

2019 SURVEY OF TORCH LAKE AND LAKE BELLAIRE FOR SWIMMER'S ITCH CERCARIAE, AND FECAL BACTERIA USING QPCR METHODOLOGY

THREE LAKES ASSOCIATION'S 2019 SUMMER INTERNS

MATTHEW BAKER, ELK RAPIDS HIGH SCHOOL
EMILY COMAI, KALKASKA HIGH SCHOOL
RILEY FILLMORE, MANCERLONA HIGH SCHOOL
ANGEL SHAW, CENTRAL LAKE HIGH SCHOOL

AUGUST 27, 2019

TORCH LAKE, LAKE BELLAIRE, AND SURROUNDING STREAMS

Lake sampling for enteric by qPCR

27 sites on Torch Lake shoreline

12 sites on Lake Bellaire shoreline

1 site at Torch Lake sandbar

Sampling for Swimmer's Itch cercariae

9 sites on Torch Lake shoreline

10 sites on Lake Bellaire shoreline

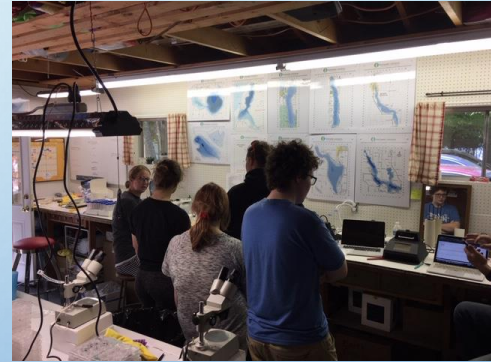
STREAM SAMPLING FOR E. COLI AND ENTERIC BACTERIA QPCR

4 CREEKS IN WET CONDITIONS

SAME 4 CREEKS IN DRIER CONDITIONS

QUANTITATIVE POLYMERASE CHAIN REACTION (QPCR)

- QUANTITATIVE POLYMERASE CHAIN REACTION, OR QPCR, IS A METHODOLOGY USED TO MEASURE EXACT AMOUNTS OF DNA IN SAMPLES.
- IN QPCR METHODOLOGY, A SPECIFIC PART OF THE DNA TEMPLATE IS AMPLIFIED IN CYCLES.
- DURING EACH CYCLE, THE AMOUNT OF TARGETED DNA SECTIONS IS DOUBLED.
- BASED ON THE NUMBER OF GENES FOUND IN THE SAMPLES AFTER X AMOUNT OF CYCLES, WE CAN DETERMINE THE NUMBER OF BACTERIA/100 ML (EC/100ML).



SWIMMER'S ITCH METHODOLOGY

- SAMPLES WERE OBTAINED BY SCOOPING 25 L OF WATER, EITHER OFF OF A DOCK OR IN HORSESHOE SHAPE IN WAIST DEEP WATER.
- AS WATER IS COLLECTED IT STRAINS THROUGH A 20 MICRON PLANKTON TOW HELD VERTICALLY.
- WATER IS REDUCED BY FILTRATION, AND 95% ETHANOL IS USED TO PRESERVE THE SAMPLE.
- THE SOLUTION IS Poured INTO A LABELED AND STERILE 50ML COLLECTION TUBE AND IS PLACED IN A COOLER BEFORE BEING DELIVERED TO THE LAB.



ENTEROCOCCUS BACTERIA METHODOLOGY

- SAMPLES WERE OBTAINED BY BOAT, 15 M FROM SHORE.
- SAMPLES WERE TAKEN APPROXIMATELY 1.5 MILES APART.
- THREE PRELABELED STERILE 50 ML TUBES WERE DUNKED IN THE FIRST SIX INCHES TO A FOOT OF WATER.
- ONE SAMPLE EACH WAS TAKEN FROM THE FRONT OF THE BOAT, SIDE OF THE BOAT AND REAR OF THE BOAT.
- THE TUBE WAS PLACED IN A COOLER UNTIL DELIVERED TO THE LAB WITHIN SIX HOURS.
- SAMPLES WERE ANALYZED USING QPCR



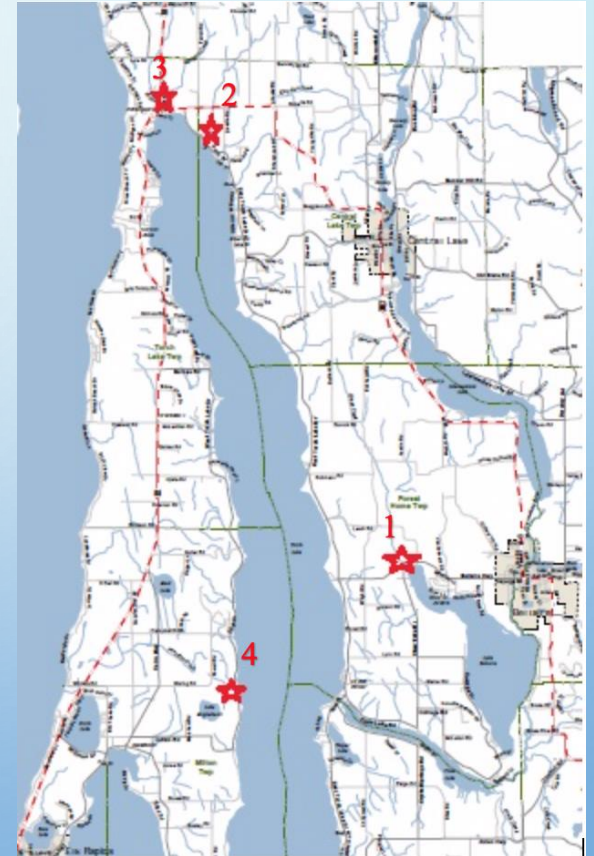
STREAM AND SANDBAR METHODOLOGY

- 100 ML WATER SAMPLES ARE COLLECTED IN STERILE BOTTLES.
- THREE SAMPLES ARE HARVESTED, KEPT COLD IN AN ICE CHEST, AND DELIVERED TO THE LABORATORY WITHIN 6 HOURS.
- THE RESULT IS CALCULATED AS THE GEOMETRIC MEAN OF THE THREE SAMPLE VALUES.
- SANDBAR DATA WAS COLLECTED USING THE SAME PROTOCOL, BUT NO GEOMETRIC MEANS WERE CALCULATED



HEAVY RAIN VS RELATIVELY DRY CREEK RESULTS

Torch Lake Tributaries					
Heavy Rain					
Sample	Date	Location	E-Coli (CFU)	Enterococcus (CCE)	Human (HF183)
1	6/13/19	Grass Creek	139	0	Negative
2	6/13/19	Wilkinson Creek	1548	0	Negative
3	6/13/19	Eastport Creek	823	991	Negative
4	6/13/19	The Creek	316	0	Negative
Relatively Dry					
1	7/2/19	Grass Creek	47	670	Negative
2	7/2/19	Wilkinson Creek	61	76	Negative
3	7/2/19	Eastport Creek	159	1308	Negative
4	7/2/19	The Creek	211	766	Negative

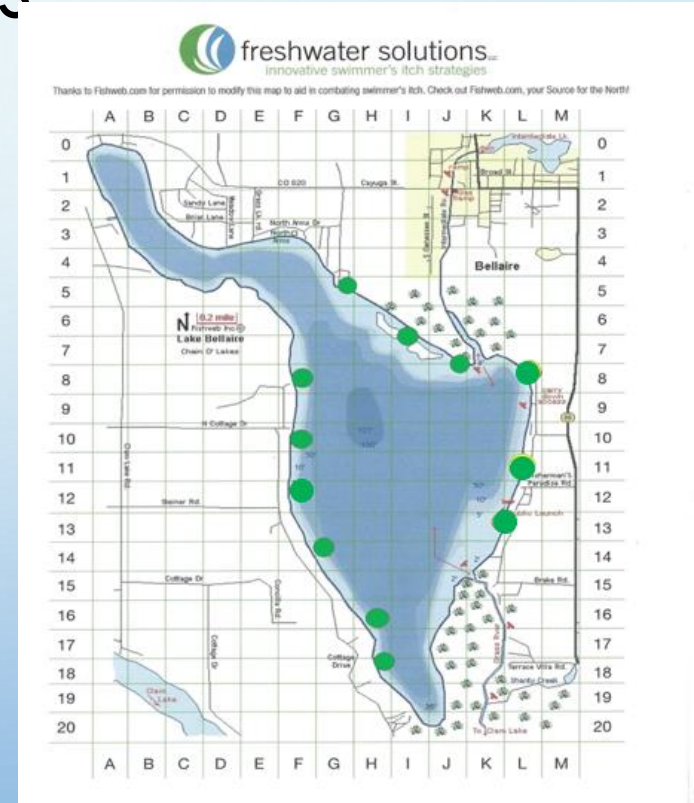


BACTERIA STREAM CONCLUSION

- E. coli in the streams increased due to heavy rainfall.
- Eastport Creek was the only creek that had a correlation between E. coli counts and enterococcus counts before and after heavy rainfall.
- The overall correlation between the E. coli and the enterococcus bacteria was not strong.
- All of the results tested negative for human assays (HF183) during dry and wet conditions.

BELLAIRE ENTEROCOCCUS RESULTS

- ALL SAMPLES TAKEN ON LAKE BELLAIRE TESTED WITHIN A SAFE RANGE.



ENTEROCOCCUS BACTERIA CONCLUSION AND RECOMMENDATIONS

- THESE RESULTS SUGGEST THAT THERE IS SPORADIC FECAL CONTAMINATION AROUND TORCH LAKE AND LAKE BELLAIRE.
- THE FECAL CONTAMINATION IN TORCH LAKE WAS FOUND AT BOTH MODERATE AND SAFE LEVELS.
- THE FECAL CONTAMINATION IN LAKE BELLAIRE WAS FOUND AT SAFE LEVELS.
- THE DATA DID NOT DISTINGUISH BETWEEN HUMAN AND NON HUMAN SOURCES, AND NO HUMAN ASSAYS (HF183) WERE FOUND.

SANDBAR FINDINGS

- SAMPLES WERE TAKEN ALONG THE SANDBAR FOR ENTEROCOCCUS BACTERIA AND ANALYZED USING QPCR, ON JULY 2ND WITH LOW HUMAN OCCUPANCY, AND ON THE 4TH OF JULY WHEN IT WAS HEAVILY OCCUPIED.

Torch Sandbar	Date	CCE
Low Occupancy	7/2/19	182.77
High Occupancy	7/4/19	680.31



NORTH TORCH SWIMMER'S ITCH

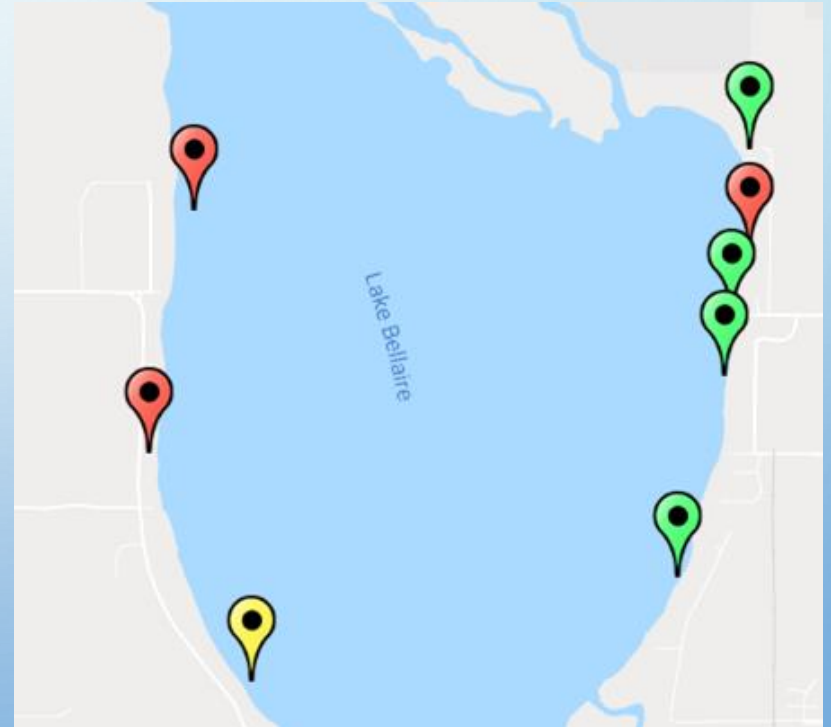
NORTH TORCH LAKE, HAS PREVIOUSLY DEALT WITH A GREAT DEAL OF SWIMMER'S ITCH, ALTHOUGH THE RESULTS OF THIS STUDY SHOWED NO CERCARIAE IN NORTH TORCH.



LAKE BELLAIRE SWIMMER'S ITCH

LAKE BELLAIRE HAD THREE AREAS TEST AT A LEVEL OF HIGH CONCERN, A SINGLE SITE ALSO TESTED AT A LEVEL OF MEDIUM CONCERN. THE REST OF THE SITES IN BELLAIRE RETURNED NEGATIVE RESULTS.

Location	Date	Ave/25L
West (G15)	7/30	15.75
West (F12)	7/30	554
West (F9)	7/30	368
East (L9)	7/30	6819



Swimmers Itch Conclusion

- Cercariae were not detected in North Torch Lake. This result in North Torch Lake was surprising due to the high frequency of swimmer's itch cases reported.
- Lake Bellaire had multiple positive findings on the west side, and one positive finding on the east side.
- It will be of interest to compare the results with a comprehensive assessment provided by Fresh Water Solutions inc.



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