Lower Manistee River Watershed Macroinvertebrate Assessment

Volunteer Stream Monitoring Program (VSMP)

Presented by the
Manistee Conservation District
In partnership with
Michigan Clean Water Corps

Spring and Fall 2021 Results

The data generated through the Manistee Conservation District's (MCD) Volunteer Stream Monitoring Program (VSMP) was established to track the relative health of the Lower Manistee River Watershed, locate specific problem areas, track changes over time, and cross-compare sites. Local stream data has been collected through this program since 2016 when it was founded by MCD's previous Conservation Specialist, Kayla Knoll. Since this inaugurate year, the District has continued to build upon this dataset with bi-annual stream sampling events, only missing one testing event due to the COVID-19 pandemic. In relation to the global pandemic and the subsequent quarantine that followed, MiCorps staff were able to take a closer look at their scoring methods and determined that there were some categorization flaws in their technique. This is not to say that our historical data scored under MiCorps legacy methodologies is insufficient, or that our efforts were in vain. It is simply a sign of advancing procedures and to be expected with a program that relies on a progressive scientific approach. This interruption in the dataset is alleviated by the high-standard operational practices applied over the lifetime of the program, as maximum accuracy has always been a core directional focus. The complexities of these scoring procedures are managed under the charge of Dr. Paul Steen and the rest of the MiCorps team, and they have taken great care in updating scoring methods in a way that allows final results to be relatively comparable to existing data. These changes will be instrumental in advancing accuracy and precision within the program, resulting in the most authentic reflections of our local streams. This is great news for VSMP participants, and the Manistee Conservation District would like to thank the Michigan Clean Water Corps network for its dedication to quality control and positive volunteer experience. Moving forward from obstacles associated with the pandemic, 2021 has been a productive year in the advancement of the program. Both sampling events produced ample macro samples, introduced us to new faces and reunited us with familiar ones. The Manistee Conservation District would also like to thank our dedicated volunteers for their contributions to the development of the VSMP program and look forward to continued success within the Lower Manistee River Watershed- a beautiful place to call home!

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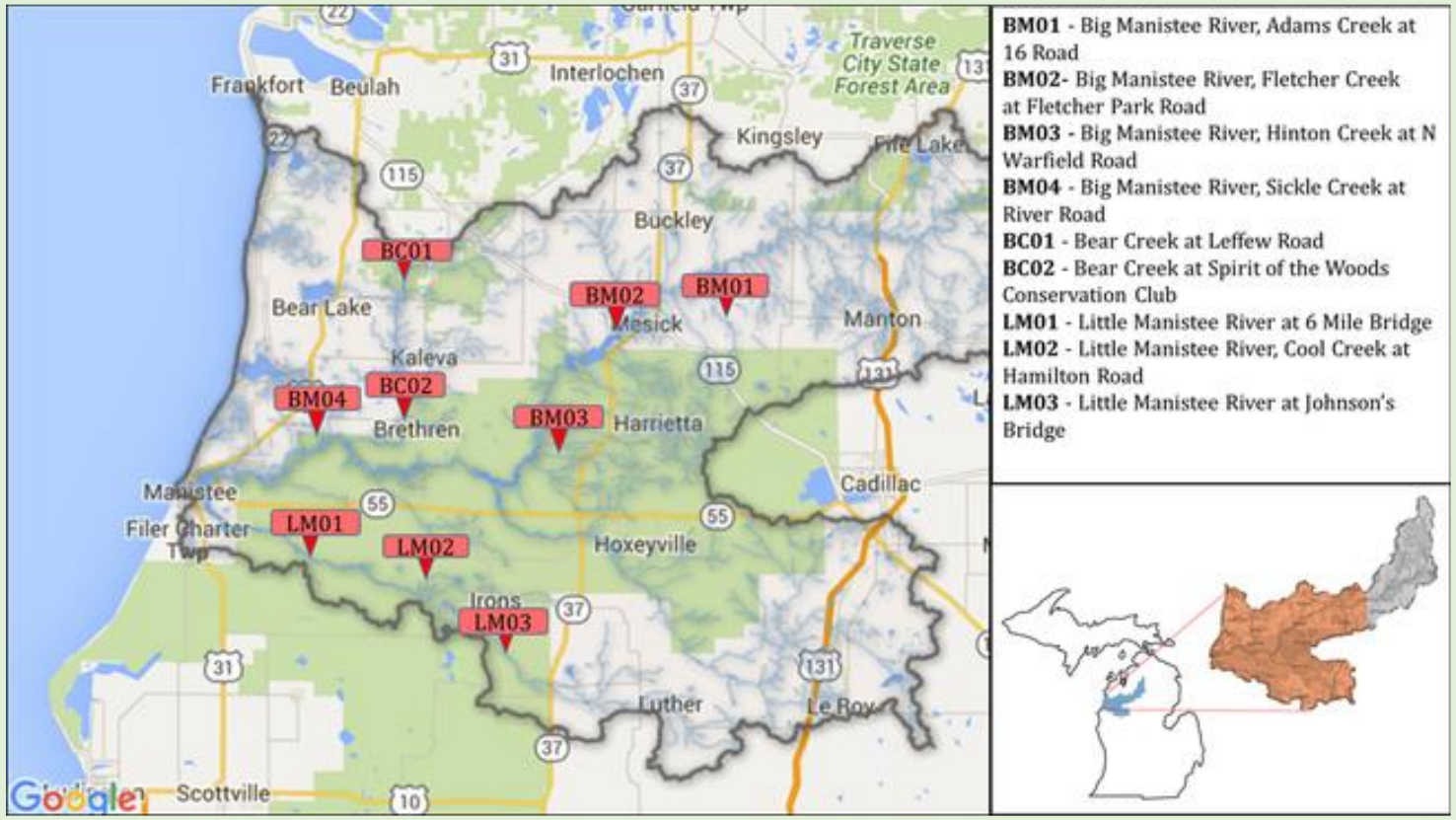
Conservation Technician

Manistee Conservation District

Manistee Conservation District's 9 sample stream locations:



These 9 sites are a collection of wadable portions of streams selected based on their direct contributions to the larger river system. Our citizen scientist volunteers revisit these sites during sampling events to collect macroinvertebrate samples from designated 300' sections. Macroinvertebrate samples can be used to investigate ecological factors that negatively influence stream conditions. Benthic macroinvertebrates are spineless, sensitive organisms that can be seen with the naked eye and inhabit various stream and river habitats. "Macro" sampling occurs in the spring and fall, the fall sample being highly critical for comparison purposes to the typically abundant spring event. During the fall, local macro communities are exposed to potentially greater levels of stress during the low-flow summer months. The summer is also a concentrated season for increased recreation and development due to our temperate climate, adding to the importance of the fall event. Two sampling events during the year is necessary to report an accurate portrayal of stream conditions, and this report will reference both sample scores to interpolate numerical results.

Materials and methods:

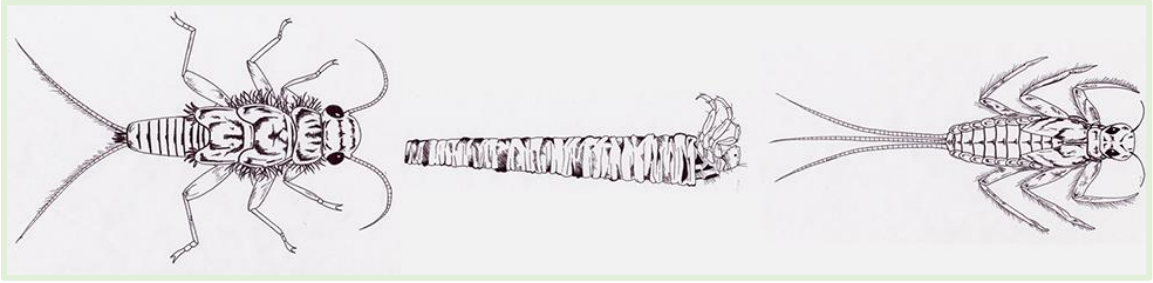
At each site location, volunteers used D-nets to sample pre-selected sections of the stream. Within each 300' stretch, volunteers sample various habitats and record which habitats they encountered. Volunteers are trained how to follow their data sheets to stay consistent and to sample as many different habitats as they can to increase diversity. Each site location is responsible for collecting at least 100 macroinvertebrates out of the stream, which are sorted on site. After sorting, our collection samples are then preserved in 95% ethanol and transported back to the District. Following the event, volunteers spend the next week collaboratively identifying macro species here in the office with the assistance of staff and various identification guides and keys. Macroinvertebrates are identified according to their taxonomic order and family and rated based on MiCorps' new sensitivity scoring method (*see page 1*). Following this, samples are stored indefinitely for reference and then final scores are recorded and added to MCD's historical and electronic files.

Understanding the metrics:

The metrics below are used to evaluate water quality. For each location, a ***lower numerical value on a 0-10 scale*** indicates a healthier stream.

- Water Quality Rating (WQR) is determined by weighing each type and number of organisms collected by their sensitivity ratings. A larger proportion of sensitive insects like stoneflies and caddisflies results in a higher WQR. Also, higher overall diversity results in a higher WQR. There are 7 WQR ratings: Excellent, Very Good, Good, Fair, Fairly Poor, Poor, and Very Poor (*Figure 1*).
- Total Taxa represents the categories of different orders/family groupings sampled.

*Sensitive refers to the number of macroinvertebrate species that rate very sensitive on the *Hilsenhof Biotic Index,* which is what MiCorps has based their new scoring system from. This biotic index bases scores for each organism on the overall tolerance of the organismal family, calculating a final score between 1 and 10 with the highest quality having a score less than 1.



Results:

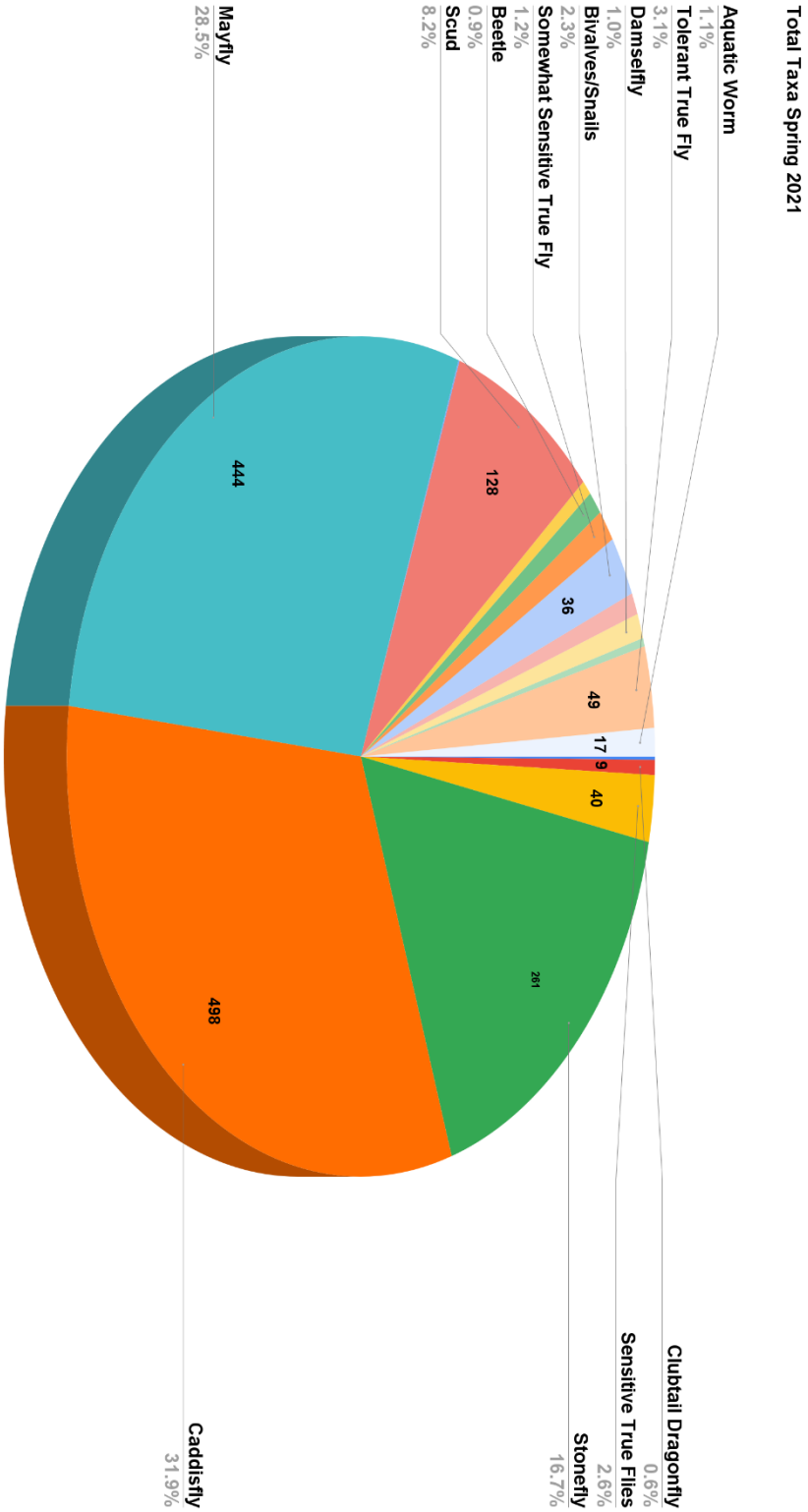
Site ID	Stream (Spring 2021)	WQR	Result:
BM01	Adam's Creek @ 16 Rd	3.2	EXELLENT
BM02	Fletcher Creek	4.7	GOOD
BM03	Hinton Creek	3.1	EXCELLENT
BM04	Sickle Creek	4.1	VERY GOOD
LM01	Little Manistee (Downstream)	3.0	EXCELLENT
LM02	Cool Creek	3.3	EXCELLENT
LM03	Little Manistee (Upstream)	3.2	EXCELLENT
BC01	Bear Creek @ Leffew Rd	3.1	EXCELLENT
BC02	Spirit of the Woods	3.1	EXCELLENT

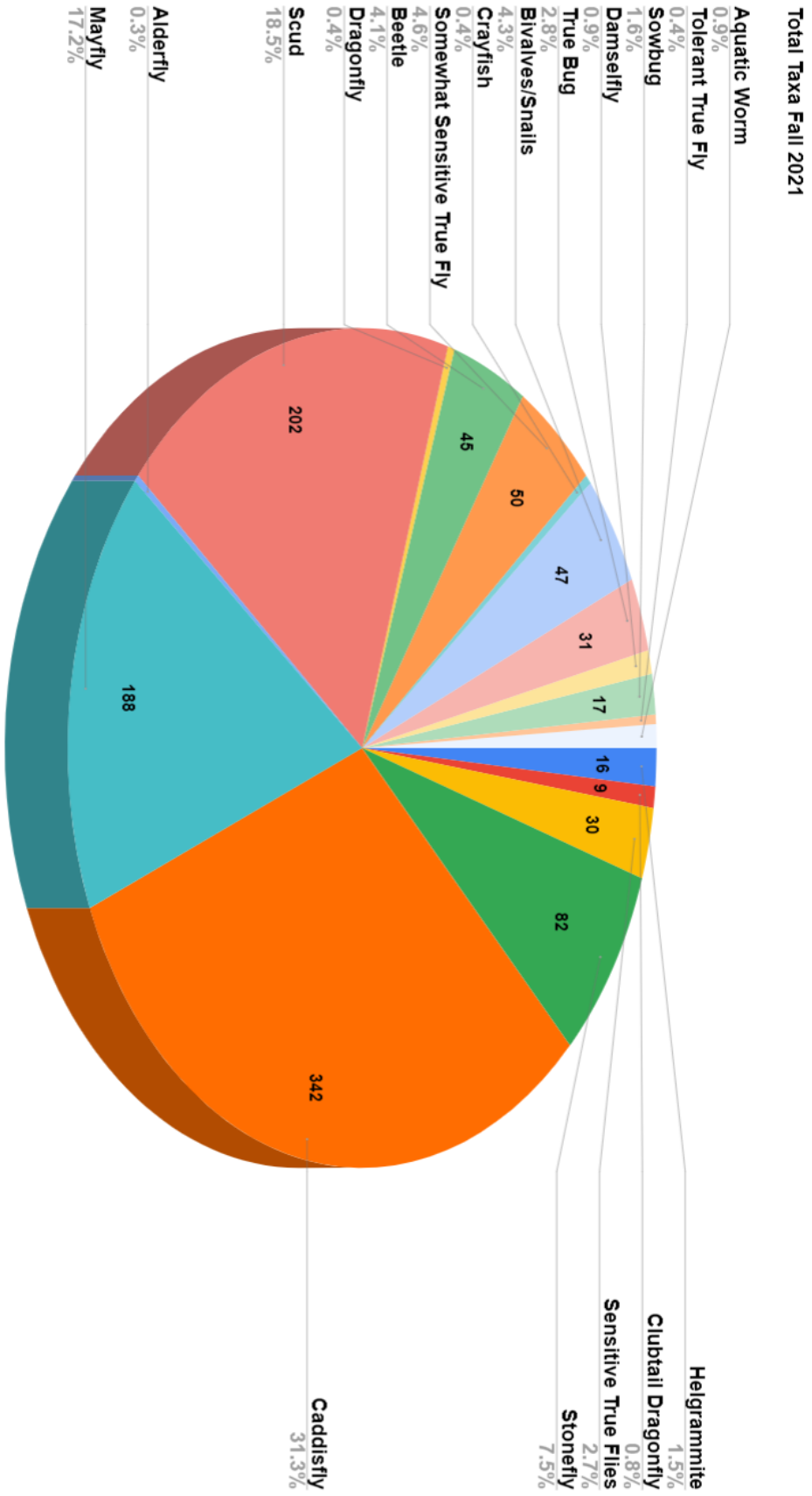
Site ID	Stream (Fall 2021)	WQR	Result:
BM01	Adam's Creek @ 16 Rd	3.4	EXCELLENT
BM02	Fletcher Creek	4.8	GOOD
BM03	Hinton Creek	3.3	EXCELLENT
BM04	Sickle Creek	4.6	GOOD
LM01	Little Manistee (Downstream)	3.9	VERY GOOD
LM02	Cool Creek	4.3	VERY GOOD
LM03	Little Manistee (Upstream)	3.4	EXCELLENT
BC01	Bear Creek @ Leffew Rd	4.1	VERY GOOD
BC02	Spirit of the Woods	3.7	VERY GOOD

Water Quality Rating			Degree of Organic Pollution
0.0-3.50	excellent		Pollution unlikely
3.51-4.50	very good		Slight pollution possible
4.51-5.50	good		Some pollution possible
5.51-6.50	fair		Fairly substantial pollution likely
6.51-7.50	fairly poor		Substantial pollution likely
7.51-8.50	poor		Very substantial pollution likely
8.51-10.0	very poor		Severe pollution likely

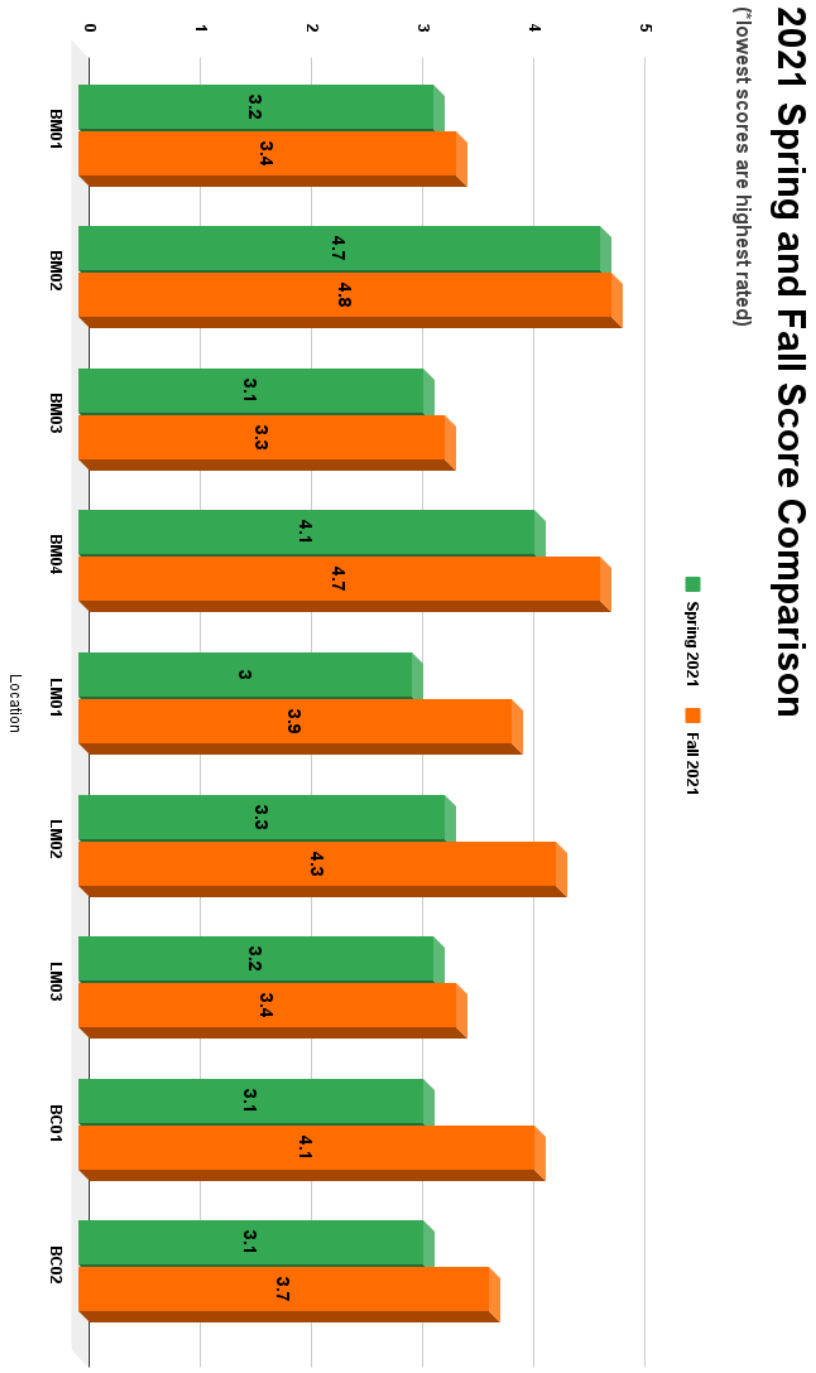
*We observed a slight "user error" in the total number of macroinvertebrates collected between sites. MiCorps protocol is to collect at least 100 organisms at each site, a standard that wasn't met at few of our study sites (all sites were above 80, and all during the fall event). This insufficient quantity is likely due to a difference in volunteer skill level and fall conditions. This issue will receive special consideration as we prepare for our next volunteer event.

Assessment:


Total Taxa Spring 2021
Aquatic Worm
1.1%
Tolerant True Fly
3.1%
Damselfly
1.0%
Bivalves/Snails
2.3%
Somewhat Sensitive True Fly
1.2%
Beetle
0.9%
Scud
8.2%
Mayfly
28.5%
444
128
36
49
17
9
40
261
498
Clubtail Dragonfly
0.6%
Sensitive True Flies
2.6%
Stonefly
16.7%
Caddisfly
31.9%


Total Taxa Fall 2021
Aquatic Worm
0.9%
Tolerant True Fly
0.4%
Sowbug
1.6%
Damselfly
0.9%
True Bug
2.8%
Bivalves/Snails
4.3%
Crayfish
0.4%
Somewhat Sensitive True Fly
4.6%
Beetle
4.1%
Dragonfly
0.4%
Scud
18.5%
Alderfly
0.3%
Mayfly
17.2%
Helgrammite
1.5%
Clubtail Dragonfly
0.8%
Sensitive True Flies
2.7%
Stonefly
7.5%
Caddisfly
31.3%
1
45
50
47
31
17
16
9
30
82
342
188
202

Varying macroinvertebrate communities are likely to be encountered during the spring and fall seasons, and sampling twice a year provides a more complete picture of the total stream community. To provide comparable results from year to year, sampling is always conducted within the same 2-week window each season.



Stream Habitat Assessment comparisons 2016-2021:

The Stream Habitat Assessment (MiCorps) is a visual assessment of stream conditions and watershed characteristics. Macroinvertebrate sampling procedures are used in conjunction with the Stream Habitat Assessment because each approach provides a different piece of the stream condition puzzle. MiCorps recommends repeating habitat assessment every 1 to 5 years, depending on the level of your concern for changes or impacts. Here are MCD's stream habitat comparisons between 2016 and 2021-

BM01	This site has channeled a bit at transect #1 since 2016 but has stayed relatively the same depth and width through our sample stretch. Sand has increased in some parts of the substrate.
BM02	This site has widened at transect #2 but has channeled at transect #3. Previous beaver dam has been removed but flow is still stagnant in some places within the sample stretch. Odd, concentrated color observed in stagnant areas- specifically ones near the adjacent road crossing. Depth has remained comparable. The stream needs extra attention going forward as it's consistently our lowest rated stream. Will inspect road crossing upon next visit to determine source of degradation.
BM03	Stream width increased quite substantially at transect #1 but depth remained comparable. Substrate has changed most notably in transect #1 where we observed the increase in stream width- some areas that were dominated by sand are now a cobble/gravel mix.
BM04	This stream has also widened quite substantially throughout sample stretch, but depth has remained comparable.
LM01	Transect #1 could not be measured in 2021 due to treacherous conditions (flow, turbidity). Depth and width of this stream showed no notable changes.
LM02	Width has decreased and depth has increased overall within our 300' section. Substrate has remained comparable. Culvert at this location could be causing this channelization.
LM03	Only significant change was some observed erosion on left bank at transect #1 (facing upstream).
BC01	Treacherous clay conditions in portions of this site. Only observed change in stream terrain was erosion on right stream bank (facing upstream) at transect #2.
BC02	Transect #3 was too deep to be sampled in 2016. Notable changes as follows: transect #3 was a navigable depth during 2021 measurement, evidence of channelization and erosion of right bank at transect #2 (facing upstream).

**1 transect equals 100 ft. There are 300 total feet (or 3 transects) assessed at each stream.*

2021 surface volume flow rate:

Surface volume flow rate was calculated using the “float method”. This is a method for measuring stream flow with mid-range accuracy. This method is best used in streams with calm areas and during days with low wind. Surface volume is a different measurement than overall volume flow rate. This is because flow near the substrate will typically have a lower flow rate due to drag. These rates are a measurement of surface water only:

	BM01	BM02	BM03	BM04	LM01	LM02	LM03	BC01	BC02
Date:	8/4	8/4	9/2	9/2	9/10	9/10	9/10	8/4	9/2
Surface Volume Flow Rate (liters per second):	270 L/s	219 L/s	278 L/s	60.48 L/s	1,025 L/s	722.2 L/s	1,808 L/s	2,184 L/s	2,752 L/s

Below is an example of how volume flow rate was calculated for **BM01** for reference:

	Method	Calculation
Average Velocity	A to B = 1 meter Average float time from A to B = 4.5 seconds Divide A to B by average float time Multiply quotient by a correction factor of .85	• 1 / 4.5 = .2 m/s • .2 m/s x .85 = .19 m/s
Average Width	Feet converted to meters	• 15.6 ft = 4.75 m
Average Depth	Inches converted to meters	• 12 in = .3 m
Surface Volume Flow Rate	Multiply the 3 results to come up with a product measuring in cubic meters per second. Convert cubic meters to liters by multiplying by 1,000	• 19 m/s x 4.75 m/s x .3 m/s = • .27 m^3/s • .27 m^3/s x 1,000 = 270 L/s

In summation:

All of MCD's test streams scored within the 3 highest quality tiers of the MiCorps biotic index scoring system, indicating high-quality conditions on average within our 9 test streams. The average score for 2021 was 3.6, which falls at the higher end of "very good". Because we have been collecting data on these sites since 2016, the data is no longer considered "preliminary". However, the changes to the scoring system should be considered, and this year will begin a new data set until all of our historical samples can be recounted. A full recount under the new scoring rubric will allow us to have a more comprehensive timeline of data to interpret overall results from. Differences among streams have been relatively consistent throughout the years and have increased under this more accurate method. It will be interesting to re-score our historical samples and determine if a more accurate system increases our historical ratings. For example, Fletcher Creek and Sickle Creek have increased scores since we began, but they have consistently been the two lowest scoring sites. Going forward into 2022, special attention will be focused on determining the cause for this, including inspections of localized road crossings and culverts. In addition to these areas of focus, we will also be enhancing our volunteer training techniques next year and bringing back our "Stream Team Leaders" strategy to ensure we're continuing to get the most out of this program.

A special thanks to our volunteers who join us at our collection events, we could not provide the Lower Manistee River Watershed with these stream scores without YOU!

MANISTEE CONSERVATION DISTRICT VOLUNTEER STREAM MONITORING PROGRAM DATA CHART

SITE ID	BC01	BC02	BM01	BM02	BM03	BM04	LM01	LM02	LM03
SITE LOCATION	Bear Creek Leffew Rd.	Bear Creek Spirit of the Woods	Adam's Creek	Fletchers Creek	Hinton Creek	Big Manistee Sickle Creek	Six Mile Bridge	Cool Creek at Hamilton	Little Manistee Johnson's Bridge
FALL 2016	Excellent	Excellent	Good	Good	Good	Good	Excellent	Good	Good
SPRING 2017	Good	Fair	Poor	Fair	Fair	Fair	Good	Fair	Fair
FALL 2017	Excellent	Excellent	Good	Good	Good	Good	Fair	Good	Good
SPRING 2018	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair
FALL 2018	Good	Good	Good	Good	Good	Good	Excellent	Good	Good
SPRING 2019	Good	Good	Good	Fair	Good	Fair	Excellent	Good	Excellent
FALL 2019	Excellent	Good	Fair	Good	Good	Good	Good	Excellent	Good
SPRING 2020	Covid 19	Covid 19	Covid 19	Covid 19	Covid 19	Covid 19	Covid 19	Covid 19	Covid 19
FALL 2020	Excellent	Good	Excellent	Excellent	Good	Fair	Good	Good	Good
SPRING 2021	Excellent	Excellent	Excellent	Good	Excellent	Very Good	Excellent	Excellent	Excellent
FALL 2021	Very Good	Very Good	Excellent	Good	Excellent	Good	Very Good	Very Good	Excellent