Save the Dogs!
Water Quality of the Maumee River from 2019-2020

McKinley STEMM Academy

7th grade class

teacher Cynthia Madanski

TPS PROUD

THE GLOBE PROGRAM

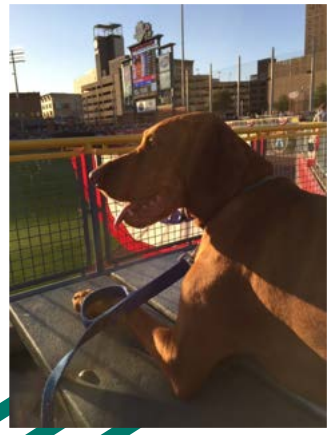
Global Learning and Observations to Benefit the Environment

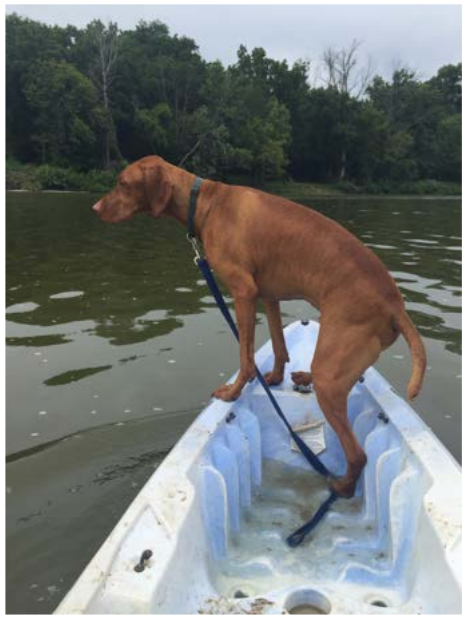
Abstract

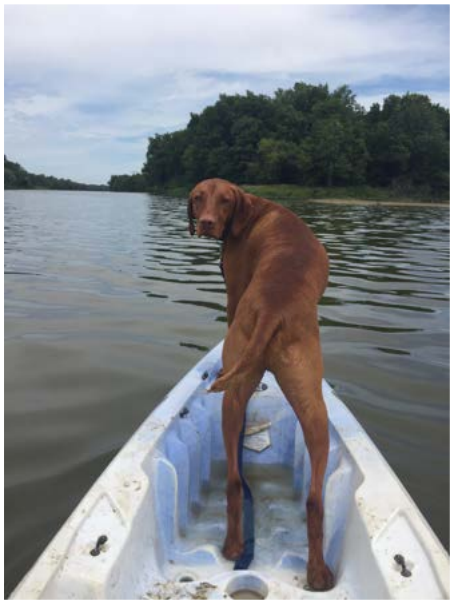
The Toledo area is notorious for having harmful algal blooms in the summer months. We read articles about toxic algae, including an article highlighting a current algal bloom happening in the summer of 2020 in Toledo. With this relevance to our own lives, we asked the question “Is the water in Toledo safe enough for Mohawk and other dogs to swim in?” Last year, students found the water was safe. We wanted to see if it is safe again this year, or if anything has changed in the Maumee River at Sidecut Metropark.

The GLOBE protocols used to answer this research question were water temperature, fecal coliform bacteria, Biochemical Oxygen Demand, phosphate, nitrate, turbidity, total solids, water transparency, pH, dissolved oxygen, and macroinvertebrates. We collected data once for all protocols, between 9:07-10:57am on October 8, 2020. We used past results from October 2019 to compare. The results showed that the water quality was worse in 2020.

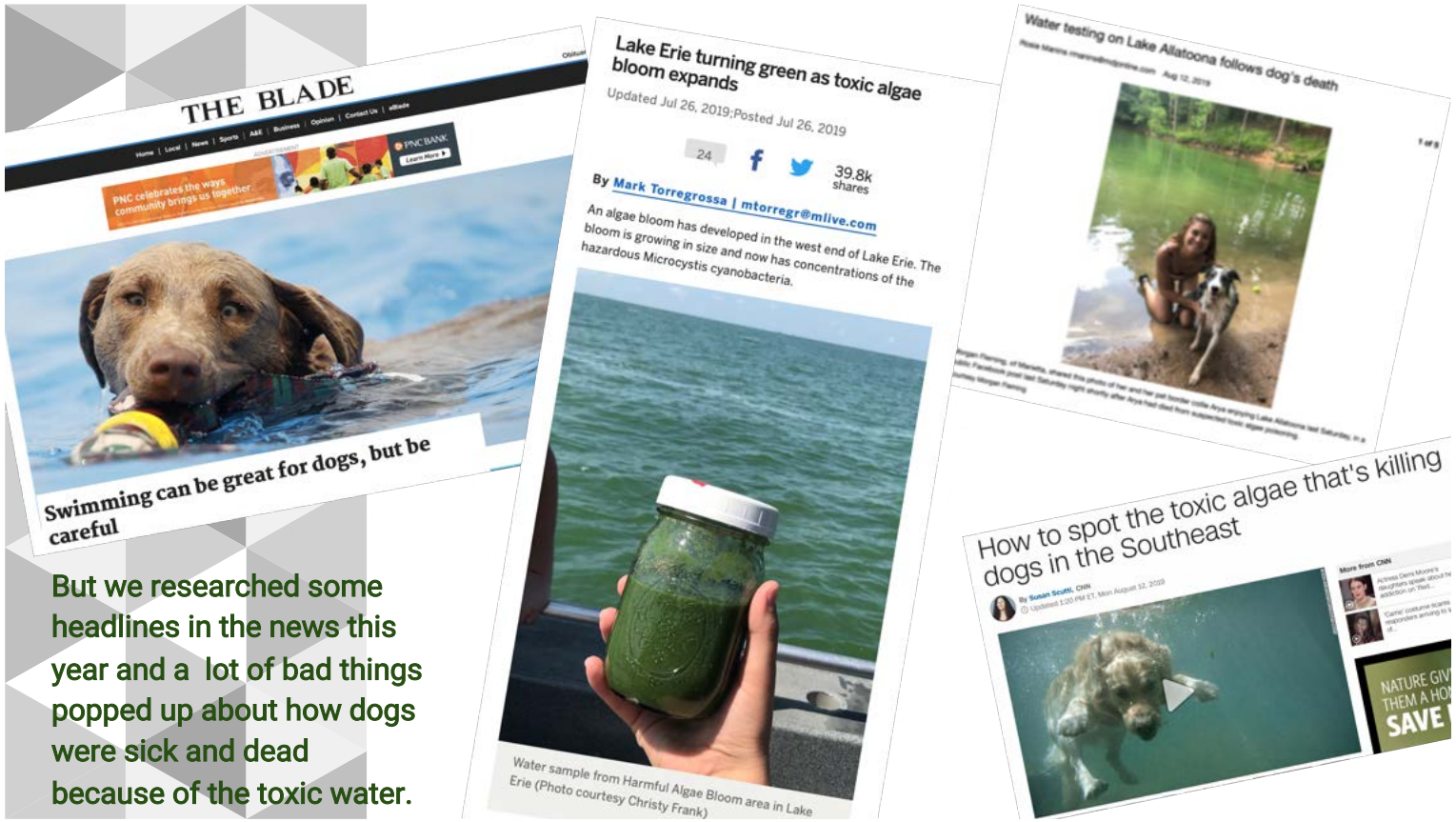
Our teacher Mrs. Madanski showed us her dog Mohawk in a Google Meet.







Mrs. Madanski and Mohawk love the go kayaking a lot around Toledo. He will jump in the water and swim around when they are kayaking.



But we researched some headlines in the news this year and a lot of bad things popped up about how dogs were sick and dead because of the toxic water.

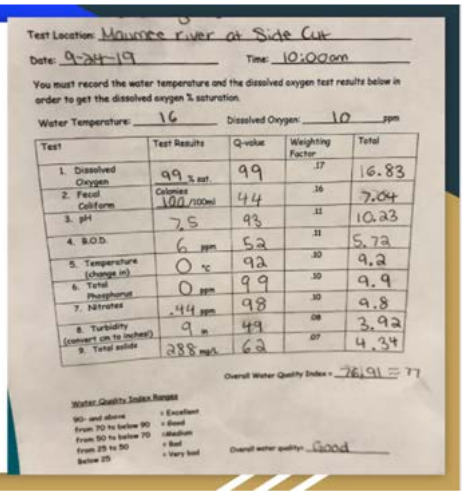
So that made us wonder...

Is the water in Toledo safe enough for Mohawk and other dogs to swim in?

2019 Data from the Maumee River at Sidecut Metropark:

Students from our school last year did the project as well. They wanted to see if the water was safe then. Here are their results: Overall, the water quality was good in October of 2019, with an overall Q-Value of 77..

Results: The Q-Value was 77 so the water quality was GOOD!



Test Location: Maumee river at Side Cut

Date: 9-24-19 Time: 10:00am

You must record the water temperature and the dissolved oxygen test results below in order to get the dissolved oxygen % saturation.

Water Temperature: 16 Dissolved Oxygen: 10 ppm

Test	Test Results	Q-value	Weighting Factor	Total
1. Dissolved Oxygen	99 % sat.	99	.17	16.83
2. Fecal Coliform	Colonies 100 /100ml	44	.16	7.04
3. pH	7.5	93	.11	10.23
4. B.O.D.	6 ppm	52	.11	5.72
5. Temperature (change in)	0 °c	92	.10	9.2
6. Total Phosphorus	0 ppm	99	.10	9.9
7. Nitrates	.44 ppm	98	.10	9.8
8. Turbidity (convert cm to inches)	9 in	49	.08	3.92
9. Total solids	288 mg/L	62	.07	4.34

Overall Water Quality Index = 76.91 = 77

Water Quality Index Ranges

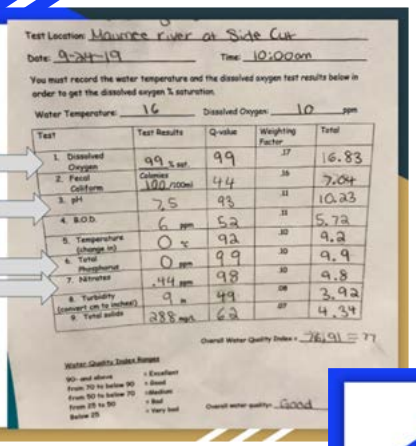
90- and above = Excellent
From 70 to below 90 = Good
From 50 to below 70 = Medium
From 25 to 50 = Bad
Below 25 = Very bad

Overall water quality: Good

2019 Data

TESTS IN THE EXCELLENT RANGE:

DISSOLVED OXYGEN
pH
TOTAL PHOSPHORUS
NITRATES

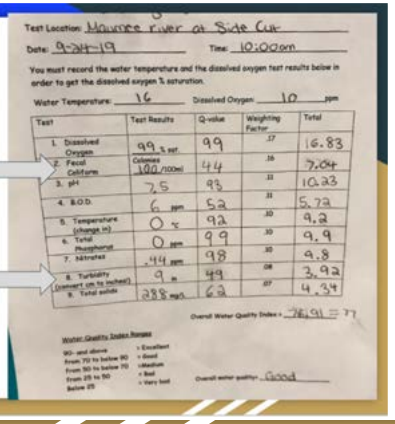


areas of concern: fecal coliform, turbidity

excellent range tests: dissolved oxygen, pH, phosphate, nitrate

AREAS OF CONCERN- TESTS IN THE BAD RANGE:

FECAL COLIFORM
TURBIDITY



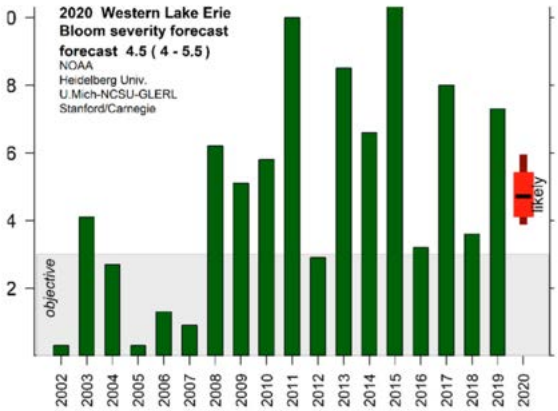
2019 Data

With a Q-Value in the good range, the water in the Maumee River at Sidecut Metropark was safe for Mohawk and other dogs to swim!

How did the water quality in the Maumee River in 2019 compare to 2020?

- Even though the water was safe last year, is it still safe in 2020?
- In August of 2014, there was a water crisis where Harmful Algal Blooms deemed the drinking water unsafe. Students researched this water being harmful to people and pets. Could it be that unsafe again?

Current Algal Bloom in Toledo 2020



A NOAA chart shows the 2020 Lake Erie algae bloom severity forecast of 4.5 on a 10-point scale.

Scum from a harmful algae bloom turns the Maumee River green near the Cherry Street bridge in downtown Toledo, Ohio, on Tuesday, July 7, 2020. Researchers are predicting a moderate-sized bloom on Lake Erie this summer. (Courtesy | Christy L. Frank photography) Courtesy | Christy L. Frank

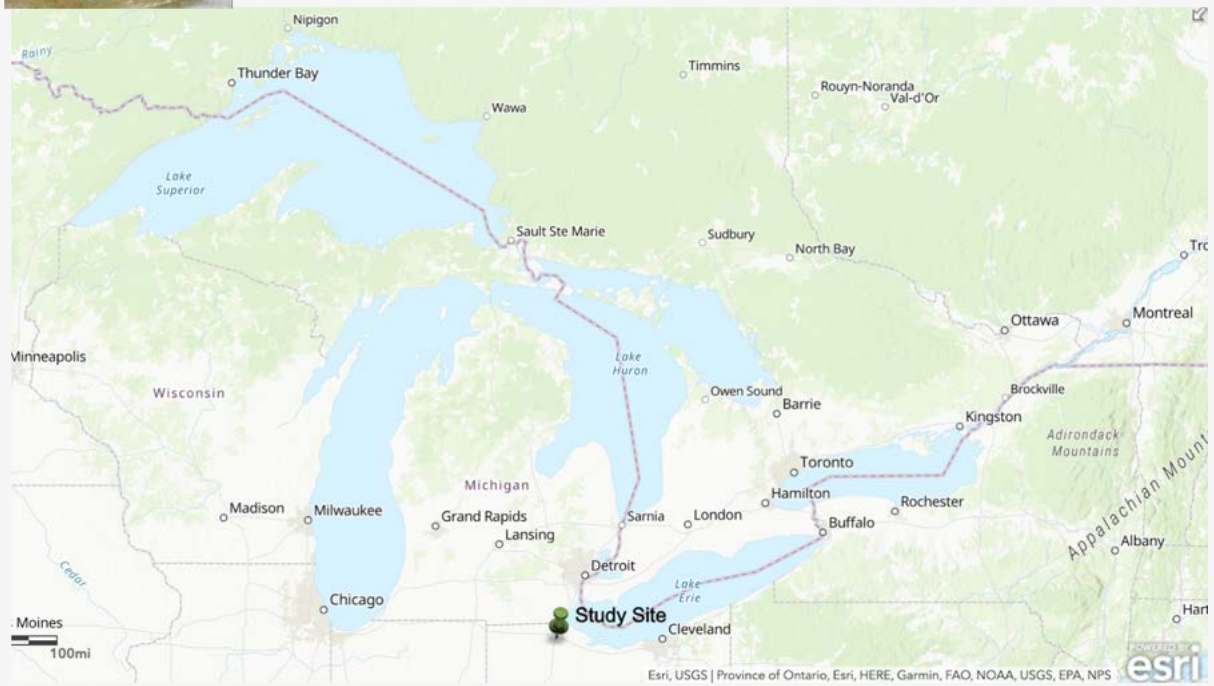
Research Methods: Describing The Planning Process (Planning Investigations)

- For this project, we decided to compare the water quality of the Maumee River at Side Cut Park in Maumee, Ohio in 2019 and again in 2020. Both years the testing was done in October, with clear skies and no precipitation. We used the exact same location on the Maumee River both years.

- For our study on water quality, we decided to use the following GLOBE protocols and the instruments: transparency (turbidity tube), water temperature (liquid), dissolved oxygen (CHEMets Kit), macroinvertebrates (using net and picking rocks), and pH (paper), fecal coliform bacteria (coliform plates), Biochemical Oxygen Demand (CHEMets Kit), phosphate (CHEMets Kit), nitrate (CHEMets Kit), total solids (Labquest with probe).

- We collected our samples between 9:07-10:57 on October 8,2020. Mrs. Madanski collected samples in person, while students participated remotely via a Google Meet due to COVID-19 restrictions.

Map of Study Site



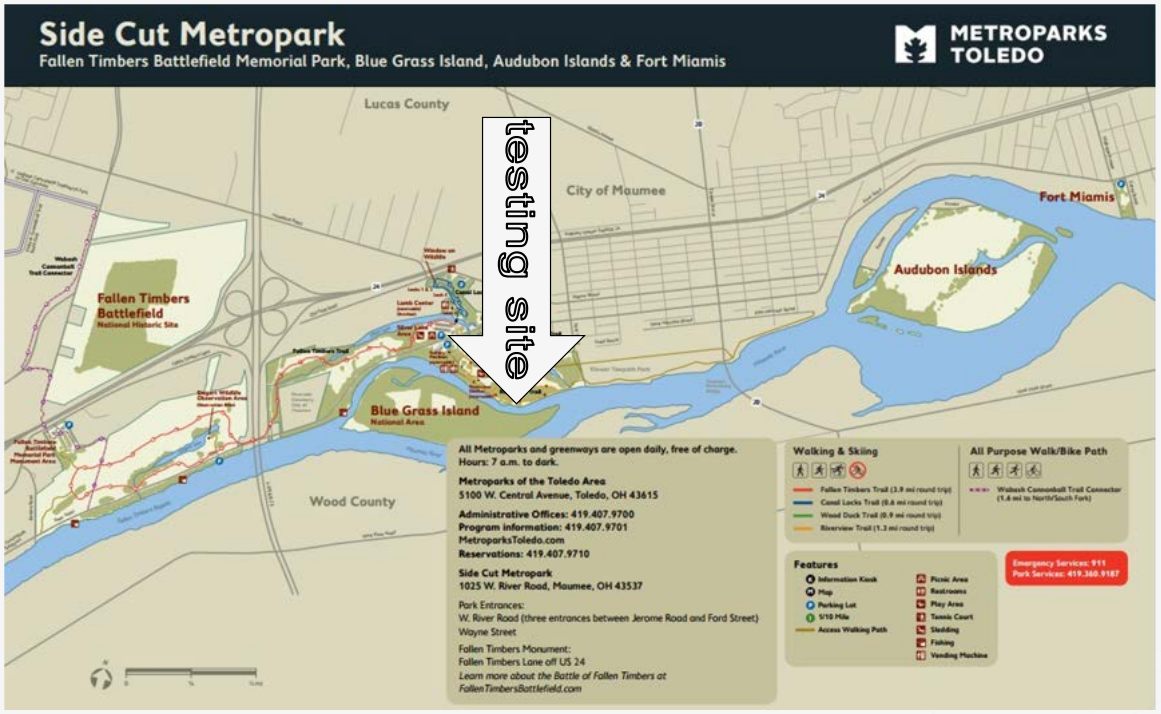
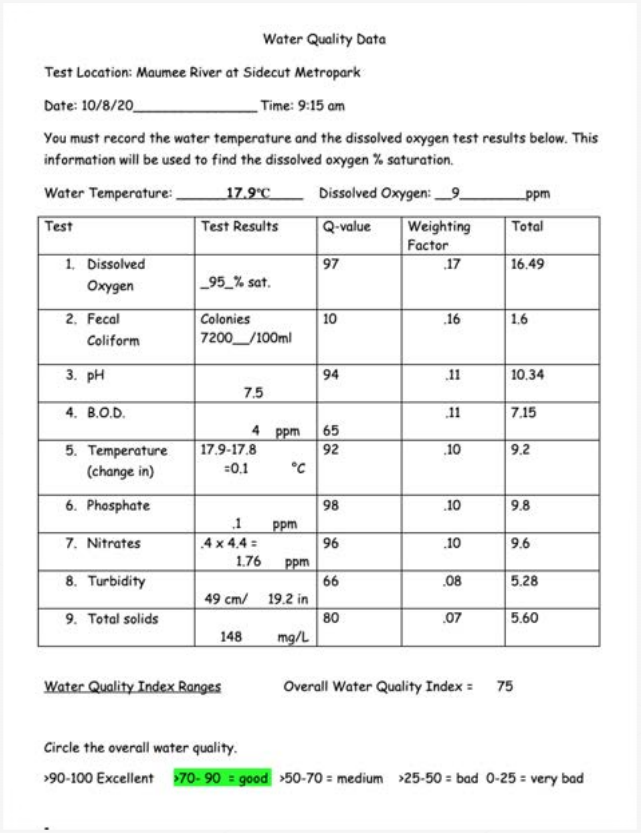

Side Cut Metropark
Fallen Timbers Battlefield Memorial Park, Blue Grass Island, Audubon Islands & Fort Miamis
METROPARKS TOLEDO
Lucas County
City of Maumee
Fort Miamis
Audubon Islands
Fallen Timbers Battlefield
National Historic Site
Blue Grass Island
National Area
Wood County
testing site
All Metroparks and greenways are open daily, free of charge.
Hours: 7 a.m. to dark.
Metroparks of the Toledo Area
5100 W. Central Avenue, Toledo, OH 43615
Administrative Offices: 419.407.9700
Program information: 419.407.9701
MetroparksToledo.com
Reservations: 419.407.9710
Side Cut Metropark
1025 W. River Road, Maumee, OH 43537
Park Entrances:
W. River Road (three entrances between Jerome Road and Ford Street)
Wayne Street
Fallen Timbers Monument:
Fallen Timbers Lane off US 24
Learn more about the Battle of Fallen Timbers at
FallenTimbersBattlefield.com
Walking & Skiing
All Purpose Walk/Bike Path
Features
Emergency Services: 911
Park Services: 419.360.9187

Photo of testing site in 2019

Photo of site in 2020

Overall Water Quality Results in 2020

75 = good



Water Quality Data

Test Location: Maumee River at Sidecut Metropark

Date: 10/8/20_____ Time: 9:15 am

You must record the water temperature and the dissolved oxygen test results below. This information will be used to find the dissolved oxygen % saturation.

Water Temperature: _____17.9°C_____ Dissolved Oxygen: __9_____ppm

Test	Test Results	Q-value	Weighting Factor	Total
1. Dissolved Oxygen	_95_% sat.	97	.17	16.49
2. Fecal Coliform	Colonies 7200__/100ml	10	.16	1.6
3. pH	7.5	94	.11	10.34
4. B.O.D.	4 ppm	65	.11	7.15
5. Temperature (change in)	17.9-17.8 =0.1 °C	92	.10	9.2
6. Phosphate	.1 ppm	98	.10	9.8
7. Nitrates	.4 x 4.4 = 1.76 ppm	96	.10	9.6
8. Turbidity	49 cm/ 19.2 in	66	.08	5.28
9. Total solids	148 mg/L	80	.07	5.60

Water Quality Index Ranges Overall Water Quality Index = 75

Circle the overall water quality.

>90-100 Excellent >70- 90 = good >50-70 = medium >25-50 = bad 0-25 = very bad

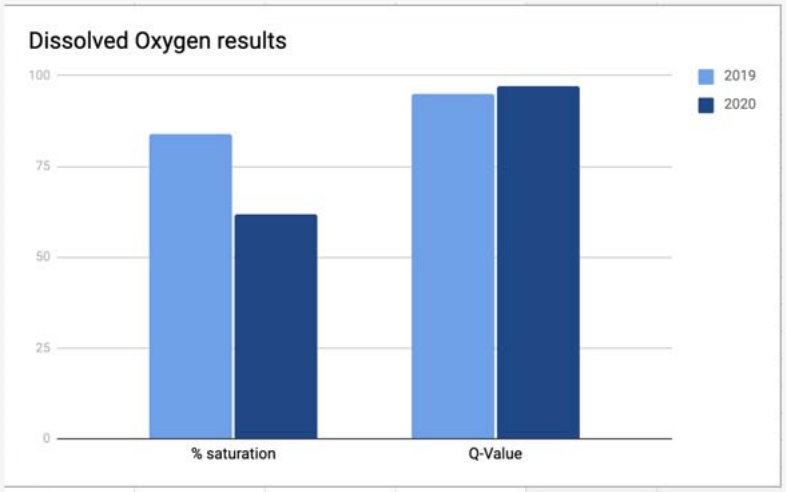
Dissolved Oxygen Protocol

Dissolved Oxygen is a measure of how much oxygen is dissolved in water. This is the oxygen that is available to living organisms in the water. The dissolved oxygen is breathed by fish and other organisms, and is needed by them to survive.

Rapidly moving water tends to contain a lot of dissolved oxygen, and still water contains less. Periods in the summer with hot, calm weather can result in very low dissolved oxygen, and will result in fish kills.

Dissolved Oxygen Results

year	% saturation	Q-Value
2019	84%	62
2020	95%	97



Biochemical Oxygen Demand (BOD) protocol

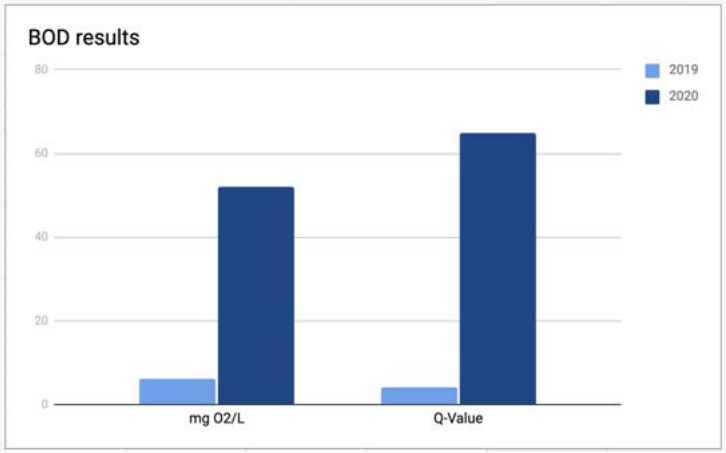
- Measures the amount of oxygen used by the microorganisms in the stream.
- Mainly bacteria which are decomposers.
- If BOD is high there will be less oxygen in the water.

Testing Directions BOD

- 1.Fill bottle with water. (NO air bubbles!)
- 2.Put in dark place for 5 days.
- 3. Run a DO test. Subtract the results from your original DO to see what the organisms used.

Biochemical Oxygen Demand Results

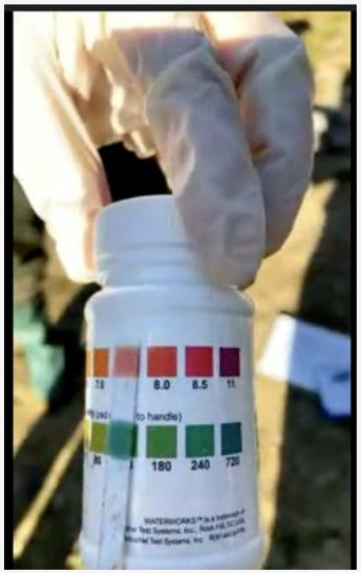
year	mg O2/L	Q-Value
2019	6	52
2020	4	65



pH Protocol

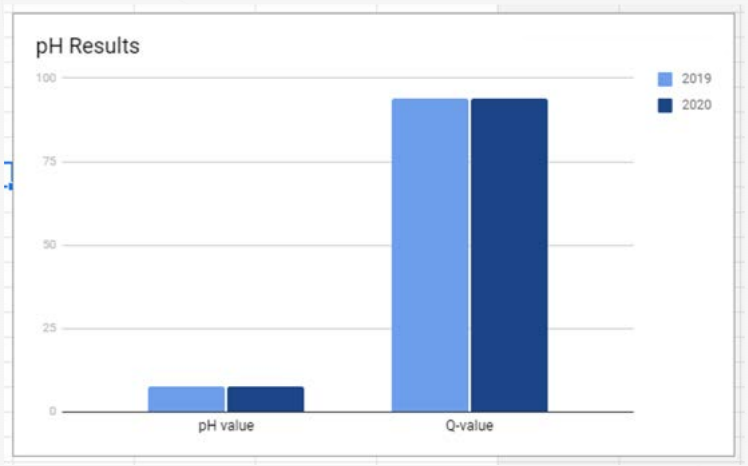
pH is a measure of how acidic or basic water is. 7 is normal. pHs of less than 7 indicate acidity, and a pH greater than 7 indicates a base.

pH is an important indicator of water quality. The pH of a river can affect organisms living in the water, and can be an indicator of increasing pollution.



pH Data

year	pH value	Q-Value
2019	7.5	94
2020	7.5	94



Phosphate Protocol

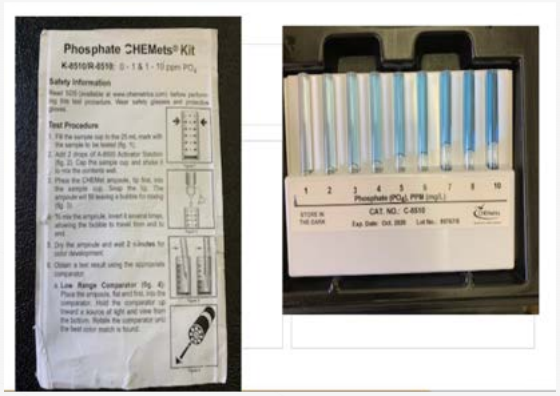
Phosphate

1. Nutrient needed by plants to grow
2. Limiting factor
3. Too much can cause algae blooms

Sources:

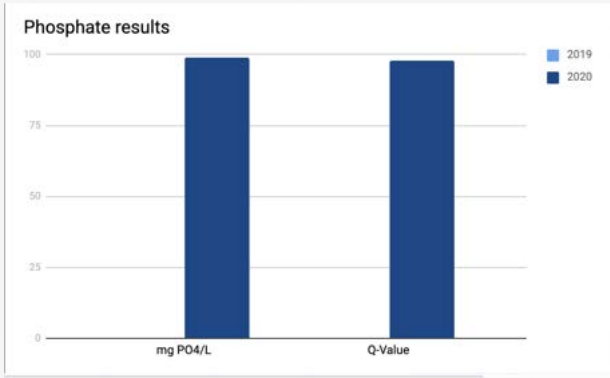
- Fertilizer
- Animal waste
- Organic waste
- Soap/laundry detergent

Cultural Eutrophication- when humans add nutrients to waterways.



Phosphate Results

year	mg PO4/L	Q-Value
2019	0	99
2020	.1	98



Nitrate Protocol

Nitrates

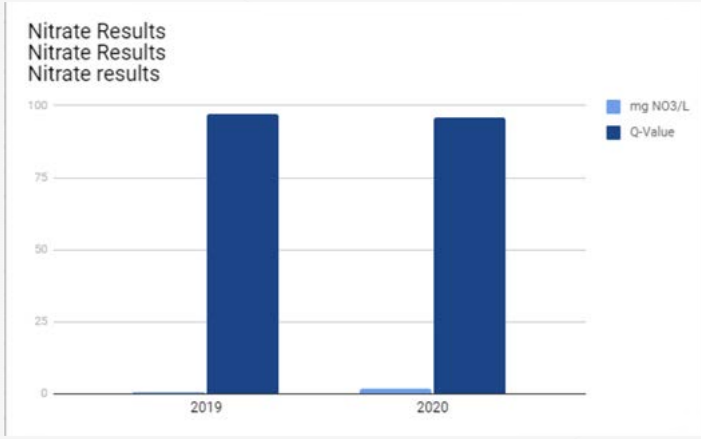
1. Nutrient needed to build proteins.
2. Limiting factor
3. Too much can add to algae blooms

Sources:

- Duck and goose waste
- Sewage
- Fertilizers
- Runoff from barnyards

Nitrate Results

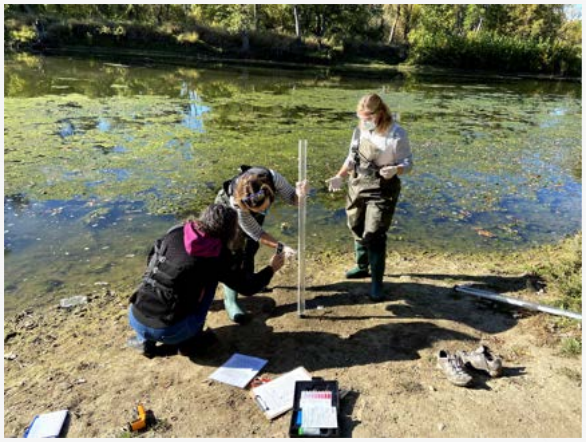
year	mg NO3/L	Q-Value
2019	.44	97
2020	1.76	96



Water Transparency (Turbidity) Protocol

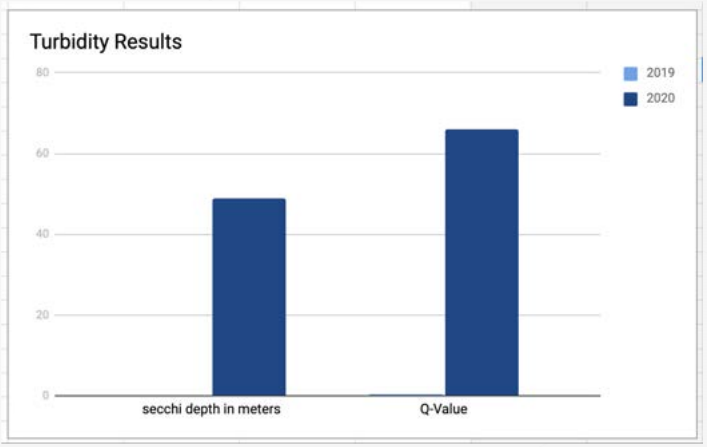
Water transparency, also referred to as turbidity, is a measure of the relative clarity of a liquid. It is a measurement of the amount of light that is scattered by material in the water when light goes through the sample. Material that causes high turbidity include clay, silt, organic matter, algae, and microscopic organisms.

USGS states excessive turbidity causes the water to be cloudy and can represent a health concern. Turbid conditions provide shelter for pathogens, specifically protozoa. The lower the turbidity, the better the water quality.



TURBIDITY RESULTS

year	secchi depth in meters	Q-Value
2019	.23	49
2020	.49	66



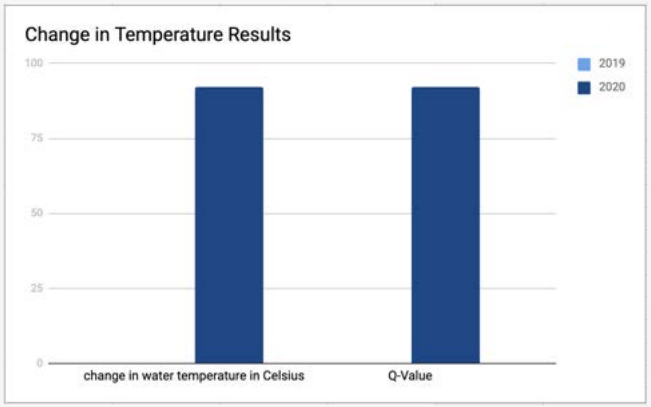
Water Temperature Protocol

Water temperature influences the kinds of organisms that live in bodies of water. Fish, insects, zooplankton, and other aquatic species have a preferred temperature range. When temperatures get too far above or below the preferred ranges, the number of organisms decreases until eventually there are none present.

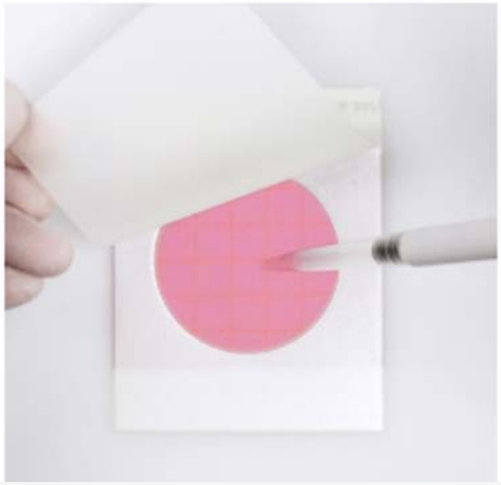
USGS states warm water holds less dissolved oxygen than cool water, which affects the survival of different species of aquatic life.

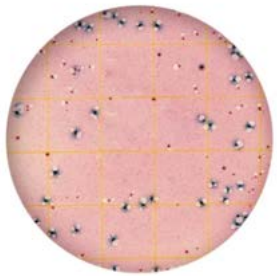
Water Temperature Data

year	change in water temperature in Celsius	Q-Value
2019	0	92
2020	.01	92



Fecal Coliform Bacteria Protocol





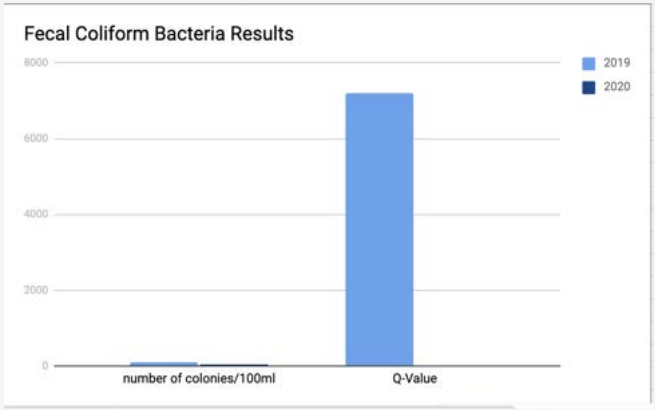
EC

E. coli/Coliform
Count Plate

Results in
24-48h

Fecal Coliform Bacteria Results

year	#/100ml	Q-Value
2019	100	44
2020	7,200	10



Total Solids Protocol

Total solids - the amount of solids in the water.

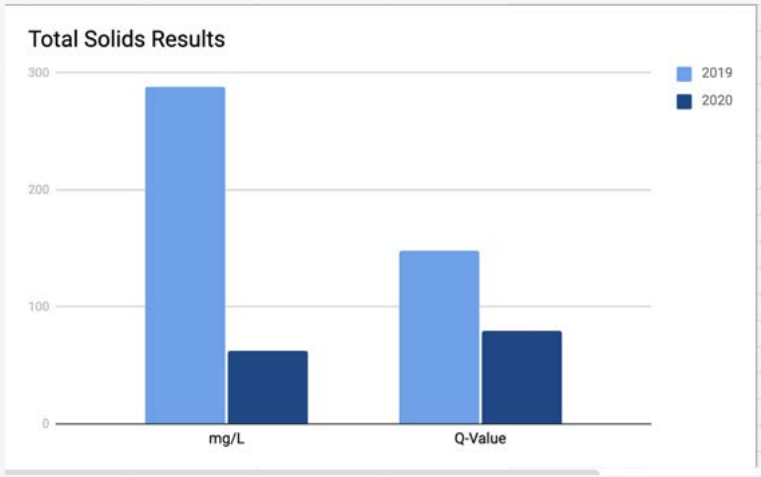
Can determine the flow of water into and out of an organism's cells.

If high can cause organisms to lose their balance in the water.

Total solids, TS, is a measure of all the suspended, colloidal, and dissolved solids in a sample of water. This includes dissolved salts such as sodium chloride, NaCl, and solid particles such as silt and plankton. An excess of total solids in rivers and streams is a very common problem.

Total Solids Data

year	mg/L	Q-Value
2019	288	62
2020	148	80

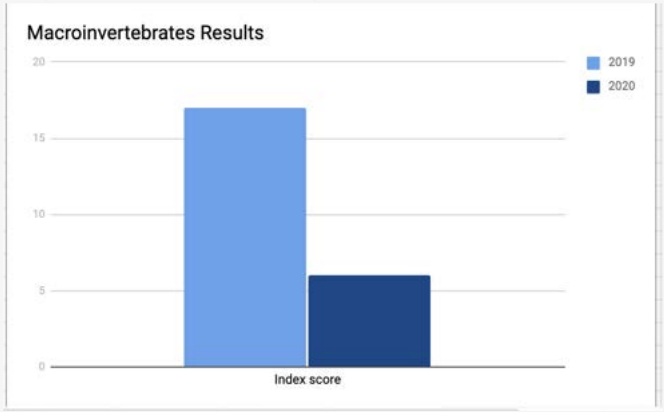


Macroinvertebrates Protocol

Macroinvertebrates are small animals without a backbone that can be seen without a microscope. They are an important part of the food chain. Macroinvertebrates can tell us a lot about the conditions within a water body. Many macroinvertebrates are sensitive to changes in pH, dissolved oxygen, temperature, salinity, turbidity and other changes in their habitat.

Macroinvertebrates Results

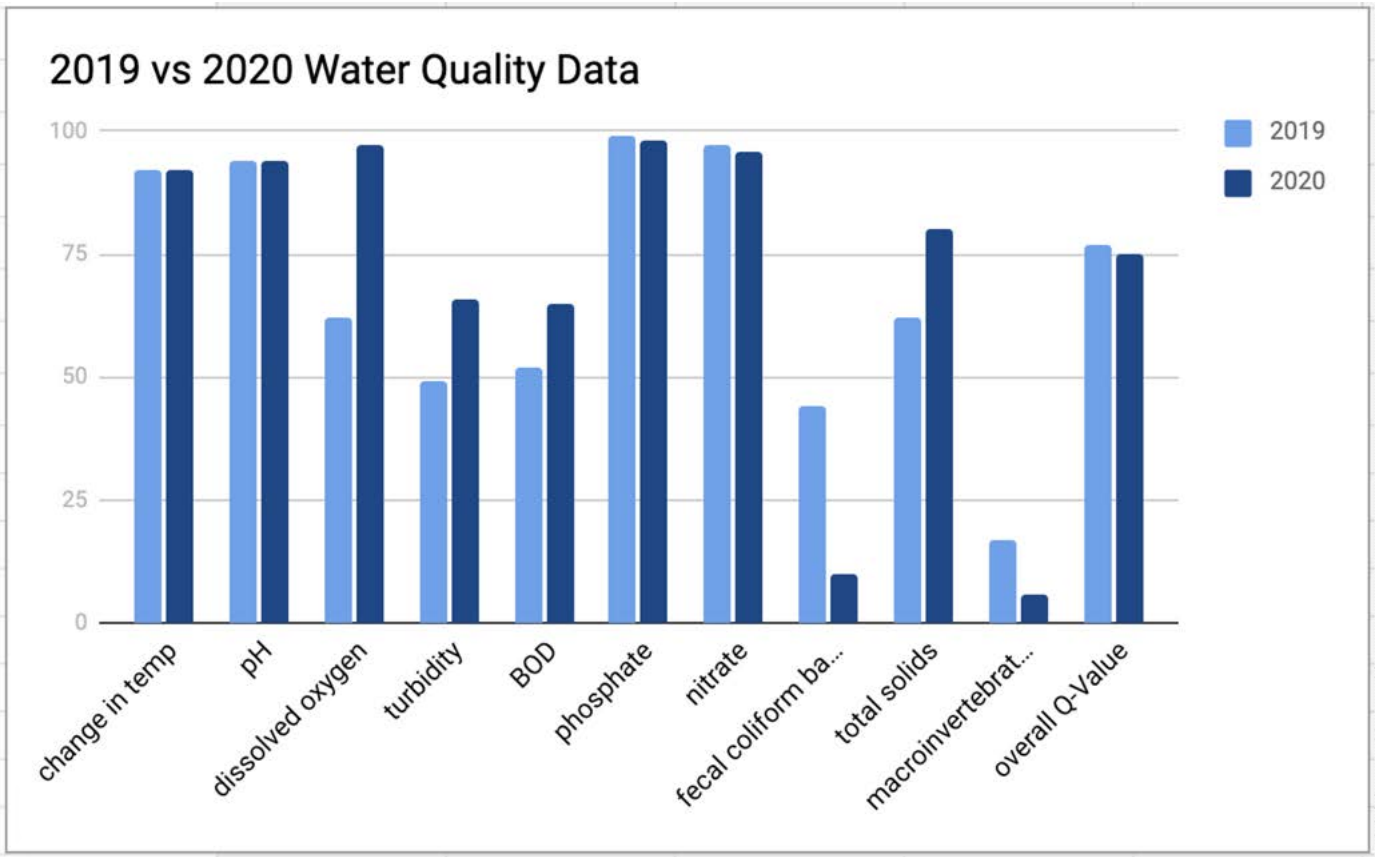
year	index score	Q-Value
2019	17	good
2020	6	poor



protocol	best water quality index year
change in water temperature	tie
pH	tie
dissolved oxygen	2020
water transparency (turbidity)	2020
BOD	2020
phosphate	2019
nitrate	2019
fecal coliform bacteria	2019
total solids	2020
macroinvertebrates	2019
Overall water quality index score	2019

Discussion (Interpreting Data)

- 2019 had 4 tests with a better water quality index score
- 2020 had 4 tests with a better water quality score
- 2 tests had the same water quality index score in both years.
- Overall water quality score in 2019 = 77
- Overall water quality score in 2020 = 75


2019 vs 2020 Water Quality Data
100
75
50
25
0
2019
2020
change in temp
pH
dissolved oxygen
turbidity
BOD
phosphate
nitrate
fecal coliform ba...
total solids
macroinvertebrat...
overall Q-Value

Conclusions
(Drawing Conclusions)

- We found 2019 had better water quality than 2020. The overall water quality score in 2019 was 77 and the overall water quality score in 2020 was 75.

- The biggest difference between years was the fecal coliform bacteria. In 2019 we only found 100 colonies of bacteria per 100mL of river water, and that was a Q-Value of 44. However in 2020 we found 7,200 colonies of bacteria on the coliform plate, which calculates to a Q-Value of only 10. 10 is a very low score, and a big concern for our water.

- The amount of macroinvertebrates found in 2020 was also an area of concern. We only found leeches, scuds, and gilled snails.

Conclusions
(Next Steps)

- The fecal coliform bacteria scores were very alarming. We learned that fecal coliform bacteria is bacteria found in the feces of animals. Some, but not all, can cause disease. It would be interesting to dig deeper and learn how to identify if the bacteria we found is disease causing. With such a high amount of fecal coliform bacteria, we are hypothesizing that some of it could be E.Coli or other disease causing bacteria. Due to the fecal coliform bacteria findings, we determined that the river is NOT safe for Mohawk and other dogs to swim in.

Bibliography

Blue, Circle of. “Toxic Algae Bloom Leaves 500,000 Without Drinking Water in Ohio.” *EcoWatch*, EcoWatch, 28 July 2017, www.ecowatch.com/toxic-algae-bloom-leaves-500-000-without-drinking-water-in-ohio-1881940537.html.

gellison@mlive.com, Garret Ellison |. “It Begins. A Moderate Toxic Algae Bloom Is Forming in Lake Erie.” *Mlive*, 10 July 2020, www.mlive.com/public-interest/2020/07/it-begins-a-moderate-toxic-algae-bloom-is-forming-in-lake-erie.html.

“GLOBE Science Data Visualization.” *GLOBE Visualization*, vis.globe.gov/GLOBE/.

National Oceanic and Atmospheric Administration, noaa.gov/.

Turbidity and Water, www.usgs.gov/special-topic/water-science-school/science/turbidity-and-water?qt-science_center_objects=0#qt-science_center_objects.