ELKHART – SOUTH BEND AQUATIC COMMUNITY MONITORING

ANNUAL REPORT 2019

City of Elkhart

Rod Roberson, Mayor

Clean river Healthy neighborhoods

ELKHART ▪ SOUTH BEND

Cover Photo: Sam Kitkowski, and young volunteer and aspiring fish biologist, holds a large St. Joseph River carp

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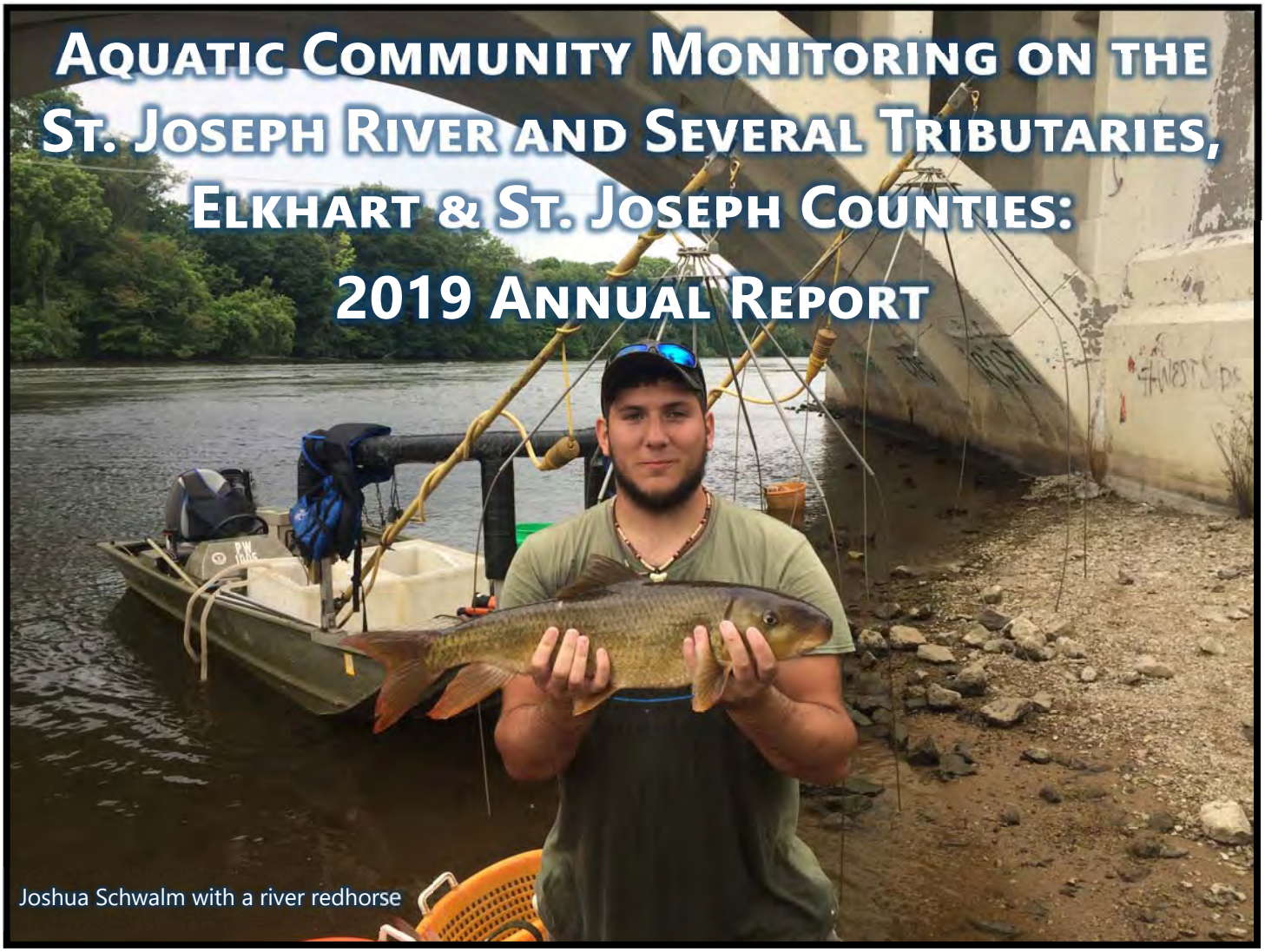
Aquatic Community Monitoring on the St. Joseph River and Several Tributaries, Elkhart & St. Joseph Counties: 2019 Annual Report



Joshua Schwalm with a river redhorse

Prepared By

Daragh Deegan

Aquatic Biologist

Introduction

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

In 2019, 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, which can play an important role 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.

A horneyhead chub from the Elkhart River. This sensitive minnow species is abundant in the Elkhart River suggesting that the river is healthy

The Aquatics Program is a unique bi-community initiative to evaluate the health of the St. Joseph River in Elkhart County and St Joseph County. While the Program operates out of the City of Elkhart, the City of South Bend co-sponsors the program.

Baseline biological monitoring was conducted in Elkhart County from 1998 to 2003 and in St. Joseph County it was conducted from 2001 to 2006.

Other biological monitoring efforts in the area include:

- Sampling in the Mishawaka area from 2007 to 2009.
- Sampling in the Goshen area in 2009 and 2010.
- An in-depth sampling initiative in the Cobus Creek Watershed in 2016.
- An evaluation of plant communities in the St. Joseph River Watershed in 2017 and 2018.

The Index of Biotic Integrity (IBI) (Simon, 1997) is the system that is used to assess local fish communities. The IBI scores a stream based on a range of 0 to 60 with 0 being very poor and 60 being perfect. The IBI is a great tool in that complex biological information can be analyzed to provide measurements of stream quality for non-biologists and members of the general public. The IBI is comprised of 12 different categories known as metrics, which are used to evaluate ecological balance within the fish communities. Examples of metrics include the number of species present in the sample or the % of the sample that are insectivores.

A northern hogsucker from the St. Joseph River in South Bend

Fish are not the only animal that are used to evaluate stream health. The Aquatics Program also monitors macroinvertebrates as a secondary group that provides additional information on stream health. The Invertebrate Community Index (ICI) (Ohio EPA, 1987) is used to evaluate macroinvertebrates and is similar in structure to the IBI, with numerous metrics and a score range of 0 to 60.

Habitat is also evaluated at every site where a fish community survey is completed using the Qualitative Habitat Evaluation Index (QHEI) (Rankin, 1989).

The QHEI is structured similarly to the IBI in that it is comprised of numerous metrics that tally-up to provide a score ranging from 0-100.

The Aquatics Program is comprised of a full-time biologist and college interns that help collect fish during the summer.

2019 Staff:

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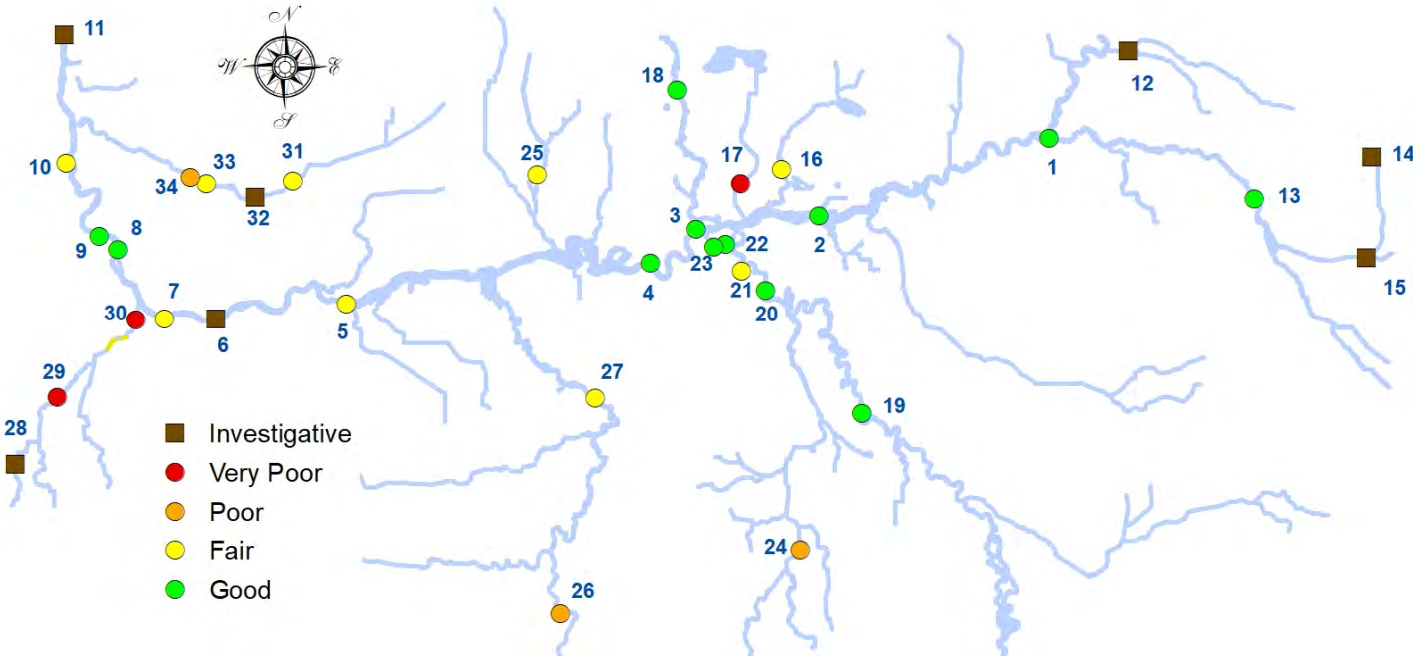
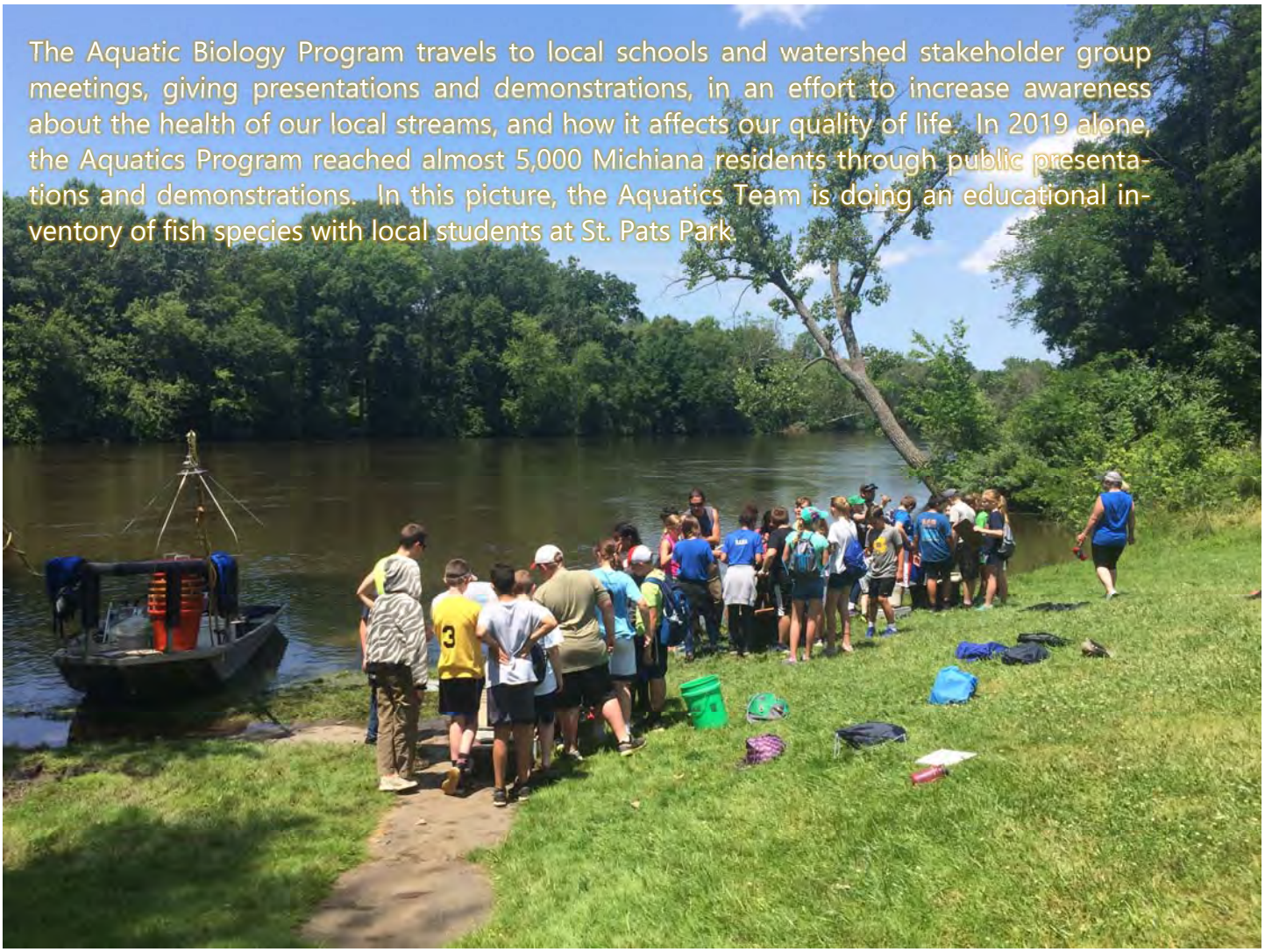
Interns: Conor Flora, Geoff Miller, Hannah Simnick, Joshua Schwalm

Figure 1: Fish sampling sites in Elkhart and St. Joseph Counties and associated fish community conditions for 2019 (see Table 12 for site information)





Geoff with a big walleye in Bristol. Walleye and smallmouth bass are tagged to obtain growth and movement information

Biological Survey Methods

Sites were sampled using two basic methods: Index and Investigative sampling. Investigative samples are more exploratory in nature and generally used to gauge species composition and general stream characteristics. Index evaluations are more thorough; the data from Index samples are used to complete stream health measurements. Index samples include:

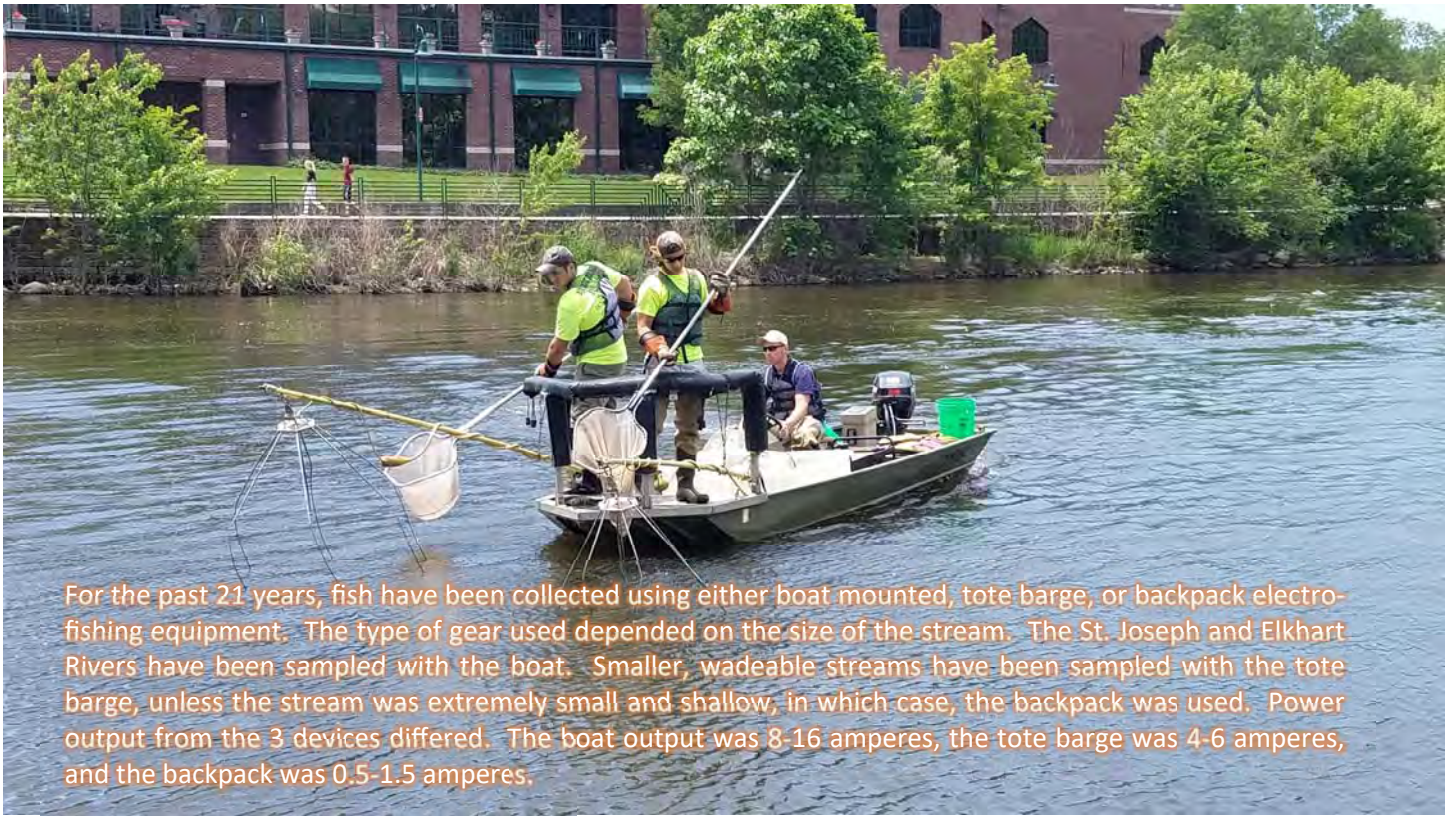
- Conducting electrofishing surveys on stream segments that are 15 times the width of the stream up to a maximum of 500 meters.
- Conducting 2 surveys on the same stream segment with a 5-week rest period (Index scores are averaged from the 2 surveys)
- Collecting length and weight data from each individual game fish
- Collecting the maximum and minimum length and combined weight of all non-game species

Macroinvertebrate sampling was also conducted at most Index sites. Hester-Dendy samplers (artificial substrates used to collect small aquatic organisms) (pictured below) were deployed at 22 Index sites in 2019. Additional sampling with a D-net is also conducted at each site for macroinvertebrates as a back-up for sites where Hester-Dendy samples are lost or disturbed.

Long-term Index monitoring consists of rotational sampling of sites. 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.

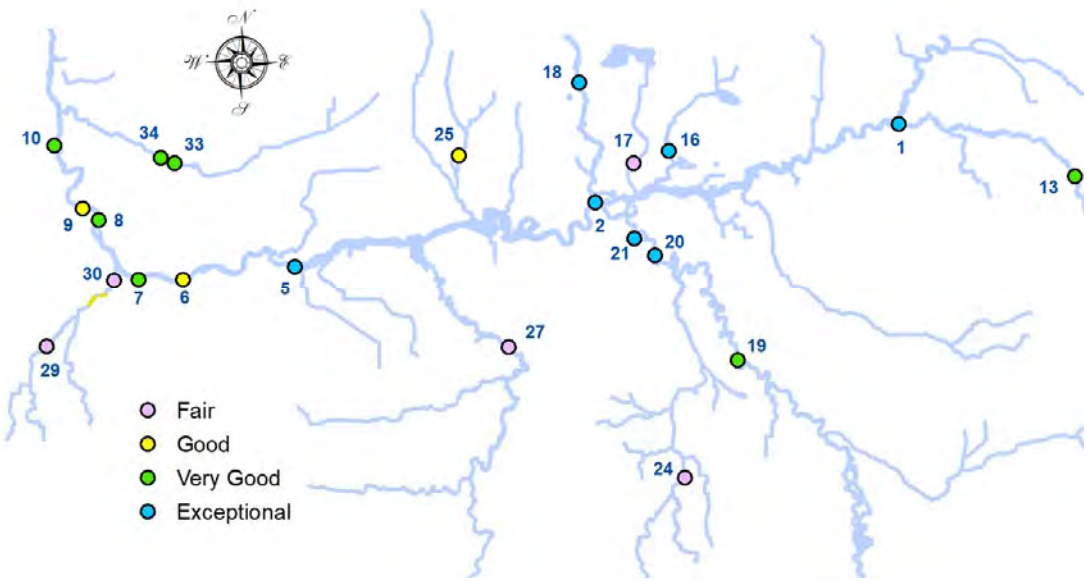
In 2019, 10 Index and 4 Investigative sites were sampled in St. Joseph County and 16 Index and 4 Investigative sites were sampled in Elkhart County. IBI scores were calculated for each of the Index sites and an average from the 2 visits was obtained to give the final score.

Hester-Dendy sampler placed into the stream bed



For the past 21 years, fish have been 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 have been sampled with the boat. Smaller, wadeable streams have been 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.

Figure 2: Macroinvertebrate sampling sites and associated condition for 2019 (see Table 12 for site information)



2019 Results and Discussion

Fish community conditions at the index sites ranged from very poor (12) at Gertrude Street and Ravina Park on Bowman Creek to good (54) at CR 4 on Christiana Creek and at Bristol on the St. Joseph River. Macroinvertebrate community scores ranged from fair (26) at Gertrude Street on Bowman Creek to exceptional (54) at Bristol on the St. Joseph River and Indiana Avenue on the Elkhart River. Habitat quality ranged from poor (26) on Hunter Lake Drain to excellent (86) at Michigan Street on the St. Joseph River and at CR 3 (N) on Baugo Creek.

Fish by the Number

During the summer of 2019 a total of 18,223 fish, representing 16 families and 71 species, were collected in Elkhart County. In St. Joseph County, 7,205 fish, representing 13 families and 51 species were collected. In total, 73 different species were captured from the 2 counties.

Rock bass (*Ambloplites rupestris*), smallmouth bass (Micropterus dolomieu), and longear sunfish (*Lepomis megalotis*) were the most abundant species collected in St. Joseph County, while mimic shiner (*Notropis volucellus*), spotfin shiner (*Cyprinella spiloptera), and striped shiner* (*Luxilus chrysocephalus*) were the most abundant in Elkhart County. For more detailed information on the number and types of fish species collected, see Appendix C.

Its not unusal for the Aquatics Program to find goldfish and other aquarium spcies. Pictured above is a large koi collected from the St. Joseph River in South Bend. Pictured below is a large goldfish collected from Baugo Creek.

Table 1. Index scores for St. Joseph River sites, Elkhart and St. Joseph Counties

Station	County	River Mile	Fish IBI Scores				2019 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2013	2016	**2019**		Baseline/ Previous Score	**2019**
SR 15 (Bristol)	Elkhart	86.8	*53*	54	55	**54**	85	42	**54**
Homan Avenue	Elkhart	79	*43*	44	32	**49**	59		
Sherman Street	Elkhart	76.2	*48*	54	47	**49**	85	44	**50**
Nappanee Street	Elkhart	73.7	*48*	49	51	**49**	62		
Capital Avenue	St. Joseph	64.4	*43*	50	46	**44**	62	48	**52**
Sample Street	St. Joseph	58.4	*40*	40		**46**	62		**46**
Michigan Street	St. Joseph	56.7	*45*	51	46	**52**	86	41	**46**
Michigan St. (Below)	St. Joseph	56				**49**	85		**42**
Pinhook (Below)	St. Joseph	53.3	*51*	54	45	**45**	85	44	**46**

St. Joseph River

Fish, macroinvertebrate, and habitat index scores for the entire Indiana portion of the St. Joseph River are displayed in Table 1. Previous index scores are also included.

In 2019, IBI scores at sites in the Elkhart County section of the St. Joseph River all fell within the good range. All Elkhart County sites with the exception of Homan Avenue were just slightly above their baseline scores. Homan Avenue received a very high IBI score (49) relative to its baseline. Fish community scores on the St. Joseph River in Elkhart County have remained stable since the completion of baseline monitoring, with a slightly positive trend. Macroinvertebrate community scores were very high relative to their baselines at the two Elkhart County sites that were sampled (SR 15 and Sherman Street). The score at SR 15 was 54, up 12 from its baseline, and the score at Sherman Street was 50, up 6 from its baseline.

IBI Scores for the St. Joseph County section were either at or above baseline values with the exception of the Pinhook (B) site. Michigan Street and Sample Street both scored well above their respective baseline values. Sample Street in particular had a pretty promising score of 46 which is the highest since the inception of monitoring at this site. The Pinhook (B) score of 45 was well below its

Kyle Walker, a guest with the Elkhart Catalyst Program takes measurements from a largemouth bass from the Elkhart River at Elkhart Avenue

baseline value of 51. It also had the same score in 2016 suggesting a long-term decline at this site. An in-depth review of fish community data at this site indicates a reduction in the number of suckers and an increase in the number of sunfish, which has had a influence on the IBI score. Similar changes have also occurred at other sites along the St. Joseph River and its tributaries. We believe that these changes may be related to flow conditions in the St. Joseph River, and not directly tied to a water quality problem. Specifically, the drought that occurred in 2012 is likely a big driver in the increase of sunfish populations, while several floods that have occurred on the St. Joseph River since 2008 are likely playing a role in decline of sucker species. Drought conditions have been documented to benefit sunfish populations while flooding conditions have been documented to negatively impact sucker populations (Keaton et al, 2005; Quist and Spiegel, 2012).

Conner with a big channel catfish from Capital Avenue on the St. Joseph River

Factors Influencing Fish Communities in the St. Joseph River Watershed

Interpreting changes in biological communities can be difficult because our rivers and streams are influenced by many factors. Change in water quality is only one reason for potential changes in the numbers and types of fish that we find. Other important factors include:

Habitat

Flooding, drought and climate effects

The influence of dams

How we manage and drain our land

Nutrient input and stream productivity

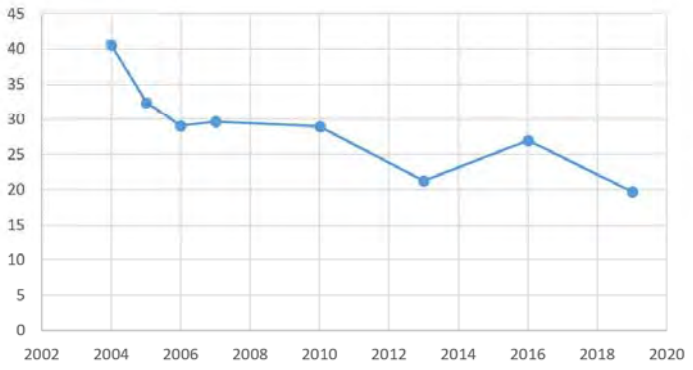


Figure 3: Decline in simple lithophils at Pinhook (B). Simple lithophils are fish species that do not make nests while spawning. Sucker species comprise a large proportion of simple lithophils in the St. Joseph River. More information on simple lithophils is presented on Page 8

In 2019, the Aquatics Program initiated baseline sampling downstream of Michigan Street at the Michgan (Below) site. Simultaneously in 2019, routine sampling was also conducted at the Michigan Street site, just upstream, which is a long-term monitoring site. Scores for both fish and macroinvertebrates were slightly higher at the Michigan Street site. Habitat varies slightly between these two sites, with slightly more habitat diversity at the Michigan Street site. This side-by-side comparison of two sites, in really close proximity, provides an interesting view of the role that habitat can play on biological communities.

Macroinvertebrate community scores for the St. Joseph County section of the St. Joseph River all fell in the exceptional range (above 45) with the exception of the Michigan (Below) site, which had a score of 42. A noteworthy score of 46 was achieved at Sample Street, which is close to IUSB. Macroinvertebrates were sampled at this site for the first time. The fish and macroinvertebrate scores at this site were surprisingly good as it has relatively poor habitat (QHEI 62) and it is within the impoundment of the South Bend Dam. The ICI score at Michigan Street (46) was also considerably higher than its baseline score of 41.

Elkhart River

IBI scores for the Elkhart River varied in 2019 (Table 2). The site at Indiana Avenue scored much higher than its baseline in 2019, while the site at Middlebury Street had a score close to its baseline value. Macroinvertebrate scores at Middlebury Street and Indiana Avenue both fell in the exceptional range in 2019. The score of 54 at Indiana Avenue was very impressive, tying for the highest score recorded of any site in 2019.

The site at Oxbow Park had a low IBI score relative to its baseline value and the scores it received from 2013 to 2016 (Table 2). This site also experienced depressed scores in 2007 and 2008. Based on an in depth review of various aspects of the fish community, there appears to be an association between the percent of simple lithophils collected during surveys and the IBI score (Figure 4). Furthermore the number of sucker species present also appears to have an influence.

Simple lithophil is the definition given to fish that broadcast their eggs on coarse rock and gravel and do not provide parental protection for their eggs or young. A reduction in simple lithophils may be the result of sedimentation that disturbs spawning substrate.

Nine (9) of the 10 sucker species that are found in St. Joseph River Watershed are simple lithophils making them important indicators of stream and habitat quality.

The Elkhart River at Oxbow Park is another site in the St. Joseph River Watershed where the number of suckers has declined while the number of sunfish species has increased. Macorinvertebrate scores have also been rather disappointing at this site over the years. Despite having excellent habitat, the ICI scores at this site tend to be lower than other Elkhart River sites, in Elkhart, that have more urban influences.

Figure 4: The relationship between the % of simple lithophils collected at Oxbow Park and the IBI score

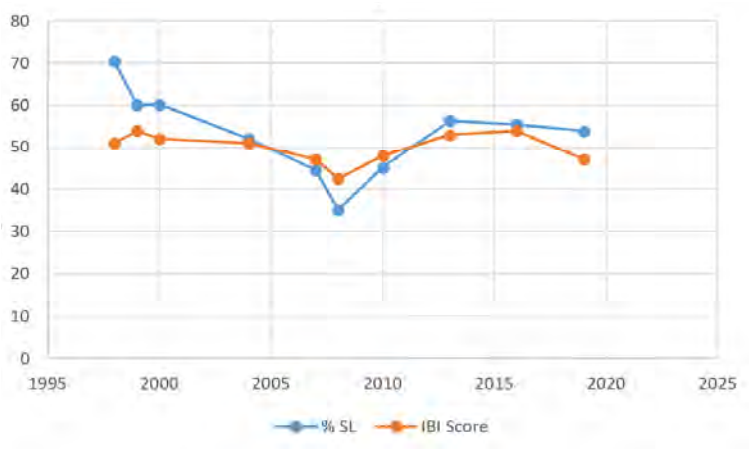
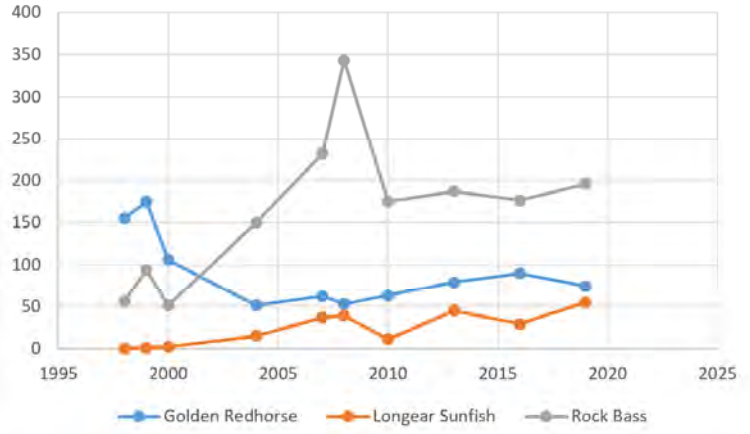


Figure 5: Decline in golden redhorse abundance at Elkhart River Oxbow Park with subsequent increase in rock bass and longear sunfish abundance



Although, this site has had reduced index scores, there are some positive trends to report. The number of species has increased at this site since the inception of monitoring and the number of sensitive species has also increased.

Table 2: Index scores for Elkhart River sites, in Elkhart County

Station	River Mile	Fish IBI Scores				2019 Habitat Scores	(ICI) Macroinvertebrate Scores	
		Baseline	2013	2016	**2019**		2016	**2019**
Oxbow Park	10.8	53	53	54	**47**	85	40	**44**
Indiana Avenue	3.9	46	56	53	**51**	83	50	54
Middlebury Street	2.4	43	42	45	**44**	77	50	**52**
Prairie Street	0.8				**49**	57		
Elkhart Ave	0.5				**50**	83		

Table 3: Index scores for Bowman Creek and Juday Creek sites, St. Joseph County

Stream	Station	Stream Mile	Fish IBI Scores (Coolwater IBI Scores)						2019 Habitat Scores
			Baseline	2013	2016	2017	2018	**2019**	
Bowman Creek	Gertrude Street	3.4	17*			19	20	**12**	55
Bowman Creek	Ravina Park	0.5	6	0	12			**12**	57
Juday Creek	Holy Cross Prkwy	6.6						31(38)	70
Juday Creek	SR 23	5.3	26(29)	36(29)	35(30)			31(37)	70
Juday Creek	Ponader Park	3.7	31(31)*			31(31)	32(30)	30(33)	72

* In 2019 after 3 years of sampling at Gertrude Street on Bowman Creek and Ponader Park on Juday Creek, baseline values have been established for future comparisons

Bowman Creek

The IBI score for Bowman Creek at Ravina Park was 12 in 2019, the same as when this site was last sampled in 2016, and up from the baseline score of 6. The City of South Bend recently performed major habitat improvements at this site by removing a former culvert crossing and improving the riparian habitat. A valid macroinvertebrate sample was collected for the first time in 2019. Attempts in previous years had failed due to lack of flow in the stream. The ICI score in 2019 was 34 which is just below the attainment value of 36 (Table 4). The "attainment value" is the score that the Indiana Department of Environmental Management (IDEM) has set for a stream to be attaining water quality standards. If a stream scores below 36, it is considered to be impaired. Although the score was below 36, this is very promising news for Bowman Creek. While the fish community may be very limited in Bowman Creek, it appears to be mostly a lack of flow issue and an issue with stream connectivity that prevents fish from moving in and colonizing the stream. Macroinvertebrate sampling confirm that water quality is not the driving force behind impairment in this stream,

The third consecutive year of baseline monitoring at Gertrude Street was completed in 2019. Respective IBI scores of 19, 20, and 12 were obtained in 2017, 2018, and 2019 establishing a 3 year average baseline value of 17. The fish community at this site appears to be relatively limited, with only a few species present. The habitat is also poor (2019 QHEI Score of 55). The macroinvertebrate score in 2019 was 26, down from the previous two years when scores were 34. The 3 year baseline average for this site was 31, which is a good score for this stream despite being below the attainment line of 36.


Conner with a brown trout from Juday Creek

Juday Creek

Baseline monitoring of fish was completed at Ponader Park in 2019. Respective IBI scores of 31, 30, and 33 were received in 2017, 2018, and 2019 providing an average baseline value of 31. This baseline value is just below the state attainment value of 32 for coolwater streams. The Aquatic Program uses a coolwater calibration of the IBI to assess Juday Creek. As mentioned in previous years, macroinvertebrate communities tend to provide a better understanding of water quality in Juday Creek. While 2019 was the second year of baseline sampling in Juday Creek, the ICI score has been 48 at this site in the past 2 years, falling in the very good range.

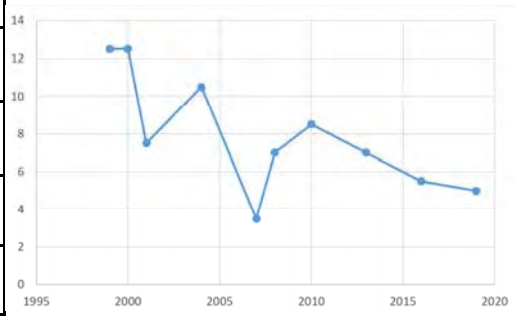
The IBI score at SR 23 was 37, the highest value this site has received since monitoring was initiated. While the

Table 4: Macroinvertebrate Scores for additional Bowman and Juday

Stream	Station	Stream Mile	2013	2016	2017	2018	2019
Bowman Creek	Gertrude Street	3.4			34	34	26
Bowman Creek	Ravina Park	0.5					34
Juday Creek	SR 23	5.3	48	*Good			48
Juday Creek	Ponader Park	3.7				48	48

***Narative rating based on qualitative sample results because Hester Dendy Samplers were lost**

Figure 6: The average number of fish species collected annually at Lily Creek Reckell Avenue



number of species has not increased at this site, trends with other IBI metrics including the % of tolerant fish, the % of detritivores, and the % of pioneering fish are showing improvement. Similar to Ponader Park, macroinvertebrate ICI scores at this site reflect superior stream quality. The score in 2019 was 48 and similar to previous ICI scores.

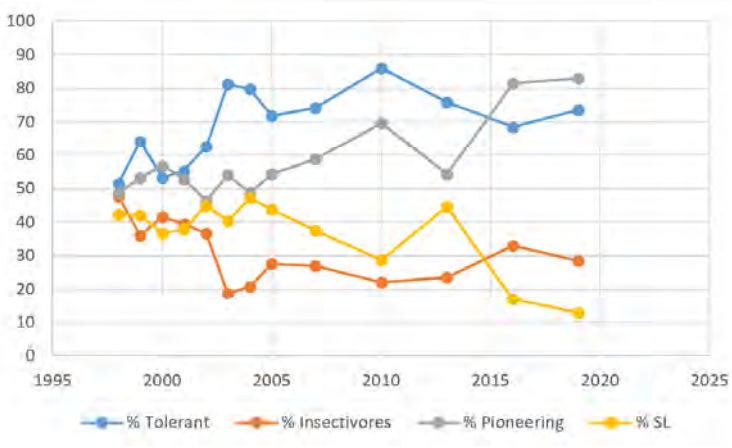
Detritivorous fish are those that consume detritus as a large portion of their diet. Detritus is a mixture of small organic and inorganic particles. In local streams, leaf material comprises a lot of the detritus that is present. A lower proportion of detritivorous fish is generally desired in a fish community.

Pioneering species are those that show up soon after a disturbance. A lower proportion of pioneers is also generally desired in a fish community.

Yellow Creek

Yellow Creek at Concord High School had a low IBI of 32 in 2019, falling below its baseline value of 36. This site also scored 36 the last time it was sampled in 2016. Having a score below 36 also puts the fish community in the "impaired" range according to IDEM standards. In general, this site has degraded since the inception of monitoring. Negative trends within the fish community have occurred; the % of tolerant fish and pioneering species

Figure 7: Negative trends in several metrics for Yellow Creek at CR 32. Note the negative relationships in the data.



has increased, while the % of insectivores and simple lithophils has decreased (Figure 7). In addition, the number of species has also decreased. These declining trends in Yellow Creek are discouraging, as many other streams in the watershed appear to be enhancing. The macroinvertebrate score at this site (34) also dropped in 2019, down from 38 in 2016.

Lily Creek

Lily Creek at Reckell Avenue had a very low IBI score of 20 relative to its baseline value of 34. This stream is a regu-

Table 5: Index scores for Yellow Creek and Lily Creek, Elkhart County

Stream	Station	River Mile	Fish IBI Scores				2019 Habitat Scores	Macroinvertebrate Scores	
			Baseline	2013	2016	2019		2016	2019
Yellow Creek	County Road 32	7.2	36	33	36	32	59	38	34
Lily Creek	Reckell Ave	1.1	34	19	19	20	44	26	30

Table 6: Index scores for sites on the Little Elkhart, Christiana Creek and Baugo Creek, Elkhart County

Stream	Station	River Mile	Fish IBI Scores (Coolwater IBI Scores)				2019 Habitat Scores	ICI Macroinvertebrate Scores	
			Baseline	2013	2016	2019		Baseline/Previous Scores	2019
Little Elkhart River	CR 10	7.3	41	43	43	**49**	78	40	**48**
Christiana Creek	CR 4	5.3	48	46	43	**54**	80	47	**52**
Puterbaugh Creek	CR 8	1	39	40	41	**41**	79	47	**50**
Cobus Creek	CR 8	2.2	30 (36)	30 (32)	28 (35)	36 (37)	74	52	**42**

lated drain which undergoes periodic "maintenance" to enhance drainage within the stream. Kring, 2008 reported drainage maintance activities just prior to 2007 that had a profound effect on the fish community. IBI scores plummeted as a result and the fish community has yet to recover. Fish species diversity also crashed at this site and has remained low since 2007 (Figure 6). Macroinvertebrates were sampled for the second time at this site in 2019, producing an ICI score of 30. This score was an increase of 4 from the previous time the site was sampled in 2016, but the score still falls well within the impaired range according to IDEM standards.


A small spiny softshell turtle from the St. Joseph River in downtown South Bend

Little Elkhart River

The IBI score for the Little Elkhart River at CR 10 of 49 was up significantly from the baseline value of 41 and the score of 43 it received in 2019 (Table 6). Several metrics including the # of species, the % of tolerant fish, and % of insectivores suggest a long term improvement at this site (see Appendix G for additional metric information). The macroinvertebrate ICI score (48) was also up significantly from the baseline value of 40.


Four darter species collected from Puterbaugh Creek: (top left—clockwise) logperch, rainbow darter, johnny darter, blackside darter

Christiana Creek

Christiana Creek at CR 4 had a very good IBI score of 54, up significantly from the baseline and the past two sampling events (Table 6). A review of IBI metrics indicates some instability at this site. For example, the average number of fish collected in 2013, 2016, and 2019 was 285, 1186, and 565 respectively. In general, however, IBI metrics are trending positively with an increase in species, insectivores, and simple lithophils (see Appendix G for additional metric information). The macroinvertebrate ICI score (52) was also up significantly from

Table 7: Index Scores for Baugo Creek, Elkhart and St. Joseph County

Stream	Station	River Mile	Fish IBI Scores				2019 Habitat Scores	ICI Macroinvertebrate Scores	
			Baseline	2013	2016	2019		Baseline Score	**2019**
Baugo Creek	CR 1 (S)	5	30	29	29	34	77		
Baugo Creek	CR 3 (N)	1.5	40	40	43	46	86	25	**32**

the baseline value of 47.

Puterbaugh Creek

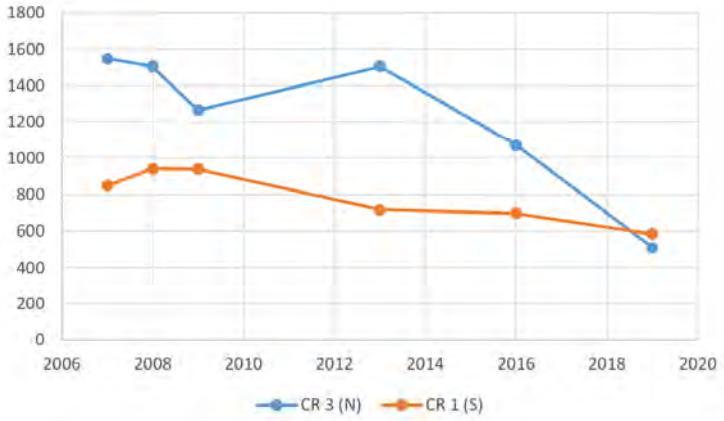
Puterbaugh Creek is an interesting stream in that it has coldwater influences and warmwater influences. This creek has a significant amount of groundwater infiltration, which promotes several coolwater species including mottled sculpin. It also connects Heaton Lake to the St. Joseph River and drains East Lake, which all promote warmwater fish species in this stream. Since the inception of monitoring at this site, the fish community has remained relatively stable, as have the IBI scores that it has received (Table 6). Macroinvertbretate scores have always been in the good to exceptional range at this site, and that did not change in 2019 with an ICI score of 50.

Cobus Creek

Cobus Creek is another site with significant coolwater influences, more so than Puterbaugh Creek. IBI scores for this site have been relatively stable, although various metrics within the IBI have fluctuated over the years. Like several other sites, the number of species collected was at its highest in 2019. The macroinvertebrate score (42), on the other hand, was poor relative to the last time the site was sampled when the ICI score was 52. This stream appears to have a lot of fine sand input from upstream sources

Hannah Simnick standing next to a stream bank in Baugo Creek. Because of the flow instability in Baugo Creek, eroded banks are common. This eroded bank offers a view of the soil profile on the stream bank. A thick clay layer is on the bottom followed by coarse rocks and gravel with topsoil on top.

Figure 8: Recent decline in the number of fish collected during surveys at Baugo Creek sites



that is limiting its habitat. The habitat disturbance from sand likely has an impact on the macroinvertebrate community.

Baugo Creek

IBI scores for sites on Baugo Creek at CR 1 (S) and CR 3 (N) were well above their respective baselines in 2019 and the highest since the completion of baseline monitoring (Table 7). While most IBI metrics do not indicate substantial changes in the fish community, the number of fish collected during surveys has decreased at both sites in recent years. At first thought, a decline in fish collected may warrant some concern, however, the numbers collected in 2019 are more inline with what is expected in a stream the size of Baugo Creek. Excessive numbers of fish is an indication of too much nutrients being present in a stream. Macroinvertebrates were only sampled in CR 3 (N) in 2019, producing a score of 32. Although this score is in the "impaired" range, it is significantly higher than the baseline value of 26. While the fish community score in 2019 at CR 3 (N) was very good for this stream, the macroinvertebrate score demonstrates the water quality issues in this stream. This stream has a lot of agricultural influence and much of its watershed has been highly modified for agricultural drainage (Deegan, 2015). As a result, flow levels in this stream fluctuate significantly, which has an impact on the biological communities that are present.

Geoff Miller and Conner Flora pose with a giant snapping turtle collected from the St. Joseph River in Bristol

Josh with a young snapping turtle from the St. Joe In downtown Elkhart

Fish Tissue

In 2019, tissue was collected from fish in both Elkhart and St. Joseph Counties. Collections were based on the current Fish Consumption Advisory (FCA) for

Table 8: 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	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 Hogsucker	ALL	Hg	Unrestricted	*1 meal/week*
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	Up to 17	Hg	Unrestricted	*1 meal/week*
Smallmouth Bass	17+	Hg	*1 meal/week*	*1 meal/week*
Walleye	ALL	PCBs/Hg	1 meal/week	*1 meal/month*
White Sucker	ALL	Hg	Unrestricted	Unrestricted

Table 9: 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	Up to 20	PCBs	1 meal/month	1 meal/month
Channel Catfish	20+	PCBs	1 meal/2 months	1 meal/2 months
Common Carp	ALL	PCBs	1 meal/month	1 meal/month
Crappie	ALL	PCBs	*1 meal/week*	*1 meal/week*
Largemouth Bass	Up to 13	PCBs/Hg	Unrestricted	*1 meal/week*
Largemouth Bass	13+	PCBs/Hg	*1 meal/week*	*1 meal/week*
Redhorse	ALL	PCBs/Hg	I meal/week	*1 meal/week*
Rock Bass	ALL	Hg	Unrestricted	*1 meal/week*
Spotted Sucker	Up to 15		Unrestricted	*Unrestricted*
	15+	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 and migratory behavior of walleye

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 10: 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/Hg	*1 meal/week*	*1 meal/week*
Bullhead Catfish	ALL	PCBs/Hg	Unrestricted	*1 meal/week*
Channel Catfish	ALL	PCBs	Do Not Eat	Do Not Eat
Coho Salmon				
Common Carp	ALL	PCBs	Do Not Eat	Do Not Eat
Crappie	ALL	Hg	Unrestricted	*1 meal/week*
Largemouth Bass	ALL	PCBs/Hg	1 meal/week	*1 meal/week*
Northern Hogsucker	ALL	PCBs	1 meal/month	*1 meal/month*
Northern Pike	ALL	PCBs	1 meal/month	*1 meal/month*
Quilback Carpsucker	ALL	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	Up to 15	PCBs/Hg	*1 meal/week*	*1 meal/month*
Smallmouth Bass	15+	PCBs/Hg	*1 meal/week*	*1 meal/month*
Steelhead	ALL	PCBs	1 meal/week	*1 meal/week*
Walleye	ALL	PCBs	1 meal/month	*1 meal/month*

Table 11: 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	Up to 20	PCBs	1 meal/month	*1 meal/month*
	20+	PCBs	1 meal/2 month	*1 meal/2 month*
Redhorse	ALL	Hg	1 meal/week	*1 meal/month*
Rock Bass	ALL	Hg	Unrestricted	*1 meal/week*
Smallmouth Bass	ALL	PCBs/Hg	1 meal/week	1 meal/week
Walleye	ALL	PCBs/Hg	1 meal/week	*1 meal/week*
White Sucker	Up to 16	Hg	1 meal/week	*1 meal/week*
	16+	Hg	1 meal/week	*1 meal/month*

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

Josh with a big northern pike at the mouth of the Little Elkhart River on the St. Joseph River

area streams and potential data gaps within the FCA. The FCA provides guidance on the rate of consumption of local wild fishes (Tables 8-11) 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 (DOH) website (http://www.in.gov/isdh/23650.htm). In 2019, the DOH released a new interactive web map that features easily accessible fish consumption information for the St. Joseph River Watershed.

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

In 2019, 8 fish tissue samples were collected by the Aquatics Program. Tissue samples were collected for 3 species (common carp, walleye, and bluegill). Multiple samples of the same species were collected in different stretches of the St. Joseph River.

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

The following narrative describes results of the Aquatics Program's fish tissue collections from Elkhart and St. Joseph Counties in 2019 based on the concentration of PCBs and Hg:

Common carp were collected from the St. Joseph River in three different locations in 2019; Main Street in Elkhart, SR 15 in Bristol, and Sample Street in South Bend. Carp (average size 26.1 inches) collected from Main Street in Elkhart had relatively low concentrations of PCBs and Hg. Guidance based on this sample would be one meal per week for the sensitive and general populations. These results illustrate the importance of repeating samples: carp (23.2 inches) collected from the same section of river in 2018 had higher concentrations of PCBs. The current FCA guidance for this section of river is one meal per month (Table 8).

The carp collected from Bristol (average size 28.1 inches) had relatively low levels of PCBs and Hg. Based on the concentrations, the guidance would be one meal per week for the sensitive and general populations.

Hannah with a little northern pike from the Elkhart River

The 2019 Intern Crew collecting data from Christiana Creek.. Pictured from left: Conor Flora, Hannah Simnick, Joshua Schwalm, and Geoff Miller

The carp collected from Sample Street (average size 29.3) had high concentrations of PCBs. Based on the concentrations, guidance for carp for the South Bend section of the river is DO NOT EAT. These results are consistent with the current guidance in the FCA (Table 10).

Three walleye samples were also collected in 2019 on the St. Joseph River. One sample (average size 16 inches) and a second sample (average size 19.5 inches) were collected from Main Street in Elkhart. The third sample (average size 21.3 inches) was collected downstream of Michigan Street in South Bend. The current guidance for walleye in Elkhart County is one meal per week for both populations (Table 8). The 16 inch walleye sample had slightly higher concentrations of Hg, than in previous years. This may alter the FCA guidance in future years.

The walleye collected downstream of Michigan Street yielded relatively low concentrations of PCBs and Hg. The current FCA guidance for walleye in South Bend is one meal per month for both populations (Table 10). This sample had much lower concentrations, which may positively influence future FCAs released by the State.

Two bluegill samples (both with average sizes of 7 inches) were collected from the St. Joseph River in St. Joseph County. One sample was collected at Capital Avenue, while the other was collected below Michigan Street. Both samples had relatively low concentrations of PCBs and Hg. The FCA was updated this year based on bluegill samples collected by the Aquatics Program with consumption guidance of one meal per week for the general and sensitive populations (Table 10). Previous FCAs had guidance of one meal per month for both populations due to high levels of PCBs. The results from 2019 confirm that PCB concentrations have reduced in bluegill from St. Joseph County.

Conclusion

Long-term biological monitoring by the cities of Elkhart

Table 12: Sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2019

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores	ICI Scores	QHEI Scores
						2019	2019	2019
St. Joseph River	SR 15 (Bristol)	1	Index	Elkhart	Boat	54	54	85
	Homan Ave.	2	Investigative	Elkhart	Boat	49		59
	Sherman St.	3	Index	Elkhart	Boat	49	50	85
	Nappanee St.	4	Index	Elkhart	Boat	49		62
	Capital Ave.	5	Index	St. Joseph	Boat	44	52	62
	Ironwood (Above)	6	Investigative	St. Joseph	Boat		42	76
	Sample St.	7	Index	St. Joseph	Boat	46	46	62
	Michigan St.	8	Index	St. Joseph	Boat	52	46	86
	Michigan St. (Below)	9	Index	St. Joseph	Boat	49	42	85
	Pinhook (Below)	10	Index	St. Joseph	Boat	45	46	84
	St. Pat's Park	11	Investigative	St. Joseph	Boat			85
York TWP Ditch	SR 15	12	Investigative	Elkhart	Back Pack			78
Little Elkhart River	CR 10	13	Index	Elkhart	Tote Barge	49	48	78
Hunter Lake Drain	Cottage Grove Drive	14	Investigative	Elkhart	Back Pack			26
Mather Ditch	CR 43	15	Investigative	Elkhart	Back Pack			43
Puterbaugh Creek	CR 8	16	Index	Elkhart	Tote Barge	41	50	79
Lily Creek	Reckell Ave.	17	Index	Elkhart	Back Pack	20	30	44
Christiana Creek	CR 4	18	Index	Elkhart	Tote Barge	54	52	80
Elkhart River	Oxbow Park	19	Index	Elkhart	Boat	47	44	85
	Indiana Ave.	20	Index	Elkhart	Boat	51	54	83
	Middlebury St.	21	Index	Elkhart	Boat	44	52	77
	Prairie St.	22	Index	Elkhart	Boat	49		57
	Elkhart Ave.	23	Index	Elkhart	Boat	50		83
Yellow Creek	CR 32	24	Index	Elkhart	Tote Barge	32	34	59
Cobus Creek	CR 8	25	Index	Elkhart	Tote Barge	36 (37)	42	74
Baugo Creek	CR 1 (South)	26	Index	Elkhart	Tote Barge	34		77
	CR 3 (North)	27	Index	Elkhart	Tote Barge	46	32	86

Table 12: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2019 (continued)

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores 2018	ICI Scores 2018	QHEI Scores 2018
Eberly Ditch	Kern Road	28	Investigative	St. Joseph	Back Pack			57
Bowman Creek	Gertrude St.	29	Index	St. Joseph	Back Pack	12	26	55
	Ravina Park	30	Index	St. Joseph	Back Pack	12	34	57
Juday Creek*	Holy Cross Parkway	31	Index	St. Joseph	Tote Barge	31 (38)		70
	Main Street	32	Investigative	St. Joseph	Back Pack			57
	SR 23	33	Index	St. Joseph	Tote Barge	31 (37)	48	70
	Ponader Park	34	Index	St. Joseph	Tote Barge	30 (33)	48	72

*** 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

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

When the Aquatics Program initiated monitoring in the St. Joseph River in 1998, IBI scores indicated that the river had good to excellent fish communities. IBI scores for the St. Joseph River have not shown much change in the past 20 years. However, a review of individual metrics, suggest that changes are occurring within the fish communities in the St. Joseph River. In 2019, for example, many sites had the highest species diversity ever collected; the SR 15 (Bristol) site on the St. Joseph River averaged almost 40 species per survey in 2019 which is incredibly high.

As was reported in the 2018 report, the total number of fish collected per survey also appears to be increasing across the watershed. This increase does affect IBI scores (sometimes negatively) as it can influence IBI metrics that are based on proportions. An increase in the total number of fish can sometimes be a reflection of too many nutrients in an aquatic ecosystem, so we are interpreting these results cautiously. Furthermore, in general across the watershed, there appears to be a decline in the abundance of sucker species and an increase in the abundance of sunfish. These changes are being reflected in some IBI scores with sites like Pinhook (B) and Oxbow Park, showing declines in IBI scores as a result. Another interesting trend that we are beginning to see, although not discussed in the body of this report, is a general increase in the abundance of some macroinvertebrate groups across the watershed. While it will take some time to determine the significance of these findings, there appears to be general increases in the abundances of some sensitive groups, including mayflies.

In 2019, several interesting findings were observed in area streams. In the St. Joseph River, sites in impounded sections of the river (Sample Street in South Bend and Homan Avenue in Elkhart) had their highest biological index scores to date.

A first valid macroinvertebrate sample was collected from Bowman Creek at Ravina Park, supporting the idea that water quality is not as impaired in this stream as once thought and that limitations to aquatic life are mostly derived from lack of habitat and flow, and stream connectivity issues.

Juday Creek also continues to support very strong macroinvertebrate communities, while the coolwater characteristics of this stream are a natural limitation on the diversity and richness of the fish community.

In Elkhart County, tributary streams like Christiana Creek and the Little Elkhart River continue to support diverse communities of fish and macroinvertebrates, while streams like Yellow Creek, Baugo Creek and Lily Creek continue to be suppressed by land drainage and water quality problems.

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APPENDICES

Appendix A

Biological Assessment Introduction and Methodology

In 2019, 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, which can play an important role 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 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 in 2009 and 2010. Additionally, in 2016 baseline monitoring was conducted on numerous sites in the Cobus Creek Watershed to support a watershed study being conducted by the St. Joseph River Basin Commission (this study is available on the St. Joseph River Basin Commission's website: http://www.sjrbc.com/). While monitoring will not continue in these areas, the baseline data that were gathered will serve as an important reference for future biological comparisons.

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

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 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 is used to 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 2019 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 communi-

ty), 2 (slightly different from the typical community), or 1 (very different from the typical community). The site scores range from 0 to 60 and are classified similar to IBI scores. This combination of fish, habitat, macroinvertebrate, and chemical monitoring provides the cities of Elkhart and South Bend with the most comprehensive view of stream health.

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

In addition to performing water quality monitoring in the St. Joseph River basin, fish collections are conducted to determine the overall species diversity throughout the watershed. Walleye (*Sander vitreus*) and smallmouth bass (*Micropterus dolomieu*) populations are monitored from previous tagging events in cooperation with the Indiana Department of Natural Resources (IDNR). Tissue from 10 fish species was collected and analyzed for mercury and polychlorinated biphenyl (PCB) content. Current Indiana Fish Consumption Advisory data for the State of Indiana (Tables 10-13) include many species from the Indiana portion of the St. Joseph River 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 21 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 2019, 10 index and 4 investigative sites were sampled in St. Joseph County and 16 index and 4 investigative sites were sampled in Elkhart County. IBI scores were calculated for each of the index sites and an average from the 2 visits was obtained to give the final score.

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

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

In late June 2019, Aquatics personnel placed Hester-Dendy samplers (artificial substrates used to collect small aquatic organisms) at 22 sites following Ohio EPA macroinvertebrate sampling procedures (Ohio EPA 1987, 1989). The data gathered from the samplers is considered a quantitative sample where species are identified and specimens are counted. This information was then used to calculate ICI scores for each site. Qualitative sampling also took place at each site with the use of a kick net through all available habitat near the location of the sampler. This extra sampling is used to capture additional species as well as provide information to make an estimate of stream health in the case where an ICI score can not be calculated due to the loss or vandalism of a sampler.

Fish tissue in the form of fillets was collected from bluegill (*Lepomis macrochirus),* common carp *(Cyprinus carpio),* and walleye (*Sander vitreus*). Data and locatoin information are presented in Appendix B of this report. 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.

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 2019

Station	Species	Length Range (in)	PCB Group General Population	Hg Group General Population	PCB Group Sensitive Population	Hg Group Sensitive Population
St. Joseph River Sample Street	Common Carp	28.0-30.0	5	2	5	2
St. Joseph River Main Street	Common Carp	25.4-26.7	2	1	2	2
St. Joseph River SR 15 (Bristol)	Common Carp	27.4-28.9	2	2	2	2
St. Joseph River Main Street	Walleye	18.6-20.6	2	2	2	3
St. Joseph River Main Street	Walleye	15.8-16.2	2	2	2	3
St. Joseph River Michigan (B)	Walleye	20.9-21.7	2	1	2	2
St. Joseph River Capital Ave	Bluegill	6.9-7.1	1	1	1	2
St. Joseph River Michigan (B)	Bluegill	6.7-7.2	1	1	1	2

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

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

Group 1—No restrictions

Group 2—1 Meal/week

Group 3—1 meal/month

Group 4—1 meal/2 months

Group 5—Do Not Eat

Appendix C

Summary of fish collected by county, 2019

Summary of species captured at index sites in Elkhart County, 2019

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs.)	% by Weight
Mimic Shiner	1,959	10.91	2,672	5.89	0.15
Spotfin Shiner	1,471	8.19	4,816	10.62	0.27
Rock Bass	1,380	7.69	88,930	196.06	4.93
Striped Shiner	1,281	7.14	16,361	36.07	0.91
Bluegill	1,233	6.87	40,425	89.12	2.24
Bluntnose Minnow	1,036	5.77	3,143	6.93	0.17
Smallmouth Bass	891	4.96	141,701	312.40	7.85
Creek Chub	777	4.33	17,639	38.89	0.98
White Sucker	748	4.17	127,701	281.53	7.08
Golden Redhorse	721	4.02	451,954	996.39	25.04
Green Sunfish	445	2.48	6,194	13.66	0.34
Longear Sunfish	441	2.46	12,725	28.05	0.71
Common Shiner	422	2.35	5,156	11.37	0.29
Sand Shiner	407	2.27	811	1.79	0.04
Hornyhead Chub	374	2.08	7,528	16.60	0.42
Largemouth Bass	363	2.02	78,196	172.39	4.33
Rosyface Shiner	359	2.00	860	1.90	0.05
Mottled Sculpin	353	1.97	1,807	3.98	0.10
Northern Hog Sucker	343	1.91	97,369	214.66	5.40
Shorthead Redhorse	342	1.91	196,559	433.34	10.89
Rainbow Darter	310	1.73	444	0.98	0.02
Blacknose Dace	265	1.48	918	2.02	0.05
Logperch	263	1.47	2021	4.46	0.11
Johnny Darter	205	1.14	392	0.86	0.02
Stoneroller, Central	196	1.09	2228	4.91	0.12
Silverjaw Minnow	134	0.75	414	0.91	0.02
Blackside Darter	112	0.62	280	0.62	0.02
Common Carp	94	0.52	240,146	529.43	13.31
Banded Killifish	81	0.45	89	0.20	0.00
Grass Pickerel	70	0.39	1,086	2.39	0.06
Chestnut Lamprey	68	0.38	679	1.50	0.04
Silver Lamprey	67	0.37	296	0.65	0.02
Silver Redhorse	64	0.36	93,017	205.07	5.15
Gizzard Shad	64	0.36	7,748	17.08	0.43
Spotted Sucker	59	0.33	10,155	22.39	0.56
Walleye	57	0.32	22,296	49.15	1.24
Northern Pike	53	0.30	43,181	95.20	2.39
Pumpkinseed	42	0.23	2,302	5.08	0.13
Yellow Bullhead	40	0.22	2,937	6.47	0.16
River Chub	38	0.21	439	0.97	0.02
Greenside Darter	37	0.21	95	0.21	0.01
Longnose Dace	36	0.20	201	0.44	0.01
Brown Trout	33	0.18	6,749	14.88	0.37

Summary of species captured at index sites in Elkhart County, 2019 (continued)

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs.)	% by Weight
Blackstripe Topminnow	15	0.08	22	0.05	0.00
Bowfin	14	0.08	18,312	40.37	1.01
Redear Sunfish	13	0.07	1,673	3.69	0.09
Brown Bullhead	11	0.06	3,378	7.45	0.19
Pirate Perch	11	0.06	83	0.18	0.00
Warmouth	10	0.06	189	0.42	0.01
Longnose Gar	9	0.05	4,504	9.93	0.25
Hybrid Sunfish	9	0.05	207	0.46	0.01
Yellow Perch	9	0.05	68	0.15	0.00
River Redhorse	8	0.04	18,600	41.01	1.03
Brook Silverside	8	0.04	18	0.04	0.00
Black Crappie	6	0.03	828	1.83	0.05
Fathead Minnow	6	0.03	17	0.04	0.00
Black Redhorse	4	0.02	3,292	7.26	0.18
Northern Brook Lamprey	4	0.02	100	0.22	0.01
Channel Catfish	3	0.02	5,101	11.25	0.28
Spotted Gar	3	0.02	1,600	3.53	0.09
Golden Shiner	3	0.02	18	0.04	0.00
YOY Suckers (Unid.)	3	0.02	4	0.01	0.00
Greater Redhorse	2	0.01	3,300	7.28	0.18
Rainbow Trout	2	0.01	624	1.38	0.03
Lake Chubsucker	2	0.01	21	0.05	0.00
Quillback	1	0.01	1,600	3.53	0.09
Goldfish	1	0.01	118	0.26	0.01
Stonecat	1	0.01	35	0.08	0.00
Tadpole Madtom	1	0.01	10	0.02	0.00
Creek Chubsucker	1	0.01	10	0.02	0.00
Total	**17,952**	**100.00**	**1,804,766**	**3,978.83**	**100.00**

Summary of species captured at investigative sites in Elkhart County, 2019

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs.)	% by Weight
Striped Shiner	137	50.55	3,005	6.62	58.44
White Sucker	29	10.70	695	1.53	13.52
Bluegill	19	7.01	276	0.61	5.37
Central Mudminnow	18	6.64	134	0.30	2.61
Johnny Darter	13	4.80	16	0.04	0.31
Creek Chub	9	3.32	423	0.93	8.23
Grass Pickerel	8	2.95	271	0.60	5.27
Blackside Darter	8	2.95	11	0.02	0.21
Stoneroller, Central	6	2.21	60	0.13	1.17
Rainbow Darter	6	2.21	17	0.04	0.33
Yellow Bullhead	5	1.85	118	0.26	2.29
Largemouth Bass	3	1.11	53	0.12	1.03
Green Sunfish	3	1.11	24	0.05	0.47
Bluntnose Minnow	2	0.74	5	0.01	0.10
Pirate Perch	2	0.74	3	0.01	0.06
Bowfin	1	0.37	15	0.03	0.29
Hornyhead Chub	1	0.37	12	0.03	0.23
Greenside Darter	1	0.37	4	0.01	0.08
Total	**271**	**100**	**5,142**	**11.34**	**100**

Index Sites	17,952
Investigative Sites	271
Elkhart County Total	18,223

Summary of species captured at investigative sites in St. Joseph County, 2019

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs.)	% by Weight
Bluegill	107	12.63	1,045	2.30	1.12
Longear Sunfish	103	12.16	1,372	3.02	1.48
Smallmouth Bass	100	11.81	9,564	21.09	10.29
Rock Bass	94	11.10	6,621	14.60	7.12
Spotfin Shiner	80	9.45	51	0.11	0.05
Golden Redhorse	56	6.61	48,400	106.70	52.06
Green Sunfish	40	4.72	337	0.74	0.36
Bluntnose Minnow	30	3.54	25	0.06	0.03
Mimic Shiner	30	3.54	19	0.04	0.02
Blacknose Dace	26	3.07	162	0.36	0.17
Mottled Sculpin	26	3.07	142	0.31	0.15
Spotted Sucker	25	2.95	7,100	15.65	7.64
Creek Chub	16	1.89	451	0.99	0.49
White Sucker	16	1.89	84	0.19	0.09
Common Carp	11	1.30	0	0.00	0.00
Blackside Darter	9	1.06	25	0.06	0.03
Sand Shiner	9	1.06	9	0.02	0.01
Logperch	8	0.94	49	0.11	0.05
Redear Sunfish	7	0.83	150	0.33	0.16
Quillback	6	0.71	6,400	14.11	6.88
Shorthead Redhorse	6	0.71	2,600	5.73	2.80
Yellow Bullhead	5	0.59	757	1.67	0.81
Central Mudminnow	5	0.59	22	0.05	0.02
Banded Killifish	5	0.59	17	0.04	0.02
Largemouth Bass	4	0.47	1,051	2.32	1.13
Rainbow Darter	4	0.47	5	0.01	0.01
Johnny Darter	4	0.47	4	0.01	0.00
Greenside Darter	4	0.47	1	0.00	0.00
Black Redhorse	2	0.24	1,800	3.97	1.94
Greater Redhorse	1	0.12	2,200	4.85	2.37
Walleye	1	0.12	1,219	2.69	1.31
Northern Pike	1	0.12	1,200	2.65	1.29
Pumpkinseed	1	0.12	42	0.09	0.05
Striped Shiner	1	0.12	34	0.07	0.04
Grass Pickerel	1	0.12	6	0.01	0.01
Brown Trout	1	0.12	6	0.01	0.01
Northern Hog Sucker	1	0.12	0	0.00	0.00
Chestnut Lamprey	1	0.12	0	0.00	0.00
Total	**847**	**100**	**92,970**	**204.96**	**100.00**

Summary of species captured at index sites in St. Joseph County, 2019

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs.)	% by Weight
Rock Bass	921	14.49	57,869	127.58	6.09
Smallmouth Bass	747	11.75	85,565	188.64	9.01
Longear Sunfish	677	10.65	17,530	38.65	1.85
Spotfin Shiner	527	8.29	1,645	3.63	0.17
Bluegill	511	8.04	13,245	29.20	1.39
Mimic Shiner	425	6.68	576	1.27	0.06
Creek Chub	362	5.69	4,686	10.33	0.49
Mottled Sculpin	350	5.50	1,855	4.09	0.20
Bluntnose Minnow	217	3.41	446	0.98	0.05
Golden Redhorse	177	2.78	159,500	351.64	16.79
Green Sunfish	174	2.74	2,762	6.09	0.29
Shorthead Redhorse	144	2.26	128,000	282.19	13.47
White Sucker	120	1.89	24,608	54.25	2.59
Northern Hog Sucker	110	1.73	37,903	83.56	3.99
Sand Shiner	110	1.73	168	0.37	0.02
Johnny Darter	90	1.42	115	0.25	0.01
Blacknose Dace	88	1.38	428	0.94	0.05
Black Redhorse	81	1.27	71,000	156.53	7.47
Logperch	73	1.15	829	1.83	0.09
Largemouth Bass	49	0.77	8,569	18.89	0.90
Walleye	41	0.64	33,500	73.85	3.53
Blackside Darter	40	0.63	71	0.16	0.01
Common Carp	36	0.57	188,620	415.84	19.86
Pumpkinseed	32	0.50	1,246	2.75	0.13
Greenside Darter	32	0.50	98	0.22	0.01
Banded Killifish	28	0.44	66	0.15	0.01
Redear Sunfish	26	0.41	941	2.07	0.10
Rainbow Trout	21	0.33	9,556	21.07	1.01
Quillback	20	0.31	33,100	72.97	3.48
Spotted Sucker	18	0.28	12,027	26.52	1.27
Rainbow Darter	18	0.28	30	0.07	0.00
Central Mudminnow	13	0.20	41	0.09	0.00
Longnose Gar	11	0.17	6,197	13.66	0.65
Yellow Bullhead	11	0.17	694	1.53	0.07
Gizzard Shad	8	0.13	1,884	4.15	0.20
River Redhorse	7	0.11	17,400	38.36	1.83
Warmouth	7	0.11	202	0.45	0.02
Black Bullhead	6	0.09	157	0.35	0.02
Chestnut Lamprey	5	0.08	67	0.15	0.01
Channel Catfish	4	0.06	11,029	24.31	1.16
Silver Redhorse	3	0.05	10,700	23.59	1.13

Summary of species captured at index sites in St. Joseph County, 2019 (continued)

COMMON NAME	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Stonecat	3	0.05	91	0.20	0.01
Striped Shiner	3	0.05	24	0.05	0.00
Brown Trout	2	0.03	1,575	3.47	0.17
Hybrid Sunfish	2	0.03	101	0.22	0.01
Spottail Shiner	2	0.03	2	0.00	0.00
Fathead Minnow	2	0.03	2	0.00	0.00
Greater Redhorse	1	0.02	3,100	6.83	0.33
Grass Pickerel	1	0.02	89	0.20	0.01
Golden Shiner	1	0.02	4	0.01	0.00
YOY Suckers (Unid.)	1	0.02	1	0.00	0.00
	6,358	100	949,914	2,094.20	100.00

Index Sites	6,358
Investigative Sites	847
St. Joseph County Total	**7,205**

Appendix D

Summary of fish collected by site, 2019
(Reference Table 12 for site numbers and locations)

Stream	St. Joseph River, Elkhart County, 2019							
Site	SR 15 (Bristol)		Homan Ave.		Sherman St.		Nappanee St.	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey	x	x	x			x	x	
#Banded Killifish			x	x	x	x	x	
Black Crappie	x	x					x	
~Black Redhorse	x				x	x		x
Blackside Darter	x	x		x	x	x	x	
Bluegill	x	x	x	x	x	x	x	x
#Bluntnose Minnow	x	x	x	x	x	x	x	x
Bowfin	x	x					x	x
~Brook Silverside					x		x	x
#Brown Bullhead	x		x	x			x	
Brown Trout								x
#Central Mudminnow		x						
#Channel Catfish	x				x	x		
Chestnut Lamprey	x	x	x	x	x		x	
#Common Carp	x	x	x	x	x	x	x	x
Common Shiner			x					
Gizzard Shad	x					x		x
~Golden Redhorse	x	x	x	x	x	x	x	x
Grass Pickerel	x	x	x					
~Greater Redhorse								x
#Green Sunfish	x	x	x	x	x	x	x	x
~Greenside Darter						x		x
~Hornyhead Chub		x					x	x
Hybrid Sunfish		x				x	x	
Johnny Darter		x		x	x	x	x	x
Largemouth Bass	x	x	x	x	x	x	x	x
~Logperch	x	x		x	x	x	x	x
~Longear Sunfish	x	x	x	x	x	x	x	x
Longnose Gar	x	x	x	x	x		x	
~Mimic Shiner	x	x	x	x	x	x	x	x
~Northern Hog Sucker	x	x		x	x	x	x	x
Northern Pike	x	x	x	x		x	x	x
Pirate Perch	x	x					x	
Pumpkinseed	x	x	x	x	x	x	x	x
#Quillback							x	
~Rainbow Darter			x	x		x	x	x
Redear Sunfish		x		x			x	
~River Redhorse					x	x	x	x
~Rock Bass	x	x	x	x	x	x	x	x
~Rosyface Shiner	x	x			x			

Stream	St. Joseph River, Elkhart County, 2019							
Site	SR 15 (Bristol)		Homan Ave.		Sherman St.		Nappanee St.	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
`Sand Shiner	x		x					
`Shorthead Redhorse	x	x	x		x	x	x	x
Silver Lamprey	x	x						
`Silver Redhorse	x	x	x	x		x	x	
`Smallmouth Bass	x	x	x	x	x	x	x	x
Spotfin Shiner	x	x	x	x	x	x	x	x
Spotted Sucker	x	x	x	x			x	x
Stoneroller, Central		x		x		x		x
Striped Shiner	x	x			x	x	x	
Walleye	x	x			x	x	x	x
Warmouth		x				x	x	
#White Sucker	x	x	x	x	x	x	x	x
#Yellow Bullhead	x	x		x		x		x
Yellow Perch			x	x				
YOY Suckers (Unid.)								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 (Below South Bend Dam) 2019						
Site	Michigan St.		Michigan St. (B)		Pinhook (B)		St. Pats Park
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
#Banded Killifish	x	x			x	x	x
~Black Redhorse	x	x	x	x	x	x	x
Blackside Darter	x	x		x		x	x
Bluegill	x	x	x	x	x	x	x
#Bluntnose Minnow	x	x	x	x			x
#Channel Catfish			x				
Chestnut Lamprey	x				x		x
#Common Carp					x	x	
#Creek Chub				x			
Gizzard Shad			x				
~Golden Redhorse	x	x	x	x	x	x	x
#Golden Shiner						x	
~Greater Redhorse							x
#Green Sunfish	x	x	x	x	x	x	x
~Greenside Darter				x		x	
Hybrid Sunfish						x	
Johnny Darter	x	x		x		x	x
Largemouth Bass			x	x	x	x	x
~Logperch	x	x		x		x	
~Longear Sunfish	x	x	x	x	x	x	x
Longnose Gar	x	x	x	x		x	
~Mimic Shiner	x	x	x	x	x		x
Mottled Sculpin					x		
~Northern Hog Sucker	x	x	x	x	x	x	
Northern Pike							x
Pumpkinseed		x		x		x	
#Quillback	x	x	x	x			x
~Rainbow Darter	x	x		x		x	x
Rainbow Trout			x		x		
Redear Sunfish		x		x	x	x	x
~River Redhorse	x	x	x			x	
~Rock Bass	x	x	x	x	x	x	x
~Sand Shiner	x	x				x	x
~Shorthead Redhorse	x	x	x	x	x	x	x
~Smallmouth Bass	x	x		x	x	x	x
Spotfin Shiner	x	x	x	x	x	x	x
Spottail Shiner				x			
Spotted Sucker						x	x

Stream	St. Joseph River, St. Joseph County (Below South Bend Dam) 2019						
Site	Michigan St.		Michigan St. (B)		Pinhook (B)		St. Pats Park
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
`Stonecat		x		x			
Striped Shiner							
Walleye	x	x	x	x	x	x	
Warmouth						x	
#White Sucker	x	x		x	x	x	x
YOY Suckers (Unid.)				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 (Above South Bend Dam), 2019				
Site	Capital Ave.		Ironwood (Above)	Sample St.	
	1st Pass	2nd Pass		1st Pass	2nd Pass
#Banded Killifish	x	x			X
Blackside Darter		x	x		X
Bluegill	x	x	x	x	X
#Bluntnose Minnow	x	x	x	x	X
#Channel Catfish	x				
Chestnut Lamprey		x		x	
#Common Carp	x	x	x	x	X
#Fathead Minnow				x	
Gizzard Shad	x	x			X
~Golden Redhorse	x	x	x	x	X
Grass Pickerel	x				
~Greater Redhorse				x	
#Green Sunfish	x	x	x	x	X
~Greenside Darter		x	x		
Hybrid Sunfish		x			
Johnny Darter	x	x			X
Largemouth Bass	x	x	x	x	X
~Logperch		x	x		
~Longear Sunfish	x	x	x	x	X
~Mimic Shiner	x	x	x	x	X
~Northern Hog Sucker		x	x	x	
Pumpkinseed	x	x	x		
#Quillback	x	x	x	x	X
~Rainbow Darter			x		X
Rainbow Trout	x			x	
Redear Sunfish			x		
~River Redhorse					X
~Rock Bass	x	x	x	x	X
~Sand Shiner			x	x	X
~Shorthead Redhorse	x	x	x	x	X
~Silver Redhorse	x				X
~Smallmouth Bass	x	x	x	x	X
Spotfin Shiner	x	x	x	x	X
Spottail Shiner		x			
Spotted Sucker	x	x	x	x	X
Striped Shiner	x		x		
Walleye	x	x	x		X
#White Sucker	x	x	x		
#Yellow Bullhead		x	x		X

Tributaries to the St. Joseph River, St. Joseph County, 2019					
Stream	**Eberly Ditch**	**Bowman Creek**			
Site	**Kern Road**	**Gertrude St.**		**Ravina Park**	
		1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**
Bluegill	X				
#Central Mudminnow	X	X	X		
#Creek Chub	X	X	X	X	X
Grass Pickerel	X				
#Green Sunfish	X	X	X		
Redear Sunfish	X				

Tributaries to the St. Joseph River, St. Joseph County, 2019							
Stream	**Juday Creek**						
Site	**Holy Cross Parkway**		**Main St.**	**SR 23**		**Ponader Park**	
	1st Pass	**2nd Pass**		**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
#Black Bullhead		X		X	X	X	X
Blacknose Dace	X	X	X		X	X	X
Brown Trout		X	X				
#Central Mudminnow			X			X	X
#Common Carp							
#Creek Chub	X	X	X	X	X	X	X
#Green Sunfish	X	X	X	X	X	X	X
Johnny Darter		X	X	X	X	X	X
~Longear Sunfish	X						
Mottled Sculpin	X	X	X	X	X	X	X
Rainbow Trout				X			
~Rock Bass				X			
~Smallmouth Bass						X	X
#White Sucker	X			X	X	X	X

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Tributaries to the St. Joseph River, Elkhart County, 2019										
Stream	**Elkhart River**									
Site	**Oxbow Park**		**Indiana Ave.**		**Middlebury St.**		**Prairie Ave.**		**Elkhart Ave.**	
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
~American Brook Lamprey	X	X	X	X	X	X				
Black Crappie								X	X	
#Blacknose Dace			X							
Blackside Darter	X	X	X	X		X		X	X	X
Blackstripe Topminnow	X	X			X					
Bluegill	X	X	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X	X	X	X
Bowfin								X	X	X
#Brown Bullhead	X								X	
#Central Mudminnow	X		X	X	X	X				
Chestnut Lamprey	X	X	X	X	X	X	X	X	X	X
#Common Carp								X	X	X
Common Shiner	X		X	X		X		X	X	
#Creek Chub		X	X							X
Gizzard Shad									X	X
~Golden Redhorse	X	X	X	X	X	X	X	X	X	X
#Golden Shiner										X
Grass Pickerel	X	X	X	X				X		
~Greater Redhorse							X			
#Green Sunfish	X	X	X	X	X	X	X	X	X	X
~Hornyhead Chub	X	X	X	X	X	X				X
Hybrid Sunfish								X		
Johnny Darter	X			X		X				X
Largemouth Bass	X	X	X	X	X	X	X	X	X	X
~Logperch										X
~Longear Sunfish	X	X	X	X	X	X	X	X	X	X
~Mimic Shiner				X					X	X
~Northern Brook Lamprey					X					
~Northern Hog Sucker	X	X	X	X	X	X	X	X	X	X
Northern Pike	X	X	X	X	X	X	X	X		X
Pirate Perch			X	X	X	X	X			
Pumpkinseed			X						X	
~Rainbow Darter		X		X	X	X		X		X
Redear Sunfish			X	X	X		X			
~River Redhorse									X	
~Rock Bass	X	X	X	X	X	X	X	X	X	X
~Rosyface Shiner	X	X	X	X	X	X	X		X	X
~Sand Shiner	X	X	X	X	X	X		X	X	
~Shorthead Redhorse									X	X
Silver Lamprey		X	X	X	X				X	X

Tributaries to the St. Joseph River, Elkhart County, 2019										
Stream	**Elkhart River**									
Site	**Oxbow Park**		**Indiana Ave.**		**Middlebury St.**		**Prairie Ave.**		**Elkhart Ave.**	
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
~Silver Redhorse										X
Silverjaw Minnow		X								
~Smallmouth Bass	X	X	X	X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X	X	X	X
Spotted Gar									X	X
Spotted Sucker	X	X	X	X	X		X	X		
Stoneroller, Central	X	X								X
Striped Shiner	X	X	X	X	X	X	X	X	X	X
Walleye	X	X	X				X	X	X	X
#White Sucker	X	X	X	X	X	X	X	X	X	X
#Yellow Bullhead					X	X		X		

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Tributaries to the St. Joseph River, Elkhart County, 2019										
Stream	Little Elkhart		Puterbaugh Creek		Christiana Creek		Baugo Creek			
Site	CR 10		CR 8		CR 4		CR 1 (S)		CR 3 (N)	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey	X		X	X						
#Banded Killifish								X		
#Blacknose Dace							X	X	X	X
Blackside Darter	X	X	X	X						
Blackstripe Topminnow					X	X				
Bluegill	X	X	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X			X	X	X	X	X	X
Bowfin					X	X				
#Brown Bullhead			X							
Brown Trout	X	X								
#Central Mudminnow	X	X				X				
Chestnut Lamprey		X								
#Common Carp						X	X	X		
Common Shiner	X	X					X	X	X	
#Creek Chub	X	X	X	X		X	X	X	X	X
Creek Chubsucker					X					
Gizzard Shad								X		
~Golden Redhorse			X		X	X	X			
#Golden Shiner								X		
#Goldfish								X		
Grass Pickerel	X	X		X	X	X				
#Green Sunfish	X	X	X	X			X	X	X	X
~Greenside Darter									X	X
~Hornyhead Chub					X	X				
Hybrid Sunfish	X							X		
Johnny Darter	X	X	X	X		X	X	X	X	X
Lake Chubsucker					X	X				
Largemouth Bass	X	X			X	X				X
~Logperch	X	X		X	X	X				X
~Longnose Dace									X	X
Mottled Sculpin	X	X	X	X						
Northern Hog Sucker	X	X			X	X				
Pirate Perch				X						
Pumpkinseed	X						X	X		X
~Rainbow Darter	X	X	X	X	X	X			X	X
Rainbow Trout	X	X								
~River Chub					X	X				
~Rock Bass	X	X			X	X	X	X	X	X

Tributaries to the St. Joseph River, Elkhart County, 2019										
Stream	**Little Elkhart**		**Puterbaugh Creek**		**Christiana Creek**		**Baugo Creek**			
Site	**CR 10**		**CR 8**		**CR 4**		**CR 1 (S)**		**CR 3 (N)**	
	1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
~Sand Shiner							X	X	X	X
~Shorthead Redhorse	X					X			X	X
Silver Lamprey	X	X			X	X				
~Silver Redhorse									X	X
Silverjaw Minnow							X	X	X	X
~Smallmouth Bass		X	X	X	X	X				X
Spotfin Shiner					X					X
Spotted Sucker		X								
~Stonecat					X					
Stoneroller, Central		X	X				X	X	X	X
Striped Shiner	X	X	X		X	X		X	X	X
~Tadpole Madtom					X					
Walleye					X					
Warmouth	X	X			X	X				
#White Sucker	X	X	X	X	X	X	X	X	X	X
#Yellow Bullhead			X		X	X	X	X		

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Tributaries to the St. Joseph River, Elkhart County, 2019									
Stream	**York Twp Ditch**	**Hunter Lake Drain**	**Mather Ditch**	**Lily Creek**		**Yellow Creek**		**Cobus Creek**	
Site	**SR 15**	**Cottage Grove Dive**	**CR 43**	**Reckell Ave.**		**CR 32**		**CR8**	
				1st Pass	**2nd Pass**	**1st Pass**	**2nd Pass**	**1st Pass**	**2nd Pass**
`American Brook Lamprey									X
#Blacknose Dace						X	X	X	X
Blackside Darter	X		X						
Bluegill			X	X	X	X	X		X
#Bluntnose Minnow			X	X		X	X		
Bowfin	X							X	
Brown Trout								X	X
#Central Mudminnow	X	X	X				X	X	X
Common Shiner						X	X		
#Creek Chub	X		X			X	X	X	X
#Fathead Minnow						X	X		
~Golden Redhorse									X
Grass Pickerel	X					X		X	X
#Green Sunfish		X	X	X	X	X	X	X	X
~Greenside Darter	X								
~Hornyhead Chub			X						
Johnny Darter	X		X			X	X		
Largemouth Bass	X	X					X	X	X
Mottled Sculpin								X	X
Pirate Perch	X								
Pumpkinseed						X			
~Rainbow Darter	X						X		
~Rock Bass								X	
Silverjaw Minnow						X	X		
Spotfin Shiner								X	
Stoneroller, Central	X		X	X					
Striped Shiner	X		X		X	X	X		
#White Sucker	X		X	X		X	X	X	X
#Yellow Bullhead	X	X				X		X	
Yellow Perch				X	X				

Appendix E

Summary of macroinvertebrates (insects) collected by site, 2019

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). The following table displays the varioy sites sampled in 2019.

Site Number	Stream	Location	Site Number	Stream	Location
1	St. Joseph River	SR 15 (Bristol)	18	Christiana Creek	CR 4
3	St. Joseph River	Sherman Street	19	Elkhart River	Oxbow Park
5	St. Joseph River	Capital Avenue	20	Elkhart River	Indiana Avenue
6	St. Joseph River	Ironwood (Above)	21	Elkhart River	Middlebury Street
7	St. Joseph River	Sample Street	24	Yellow Creek	CR 32
8	St. Joseph River	Michigan Street	25	Cobus Creek	CR 8
9	St. Joseph River	Michigan St (Below)	27	Baugo Creek	CR 3 (North)
10	St. Joseph River	Pinhook (Below)	29	Bowman Creek	Gertrude Street
13	Little Elkhart River	CR 10	30	Bowman Creek	Ravina Park
16	Puterbaugh Creek	CR 8	33	Juday Creek	SR 23
17	Lily Creek	Reckell Ave	34	Juday Creek	Ponader Park

St. Joseph River - SR 15 (Bristol)

Date Collected: 8/14/2019 Site # 1

Taxa Name	Qualitative	Quantitative	Tolerance	Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	29	+	F	Brachycentrus numerosus	11	+	MI
Oligochaeta	9	+	T	Neophylax sp	0	+	MI
Helobdella papillata	0	+	MT	Pycnopsyche sp	0	+	MI
Placobdella ornata	0	+	MT	Lepidostoma sp	9	+	MI
Hyalella azteca	1	+	F	Helicopsyche borealis	1	+	MI
Gammarus fasciatus	0	+	F	Oecetis sp	1		F
Hydrachnidia	0	+	F	Triaenodes injustus	0	+	MI
Baetis flavistriga	5		F	Parapoynx sp	0	+	MI
Baetis intercalaris	219	+	F	Dineutus sp	0	+	F
Labiobaetis propinquus	0	+	MI	Hydrocanthus sp	0	+	T
Iswaeon anoka	0	+	MI	Psephenus herricki	0	+	MI
Procloeon sp (w/ hindwing pads)	0	+	MI	Dubiraphia sp	0	+	F
Isonychia sp	495	+	MI	Macronychus glabratus	16	+	F
Leucrocuta sp	0	+	MI	Stenelmis sp	0	+	F
Stenacron sp	0	+	F	Anopheles sp	0	+	F
Maccaffertium exiguum	65	+	MI	Simulium sp	11	+	F
Maccaffertium mediopunctatum	86	+	MI	Nilotanypus fimbriatus	4		F
Maccaffertium terminatum	28	+	MI	Orthocladiinae	4		
Teloganopsis deficiens	65		I	Corynoneura lobata	25		F
Tricorythodes sp	22	+	MI	Cricotopus (C.) bicinctus	6		T
Caenis sp	0	+	F	Cricotopussylvestris group	0	+	T
Anthopotamus sp	0	+	MI	Parametriocnemus sp	1		F
Hetaerina sp	0	+	F	Thienemanniella taurocapita	12		MI
Coenagrionidae	0	+	T	Tvetenia bavarica group	9		MI
Argia sp	0	+	F	Cryptochironomus sp	0	+	F
Boyeria vinosa	0	+	F	Cryptotendipes sp 1	0	+	
Nasiaeschna pentacantha	0	+	MT	Dicrotendipes simpsoni	4		T
Pteronarcys sp	0	+	MI	Glyptotendipes (G.) sp	8		MT
Acroneuria abnormis	4		MI	Paratendipes albimanus	0	+	F
Acroneuria internata	0	+	MI	Polypedilum flavum	71		F
Neoperla clymene complex	0	+	I	Polypedilum (P.) fallax group	1		F
Paragnetina sp	8		MI	Polypedilum (P.) illinoense	9	+	T
Agnetina capitata complex	0	+	MI	Polypedilum (P.) laetum grp.	2		MI
Belostoma sp	0	+	T	Rheotanytarsus sp	38	+	F
Pelocoris sp	0	+	MT	Elimia sp	5	+	MI
Notonecta sp	0	+	T	Physella sp	0	+	T
Corydalus cornutus	7		MI	Ferrissia sp	8		F
Chimarra obscura	587	+	MI				
Cyrnellus fraternus	3		F				
Neureclipsis sp	9	+	MI				
Cheumatopsyche sp	276	+	F				
Hydropsyche phalerata	143	+	MI				
Macrostemum zebratum	67	+	I				
Ochrotrichia sp	29		MI				

No. of Quantitative Taxa	43
No. of Qualitative Taxa	60
Total Taxa	81
No. Organisms	2413
Qualitative EPT	28
ICI	**54**

St. Joseph River - Sherman Street

Date Collected: 8/14/2019 Site # 3

Taxa Name	Qualitative	Quantitative	Tolerance	Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	280		F	Ancyronyx variegata	0	+	F
Oligochaeta	0	+	T	Macronychus glabratus	2	+	F
Caecidotea sp	0	+	T	Stenelmis sp	0	+	F
Gammarus fasciatus	0	+	F	Simulium sp	2	+	F
Hydrachnidia	0	+	F	Nilotanypus fimbriatus	8		F
Plauditus dubius or P. virilis	133	+	I	Cardiocladius obscurus	70		MI
Baetis flavistriga	0	+	F	Cricotopus (C.) sp	39		F
Baetis intercalaris	37	+	F	Cricotopus (C.) bicinctus	31		T
Paracloeodes minutus	0	+	MI	Cricotopus (C.) trifascia	8		F
Isonychia sp	662	+	MI	Tvetenia discoloripes group	109	+	MI
Nixe sp	0	+	MI	Dicrotendipes neomodestus	8	+	F
Stenacron sp	0	+	F	Polypedilum flavum	148		F
Maccaffertium exiguum	628	+	MI	Polypedilum (P.) fallax group	0	+	F
Maccaffertium mediopunctatum	56	+	MI	Rheotanytarsus sp	258		F
Maccaffertium m. integrum	2		MI	Hemerodromia sp	16		F
Maccaffertium pulchellum	211	+	MI	Hydrobiidae	0	+	F
Maccaffertium terminatum	0	+	MI	Elimia sp	1	+	MI
Teloganopsis deficiens	206	+	I	Corbicula fluminea	0	+	F
Tricorythodes sp	37	+	MI	Hydroptila sp	61		F
Sparbarus lacustris	0	+	MI	Ochrotrichia sp	81		MI
Anthopotamus sp	0	+	MI	Brachycentrus numerosus	16		MI
Boyeria vinosa	0	+	F	Helicopsyche borealis	0	+	MI
Pteronarcys sp	0	+	MI	Dineutus sp	1		F
Paragnetina sp	1		MI	Ectopria sp	0	+	F
Agnetina capitata complex	2	+	MI	Psephenus herricki	0	+	MI
Chimarra obscura	8		MI	Ancyronyx variegata	0	+	F
Lype diversa	4		MI	Macronychus glabratus	2	+	F
Cyrnellus fraternus	1		F	Stenelmis sp	0	+	F
Cheumatopsyche sp	301	+	F	Simulium sp	2	+	F
Ceratopsyche morosa group	2		MI	Nilotanypus fimbriatus	8		F
Hydropsyche aerata	83		MI	Cardiocladius obscurus	70		MI
Hydropsyche depravata group	10		F	Cricotopus (C.) sp	39		F
Hydropsyche phalerata	45	+	MI	Cricotopus (C.) bicinctus	31		T
Hydropsyche simulans	2		MI	Cricotopus (C.) trifascia	8		F
Macrostemum zebratum	323	+	I	Tvetenia discoloripes group	109	+	MI
Potamyia flava	2		MI	Dicrotendipes neomodestus	8	+	F
Hydroptila sp	61		F	Polypedilum flavum	148		F
Ochrotrichia sp	81		MI	Polypedilum (P.) fallax group	0	+	F
Brachycentrus numerosus	16		MI	Rheotanytarsus sp	258		F
Helicopsyche borealis	0	+	MI	Hemerodromia sp	16		F
Dineutus sp	1		F	Hydrobiidae	0	+	F
Ectopria sp	0	+	F	Elimia sp	1	+	MI
Psephenus herricki	0	+	MI	Corbicula fluminea	0	+	F

St. Joseph River - Sherman Street—continued
Date Collected: 8/14/2019 Site # 3

No. of Quantitative Taxa	40
No. of Qualitative Taxa	51
Total Taxa	86
No. Organisms	4754
Qualitative EPT	21
ICI	**50**

St. Joseph River - Capital Ave

Date Collected: 8/12/2019 Site # 5

Taxa Name	Qualitative	Quantitative	Tolerance
Spongillidae	0	+	F
Turbellaria	468	+	F
Nemertea	18		F
Oligochaeta	0	+	T
Caecidotea sp	0	+	T
Orconectes sp	1		F
Orconectes rusticus	0	+	F
Hydrachnidia	0	+	F
Plauditus dubius or P. virilis	1		I
Labiobaetis dardanus	1		MI
Baetis intercalaris	39	+	F
Paracloeodes minutus	0	+	MI
Isonychia sp	2041	+	MI
Leucrocuta sp	0	+	MI
Nixe sp	0	+	MI
Maccaffertium exiguum	647	+	MI
Maccaffertium mediopunctatum	41		MI
Maccaffertium pulchellum	187	+	MI
Maccaffertium terminatum	0	+	MI
Teloganopsis deficiens	23		I
Tricorythodes sp	34	+	MI
Sparbarus lacustris	0	+	MI
Acroneuria abnormis	1		MI
Acroneuria carolinensis	1		MI
Paragnetina sp	1		MI
Sisyra sp	2		F
Chimarra obscura	30		MI
Cheumatopsyche sp	1658	+	F
Hydropsyche aerata	67		MI
Hydropsyche orris	62		MI
Hydropsyche phalerata	165	+	MI
Macrostemum zebratum	11		I
Potamyia flava	7		MI
Hydroptila sp	20		F
Ochrotrichia sp	29		MI
Brachycentrus numerosus	12	+	MI

Taxa Name	Qualitative	Quantitative	Tolerance
Oecetis persimilis	0	+	MI
Psephenus herricki	0	+	MI
Ancyronyx variegata	0	+	F
Macronychus glabratus	3	+	F
Stenelmis sp	2	+	F
Simulium sp	166	+	F
Procladius (Holotanypus) sp	0	+	MT
Cardiocladius obscurus	11	+	MI
Cricotopus (C.) bicinctus	11		T
Thienemanniella xena	1		F
Tvetenia discoloripes group	17		MI
Axarus sp	0	+	F
Dicrotendipes neomodestus	0	+	F
Paralauterborniella nigrohalteralis	0	+	F
Polypedilum flavum	57	+	F
Polypedilum (P.) illinoense	6	+	T
Rheotanytarsus sp	137	+	F
Hemerodromia sp	1		F
Elimia sp	50	+	MI
Planorbella (Pierosoma) pilsbryi	0	+	T
Corbicula fluminea	2	+	F
Sphaerium sp	0	+	F

No. of Quantitative Taxa	39
No. of Qualitative Taxa	37
Total Taxa	58
No. Organisms	6031
Qualitative EPT	14
ICI	**52**

St. Joseph River - Ironwood (A)

Date Collected: 8/13/2019 Site # 6

Taxa Name	Qualitative	Quantitative	Tolerance	Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	1095	+	F	Oecetis persimilis	8		MI
Nemertea	1		F	Scirtidae	0	+	F
Oligochaeta	20	+	T	Ancyronyx variegata	1		F
Placobdella parasitica	1		MT	Macronychus glabratus	1	+	F
Erpobdella sp	0	+	MT	Stenelmis sp	0	+	F
Caecidotea sp	0	+	T	Simulium sp	0	+	F
Hyalella azteca	1	+	F	Ablabesmyia mallochi	2		F
Crangonyx sp	0	+	MT	Ablabesmyia rhamphe group	11		MT
Gammarus fasciatus	16	+	F	Helopelopia sp	1		F
Orconectes rusticus	0	+	F	Labrundinia pilosella	1		F
Hydrachnidia	0	+	F	Pentaneura inconspicua	1		F
Labiobaetis dardanus	0	+	MI	Procladius (Holotanypus) sp	0	+	MT
Baetis intercalaris	1	+	F	Thienemannimyia group	5		F
Iswaeon anoka	0	+	MI	Cricotopus (C.) bicinctus	0	+	T
Isonychia sp	98		MI	Thienemanniella xena	1		F
Stenacron sp	435	+	F	Chironomus (C.) decorus group	4	+	T
Maccaffertium exiguum	280	+	MI	Cryptochironomus sp	1		F
Maccaffertium mediopunctatum	8		MI	Dicrotendipes neomodestus	2		F
Maccaffertium m. integrum	2		MI	Glyptotendipes (G.) sp	1		MT
Maccaffertium pulchellum	122		MI	Polypedilum flavum	7		F
Maccaffertium terminatum	5		MI	Polypedilum (P.) fallax group	1		F
Teloganopsis deficiens	17	+	I	Polypedilum (P.) illinoense	0	+	T
Tricorythodes sp	130	+	MI	Polypedilum halterale group	1	+	MT
Hexagenia sp	0	+	F	Tribelos fuscicorne	3		F
Coenagrionidae	0	+	T	Tribelos jucundum	3		MT
Argia sp	10	+	F	Hydrobiidae	20	+	F
Agnetina capitata complex	3		MI	Elimia sp	55	+	MI
Climacia sp	1		F	Physella sp	0	+	T
Polycentropus sp	2		MI	Corbicula fluminea	6	+	F
Cheumatopsyche sp	135		F	Dreissena polymorpha	0	+	F
Hydropsyche aerata	1		MI	Pisidium sp	9	+	MT
Hydropsyche phalerata	0	+	MI	Sphaerium sp	10		F
Macrostemum zebratum	264	+	I	No. of Quantitative Taxa	51		
Protoptila sp	2		I	No. of Qualitative Taxa	37		
Hydroptila sp	12		F	Total Taxa	70		
Ochrotrichia sp	12		MI	No. Organisms	2832		
Brachycentrus numerosus	3		MI	Qualitative EPT	11		
Pycnopsyche sp	0	+	MI	**ICI**	**42**		

St. Joseph River - Sample Street

Date Collected: 8/12/2019 Site # 7

Taxa Name	Qualitative	Quantitative	Tolerance
Spongillidae	1		F
Turbellaria	73	+	F
Oligochaeta	16		T
Hirudinida	0	+	MT
Caecidotea sp	0	+	T
Gammarus fasciatus	1	+	F
Hydrachnidia	0	+	F
Plauditus dubius or P. virilis	1	+	I
Baetis intercalaris	344	+	F
Labiobaetis propinquus	0	+	MI
Callibaetis sp	0	+	MT
Isonychia sp	220		MI
Nixe sp	1		MI
Stenacron sp	117	+	F
Maccaffertium exiguum	332		MI
Maccaffertium mediopunctatum	3		MI
Maccaffertium m. integrum	3		MI
Maccaffertium pulchellum	208		MI
Teloganopsis deficiens	117		I
Tricorythodes sp	92	+	MI
Caenis sp	0	+	F
Coenagrionidae	0	+	T
Argia sp	1	+	F
Chimarra obscura	9		MI
Cheumatopsyche sp	399		F
Hydropsyche aerata	2		MI
Hydropsyche orris	22		MI
Hydropsyche phalerata	317		MI
Macrostemum zebratum	126		I
Brachycentrus numerosus	17	+	MI
Triaenodes injustus	0	+	MI
Macronychus glabratus	2		F
Simulium sp	8		F
Nilotanypus fimbriatus	2		F
Thienemannimyia group	2		F
Corynoneura floridaensis	0	+	MI
Cricotopus (C.) bicinctus	5	+	T
Cricotopus sylvestris group	0	+	T
Tvetenia discoloripes group	17		MI
Chironomus (C.) decorus group	0	+	T
Cryptochironomus sp	0	+	F
Dicrotendipes neomodestus	0	+	F
Polypedilum flavum	8		F
Polypedilum (P.) illinoense	0	+	T
Cladotanytarsus mancus group	0	+	F
Rheotanytarsus sp	99		F
Tanytarsus sp	0	+	F
Hydrobiidae	0	+	F
Elimia sp	4	+	MI
Physella sp	0	+	T
Gyraulus sp	0	+	MT
Ferrissia sp	0	+	F

No. of Quantitative Taxa	32
No. of Qualitative Taxa	30
Total Taxa	52
No. Organisms	2569
Qualitative EPT	9
ICI	**46**

St. Joseph River - Michigan Street
Date Collected: 8/12/2019 Site # 8

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	116	+	F
Nemertea	8		F
Oligochaeta	0	+	T
Gammarus sp	0	+	F
Plauditus dubius or P. virilis	0	+	I
Baetis intercalaris	922	+	F
Heterocloeon (H.) sp	57	+	I
Isonychia sp	154	+	MI
Stenacron sp	13	+	F
Maccaffertium exiguum	86	+	MI
Maccaffertium integrum	2		MI
Maccaffertium pulchellum	63	+	MI
Maccaffertium terminatum	0	+	MI
Teloganopsis sp	0	+	I
Teloganopsis deficiens	66		I
Tricorythodes sp	66	+	MI
Hetaerina sp	0	+	F
Argia sp	0	+	F
Chimarra obscura	275	+	MI
Cheumatopsyche sp	535	+	F
Hydropsyche aerata	41		MI
Hydropsyche orris	33		MI
Hydropsyche phalerata	593	+	MI
Hydropsyche simulans	1		MI
Macrostemum zebratum	652	+	I
Hydroptila sp	29		F
Brachycentrus numerosus	0	+	MI
Macronychus glabratus	1	+	F
Stenelmis sp	0	+	F
Simulium sp	1126	+	F
Cardiocladius obscurus	144		MI
Cricotopus (C.) bicinctus	32		T
Cricotopus (C.) tremulus group	8		MT
Cricotopus (C.) trifascia	0	+	F
Nanocladius (N.) crassicornus	8		F
Tvetenia discoloripes group	312		MI

Taxa Name	Qualitative	Quantitative	Tolerance
Chironomus (C.) decorus group	0	+	T
Polypedilum flavum	176		F
Polypedilum scalaenum grp.	0	+	F
Rheotanytarsus sp	120		F
Hemerodromia sp	24		F
Elimia sp	1	+	MI
Physella sp	0	+	T
Sphaerium sp	0	+	F

No. of Quantitative Taxa	30
No. of Qualitative Taxa	29
Total Taxa	44
No. Organisms	5664
Qualitative EPT	15
ICI	**46**

St. Joseph River - Michigan Street (Below)
Date Collected: 8/12/2019 Site # 9

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	18	+	F
Nemertea	16		F
Oligochaeta	14	+	T
Erpobdellidae	0	+	MT
Caecidotea sp	0	+	T
Gammarus fasciatus	5	+	F
Plauditus dubius or P. virilis	1	+	I
Baetis flavistriga	3		F
Baetis intercalaris	79	+	F
Labiobaetis propinquus	0	+	MI
Isonychia sp	4	+	MI
Leucrocuta sp	1	+	MI
Stenacron sp	6	+	F
Maccaffertium exiguum	28	+	MI
Maccaffertium integrum	3		MI
Maccaffertium pulchellum	0	+	MI
Maccaffertium terminatum	6	+	MI
Teloganopsis deficiens	2	+	I
Tricorythodes sp	34	+	MI
Hetaerina sp	0	+	F
Coenagrionidae	0	+	T
Argia sp	1	+	F
Boyeria vinosa	0	+	F
Agnetina capitata complex	0	+	MI
Pelocoris sp	0	+	MT
Chimarra obscura	2		MI
Neureclipsis sp	5		MI
Polycentropus sp	1	+	MI
Cheumatopsyche sp	69	+	F
Hydropsyche phalerata	14	+	MI
Macrostemum zebratum	11	+	I
Protoptila sp	0	+	I
Hydroptila sp	10		F
Brachycentrus numerosus	2	+	MI
Oecetis persimilis	7		MI
Macronychus glabratus	3	+	F

Taxa Name	Qualitative	Quantitative	Tolerance
Stenelmis sp	1	+	F
Simulium sp	2	+	F
Ablabesmyia mallochi	1	+	F
Hayesomyia senata	4		F
Labrundinia pilosella	1		F
Procladius (Holotanypus) sp	0	+	MT
Corynoneura floridaensis	1		MI
Corynoneura lobata	1		F
Cricotopus (C.) bicinctus	1	+	T
Nanocladius (N.) crassicornus	1		F
Thienemanniella xena	16		F
Chironomus (C.) decorus group	1		T
Dicrotendipes neomodestus	3	+	F
Glyptotendipes (G.) sp	1		MT
Polypedilum flavum	2	+	F
Polypedilum (P.) illinoense	1	+	T
Stenochironomus sp	9		F
Rheotanytarsus sp	34		F
Hemerodromia sp	1		F
Elimia sp	10	+	MI
Physella sp	121		T
Planorbella sp	1		T
Planorbella trivolvis	0	+	MT
Corbicula fluminea	0	+	F
Sphaerium sp	0	+	F

No. of Quantitative Taxa	47
No. of Qualitative Taxa	41
Total Taxa	61
No. Organisms	558
Qualitative EPT	14
ICI	**42**

St. Joseph River - Pinhook (B)

Date Collected: 8/12/2019 Site # 10

Taxa Name	Qualitative	Quantitative	Tolerance
Cordylophora caspia	1		MT
Hydra sp	2		F
Turbellaria	27	+	F
Oligochaeta	0	+	T
Placobdella ornata	0	+	MT
Gammarus sp	0	+	F
Hydrachnidia	0	+	F
Plauditus dubius or P. virilis	2	+	I
Labiobaetis dardanus	0	+	MI
Baetis intercalaris	103	+	F
Callibaetis sp	0	+	MT
Isonychia sp	277	+	MI
Leucrocuta sp	0	+	MI
Stenacron sp	1	+	F
Maccaffertium exiguum	360	+	MI
Maccaffertium m.integrum	1		MI
Maccaffertium pulchellum	145	+	MI
Teloganopsis deficiens	46		I
Tricorythodes sp	12	+	MI
Sparbarus lacustris	0	+	MI
Caenis sp	0	+	F
Coenagrionidae	0	+	T
Argia sp	0	+	F
Boyeria vinosa	0	+	F
Stylurus sp	0	+	MI
Corduliidae	0	+	
Agnetina capitata complex	3	+	MI
Belostoma sp	0	+	T
Neureclipsis sp	1		MI
Cheumatopsyche sp	66	+	F
Hydropsyche phalerata	7	+	MI
Hydropsyche venularis	0	+	MI
Macrostemum zebratum	43	+	I
Protoptila sp	0	+	I
Brachycentrus numerosus	2	+	MI
Pycnopsyche sp	0	+	MI
Lepidostoma sp	1		MI
Mystacides sepulchralis	0	+	MI

Taxa Name	Qualitative	Quantitative	Tolerance
Triaenodes injustus	0	+	MI
Dineutus sp	1		F
Gyrinus sp	0	+	F
Peltodytes sp	0	+	MT
Tropisternus sp	0	+	T
Macronychus glabratus	13	+	F
Stenelmis sp	0	+	F
Anopheles sp	0	+	F
Simulium sp	0	+	F
Ablabesmyia simpsoni	0	+	F
Cricotopus (C.) bicinctus	0	+	T
Cricotopus reversus group	0	+	MT
Cricotopus sylvestris group	0	+	T
Thienemanniella xena	3		F
Tvetenia discoloripes group	2		MI
Dicrotendipes modestus	0	+	MT
Dicrotendipes neomodestus	0	+	F
Polypedilum flavum	2		F
Polypedilum (P.) illinoense	1	+	T
Polypedilum halterale group	0	+	MT
Stenochironomus sp	1	+	F
Stictochironomus sp	1		F
Tribelos jucundum	0	+	MT
Rheotanytarsus sp	8	+	F
Valvata bicarinata	0	+	
Hydrobiidae	0	+	F
Elimia sp	15	+	MI
Physella sp	0	+	T
Planorbella (Pierosoma) pilsbryi	0	+	T
Corbicula fluminea	0	+	F
Sphaerium sp	0	+	F

No. of Quantitative Taxa	29
No. of Qualitative Taxa	58
Total Taxa	69
No. Organisms	1147
Qualitative EPT	22
ICI	**46**

Little Elkhart River - CR 10

Date Collected: 8/14/2019 Site # 13

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	2	+	F
Caecidotea sp	1	+	T
Gammarus fasciatus	11	+	F
Orconectes rusticus	0	+	F
Hydrachnidia	0	+	F
Baetis flavistriga	16	+	F
Baetis intercalaris	9		F
Labiobaetis propinquus	0	+	MI
Iswaeon anoka	0	+	MI
Stenacron sp	6		F
Maccaffertium sp	32		MI
Maccaffertium exiguum	21	+	MI
Maccaffertium terminatum	21		MI
Maccaffertium vicarium	58	+	MI
Calopteryx sp	0	+	F
Boyeria vinosa	0	+	F
Gomphus sp	0	+	F
Lype diversa	4	+	MI
Cheumatopsyche sp	50	+	F
Ceratopsyche morosa group	67	+	MI
Ceratopsyche sparna	89	+	F
Protoptila sp	1	+	I
Brachycentrus numerosus	3	+	MI
Neophylax sp	0	+	MI
Pycnopsyche sp	2	+	MI
Lepidostoma sp	0	+	MI
Sperchopsis tesselata	0	+	F
Macronychus glabratus	19	+	F
Optioservus sp	3		MI
Stenelmis sp	0	+	F
Simulium sp	1		F
Conchapelopia sp	19		F
Diamesa sp	0	+	F
Prodiamesa olivacea	0	+	MT
Orthocladiinae	4		
Corynoneura sp	8		
Parametriocnemus sp	4		F
Thienemanniella xena	14		F
Tvetenia bavarica group	39		MI
Microtendipes pedellus group	4	+	F
Paratendipes albimanus	4		F
Polypedilum aviceps	4		MI
Polypedilum (P.) fallax group	27		F
Polypedilum scalaenum group	4		F
Rheotanytarsus sp	224		F
Hemerodromia sp	3		F
Hydrobiidae	1		F
Elimia sp	1	+	MI
Physella sp	0	+	T
Corbicula fluminea	0	+	F
Pisidiidae	0	+	

No. of Quantitative Taxa	35
No. of Qualitative Taxa	32
Total Taxa	51
No. Organisms	776
Qualitative EPT	14
ICI	**48**

Puterbaugh Creek - CR 8

Date Collected: 8/7/2019 Site # 16

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	1	+	F
Oligochaeta	8		T
Erpobdella punctata punctata	1		MT
Gammarus fasciatus	28	+	F
Orconectes sp	0	+	F
Hydrachnidia	2	+	F
Baetis flavistriga	38		F
Baetis intercalaris	57	+	F
Labiobaetis propinquus	0	+	MI
Stenacron sp	103	+	F
Maccaffertium exiguum	56		MI
Maccaffertium terminatum	148		MI
Maccaffertium vicarium	31	+	MI
Tricorythodes sp	0	+	MI
Calopteryx sp	0	+	F
Stylurus sp	0	+	MI
Chimarra obscura	10	+	MI
Cheumatopsyche sp	244	+	F
Ceratopsyche morosa group	4		MI
Ceratopsyche sparna	0	+	F
Hydropsyche depravata group	41	+	F
Brachycentrus numerosus	24	+	MI
Helicopsyche borealis	1	+	MI
Nectopsyche sp	0	+	MI
Sperchopsis tesselata	0	+	F
Scirtidae	0	+	F
Macronychus glabratus	16	+	F
Optioservus sp	9	+	MI
Simulium sp	0	+	F
Conchapelopia sp	21		F
Corynoneura sp	12		
Parametriocnemus sp	16		F
Thienemanniella xena	17		F
Tvetenia bavarica group	25		MI
Microtendipes pedellus group	8		F
Microtendipes rydalensis	62		MI
Paratendipes albimanus	4		F
Polypedilum flavum	21		F
Polypedilum (P.) fallax group	41		F
Polypedilum scalaenum group	8		F
Rheotanytarsus pellucidus	4		MI
Rheotanytarsus sp	99	+	F
Neoplasta sp	4		MI
Hemerodromia sp	3		F
Elimia sp	12	+	MI
Ferrissia sp	25	+	F
Sphaerium sp	0	+	F

No. of Quantitative Taxa	36
No. of Qualitative Taxa	46
Total Taxa	72
No. Organisms	1966
Qualitative EPT	12
ICI	**50**

Lily Creek - Reckell Ave

Date Collected: 8/7/2019 Site # 17

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	28	+	F
Oligochaeta	34		T
Helobdella stagnalis	0	+	T
Gammarus fasciatus	203	+	F
Baetis flavistriga	25	+	F
Stenacron sp	5		F
Calopteryx sp	1	+	F
Coenagrionidae	0	+	T
Notonecta sp	0	+	T
Sialis sp	0	+	MT
Chimarra obscura	1		MI
Cheumatopsyche sp	17	+	F
Hydropsyche depravata group	66	+	F
Hydroptila sp	12		F
Berosus sp	0	+	MT
Psephenus herricki	0	+	MI
Anopheles sp	0	+	F
Clinotanypus pinguis	0	+	MT
Conchapelopia sp	59	+	F
Hayesomyia senata	7		F
Corynoneura sp	4		
Cricotopus (C.) bicinctus	18	+	T
Cricotopus (C.) tremulus group	29		MT
Psectrocladius sp	0	+	MT
Thienemanniella sp	4		
Tvetenia bavarica group	0	+	MI
Microtendipes "caelum"	4		MI
Microtendipes pedellus group	7		F
Paratendipes albimanus	7	+	F
Phaenopsectra obediens group	0	+	F
Polypedilum flavum	139	+	F
Polypedilum (P.) fallax group	15		F
Polypedilum (P.) illinoense	4		T
Polypedilum scalaenum group	4	+	F
Saetheria sp	0	+	F
Micropsectra sp	7		MT

Taxa Name	Qualitative	Quantitative	Tolerance
Paratanytarsus sp	37	+	F
Rheotanytarsus sp	22		F
Tanytarsus glabrescens sp 7	7		F
Hemerodromia sp	12		F
Fossaria sp	0	+	MT
Physella sp	0	+	T
Planorbidae	2		MT
Ferrissia sp	16	+	F
Pisidiidae	1	+	

No. of Quantitative Taxa	31
No. of Qualitative Taxa	28
Total Taxa	45
No. Organisms	797
Qualitative EPT	3
ICI	**30**

Christiana Creek - CR 4

Date Collected: 8/7/2019 Site # 18

Taxa Name	Qualitative	Quantitative	Tolerance	Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	9	+	F	Lepidostoma sp	3	+	MI
Erpobdella punctata punctata	0	+	MT	Helicopsyche borealis	10	+	MI
Caecidotea sp	0	+	T	Mystacides sp	0	+	MI
Gammarus fasciatus	13	+	F	Nectopsyche diarina	0	+	MI
Orconectes sp	0	+	F	Nectopsyche pavida	0	+	MI
Hydrachnidia	2	+	F	Oecetis persimilis	21	+	MI
Plauditus dubius or P. virilis	1		I	Parapoynx sp	0	+	MI
Labiobaetis dardanus	0	+	MI	Dineutus sp	1	+	F
Baetis intercalaris	337	+	F	Psephenus herricki	0	+	MI
Labiobaetis propinquus	0	+	MI	Macronychus glabratus	1		F
Iswaeon anoka	0	+	MI	Stenelmis sp	3	+	F
Heterocloeon (H.) sp	0	+	I	Dixella sp	0	+	F
Paracloeodes minutus	0	+	MI	Simulium sp	13	+	F
PSEUDOCENTROPTILOIDES	0	+	MI	Helopelopia sp	3		F
Isonychia sp	0	3	MI	Nilotanypus fimbriatus	2		F
Stenacron sp	113	+	F	Pentaneura sp	1		F
Maccaffertium exiguum	356	+	MI	Cricotopus (C.) sp	0	+	F
Maccaffertium mediopunctatum	113	+	MI	Nanocladius (N.) sp	1		F
Maccaffertium terminatum	319	+	MI	Rheocricotopus robacki	3		F
Teloganopsis deficiens	422	+	I	Thienemanniella xena	5		F
Tricorythodes sp	41	+	MI	Tvetenia discoloripes group	22		MI
Caenis sp	8		F	Microtendipes "caelum"	6		MI
Baetisca sp	0	+	MI	Polypedilum flavum	13		F
Calopteryx sp	9		F	Polypedilum (P.) fallax grp.	4		F
Hetaerina sp	0	+	F	Polypedilum (P.) illinoense	0	+	T
Coenagrionidae	0	+	T	Polypedilum scalaenum grp.	5		F
Argia sp	0	+	F	Rheotanytarsus sp	12		F
Anax sp	0	+	MT	Cipangopaludina japonica	0	+	MT
Acroneuria internata	2	+	MI	Hydrobiidae	13	+	F
Neoplea sp	0	+	F	Elimia sp	0	+	MI
Corydalus cornutus	13	+	MI	Ferrissia sp	6		F
Chimarra obscura	99		MI	Corbicula fluminea	0	+	F
Neureclipsis sp	0	+	MI	Dreissena polymorpha	0	+	F
Polycentropus sp	0	+	MI	No. of Quantitative Taxa	42		
Cheumatopsyche sp	109	+	F	No. of Qualitative Taxa	52		
Ceratopsyche morosa group	7		MI	Total Taxa	72		
Ceratopsyche sparna	1	+	F	No. Organisms	2178		
Hydropsyche phalerata	44	+	MI	Qualitative EPT	26		
Hydroptila sp	12		F	**ICI**	**52**		

Elkhart River - Oxbow Parl

Date Collected: 8/12/2019 Site # 19

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	10	+	F
Oligochaeta	4	+	T
Caecidotea sp	0	+	T
Gammarus fasciatus	0	+	F
Orconectes sp	0	+	F
Hydrachnidia	0	+	F
Plauditus dubius or P. virilis	0	+	I
Baetis flavistriga	5	+	F
Baetis intercalaris	166	+	F
Labiobaetis propinquus	0	+	MI
Iswaeon anoka	0	+	MI
Leucrocuta sp	0	+	MI
Maccaffertium exiguum	44	+	MI
Maccaffertium mediopunctatum	1	+	MI
Maccaffertium pulchellum	9		MI
Maccaffertium terminatum	13		MI
Tricorythodes sp	2	+	MI
Hetaerina sp	0	+	F
Coenagrionidae	0	+	T
Pteronarcys sp	1		MI
Acroneuria internata	2		MI
Agnetina capitata complex	0	+	MI
Sisyridae	0	+	F
Cheumatopsyche sp	35	+	F
Ceratopsyche morosa group	55	+	MI
Ceratopsyche sparna	19	+	F
Hydropsyche phalerata	0	+	MI
Protoptila sp	0	+	I
Hydroptila sp	5		F
Brachycentrus numerosus	0	+	MI
Nectopsyche diarina	0	+	MI
Berosus sp	0	+	MT
Psephenus herricki	0	+	MI
Ancyronyx variegata	1	+	F
Macronychus glabratus	9	+	F
Stenelmis sp	0	+	F
Simulium sp	8	+	F
Nilotanypus fimbriatus	1		F
Pentaneura sp	1	+	F
Corynoneura sp	1		
Cricotopus (C.) bicinctus	0	+	T
Cricotopus sylvestris group	0	+	T
Rheocricotopus robacki	3		F
Thienemanniella xena	2	+	F
Tvetenia discoloripes group	57		MI
Cryptotendipes pseudotener	0	+	F
Paratendipes albimanus	0	+	F
Polypedilum flavum	1	+	F
Polypedilum (P.) fallax group	4		F
Polypedilum (P.) illinoense	0	+	T
Stenochironomus sp	1		F
Rheotanytarsus sp	26	+	F
Hemerodromia sp	1	+	F
Elimia sp	2	+	MI
Physella sp	0	+	T
Corbicula fluminea	0	+	F
Sphaerium sp	0	+	F

No. of Quantitative Taxa	30
No. of Qualitative Taxa	46
Total Taxa	57
No. Organisms	489
Qualitative EPT	17
ICI	**44**

Elkhart River - Indiana Avenue

Date Collected: 8/12/2019 Site # 20

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	19		F
Oligochaeta	8		T
Gammarus fasciatus	10	+	F
Hydrachnidia	4	+	F
Baetis flavistriga	40	+	F
Baetis intercalaris	297	+	F
Iswaeon anoka	15	+	MI
Isonychia sp	27		MI
Leucrocuta sp	0	+	MI
Stenacron sp	1	+	F
Maccaffertium exiguum	43	+	MI
Maccaffertium mediopunctatum	27	+	MI
Maccaffertium pulchellum	34		MI
Maccaffertium terminatum	83	+	MI
Teloganopsis deficiens	41		I
Tricorythodes sp	6	+	MI
Pteronarcys sp	1	+	MI
Neoperla clymene complex	0	+	I
Paragnetina sp	3		MI
Agnetina capitata complex	3	+	MI
Cheumatopsyche sp	66	+	F
Ceratopsyche morosa group	140	+	MI
Ceratopsyche sparna	259	+	F
Hydropsyche depravata group	8		F
Hydropsyche phalerata	19		MI
Hydropsyche venularis	0	+	MI
Protoptila sp	0	+	I
Hydroptila sp	21		F
Ochrotrichia sp	4		MI
Brachycentrus numerosus	2	+	MI
Pycnopsyche sp	0	+	MI
Lepidostoma sp	11	+	MI
Berosus sp	1		MT
Psephenus herricki	0	+	MI
Dubiraphia sp	9		F
Macronychus glabratus	5		F

Taxa Name	Qualitative	Quantitative	Tolerance
Optioservus sp	2	+	MI
Stenelmis sp	10	+	F
Antocha sp	9		MI
Tipula sp	0	+	F
Simulium sp	4		F
Meropelopia sp	2		F
Cardiocladius obscurus	12		MI
Cricotopus (C.) trifascia	4		F
Tvetenia discoloripes group	102		MI
Polypedilum flavum	8		F
Rheotanytarsus sp	44		F
Sublettea coffmani	1		MI
Elimia sp	16	+	MI
Ferrissia sp	0	+	F
Corbicula fluminea	0	+	F
Sphaerium sp	0	+	F

No. of Quantitative Taxa	42
No. of Qualitative Taxa	30
Total Taxa	52
No. Organisms	1421
Qualitative EPT	20
ICI	**54**

Elkhart River Middlebury Street

Date Collected: 8/12/2019 Site # 21

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	30	+	F
Oligochaeta	0	+	T
Gammarus fasciatus	49	+	F
Hydrachnidia	5	+	F
Baetis flavistriga	12	+	F
Baetis intercalaris	198	+	F
Labiobaetis propinquus	0	+	MI
Iswaeon anoka	0	+	MI
Isonychia sp	6	+	MI
Leucrocuta sp	5	+	MI
Stenacron sp	3		F
Maccaffertium exiguum	73	+	MI
Maccaffertium mediopunctatum	20	+	MI
Maccaffertium pulchellum	4		MI
Maccaffertium terminatum	20		MI
Teloganopsis deficiens	29	+	I
Tricorythodes sp	4	+	MI
Boyeria vinosa	0	+	F
Stylurus sp	0	+	MI
Pteronarcys sp	0	+	MI
Acroneuria lycorias	2		I
Agnetina capitata complex	1	+	MI
Cheumatopsyche sp	61		F
Ceratopsyche morosa group	62	+	MI
Ceratopsyche sparna	82		F
Hydropsyche phalerata	6	+	MI
Protoptila sp	0	+	I
Hydroptila sp	5		F
Brachycentrus numerosus	1	+	MI
Lepidostoma sp	3	+	MI
Psephenus herricki	0	+	MI
Ancyronyx variegata	0	+	F
Dubiraphia vittata group	0	+	F
Macronychus glabratus	11	+	F
Optioservus sp	0	+	MI
Stenelmis sp	3	+	F
Simulium sp	5		F
Cardiocladius obscurus	1		MI
Rheocricotopus robacki	1		F
Thienemanniella xena	3		F
Tvetenia discoloripes group	18		MI
Polypedilum flavum	5		F
Polypedilum (P.) fallax group	4		F
Stictochironomus sp	0	+	F
Rheotanytarsus sp	9	+	F
Hemerodromia sp	1	+	F
Elimia sp	1	+	MI
Ferrissia sp	2		F
Corbicula fluminea	0	+	F

No. of Quantitative Taxa	36
No. of Qualitative Taxa	33
Total Taxa	49
No. Organisms	745
Qualitative EPT	17
ICI	**52**

Yellow Creek - County Road 32

Date Collected: 8/7/2019 Site # 24

Taxa Name	Qualitative	Quantitative	Tolerance
Hydra sp	4		F
Spongillidae	0	+	F
Turbellaria	74	+	F
Oligochaeta	423		T
Helobdella stagnalis	2		T
Erpobdella punctata punctata	9	+	MT
Gammarus sp	1	+	F
Hydrachnidia	41	+	F
Baetis flavistriga	1	+	F
Baetis intercalaris	0	+	F
Calopteryx sp	2	+	F
Coenagrionidae	0	+	T
Argia sp	1		F
Cheumatopsyche sp	230	+	F
Hydropsyche depravata group	1		F
Helicopsyche borealis	1	+	MI
Enochrus sp	0	+	MT
Ancyronyx variegata	32	+	F
Dubiraphia sp	51		F
Dubiraphia vittata group	0	+	F
Macronychus glabratus	17		F
Stenelmis sp	104	+	F
Simulium sp	0	+	F
Ablabesmyia mallochi	14		F
Conchapelopia sp	210	+	F
Hayesomyia senata or T. norena	14		F
Helopelopia sp	14		F
Pentaneura inconspicua	14		F
Procladius (Holotanypus) sp	0	+	MT
Cricotopus (C.) tremulus group	14	+	MT
Parametriocnemus sp	28		F
Rheocricotopus robacki	28	+	F
Chironomus (C.) decorus group	28		T
Cryptochironomus sp	28	+	F
Dicrotendipes neomodestus	56	+	F
Microtendipes "caelum"	0	+	MI
Paratendipes albimanus	70	+	F
Phaenopsectra obediens group	0	+	F
Phaenopsectra flavipes	14		MT
Polypedilum aviceps	14		MI
Polypedilum flavum	266	+	F
Polypedilum (P.) fallax group	14		F
Polypedilum (P.) illinoense	0	+	T
Polypedilum scalaenum group	238	+	F
Saetheria species 1	0	+	F
Stenochironomus sp	0	+	F
Stictochironomus sp	28	+	F
Cladotanytarsus mancus group	0	+	F
Micropsectra sp	14		MT
Paratanytarsus sp	238		F
Rheotanytarsus sp	98		F
Tanytarsus sp	0	+	F
Tanytarsus glabrescens group sp 7	42		F
Tanytarsus sepp	0	+	F
Empididae	8		F
Hemerodromia sp	0	+	F
Physella sp	61		T
Helisoma anceps anceps	3		F
Ferrissia sp	2	+	F
Dreissena polymorpha	8		F
Pisidium sp	40		MT
Sphaerium sp	135	+	F

No. of Quantitative Taxa	46
No. of Qualitative Taxa	39
Total Taxa	62
No. Organisms	2735
Qualitative EPT	4
ICI	**34**

Cobus Creek - CR 8

Date Collected: 8/7/2019 Site # 25

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	2	+	F
Oligochaeta	204		T
Caecidotea sp	0	+	T
Gammarus fasciatus	0	+	F
Orconectes sp	4		F
Hydrachnidia	0	+	F
Acerpenna pygmaea	4		MI
Baetis tricaudatus	0	+	MI
Plauditus dubius or P. virilis	0	+	I
Baetis flavistriga	16	+	F
Baetis intercalaris	2	+	F
Labiobaetis propinquus	0	+	MI
Stenacron sp	267	+	F
Maccaffertium exiguum	37	+	MI
Maccaffertium terminatum	17		MI
Maccaffertium vicarium	15	+	MI
Sigara sp	0	+	MT
Notonecta sp	0	+	T
Lype diversa	2		MI
Polycentropus sp	3	+	MI
Cheumatopsyche sp	15	+	F
Ceratopsyche morosa group	1		MI
Hydropsyche depravata group	0	+	F
Brachycentrus numerosus	2		MI
Neophylax sp	0	+	MI
Pycnopsyche sp	1	+	MI
Molanna sp	0	+	MI
Helicopsyche borealis	1	+	MI
Ancyronyx variegata	0	+	F
Macronychus glabratus	4	+	F
Optioservus sp	0	+	MI
Stenelmis sp	0	+	F
Simulium sp	0	+	F
Ablabesmyia mallochi	1		F
Clinotanypus pinguis	0	+	MT
Conchapelopia sp	9	+	F
Helopelopia sp	3		F
Corynoneura lobata	5		F
Orthocladius lignicola	1		MI
Parametriocnemus sp	1		F
Rheocricotopus robacki	1		F
Thienemanniella sp	19		
Tvetenia bavarica group	2	+	MI
Dicrotendipes neomodestus	1		F
Dicrotendipes simpsoni	2		T
Glyptotendipes (G.) sp	1		MT
Microtendipes rydalensis	1		MI
Paratendipes albimanus	0	+	F
Polypedilum flavum	1		F
Polypedilum (P.) fallax group	4		F
Polypedilum (P.) illinoense	0	+	T
Saetheria sp	0	+	F
Rheotanytarsus pellucidus	0	+	MI
Rheotanytarsus sp	36		F
Ephydridae	1		F
Physella sp	3		T
Ferrissia sp	16		F

No. of Quantitative Taxa	37
No. of Qualitative Taxa	33
Total Taxa	57
No. Organisms	705
Qualitative EPT	15
ICI	**42**

Baugo Creek - CR 3 (N)

Date Collected: 8/12/2019 Site # 27

Taxa Name	Qualitative	Quantitative	Tolerance
Hydra sp	24		F
Turbellaria	0	+	F
Oligochaeta	8		T
Amphipoda	8		
Gammarus sp	0	+	F
Hydrachnidia	0	+	F
Baetis flavistriga	0	+	F
Stenacron sp	19	+	F
Calopteryx sp	8	+	F
Argia sp	8		F
Trichocorixa sp	0	+	MT
Cheumatopsyche sp	183	+	F
Ceratopsyche morosa group	74	+	MI
Hydropsyche depravata group	16	+	F
Oecetis sp	1		F
Agabus sp	1		T
Ancyronyx variegata	26		F
Stenelmis sp	2	+	F
Tipulidae	0	+	
Antocha sp	0	+	MI
Tipula sp	0	+	F
Simulium sp	0	+	F
Ablabesmyia mallochi	51	+	F
Conchapelopia sp	13		F
Hayesomyia senata	89	+	F
Labrundinia pilosella	25		F
Meropelopia sp	13		F
Procladius (Holotanypus) sp	0	+	MT
Cricotopus (C.) sp	165		F
Cricotopus (C.) bicinctus	13		T
Cricotopus (C.) tremulus group	152	+	MT
Cricotopus (C.) or Orthocladius (O.) sp	13		
Rheocricotopus (Psilocricotopus) robacki	25		F
Chironomus (C.) decorus group	63	+	T
Cryptochironomus sp	13	+	F
Cryptotendipes sp	0	+	F
Dicrotendipes neomodestus	76	+	F
Microtendipes "caelum"	0	+	MI
Paralauterborniella nigrohalteralis	0	+	F
Paratendipes albimanus	51	+	F
Phaenopsectra obediens group	140	+	F
Phaenopsectra flavipes	13		MT
Polypedilum flavum	292	+	F
Polypedilum (P.) fallax group	76		F
Polypedilum (P.) illinoense	13	+	T
Polypedilum halterale group	0	+	MT
Polypedilum scalaenum group	38	+	F
Stictochironomus sp	0	+	F
Paratanytarsus sp	63		F
Rheotanytarsus pellucidus	25		MI
Rheotanytarsus sp	152		F
Tanytarsus sp	0	+	F
Tanytarsus glabrescens grp. sp 7	51		F
Corbicula fluminea	76		F

No. of Quantitative Taxa	38
No. of Qualitative Taxa	33
Total Taxa	54
No. Organisms	2079
Qualitative EPT	5
ICI	**32**

Bowman Creek - Gertrude

Date Collected: 8/19/2019 Site # 29

Taxa Name	Qualitative	Quantitative	Tolerance
Oligochaeta	0	+	T
Gammarus sp	514	+	F
Orconectes sp	0	+	F
Baetis tricaudatus	97	+	MI
Stenacron sp	0	+	F
Calopteryx sp	0	+	F
Coenagrionidae	8		T
Argia sp	0	+	F
Boyeria vinosa	0	+	F
Cheumatopsyche sp	67	+	F
Hydropsyche depravata group	65	+	F
Macronychus glabratus	11	+	F
Optioservus sp	0	+	MI
Stenelmis sp	2		F
Simulium sp	0	+	F
Conchapelopia sp	1		F
Brillia flavifrons group	1		F
Corynoneura lobata	30		F
Parametriocnemus sp	5		F
Thienemanniella xena	10		F
Tvetenia bavarica group	22		MI
Microtendipes pedellus group	0	+	F
Polypedilum aviceps	31		MI
Polypedilum (P.) fallax group	0	+	F
Rheotanytarsus sp	27		F
Cipangopaludina japonica	0	+	MT
Physella sp	0	+	T
Planorbella (Pierosoma) pilsbryi	0	+	T
Sphaerium sp	0	+	F

No. of Quantitative Taxa	15
No. of Qualitative Taxa	19
Total Taxa	29
No. Organisms	891
Qualitative EPT	4
ICI	**26**

Bowman Creek - Ravina Park

Date Collected: 8/5/2019 Site # 30

Taxa Name	Qualitative	Quantitative	Tolerance
Cordylophora caspia	1		MT
Hydra sp	1		F
Turbellaria	5	+	F
Oligochaeta	5		T
Erpobdellidae	0	+	MT
Gammarus sp	0	+	F
Orconectes sp	1		F
Orconectes rusticus	0	+	F
Hydrachnidia	0	+	F
Baetis flavistriga	1	+	F
Baetis intercalaris	7	+	F
Stenacron sp	159	+	F
Calopteryx sp	0	+	F
Cyrnellus fraternus	1		F
Cheumatopsyche sp	15	+	F
Hydropsyche depravata group	1		F
Helicopsyche borealis	1		MI
Macronychus glabratus	1		F
Stenelmis sp	0	+	F
Tipula sp	0	+	F
Simulium sp	0	+	F
Conchapelopia sp	6	+	F
Helopelopia sp	1		F
Nilotanypus fimbriatus	2		F
Corynoneura lobata	3		F
Cricotopus (C.) bicinctus	0	+	T
Cricotopus intersectus group	1		MT
Cryptochironomus sp	0	+	F
Dicrotendipes sp	1		F
Microtendipes "caelum"	0	+	MI
Microtendipes pedellus group	1		F
Paratendipes albimanus	0	+	F
Phaenopsectra flavipes	1		MT
Polypedilum flavum	0	+	F
Polypedilum (P.) fallax group	3		F
Polypedilum scalaenum group	0	+	F
Rheotanytarsus sp	1		F
Ferrissia sp	72	+	F
Dreissena polymorpha	2		F

No. of Quantitative Taxa	25
No. of Qualitative Taxa	21
Total Taxa	39
No. Organisms	293
Qualitative EPT	4
ICI	**34**

Juday Creek - SR 23

Date Collected: 8/12/2019 Site # 33

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	30	+	F
Oligochaeta	1		T
Gammarus sp	8	+	F
Hydrachnidia	26	+	F
Baetis tricaudatus	38	+	MI
Baetis flavistriga	2		F
Baetis intercalaris	4	+	F
Stenacron sp	26	+	F
Tricorythodes sp	0	+	MI
Caenis sp	8		F
Coenagrionidae	0	+	T
Boyeria vinosa	0	+	F
Lype diversa	8		MI
Polycentropus sp	1		MI
Cheumatopsyche sp	614	+	F
Ceratopsyche morosa group	280	+	MI
Ceratopsyche sparna	2		F
Hydropsyche depravata group	285	+	F
Hydroptila sp	3		F
Mystacides sp	0	+	MI
Peltodytes sp	0	+	MT
Dubiraphia quadrinotata	0	+	F
Macronychus glabratus	10		F
Simulium sp	0	+	F
Conchapelopia sp	49	+	F
Nilotanypus fimbriatus	49		F
Procladius (Holotanypus) sp	0	+	MT
Cricotopus (C.) sp	0	+	F
Cricotopus (C.) bicinctus	0	+	T
Orthocladius (O.) sp	0	+	F
Parametriocnemus sp	98		F
Rheocricotopus robacki	123		F
Tvetenia bavarica group	172		MI
Microtendipes "caelum"	0	+	MI
Microtendipes pedellus group	49	+	F
Paratendipes albimanus	0	+	F
Phaenopsectra obediens group	0	+	F
Polypedilum sp	25	+	
Polypedilum aviceps	25		MI
Polypedilum scalaenum group	25		F
Micropsectra sp	49		MT
Paratanytarsus sp	25		F
Rheotanytarsus pellucidus	147		MI
Rheotanytarsus sp	1597	+	F
Neoplasta sp	106		MI
Fossaria sp	0	+	MT
Physella sp	0	+	T
Helisoma anceps anceps	0	+	F
Ferrissia sp	2		F
Corbicula fluminea	0	+	F

No. of Quantitative Taxa	32
No. of Qualitative Taxa	31
Total Taxa	50
No. Organisms	3887
Qualitative EPT	8
ICI	48

Juday Creek - Ponader Park

Date Collected: 8/12/2019 Site # 34

Taxa Name	Qualitative	Quantitative	Tolerance
Turbellaria	13	+	F
Oligochaeta	9	+	T
Gammarus fasciatus	20	+	F
Orconectes sp	0	+	F
Hydrachnidia	51	+	F
Baetis tricaudatus	14	+	MI
Baetis flavistriga	28	+	F
Baetis intercalaris	11		F
Stenacron sp	57	+	F
Maccaffertium exiguum	29		MI
Tricorythodes sp	19	+	MI
Caenis sp	17		F
Calopterygidae	8	+	F
Boyeria vinosa	0	+	F
Neureclipsis sp	1		MI
Polycentropus sp	3		MI
Cheumatopsyche sp	371	+	F
Ceratopsyche morosa group	585	+	MI
Ceratopsyche sparna	29		F
Hydropsyche depravata group	365	+	F
Hydroptila sp	165		F
Ochrotrichia sp	44		MI
Brachycentrus numerosus	0	+	MI
Pycnopsyche sp	0	+	MI
Nectopsyche diarina	1	+	MI
Oecetis persimilis	5		MI
Peltodytes sp	0	+	MT
Sperchopsis tesselata	0	+	F
Macronychus glabratus	5	+	F
Stenelmis sp	10	+	F
Antocha sp	21		MI
Simulium sp	0	+	F
Conchapelopia sp	324	+	F
Helopelopia sp	81	+	F
Diamesa sp	0	+	F
Corynoneura lobata	16		F

Taxa Name	Qualitative	Quantitative	Tolerance
Cricotopus (C.) bicinctus	45		T
Eukiefferiella claripennis group	45		MT
Parametriocnemus sp	180		F
Rheocricotopus robacki	360		F
Thienemanniella xena	32		F
Tvetenia bavarica group	225		MI
Tvetenia discoloripes group	90		MI
Cryptochironomus sp	0	+	F
Microtendipes "caelum"	0	+	MI
Microtendipes pedellus group	270	+	F
Paratendipes albimanus	0	+	F
Phaenopsectra obediens group	0	+	F
Polypedilum aviceps	45		MI
Polypedilum (P.) fallax group	0	+	F
Stictochironomus sp	0	+	F
Paratanytarsus sp	90		F
Rheotanytarsus pellucidus	629	+	MI
Rheotanytarsus sp	1572		F
Neoplasta sp	13		MI
Physella sp	0	+	T
Ferrissia sp	36		F
Corbicula fluminea	0	+	F
Pisidium sp	1		MT

No. of Quantitative Taxa	43
No. of Qualitative Taxa	35
Total Taxa	59
No. Organisms	5935
Qualitative EPT	10
ICI	**48**

Appendix F
Aerial Site Location Maps

Site #1: St. Joseph River SR 15 (Bristol)

Site #2: St. Joseph River Homan Avenue

Site #3: St. Joseph River Sherman Street

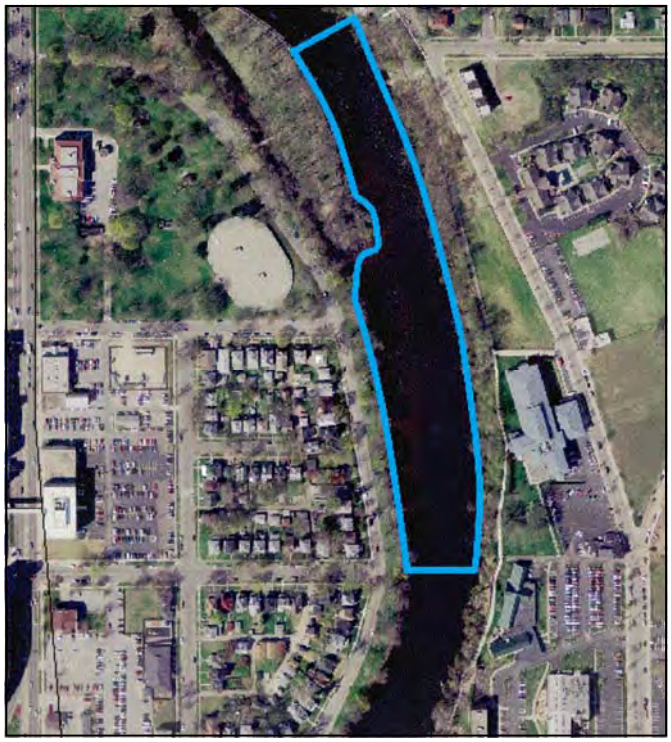
Site #4: St. Joseph River Nappanee Street

Site #5: St. Joseph River Capital Avenue

Site #6: St. Joseph River Ironwood Above

Site #7: St. Joseph River Sample Street

Site #8: St. Joseph River Michigan Street



Site #9: St. Joseph River Michigan Street (B)

Site #10: St. Joseph River Pinhook Park (Below)

Site #11: St. Joseph River St. Pats Park

Site #12: York TWP Ditch SR 15

Site #13: Christiana Creek CR4

Site #13: Little Elkhart River CR 10

Site #14: Hunter Lake Drain Cottage Grove Dive

Site #15: Mather Ditch CR 43

Site #16: Puterbaugh Creek CR 8

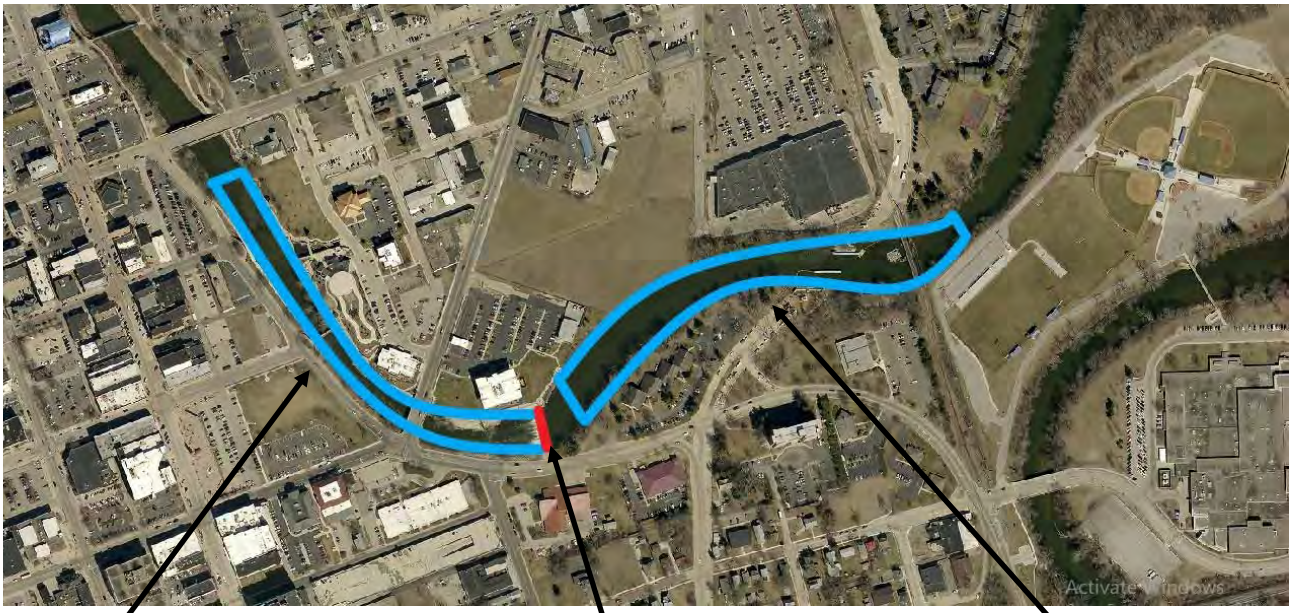
Site #17: Lily Creek Reckell Ave.

Site #18: Christiana Creek CR 4

Site #19: Elkhart River Oxbow Park

Site #21: Elkhart River Middlebury Street

Site #20: Elkhart River Indiana Avenue



Site #23: Elkhart River Elkhart Avenue

Elkhart River Dam

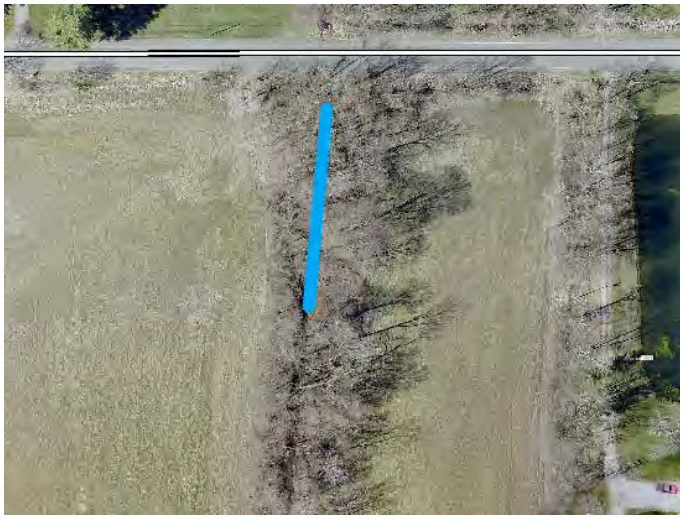
Site #22: Elkhart River Prairie Street

Site #24: Yellow Creek CR 32

Site #25: Cobus Creek CR 8

Site #26: Baugo Creek CR 1 (S)

Site #27: Baugo Creek CR 3 (N)



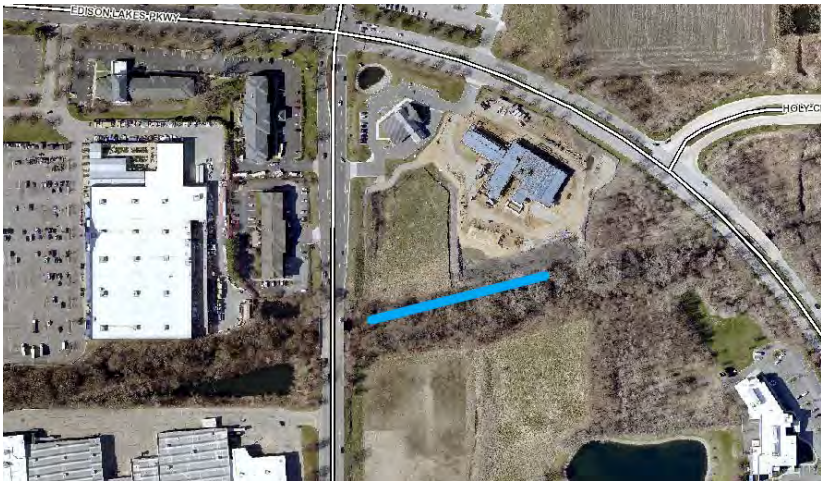
Site #28: Eberly Ditch Kern Road

Site #29: Bowman Creek Gertrude St.

Site #30: Bowman Creek, Ravina Park

Site #31: Juday Creek Holy Cross Pkwy

Site # 32: Juday Creek Main St



Site # 33: Juday Creek SR 23

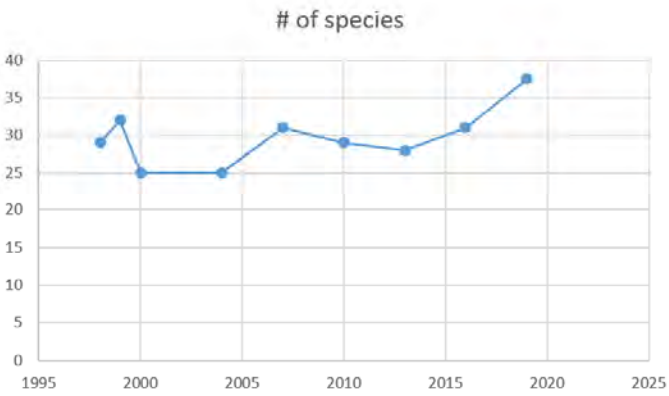
Site #34: Juday Creek Ponader Park

Appendix G

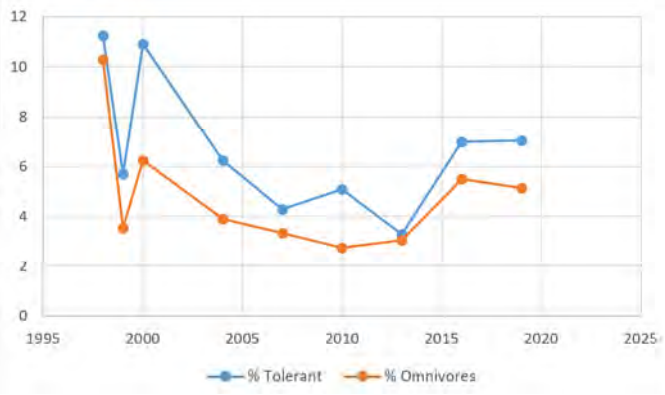
In-depth Metric Analysis

The following is an analysis of metrics contained within the IBI comparing changes to the fish communities 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.

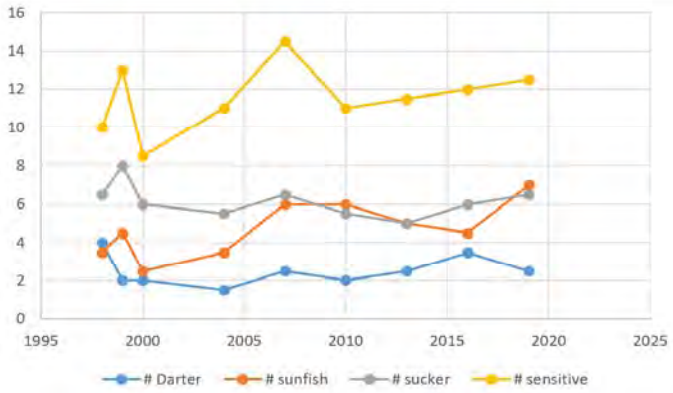
Site 1: St. Joseph River—SR 15 (Bristol)



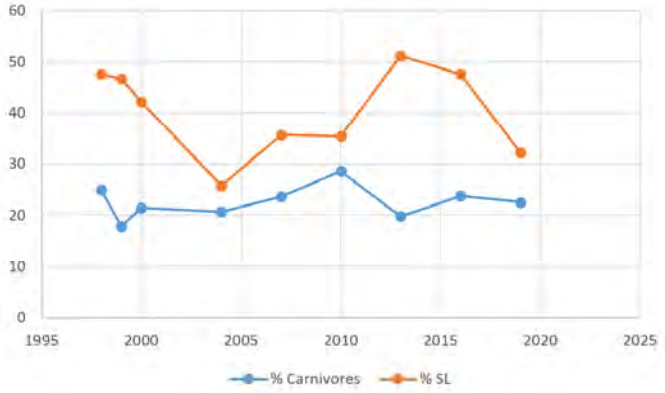
The number of species increased significantly in 2019.



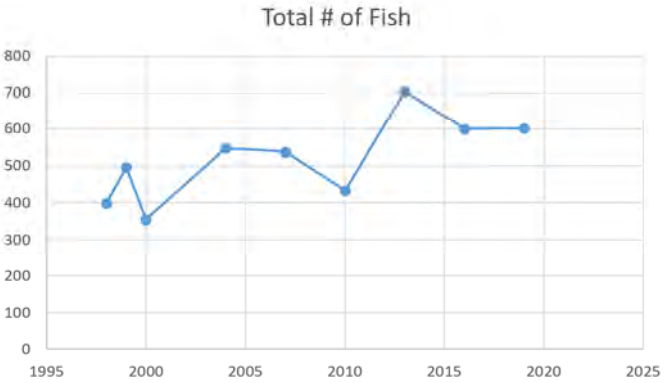
% of tolerant individuals and omnivores has decreased over time, however, these metrics were always low*.



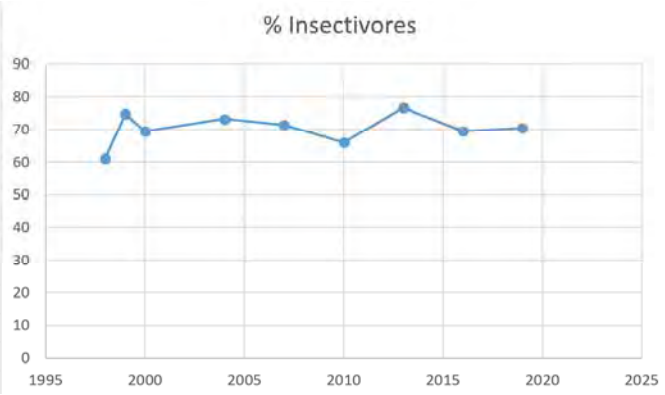
The # of sensitive species, sucker species, and darter species have remained similar over time. The # of sunfish has increased.



The % of simple lithophils has fluctuated over time while the % of carnivores has remained relatively consistent.



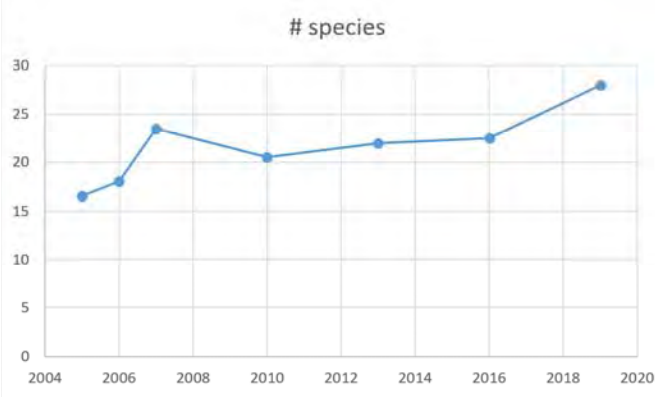
The total # of fish has increased since the inception of monitoring.



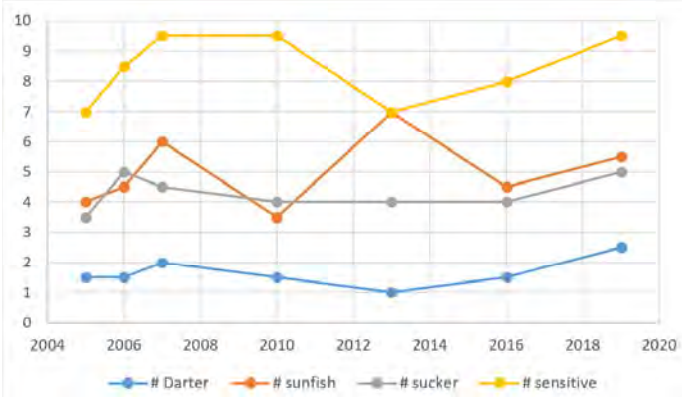
The % of insectivores has remained consistent since the inception of monitoring.

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

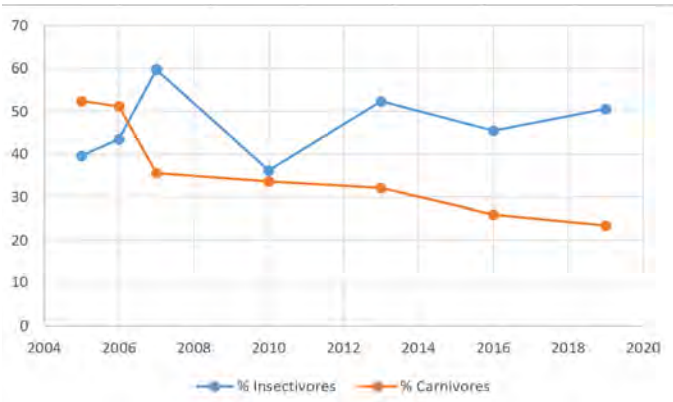
Site 2: St. Joseph River—Homan Avenue



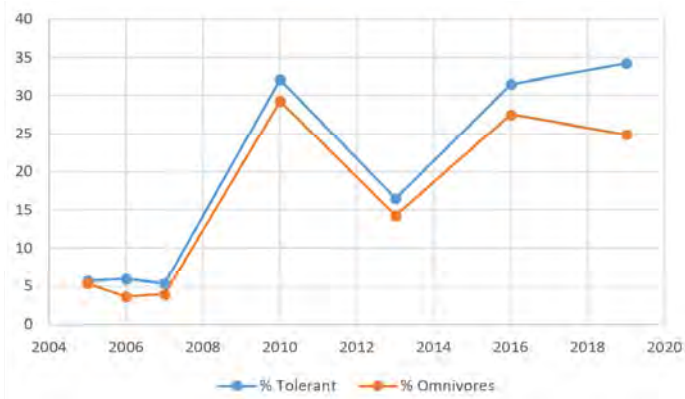
The # of species has increased since the inception of monitoring and increased significantly in 2019.



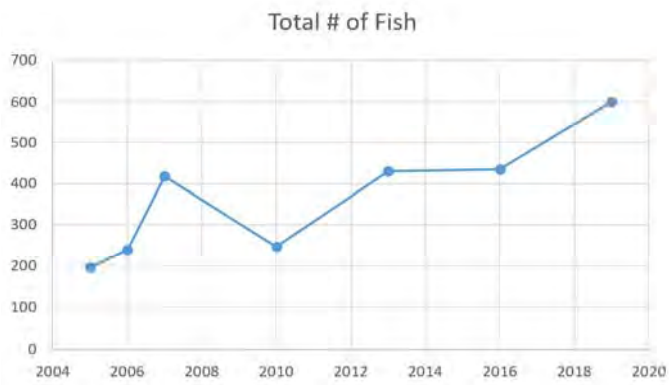
The # of sensitive species, darter species, sunfish species and sucker species have remained relatively similar over time, with modest fluctuations in the # of sunfish occurring over the years.



The % of insectivores has remained relatively similar over time, while the % of carnivores has decreased.



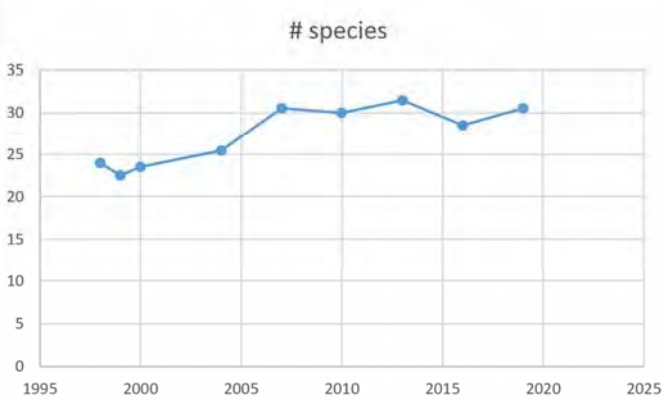
The % of tolerant individuals and omnivores has increased significantly over time.



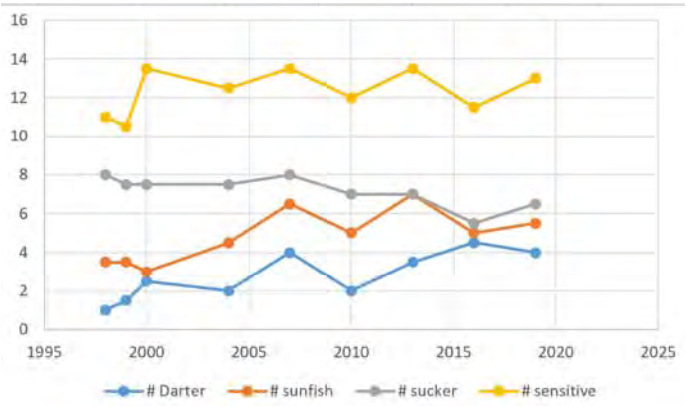
The total # of fish has increased significantly since the inception of monitoring.

The % of simple lithophils has decreased significantly since baseline monitoring.

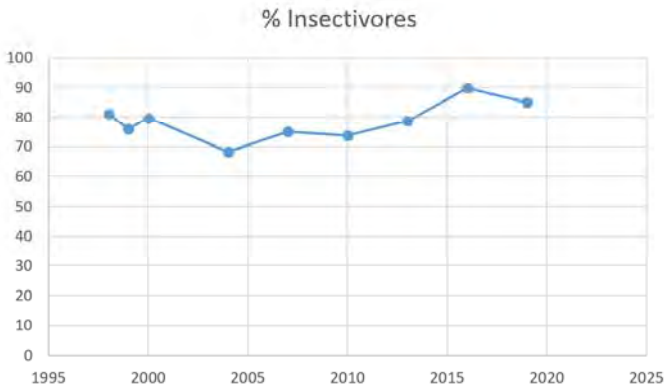
Site 3: St. Joseph River—Sherman Street



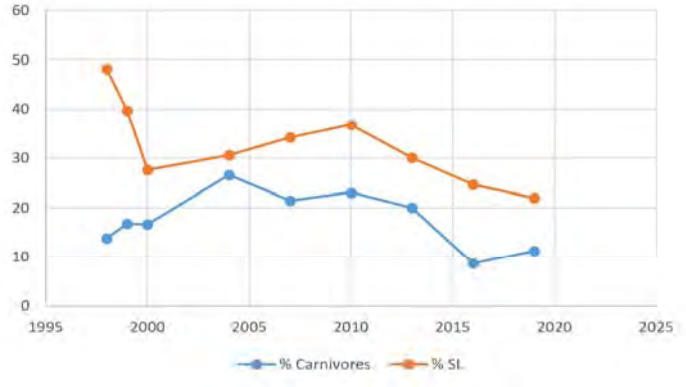
The number of species has increased since the inception of monitoring.



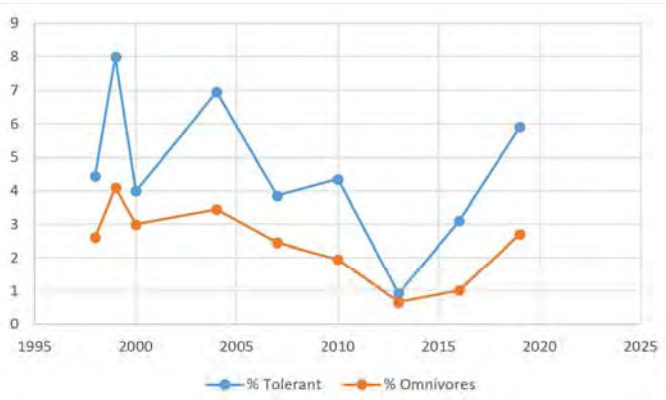
The # of sunfish and darter species have increased over time, while the number of suckers has decreased slightly. The number of sensitive species has been relatively consistent.



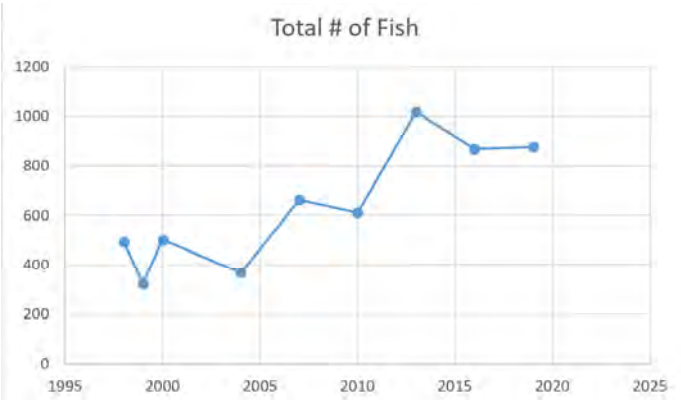
The % of insectivores has remained relatively similar since the inception of monitoring.



The % of simple lithophils decreased since the inception of monitoring, while the % of carnivores increased following baseline monitoring, but has decreased in recent years.

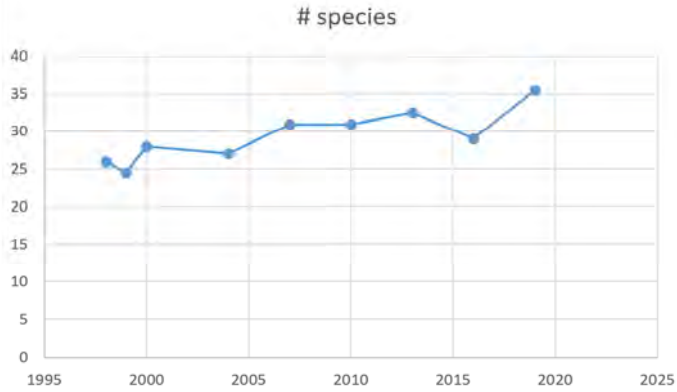


The % of tolerant individuals and omnivores has fluctuated since the inception of monitoring, however, both metrics have always been very low at this site.

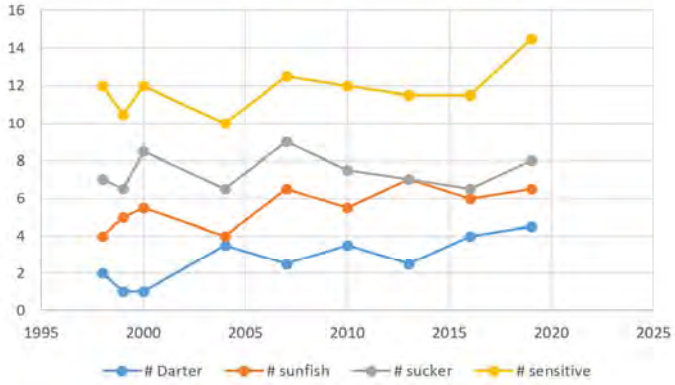


The total # of fish has increased significantly since the inception of monitoring.

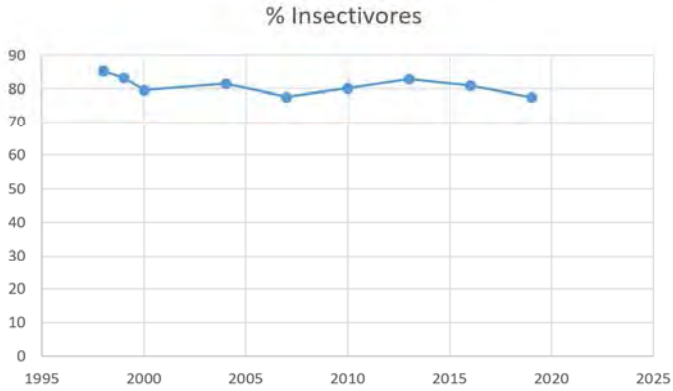
Site 4: St. Joseph River—Nappanee Street



The number of species has increased since the inception of monitoring.

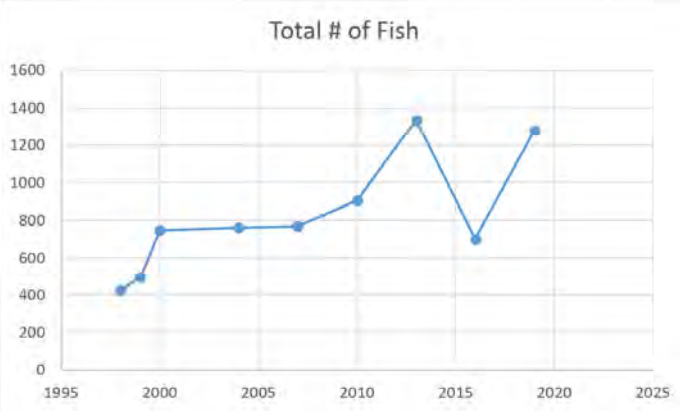


The number of sensitive species, sunfish species, and darter species have increased since the inception of monitoring, while the number of sucker species has remained similar.

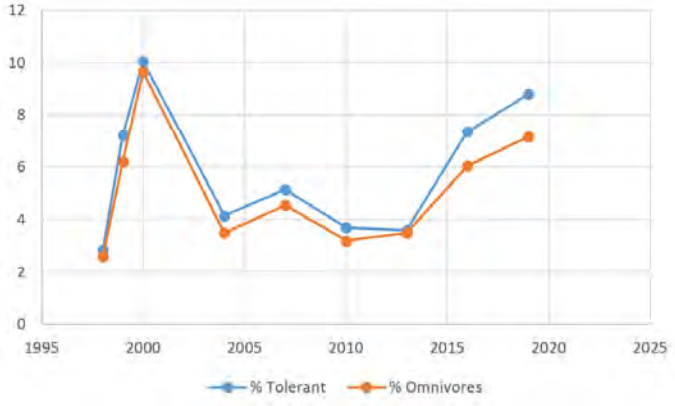


The % of insectivores has remained relatively similar since the inception of monitoring.

The % of simple lithophils has fluctuated since the inception of monitoring.

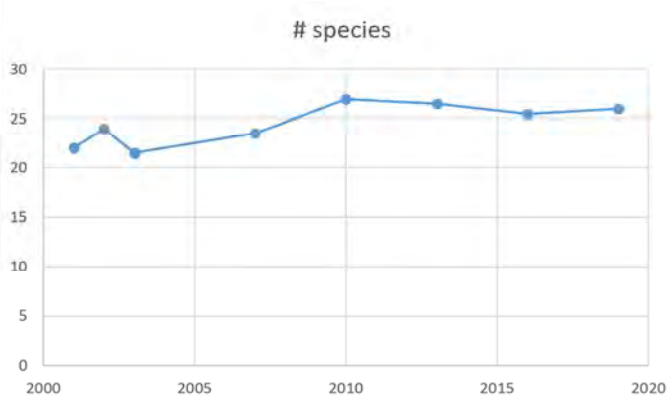


The total # of fish has generally increased since the inception of monitoring.

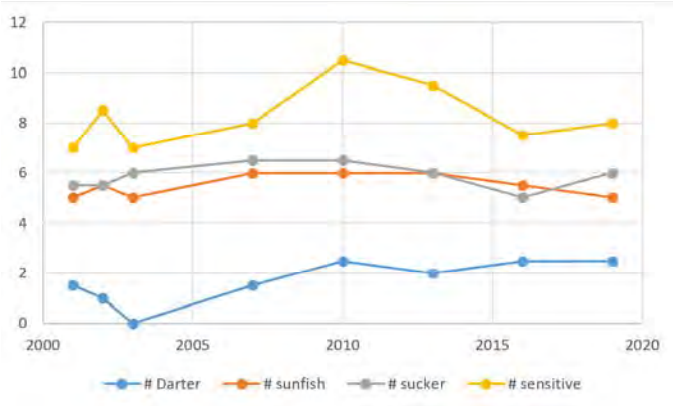


The % of tolerant individuals and omnivores has fluctuated since the inception of monitoring, although these metrics have always been very low.

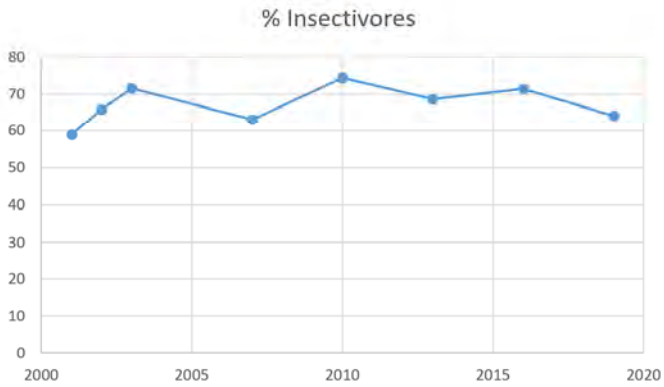
Site 5: St. Joseph River—Capital Avenue



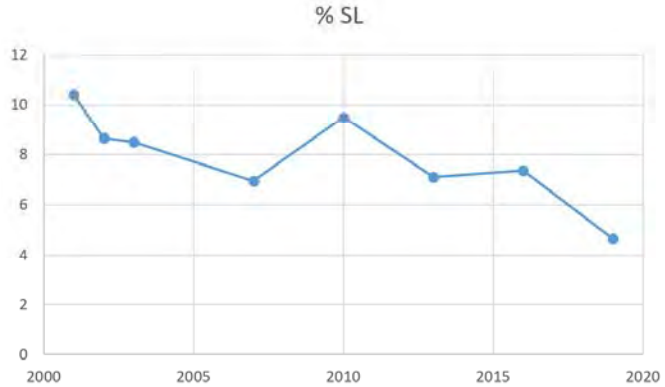
The number of species has increased at this site, starting in 2010.



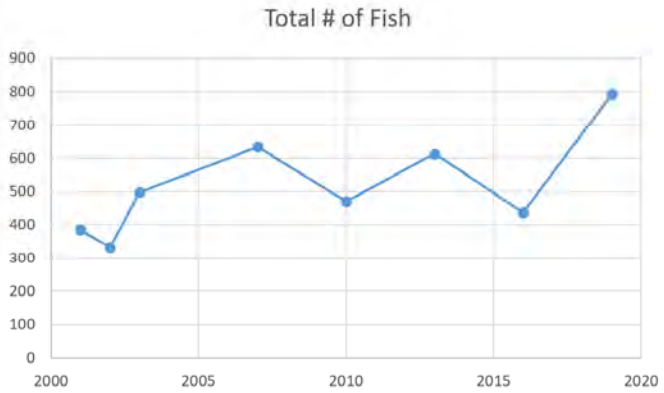
The number of sensitive species, darter species, sunfish species, and sucker species have remained the same since the inception of monitoring.



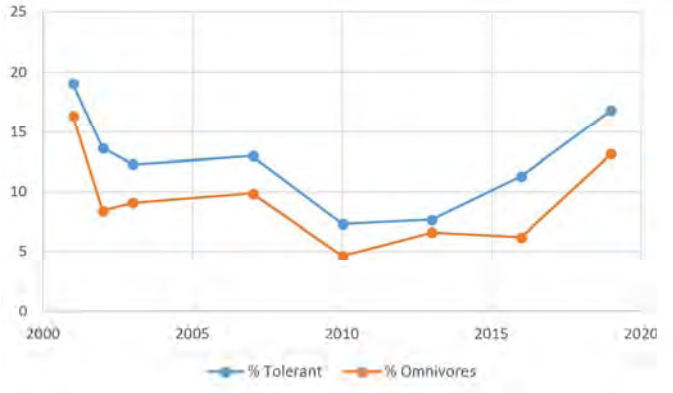
The percent of insectivores has remained relatively similar since the inception of monitoring.



The % of simple lithophils has decreased since the inception of monitoring.

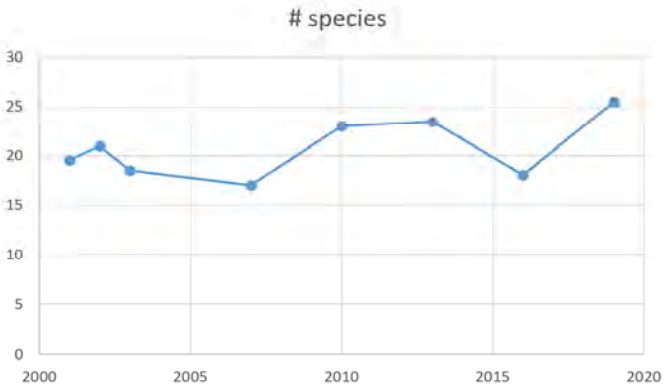


The total # of fish has increased since the inception of monitoring.

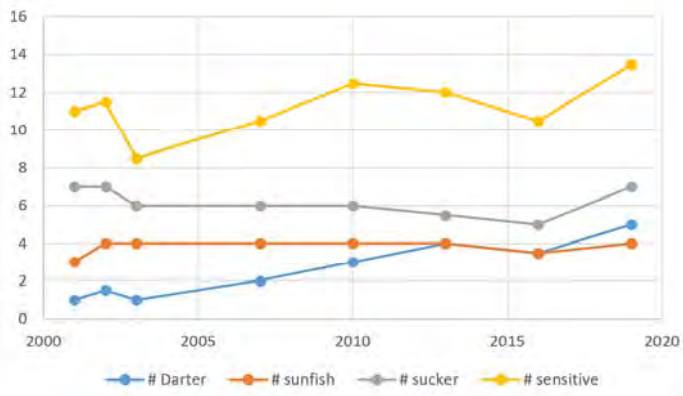


The % of tolerant individuals and omnivores has remained relatively similar since the inception of monitoring. These metric values have always been low.

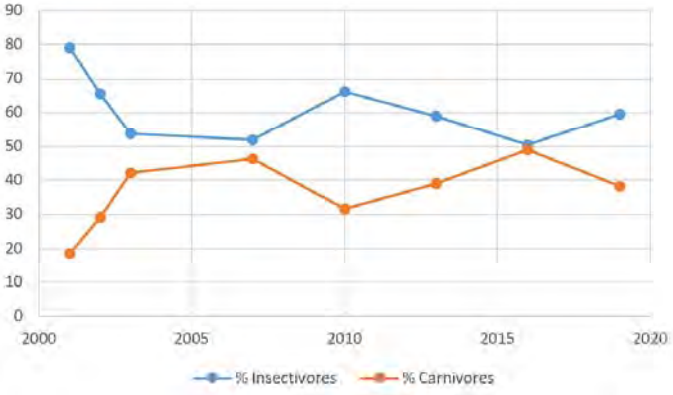
Site 8: St. Joseph River—Michigan Street



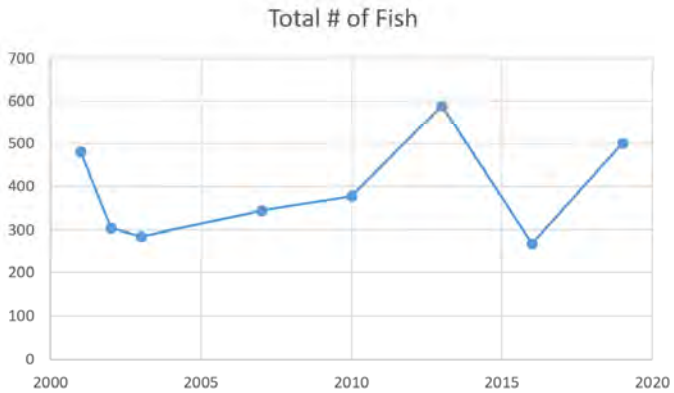
The number of species has increased since the inception of monitoring.



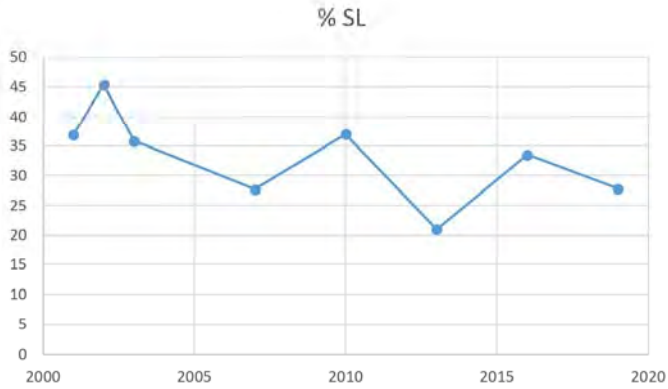
The # of sucker species and sunfish species have stayed relatively similar while the # of sensitive species and the # of darter species has increased.



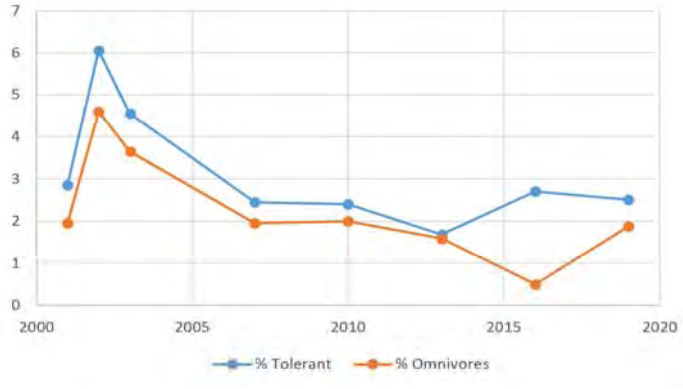
The % of insectivores has decreased while the % of carnivores has increased.



The total # of fish has fluctuated in recent years, but has remained relatively similar over time.

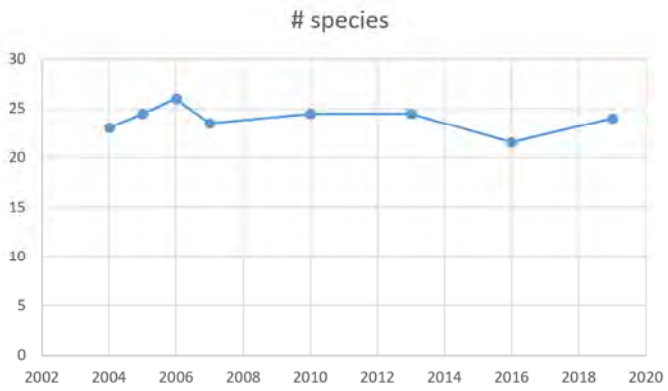


The % of simple lithophils has decreased since the inception of monitoring.

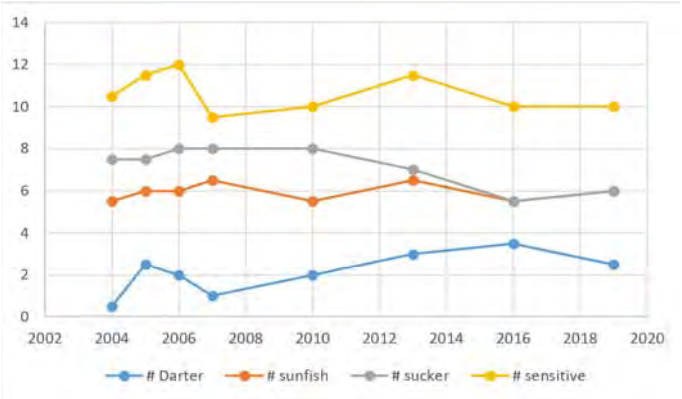


The % of tolerant individuals and omnivores has decreased since the inception of monitoring. Regardless, both metrics have had very low values.

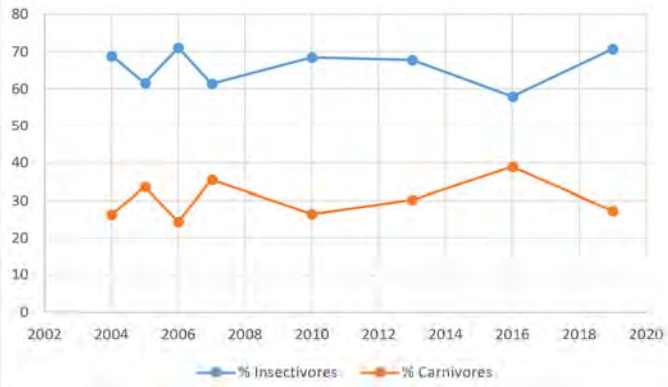
Site 10: St. Joseph River—Pinhook (B)



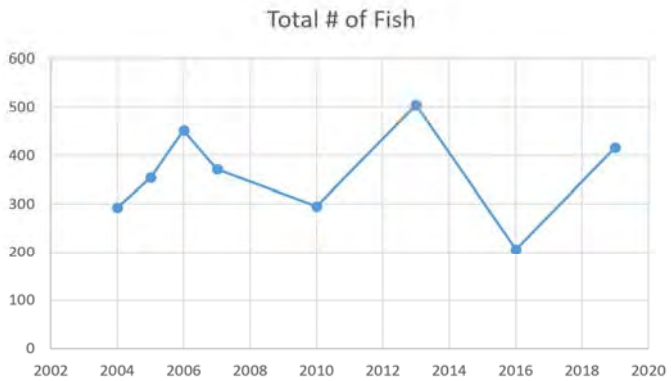
The # of species has remained relatively similar over time.



The # of sensitive species and sunfish species has remained similar over time, while the # of sucker species has decreased slightly and the # of darters has increased slightly.

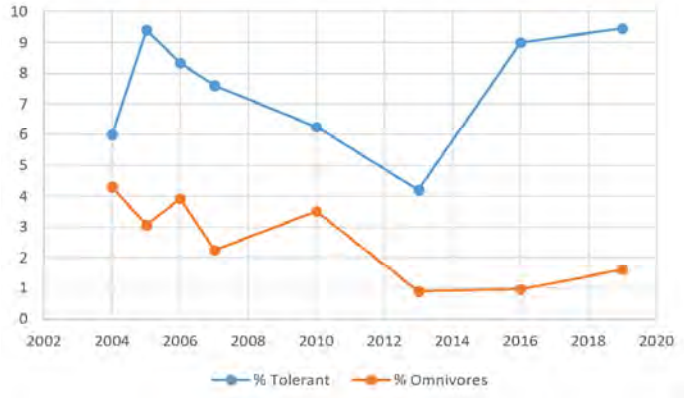


The % of insectivores and carnivores has remained relatively similar over time.



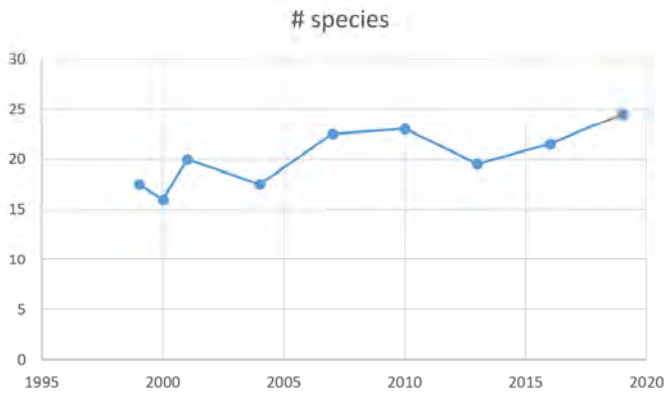
The total # of fish has fluctuated over the years.

The % of simple lithophils has decreased over time.

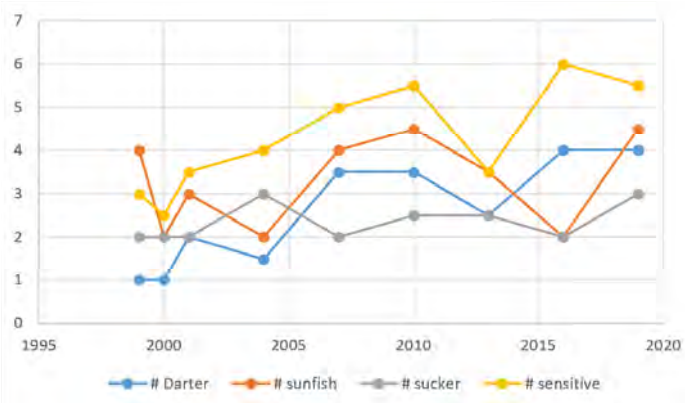


The % of tolerant species and omnivores have always been low at this site.

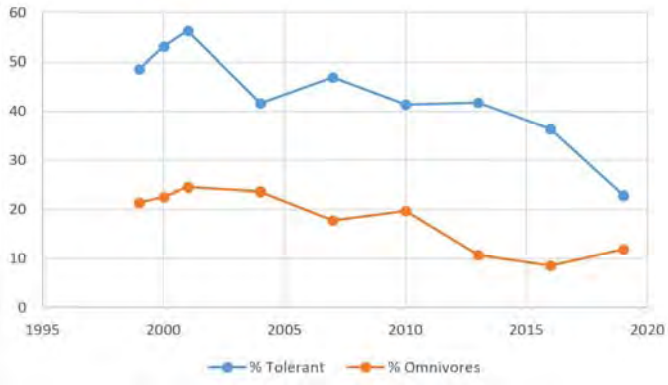
Site 13: Little Elkhart River—County Road 10



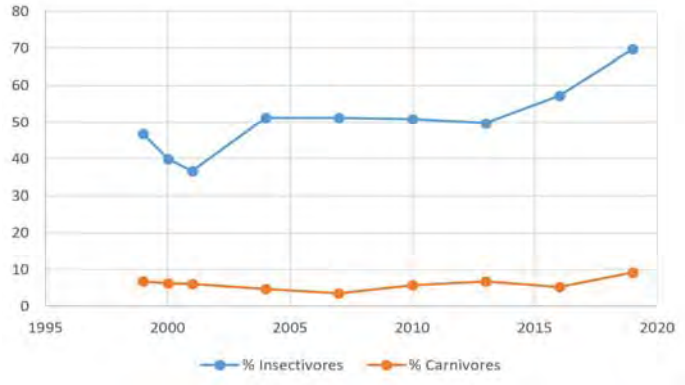
The # of species has increased over time.



The #of sensitive species and darter species have increased over time, while the # of sunfish species and suckers species have remained relatively similar.

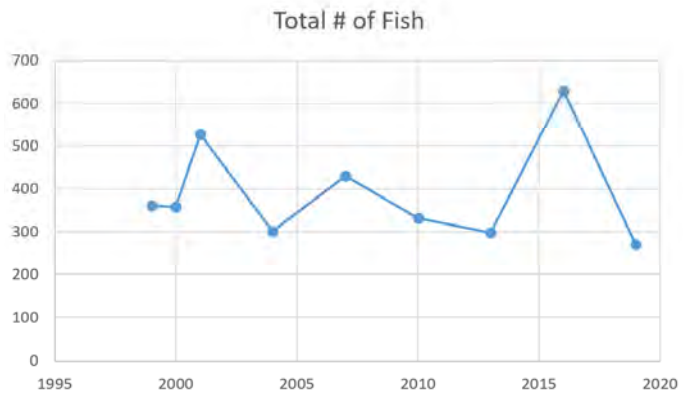


The % of tolerant individuals and omnivores have decreased over time.



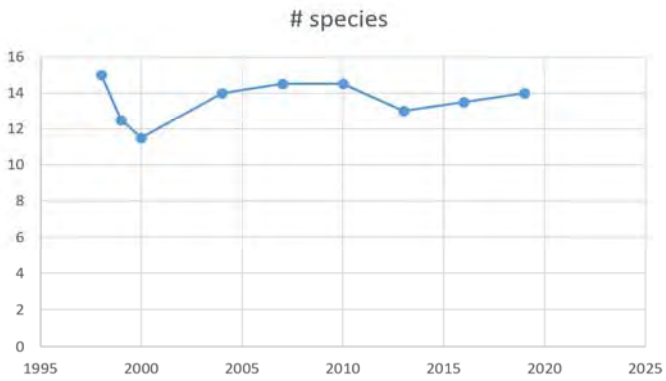
The % of carnivores have always been low at this site, while the % of insectivores has increased significantly in recent years.

The percent of simple lithophils has decreased over time.

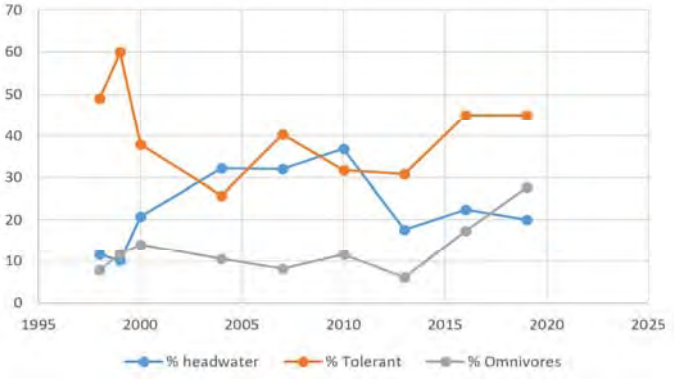


The total # of fish has fluctuated over the years.

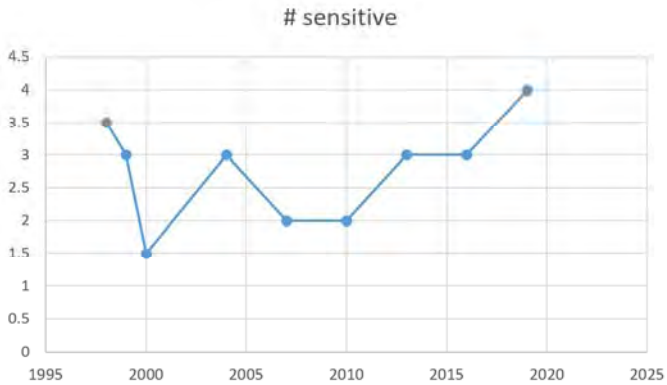
Site 16: Puterbaugh Creek—CR 8



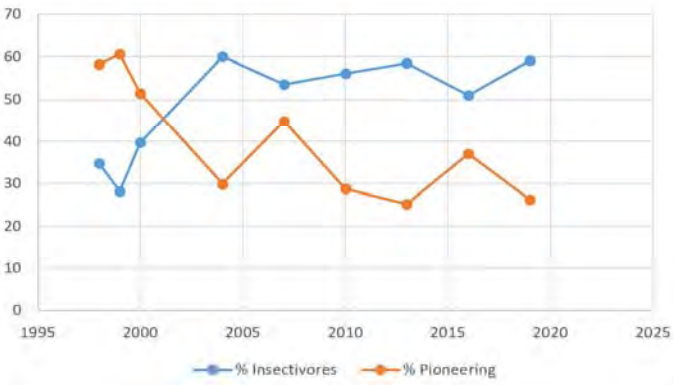
The # of species has remained relatively similar over time.



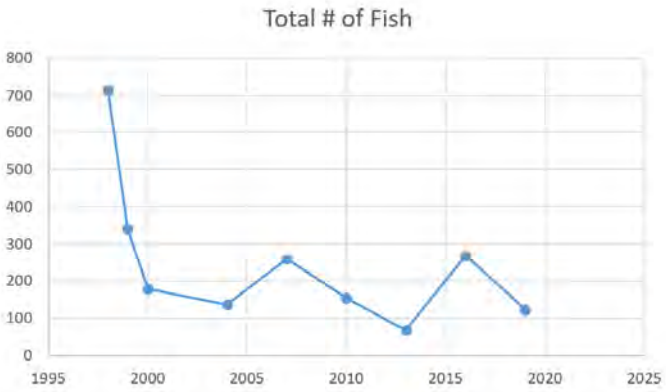
The % of omnivores has increased in recent years, while the % of headwater species increased significantly following baseline sampling, but reduced in recent years. The % of tolerant individuals dropped significantly following baseline monitoring, but increased in recent years.



The number of sensitive species has fluctuated over the years, but has always been low.

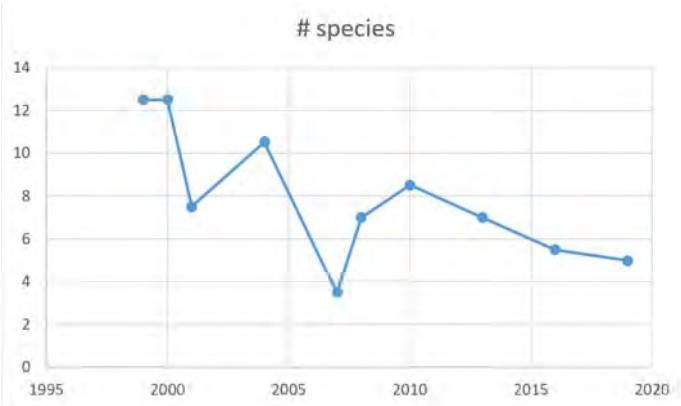


The % of pioneers has decreased over the years, while the % of insectivores has increased.

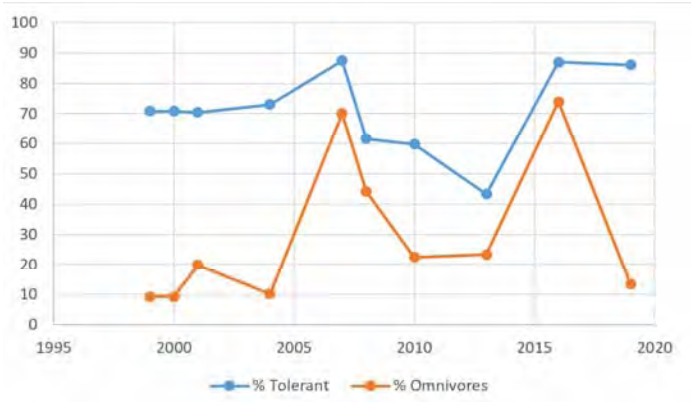


The total # of fish decreased significantly during baseline monitoring and has remained low since.

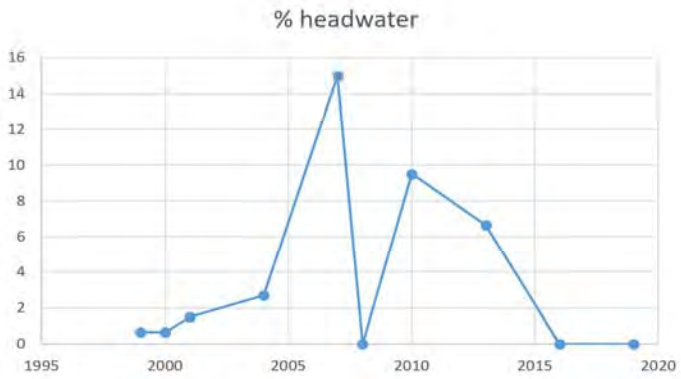
Site 17: Lily Creek– Reckell Avenue



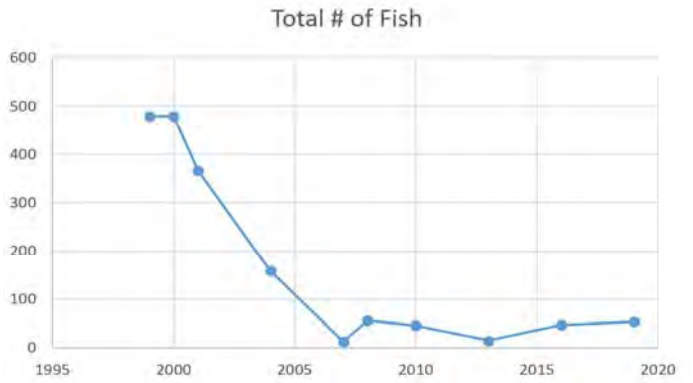
The number of species dropped significantly between 2004 and 2007 coinciding with a major disturbance at this site. Although the number of species increased following the disturbance, it appears that species diversity is slow to recover.



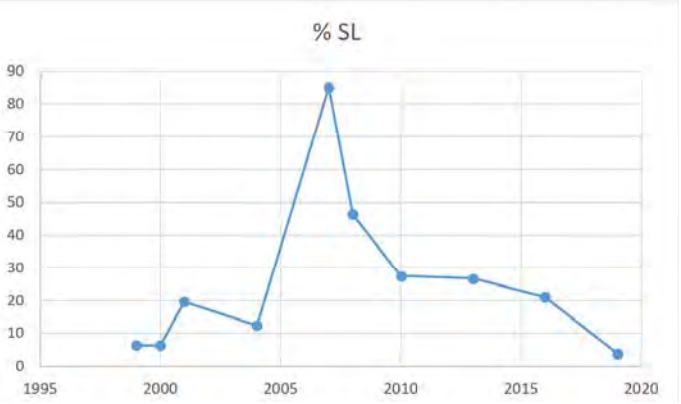
The % of tolerant individuals and % of omnivores have fluctuated over the years.



The % of headwater species has fluctuated over the years.

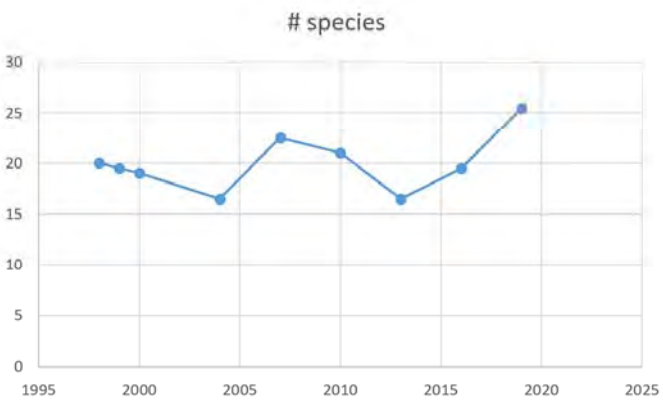


The total # of fish plummeted between 2004 and 2007 coinciding with a major disturbance at this site.

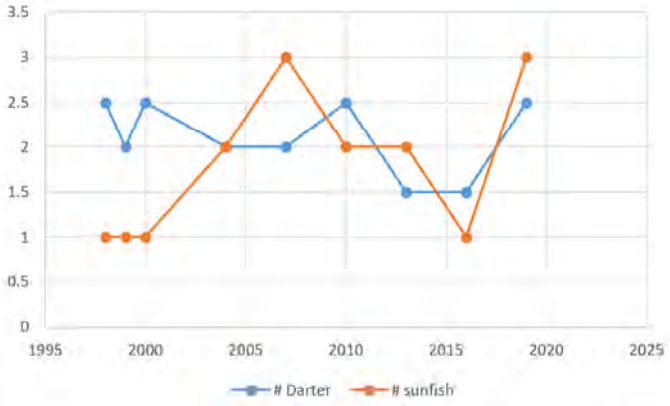


The percent of simple lithophils spiked in 2007, but has since decreased to levels seen during baseline monitoring.

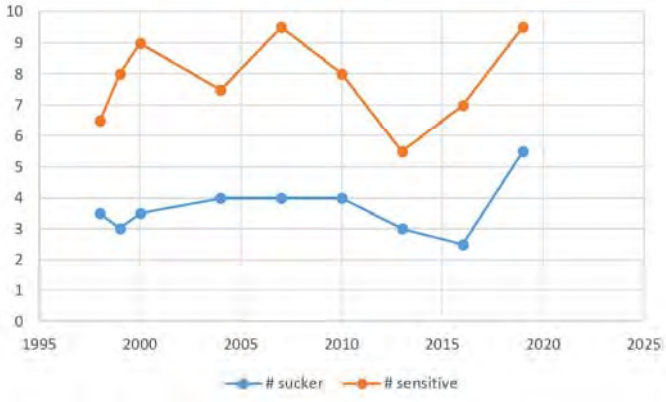
Site 18: Christiana Creek—CR 4



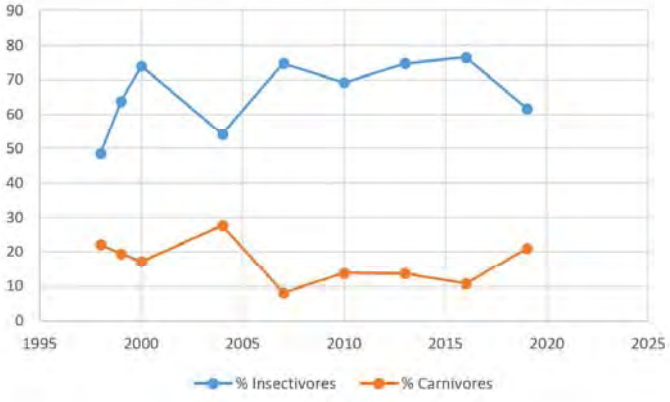
The number of species at this site has fluctuated but reached an all time high in 2019.



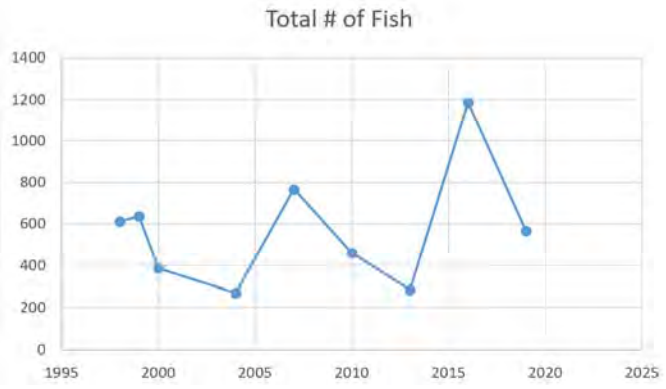
The # of darter species and # of sunfish have fluctuated since the inception of monitoring.



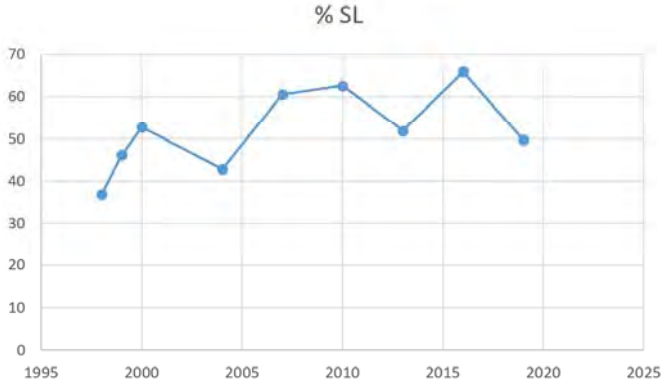
The # of sucker species increased in 2019, while the # of sensitive species has fluctuated over time.



The % of carnivores and insectivores have been relatively similar over time.

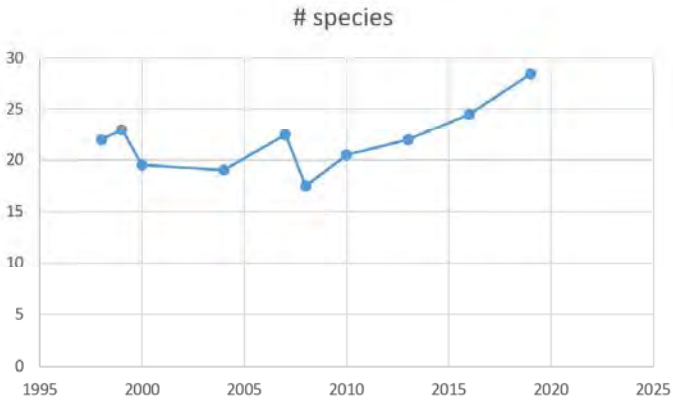


The total number of fish has fluctuated at this site over-time.

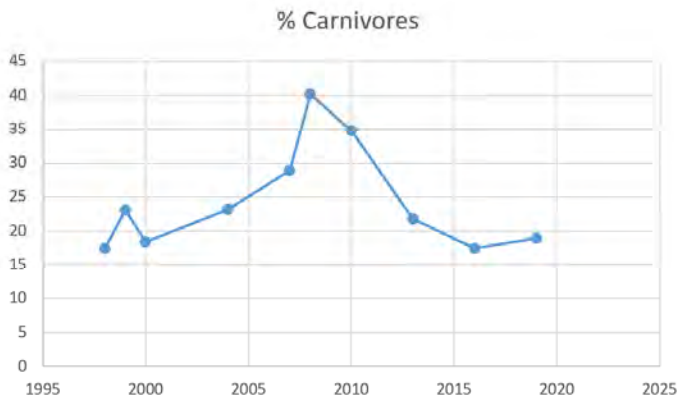


The % of simple lithophils has increased at this site over time.

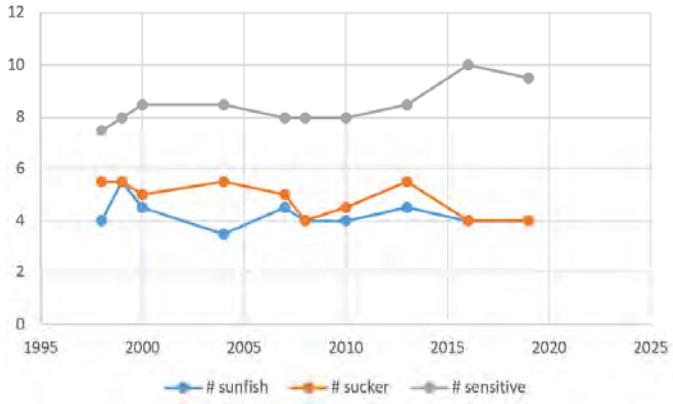
Site 19: Elkhart River—Oxbow Park



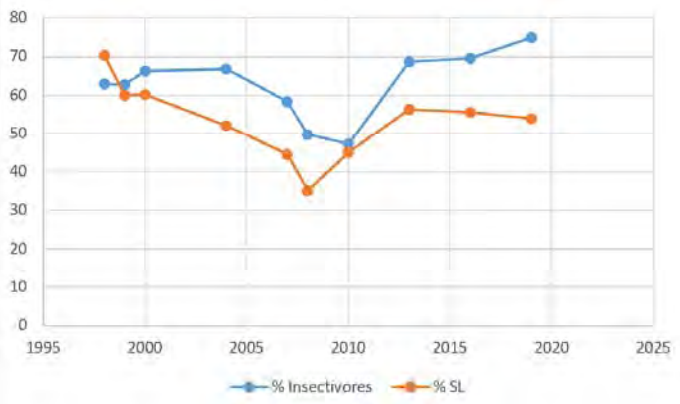
The # of species appears to have increased in recent years.



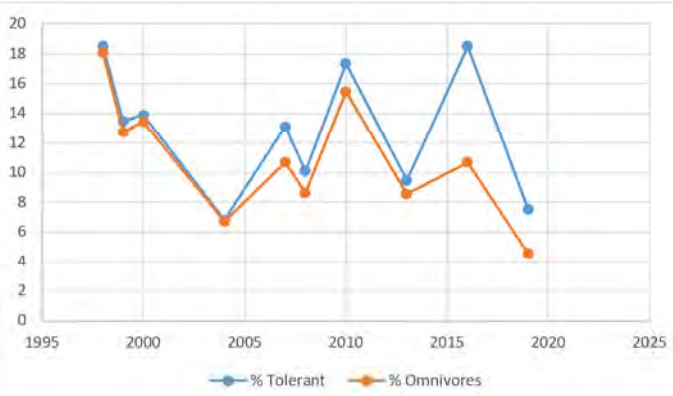
The % of carnivores has remained the same since initial baseline monitoring despite a sharp spike between 2007 and 2010.



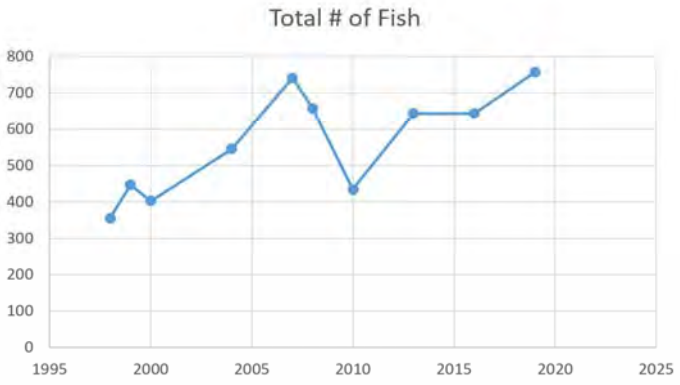
The # of sensitive species has increased in the last few years. The # of sunfish and sucker species has remained the same over time.



The % of simple lithophils and insectivores decreased from 2007 to 2010, but both metrics have recovered since. The drop from 2007 to 2010 coincides with a reduced IBI scores during that time.

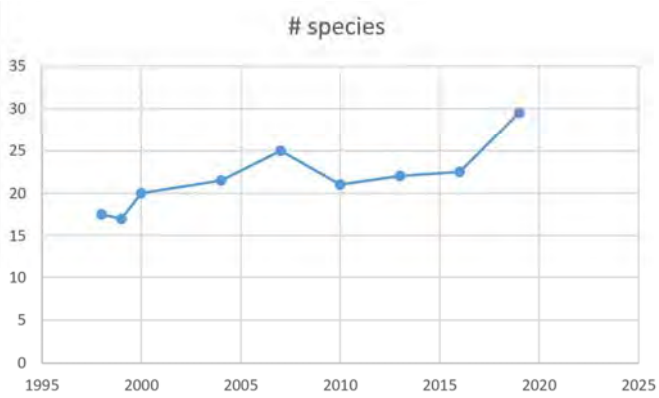


The % of tolerant individuals and omnivores have fluctuated over time, although both metrics have always had low values.

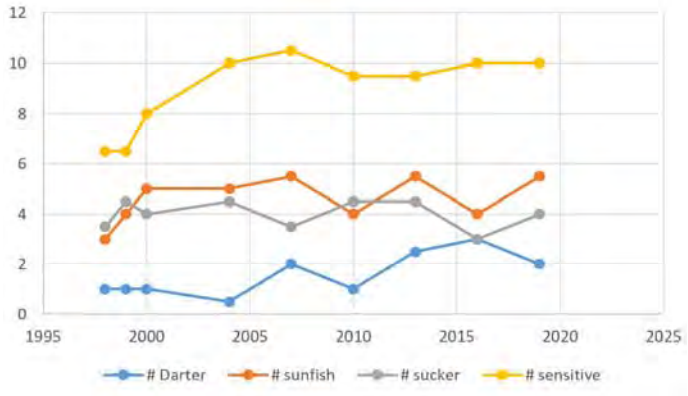


The total # of fish has fluctuated slightly over the years but the general trend is an increase over time.

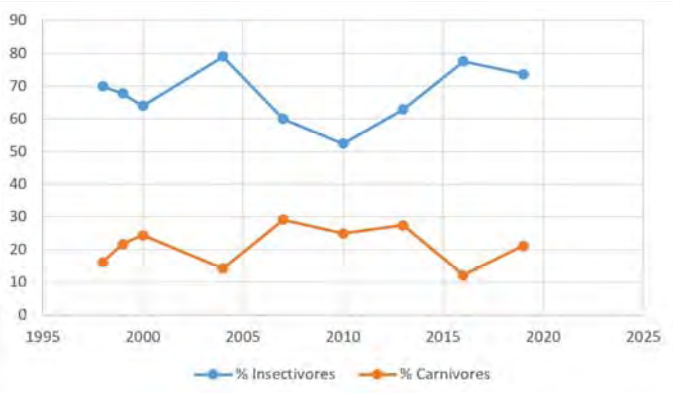
Site 20: Elkhart River—Indiana Avenue



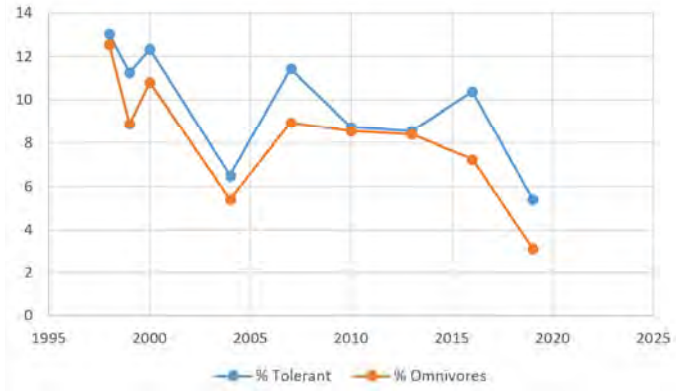
The # of species as been consistent over time, although it spiked to an all-time high in 2019.



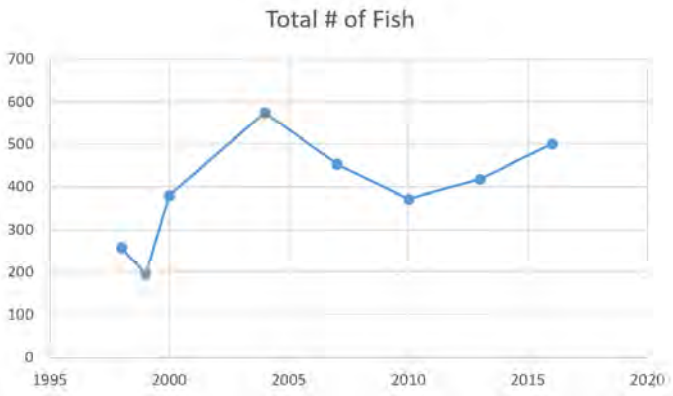
The # of sensitive species increased in 2004 and has remained consistent over time. The # of darter, sunfish, and sucker species has remained consistent over time.



The % of carnivores and insectivores has been relatively consistent over time.

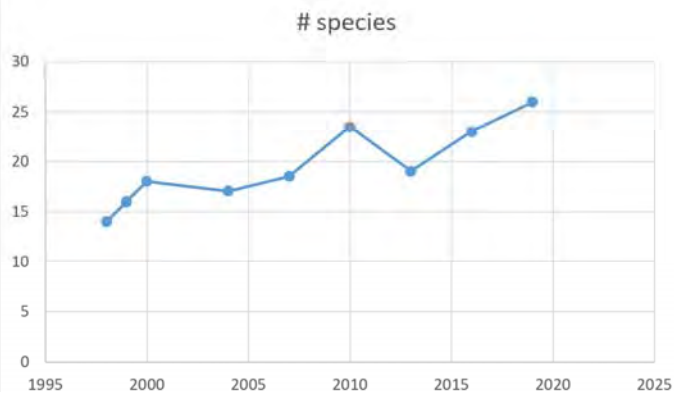


The % of tolerant individuals and omnivores has fluctuated with a general decline over time. Both metrics have been very low (<15%) since the inception of monitoring.

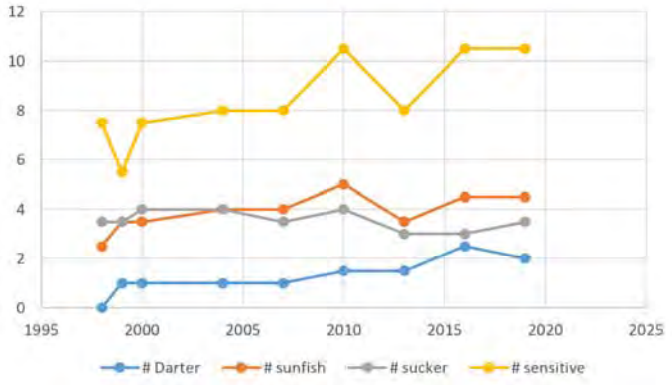


The total # of fish increased significantly in 2000 and has remained relatively high since.

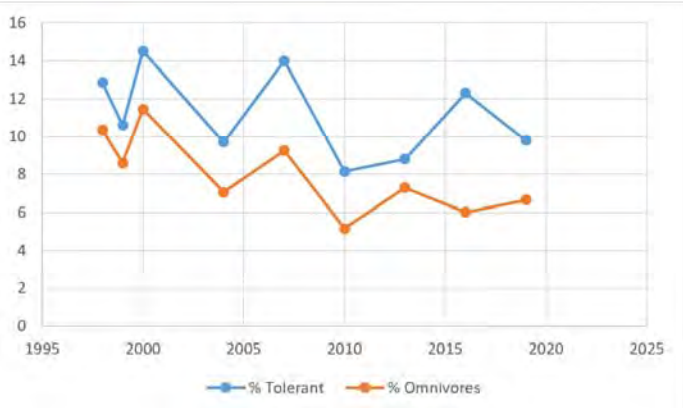
Site 21: Elkhart River—Middlebury Street



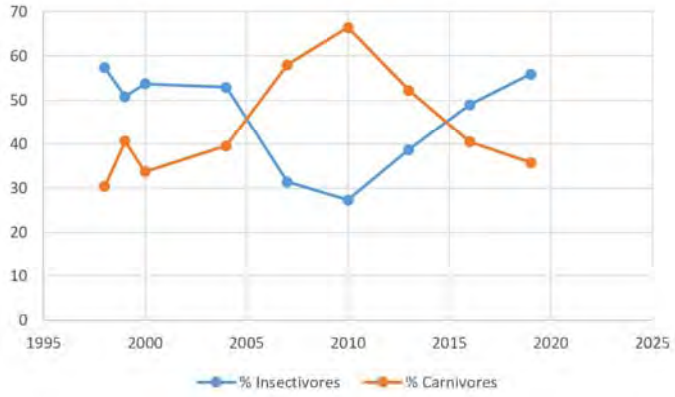
The # of species has increased substantially over the years.



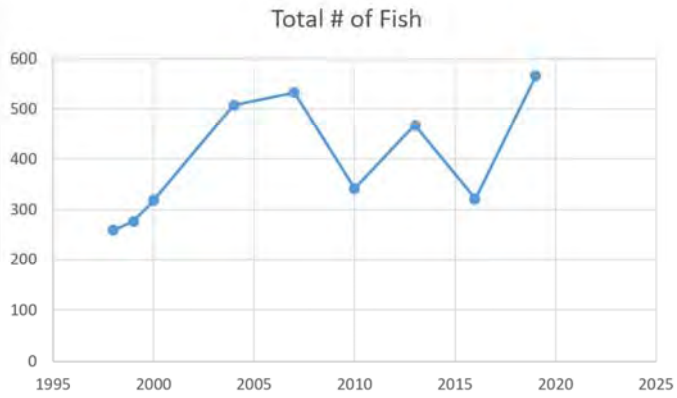
The # of sensitive species has increased over time, while the # of sunfish species and darter species have increased slightly. The # of sucker species has remained relatively similar.



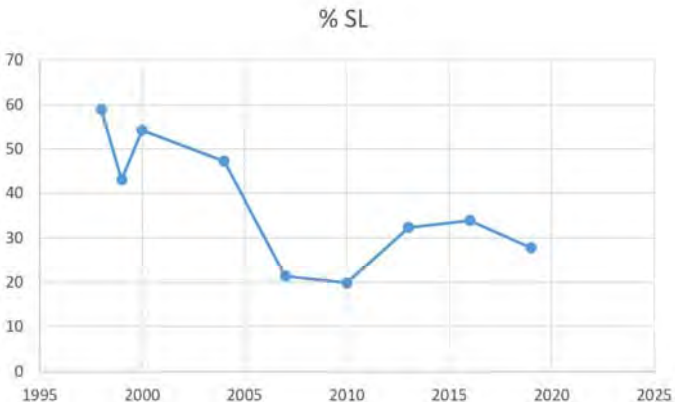
The % of tolerant individuals and omnivores have reduced slightly over time, although both metrics have been very low (<15%) since the inception of monitoring.



The % of insectivores and carnivores have fluctuated over time. The above graph depicts the negative relationship between these two metrics (as one increases, the other decreases).

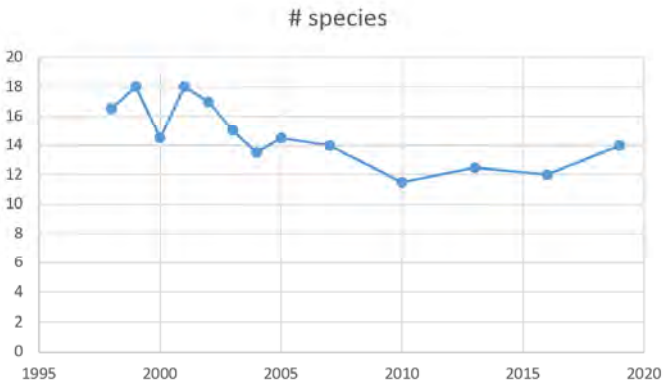


The total # of fish has fluctuated with a general increasing trend over time.

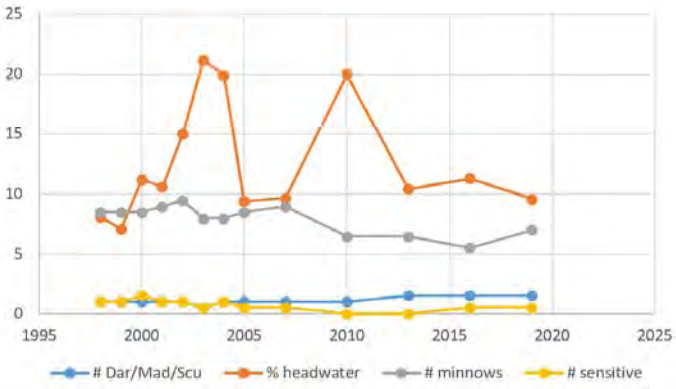


The % of simple lithophils has decreased significantly over the years.

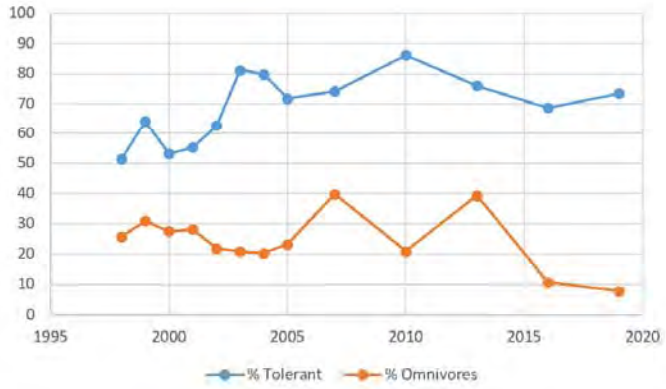
Site 24: Yellow Creek—County Road 32



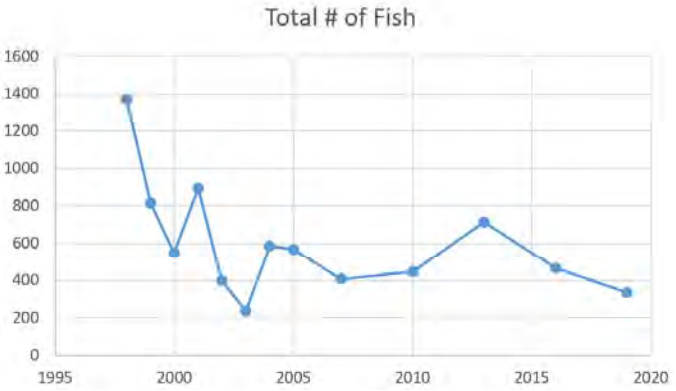
The number of species has decreased at this site since the inception of monitoring.



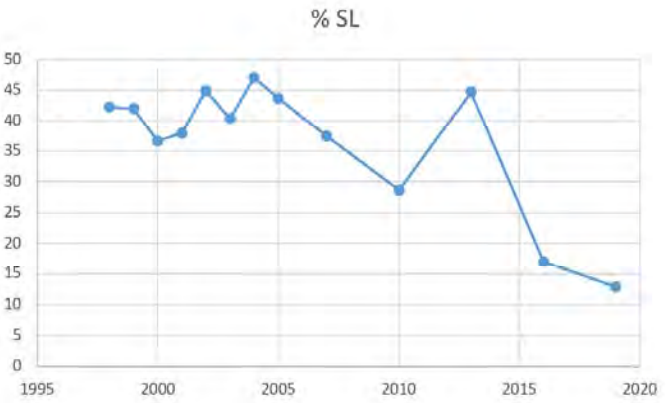
The # of minnows has decreased at this site since the inception of monitoring, while the % of headwater species has fluctuated and the # of minnow species and sensitive species has remained consistent.



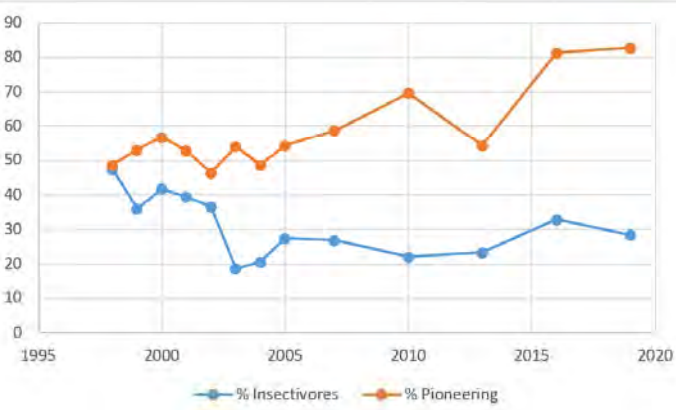
The % of tolerant individuals has increased while the % of omnivores has fluctuated but been low in recent years.



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

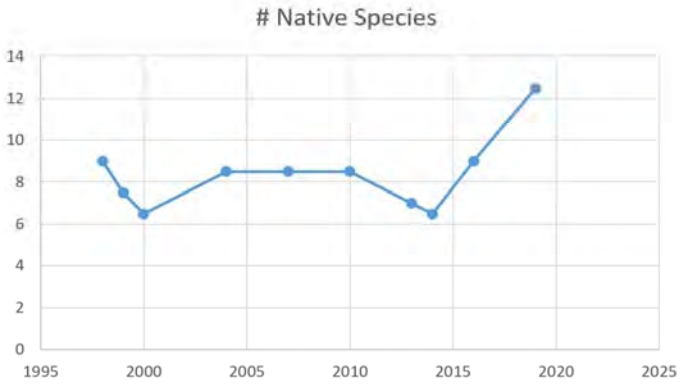


The % of simple lithophils has decreased in recent years

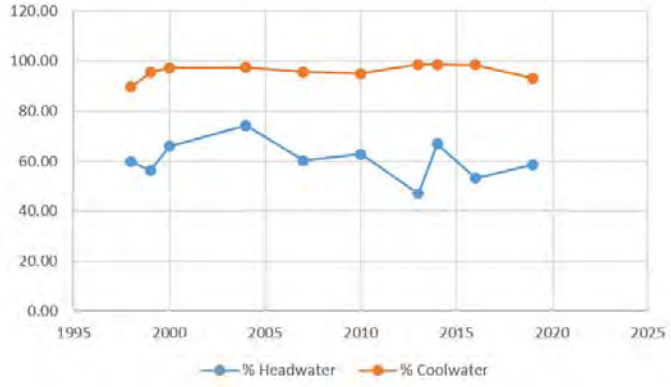


The % of insectivores has decreased over time while the % of pioneering species has increased significantly.

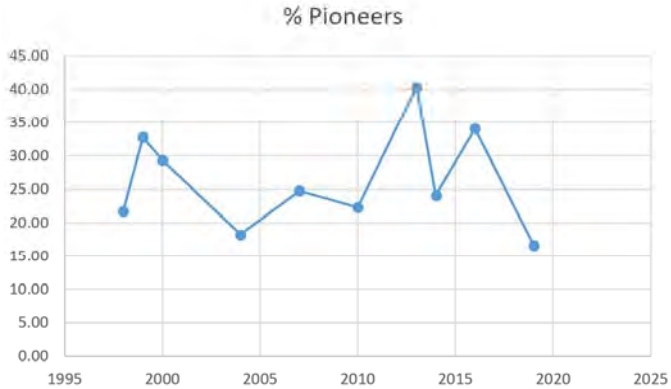
Site 25: Cobus Creek—County Road 8



The # of native species has been relatively similar over time, however, a huge spike in species diversity occurred in 2019.

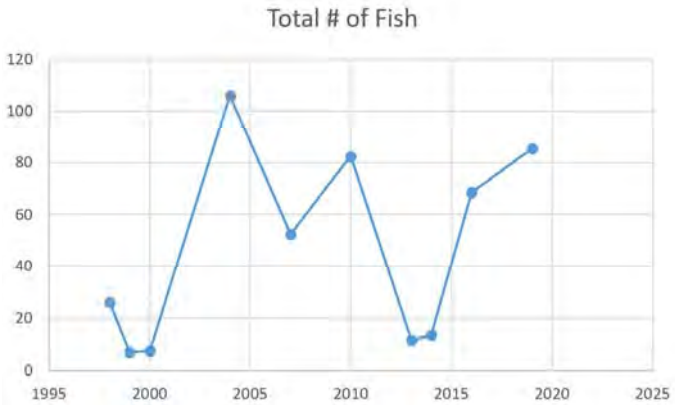


The % of head water species has been relatively similar over time. The % of coolwater species has also been consistent over time and a very high percentage of the fish community (close to 100%) has been coolwater species.

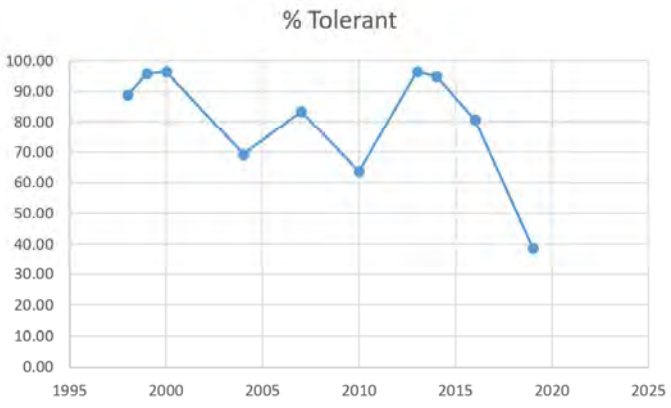


The % of pioneering individuals has fluctuated between 15 and 45%.

The % of insectivores has generally declined overtime, while the % of simple lithophils appears to have dropped more drastically.

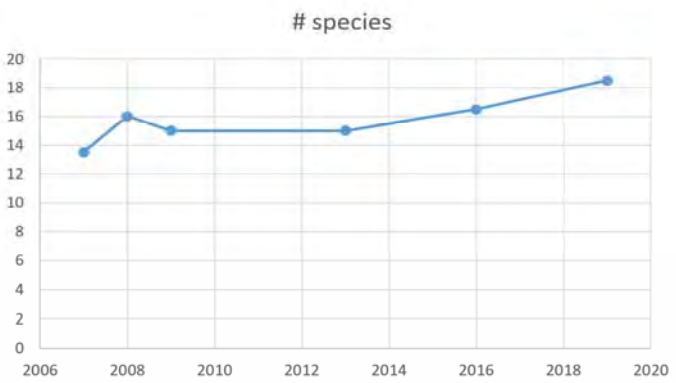


The total # of fish has fluctuated over time.

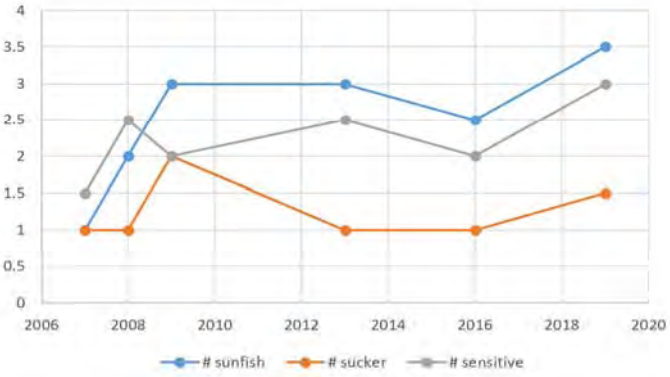


The % of tolerant individuals has fluctuated over time, although there appears to be a general decline.

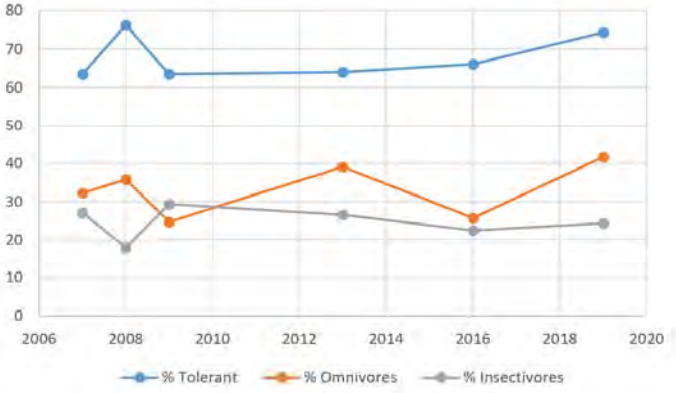
Site 26: Baugo Creek—CR 1 (South)



The # of species has increased slightly in recent years.

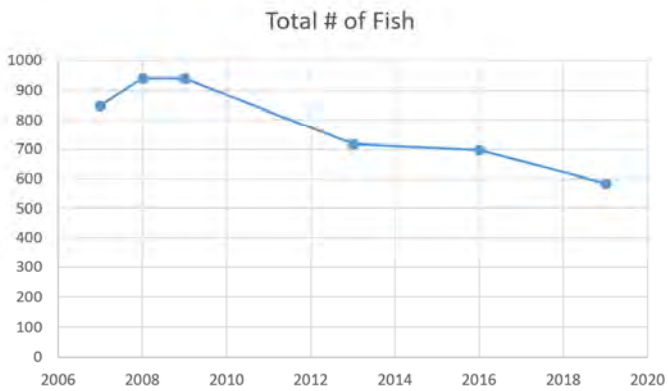


The # of sucker species and sunfish species has increased slightly over the years, while the # of sucker species has generally stayed the same.



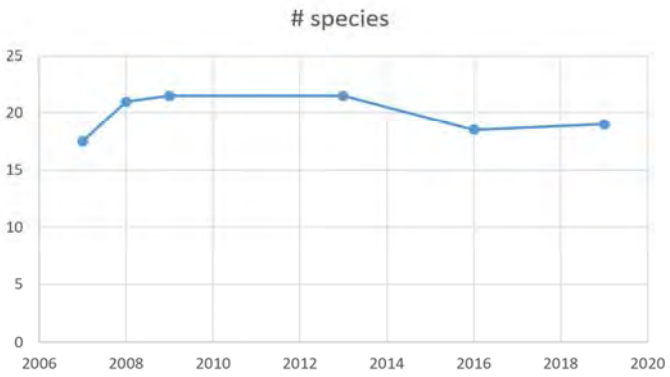
The % of tolerant individuals, omnivores and insectivores has remained relatively similar over time. The % of tolerant individuals is very high relative to most St. Joseph River Watershed sites.

The % of simple lithophils has remained relatively consistent overtime.

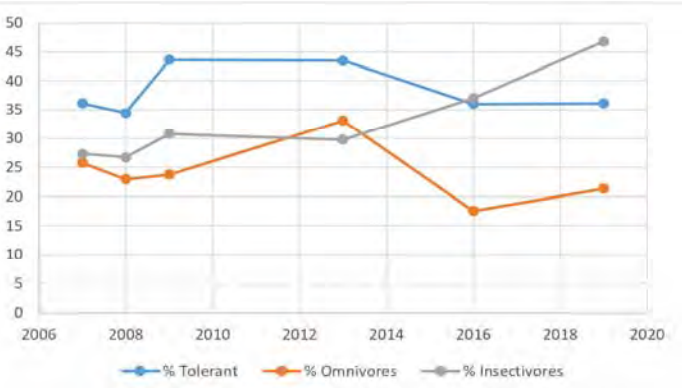


The total # of fish has decreased at this site over time.

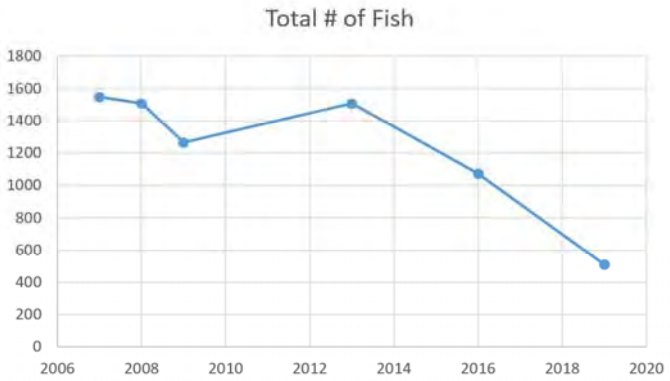
Site 27: Baugo Creek—CR 3 (North)



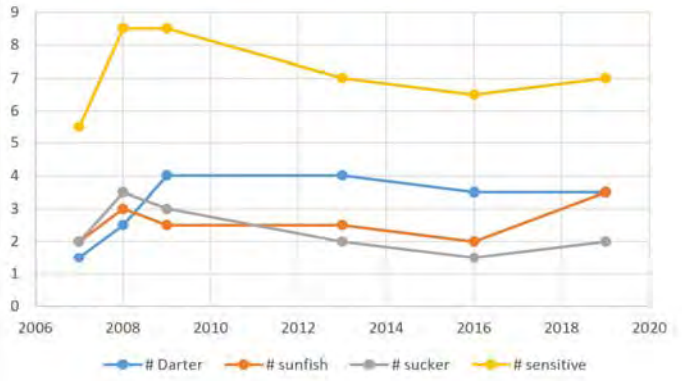
The # of species has been relatively similar over time, although this metric has been lower in recent years compared to the period between 2008 and 2013.



The % of insectivores has increased significantly in recent years. The % of omnivores and tolerant individuals has remained relatively similar.



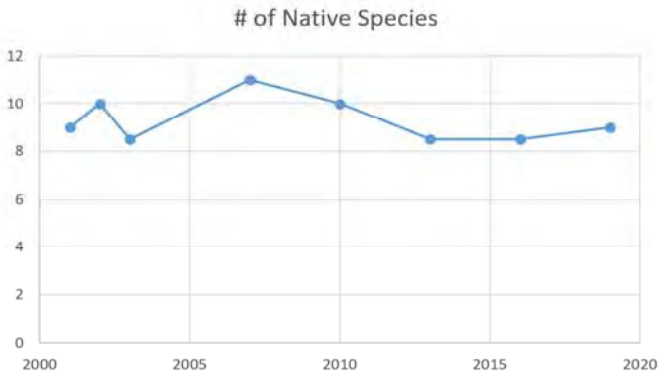
The total # of fish has decreased significantly over time.



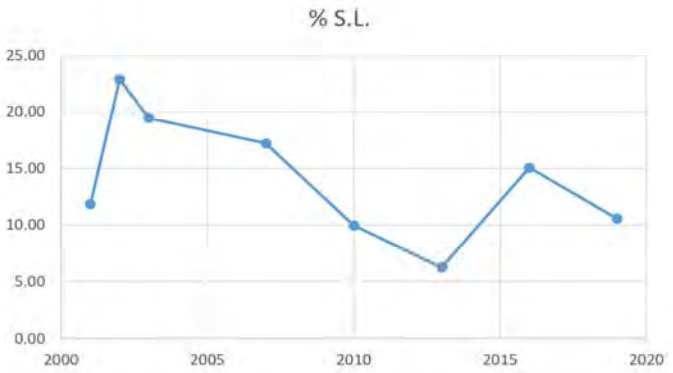
The # of suckers, sunfish, and sensitive species has been relatively similar over time, while the # of darters increased from 1.5 to 4 during the baseline monitoring period and has remained high since.

The percent of simple lithophils has increased over time.

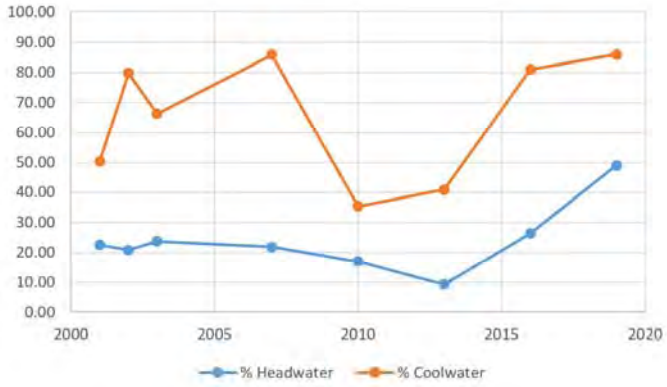
Site 33: Juday Creek—SR 23



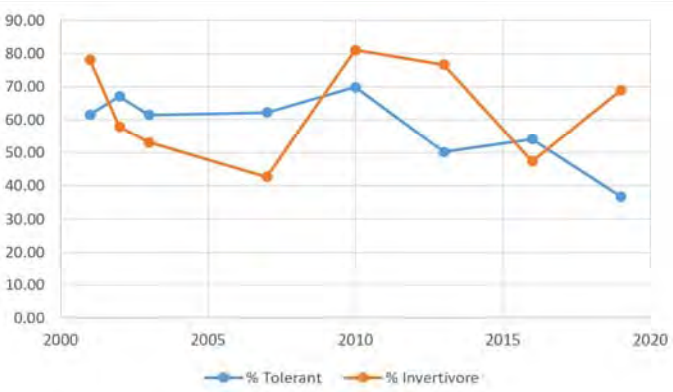
The # of native species has remained similar over time.



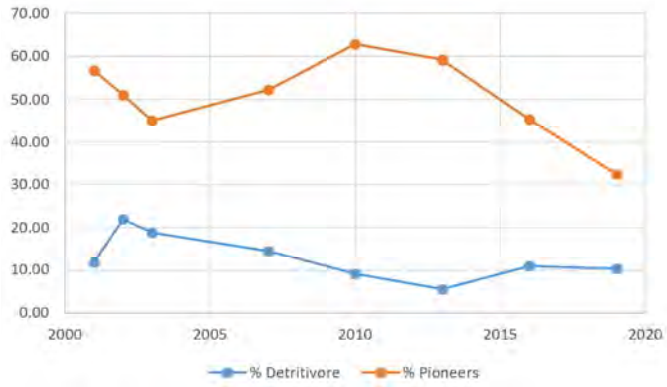
The % of simple lithophils has fluctuated over time.



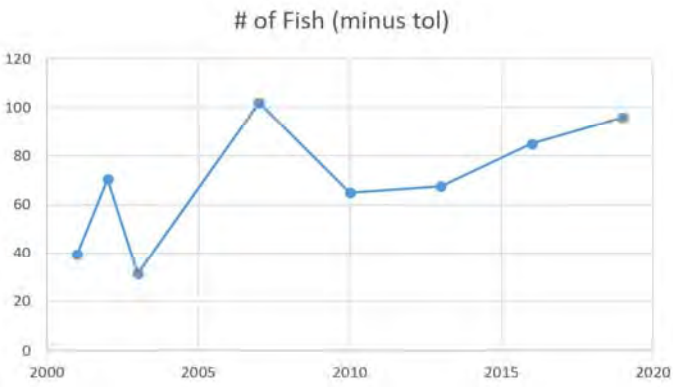
The % of headwater species has increased in recent years, while the % of coolwater species has fluctuated over time.



The % of tolerant individuals has decreased overtime, and the % of insectivores has fluctuated over time.



The % of pioneering species has reduced overtime at this site. The % of detritivores has decreased slightly over the years.



The # of fish collected (minus tolerant species) has increased overtime at this site.