

Macroinvertebrate and Stream Habitat Surveys Big Sable and Lincoln River Watersheds, Michigan

August 2019 and September 2020

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INTRODUCTION

Michigan has over 76,000 miles of rivers and streams. Understanding the quality of those waters is an important part of the Michigan Department of Environment, Great Lakes, and Energy’s (EGLE) mission to protect Michigan’s environment and public health by managing air, water, land, and energy resources. All of Michigan’s watersheds are surveyed once every five years. As part of that effort, the Big Sable and Lincoln River watersheds were sampled in 2019 and 2020; this report includes the information collected as part of those surveys.

Water quality can be measured different ways including sampling macroinvertebrate and fish communities and collecting water or sediment samples. EGLE biologists sample macroinvertebrates and fish living in our rivers and streams because some are more sensitive to pollution than others. In general, macroinvertebrate and fish communities in healthy streams include those sensitive to pollution.

Looking at the quality of the physical habitat is helpful in understanding what may be limiting the kinds of life in a stream. Habitat includes the wood, rocks, gravel, silt, and sand in the stream or river and the vegetation in the water and along the shore. Typically, a range of habitats provides for diverse types of macroinvertebrates and fish.

Sometimes water or sediment samples are collected as indicators of potential pollution. Chemicals analyzed from these samples can be compared to levels expected and determined to be safe and helps to provide additional clues to possible water quality problems. Michigan has developed [Water Quality Standards](#) (WQS) to help with this comparison process; the WQS are rules that tell us the levels of various pollutants and other water quality conditions necessary for our rivers, streams, wetlands, and lakes to function properly.

All surface waters in Michigan are protected for “designated uses” such as swimming and wading, warmwater and coldwater (when applicable) fish communities, eating fish, aquatic life, and wildlife. All rivers, streams, lakes, ponds, drains, creeks, and the Great Lakes must be clean enough and meet WQS to support these uses. These streams are designated on the online [Watershed Monitoring Story Map](#). All sites surveyed are used to assess the ability to support designated uses through the [Integrated Report process](#).

WATERSHED INFORMATION

A [watershed](#) is all the land that drains to a lake or stream. The Big Sable and Lincoln River watersheds are comprised of largely coldwater rivers and streams, which are dominated by sand substrate. The watersheds are in both the Southern Michigan Northern Indiana Till Plains (SMNITP) and the Northern Lakes and Forest ecoregions (Omernik and Gallant, 2010). Land use/cover is a mixture of forest and agriculture, with some residential uses. Water quality is generally good in these rivers but increases in agriculture have been noted in the recent past. For more background information regarding these watersheds, see previous staff reports (Walker, 2002a; Walker, 2002b; Roush, 2008; Lipsey, 2010; Knoll, 2013; and Holden, 2016).

Since the last sampling effort in 2014, portions of the lower Big Sable River and some of its tributaries have been listed as not meeting the Total Body Contact WQS due to high *E. coli* concentrations. More information on these listings can be found in the Integrated Report (Goodwin and Smith, 2022) and [Michigan’s *E. coli* Pollution and Solution Mapper](#). Upstream of these locations, the river and its tributaries are meeting every assessed WQS. Two lakes in the watershed have been assessed in the past. Big Bass Lake is mesotrophic, or moderately productive. Hamlin Lake at the base of the Big Sable River is mesotrophic in the lower basin, but samples collected closer to the river outlet indicated the upper portion of the lake may be eutrophic, or more productive. As of 2015, there is a Hamlin Lake fish consumption advisory due to mercury in fish tissue. People are recommended to limit consumption of walleye to twice per month and northern pike, largemouth bass, and smallmouth bass to once per month. In 2010 Michigan Department of Natural Resources, Fisheries Division, staff conducted a survey of Hamlin Lake, which documented that the current sport fish community was in good condition and made recommendations for both future stocking in the lake and protection of fisheries habitat (Tonello, 2012).

The majority of the North Branch Lincoln River watershed is listed as not meeting the Total Body Contact WQS due to high *E. coli* concentrations and the Other Indigenous Aquatic Life and Wildlife (OIALW) WQS due to high mercury concentrations in the water. The other rivers in the Lincoln River watershed meet every other assessed WQS. Six lakes in the Lincoln River watershed have been assessed; half are considered mesotrophic and the other half are considered eutrophic.

HISTORIC SAMPLING EFFORTS

Table 1 contains a summary of the biosurvey reports dating back to 2004. For more information about older reports and results or for any other questions about this watershed, please contact the watershed biologist by finding their contact information on the [Watershed Monitoring Story Map](#).

Table 1. Historical EGLE biosurvey reports available for the Big Sable and Lincoln River watersheds.

Survey Year	Report Citation Report Number	Finding/Comments
2014	Holden, S. 2016 #MI/DEQ/WRD-16/014	<ul style="list-style-type: none"> • Macroinvertebrate community samples were collected at 2 stations in the Big Sable River watershed and 2 stations in the Lincoln River watershed with ratings of acceptable or excellent. • Habitat was surveyed at 2 stations in the Big Sable River watershed, which rated excellent and 2 stations in the Big Sable River watershed, which rated good.
2010	Knoll, M., 2013 #MI/DEQ/WRD-13/012	<ul style="list-style-type: none"> • Macroinvertebrate community samples were collected at 3 stations in the Lincoln River watershed with ratings of acceptable or excellent. • Habitat was rated as good for all stations.
2009	Lipsey, T., 2010 #MI/DEQ/WB-10/016	<ul style="list-style-type: none"> • Macroinvertebrate community samples were collected at 2 stations in the Big Sable River watershed with ratings of acceptable or excellent. • Habitat was rated as good for both stations.
2004	Roush, D., 2008 #MI/DEQ/WB-08/044	<ul style="list-style-type: none"> • Macroinvertebrate community samples were collected at 9 stations in the Big Sable River watershed and 5 stations in the Lincoln River watershed with ratings of acceptable or excellent. • Habitat was surveyed at 9 stations in the Big Sable River watershed and 5 stations in the Lincoln River watershed with ratings ranging from good to excellent. • Water chemistry data was collected at 8 stations in the Big Sable River watershed and 5 stations in the Lincoln River watershed. WQS were met at all stations.

Sampling Goals:

1. Assess the current condition of individual rivers, streams, and lakes and determine whether Michigan’s WQS and designated uses are being met.
2. Evaluate water quality trends across the state.

SITE-SELECTION/METHODS

In August 2019, one site was sampled in the Lincoln River, and in September 2020, one site was sampled in the Big Sable River. All sampling in the Big Sable and Lincoln River watersheds was intended to be conducted in 2019; however, exceedingly high water levels in the Big Sable River precluded sampling during that year. [Procedure 51: Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers](#) was used to collect habitat and macroinvertebrate community information.

One type of site-selection method was used in the Big Sable and Lincoln Rivers watersheds:

- (1) Trend sites: Two sites, originally selected from a random group, became trend sites that are sampled every five years. These sites will be used for a separate statewide trend report following analysis of 2006-2020 data.

[Procedure 51](#) is used in streams and rivers that can be safely waded (Creal et al., 1996). This procedure evaluates macroinvertebrate communities based on several characteristics and combines all results into a one-number score that ranges from +9 to -9 (Table 2). Using Procedure 51, the macroinvertebrate community can be rated as Excellent, Acceptable, or Poor. Habitat is rated as Excellent, Good, Marginal, or Poor based on measures that describe the habitat in the stream and along the banks of the stream.

Table 2. EGLE Procedure 51 macroinvertebrate and habitat scoring and rating system.

Macroinvertebrate Score	Macroinvertebrate Rating	Habitat Score	Habitat Rating
5 to 9	Excellent	> 154	Excellent
-4 to 4	Acceptable	105 to 154	Good
-5 to -9	Poor	56 to 104	Marginal
		<56	Poor

Macroinvertebrate community scores are one component used to evaluate the OIALW designated use. Habitat scores are used to help better understand what might influence the macroinvertebrate scores. More information on the metrics and scoring can be found in the [Procedure-51 Scoring Document](#).

MONITORING FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Goal 1: Determine the condition of individual waters of the state and if Michigan WQS are being met.

Both sampled stations had macroinvertebrate community ratings that were acceptable (Tables 3 and 5, Figure 1). Therefore, the OIALW designated use was supported at all stations.

Big Sable River

The Big Sable River was sampled downstream of Darr Road and had an acceptable macroinvertebrate community score (3). Forty-two taxa were collected including 6 mayfly, 2 stonefly, and 4 caddisfly (Table 5). A relatively high percentage of isopod and leech taxa lowered the community score at this site. The glide-pool habitat scored excellent (Table 4). The substrate at this location was largely comprised of sand. Habitat for macroinvertebrate colonization was provided mainly by undercut banks, submergent aquatic vegetation (e.g., elodea), overhanging vegetation, and large woody debris. This site had little evidence of streambank erosion and extensive riparian habitat. This site was also assessed in 2014 and 2009 and received macroinvertebrate scores of 7 both years. Given that no other alterations to habitat were noted between the 2014 and 2020 field seasons, the 4-point decline in macroinvertebrate score may have been the result of high water levels in 2019. Increased discharge in this section of river could have displaced aquatic macroinvertebrates, and because sampling occurred only a year after this event, not enough time may have elapsed for communities to recolonize.

South Branch Lincoln River

The South Branch Lincoln River was sampled upstream of Victory Corner Road and had an acceptable macroinvertebrate community score (4). Twenty-four taxa were collected, including 3 mayfly, 1 stonefly, and 4 caddisfly (Table 5). The macroinvertebrate community was primarily dominated by amphipods and caddisflies, specifically Brachycentridae. The riffle-run habitat scored excellent (Table 4). The substrate at this location consisted of mostly sand with minimal coarse substrate. If coarse substrate was observed, it was highly embedded. The primary habitat available for macroinvertebrate colonization was in the form of snags and submerged logs. The streambanks were relatively stable with minimal erosion and bordered by largely intact and extensive riparian habitat. This site was also assessed in 2014, 2010, and 2000 and received macroinvertebrate scores of 4, 2, and 8, respectively.

Table 3. Procedure 51 sampling results for stations sampled in the Big Sable and Lincoln River watersheds, 2019 and 2020. Unless otherwise noted, stations are sampled upstream of road crossings.

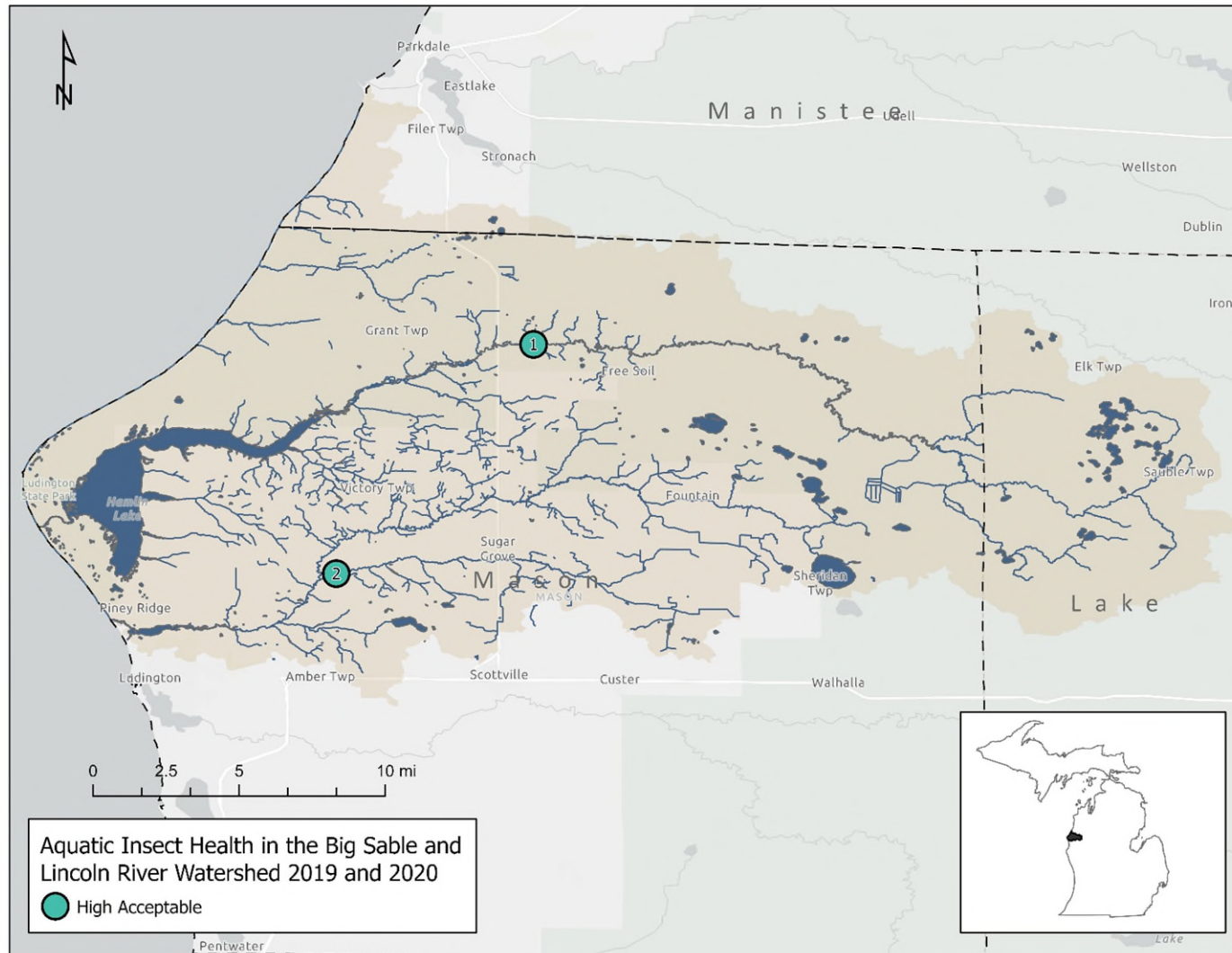
Station	Stream Name	Road Crossing	STORET	Latitude	Longitude	Date	Habitat Rating	Habitat Score ¹	Bug Rating	Bug Score ²	Station Type ³
1	Big Sable River	Downstream of Darr Road	530292	44.12086	-86.26247	9/8/2020	Excellent	162	Acceptable	3	Tr
2	South Branch Lincoln River	Victory Corner Road	530211	44.007468	-86.36008	8/5/2019	Excellent	163	Acceptable	4	Tr

¹ **Habitat Scoring** Poor <56, Marginal 56-104, Good 105-154, Excellent >154

² **Macroinvertebrate Scoring** Poor -9 to -5, Acceptable -4 to 4, Excellent 5-9

³ **Tr=Trend, T=Targeted, S=Status**

Figure 1. Macroinvertebrate ratings for stations sampled in the Big Sable and Lincoln River watersheds, August 2019 and September 2020.



Goal 2: Evaluate biological integrity temporal trends.

The two sites within the Big Sable and Lincoln River watersheds were part of the statewide trend analysis. Statewide trend information will be summarized in a separate statewide report.

RECOMMENDATIONS

1. These trend stations will be resampled during the 2024 field season. If the macroinvertebrate score has not improved at the Big Sable River downstream of Darr Road, we will investigate potential causes of the reduced score.

Field Work By: Amanda Chambers, Aquatic Biologist
Elizabeth Stieber, Aquatic Biologists
Surface Water Assessment Section
Water Resources Division

Mapping and Report By: Amanda Chambers, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division

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- Walker, B. 2002b. A Biological Survey of the Big Sable River, Mason and Lake Counties, June 5-6 and September 12, 2000. Report #MI/DEQ/SWQ-02/050.

BIOSURVEY TABLES

Table 4. Habitat evaluation for selected stations in the Big Sable and Lincoln River watersheds, Michigan, August 2019 and September 2020.

Date	Station 1 Big Sable River Downstream Darr Road	Station 2 South Branch Lincoln River at Victory Corner Road
	9/8/2020	8/5/2019
HABITAT METRICS	GLIDE/POOL	RIFFLE/RUN
Substrate and Instream Cover		
Epifaunal Substrate/ Available Cover (20)	13	16
Embeddedness (20)*1		20
Velocity/Depth Regime (20)*1		13
Pool Substrate Characterization (20)**2	11	
Pool Variability (20)**2	13	
Channel Morphology		
Sediment Deposition (20)	16	13
Flow Status -Maintenance Flow Volume (10)	10	9
Flow Status -Flashiness (10)	9	9
Channel Alteration (20)	20	18
Frequency of Riffles/Bends (20)*1		15
Channel Sinuosity (20)**2	16	
Riparian and Bank Structure		
Bank Stability (L) (10)	9	7
Bank Stability (R) (10)	9	9
Vegetative Protection (L) (10)	8	7
Vegetative Protection (R) (10)	8	9
Riparian Vegetative Zone Width (L) (10)	10	9
Riparian Vegetative Zone Width (R) (10)	10	9
TOTAL SCORE (200):	162	163
HABITAT RATING:	EXCELLENT	EXCELLENT
Weather:	cloudy	sunny
Air Temperature: °F	50	75
Water Temperature: °F	59	60
Average Stream Width: Feet	42.6	18
Average Stream Depth: Feet		
Surface Velocity: Feet/Second	1.217735043	0.690767402
Estimated Flow: Cubic Feet/Second	104.1666792	9.201021795
Stream Modifications:	none	none
Nuisance Plants (Yes/No):	N	N
STORET Number:	530292	530211
County Code:	53	53
Town Range Section:	20N16W19	19N17W28
Latitude (dd):	44.12086	44.007468
Longitude (dd):	-86.26247	-86.3600823
Ecoregion:	SMNITP	SMNITP

*1 Only applies to Riffle/Run stream surveys

*2 Only applies to Glide/Pool stream surveys

Table 5. Qualitative macroinvertebrate sampling results at selected stations in the Big Sable and Lincoln River watersheds, Michigan, August 2019 and September 2020.

	Big Sable River Downstream Darr Road 9/8/2020	South Branch Lincoln River Victory Corner Road 8/5/2019
Taxa	Station 1	Station 2
ANNELIDA (segmented worms)		
Hirudinea (leeches)	1	
Oligochaeta (worms)	1	
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	29	150
Decapoda (crayfish)	5	2
Isopoda (sowbugs)	16	1
Arachnoidea		
Hydracarina	1	1
Insecta		
Ephemeroptera (mayflies)		
Baetiscidae	7	
Baetidae	59	39
Caenidae		2
Ephemeridae	1	
Heptageniidae	7	4
Isonychiidae	4	
Leptophlebiidae	1	
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	1	2
Gomphidae	2	
Zygoptera (damselflies)		
Calopterygidae	15	4
Coenagrionidae	1	
Plecoptera (stoneflies)		
Perlidae	1	
Pteronarcyidae	1	2
Hemiptera (true bugs)		
Belostomatidae	1	
Corixidae	5	
Gerridae	1	1
Nepidae	3	
Pleidae	5	
Megaloptera		
Corydalidae (dobson flies)		1
Trichoptera (caddisflies)		
Brachycentridae	1	151

Taxa	Big Sable River Downstream Darr Road 9/8/2020	South Branch Lincoln River Victory Corner Road 8/5/2019
	Station 1	Station 2
Hydropsychidae	47	26
Leptoceridae	18	
Limnephilidae		1
Polycentropodidae	1	
Uenoidae		1
Coleoptera (beetles)		
Gyrinidae (adults)	5	
Haliplidae (adults)	2	
Hydrophilidae (total)	1	
Elmidae	2	11
Diptera (flies)		
Athericidae	1	
Ceratopogonidae	1	1
Chironomidae	15	25
Culicidae	1	
Dixidae	3	
Simuliidae	3	5
Tabanidae	1	1
Tipulidae	1	2
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	6	
Physidae	7	1
Pisidiidae	1	1
Total Individuals	285	435

Table 6. Macroinvertebrate metric evaluation of selected stations in the Big Sable and Lincoln River watersheds, Michigan, August 2019 and September 2020.

METRIC	Station 1		Station 2	
	9/8/2020		8/5/2019	
	Value	Score	Value	Score
Total Number of Taxa	42	1	24	0
Number of Mayfly Taxa	6	1	3	0
Number of Caddisfly Taxa	4	0	4	0
Number of Stonefly Taxa	2	1	1	1
Percent Mayfly Composition	27.72	1	10.34	0
Percent Caddisfly Composition	23.51	0	41.15	1
Percent Dominant Taxon	20.70	0	34.71	0
Percent Isopod, Snail, Leech	10.53	-1	0.46	1
Percent Surface Air Breathers	8.42	0	0.23	1
TOTAL SCORE		3		4
Macroinvertebrate Community Rating	Acceptable		Acceptable	