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Intermediate Lake Swimmer's Itch Assessment and Evaluation of a Novel Schistosome Species Found in *Helisoma* sp. Snails

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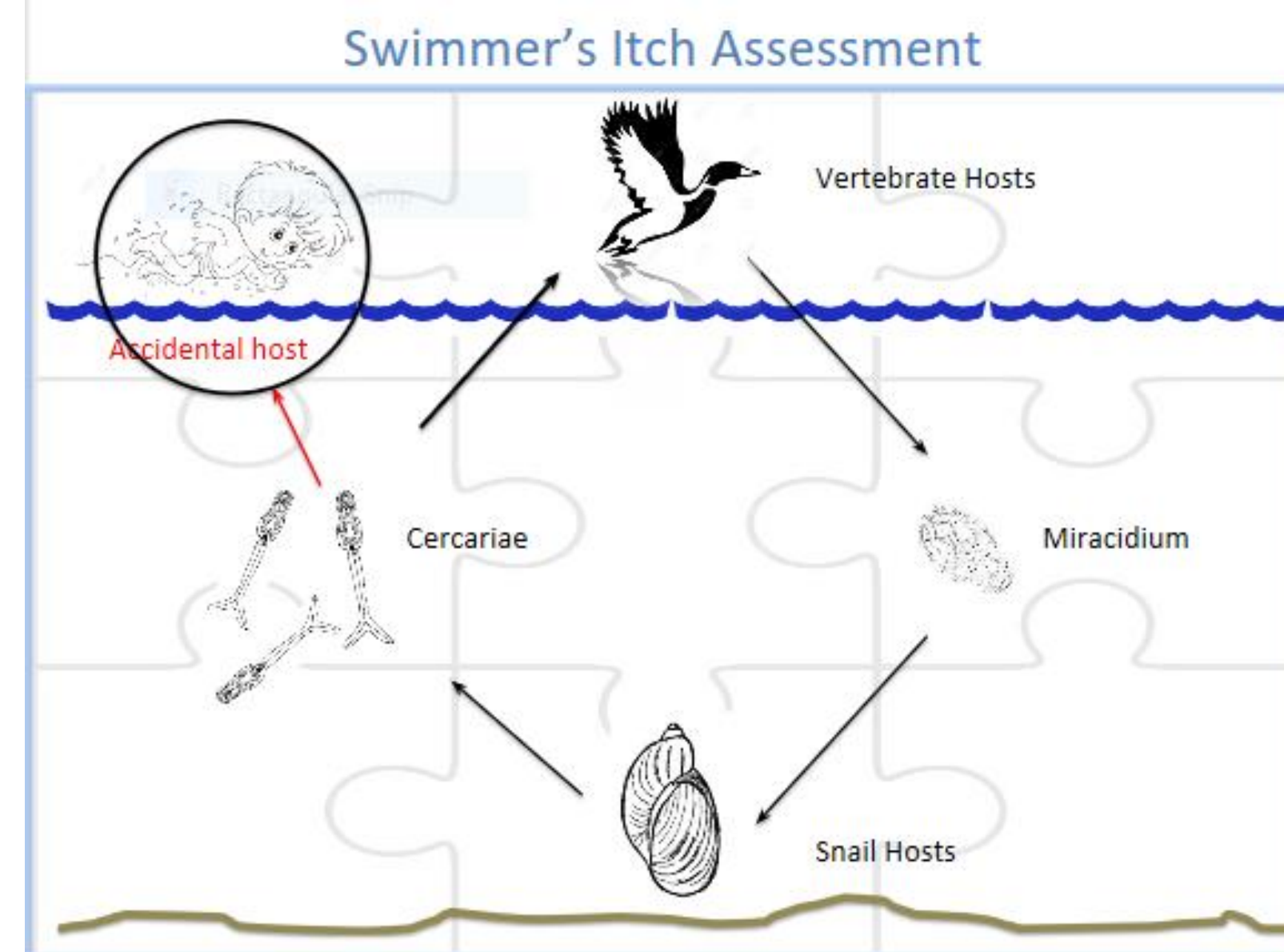
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Intermediate Lake Assessment

Introduction

“Swimmer’s itch” is a dermatitis caused by a family of parasitic flatworms (schistosomes) that have a 2-host cycle: an aquatic snail intermediate host, and a bird or mammal vertebrate host.

Humans are accidental “hosts”, wherein the cercariae die upon entering the dermis, causing red, itchy papules in some people.



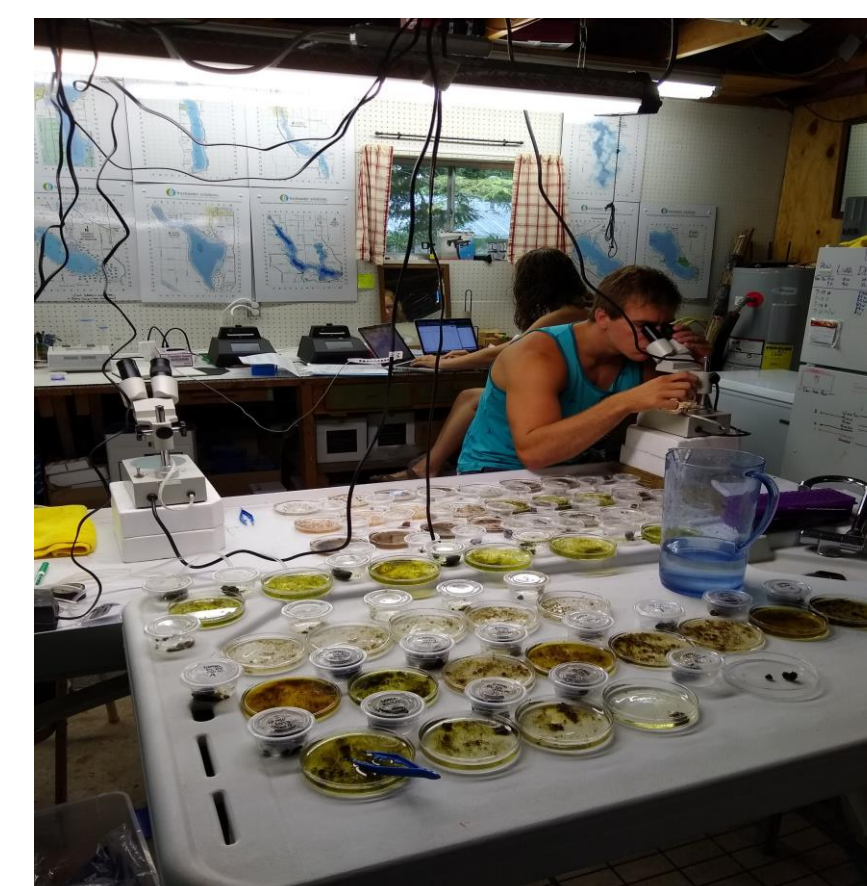
Our goal was to determine the different species of schistosomes cycling within the Intermediate Lake ecosystem to equip them for starting control.

Methods

Snail Collection: 1 m² hoops were thrown at 12 locations, all snails within the hoops were collected, all pulmonate snails were isolated in 12 well culture plates, allowed to sit overnight in the dark, observed individually for the presence of schistosomes and all positives were extracted and barcoded.

Water Sampling: Lake water samples from 12 locations underwent DNA extraction and were run through qPCR to determine the number/species of schistosome present at each site.

Bird Surveys: Number and species of waterfowl per shoreline mile were recorded along all 15 miles of Intermediate Lake. Any fresh fecal samples were examined for miracidia, which was barcoded for identification.



Results

Snail collection showed that 2 of the 12 locations had snails positive for schistosomes from 2 different snail genera: *Stagnicola* and *Physa*.

Species	Snails Examined	Snails in Hoops	Density (sq.m)	% Snail Fauna	Schistosome Infections	% Schistosome	Trematode Infections	% Infections	% Total Infections
<i>Stagnicola</i> sp.	257	257	2.52	33.91%	0	1.68%	73	20.45%	65.83%
<i>Physa</i> sp.	265	208	2.04	27.44%	2	0.75%	12	4.53%	14.12%
<i>Gyraulus</i> sp.	193	191	1.87	25.20%	0	0.00%	0	0.00%	0.00%
<i>Pleurocera</i> sp.	30	30	0.29	3.96%	n/a	n/a	n/a	n/a	n/a
<i>Helisoma</i> sp.	24	22	0.22	2.90%	0	0.00%	0	0.00%	0.00%
<i>Viviparis</i> sp.	50	50	0.49	6.60%	n/a	n/a	n/a	n/a	n/a
Total	919	758	7.43	100.00%	0	1.22%	85	6.24%	100.00%

Water samples showed very high cercariae counts at 3 locations, but almost none at the other 9 locations.

Site	Avg Cer/25L
J14	1.0
I14	0.0
E11	>100
D7 East	1.0
D7 West	1.1
E10	1.0
E12	>100
F13	2.5
G15	1.7
I15	>100
J15	0.0
J18	0.0
Ratio >30<30	0.33

Both I15 and E12 match where positive snails were found.

Bird survey data shows relatively high numbers of mallards.

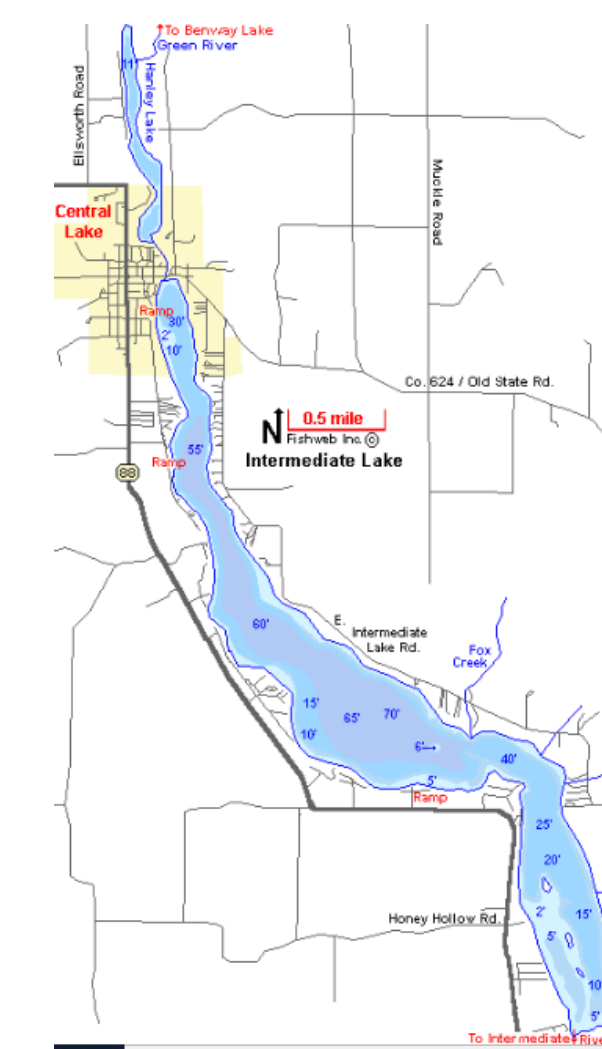
Species	Total Birds	AHY	HY	Broods	% of Population
Mallard	177	106	71	17	70.80%
Mute Swan	19	18	1	1	7.60%
Common Merganser	17	2	15	2	6.80%
Common Loon	13	7	6	4	5.20%
Hooded Merganser	11	1	10	1	4.40%
Canada Goose	13	4	9	2	5.20%
Totals	250	138	112	27	100.00%

No positive fecal samples were found upon sampling of goose, mallard, swan, and common merganser.

Conclusion

Distribution of snails is patchy, causing higher cercariae counts on the west shore, but almost none in other locations.

Species of schistosome’s cycling on Intermediate Lake are *T. stagnicola*, *T. physellae*, and new species from *Helisoma* snail.



Implications

- Limited range of the intermediate host on the lake could cause hyper concentrated areas of swimmer’s itch, and many areas of little swimmer’s itch.
- Migratory birds may play a significant role in transmission.

Limitations: It is possible that the 12 sites from which water and snails were collected did not contain the largest portion of the schistosomes/hosts on the lake, or that snails were more prevalent in deeper water past the drop-off. Migratory birds could also be causing a significant portion of the swimmer’s itch, while summer resident birds are less influential

Helisoma Schistosome Study

Introduction

Helisoma snails, previously thought to not carry schistosomes, were found to be positive on multiple Northern Michigan lakes. It is known that other schistosome’s cercariae emerge in early morning to infect waterfowl, but the new species’ vertebrate host is unknown, as well as the time the cercariae emerge. Discovering peak times of cercariae emergence could provide a clue as to what vertebrate may serve as the definitive host.

Methods

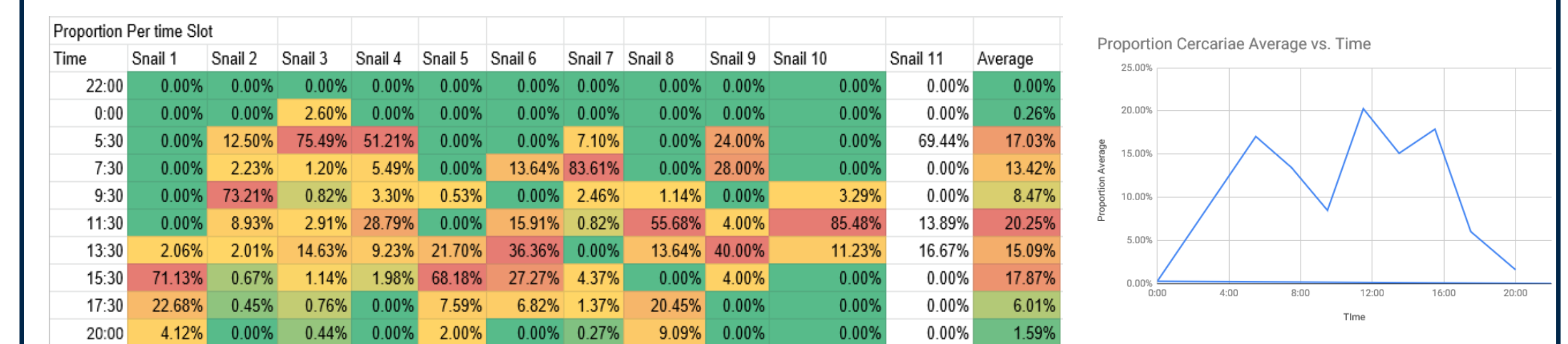
Previously screened positive snails were placed in individual condiment cups at 22:00, then moved to a new cup at 00:00, 5:30, and every 2-hour interval after for a total of 24 hours.



Crystal violet stain was added to each cup (3µL per mL) and cercariae were counted 24 hours post-staining.

Results

Cercariae emerge sporadically during daylight hours, but do not emerge during darkness.



Proportionally, peak time for the emergence of the *Helisoma* schistosome is shown above.

Conclusion

- Definitive host for *Helisoma* schistosome is likely not nocturnal.
- There is no distinct advantage for cercariae to emerge in morning i.e. host spends equal amount of time in water contact during all daylight hours.

Limitations: More trials are necessary to definitively form and expand conclusions. Additionally, the snails may have been stressed which could influence the number of cercariae that emerged.