

Environmental Predictors of Avian Schistosomiasis (“Swimmer’s Itch”) in Michigan Lakes

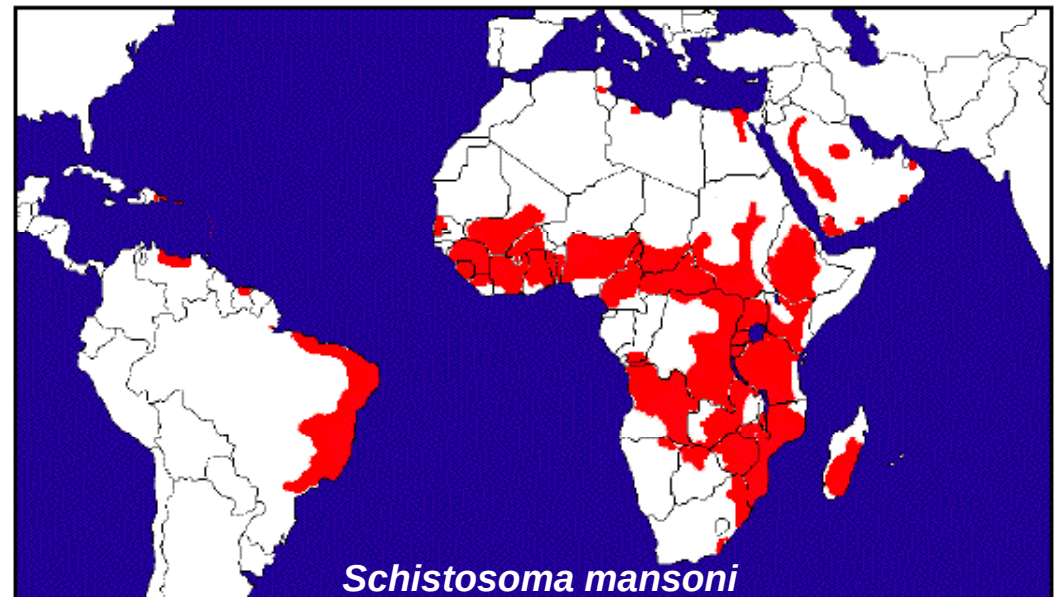
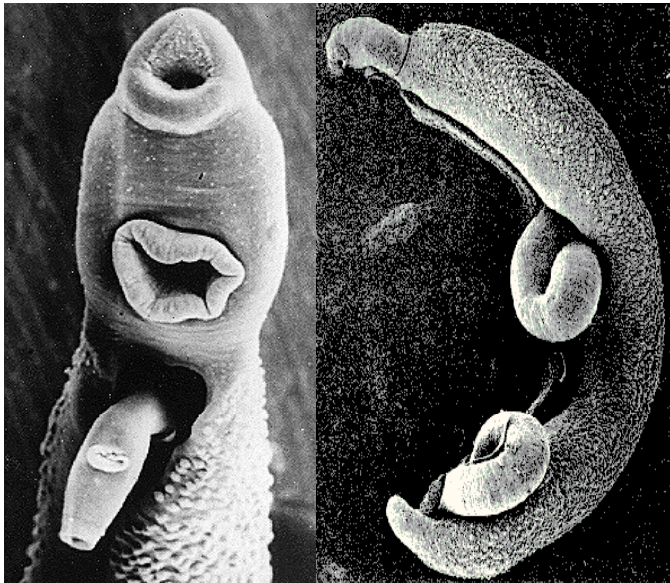


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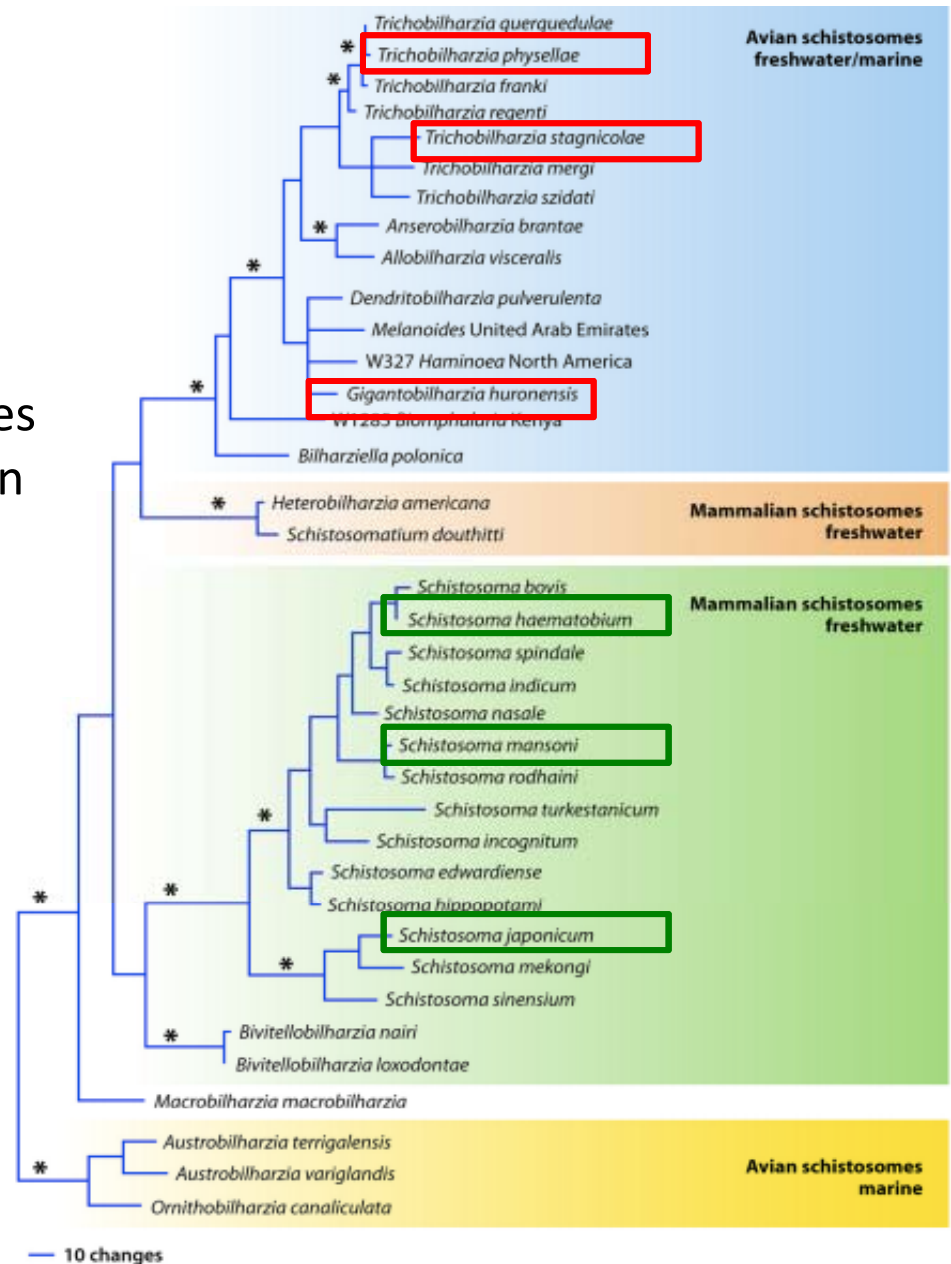
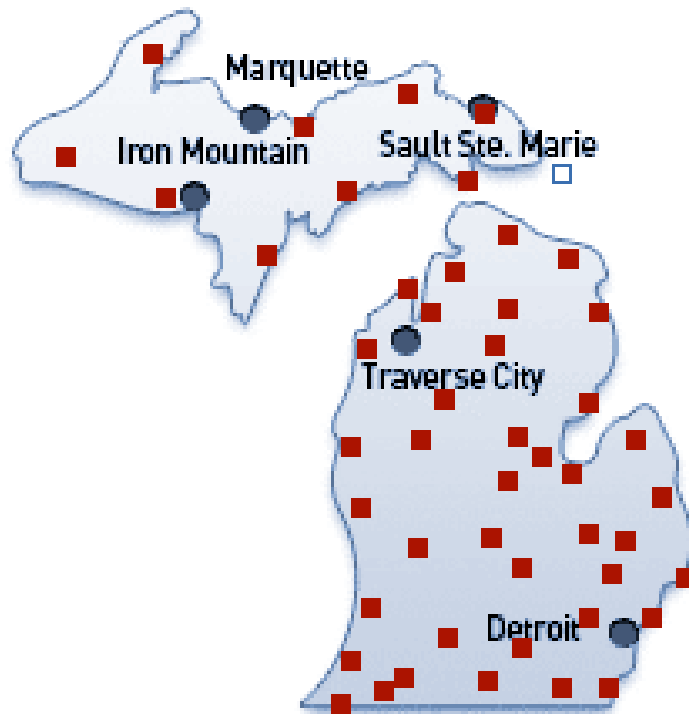
Human Schistosomiasis

- *Schistosoma sp.*
- Ranked 2nd most important tropical disease by WHO
- 200-300 million people infected
 - many school age children
 - 20 million severe disease
 - Estimated 800,000 deaths/year



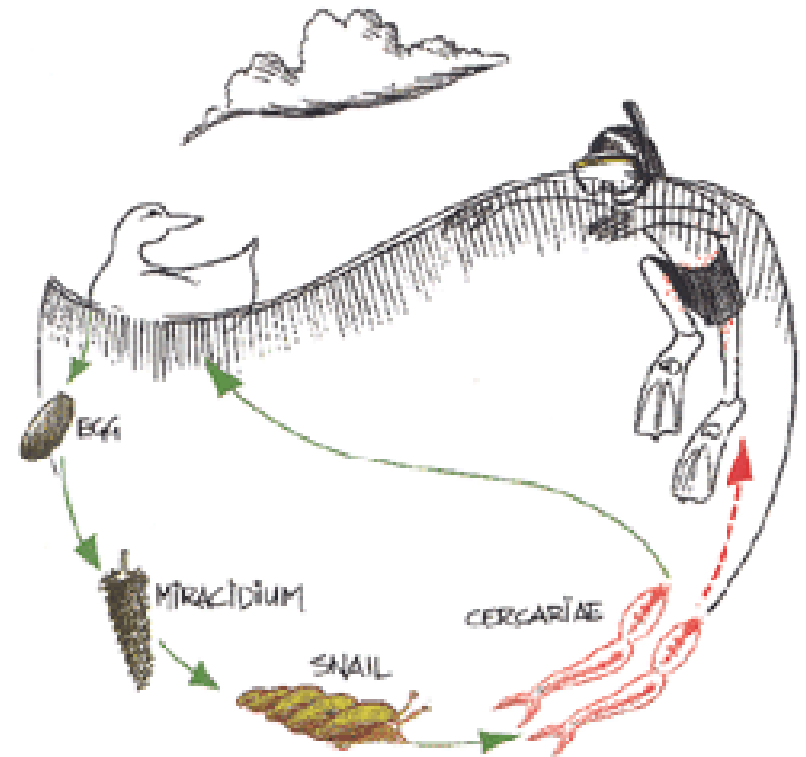
Family Schistosomatidae

- *Schistosoma sp.* infect humans in tropical regions
- **Avian schistosomes** infect birds
 - Causative agents of “swimmer’s itch”
 - Widely distributed in northern latitudes
 - Reported from ~1000 lakes in Michigan (1970s)



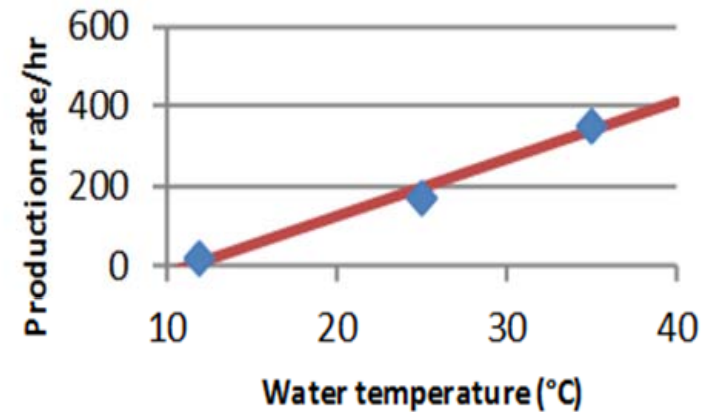
Swimmer's itch

- 2-host life cycle
 - Snails
 - Birds (waterfowl)
 - Humans >> accidental host
- Exposure in water (especially shallows)
- Cercariae penetrate skin and illicit host immune response
 - Tingling, itchy
 - Raised papules = dead cercariae
- Impacts lake tourism

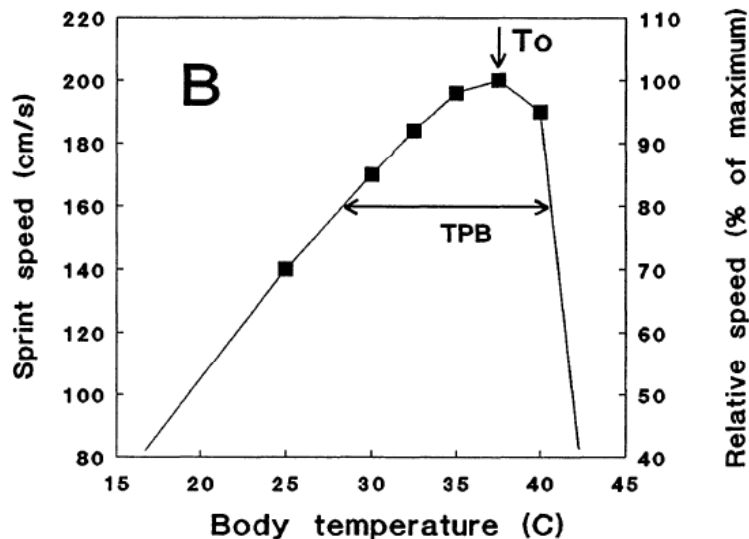


Gaps in Knowledge

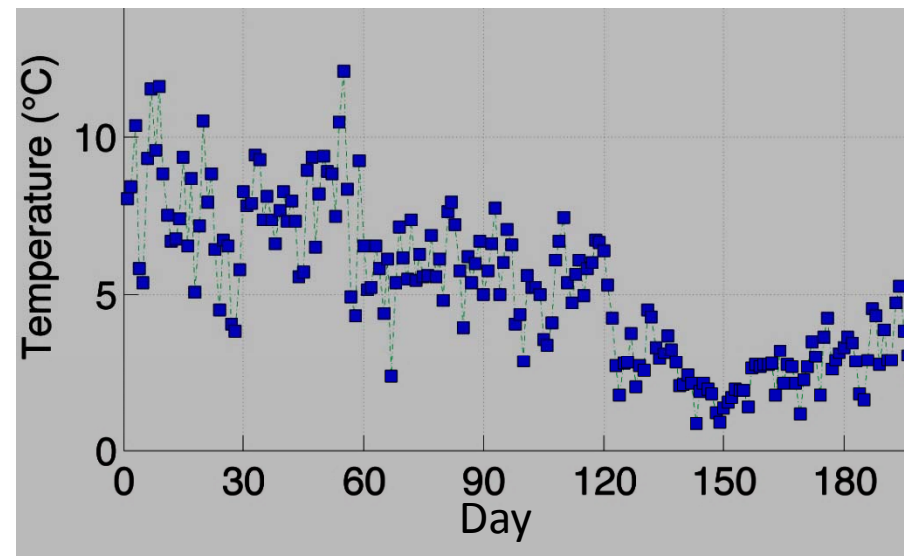
- Trematode biology is temperature-dependent
 - Snail growth & reproductive rates
 - Trematode development rate
 - Cercaria production rate**
- BUT most studies ignore:



Nonlinearities



Variability

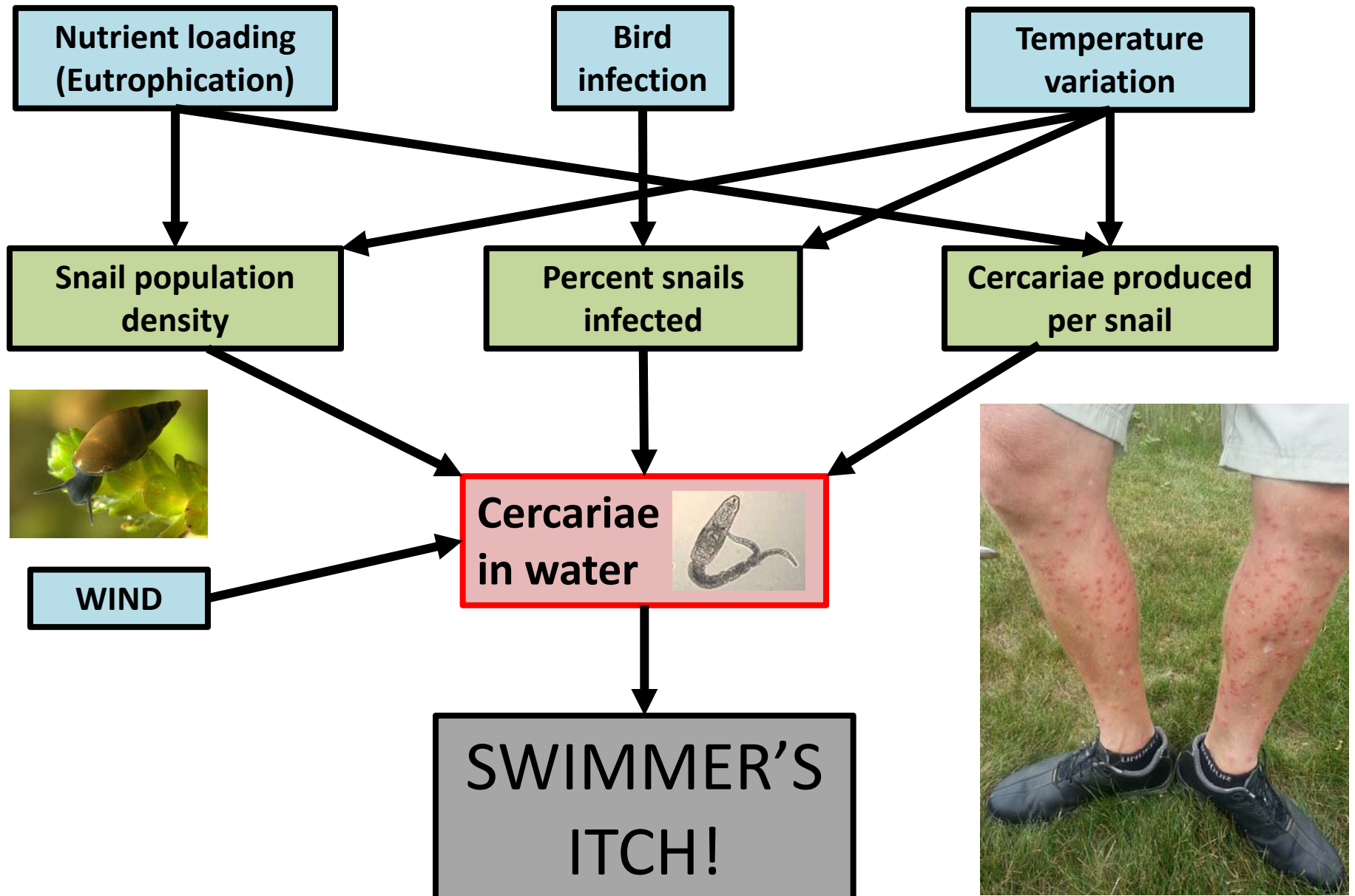


Gaps in Knowledge

- No **daily** field data for cercaria abundance
 - predictive models
- Effects of **physical characteristics** of lakes
 - Why some shorelines have higher incidence than others?
- How does land use and **nutrient input** impact swimmer's itch?



What are the best predictors of daily abundance of avian schistosome cercariae?



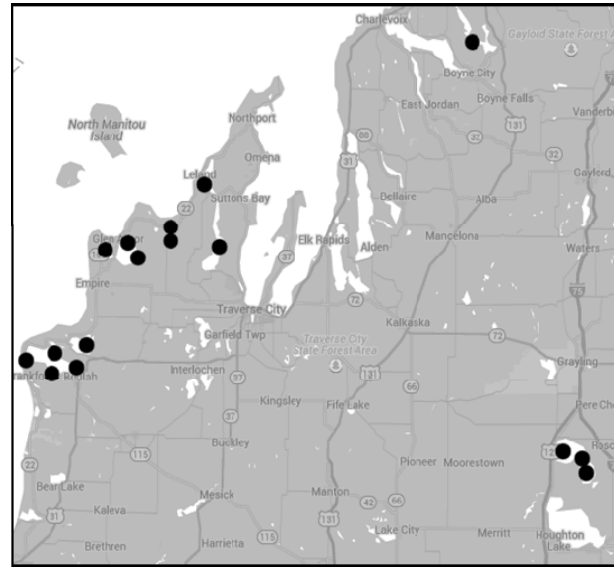
1. Temporal survey: *July 6, 2015 – August 2, 2015*

- Daily cercaria samples: filtered **50 liters** of surface water
- HOBO loggers: temp & light
- Weather conditions
- Wind speed and direction
- Bird visitation
- Wave action
- Human activity

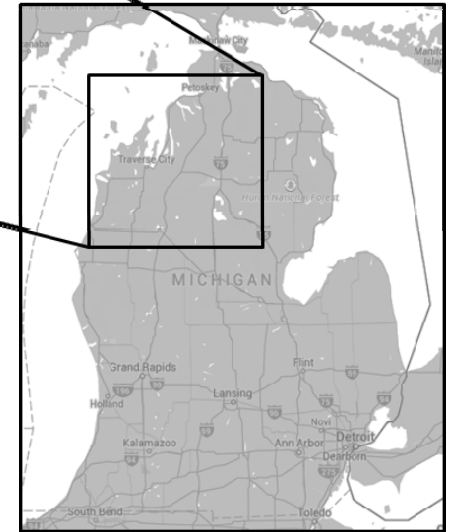


2. Spatial survey

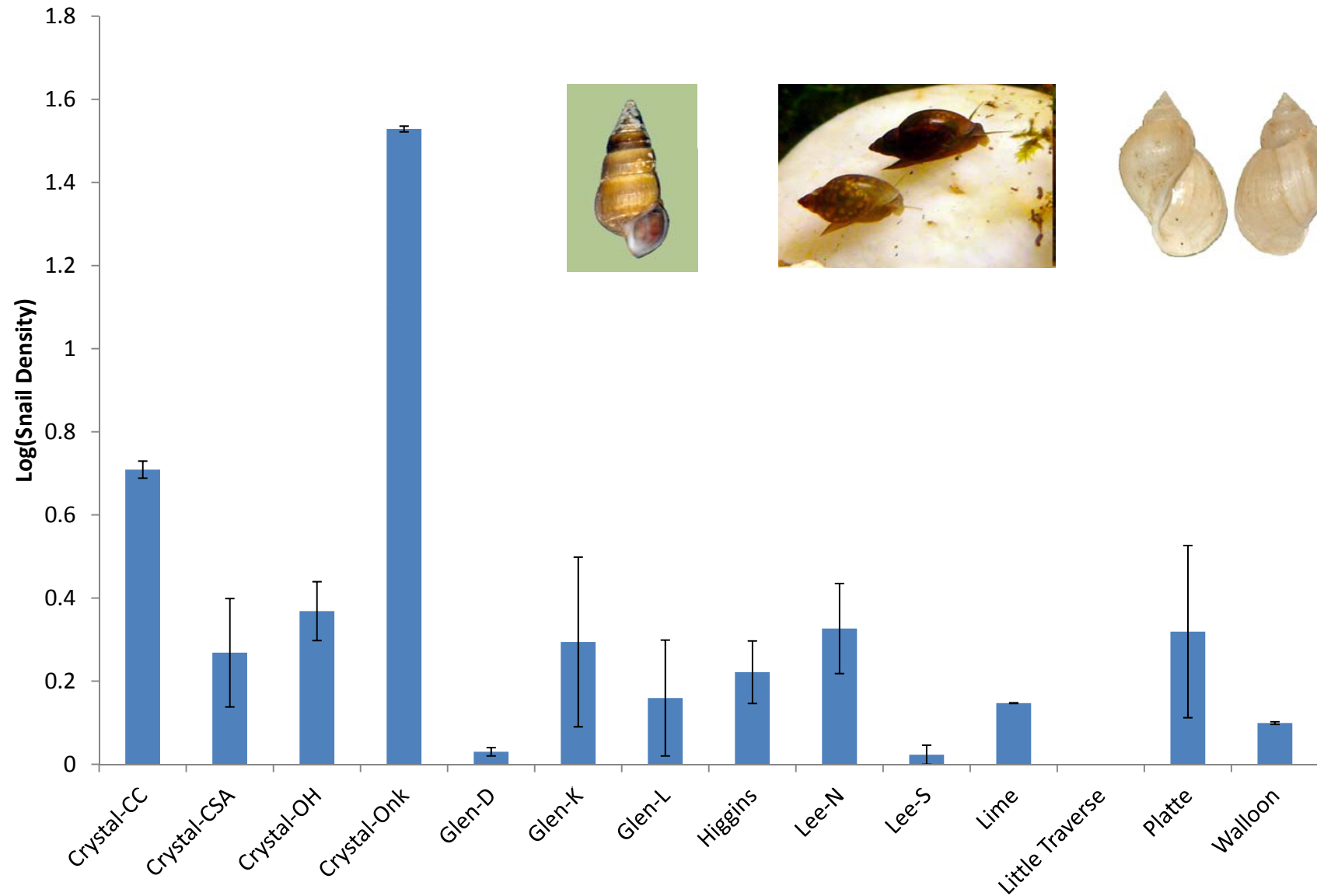
- Lake size & depth
- Land use: riparian and watershed
- Snail densities: visual quadrat counts
- Water samples
 - Phosphorus
 - Nitrate/Nitrite
 - Ammonia
- Littoral substrate



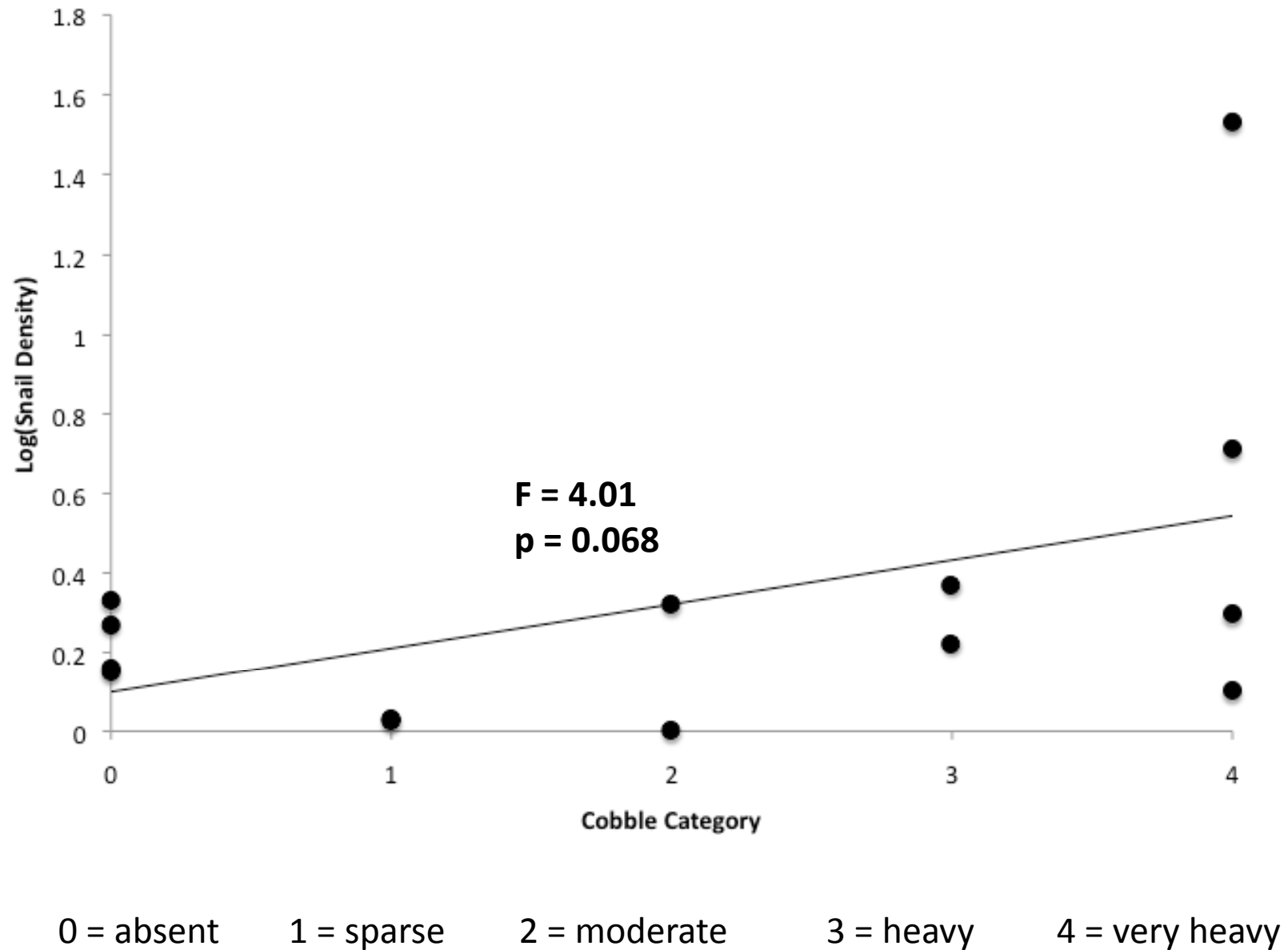
14 sampling sites
on 8 lakes

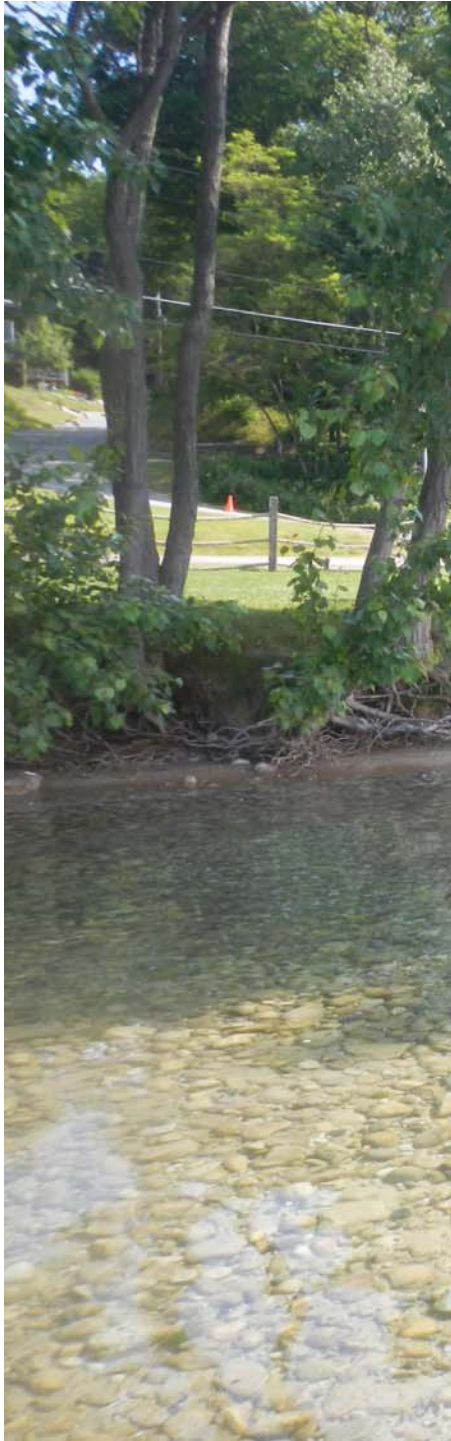


Preliminary Results: Snail Density



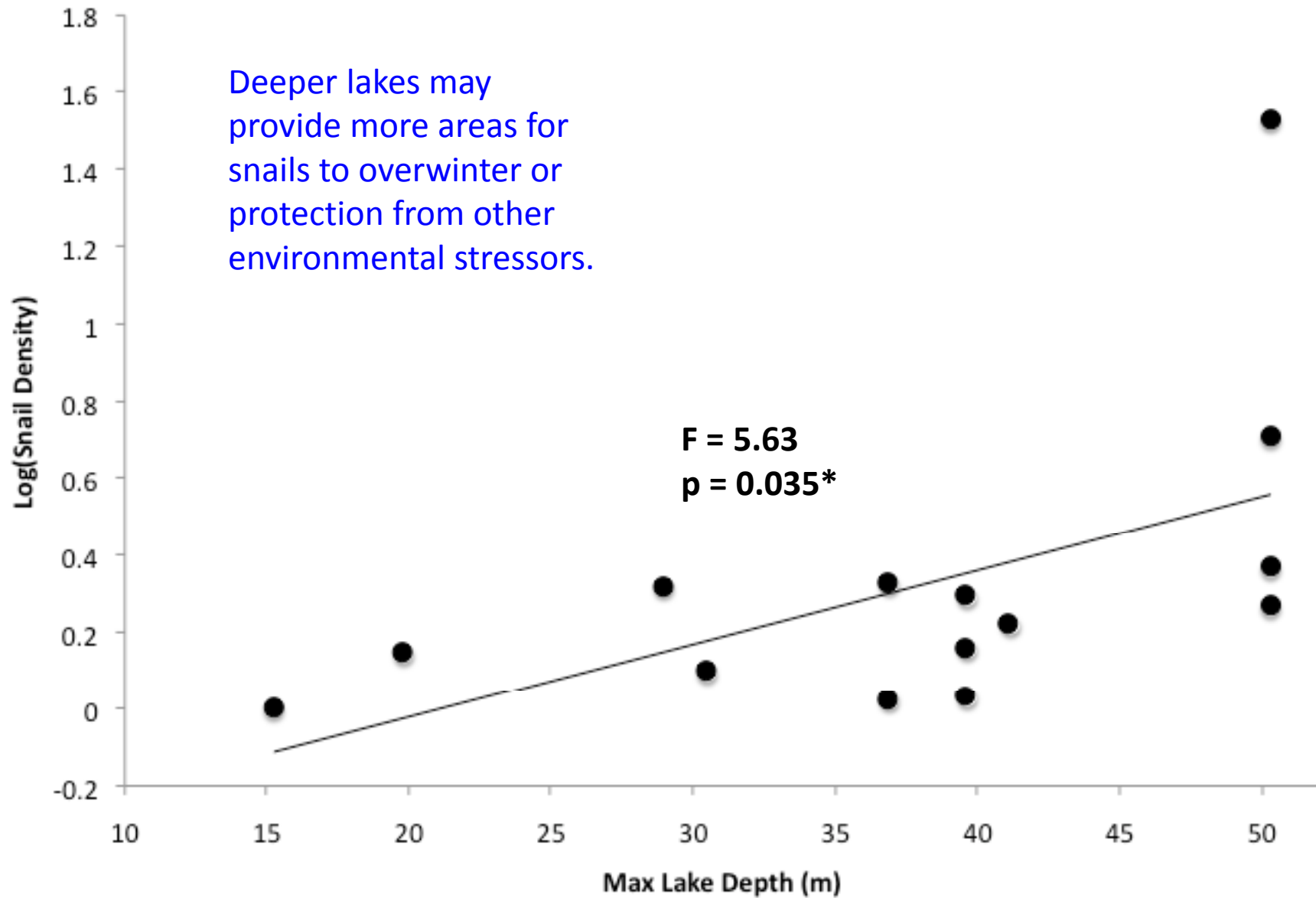
Preliminary Results: Cobble Substrate





Preliminary Results: Max Lake Depth

Deeper lakes may provide more areas for snails to overwinter or protection from other environmental stressors.

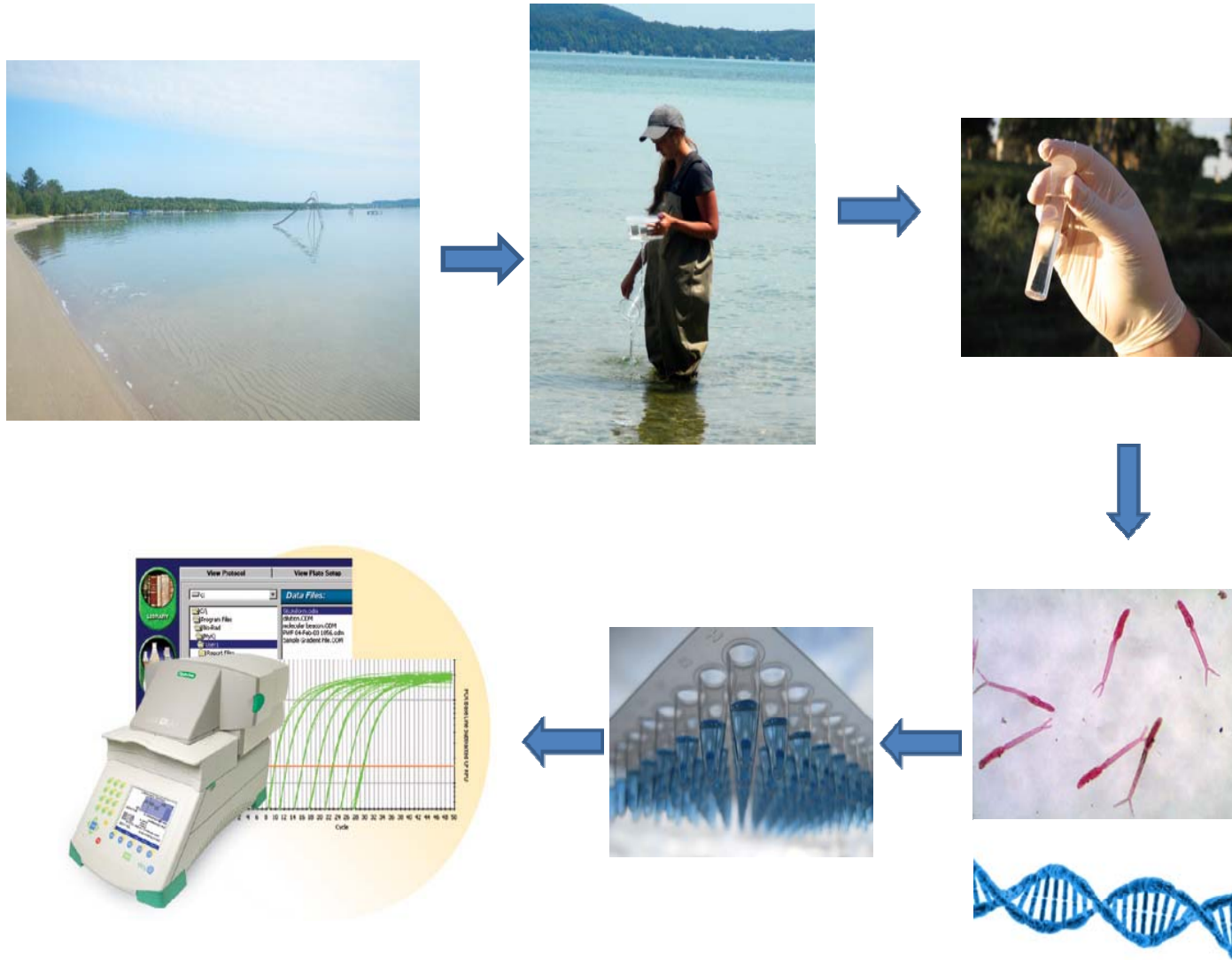


Preliminary Results: Periphyton

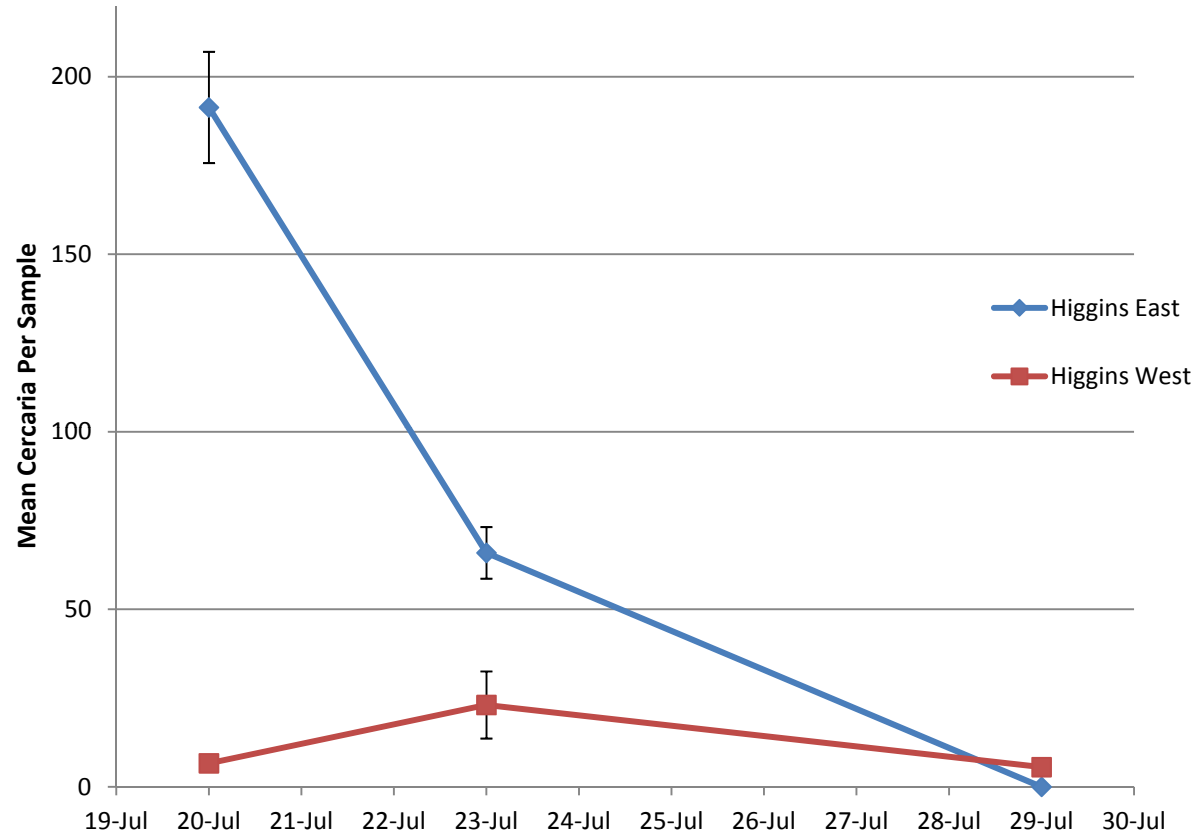
- **Primary food source for snails**
- Grows on lake bottom substrates
- Can be influenced by fertilizer, nutrients, and sunlight
- Chlorophyll *a* will be extracted from filters and compared among sites



DNA Detection from Environmental Samples



DNA Detection from Environmental Samples



Able to generate precise estimates of cercaria in water samples through time.

Hope to refine methods so that lake associations and volunteers can incorporate this testing into future monitoring efforts.

Conclusions

- **Swimmer's itch** = local model system for schistosome parasites
- Temporal and spatial survey methods to fill knowledge gaps
- May inform management practices for swimmer's itch and schistosomiasis
- Fall/Winter 2015: Data entry and sample processing
- Summer 2016: Increase survey to 20 lakes
- **Michigan Swimmer's Itch Partnership (MSIP)**
 - 13 Michigan lake associations (Bellaire/Clam/Torch, Burt, Crystal, Douglas, Glen, Higgins, Leelanau, Lime, Long, Margrethe, Mullet, Sapphire and Walloon) is working together to address the problem of swimmer's itch (SI).
 - Coordinating with SICON LLC biologists and Oakland University biologists on research and control programs.
 - Working with Michigan DNR/DEQ and state legislators on ways to further advance SI research and control and supplement private funding of these efforts.



Acknowledgements

Local Michigan Support:

Crystal Lake and Watershed Association, Al Flory, Monica Schultz, Chimney Corners Resort, Platte Lake Improvement Association, Glen Lake Association, Lake Leelanau Lake Association, Leelanau Clean Water, Walloon Lake Association, Lime Lake Association, Little Traverse Lake, SICON, AND ALL MY VOLUNTEERS!!!



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