

2019 SURVEY of TORCH LAKE and LAKE BELLAIRE for SWIMMER'S ITCH CERCARIAE, and FECAL BACTERIA USING qPCR METHODOLOGY

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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

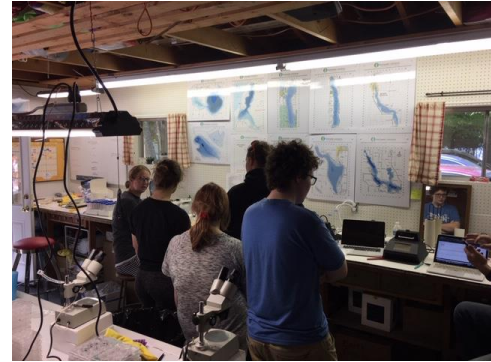
Stream sampling for E. coli and enteric bacteria qPCR

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.



Enteric Bacteria Methodology

- Samples were obtained by boat, 15 m from shore.
- Samples were taken approximately 1.5 miles apart.
- Three pre-labeled 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



E. coli v.s Enteric

- Enteric bacteria is the broad term used for the bacteria found in the intestines of humans and animals.
- E. coli was measured in four streams, and enteric bacteria was measured in streams, lakes, and at the sandbar.
- Different ways of testing:
 - E. coli samples have to be cultured and form colonies. E. coli is measured in colony forming units per 100ml (CFU/100ml)
 - Enteric is measured using qPCR in EC/100ml

Heavy Rain vs Relatively Dry Creek Results

	Heavy Rain (6/13/19)		Relatively Dry (7/2/19)	
	CFU/100ml	EC/100ml	CFU/100ml	EC/100ml
1: Grass Creek	139.5	0	47.1	766.6
2: Wilkinson Creek	1548.1	0	61.8	1308.2
3: Eastport Creek	823.9	991.7	159.5	670.2
4: The Creek	316.0	0	211.4	76.2



Bacteria Stream Conclusion

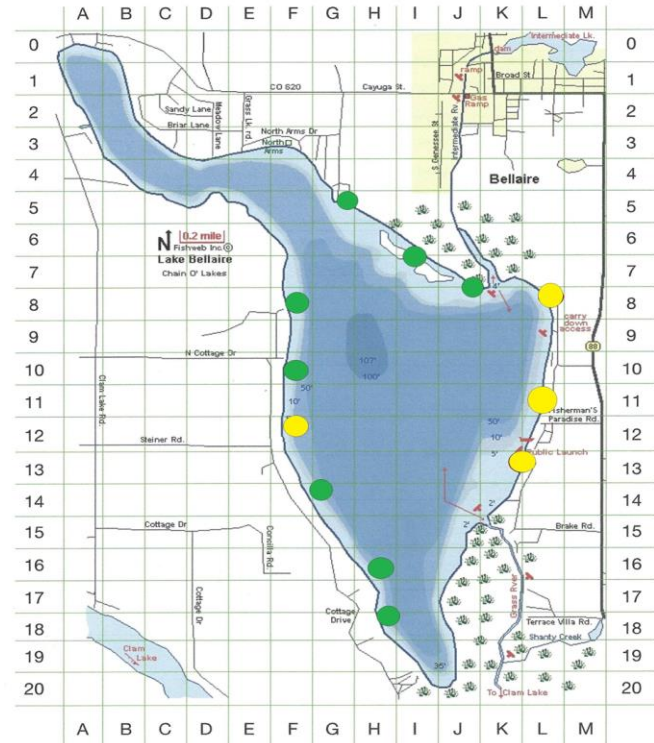
- E. coli in the streams increased due to heavy rainfall.
- Eastport Creek had a correlation between E. coli counts and enteric counts before and after heavy rainfall.
- The overall correlation between the E. coli and the enteric bacteria was not strong.
- Possible explanations include errors in sample handling or the analysis process.

Bellaire Enteric Results

- 0/12 sample sites tested positive for 300+EC/100ml (no red dots)
- 4/12 sample sites tested positive for 1-299 EC/100ml (yellow dots)
- 8/12 sample sites tested positive for 0 EC/100ml (green dots)



Thanks to Fishweb.com for permission to modify this map to aid in combating swimmer's itch. Check out Fishweb.com, your Source for the North!



Enteric 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 high and moderate levels.
- The fecal contamination in Lake Bellaire was found at moderate levels.
- The data did not distinguish between human and non human sources.
- Confirmation of causes could be determined by an additional and more comprehensive study.

Sandbar Findings

- Samples were taken along the sandbar for enteric bacteria and analyzed using qPCR, on July 2nd with low human occupancy, and on the 4th of July when it was heavily occupied.

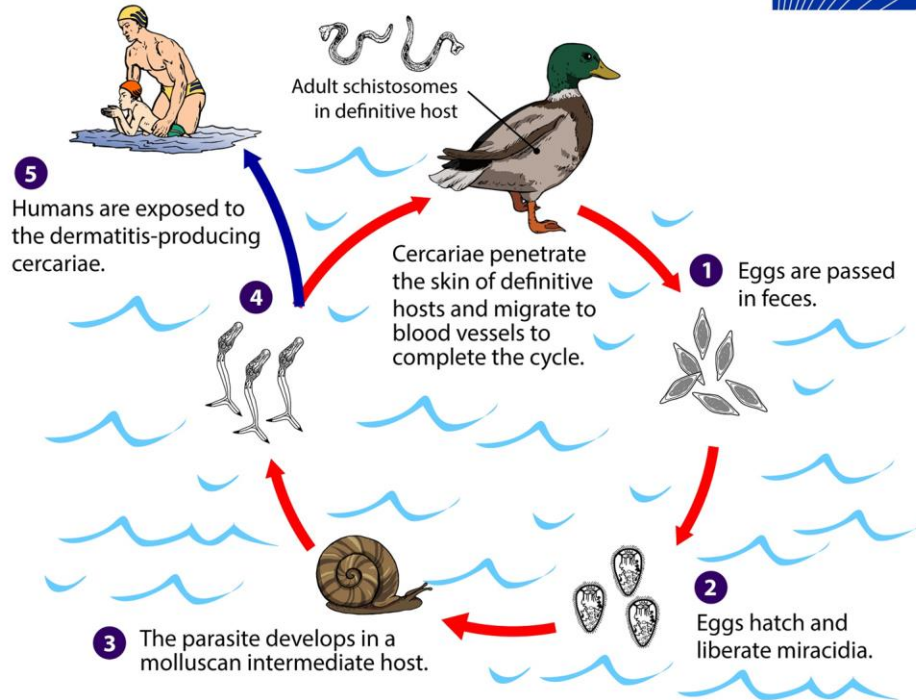
Torch Sandbar	Date	EC/100ml
Low Occupancy	7/2/19	182.77
High Occupancy	7/4/19	680.31



What is Swimmer's Itch?



Cercarial Dermatitis



Site Selection

- To ensure effective and useful sampling, we strove to test sites that were known to have previously had cercariae.
- We also worked to sample in areas where cercariae would have greater chance of human contact.
- We also did our best to avoid testing in areas where very little human contact was to be had.

North Torch

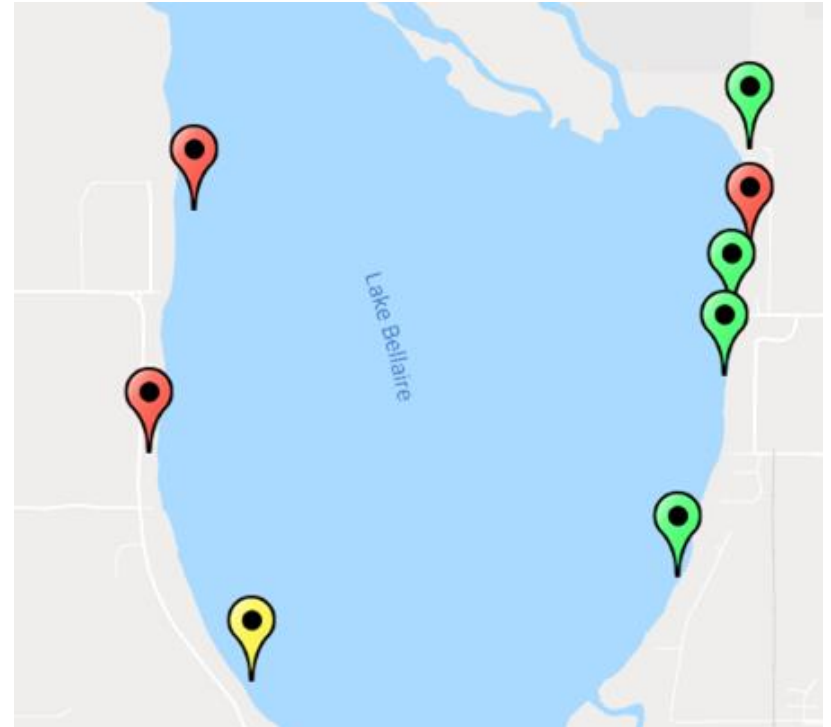
North Torch Lake, has previously dealt with a great deal of swimmer's itch, although the results of this study showed no *Cercariae* in North Torch.



Lake Bellaire

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.



Acknowledgments

INTERNSHIP DIRECTOR:

Matthew Carter

TLA VOLUNTEERS:

Dean Branson

Becky Norris

Steve Detwiler

John Curtis

Art Hoadley



Questions?