

# Using parasites as surrogates for host biodiversity in reclaimed wetlands

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NSWA WATERSHED WEDNESDAY

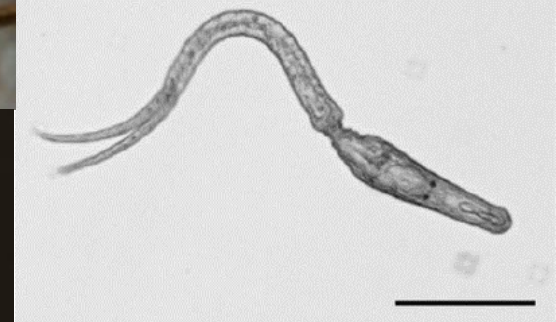
NOVEMBER 3<sup>RD</sup>, 2021



UNIVERSITY OF ALBERTA  
SCHOOL OF PUBLIC HEALTH

# “Parasites?... Gross”

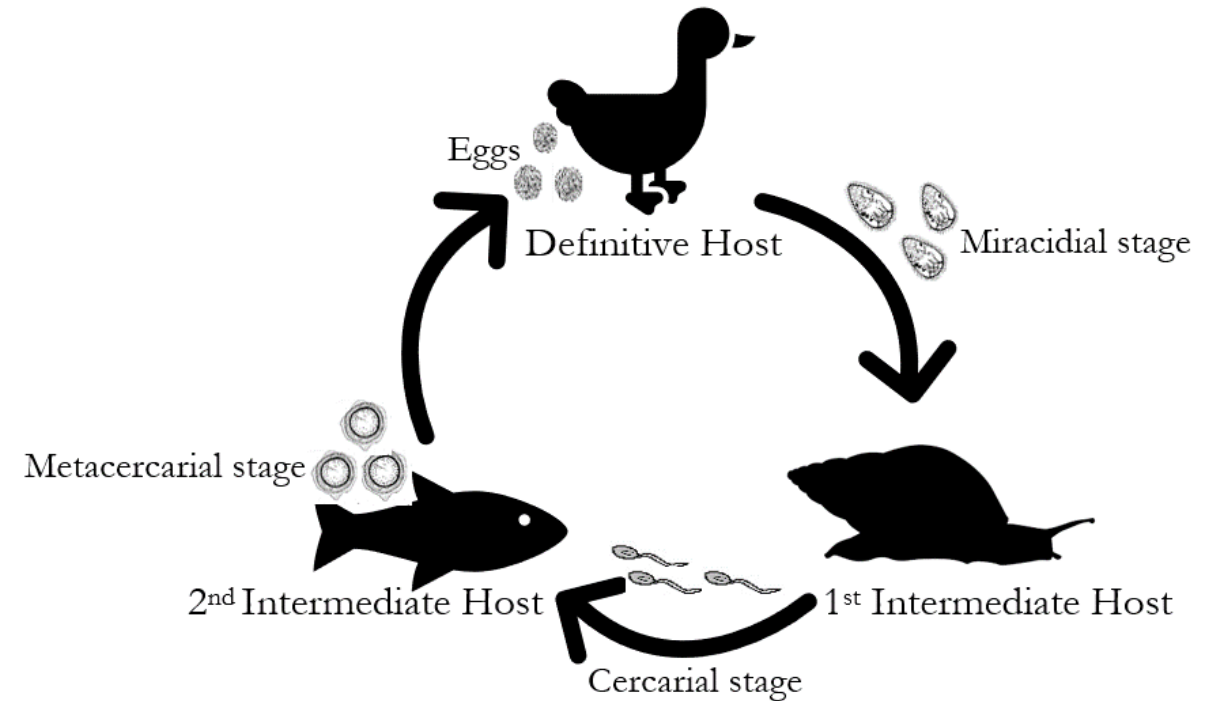
- This is the most common reaction I get
- A healthy ecosystem should have parasites
- Parasitism = most common lifestyle on Earth
- Even so, parasites are overlooked
- They are part of biodiversity and often make up significant biomass



# Digenean trematodes 101

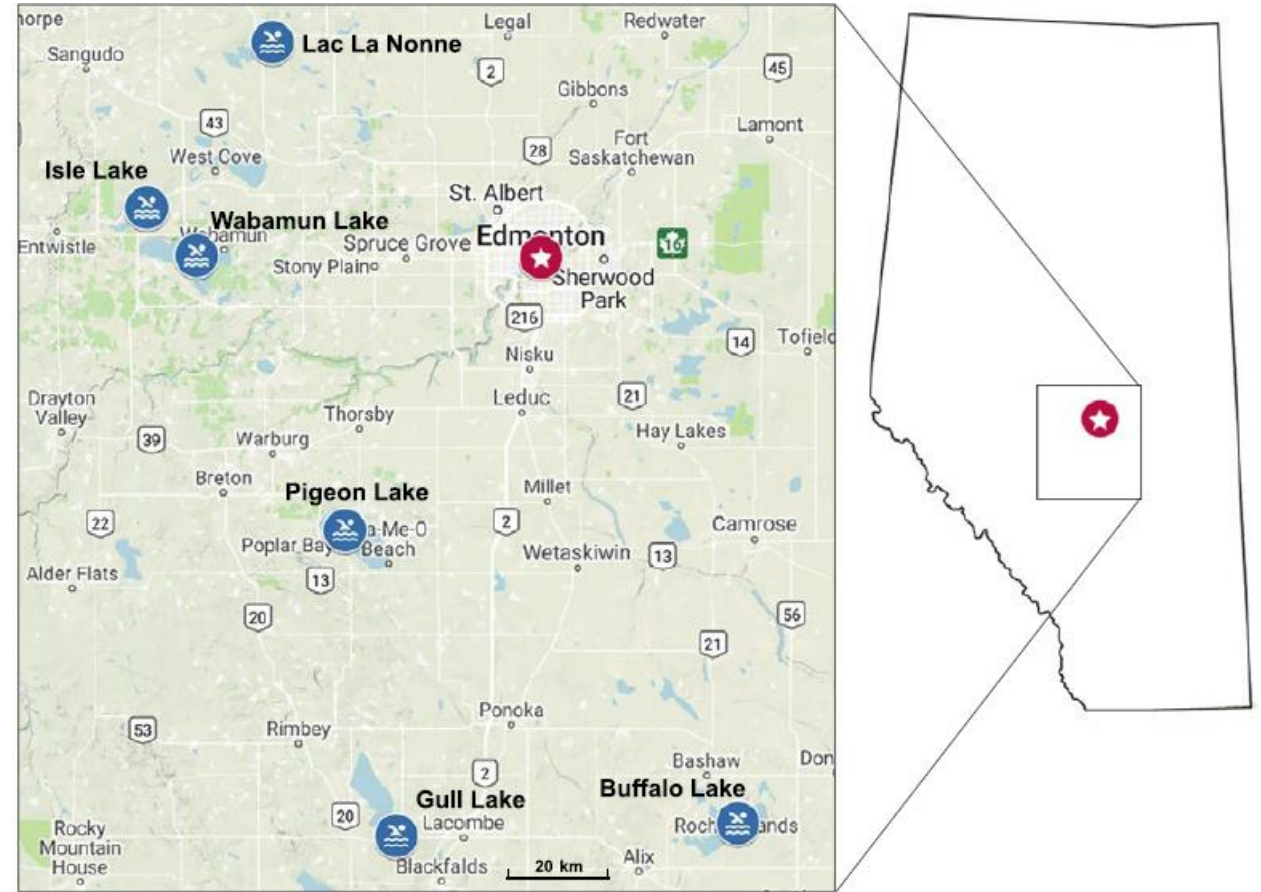
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- Flatworms
- Complex life cycles
  - Involve 2-4 hosts
- Wide range of hosts
  - Generalists
  - Specialists
- Great candidates to be indicator species



# What We Know So Far in AB

- Know more about the trematode community in Alberta than anywhere else in the world
- Comprehensive study (6 lakes, 3 years)
- Found 79 species of trematodes

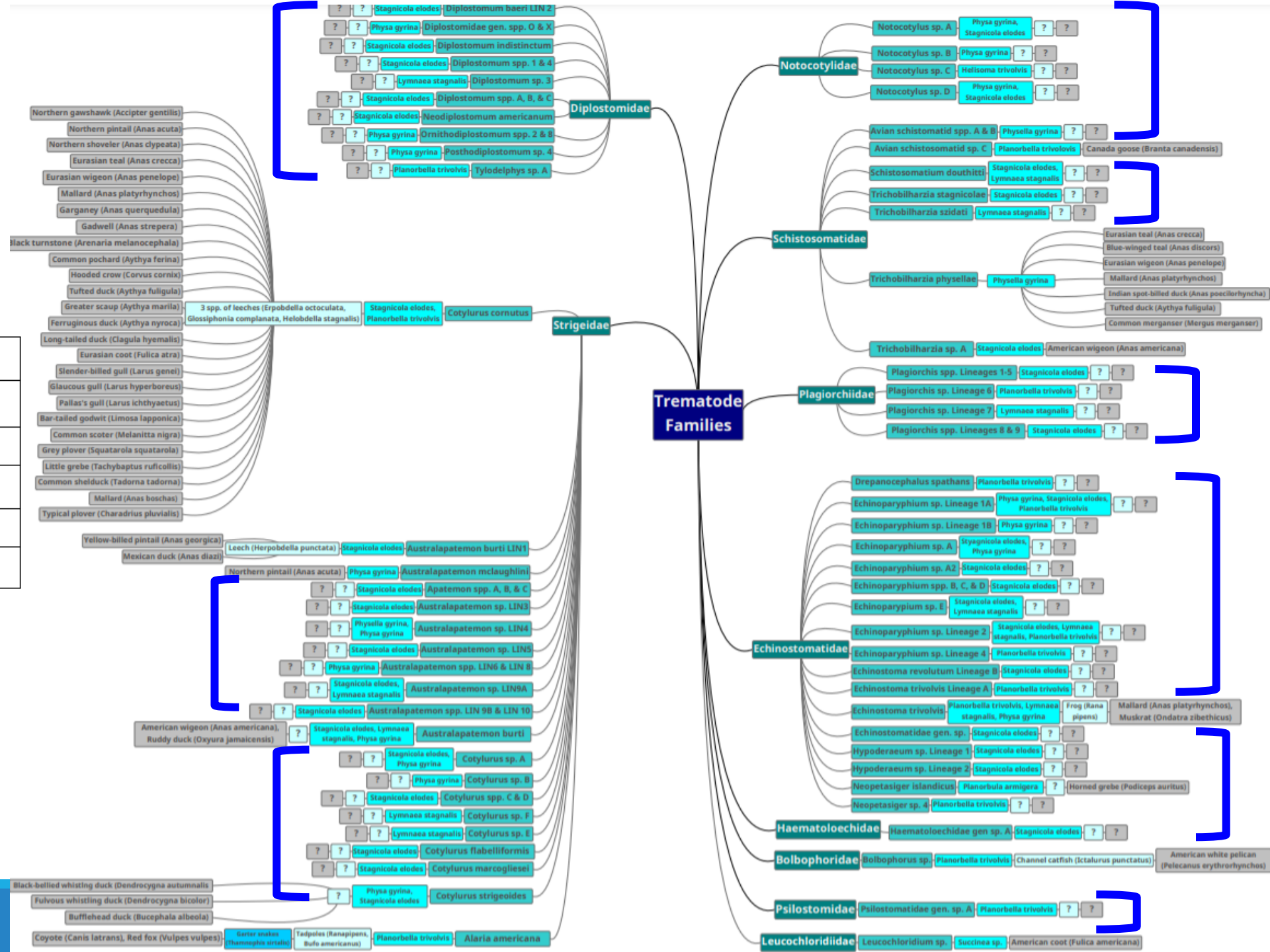


Gordy & Hanington, 2019

# Parasite Web

**Legend**

<span style="color: #008080;">●</span>	Trematode families found in Alberta
<span style="color: #40E0D0;">●</span>	Trematodes found in Alberta
<span style="color: #00FFFF;">●</span>	Known snail 1 <sup>st</sup> intermediate hosts
<span style="color: #ADD8E6;">●</span>	2 <sup>nd</sup> intermediate hosts
<span style="color: #00BFFF;">●</span>	Paratenic hosts
<span style="color: #A9A9A9;">●</span>	Definitive hosts



# Biodiversity Assessments

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- Costly and time-consuming
- Can be simplified by assessing the diversity of indicator species
- Trematodes are excellent candidates to be indicator species
- An array of organisms have been used to assess biodiversity in the past
  - Few examples of parasites being used for this purpose
  - Possible that this method is more accurate



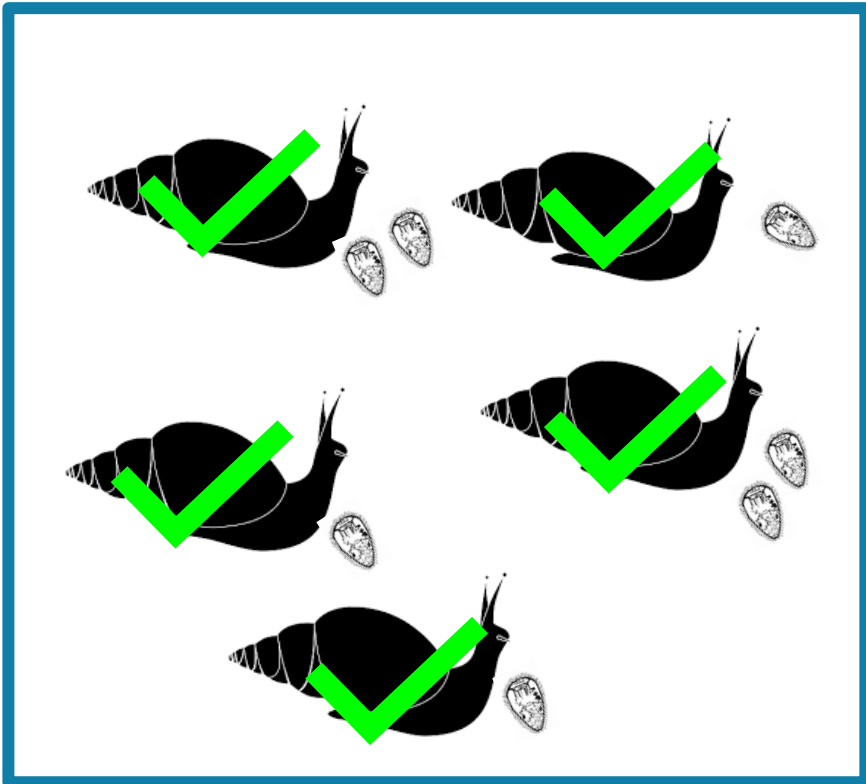
# The Great Biodiversity Debate

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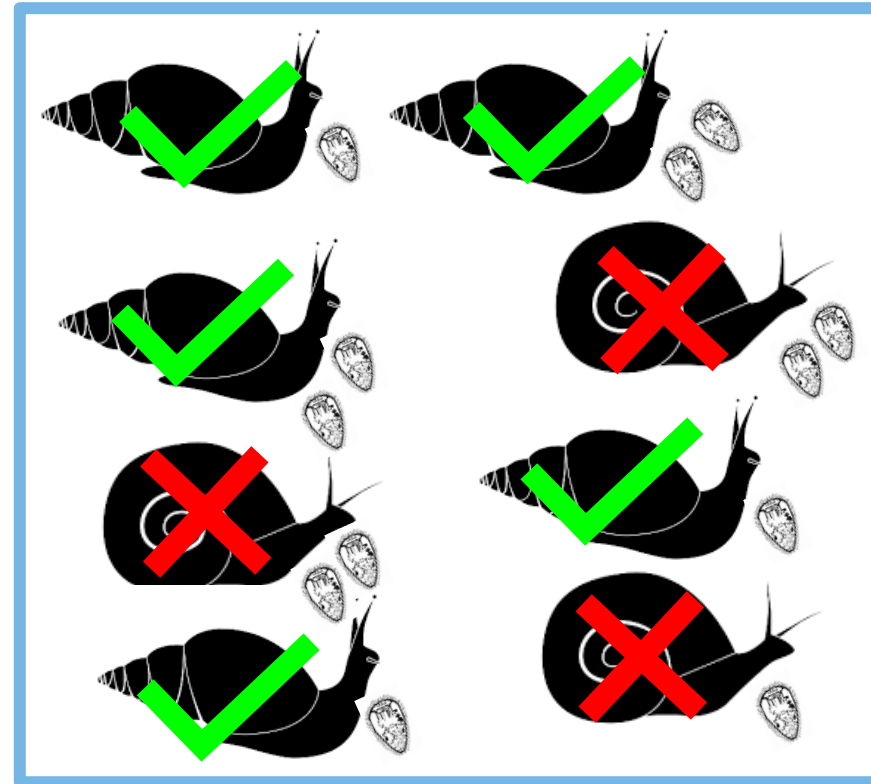
- There are 2 schools of thought when it comes to host-parasite interactions and how they are impacted by changes in diversity
  - The Dilution Effect hypothesis
    - $\uparrow$  diversity means  $\downarrow$  disease
  - The “Host Diversity Begets Parasite Diversity” hypothesis
    - $\uparrow$  diversity means  $\uparrow$  disease

# The Dilution Effect

Environment #1  
Compatible hosts only



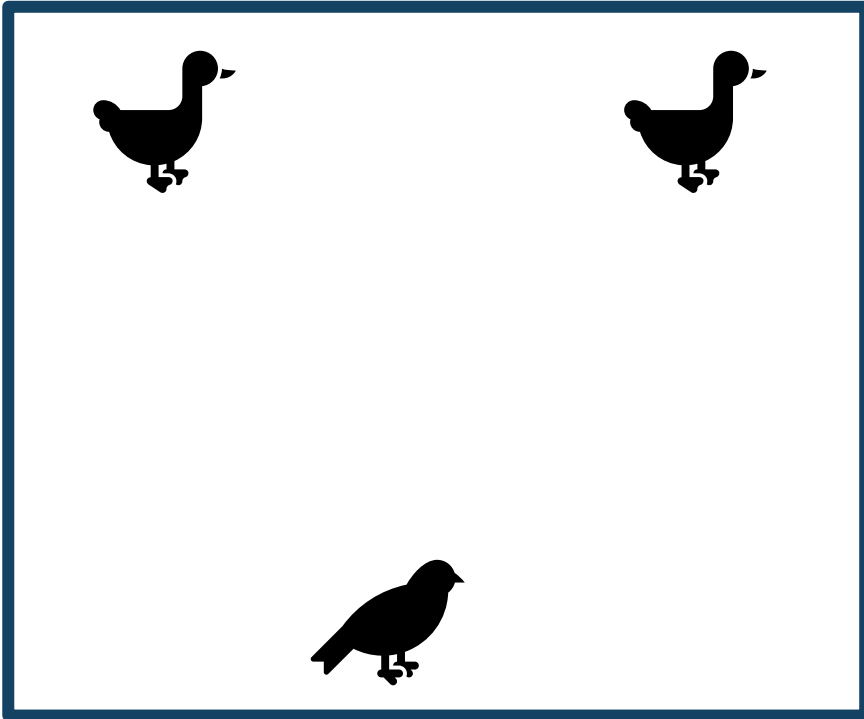
Environment #2  
Compatible & Incompatible hosts





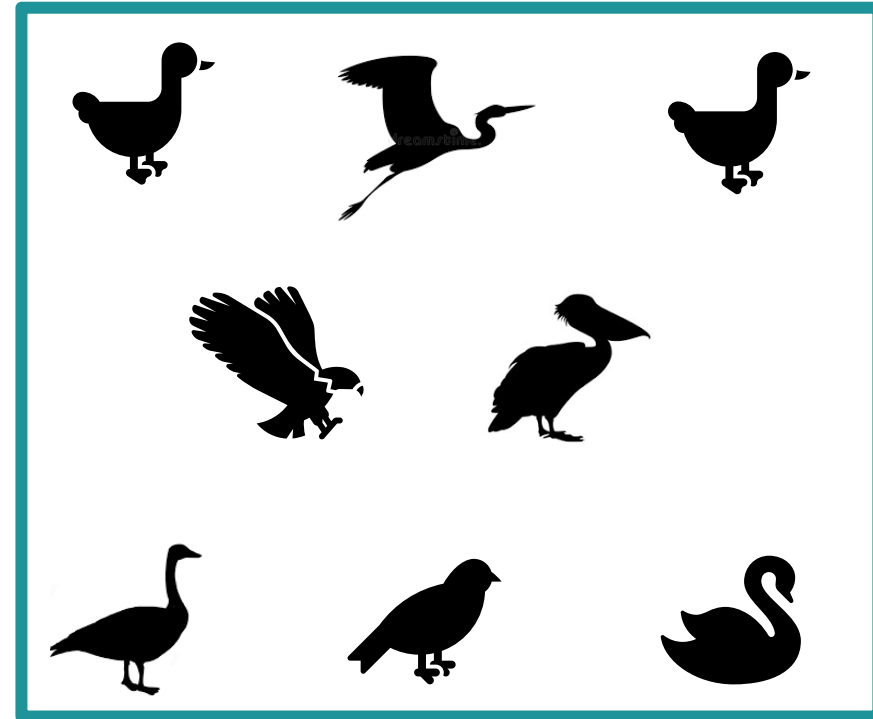
# The Diversity Begets Diversity Hypothesis

Environment A



- ↓ diversity
- Few niches to occupy
- Few contributors

Environment B



- ↑ diversity
- Many niches to occupy
- Many contributors

# The Great Biodiversity Debate (cont.)

- This issue has divided researchers for many many years now
- These are not necessarily mutually exclusive
- Perhaps we are comparing apples to oranges?
  - Relationship often studied using modelling or mesocosm studies



**comment**

## Defuse the dilution effect debate

Debate surrounding the dilution effect hypothesis in disease ecology has reached such intensity that it is stymying further research. Yet collaborative progress is important for human health and biodiversity conservation.

Samniqueka Halsey

# Hypothesis & Objectives

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- Hypothesis:
  - I predict that host-specialist trematodes will be impacted by host biodiversity more so than host-generalists.
  - Thus, I hypothesize that trematode species richness will relate positively with host biodiversity when the trematode population is defined by host-generalists, rather than host-specialists.
- Objective 1: Use DNA barcoding and gold-standard biodiversity survey methods to assess how host and parasite diversity relate to one another in a natural environment.
- Objective 2: Assess the effect of habitat age on the host-parasite diversity relationship.



# Study Sites

- 8 wetland sites in Strathcona County, Alberta
  - Previous mining sites
  - Wetlands varied in age:
    - Youngest – 4 yrs
    - Oldest – 16 yrs
  - Collected here for the past 3 summers
- Heritage Lake in Morinville, Alberta (Sturgeon County)
  - Less frequent collections; started in 2020



# Field Sampling

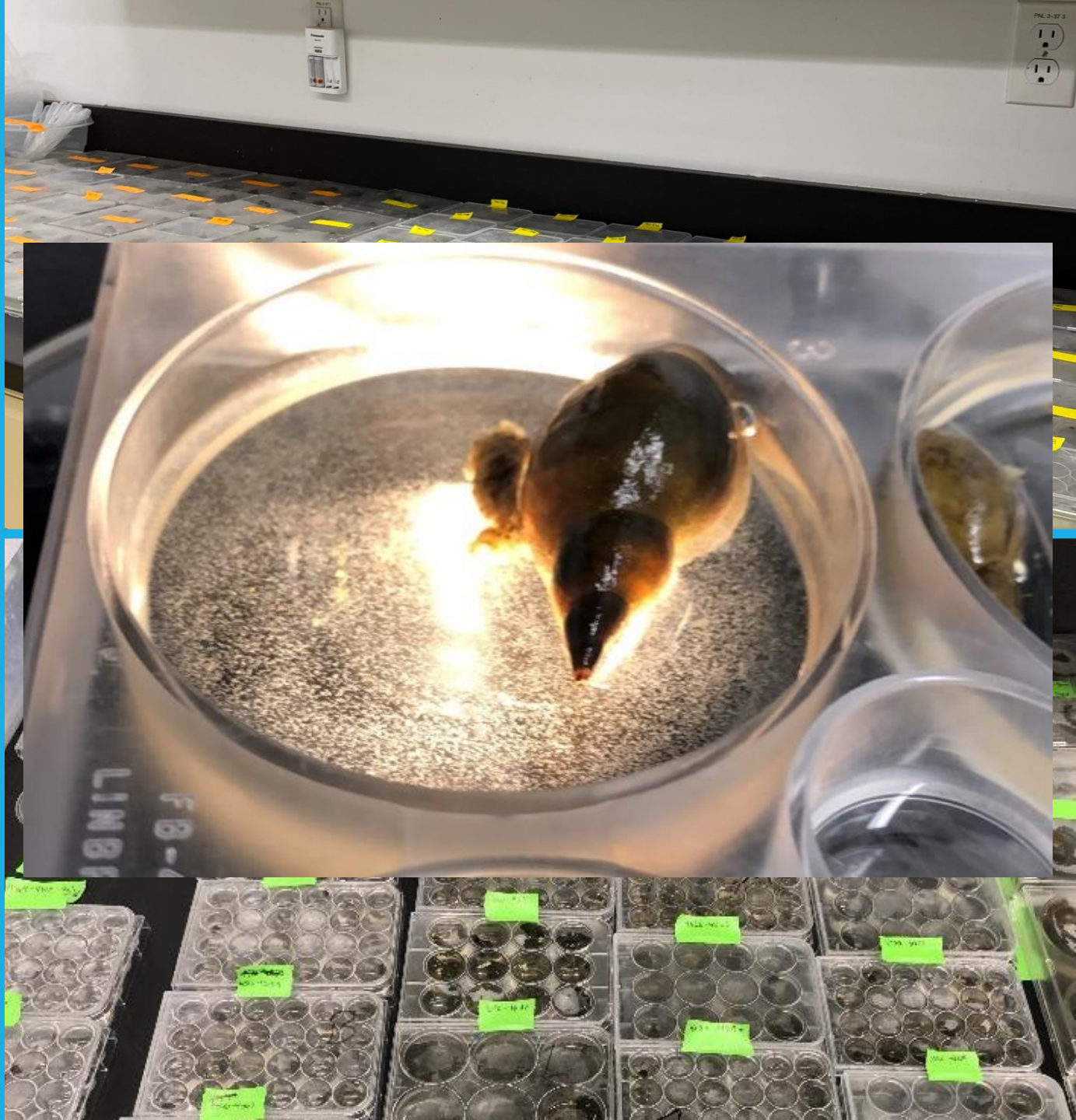
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- Snail collections
  - Biweekly collections
  - 200 snails/site on every collection day
  - Timed
- Gold-Standard Survey Methods
  - Invertebrate tows
  - Kick netting
  - Field cameras
  - Bird song recorders



# Snail Processing

- In the lab:
  - Placed in well plates
  - Left under timed fluorescent lights
  - Checked under microscope for infection
  - Cercariae preserved in 95% ethanol



# Results to Date

# Species ID Results to Date

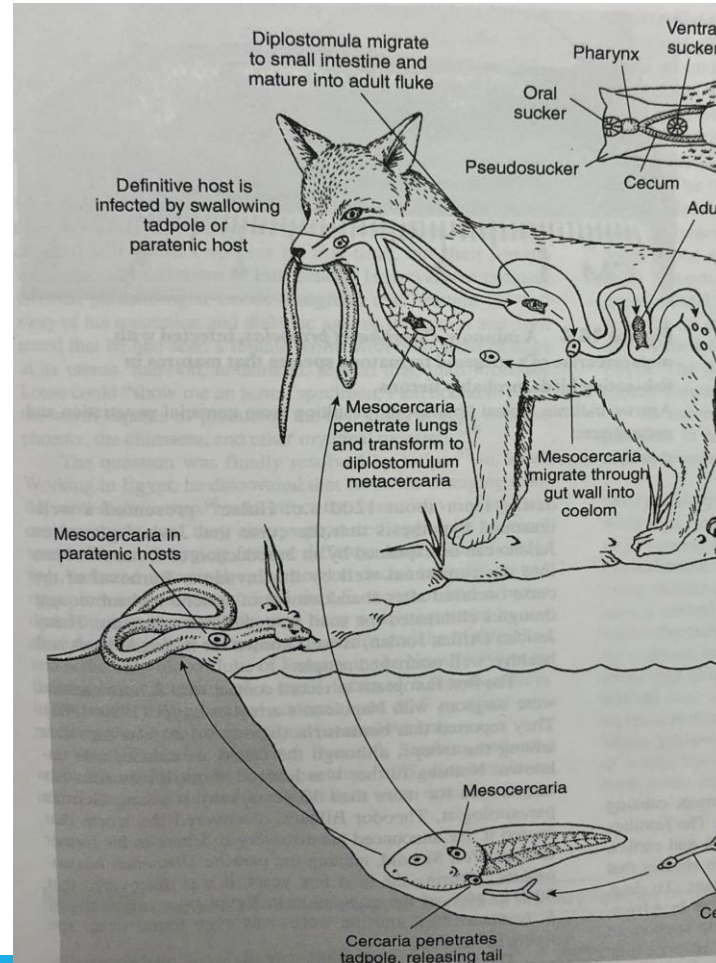
- 42 species identified (so far)
- Province-wide total: 85 species
- 9 families
  - Family of particular interest: Schistosomatidae
    - Cause swimmer's itch
    - Cousins of the parasites that cause human schistosomiasis
    - Report your cases to the lab website





# Cool Trematodes We've Found

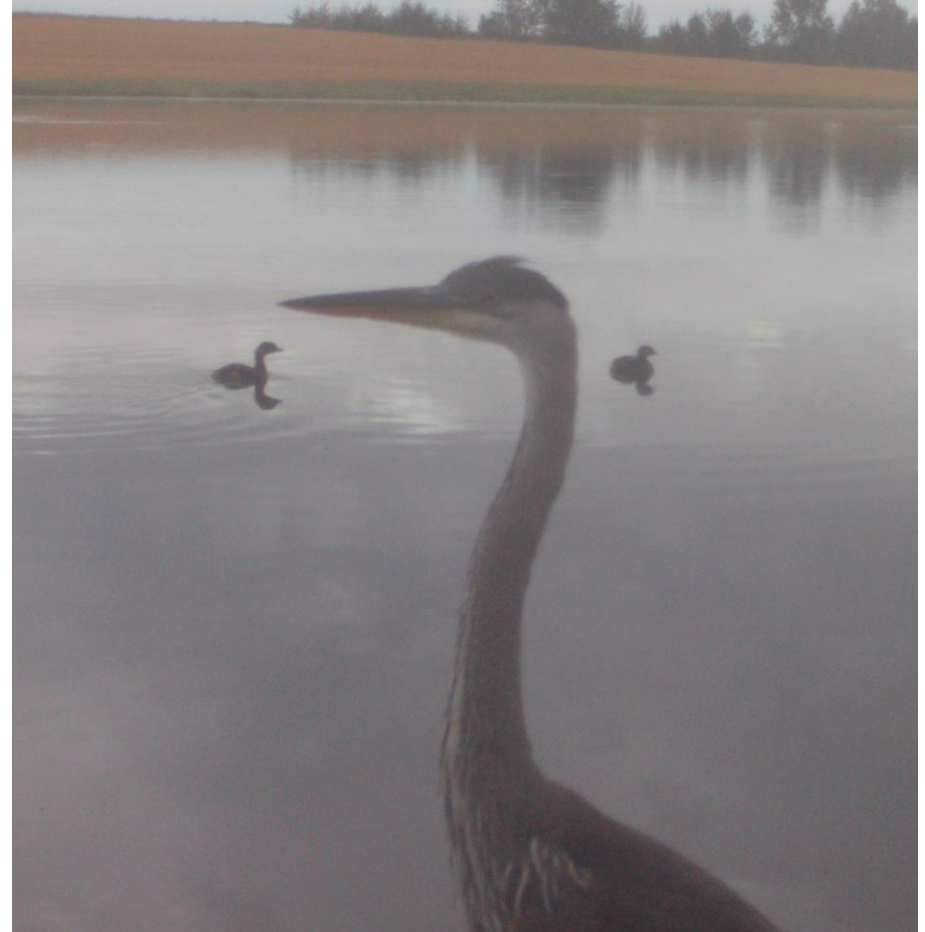
- *Alaria americana*
  - 4 host life cycle
  - This means all of these moving parts are in and around the wetlands
- *Leucochloridium* sp.
  - Exhibits some mind control on the snail host
- *Petasiger* sp. 4
  - Move around in an 'S' shaped pattern



# Current State of the Project

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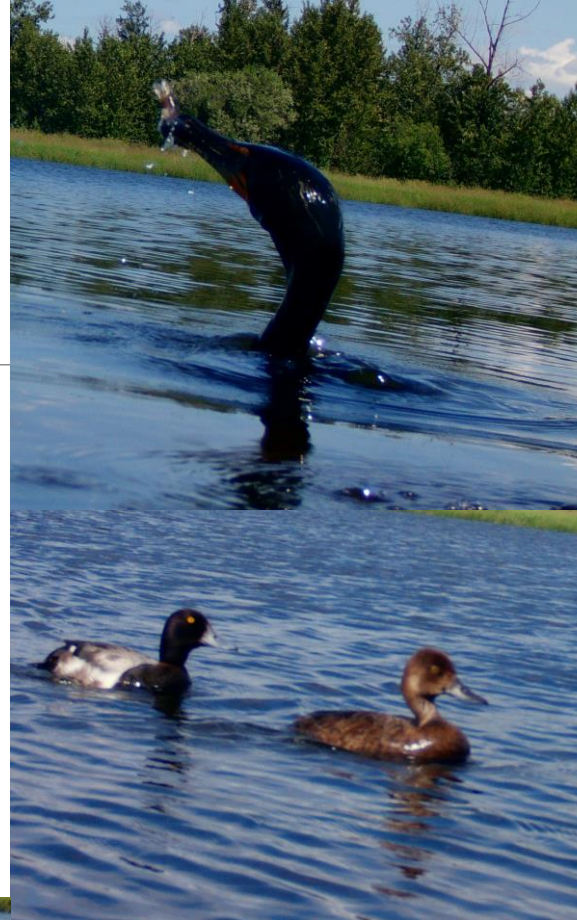
- 3 collection seasons completed
- 15 121 snails collected
- 1 508 snails infected with trematodes
- 9.97% overall infection prevalence
- 622 samples identified



# Host Survey Results to Date

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- Of the 9 trematode families we know are present...
- We have evidence of hosts that are exploited by 8 of them
- 29 potential host species present





# Invertebrate Collections

- Tows & kick netting performed 3 times a season
  - Aquatic mites
  - Leeches
  - Dragon fly larvae
  - *Gammarus* sp.
  - Water boatmen (*Sigara* sp.)

# Filling in the Gaps

- Use this host & parasite information to fill in some of the question marks on the map
- Generalists vs. Specialists



# Future Work

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- Barcode our invertebrate samples
- Develop eDNA tests for common parasites at these sites
  - Test water & invert samples
- Potential research opportunity at a new, well monitored tailings pond in northern Alberta





# Summary

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- Parasites are important and useful
- Digenean trematode parasites are going to be particularly useful in helping us understand host-parasite interactions as they relate to biodiversity
- We are uniquely set up to study this relationship because of the previous knowledge obtained
- Identified 42 species to date at these wetlands from 9 families
- Updated the trematode province-wide total to 85 species

# Acknowledgements

Dr. Patrick Hanington Dr. Simon Otto Dr. Carol Frost

Ron Reimink

Lab mates:

-Alyssa Turnbull

-Jacob Hambrook

-Monica Ayala-Diaz

-Dr. Sydney Rudko

-Sara Tomusiak

-Danielle Barry

-Dr. Elisabeth Richardson

-Ceilidh Welch

-Veronika Franzova

-Robert Lu

-Dr. Michelle Gordy

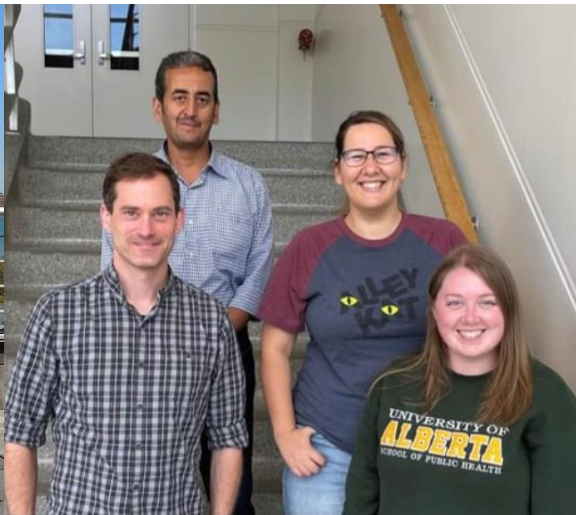
-Dr. Abdullah Gharamah

-Kelsey Froelich

-Sabeak G. Mariam

-Dr. Hongyu Li

-Dr. Emmanuel Pila







# Thank you!

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