		
Ochrotrichia sp	5		MI
Brachycentrus numerosus	0	+	MI
Lepidostoma sp	0	+	MI
Helicopsyche borealis	1	+	MI
Oecetis persimilis	1		MI
Lepidoptera	8		
Dineutus sp	1	+	F
Scirtidae	0	+	F
Macronychus glabratus	13	+	F
Ablabesmyia janta	8		F
Ablabesmyia mallochi	4		F
Nilotanypus fimbriatus	9		F
Pentaneura inconspicua	12	+	F
Corynoneura lobata	33		F
Cricotopus (C.) sp	12		F
Cricotopus (C.) bicinctus	8		T
Dicrotendipes neomodestus	102		F
Glyptotendipes (G.) sp	4		MT
Microtendipes pedellus group	4		F
Microtendipes rydalensis	4		MI
Polypedilum (Uresipedilum) flavum	55	+	F
Polypedilum (Tripodura) scalaenum group	4	+	F
Xenochironomus xenolabis	8		F
Cladotanytarsus vanderwulpi group sp 4	0	+	MI
Rheotanytarsus sp	212	+	F
Hemerodromia sp	4		F
Campeloma decisum	0	+	F
Ferrissia sp	5		F
Laevapex fuscus	2		MT
Corbicula fluminea	0	+	F
Lampsilis radiata luteola	0	+	MI

No. of Quantitative Taxa:	47
No. of Qualitative Taxa:	24
Total Taxa:	57
No. of Organisms	1312
Qualitative EPT:	10
ICI:	**48**

St. Joseph River - Bridge Street

Date Collected: 8/7/17 Site #: 3

Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F
Turbellaria	74	+	F
Nemertea	16		F
Oligochaeta	12	+	T
Caecidotea sp	0	+	T
Gammarus sp	17	+	F
Plauditus dubius or P. virilis	10	+	I
Baetis intercalaris	17		F
Labiobaetis propinquus	0	+	MI
Isonychia sp	263	+	MI
Leucrocuta sp	8		MI
Stenacron sp	121	+	F
Maccaffertium exiguum	155	+	MI
Maccaffertium mediopunctatum	66		MI
Maccaffertium terminatum	30	+	MI
Teloganopsis deficiens	40	+	I
Tricorythodes sp	133	+	MI
Caenis sp	5	+	F
Coenagrionidae	4	+	T
Argia sp	0	+	F
Pteronarcys sp	0	+	MI
Corydalus cornutus	8		MI
Polycentropus sp	62	+	MI
Cheumatopsyche sp	270	+	F
Ceratopsyche morosa group	12		MI
Hydropsyche depravata group	1		F
Hydropsyche phalerata	67	+	MI
Hydropsyche venularis	12		MI
Macrostemum zebratum	5	+	I
Protoptila sp	0	+	I
Hydroptila sp	17		F
Brachycentrus numerosus	2	+	MI
Neophylax sp	0	+	MI
Pycnopsyche sp	0	+	MI
Helicopsyche borealis	0	+	MI
Oecetis persimilis	4		MI
Triaenodes sp	1	+	MI
Petrophila sp	3		MI
Psephenus herricki	0	+	MI
Macronychus glabratus	20	+	F
Stenelmis sp	0	+	F
Simulium sp	0	+	F
Tanypodinae	3		
Ablabesmyia janta	31	+	F
Ablabesmyia mallochi	9		F
Hayesomyia senata or Thienemannimyia norena	9		F
Labrundinia pilosella	4		F
Cricotopus (C.) sp	6	+	F
Thienemanniella xena	4		F
Cryptochironomus sp	0	+	F
Dicrotendipes neomodestus	47	+	F
Paratendipes albimanus or P. duplicatus	0	+	F
Phaenopsectra obediens group	9	+	F
Polypedilum (Uresipedilum) flavum	16		F
Polypedilum (P.) fallax group	6		F
Polypedilum (P.) illinoense	0	+	T
Polypedilum (Tripodura) scalaenum group	3		F
Stenochironomus sp	9	+	F
Tribelos jucundum	9	+	MT
Rheotanytarsus sp	78	+	F
Atherix lantha	0	+	MI
Hemerodromia sp	8		F
Elimia sp	13	+	MI
Corbicula fluminea	6	+	F
Dreissena polymorpha	0	+	F
Pisidiidae	9		

No. of Quantitative Taxa:	49
No. of Qualitative Taxa:	45
Total Taxa:	66
No. of Organisms	1734
Qualitative EPT:	20
ICI:	**50**

St. Joseph River - Ironwood
Date Collected: 8/9/17 Site #: 4

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	42	+	F
Oligochaeta	8	+	T
Erpobdellidae	0	+	MT
Caecidotea sp	0	+	T
Gammarus sp	77	+	F
Orconectes sp	0	+	F
Hydrachnidia	0	+	F
Plauditus dubius or P. virilis	2		I
Baetis intercalaris	75	+	F
Isonychia sp	25	+	MI
Stenacron sp	101	+	F
Maccaffertium exiguum	20		MI
Maccaffertium mediopunctatum	18		MI
Maccaffertium pulchellum	20	+	MI
Maccaffertium terminatum	18		MI
Teloganopsis deficiens	25	+	I
Tricorythodes sp	33	+	MI
Climacia sp	0	+	F
Lype diversa	1		MI
Polycentropus sp	3	+	MI
Cheumatopsyche sp	233	+	F
Hydropsyche phalerata	25		MI
Hydropsyche venularis	1		MI
Macrostemum zebratum	12	+	I
Hydroptila sp	22		F
Helicopsyche borealis	0	+	MI
Oecetis persimilis	1	+	MI
Psephenus herricki	0	+	MI
Stenelmis sp	0	+	F
Ablabesmyia mallochi	0	+	F
Hayesomyia senata or Thienemannimyia norena	3		F
Labrundinia pilosella	4		F
Pentaneura inconspicua	8		F
Cricotopus (C.) bicinctus	84	+	T
Cricotopus (Isocladius) intersectus group	3		MT
Nanocladius sp	3		F
Thienemanniella xena	6		F
Tvetenia discoloripes group	10		MI
Dicrotendipes neomodestus	13	+	F
Dicrotendipes lucifer	3		MT
Glyptotendipes (G.) sp	21		MT
Parachironomus sp	0	+	MT
Polypedilum (Uresipedilum) flavum	39		F
Stenochironomus sp	3		F
Rheotanytarsus sp	13		F
Hemerodromia sp	2		F
Elimia sp	0	+	MI
Physella sp	0	+	T
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	36
No. of Qualitative Taxa:	28
Total Taxa:	49
No. of Organisms	977
Qualitative EPT:	11
ICI:	**40**

St. Joseph River - Angela Blvd
Date Collected: 8/9/17 Site #: 6

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	82	+	F
Oligochaeta	17	+	T
Erpobdella sp	0	+	MT
Caecidotea sp	0	+	T
Gammarus sp	0	+	F
Orconectes sp	0	+	F
Hydrachnidia	1		F
Plauditus dubius or P. virilis	51	+	I
Baetis flavistriga	3		F
Baetis intercalaris	473	+	F
Labiobaetis propinquus	0	+	MI
Procloeon sp (w/ hindwing pads)	0	+	MI
Isonychia sp	141	+	MI
Stenacron sp	10	+	F
Maccaffertium exiguum	165	+	MI
Maccaffertium mexicanum integrum	5		MI
Maccaffertium pulchellum	38		MI
Teloganopsis deficiens	125	+	I
Tricorythodes sp	26	+	MI
Argia sp	0	+	F
Neoplea sp	0	+	F
Chimarra obscura	7	+	MI
Polycentropus sp	2	+	MI
Cheumatopsyche sp	649	+	F
Hydropsyche frisoni	2		MI
Hydropsyche phalerata	259		MI
Macrostemum zebratum	43	+	I
Hydroptila sp	29		F
Brachycentrus numerosus	2	+	MI
Neophylax sp	0	+	MI
Pycnopsyche sp	0	+	MI
Lepidostoma sp	0	+	MI
Ceraclea spongillovorax	1	+	MI
Peltodytes sp	0	+	MT
Psephenus herricki	0	+	MI

Taxa Name	Quantitative	Qualitative	Tol.
Ancyronyx variegata	0	+	F
Macronychus glabratus	2	+	F
Stenelmis sp	0	+	F
Simulium sp	28		F
Hayesomyia senata or Thienemannimyia norena	3		F
Rheopelopia paramaculipennis	2		MI
Corynoneura sp	1		
Cricotopus (C.) bicinctus	1	+	T
Thienemanniella xena	6		F
Tvetenia discoloripes group	35		MI
Dicrotendipes neomodestus	1		F
Polypedilum (Uresipedilum) flavum	4		F
Polypedilum (P.) illinoense	5	+	T
Polypedilum (Tripodura) scalaenum group	1		F
Stenochironomus sp	3		F
Rheotanytarsus sp	21		F
Elimia sp	0	+	MI
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	36
No. of Qualitative Taxa:	35
Total Taxa:	53
No. of Organisms	2244
Qualitative EPT:	18
ICI:	**56**

St. Joseph River - Darden Road
Date Collected: 8/9/17 Site #: 8

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	64	+	F
Oligochaeta	29	+	T
Erpobdella microstoma	0	+	MT
Caecidotea sp	0	+	T
Hyalella azteca	0	+	F
Crangonyx sp	0	+	MT
Gammarus sp	0	+	F
Plauditus dubius or P. virilis	0	+	I
Baetis intercalaris	635	+	F
Isonychia sp	138		MI
Stenacron sp	72	+	F
Maccaffertium exiguum	133		MI
Maccaffertium pulchellum	66		MI
Maccaffertium terminatum	0	+	MI
Teloganopsis deficiens	90		I
Tricorythodes sp	80	+	MI
Coenagrionidae	0	+	T
Argia sp	10		F
Boyeria vinosa	0	+	F
Belostoma sp	0	+	T
Ranatra sp	0	+	F
Neoplea sp	0	+	F
Chimarra obscura	31		MI
Cyrnellus fraternus	4		F
Neureclipsis sp	3		MI
Polycentropus sp	1	+	MI
Cheumatopsyche sp	265	+	F
Ceratopsyche morosa group	11		MI
Hydropsyche bidens or H. orris	3		MI
Hydropsyche phalerata	339	+	MI
Hydropsyche simulans	1		MI
Macrostemum zebratum	77	+	I
Protoptila sp	0	+	I
Hydroptilidae	8		F
Brachycentrus numerosus	69	+	MI
Neophylax sp	0	+	MI
Pycnopsyche sp	0	+	MI
Lepidostoma sp	25	+	MI
Helicopsyche borealis	0	+	MI
Ceraclea sp	1		MI
Triaenodes injustus	0	+	MI
Haliplus sp	0	+	MT
Psephenus herricki	0	+	MI

Taxa Name	Quantitative	Qualitative	Tol.
Ancyronyx variegata	0	+	F
Macronychus glabratus	9	+	F
Stenelmis sp	13	+	F
Anopheles sp	0	+	F
Simulium sp	8	+	F
Ablabesmyia rhamphe group	0	+	MT
Hayesomyia senata or Thiene-mannimyia norena	2		F
Nilotanypus fimbriatus	7		F
Pentaneura inconspicua	4		F
Rheopelopia paramaculipennis	1		MI
Corynoneura lobata	5		F
Cricotopus (C.) bicinctus	7		T
Cricotopus (C.) or Orthocladius (O.) sp	1		
Thienemanniella xena	15		F
Tvetenia discoloripes group	33		MI
Dicrotendipes simpsoni	1		T
Polypedilum (Uresipedilum) flavum	30		F
Polypedilum (P.) illinoense	10	+	T
Polypedilum (Tripodura) halter-ale group	0	+	MT
Tribelos jucundum	0	+	MT
Rheotanytarsus pellucidus	1		MI
Rheotanytarsus sp	1		F
Hemerodromia sp	9		F
Valvata bicarinata	0	+	
Hydrobiidae	0	+	F
Elimia sp	9	+	MI
Physella sp	0	+	T
Planorbella sp	0	+	T
Ferrissia sp	9		F
Corbicula fluminea	0	+	F
Dreissena polymorpha	0	+	F

No. of Quantitative Taxa:	44
No. of Qualitative Taxa:	46
Total Taxa:	74
No. of Organisms	2330
Qualitative EPT:	16
ICI:	**50**

Trout Creek - CR2
Date Collected: 8/4/17 Site #: 9

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	49	+	F
Oligochaeta	0	+	T
Gammarus sp	8	+	F
Orconectes sp	0	+	F
Baetis flavistriga	0	+	F
Baetis intercalaris	59	+	F
Iswaeon anoka	2	+	MI
Stenacron sp	25	+	F
Maccaffertium exiguum	80	+	MI
Maccaffertium mediopunctatum	52	+	MI
Maccaffertium terminatum	67	+	MI
Teloganopsis deficiens	5		I
Tricorythodes sp	23	+	MI
Hetaerina sp	0	+	F
Boyeria vinosa	0	+	F
Ophiogomphus sp	0	+	MI
Acroneuria abnormis	3		MI
Agnetina capitata complex	1	+	MI
Ranatra sp	0	+	F
Corydalus cornutus	6	+	MI
Chimarra obscura	13	+	MI
Neureclipsis sp	14		MI
Polycentropus sp	0	+	MI
Cheumatopsyche sp	61	+	F
Ceratopsyche morosa group	1		MI
Ceratopsyche sparna	4		F
Hydropsyche depravata group	43	+	F
Hydropsyche venularis	0	+	MI
Macrostemum zebratum	61	+	I
Lepidostoma sp	9	+	MI
Helicopsyche borealis	4	+	MI
Dineutus sp	1		F
Liodessus sp	0	+	MT
Psephenus herricki	1	+	MI
Scirtidae	0	+	F
Macronychus glabratus	1		F

Taxa Name	Quantitative	Qualitative	Tol.
Optioservus sp	0	+	MI
Stenelmis sp	0	+	F
Dixella sp	0	+	F
Anopheles sp	0	+	F
Simulium sp	0	+	F
Nilotanypus fimbriatus	10	+	F
Pentaneura inconspicua	8		F
Corynoneura sp 12	8	+	MI
Corynoneura lobata	24		F
Rheocricotopus (Psilocricotopus) robacki	9	+	F
Thienemanniella taurocapita	5		MI
Thienemanniella xena	25		F
Cryptochironomus sp	0	+	F
Demicryptochironomus sp	0	+	MI
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	0	+	MI
Polypedilum (Uresipedilum) flavum	87		F
Polypedilum (P.) fallax group	0	+	F
Polypedilum (P.) illinoense	0	+	T
Polypedilum (Tripodura) scalaenum group	0	+	F
Rheotanytarsus sp	14		F
Tanytarsus glabrescens group sp 7	7		F
Tabanidae	0	+	F
Hemerodromia sp	5		F
Campeloma decisum	0	+	F
Physella sp	0	+	T
Ferrissia sp	18		F
Laevapex fuscus	4		MT
Corbicula fluminea	0	+	F
Sphaerium sp	0	+	F
No. of Quantitative Taxa:	38		
No. of Qualitative Taxa:	48		
Total Taxa:	65		
No. of Organisms	817		
Qualitative EPT:	17		
ICI:	**50**		

Little Elkhart River - SR 120
Date Collected: 8/14/17 Site #: 10

Taxa Name	Quantitative	Qualitative	Tol.
Oligochaeta	8	+	T
Caecidotea sp	0	+	T
Gammarus sp	42	+	F
Hydrachnidia	0	+	F
Baetis flavistriga	58	+	F
Baetis intercalaris	3		F
Labiobaetis propinquus	0	+	MI
Isonychia sp	3		MI
Leucrocuta sp	0	+	MI
Stenacron sp	22	+	F
Maccaffertium exiguum	56	+	MI
Maccaffertium terminatum	88	+	MI
Maccaffertium vicarium	6	+	MI
Teloganopsis deficiens	0	+	I
Tricorythodes sp	0	+	MI
Coenagrionidae	1		T
Dromogomphus sp	0	+	F
Ophiogomphus sp	0	+	MI
Pteronarcys sp	2	+	MI
Acroneuria abnormis	1		MI
Paragnetina sp	3	+	MI
Perlesta placida complex	1	+	F
Lype diversa	22	+	MI
Cheumatopsyche sp	24	+	F
Ceratopsyche morosa group	14	+	MI
Ceratopsyche sparna	12	+	F
Glossosoma sp	0	+	MI
Brachycentrus numerosus	4	+	MI
Neophylax sp	0	+	MI
Pycnopsyche sp	2	+	MI
Helicopsyche borealis	0	+	MI
Nectopsyche diarina	0	+	MI
Oecetis sp	1		F
Ancyronyx variegata	0	+	F
Macronychus glabratus	16	+	F
Optioservus sp	0	+	MI
Stenelmis sp	0	+	F
Antocha sp	4	+	MI
Dixella sp	0	+	F
Simulium sp	1		F
Meropelopia sp	1		F
Nilotanypus fimbriatus	12		F
Thienemannimyia group	12		F
Pagastia sp	0	+	F
Corynoneura sp	37		
Cricotopus (C.) sp	1	+	F
Cricotopus (C.) bicinctus	6	+	T
Cricotopus (C.) or Orthocladius (O.) sp	8		
Nanocladius (N.) crassicornus or N. (N.) "rectinervis"	1		F
Orthocladius (Symposiocladius) lignicola	12		MI
Paratrichocladius sp	0	+	MI
Rheocricotopus (Psilocricotopus) robacki	8		F
Thienemanniella sp	42		
Thienemanniella xena	84		F
Tvetenia bavarica group	40	+	MI
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	4	+	MI
Microtendipes rydalensis	3		MI
Paratendipes albimanus or P. duplicatus	0	+	F
Polypedilum (Uresipedilum) flavum	13		F
Polypedilum (P.) fallax group	5		F
Polypedilum (P.) illinoense	0	+	T
Polypedilum (Tripodura) scalaenum group	13	+	F
Stictochironomus sp	0	+	F
Paratanytarsus sp	3		F
Rheotanytarsus pellucidus	13	+	MI
Rheotanytarsus sp	35		F
Tanytarsus sepp	1		F
Empididae	7	+	F
Elimia sp	5	+	MI
Laevapex fuscus	22		MT
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	49
No. of Qualitative Taxa:	48
Total Taxa:	71
No. of Organisms	782
Qualitative EPT:	22
ICI:	**46**

Puterbaugh Creek - Reedy Drive
Date Collected: 8/7/17 Site #: 12

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	0	+	F
Oligochaeta	29	+	T
Gammarus sp	20	+	F
Hydrachnidia	8		F
Baetis tricaudatus	1		MI
Baetis flavistriga	29	+	F
Baetis intercalaris	28		F
Stenacron sp	152	+	F
Maccaffertium exiguum	0	+	MI
Caenis sp	1		F
Calopteryx sp	5	+	F
Boyeria vinosa	1	+	F
Lype diversa	14		MI
Cheumatopsyche sp	109	+	F
Hydropsyche depravata group	11		F
Neophylax sp	0	+	MI
Pycnopsyche sp	0	+	MI
Molanna sp	0	+	MI
Helicopsyche borealis	0	+	MI
Triaenodes injustus	0	+	MI
Macronychus glabratus	12	+	F
Stenelmis sp	0	+	F
Simulium sp	0	+	F
Conchapelopia sp	51		F
Helopelopia sp	29		F
Nilotanypus fimbriatus	12		F
Procladius (Holotanypus) sp	0	+	MT
Thienemannimyia group	0	+	F
Corynoneura sp 12	16		MI
Corynoneura lobata	76		F
Thienemanniella lobapodema	8		F
Thienemanniella xena	4		F
Cryptochironomus sp	0	+	F
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	0	+	MI
Microtendipes pedellus group	59	+	F
Paratendipes albimanus or P. duplicatus	0	+	F
Polypedilum (Uresipedilum) flavum	35		F
Polypedilum (P.) fallax group	15	+	F
Polypedilum (Tripodura) scalaenum group	0	+	F
Cladotanytarsus vanderwulpi group sp 3	0	+	MI
Rheotanytarsus sp	262	+	F
Tanytarsus sp	10		F
Chrysops sp	0	+	F
Hemerodromia sp	13	+	F
Elimia sp	7	+	MI
Ferrissia sp	44	+	F
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	29
No. of Qualitative Taxa:	32
Total Taxa:	47
No. of Organisms	1061
Qualitative EPT:	9
ICI:	**46**

Christiana Creek - CR 6
Date Collected: 8/7/17 Site #: 13

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	73	+	F	Simulium sp	0	+	F
Nemertea	2		F	Conchapelopia sp	0	+	F
Oligochaeta	1	+	T	Helopelopia sp	13		F
Caecidotea sp	0	+	T	Nilotanypus fimbriatus	6		F
Gammarus sp	8	+	F	Pentaneura inconspicua	1		F
Hydrachnidia	0	+	F	Rheopelopia paramaculipennis	1		MI
Baetis tricaudatus	0	+	MI	Corynoneura sp	5		
Plauditus dubius or P. virilis	9	+	I	Corynoneura lobata	14	+	F
Baetis flavistriga	17	+	F	Cricotopus (C.) sp	17		F
Baetis intercalaris	52	+	F	Cricotopus (C.) bicinctus	12		T
Iswaeon anoka	0	+	MI	Nanocladius (N.) crassicornus or N. (N.) "rectinervis"	0	+	F
Isonychia sp	0	+	MI	Orthocladius (O.) sp	1		F
Nixe sp	0	+	MI	Parametriocnemus sp	2		F
Stenacron sp	26	+	F	Rheocricotopus (Psilocricotopus) robacki	6		F
Maccaffertium exiguum	29	+	MI	Thienemanniella taurocapita	67		MI
Maccaffertium mediopunctatum	76	+	MI	Thienemanniella xena	6	+	F
Maccaffertium pulchellum	6	+	MI	Tvetenia discoloripes group	1		MI
Teloganopsis deficiens	17	+	I	Cryptochironomus sp	0	+	F
Tricorythodes sp	49	+	MI	Dicrotendipes neomodestus	5		F
Caenis sp	0	+	F	Microtendipes "caelum" (sensu Simpson & Bode, 1980)	2	+	MI
Baetisca sp	0	+	MI	Paracladopelma sp	0	+	
Hetaerina sp	0	+	F	Phaenopsectra flavipes	5		MT
Coenagrionidae	0	+	T	Polypedilum (Uresipedilum) flavum	12	+	F
Argia sp	2	+	F	Polypedilum (P.) fallax group	2		F
Acroneuria abnormis	3	+	MI	Polypedilum (P.) illinoense	1		T
Corydalus cornutus	5	+	MI	Polypedilum (Tripodura) scalaenum group	0	+	F
Neureclipsis sp	0	+	MI	Stenochironomus sp	1		F
Polycentropus sp	1		MI	Cladotanytarsus sp	0	+	
Cheumatopsyche sp	7	+	F	Cladotanytarsus vanderwulpi group sp 3	0	+	MI
Ceratopsyche morosa group	1	+	MI	Rheotanytarsus sp	31	+	F
Ceratopsyche sparna	0	+	F	Hemerodromia sp	13	+	F
Hydropsyche phalerata	2	+	MI	Hydrobiidae	7	+	F
Protoptila sp	3		I	Elimia sp	17	+	MI
Hydroptila sp	27		F	Physella sp	0	+	T
Pycnopsyche sp	0	+	MI	Menetus (Micromenetus) dilatatus	8		MT
Lepidostoma sp	0	+	MI	Planorbella (Pierosoma) pilsbryi	0	+	T
Helicopsyche borealis	8	+	MI	Ferrissia sp	68		F
Oecetis avara	8	+	I	Dreissena polymorpha	0	+	F
Petrophila sp	44		MI	Sphaerium sp	2	+	F
Dineutus sp	0	+	F	No. of Quantitative Taxa:	57		
Psephenus herricki	5	+	MI	No. of Qualitative Taxa:	58		
Macronychus glabratus	12		F	Total Taxa:	84		
Optioservus trivittatus	0	+	MI	No. of Organisms	825		
Stenelmis sp	5	+	F	Qualitative EPT:	25		
Antocha sp	1		MI	**ICI:**	**44**		

Christiana Creek - Willowdale Park

Date Collected: 8/3/17 Site #: 14

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	2	+	F
Nemertea	2		F
Oligochaeta	6		T
Caecidotea sp	0	+	T
Gammarus sp	14	+	F
Acentrella turbida	3		I
Plauditus dubius or P. virilis	0	+	I
Baetis flavistriga	3	+	F
Baetis intercalaris	88	+	F
Iswaeon anoka	0	+	MI
Maccaffertium exiguum	151	+	MI
Maccaffertium mediopunctatum	35	+	MI
Maccaffertium pulchellum	0	+	MI
Teloganopsis deficiens	36	+	I
Tricorythodes sp	0	+	MI
Hetaerina sp	0	+	F
Sialis sp	2		MT
Corydalus cornutus	1	+	MI
Climacia sp	0	+	F
Chimarra obscura	0	+	MI
Neureclipsis sp	1	+	MI
Cheumatopsyche sp	20	+	F
Ceratopsyche morosa group	14		MI
Ceratopsyche sparna	28	+	F
Hydropsyche depravata group	25		F
Hydropsyche frisoni	0	+	MI
Hydropsyche phalerata	6	+	MI
Hydroptila sp	8	+	F
Leucotrichia pictipes	45	+	MI
Brachycentrus numerosus	0	+	MI
Goera sp	0	+	MI
Neophylax sp	0	+	MI
Pycnopsyche sp	0	+	MI
Helicopsyche borealis	0	+	MI
Oecetis cinerascens	0	+	F
Oecetis persimilis	2	+	MI

Taxa Name	Quantitative	Qualitative	Tol.
Dineutus sp	0	+	F
Psephenus herricki	2	+	MI
Scirtidae	0	+	F
Macronychus glabratus	17	+	F
Optioservus ampliatus	0	+	MI
Stenelmis sp	0	+	F
Simulium sp	200		F
Conchapelopia sp	12		F
Cardiocladius obscurus	21		MI
Corynoneura sp	4		
Cricotopus (C.) bicinctus	6		T
Parametriocnemus sp	3		F
Thienemanniella xena	8		F
Tvetenia discoloripes group	39	+	MI
Dicrotendipes neomodestus	3		F
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	0	+	MI
Polypedilum (Uresipedilum) flavum	3		F
Polypedilum (P.) illinoense	3		T
Cladotanytarsus vanderwulpi group sp 3	0	+	MI
Rheotanytarsus pellucidus	6		MI
Rheotanytarsus sp	139		F
Hemerodromia sp	15		F
Elimia sp	11	+	MI
Ferrissia sp	23		F
Corbicula fluminea	0	+	F
Dreissena polymorpha	0	+	F

No. of Quantitative Taxa:	39
No. of Qualitative Taxa:	42
Total Taxa:	62
No. of Organisms	1007
Qualitative EPT:	24
ICI:	**46**

Elkhart River - CR 18 (Hively Ave)

Date Collected: 8/14/17 Site #: 15

Taxa Name	Quantitative	Qualitative	Tol.	Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F	Macronychus glabratus	15	+	F
Turbellaria	4	+	F	Optioservus sp	0	+	MI
Oligochaeta	0	+	T	Stenelmis sp	4	+	F
Caecidotea sp	2	+	T	Anopheles sp	0	+	F
Gammarus sp	54	+	F	Nilotanypus fimbriatus	2		F
Orconectes sp	0	+	F	Rheopelopia paramaculipennis	2		MI
Hydrachnidia	0	+	F	Corynoneura lobata	6		F
Baetis flavistriga	3	+	F	Cricotopus (C.) bicinctus	2		T
Baetis intercalaris	3	+	F	Parametriocnemus sp	2		F
Iswaeon anoka	0	+	MI	Rheocricotopus (Psilocricotopus) robacki	5		F
Isonychia sp	2		MI	Thienemanniella xena	2		F
Leucrocuta sp	0	+	MI	Tvetenia bavarica group	2		MI
Stenacron sp	26	+	F	Xylotopus par	0	+	MI
Maccaffertium exiguum	18		MI	Glyptotendipes (G.) sp	1		MT
Maccaffertium mediopunctatum	18	+	MI	Microtendipes "caelum" (sensu Simpson & Bode, 1980)	0	+	MI
Maccaffertium pulchellum	32	+	MI	Microtendipes pedellus group	0	+	F
Maccaffertium terminatum	10	+	MI	Polypedilum (Uresipedilum) flavum	4		F
Teloganopsis deficiens	4		I	Polypedilum (P.) fallax group	5		F
Tricorythodes sp	1	+	MI	Polypedilum (P.) illinoense	0	+	T
Ephemera sp	0	+	MI	Polypedilum (Tripodura) scalaenum group	0	+	F
Coenagrionidae	0	+	T	Stenochironomus sp	6		F
Argia sp	0	+	F	Tribelos fuscicorne	0	+	F
Neurocordulia sp	0	+	F	Cladotanytarsus vanderwulpi group sp 3	0	+	MI
Plecoptera	2			Rheotanytarsus pellucidus	4		MI
Pteronarcys sp	1	+	MI	Rheotanytarsus sp	93		F
Acroneuria abnormis	0	+	MI	Hemerodromia sp	1		F
Agnetina capitata complex	0	+	MI	Hydrobiidae	1	+	F
Corydalus cornutus	0	+	MI	Elimia sp	83	+	MI
Climacia sp	0	+	F	Planorbella (Pierosoma) pilsbryi	0	+	T
Lype diversa	2		MI	Corbicula fluminea	0	+	F
Cheumatopsyche sp	71	+	F	Dreissena polymorpha	0	+	F
Ceratopsyche morosa group	51	+	MI	Actinonaias ligamentina carinata	0	+	MI
Ceratopsyche sparna	2	+	F	No. of Quantitative Taxa:	40		
Brachycentrus numerosus	4		MI	No. of Qualitative Taxa:	49		
Neophylax sp	0	+	MI	Total Taxa:	71		
Pycnopsyche sp	0	+	MI	No. of Organisms	552		
Nectopsyche diarina	0	+	MI	Qualitative EPT:	19		
Psephenus herricki	0	+	MI	**ICI:**	**48**		
Ancyronyx variegata	2		F				

Elkhart River - Studebaker Golf Course

Date Collected: 8/16/17 Site #: 16

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	1		F
Oligochaeta	1	+	T
Placobdella ornata	0	+	MT
Caecidotea sp	0	+	T
Hyalella azteca	0	+	F
Gammarus sp	3	+	F
Orconectes sp	0	+	F
Hydrachnidia	0	+	F
Baetis tricaudatus	2		MI
Baetis flavistriga	6	+	F
Baetis intercalaris	25	+	F
Isonychia sp	6	+	MI
Leucrocuta sp	0	+	MI
Stenacron sp	6		F
Maccaffertium exiguum	21	+	MI
Maccaffertium mediopunctatum	1	+	MI
Maccaffertium pulchellum	20	+	MI
Maccaffertium terminatum	10	+	MI
Teloganopsis deficiens	1	+	I
Tricorythodes sp	5	+	MI
Calopteryx sp	0	+	F
Argia sp	0	+	F
Boyeria vinosa	0	+	F
Dromogomphus sp	0	+	F
Neurocordulia sp	0	+	F
Plecoptera	1	+	
Pteronarcys sp	0	+	MI
Acroneuria lycorias	1		I
Neoperla clymene complex	2		I
Agnetina capitata complex	1		MI
Corydalus cornutus	1	+	MI
Cyrnellus fraternus	1		F
Cheumatopsyche sp	18	+	F
Ceratopsyche morosa group	24	+	MI
Ceratopsyche sparna	10	+	F
Brachycentrus numerosus	0	+	MI
Neophylax sp	0	+	MI
Pycnopsyche sp	0	+	MI
Lepidostoma sp	1	+	MI
Nectopsyche diarina	0	+	MI
Tropisternus sp	0	+	T
Psephenus herricki	0	+	MI
Ancyronyx variegata	1		F
Dubiraphia vittata group	0	+	F
Macronychus glabratus	11		F
Optioservus sp	0	+	MI
Stenelmis sp	0	+	F
Anopheles sp	0	+	F
Simulium sp	0	+	F
Ablabesmyia janta	0	+	F
Pentaneura inconspicua	0	+	F
Corynoneura lobata	2		F
Cricotopus (C.) bicinctus	4	+	T
Parametriocnemus sp	2		F
Rheocricotopus (Psilocricotopus) robacki	1		F
Tvetenia bavarica group	3	+	MI
Tvetenia discoloripes group	2		MI
Paratendipes albimanus or P. duplicatus	0	+	F
Polypedilum (Uresipedilum) flavum	1	+	F
Polypedilum (P.) fallax group	2		F
Polypedilum (P.) illinoense	0	+	T
Stenochironomus sp	15		F
Rheotanytarsus sp	46		F
Empididae	1		F
Elimia sp	15	+	MI
Physella sp	0	+	T
Corbicula fluminea	0	+	F
Dreissena polymorpha	0	+	F
Actinonaias ligamentina carinata	0	+	MI

No. of Quantitative Taxa:	38
No. of Qualitative Taxa:	52
Total Taxa:	69
No. of Organisms	274
Qualitative EPT:	20
ICI:	**48**

Yellow Creek - US 20 Bypass

Date Collected: 8/01/17 Site #: 18

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	12	+	F
Oligochaeta	8	+	T
Erpobdella punctata punctata	0	+	MT
Caecidotea sp	9	+	T
Gammarus sp	13	+	F
Hydrachnidia	0	+	F
Baetis tricaudatus	23	+	MI
Baetis flavistriga	209	+	F
Baetis intercalaris	23		F
Stenacron sp	7	+	F
Calopterygidae	0	+	F
Boyeria vinosa	0	+	F
Notonecta sp	0	+	T
Cheumatopsyche sp	136	+	F
Ceratopsyche morosa group	130	+	MI
Ceratopsyche sparna	103	+	F
Hydropsyche depravata group	268	+	F
Hydrochus sp	0	+	MT
Staphylinidae	0	+	F
Scirtidae	0	+	F
Ancyronyx variegata	8	+	F
Dubiraphia vittata group	0	+	F
Macronychus glabratus	18	+	F
Optioservus sp	0	+	MI
Stenelmis sp	0	+	F
Antocha sp	2	+	MI
Pilaria sp	0	+	F
Tipula sp	0	+	F
Simulium sp	1	+	F
Conchapelopia sp	18	+	F
Corynoneura lobata	8		F
Cricotopus (C.) bicinctus	18		T
Cricotopus (C.) tremulus group	18	+	MT
Rheocricotopus (Psilocricotopus) robacki	18		F
Tvetenia sp	18		MI
Microtendipes pedellus group	0	+	F
Paratendipes albimanus or P. duplicatus	0	+	F
Polypedilum (Uresipedilum) flavum	91	+	F
Polypedilum (P.) fallax group	0	+	F
Polypedilum (P.) illinoense	18	+	T
Polypedilum (Tripodura) scalaenum group	0	+	F
Stictochironomus sp	0	+	F
Cladotanytarsus vanderwulpi group sp 4	0	+	MI
Rheotanytarsus sp	1551		F
Tanytarsus sp	0	+	F
Tanytarsus glabrescens group sp 7	36		F
Tanytarsus sepp	0	+	F
Physella sp	0	+	T
Planorbidae	1		MT
Ferrissia sp	26		F
Pisidium sp	0	+	MT

No. of Quantitative Taxa:	28
No. of Qualitative Taxa:	42
Total Taxa:	51
No. of Organisms	2791
Qualitative EPT:	7
ICI:	**42**

Baugo Creek - Restoration Site
Date Collected: 8/3/17 Site #: 20

Taxa Name	Quantitative	Qualitative	Tol.
Hydra sp	8		F
Turbellaria	5	+	F
Nemertea	2		F
Oligochaeta	16	+	T
Erpobdella punctata punctata	0	+	MT
Caecidotea sp	0	+	T
Crangonyx sp	0	+	MT
Gammarus sp	8	+	F
Orconectes sp	0	+	F
Hydrachnidia	8	+	F
Baetis tricaudatus	0	+	MI
Baetis flavistriga	76	+	F
Baetis intercalaris	447		F
Iswaeon anoka	0	+	MI
Stenacron sp	1	+	F
Maccaffertium exiguum	3		MI
Caenis sp	0	+	F
Hetaerina sp	0	+	F
Boyeria vinosa	0	+	F
Corixidae	0	+	F
Cheumatopsyche sp	215	+	F
Ceratopsyche morosa group	407	+	MI
Hydropsyche depravata group	129	+	F
Oecetis persimilis	0	+	MI
Peltodytes sp	0	+	MT
Liodessus sp	0	+	MT
Tropisternus sp	0	+	T
Scirtidae	0	+	F
Ancyronyx variegata	0	+	F
Dubiraphia vittata group	0	+	F
Tipula sp	0	+	F
Anopheles sp	0	+	F
Simulium sp	18	+	F
Conchapelopia sp	11		F
Nilotanypus fimbriatus	3		F
Corynoneura caudicula	8		F
Corynoneura lobata	8		F
Cricotopus (C.) bicinctus	11	+	T
Cricotopus (C.) tremulus group	0	+	MT
Psectrocladius (P.) sordidellus group	5	+	
Rheocricotopus (Psilocricotopus) robacki	54		F
Thienemanniella lobapodema	8		F
Tvetenia bavarica group	49	+	MI
Tvetenia discoloripes group	0	+	MI
Chironomus (C.) decorus group	0	+	T
Cryptotendipes pseudotener	0	+	F
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	0	+	MI
Microtendipes pedellus group	5	+	F
Paratendipes albimanus or P. duplicatus	0	+	F
Phaenopsectra obediens group	0	+	F
Polypedilum (Uresipedilum) aviceps	11		MI
Polypedilum (Uresipedilum) flavum	104		F
Polypedilum (P.) illinoense	22	+	T
Polypedilum (Tripodura) scalaenum group	0	+	F
Stictochironomus sp	0	+	F
Rheotanytarsus pellucidus	71	+	MI
Rheotanytarsus sp	163		F
Tanytarsus sp	5	+	F
Tanytarsus glabrescens group sp 7	11	+	F
Stratiomys sp	0	+	MT
Hemerodromia sp	1		F
Elimia sp	1	+	MI
Physella sp	0	+	T
Ferrissia sp	14		F
Bivalvia	2		
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	35
No. of Qualitative Taxa:	50
Total Taxa:	66
No. of Organisms	1910
Qualitative EPT:	9
ICI:	**40**

Auten Ditch - Locust Road (S)
Date Collected: 8/8/17 Site #: 24

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	40	+	F
Plumatella sp	1		F
Oligochaeta	108	+	T
Caecidotea sp	0	+	T
Gammarus sp	246	+	F
Hydrachnidia	0	+	F
Baetis tricaudatus	67	+	MI
Baetis flavistriga	17	+	F
Baetis intercalaris	2		F
Calopteryx sp	28	+	F
Coenagrionidae	0	+	T
Nepa apiculata	0	+	MT
Lype diversa	1		MI
Cheumatopsyche sp	62	+	F
Hydropsyche depravata group	44	+	F
Hydroptila sp	30		F
Scirtidae	0	+	F
Dubiraphia sp	0	+	F
Dubiraphia bivittata	0	+	F
Dubiraphia quadrinotata	1		F
Dubiraphia vittata group	3		F
Optioservus sp	0	+	MI
Optioservus fastiditus	4	+	MI
Stenelmis sp	4	+	F
Anopheles sp	0	+	F
Simulium sp	2		F
Conchapelopia sp	53	+	F
Helopelopia sp	0	+	F
Meropelopia sp	13	+	F
Procladius (Holotanypus) sp	0	+	MT
Zavrelimyia sp	0	+	F
Diamesa sp	0	+	F
Nanocladius (N.) spiniplenus	27		F
Parametriocnemus sp	13		F
Tvetenia bavarica group	0	+	MI
Cryptochironomus sp	0	+	F
Microtendipes pedellus group	517	+	F
Paratendipes albimanus or P. duplicatus	0	+	F
Phaenopsectra flavipes	0	+	MT
Polypedilum (Uresipedilum) aviceps	146	+	MI
Polypedilum (Uresipedilum) flavum	40		F
Polypedilum (P.) fallax group	0	+	F
Polypedilum (P.) illinoense	0	+	T
Polypedilum (Tripodura) scalaenum group	0	+	F
Stictochironomus sp	0	+	F
Paratanytarsus sp	66	+	F
Rheotanytarsus pellucidus	13	+	MI
Rheotanytarsus sp	146		F
Tanytarsus glabrescens group sp 7	13		F
Hemerodromia sp	17		F
Ferrissia sp	20		F

No. of Quantitative Taxa:	30
No. of Qualitative Taxa:	37
Total Taxa:	51
No. of Organisms	1744
Qualitative EPT:	4
ICI:	**34**

Bowman Creek - Gertrude St.

Date Collected: 8/8/17 Site #: 25

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	0	+	F
Oligochaeta	2	+	T
Erpobdella punctata punctata	0	+	MT
Erpobdella sp (= Mooreobdella)	0	+	MT
Gammarus sp	450	+	F
Orconectes sp	0	+	F
Baetis tricaudatus	0	+	MI
Stenacron sp	0	+	F
Hetaerina sp	29	+	F
Coenagrionidae	1		T
Boyeria vinosa	1	+	F
Chimarra obscura	0	+	MI
Cyrnellus fraternus	2		F
Cheumatopsyche sp	5	+	F
Hydropsyche depravata group	38	+	F
Dubiraphia sp	0	+	F
Macronychus glabratus	17	+	F
Optioservus sp	2	+	MI
Stenelmis sp	0	+	F
Tipula abdominalis	0	+	F
Conchapelopia sp	5		F
Helopelopia sp	10		F
Meropelopia sp	5	+	F
Diamesa sp	0	+	F
Corynoneura lobata	10		F
Parametriocnemus sp	25	+	F
Thienemanniella sp	2		
Tvetenia bavarica group	0	+	MI
Cryptochironomus sp	5		F
Glyptotendipes (G.) sp	10		MT
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	40		MI
Paratendipes albimanus or P. duplicatus	0	+	F
Phaenopsectra flavipes	10		MT
Polypedilum (Uresipedilum) aviceps	65	+	MI
Polypedilum (P.) fallax group	10		F
Stictochironomus sp	0	+	F
Paratanytarsus sp	15		F
Rheotanytarsus pellucidus	5		MI
Rheotanytarsus sp	206		F
Tanytarsus n. sp nr. curticornis	5		F
Tabanidae	0	+	F
Neoplasta sp	3		MI
Physella sp	5	+	T
Ferrissia sp	8		F

No. of Quantitative Taxa:	29
No. of Qualitative Taxa:	27
Total Taxa:	44
No. of Organisms	991
Qualitative EPT:	5
ICI:	**34**

Bowman Creek - Studebaker GC

Date Collected: 8/8/17 Site #:26

Taxa Name	Quantitative	Qualitative	Tol.
Spongillidae	0	+	F
Turbellaria	204	+	F
Nemertea	8		F
Oligochaeta	8	+	T
Gammarus sp	1	+	F
Hydrachnidia	16	+	F
Baetis flavistriga	209	+	F
Baetis intercalaris	21	+	F
Caenis sp	0	+	F
Argia sp	0	+	F
Cheumatopsyche sp	14	+	F
Hydropsyche depravata group	227	+	F
Hydroptila sp	152	+	F
Helicopsyche borealis	2		MI
Leptoceridae	0	+	
Oecetis sp	5		F
Peltodytes sp	0	+	MT
Macronychus glabratus	106		F
Optioservus sp	0	+	MI
Stenelmis sp	82	+	F
Dicranota sp	0	+	MI
Conchapelopia sp	189		F
Helopelopia sp	76		F
Nilotanypus fimbriatus	20		F
Thienemannimyia group	0	+	F
Cricotopus (C.) bicinctus	57	+	T
Cricotopus (C.) tremulus group	19	+	MT
Nanocladius (N.) crassicornus or N. (N.) "rectinervis"	19		F
Parametriocnemus sp	38		F
Cryptochironomus sp	0	+	F
Glyptotendipes (G.) sp	19		MT
Microtendipes pedellus group	38	+	F
Paratendipes albimanus or P. duplicatus	19	+	F
Phaenopsectra flavipes	114		MT
Polypedilum (Uresipedilum) flavum	397	+	F
Polypedilum (P.) fallax group	95		F
Stictochironomus sp	0	+	F
Paratanytarsus sp	587	+	F
Rheotanytarsus sp	132	+	F
Tanytarsus sp	0	+	F
Tanytarsus glabrescens group sp 7	38		F
Hemerodromia sp	65		F
Pisidiidae	4		

No. of Quantitative Taxa:	32
No. of Qualitative Taxa:	28
Total Taxa:	43
No. of Organisms	2981
Qualitative EPT:	7
ICI:	**40**

Juday Creek - Holy Cross Pkwy
Date Collected: 8/10/17 Site #: 28

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	11		F
Oligochaeta	24		T
Caecidotea sp	0	+	T
Gammarus sp	10	+	F
Hydrachnidia	9	+	F
Baetis tricaudatus	1	+	MI
Labiobaetis frondalis	0	+	MI
Iswaeon anoka	0	+	MI
Stenacron sp	18	+	F
Maccaffertium vicarium	0	+	MI
Tricorythodes sp	4		MI
Boyeria vinosa	1	+	F
Lype diversa	2		MI
Cheumatopsyche sp	278	+	F
Ceratopsyche sparna	59	+	F
Hydropsyche depravata group	81	+	F
Hydroptila sp	1	+	F
Brachycentrus numerosus	14	+	MI
Mystacides sp	4		MI
Nectopsyche diarina	0	+	MI
Triaenodes ignitus	1	+	MI
Sperchopsis tesselata	0	+	F
Scirtidae	1		F
Dubiraphia quadrinotata	0	+	F
Macronychus glabratus	1		F
Stenelmis sp	1		F
Dixella sp	0	+	F
Anopheles sp	0	+	F
Simulium sp	1	+	F
Conchapelopia sp	180		F
Meropelopia sp	20		F
Procladius (Holotanypus) sp	0	+	MT
Pagastia sp	0	+	F
Corynoneura lobata	80		F
Cricotopus (C.) or Orthocladius (O.) sp	0	+	
Parametriocnemus sp	80		F
Rheocricotopus (Psilocricotopus) robacki	80		F
Thienemanniella xena	16		F
Tvetenia bavarica group	60	+	MI
Cryptochironomus sp	0	+	F
Microtendipes "caelum" (sensu Simpson & Bode, 1980)	20		MI
Paratendipes albimanus or P. duplicatus	0	+	F
Polypedilum (Uresipedilum) aviceps	340	+	MI
Polypedilum (Uresipedilum) flavum	20		F
Polypedilum (P.) fallax group	140		F
Polypedilum (P.) illinoense	0	+	T
Polypedilum (P.) laetum group	0	+	MI
Polypedilum (Tripodura) scalaenum group	0	+	F
Stictochironomus sp	0	+	F
Cladotanytarsus vanderwulpi group sp 5	0	+	MI
Micropsectra sp	60	+	MT
Rheotanytarsus pellucidus	200		MI
Rheotanytarsus sp	300	+	F
Tanytarsus sp	40	+	F
Neoplasta sp	5		MI
Physella sp	0	+	T
Ferrissia sp	1		F
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	37
No. of Qualitative Taxa:	38
Total Taxa:	58
No. of Organisms	2164
Qualitative EPT:	12
ICI:	**44**

Juday Creek - Driftwood
Date Collected: 8/10/17 Site #: 29

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	143	+	F
Oligochaeta	8	+	T
Gammarus sp	146	+	F
Cambaridae	0	+	
Hydrachnidia	42	+	F
Baetis tricaudatus	2	+	MI
Baetis flavistriga	0	+	F
Baetis intercalaris	2		F
Stenacron sp	23	+	F
Maccaffertium vicarium	6		MI
Tricorythodes sp	1	+	MI
Boyeria vinosa	1	+	F
Cheumatopsyche sp	506	+	F
Ceratopsyche morosa group	41	+	MI
Hydropsyche depravata group	155	+	F
Hydroptila sp	5		F
Brachycentrus numerosus	4		MI
Lepidostoma sp	1	+	MI
Helicopsyche borealis	1		MI
Nectopsyche sp	3		MI
Oecetis sp	1		F
Anacaena sp	0	+	MT
Scirtidae	0	+	F
Tipula sp	1		F
Conchapelopia sp	774		F
Helopelopia sp	0	+	F
Procladius (Holotanypus) sp	0	+	MT
Pagastia orthogonia	0	+	F
Cricotopus (C.) bicinctus	55	+	T
Cricotopus (C.) tremulus group	166		MT
Parametriocnemus sp	221		F
Rheocricotopus (Psilocricotopus) robacki	221	+	F
Tvetenia bavarica group	55		MI
Tvetenia discoloripes group	166	+	MI
Chironomus (C.) decorus group	0	+	T
Cryptochironomus sp	0	+	F
Microtendipes pedellus group	221	+	F
Polypedilum (Uresipedilum) aviceps	55		MI
Polypedilum (Uresipedilum) flavum	609	+	F
Polypedilum (P.) illinoense	0	+	T
Stictochironomus sp	0	+	F
Rheotanytarsus sp	2600		F
Tanytarsus sp	55		F
Neoplasta sp	27		MI
Hemerodromia sp	3		F
Physella sp	2	+	T
Helisoma anceps anceps	0	+	F
Menetus (Micromenetus) dilatatus	1		MT
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	36
No. of Qualitative Taxa:	31
Total Taxa:	49
No. of Organisms	6323
Qualitative EPT:	8
ICI:	**44**

Juday Creek - Kintz Ave.

Date Collected: 8/10/17 Site #: 31

Taxa Name	Quantitative	Qualitative	Tol.
Gammarus sp	8	+	F
Orconectes sp	1		F
Hydrachnidia	1	+	F
Baetis flavistriga	1	+	F
Iswaeon anoka	0	+	MI
Stenacron sp	96	+	F
Maccaffertium exiguum	113	+	MI
Maccaffertium vicarium	65		MI
Teloganopsis deficiens	1		I
Caenis sp	0	+	F
Ephemera sp	13	+	MI
Calopteryx sp	0	+	F
Hetaerina sp	0	+	F
Coenagrionidae	0	+	T
Boyeria vinosa	1	+	F
Sialis sp	1	+	MT
Lype diversa	16		MI
Polycentropus sp	1		MI
Cheumatopsyche sp	101	+	F
Ceratopsyche morosa group	73	+	MI
Ceratopsyche sparna	14		F
Hydropsyche depravata group	8		F
Hydroptilidae	1		F
Brachycentrus numerosus	48	+	MI
Pycnopsyche sp	0	+	MI
Helicopsyche borealis	0	+	MI
Mystacides sp	0	+	MI
Nectopsyche diarina	0	+	MI
Oecetis persimilis	2		MI
Scirtidae	0	+	F
Macronychus glabratus	18		F
Stenelmis sp	39	+	F
Simulium sp	16		F
Clinotanypus pinguis	0	+	MT
Procladius (Holotanypus) sp	0	+	MT
Pagastia sp	0	+	F
Prodiamesa olivacea	0	+	MT
Cryptotendipes sp	0	+	F
Paratanytarsus sp	0	+	F
Rheotanytarsus pellucidus	0	+	MI
Rheotanytarsus sp	0	+	F
Neoplasta sp	1		MI
Hemerodromia sp	1		F
Elimia sp	1		MI
Physella sp	0	+	T
Ferrissia sp	214	+	F
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	27
No. of Qualitative Taxa:	33
Total Taxa:	47
No. of Organisms	855
Qualitative EPT:	13
ICI:	**38**

Juday Creek - Izaak Walton League

Date Collected: 8/10/17 Site #: 33

Taxa Name	Quantitative	Qualitative	Tol.
Turbellaria	91	+	F
Nemertea	4		F
Oligochaeta	5	+	T
Gammarus sp	8	+	F
Orconectes sp	0	+	F
Baetis tricaudatus	0	+	MI
Baetis flavistriga	32	+	F
Stenacron sp	7	+	F
Maccaffertium exiguum	50	+	MI
Maccaffertium pulchellum	20	+	MI
Maccaffertium vicarium	62	+	MI
Calopteryx sp	0	+	F
Boyeria vinosa	0	+	F
Chimarra obscura	9	+	MI
Lype diversa	5	+	MI
Polycentropus sp	1		MI
Cheumatopsyche sp	164	+	F
Ceratopsyche morosa group	3	+	MI
Ceratopsyche sparna	65	+	F
Hydropsyche depravata group	7	+	F
Brachycentrus numerosus	1	+	MI
Pycnopsyche sp	0	+	MI
Lepidostoma sp	11		MI
Oecetis persimilis	0	+	MI
Macronychus glabratus	31	+	F
Optioservus sp	18		MI
Stenelmis sp	31	+	F
Simulium sp	22	+	F
Pagastia sp	0	+	F
Parametriocnemus sp	0	+	F
Tvetenia bavarica group	0	+	MI
Polypedilum (Uresipedilum) flavum	0	+	F
Neoplasta sp	4		MI
Hemerodromia sp	2		F
Physella sp	1		T
Corbicula fluminea	0	+	F

No. of Quantitative Taxa:	25
No. of Qualitative Taxa:	29
Total Taxa:	36
No. of Organisms	654
Qualitative EPT:	15
ICI:	**42**

Appendix F
Aerial Site Location Maps

Site #1: St. Joseph River Toll Road (Bristol)

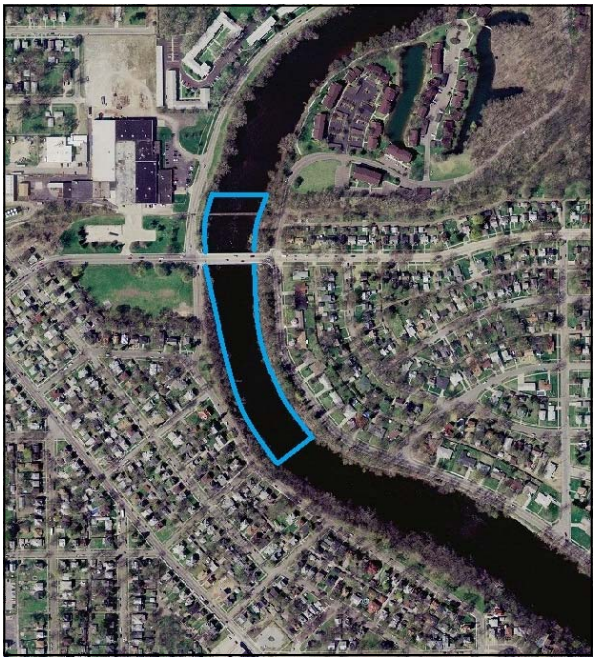
Site #2: St. Joseph River CR 17 (Six Span)

Site #3: St. Joseph River Bridge Street

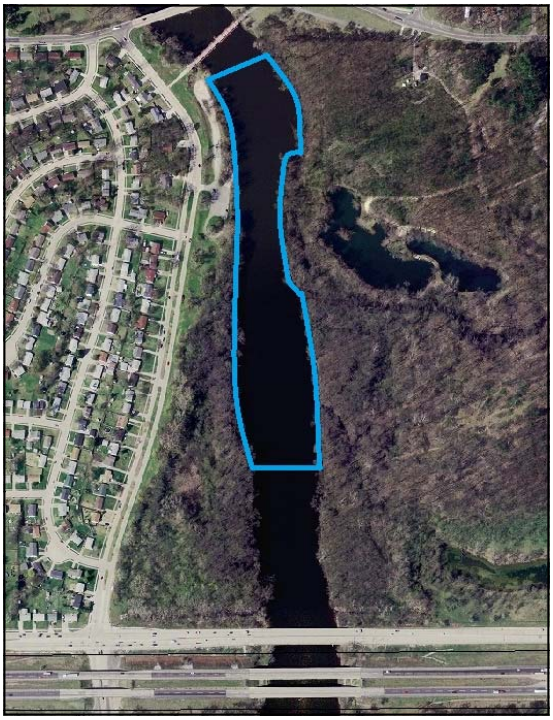
Site #4: St. Joseph River Ironwood Drive

Site #5: St. Joseph River—Dam Below

Site #6: St. Joseph River Angela Blvd



Site #7: St. Joseph River Sherman Avenue



Site #8: St. Joseph River Darden Road

Site #9: Trout Creek CR 2

Site #10: Little Elkhart River SR 120

Site #11: Pine Creek US 20 Bypass

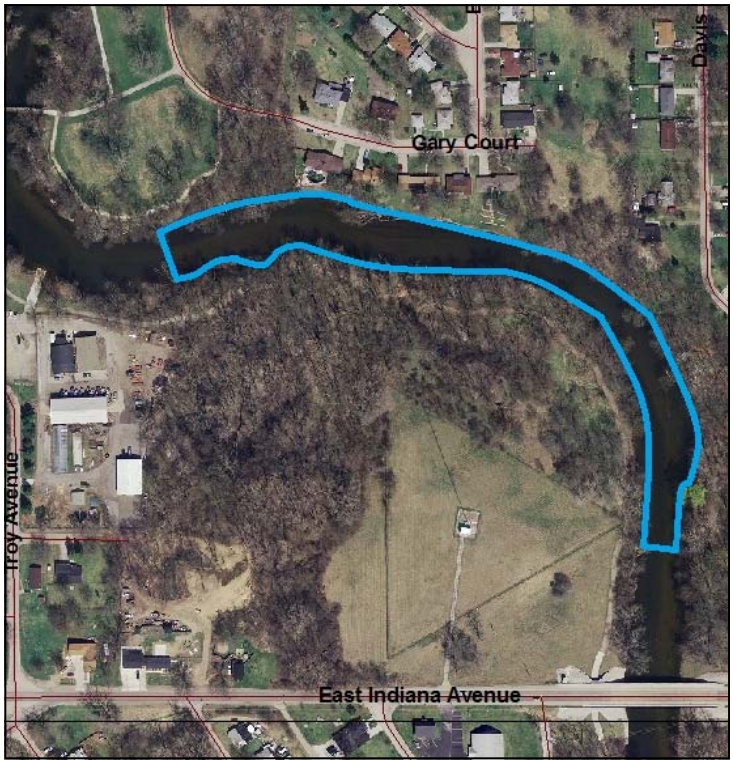
Site #12: Puterbaugh Creek Reedy Drive

Site #13: Christiana Creek CR6

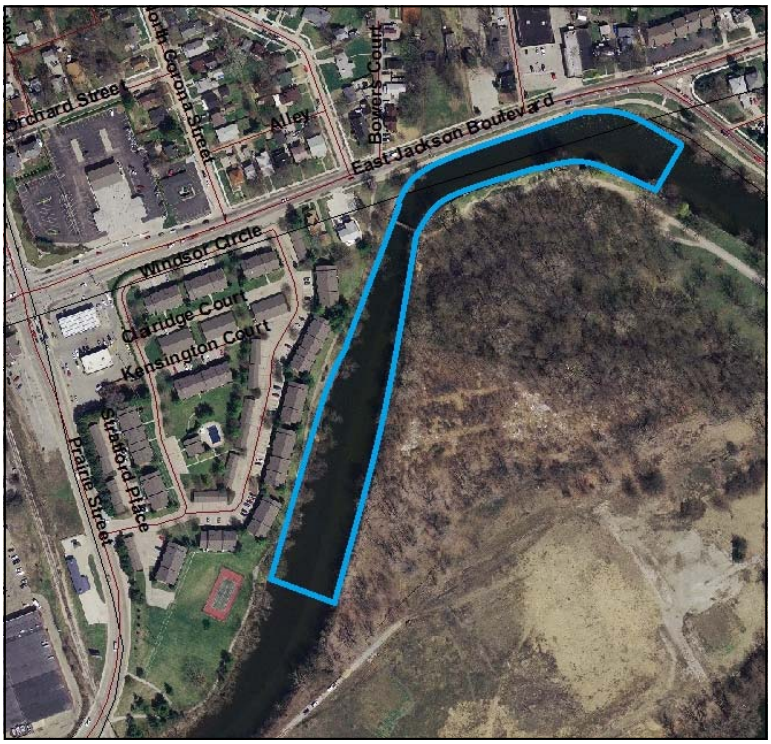
Site #14: Christiana Creek Willowdale Park

Site #13: Christiana Creek CR4

Site #15: Elkhart River CR 18 (Hively Ave.)

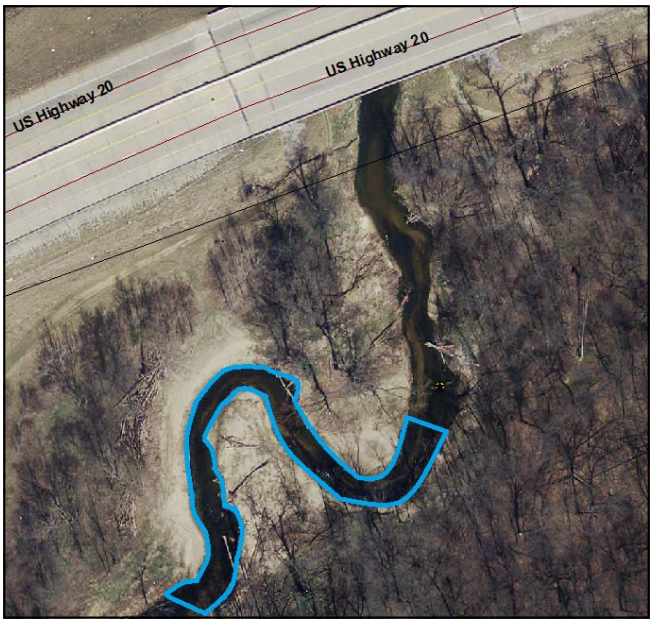


Site #16: Elkhart River Studebaker Park



Site #17: ER American Park

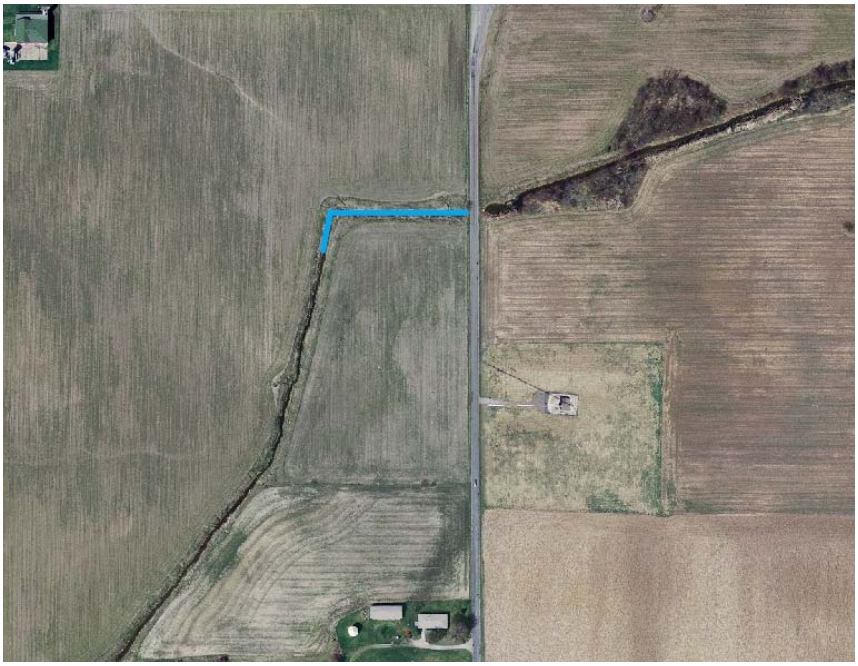
Site #18: Yellow Creek US 20 Bypass



Site #19: Osborn Manning Ditch Lexington Park Drive

Site #20: Baugo Creek Restoration Site

Site #21: Baugo Creek CR 3 (Wakarusa)

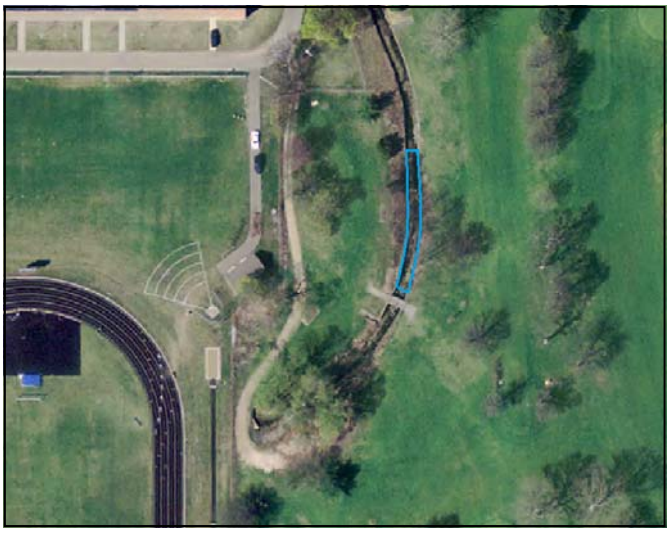


Site #22: Rogers Ditch Beech Road

Site #23: Grimes Ditch Madison Road

Site #24: Auten Ditch Locust Road South
Macroinvertebrate Sampler Location

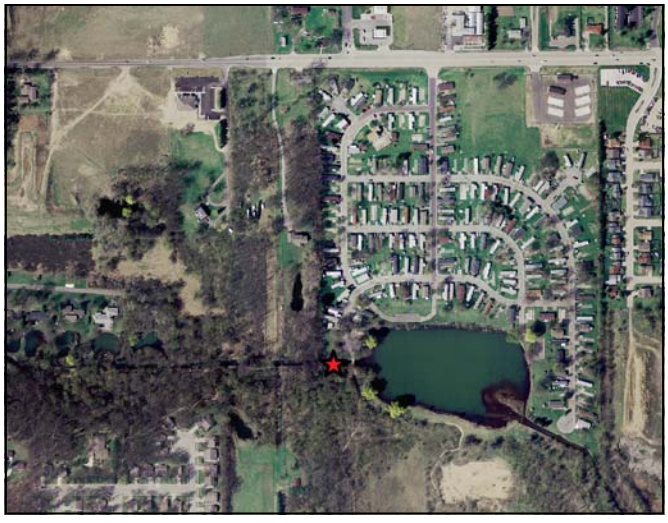
Site #25: Bowman Creek Gertrude Street



Site #26: Bowman Creek Studebaker Golf Course

Site #27: Phillips Ditch Ireland Road

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



Site #29: Juday Creek Driftwood
Macroinvertebrate Sampler Location

Site #30: Juday Creek Ponader Park

Site #31: Juday Kintz Ave.
Macroinvertebrate Sampler Location

Site #32: Juday Creek Cleveland Ave.

Site #33: Juday Creek Izaak Walton League

Site #34: Juday Creek Izaak Walton League (Above)

Site #35: Manion Drain St. Pats Park

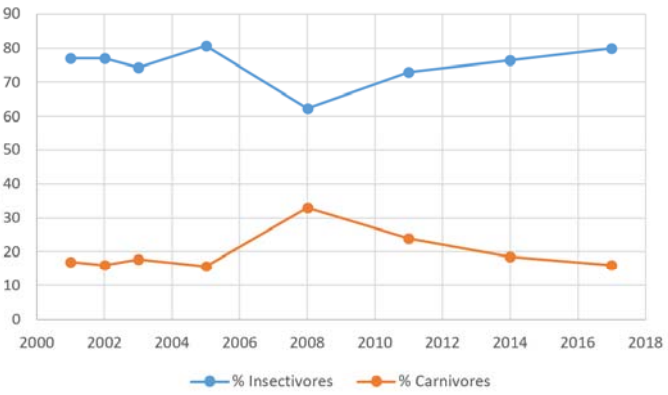
Site #36: St. Pats Drain St. Pats Park

Appendix G

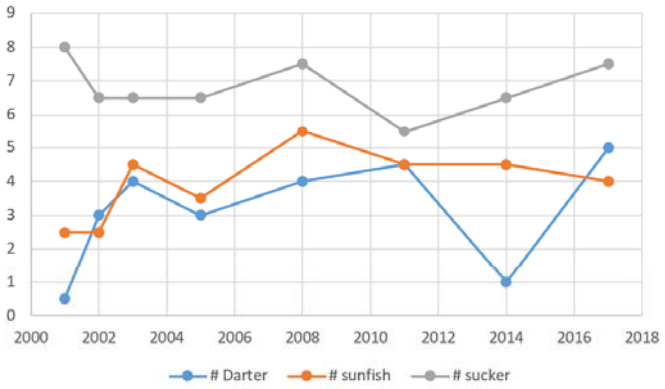
In-depth Metric Analysis

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.

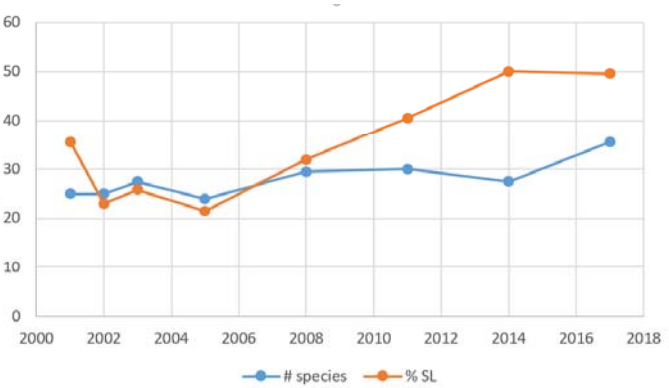
Site 1: St. Joseph River—Toll Road



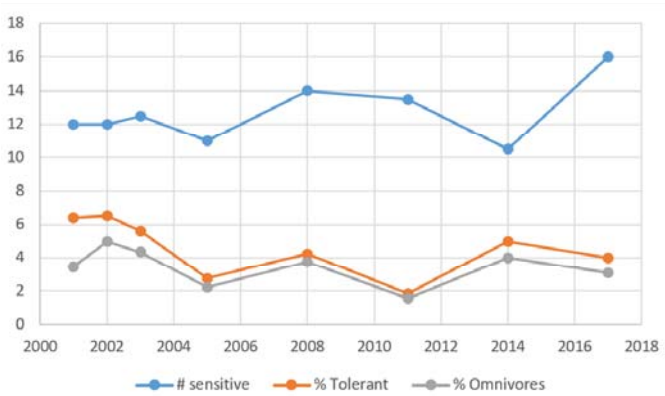
Since the inception of monitoring, the % carnivores and insectivores has generally remained the same. A large increase in carnivores occurred in 2008 with a corresponding decrease of insectivores. However, both metrics have gradually shifted back to their original levels.



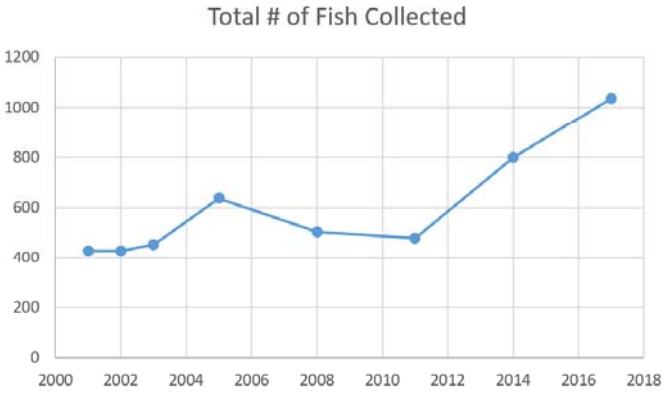
Over the years of monitoring, the number of darter, sunfish and sucker species have remained relatively the same. Of the three metrics, the number of sunfish is the only metric that has shown a slight increase. The number of darters have fluctuated, while the number of suckers have been trending slightly downwards.



Since the inception of monitoring, the number of species and the % of simple lithophils have increased significantly. Both metrics are an indication of a long-term improvement at this site.



Since the inception of monitoring, the % of tolerant individuals and omnivores has gradually decreased. There appears to have been a general increase in the number of sensitive species, although it may be too early to tell with this metric given the drop in 2014. These are all indicators of long-term improvement at this site.

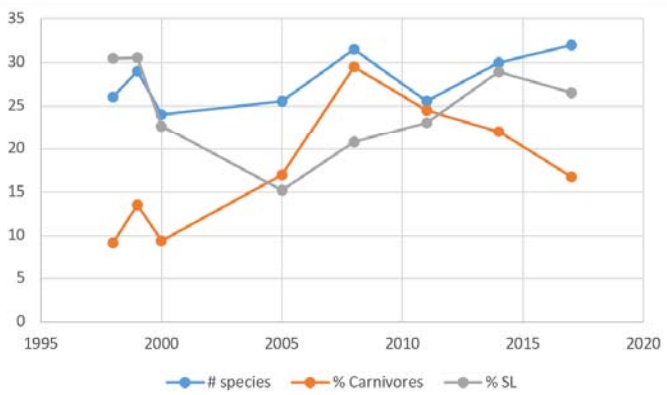


In the last few years the number of fish collected has increased substantially. It is too early to tell what exactly what this means, but major increases in the number of fish collected can sometimes reflect an increase in productivity in a stream (suggesting that nutrient levels may be causing this to occur).

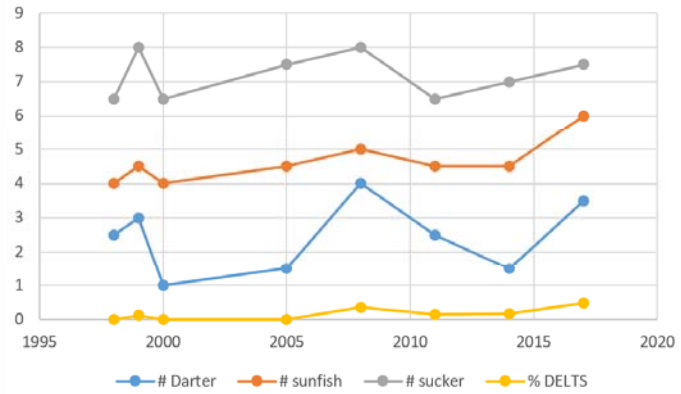
*Note that % of carnivores and insectivores in a fish community is typically negatively related. As one increases the other decreases. This is observed in the fish community at many other sites.

*Note that the % of tolerant species 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.

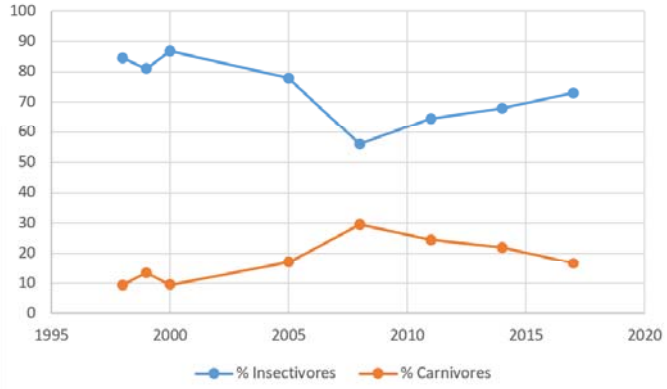
Site 2: St. Joseph River—Six Span



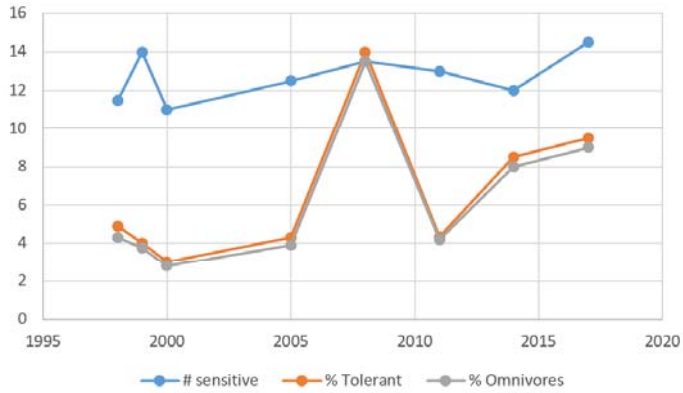
Over the years of monitoring, the number of species has increased. The % of simple lithophils plummeted in 2005, but appears to have generally increased back towards levels seen in 1998. In addition the % of carnivores has increased significantly.



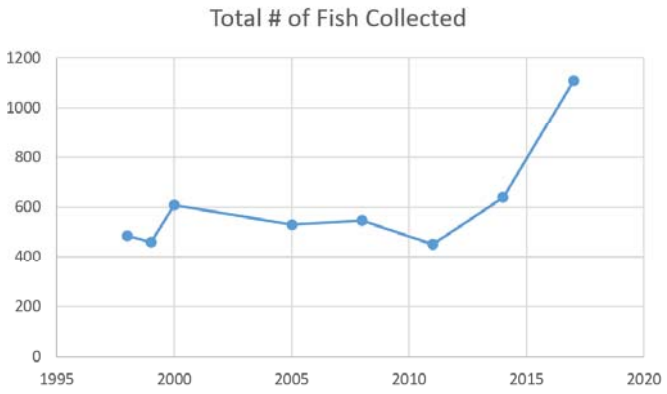
Over the years of monitoring, the % DELTs (abnormalities) and the number of darter and sucker species has generally remained the same, although there has been a slight increase in the % DELTs. The number of sunfish species has increased significantly.



Since the inception of monitoring, the % of insectivores has decreased. This metric plummeted in 2008, but has been gradually increasing back towards levels seen in 1998. Note the negative relationship between the % carnivores and % insectivores metrics.

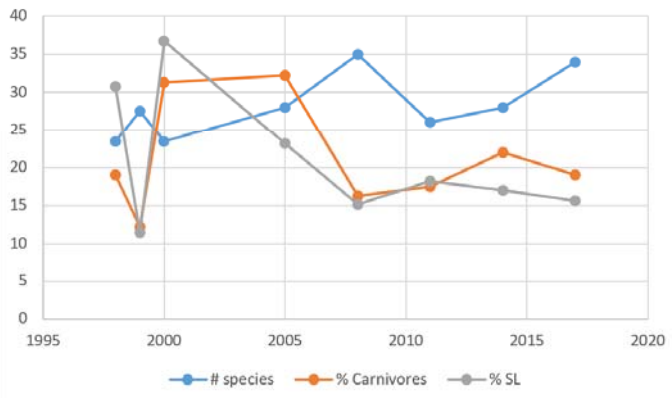


Since the inception of monitoring, the % of tolerant species and omnivores has increased. This is an indication of a long-term negative trend in the fish community at this site. The number of sensitive species has generally stayed the same over the years.

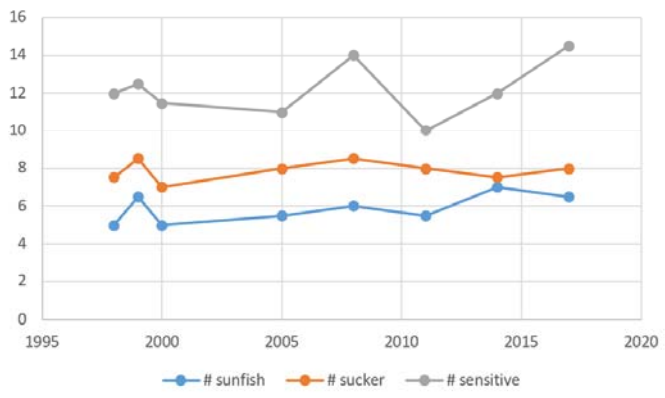


In the last few years the number of fish collected has increased substantially. This is a similar trend being recognized in most streams across the watershed.

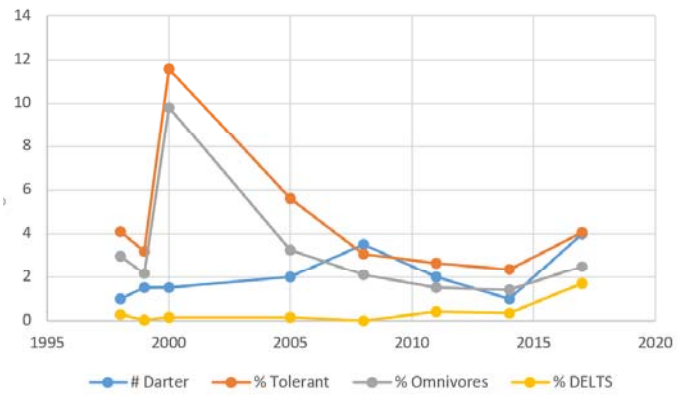
Site 3: St. Joseph River—Bridge Street



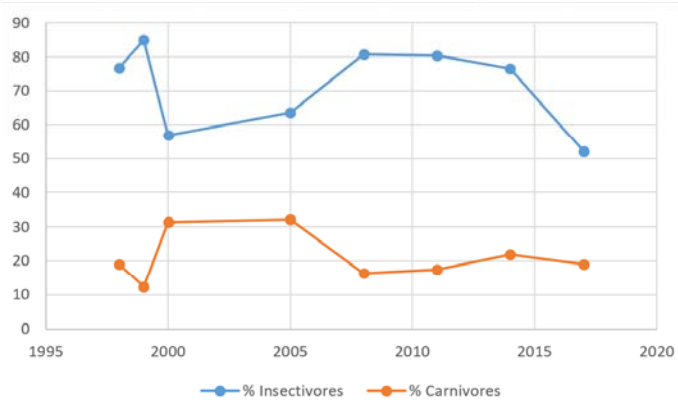
The number of species has increased since the inception of monitoring. Although the % of simple lithophils has fluctuated over the years, there has been a general decline. The % of carnivores has generally stayed the same despite an increase between 2001 and 2005.



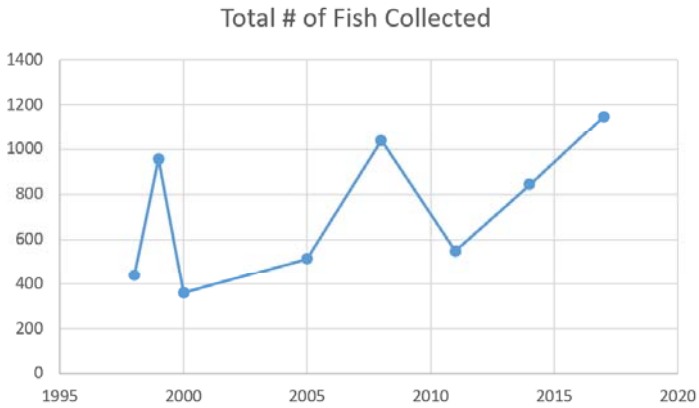
The number of sunfish, sucker, and sensitive species have generally stayed the same, although the # of sensitive species has had some minor fluctuations over the years.



Despite a significant spike in 2000, the % of tolerant species and omnivores has been very low over the years. The number of darter species and the % of DELTs (abnormalities) have increased slightly.

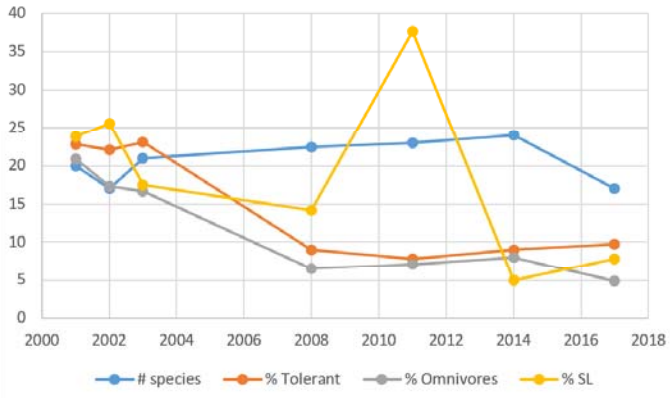


The % of insectivores has had some declines and increases over the past 20 years, with the lowest percentage occurring in 2017. The % of carnivores has generally stayed the same.

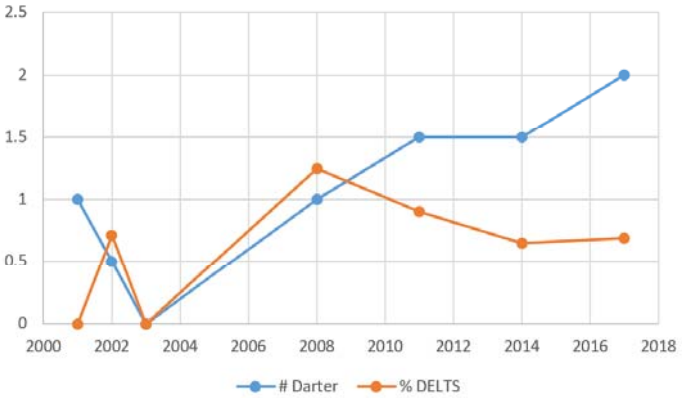


While the number of fish collected over the years has fluctuated, as with other sites, there appears to be an upward trend in the abundance of fish.

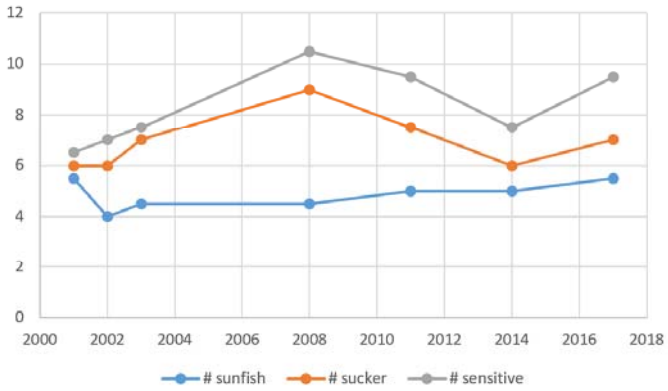
Site 4: St. Joseph River—Ironwood



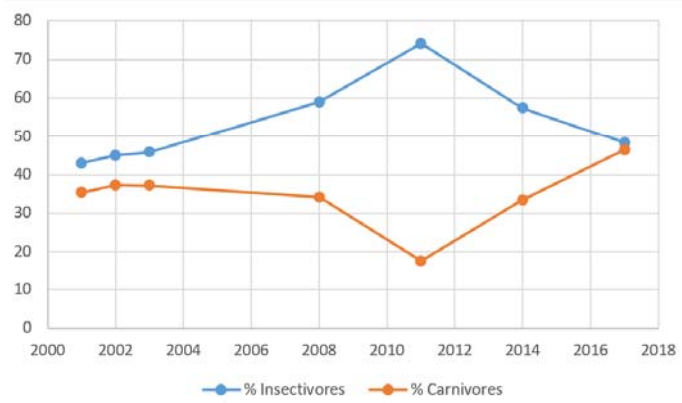
Since the inception of monitoring the % of tolerant individuals and omnivores has decreased significantly at this site. The percentage of simple lithophils has fluctuated signifcantly, but appears to have generally declined over time. Overall it appears the number of species has generally stayed the same.



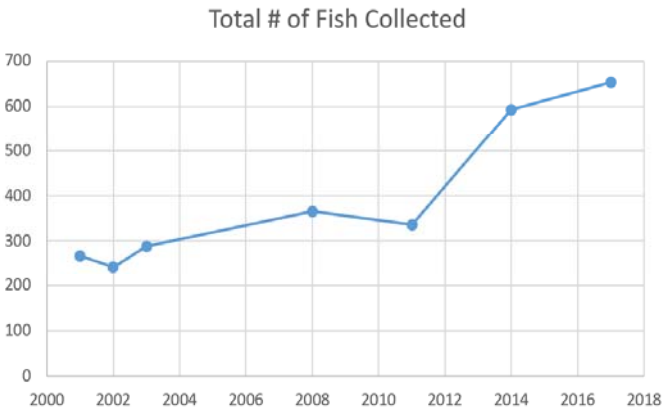
The number of darters has generally increased over time, while the % of DELTs (abnormalities) has also increased slightly.



The number of sensistive species appears to have increased since the inceptions of monitoring, while the number of sunfish and suckers has generally stayed the same.

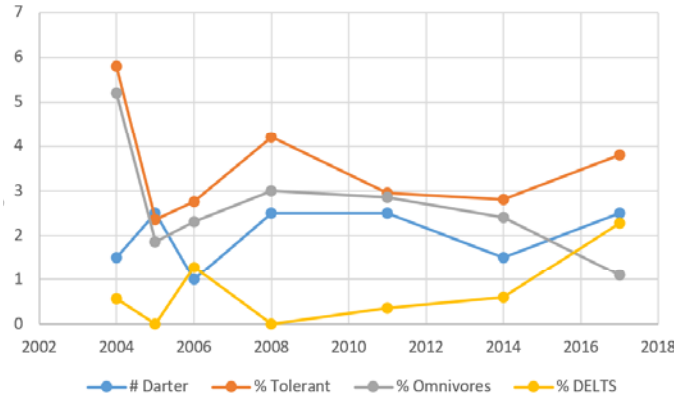


Since the inception of monitoring, the % of insectivores has risen slightly, while the % of carnivores hasn't changed much. Both metrics fluctuated significantly in 2011.

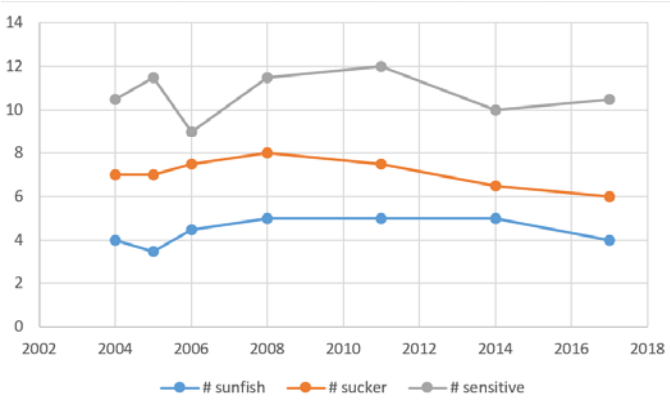


As with other sites in the last few years, the number of fish collected has increased substantially.

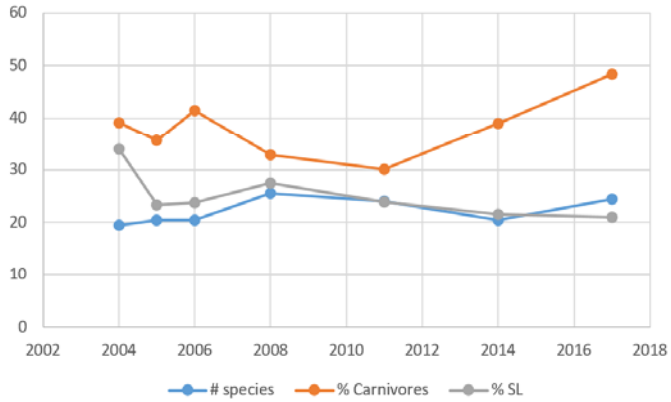
Site 6: St. Joseph River—Angela Boulevard



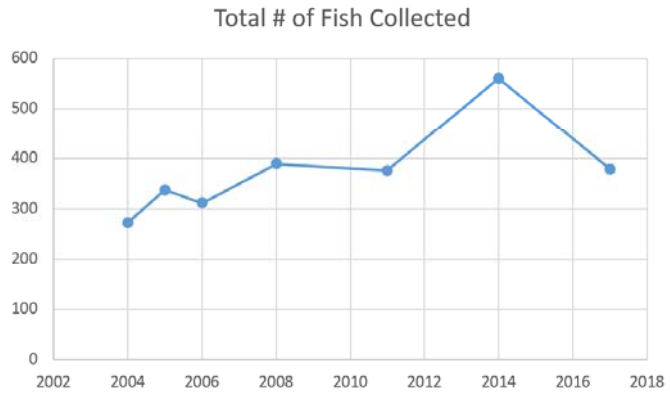
The % of tolerant individuals and omnivores has dropped slightly since the inception of monitoring, although both metrics were always very low. DELTs (abnormalities) have increased substantially in 2017, while the # of darters has remained similar over time.



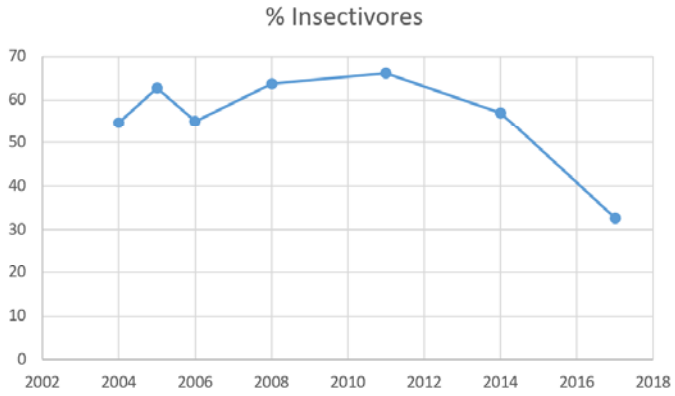
The number of sensitive species and sunfish has remained similar over the past 14 years, while the number of suckers has declined slightly.



The number of species and % of carnivores have increased slightly in the last 14 years, while % of simple lithophils has decreased.

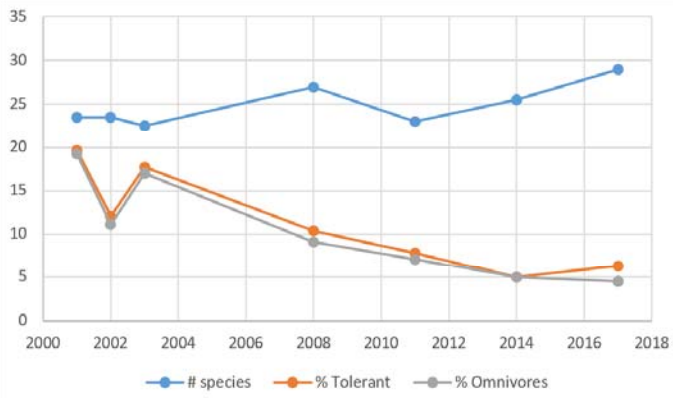


The total number of fish collected at this site rose significantly in 2014, but dropped back to lower levels in 2017. This is one of the few river sites that has not show a long-term increase in overall abundance of fish, which is not necessarily a bad thing.

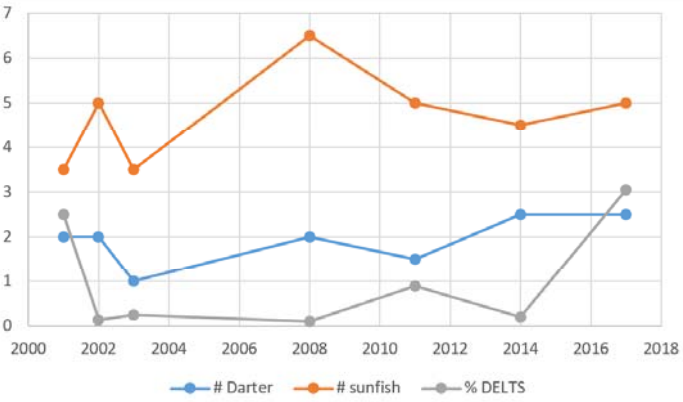


The % of insectivores has decreased considerably in 2018, however this metric has remained relatively consistent in preceding years. Its quite possible that this metric will bounce back in the coming years.

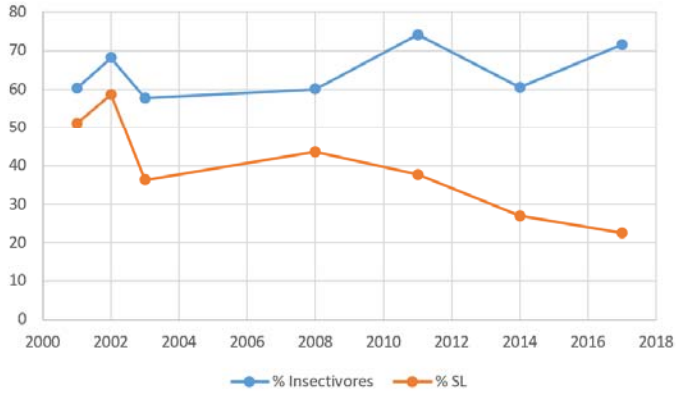
Site 8: St. Joseph River—Darden Road



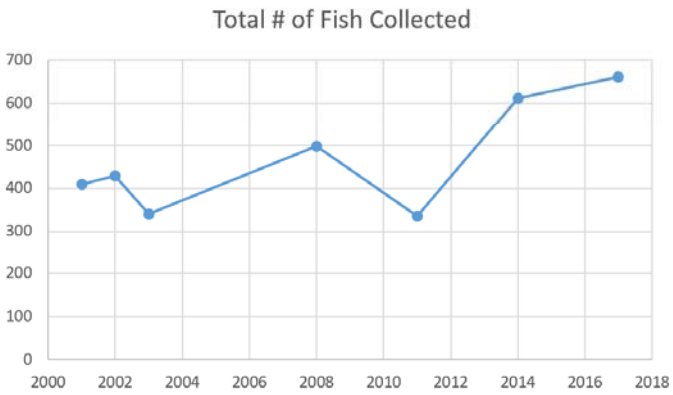
The number of species has increased significantly at this site since the inception of monitoring. In addition, the % of tolerant individuals and omnivores has decreased significantly.



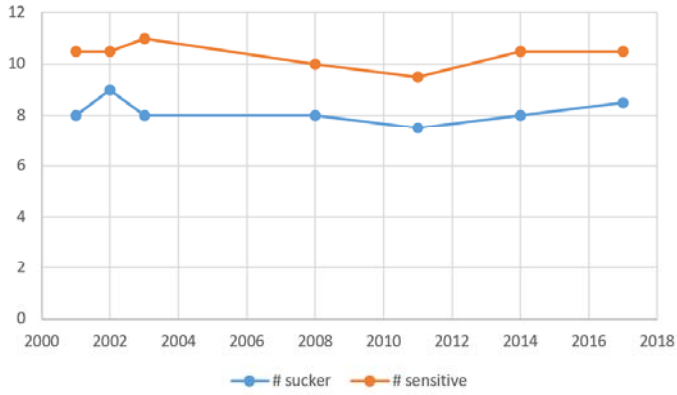
The # of sunfish and darters have fluctuated a little, but have remained similar to initial levels. DELTs (abnormalities) were very high on the first sampling event and again in 2017, but were relatively low over the years.



The % of insectivores has remained similar over time, however, the % simple lithophils has dropped significantly since the since the inception of monitoring.

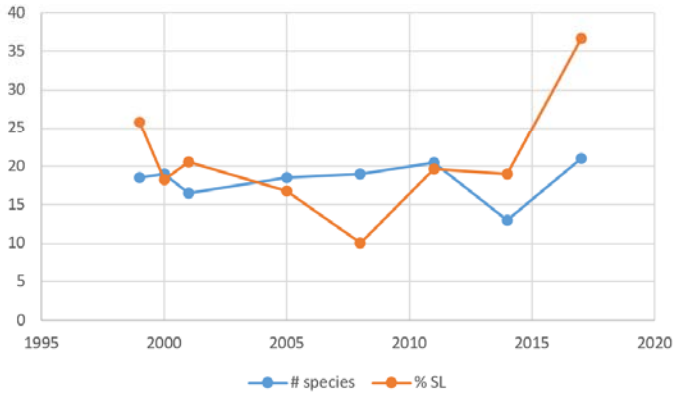


As with other sites in the last few years, the number of fish collected has increased substantially.

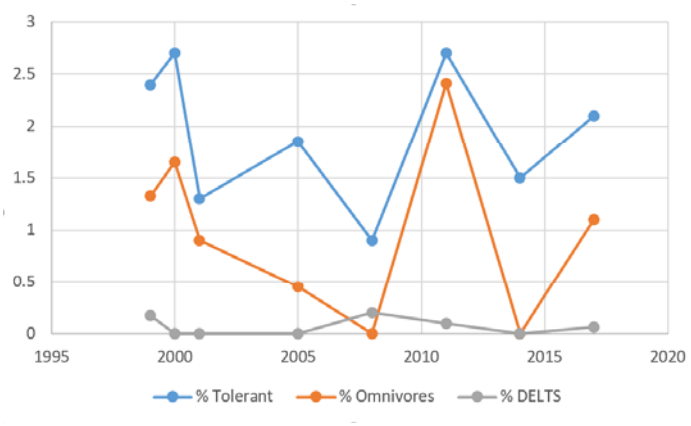


The # of suckers and sensitive species has remained similar over time.

Site 9: Trout Creek—CR 2

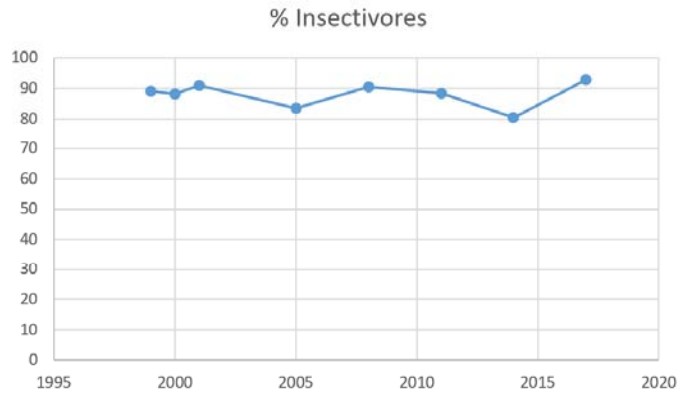


The % of simple lithophils has varied significantly over the years, with a large spike in this metric in 2017. The number of species did fall considerably in 2014 from previous years, but rose again to normal levels in 2017.

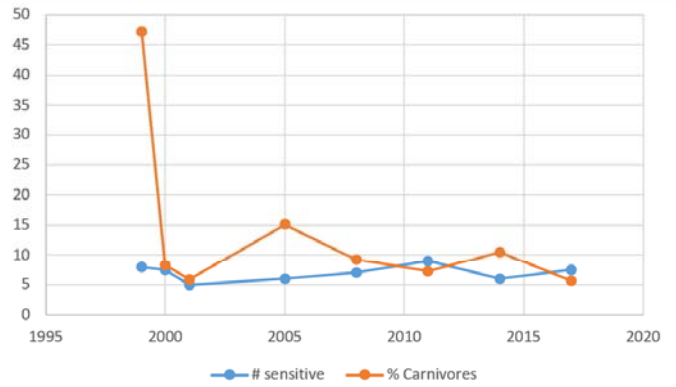


The % of tolerant individuals and omnivores have fluctuated over the years, however, their numbers have remained really low since the inception of monitoring. DELTs (abnormalities) have always been low at this site.

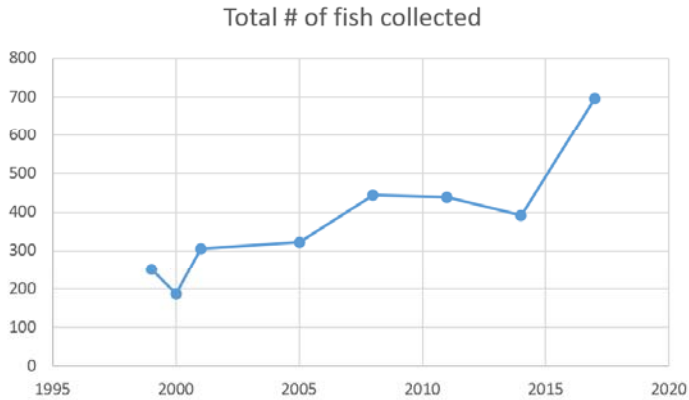
The # of suckers has remained relatively similar since the inception of monitoring. Darters have fluctuated considerably over the years, while the # of sunfish have increased slightly.



The % of insectivores has pretty much stayed the same since the inception of monitoring with the community being dominated by insectivores. Trout Creek is a small stream that connects the St. Joseph River and Long Lake. The high number of insectivores is caused by an overabundance of bluegill, which are moving between the river and the Long Lake.

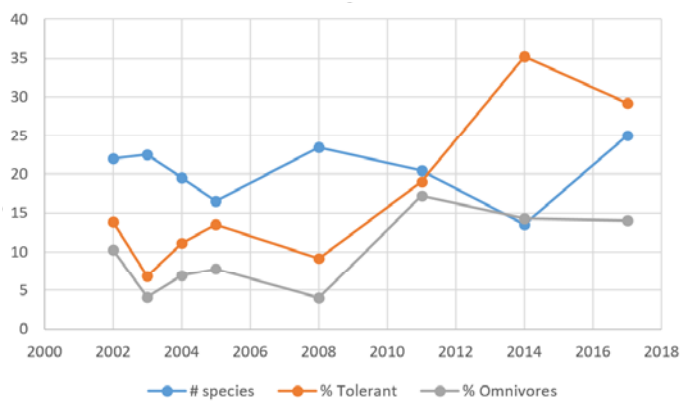


The % carnivores was very high the first year of sampling in 1998 and plummeted the following year to approximately 10%. It has remained very low since 1999. The number of sensitive species has remained similar over time.

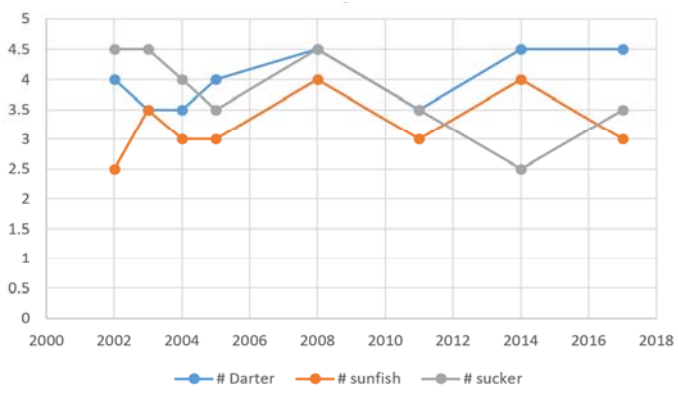


As with other sites in the last few years, the number of fish collected has increased substantially.

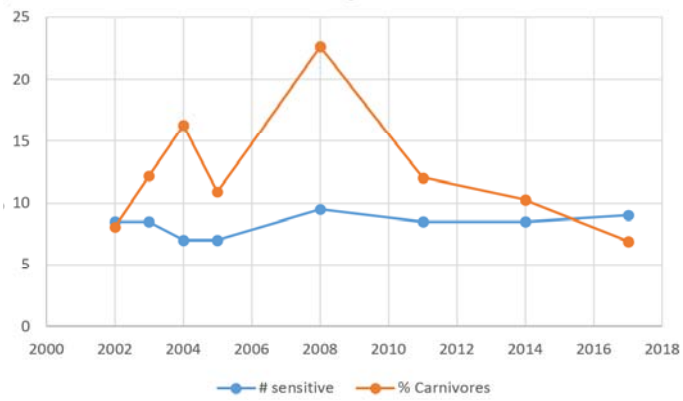
Site 10: Little Elkhart River—SR 120



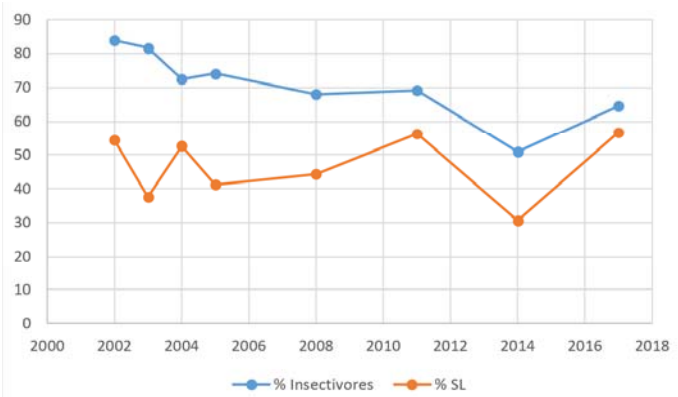
The % of omnivores and # of species has fluctuated moderately since the inception of monitoring. The percent of tolerant individuals has increased significantly.



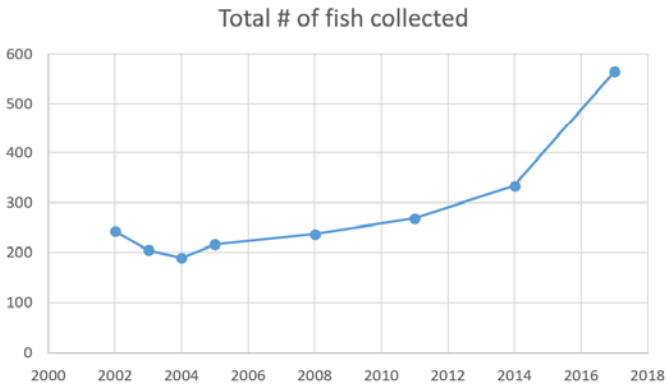
The number of darters, sunfish and suckers have fluctuated moderately since the inception of monitoring, although the numbers for each metric have always been low (ranging from 2.5 to 4.5).



The number of carnivores has fluctuated since the inception of monitoring but has been low for the past three sampling events. The number of sensitive species has remained consistent over time.

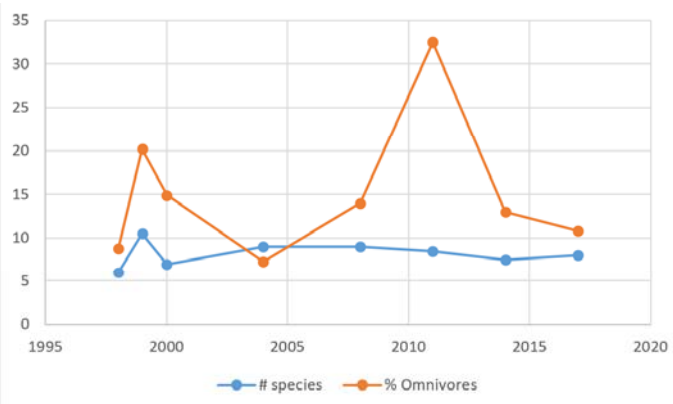


The % of insectivores has dropped considerably since the inception of monitoring. The % of simple lithophils has fluctuated moderately over time, but has remained similar.

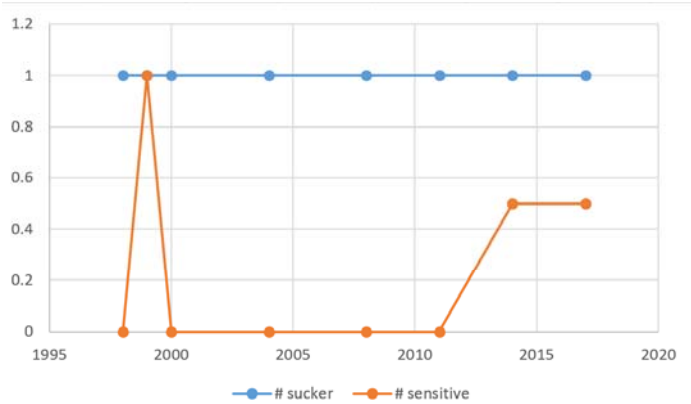


As with other sites in the last few years, the number of fish collected has increased substantially.

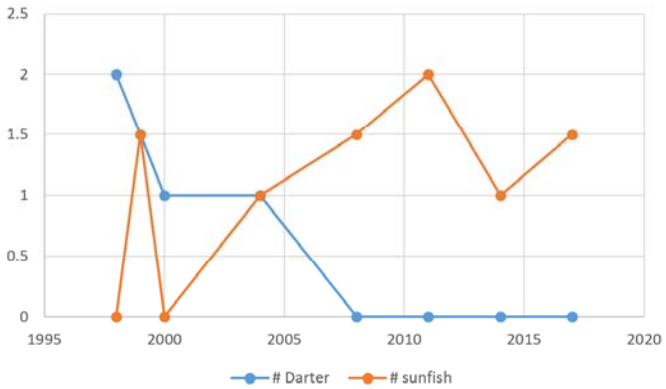
Site 11: Pine Creek—US 20 Bypass



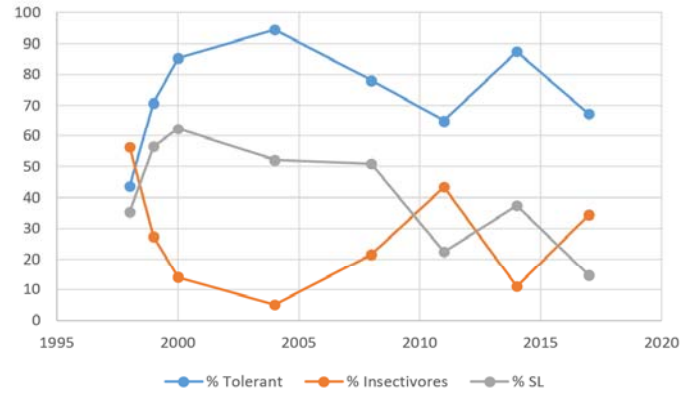
The # of species at this site has remained the same since the inception of sampling. The % of omnivores as fluctuated, but has remained relatively low.



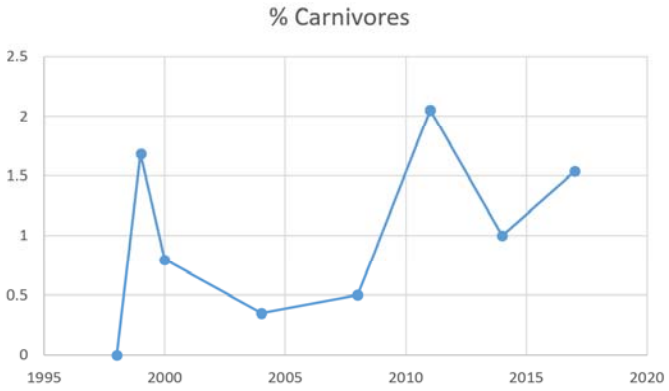
Only one sucker species (white sucker) has been collected at this location since the inception of monitoring. The number of sensitive species has remained very low, with no sensitive species being collected during several of those years.



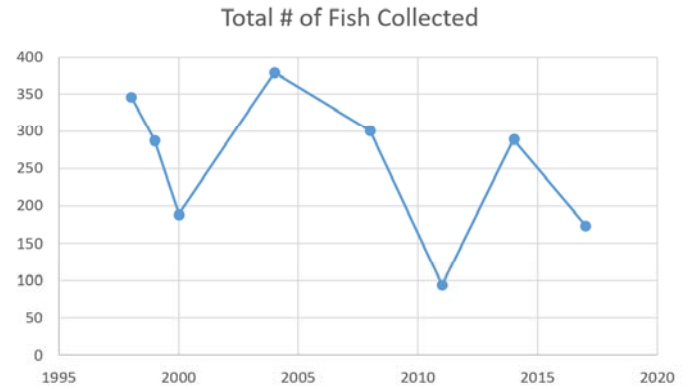
The number of darter species has declined significantly since the inception of monitoring, while the number of sunfish species has remained relatively the same.



The % of tolerant individuals has increased since the inception of monitoring while the % of insectivores and simple lithophils has decreased.

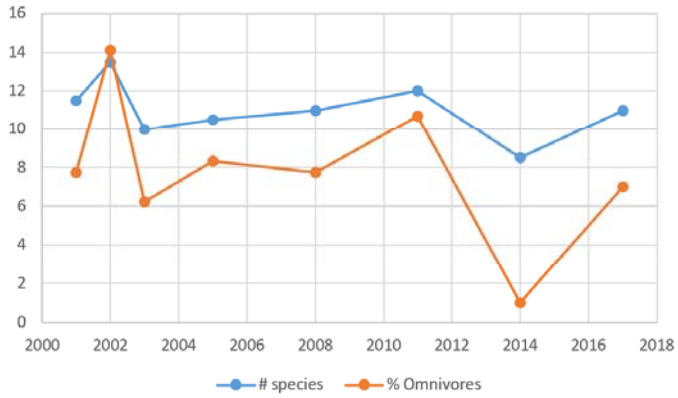


The percent of carnivores has always been very low at this site.

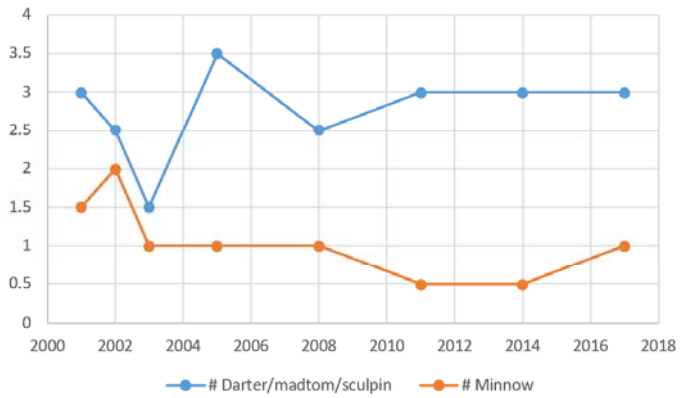


The abundance of fish has fluctuated, but has generally declined over the years.

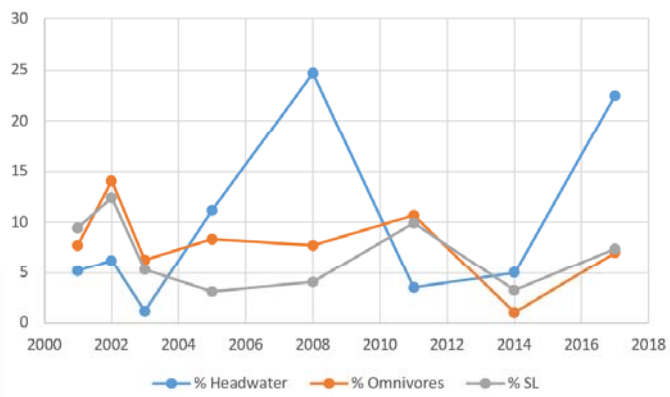
Site 12: Puterbaugh Creek—Reedy Drive



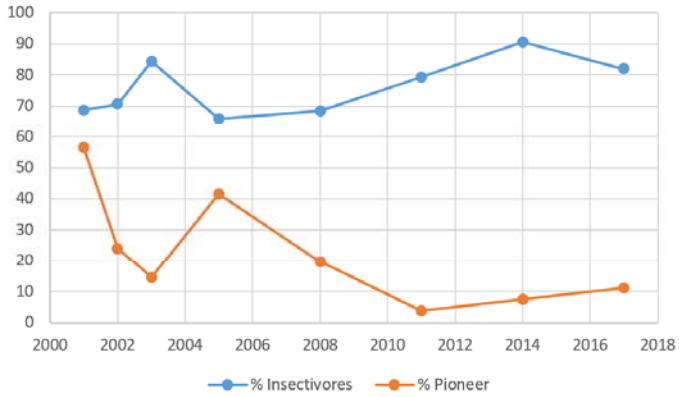
The % of omnivores has generally decreased since the inception of monitoring, while the number has species has generally remained the same.



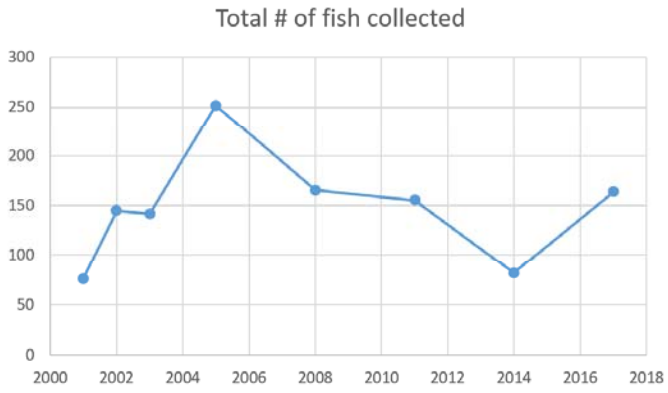
The number of darters/madtoms/sculpins is the same as it was when the site was first sampled in 2001. This metric has become more stable in recent years. The number of minnow species has always been low at this site, but more than 1 species was collected in the initial years of sampling at this site.



The % of omnivores and simple lithophils has generally declined over the years, while the % of headwater species has fluctuated considerably.

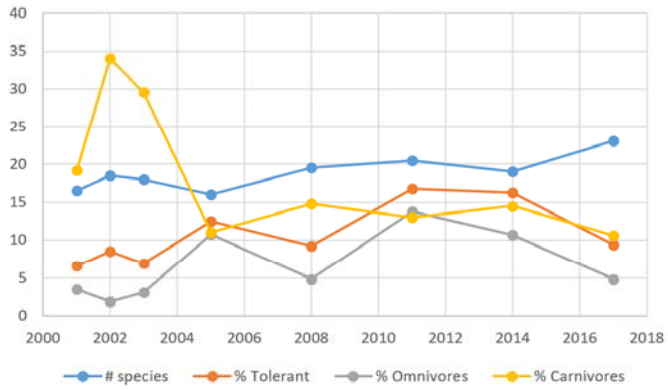


The % of pioneering species has decreased significantly since the inception of monitoring, while the % of insectivores has generally increased.

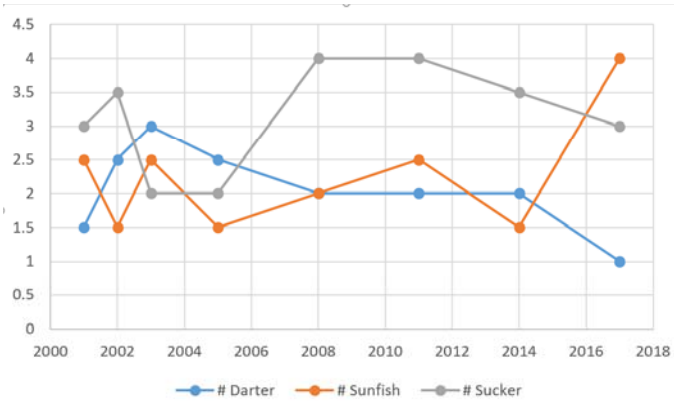


The total number of fish has fluctuated over the years.

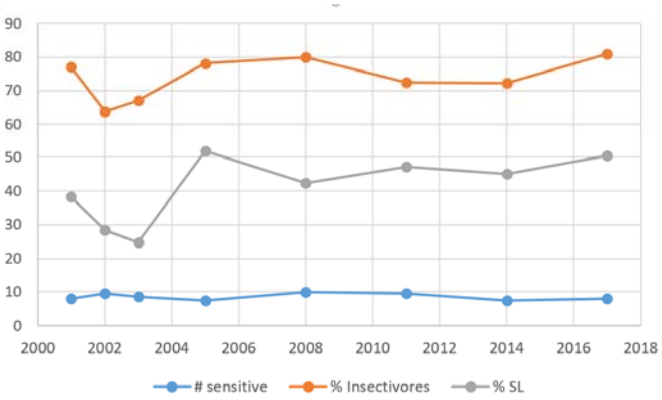
Site 13: Christiana Creek—CR 6



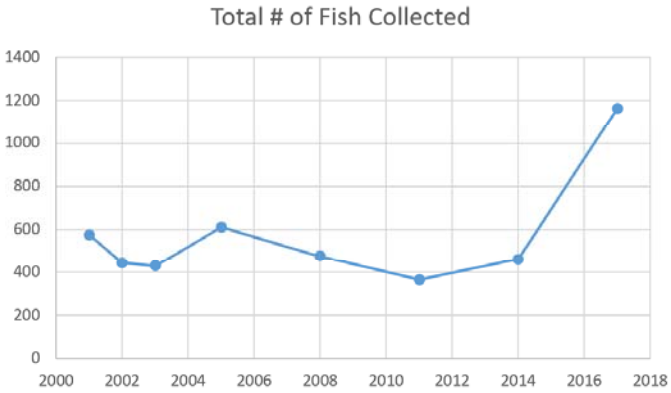
The % of tolerant individuals and omnivores has increased over the years. Species richness has also increased, while the % of simple lithophils declined sharply in 2005 and has remained low since.



The # of sucker species has been variable over the years, although it has been more consistent in recent sampling events. The # of sunfish species has also shown a little variability, but increased significantly in 2017 from previous years. The # of darter species has been a little more consistent, although, it fell to its lowest point in 2017.

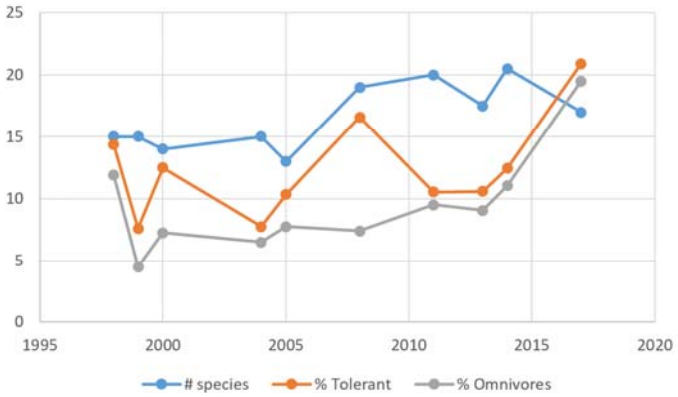


The # of sensitive species has remained the same since the inception of monitoring. The % of insectivores has fluctuated slightly and the % of simple lithophils increased in 2005 and has remained relatively high since.

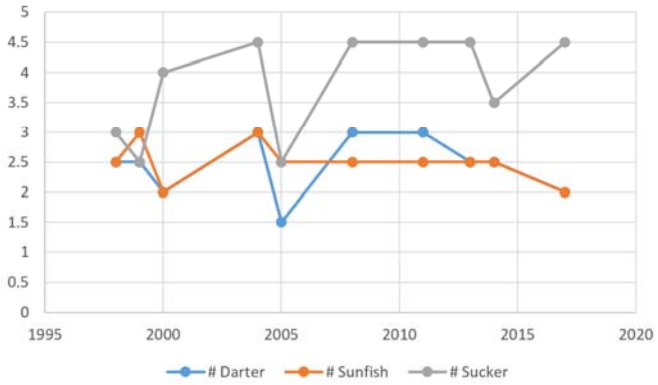


The total # of fish has been between 400 and 600 over the years with low abundances between 2008 and 2014. One exception, however, was the sharp increase recorded in 2017, with more than double the number of fish collected. Several species were captured in very high abundance in 2017 including striped shiner, northern hogsucker, and hornyhead chub.

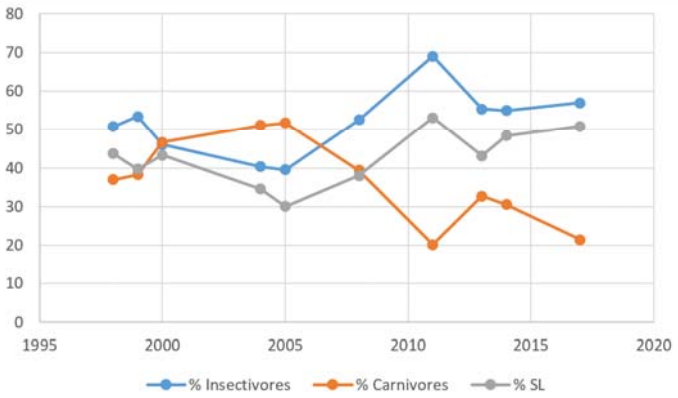
Site 14: Christiana Creek—Willowdale Park



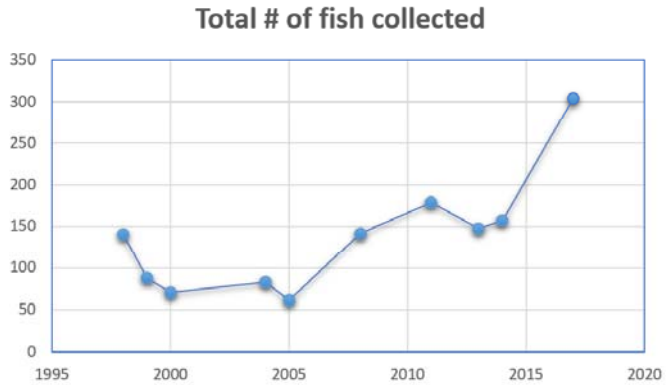
The % of tolerant individuals and omnivores has been relatively low over the years, but both metrics increased substantially in 2017. The # of species has generally increased since the inception of monitoring.



The # of suckers and darters has varied slightly over the years, while the # of sunfish has been more stable.

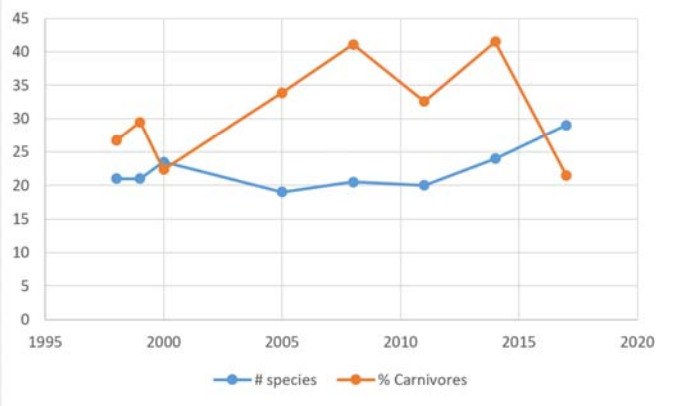


The % of carnivores has decreased significantly over the years, while the % of insectivores and simple lithophils have fluctuated but generally increased over the years.

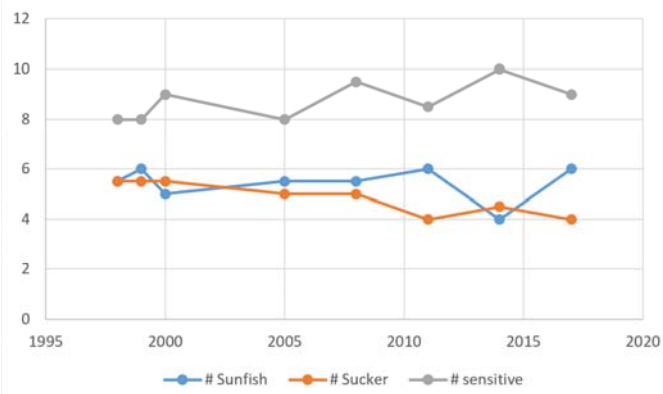


The total number of fish has fluctuated over the years with a significant decline in the early 2000s. However, fish abundance has increased since that time with a substantial increase in 2017.

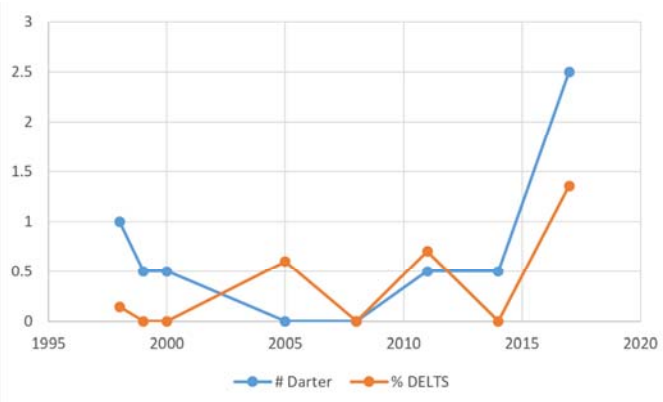
Site 15: Elkhart River—CR 18 (Hively Ave)



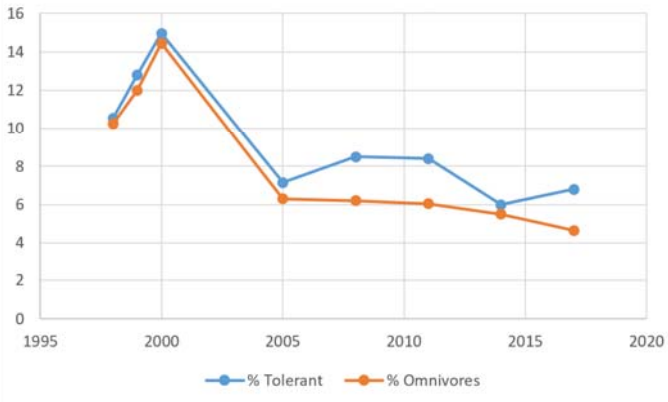
The # of species has increased substantially in recent years while the % of carnivores has fluctuated significantly.



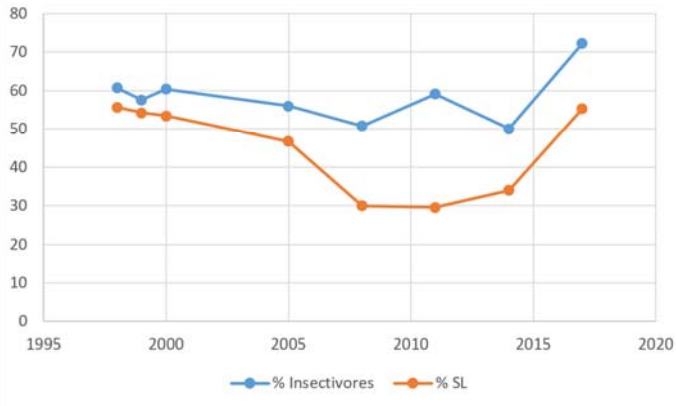
The # of suckers has declined slightly over the years, while the # of sunfish has stayed the same and the # of sensitive species has increased slightly.



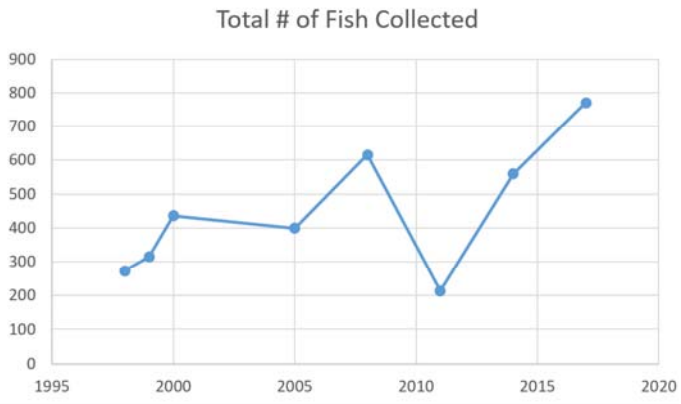
The # of darters and % DELTS (abnormalities) has been relatively low over the years, however, both metrics increased substantially in 2017.



The % of tolerant individuals and omnivores has decreased substantially since the inception of monitoring, a positive indication for this site.

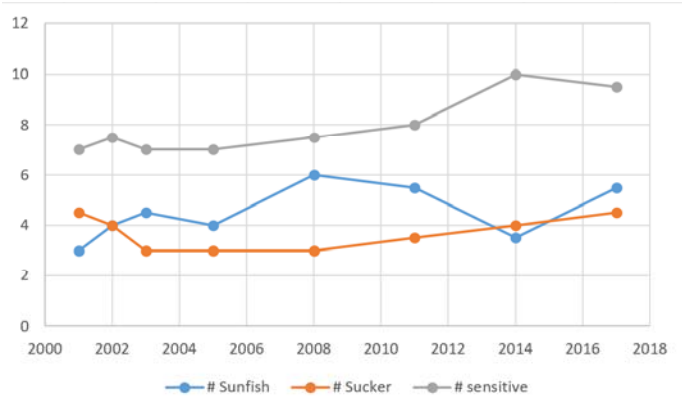


The % of insectivores and simple lithophils showed a decline since the inception of monitoring, but both metrics rebounded in 2017.

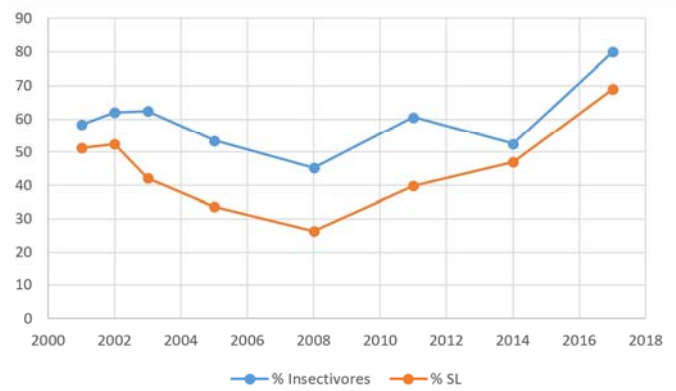


The total # of fish collected has fluctuated over the years, but increased to its highest point in 2017.

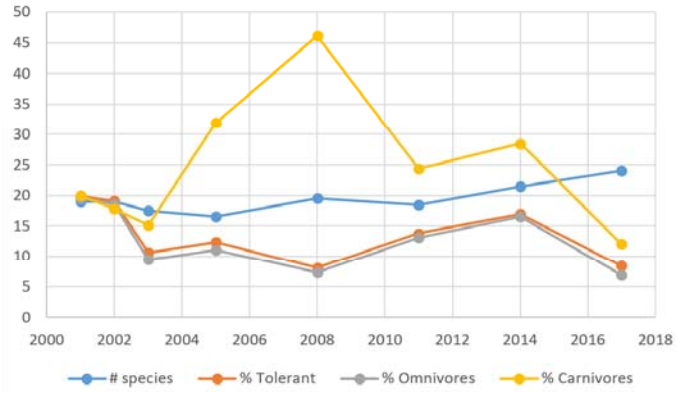
Site 16: Elkhart River—Studebaker Park (A)



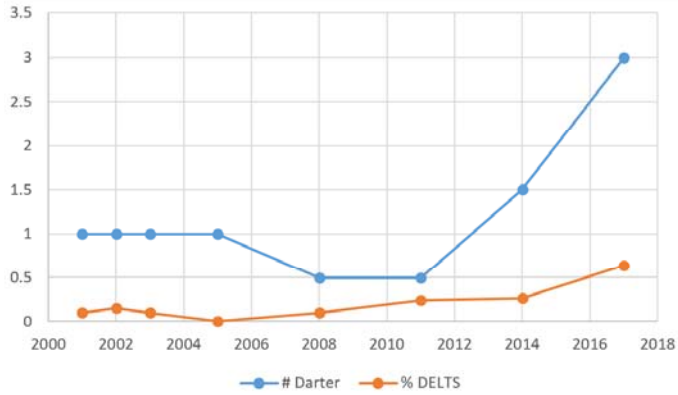
The # of sucker species declined in the early 2000s, but this metric has gradually increased since that time. The # of sunfish has fluctuated over time, while the # of sensitive species has increased significantly since the inception of monitoring.



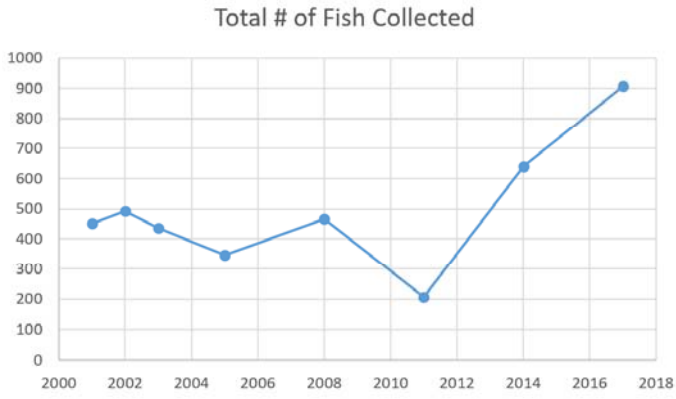
The % of insectivores and simple lithophils decreased substantially in 2008, but both metrics have recovered and reached their highest point in 2017.



The % of omnivores and tolerant individuals has declined over the years. The # of species has gradually increased, while the % of carnivores has fluctuated substantially.

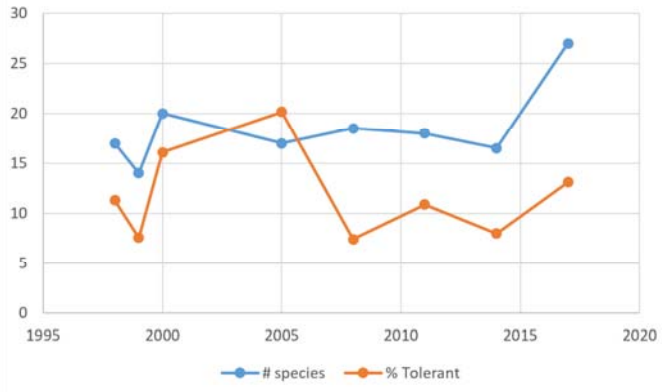


The % of DELTS (abnormalities) has gradually increased over the years, while the number of darter species has increased significantly.

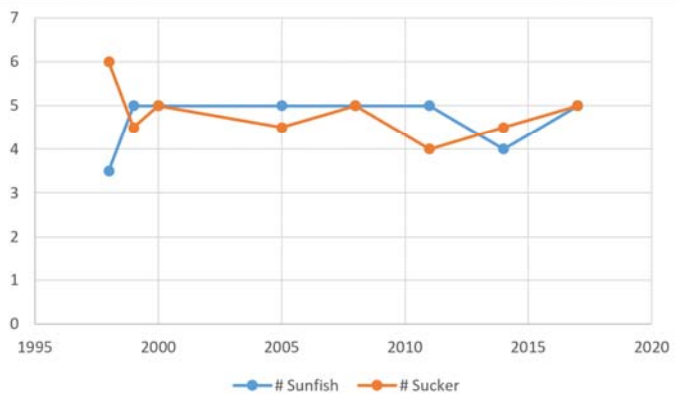


The total number of fish collected dropped in 2011, but rose significantly following 2011 to its highest point in 2017.

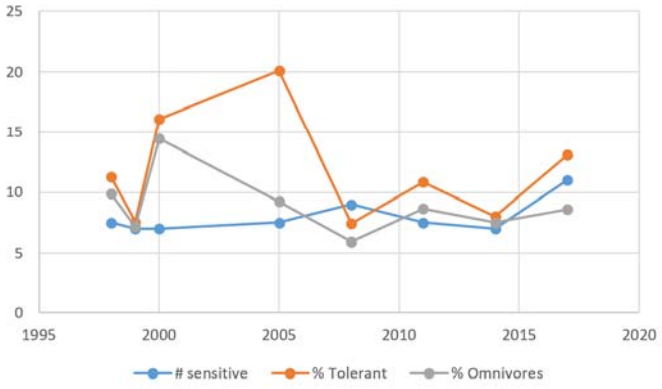
Site 17: Elkhart River—American Park



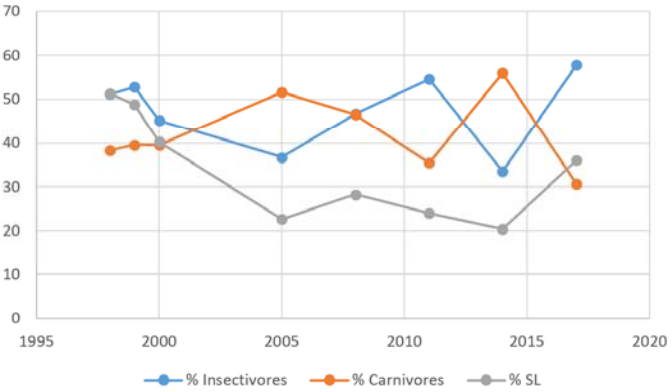
The # of species has remained low at this site since the inception of monitoring, but species diversity sky rocketed in 2017.



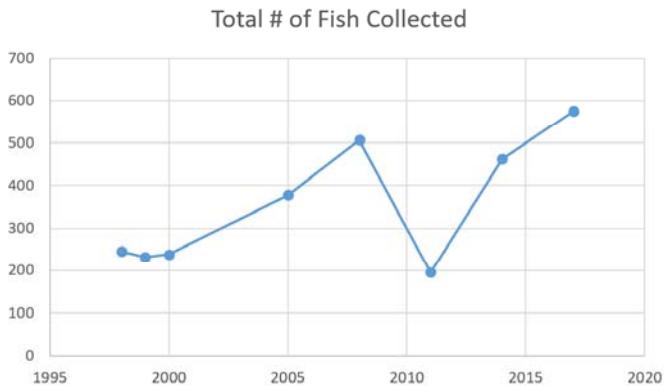
The # of sunfish and sucker species have fluctuated slightly over the years.



The % of tolerant individuals and omnivores rose significantly in the early 2000s, however, both metrics dropped back to original levels. The # of species has increased since the inception of monitoring.

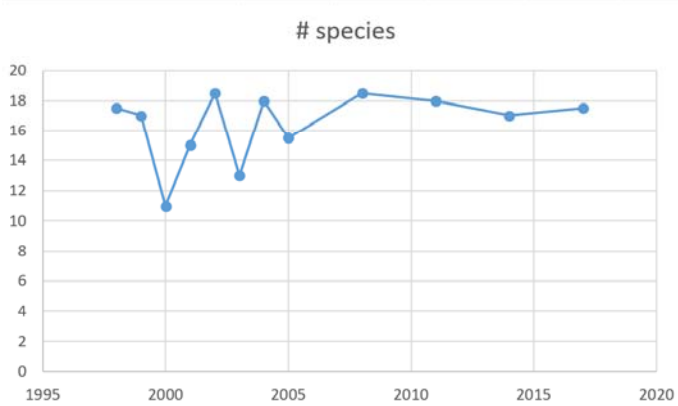


The % of simple lithophils has dropped significantly since the inception of monitoring. The % of carnivores and insectivores has fluctuated significantly over the years.

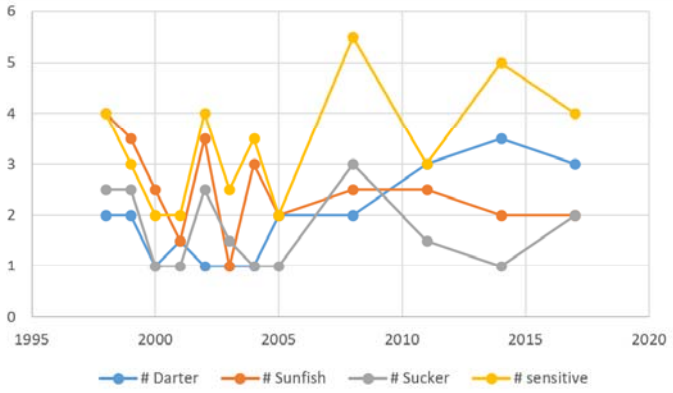


The # of fish collected has increased substantially over the years, with one significant drop in 2011.

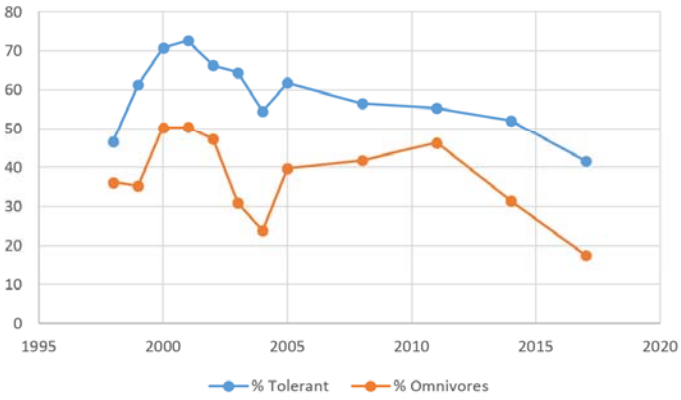
Site 18: Yellow Creek—US 20 Bypass



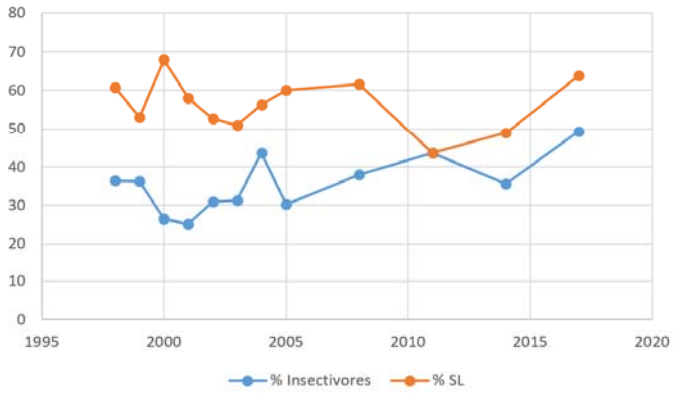
The # of species fluctuated in the early years of monitoring. This sites was sampled for a number of years (back to back) due to major habitat disturbance at this site. Species diversity has recovered since the early 2000s.



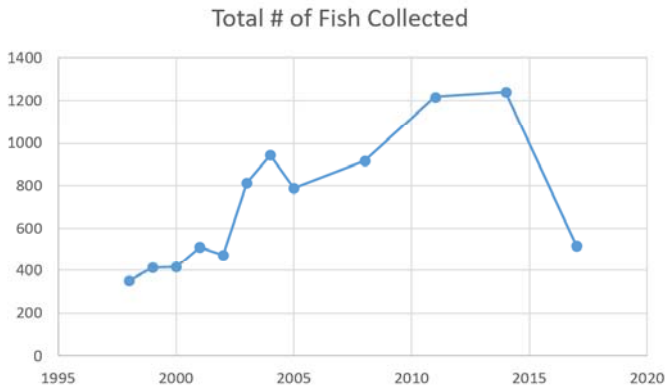
Similar to species diversity, other general species metrics have fluctuated significantly over the years.



The % of tolerant individuals and omnivores rose significantly in the early 2000s but have gradually dropped close to levels observed during the initial surveys.

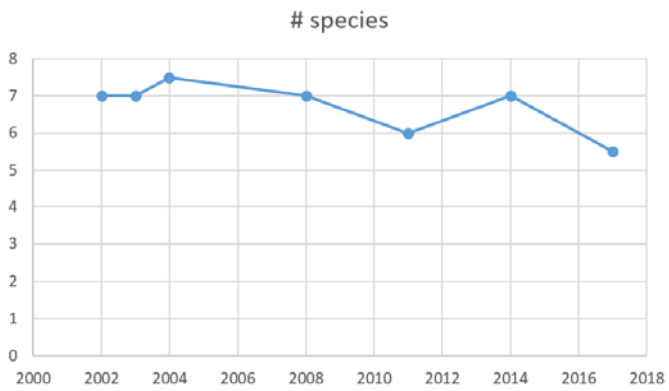


The % of insectivores and simple lithophils have remained relatively similar over the years, with a slight increase in the % insectivores in 2017.

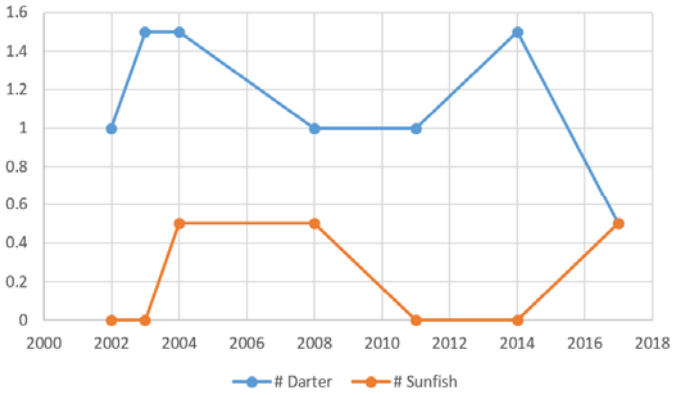


The total # of fish collected increased substantially over the years but crashed back to #s originally observed in the early 2000s.

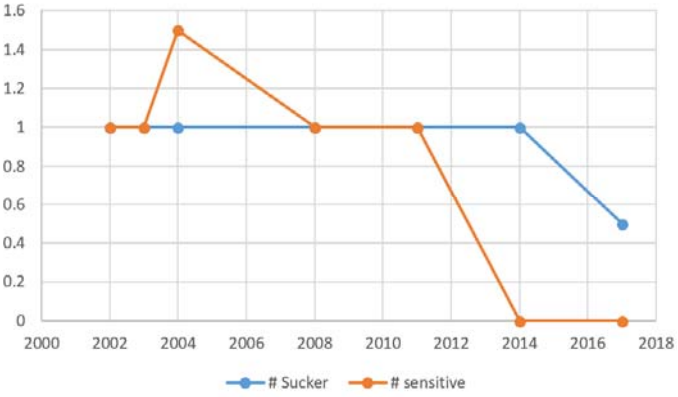
Site 33: Juday Creek—Izaak Walton League



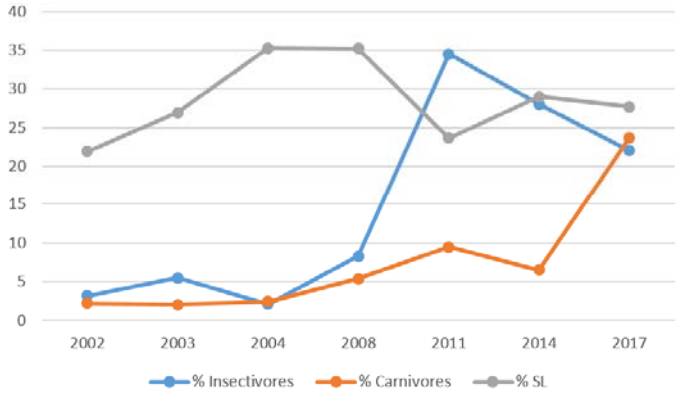
The number of species collected at this site has decreased slightly since the inception of monitoring. In the early years of monitoring, species like largemouth bass and bluegill were collected at this site. The absence of these species is not necessarily a bad thing given they are warmwater species and Juday Creek is a coolwater stream.



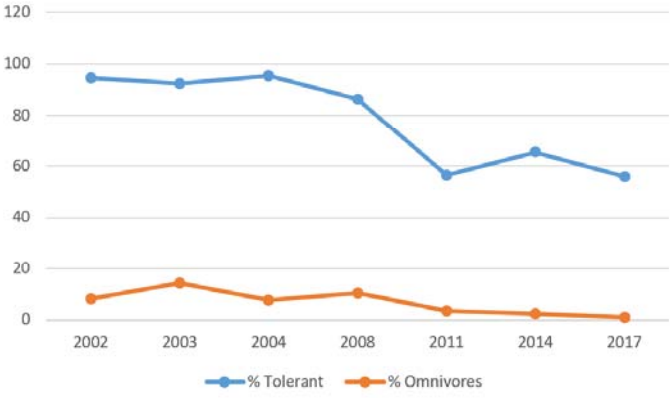
The number of darters and sunfish have always been very low at this site.



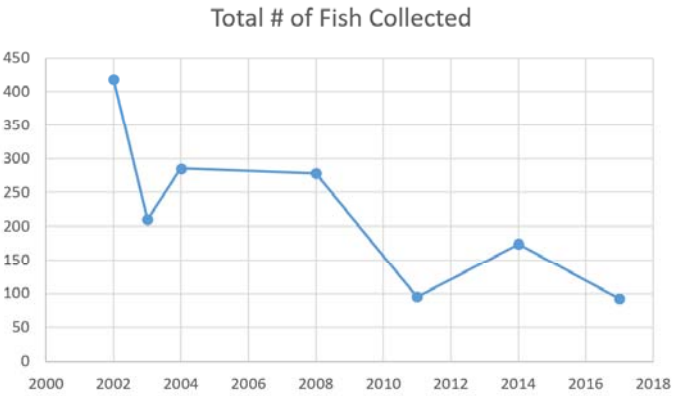
The number of sensitive species and suckers have always been low at this site.



The % of carnivores and insectivores has increased significantly at this site in recent years, while the % of simple lithophils has fluctuated.



The % of tolerant indivduals and omnivores has decreased since the inception of monitoring.



The total # of fish collected has decreased since the inception of monitoring.