

Invasive snails and their potential to serve as hosts for parasites in the Midwest



Gregory J. Sandland

Department of Biology
University of Wisconsin-La Crosse

Invasive snails and disease

- Mollusks (including gastropods) are relatively common invaders
- Can generate issues due to interactions with free-living species
- Can cause problems through their transmission of macroparasitic organisms such as:
 - Roundworm parasites (nematodes)
 - Flatworm parasites (digeneans)



The Midwest's most wanted

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Faucet snail

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Faucet snail

- Native of Europe
- Introduced into the Great Lakes in the 1880s
- Detected in the Mississippi in 2002
- Adults reach 12-15 mm in length
- ~3 year lifespan
- Disrupts the integrity of native aquatic communities

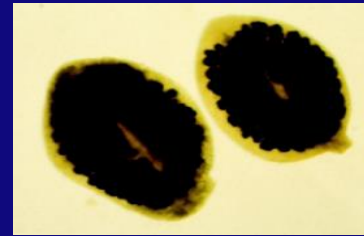


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And if that wasn't bad enough... digenean parasites as well!!!

Cyathocotyle bushiensis



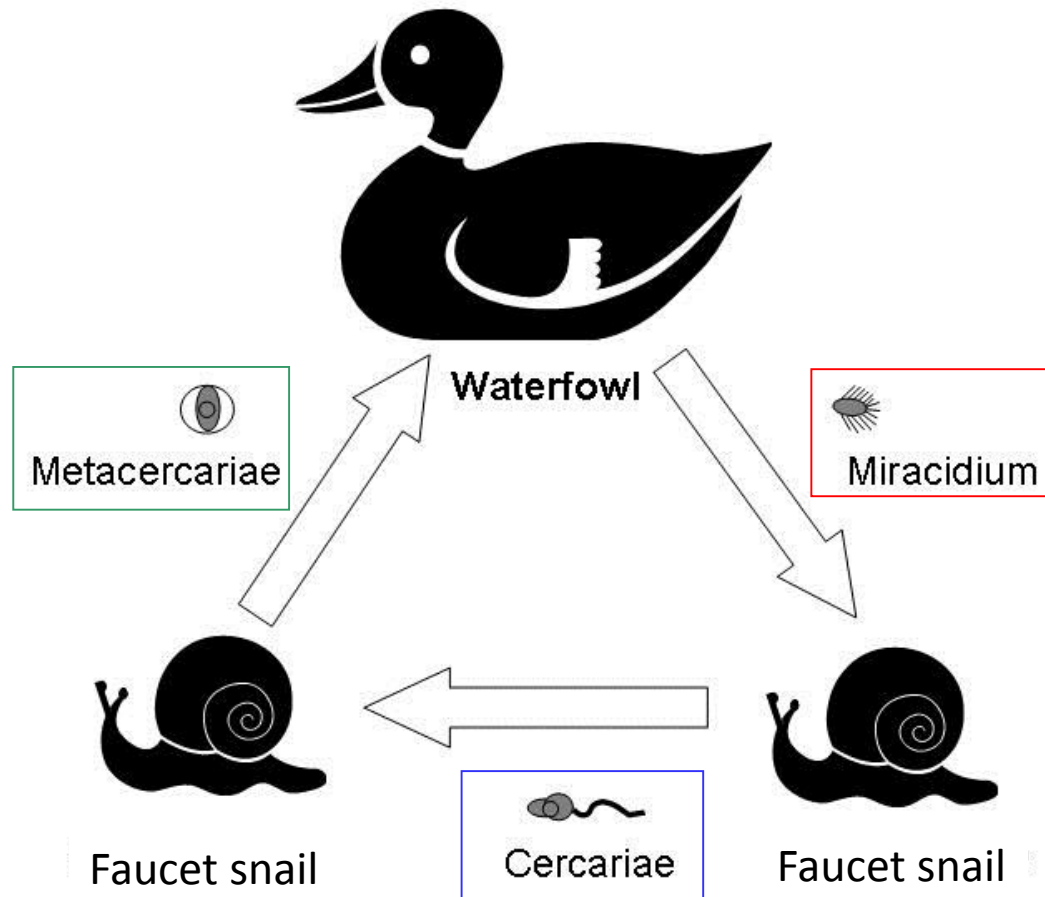
2 species of *Sphaeridiotrema*



Leyogonimus polyoon

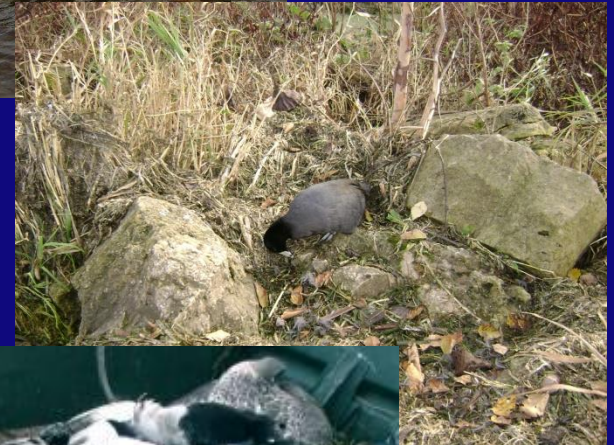


Life cycles

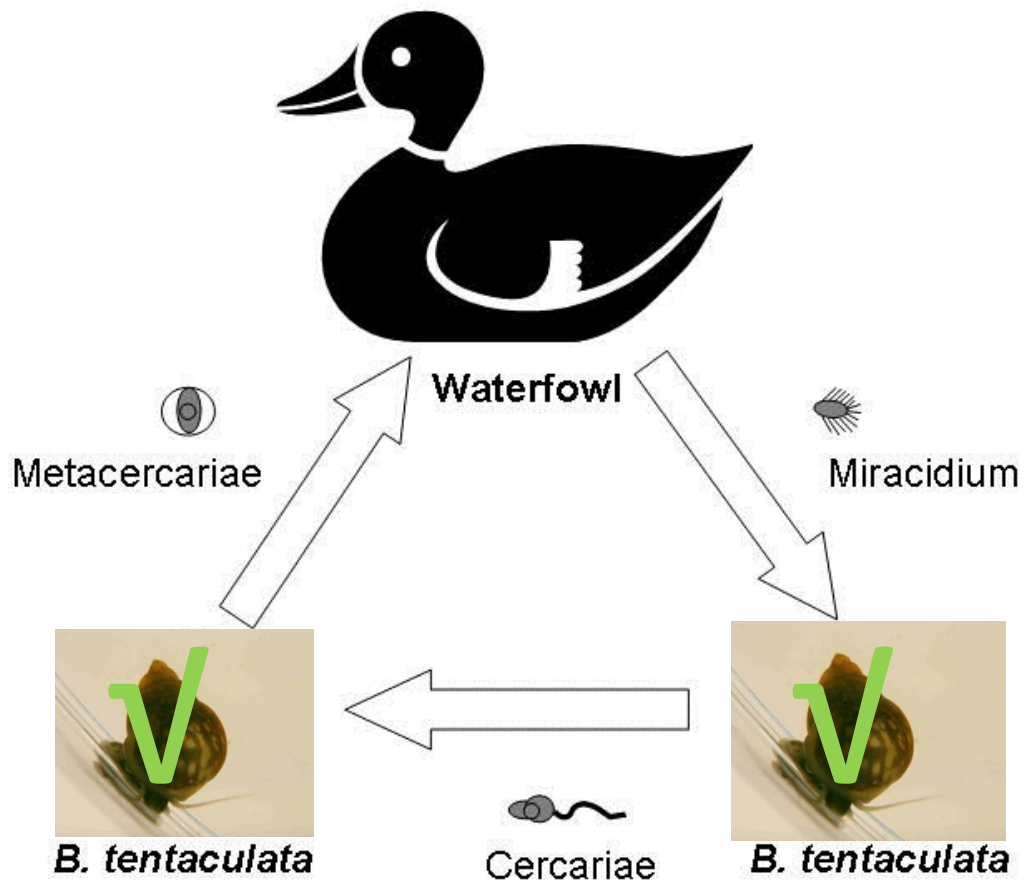


Mortality in the Upper Mississippi River

- Thousands of bird deaths each year
- > 80,000 deaths have been reported since 2002
- 13 species reported
- Thought to be further stressing avian populations already in decline



Bithynia as hosts for digenean worms in the Midwest?



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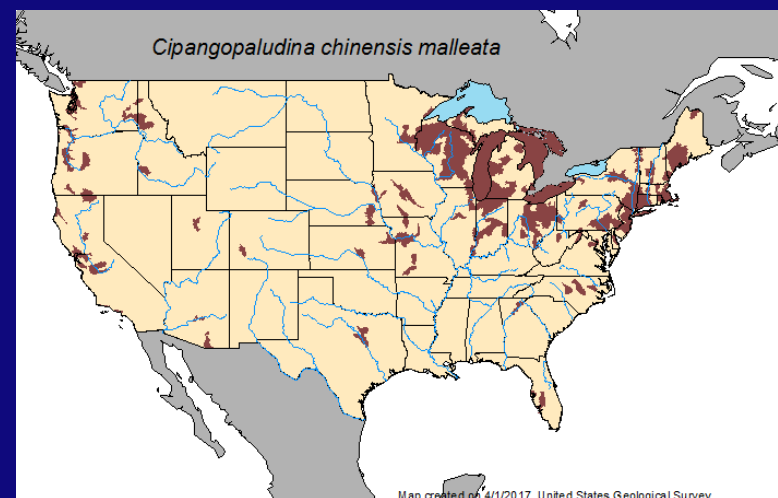
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Chinese Mystery Snails (CMS)

- Native to Asia
- First reported in San Francisco (1892)
- Currently reported from 834 sites just in Wisconsin (includes lakes and rivers)
- Suggested negative correlations between CMS densities and those of native snails
- Another concern: in its native range it hosts human digeneans



Wisconsin CMS assessment

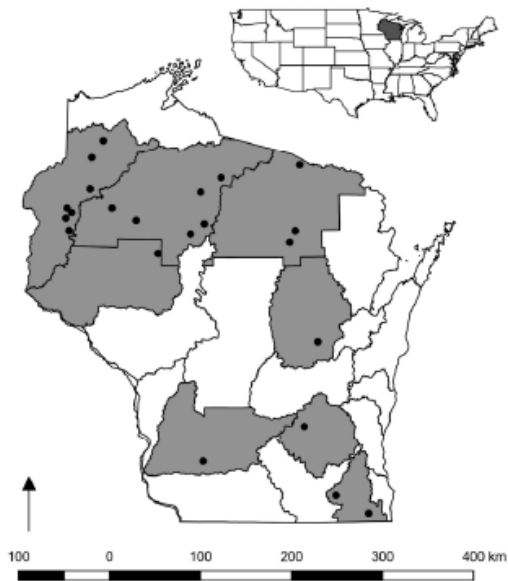
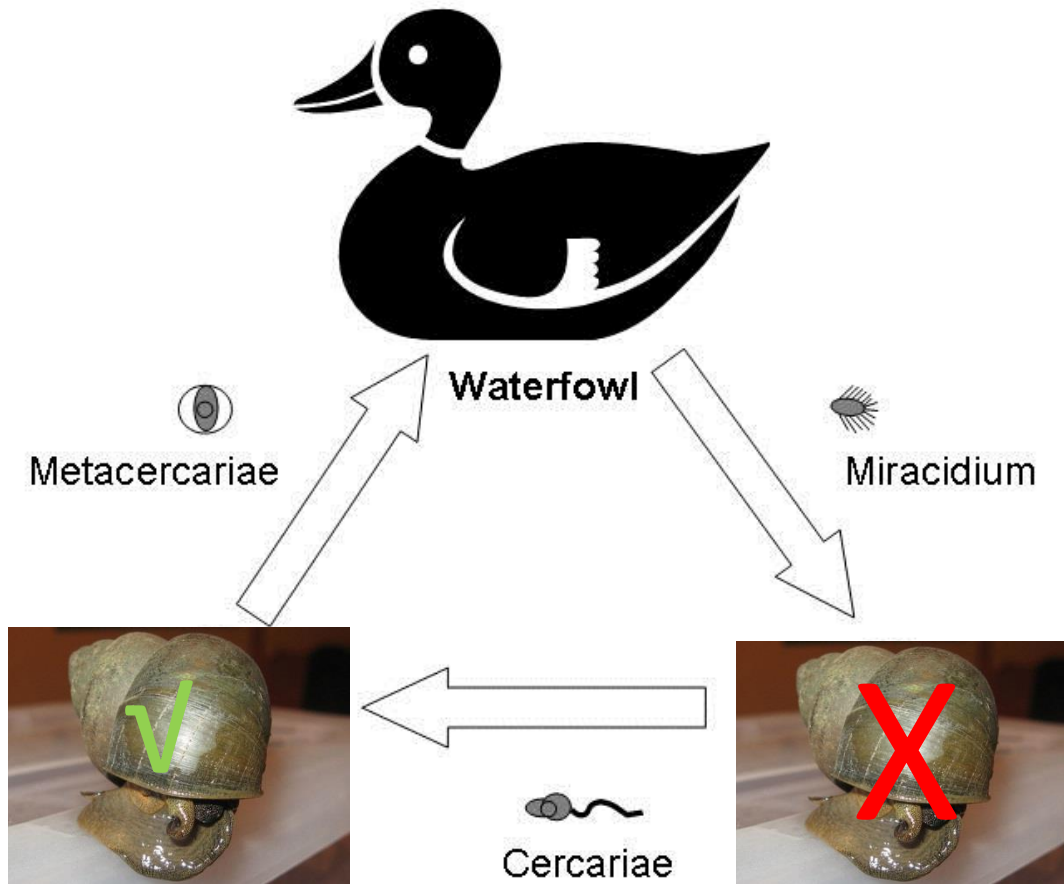


Figure 1. Inset: Map of the United States with study area, Wisconsin, indicated by filled polygon. Larger map: State of Wisconsin with major drainage basins outlined. Drainages sampled are shown in gray; the location of each lake with populations of CMS examined in this study indicated by filled black circle.

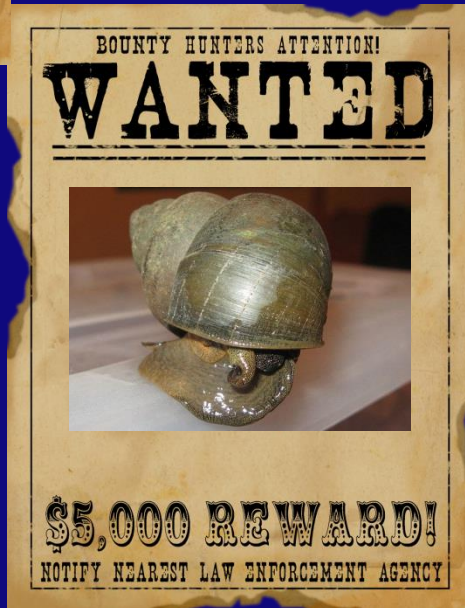
Table 1. Wisconsin drainage basins with number of lakes surveyed and number (n) of Chinese mystery snails (CMS) necropsied per basin. Number of infected CMS is also indicated. (* Indicates the watershed where one individual was infected with *Aspidogaster conchicola* and a second individual was infected with *Cyathocotyle bushiensis*).

Lake	n snails necropsied	n infections	Parasite species
Lake Poygan	1	0	
Sauntry's Pocket	1	0	
Ward Lake	14	0	
Antler Lake	15	0	
Big Blake Lake	1	0	
Camelia Lake	9	0	
Amacoy Lake	3	0	
Round Lake	15	0	
Sailor Lake	10	0	
Little Chelsea Lake*	4	2	<i>A. conchicola</i> , <i>C. bushiensis</i>
Mondeaux Flowage	16	0	
Hulls Lake	17	0	
Big Sand Lake	1	0	
Red Cedar	13	0	
Blackhawk Lake	1	0	
Lazy Lake	2	0	
Paddock Lake	3	0	
Powers Lake	4	0	
Kimbal Lake	1	0	
South Neva Lake	1	0	
Big Bass Lake	3	0	
Lincoln Lake	12	0	
	$n = 147$	$n = 2$	

CMS as hosts for digenean worms in the Midwest?

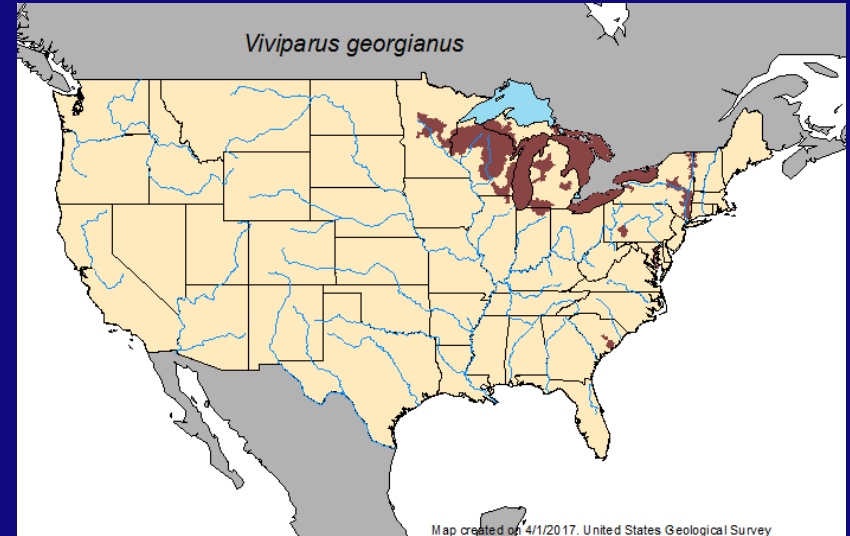


The Midwest's most wanted



Banded Mystery Snails

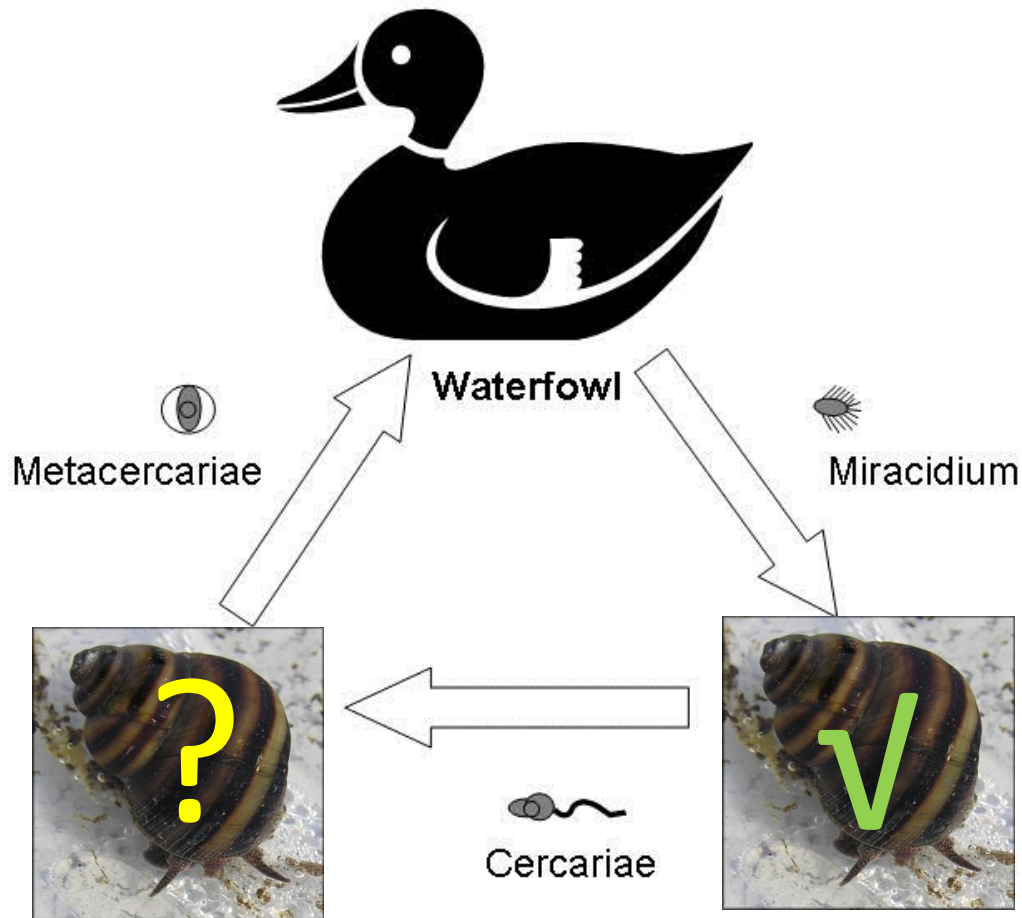
- Introduced from the south eastern region of the US
- First introduced into the Hudson River Drainage in 1867
- 3-4 year life span
- Reported from > 300 waterbodies in Wisconsin
- BMS can consume largemouth bass embryos when they invade nests



Banded Mystery Snails - infections

- Not well-studied
- Anecdotal report from New York suggested that BMS in can be “infected” by digenean parasites
- Last fall, student necropsies revealed a single digenean infection in this species
 - *Microphallus* sp. (non-human parasite)

BMS as hosts for digenean worms in the Midwest?



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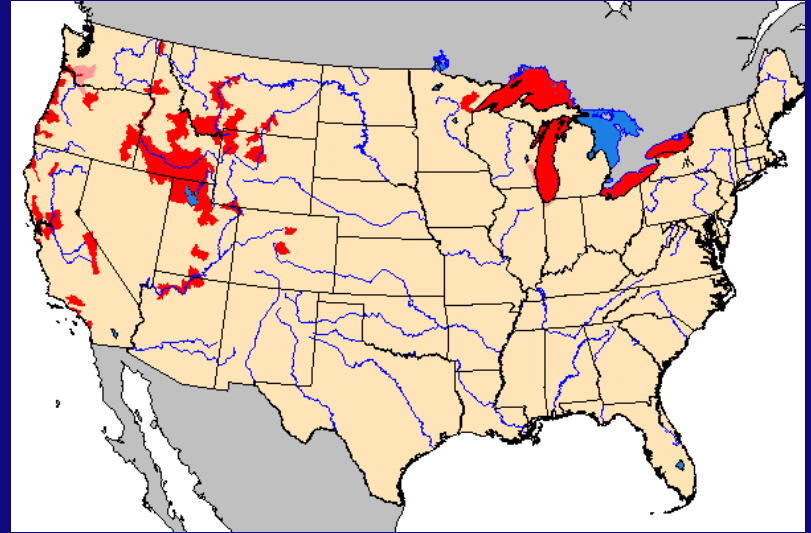
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New Zealand Mud Snail

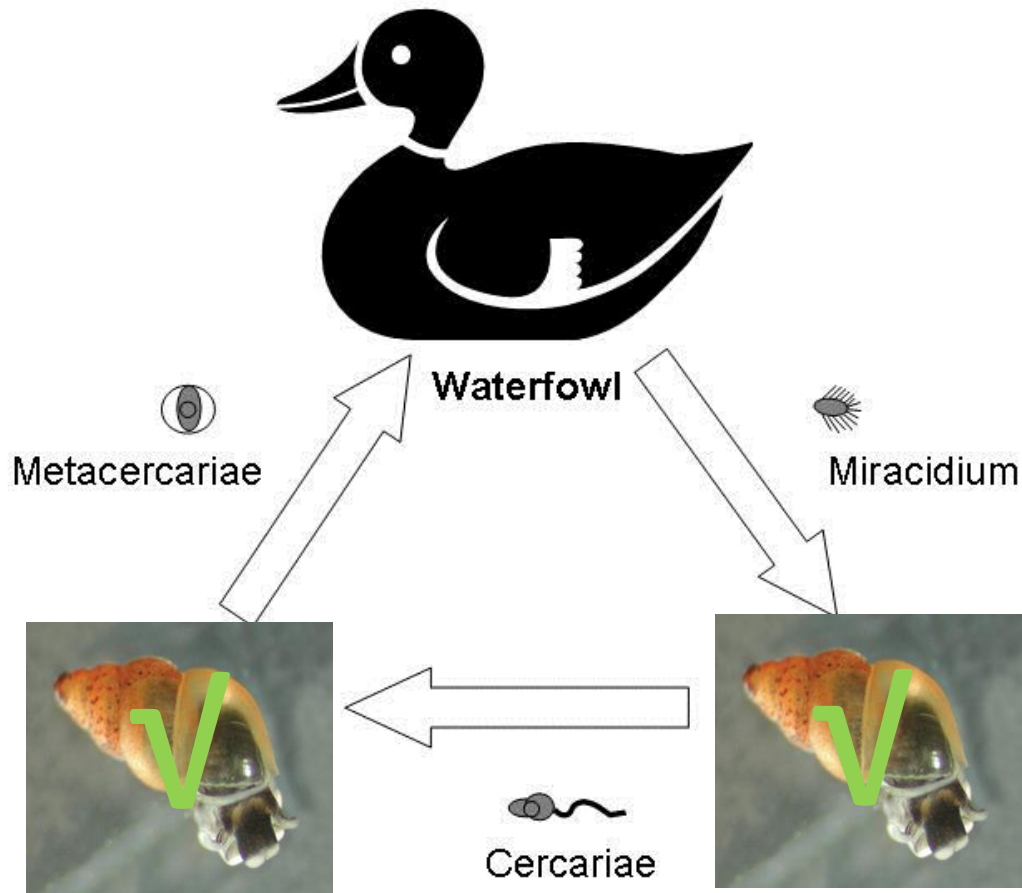
- Introduced from New Zealand
- Very small
- Asexual populations
- Half a million snails/m²
- Impacts on entire freshwater food webs by impacting invertebrates and fish



New Zealand Mudsnail infections

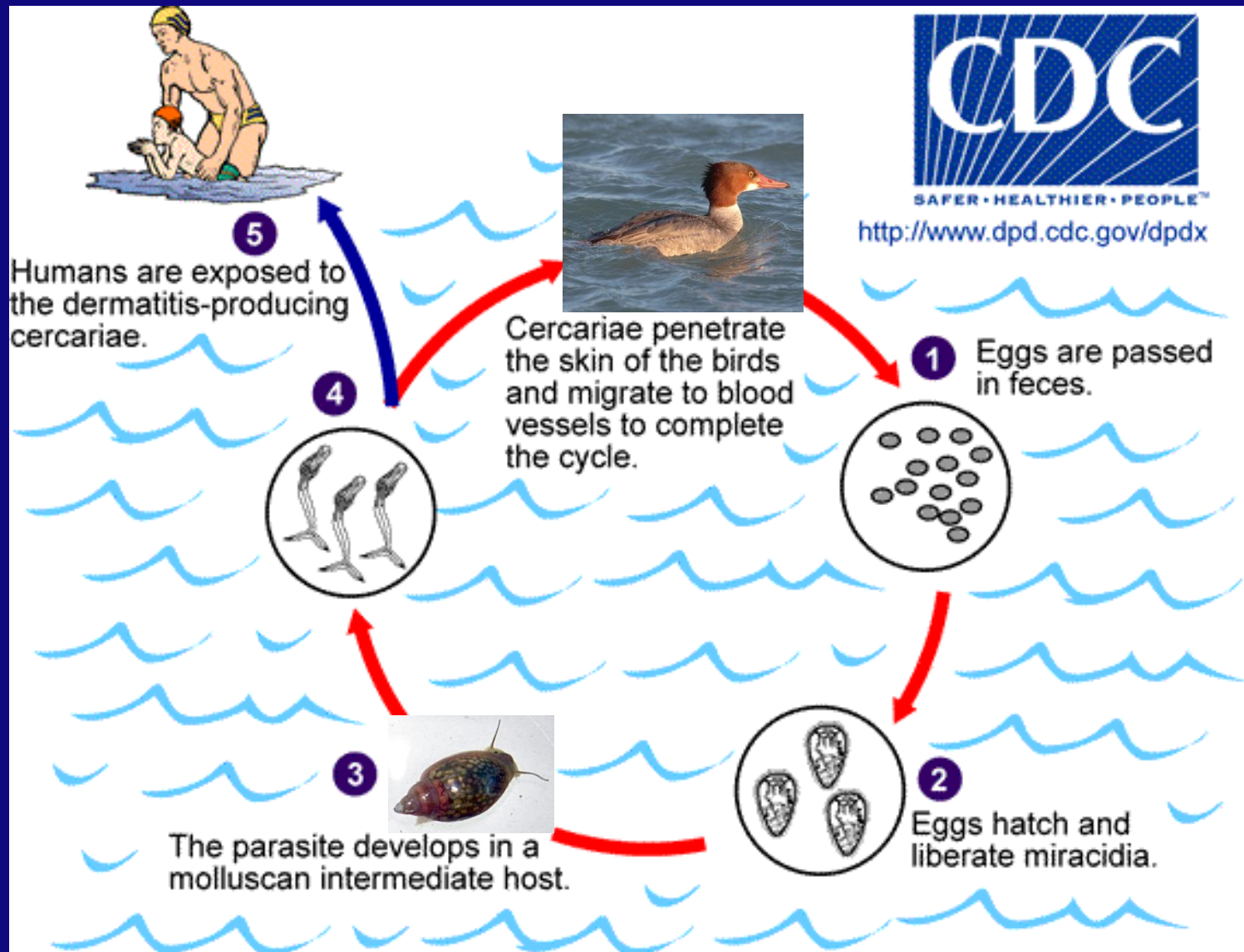
- 270 snails dissected from Lake Ontario tributary
 - NONE of the snails were infected (Karatayev et al. 2012. J. Shellfish Res.)
- 1210 snails assessed from Wyoming
 - 6 snails were infected with both digenean stages (Cohen et al. 2009. J. Parasitol.)

NZMS as hosts for digenean worms in the Midwest?



Can these invaders serve as hosts
for digeneans of human concern,
such as Swimmer's Itch?

Swimmer's Itch life cycle



Reported hosts for Swimmer's Itch digeneans

TABLE 1 Summary of general host use of known genera of schistosomes, reflecting current knowledge, habitat in the definitive host, and broad geographic locality

Genus	Snail host	Mammalian/avian host	Definitive host habitat	Locality	Aquatic habitat	Major areas for outbreaks
<i>Austrobilharzia</i>	Nassariidae, Batillariidae, Littoriniidae, Potamididae	Charadriiformes	Visceral	Global	Marine	Shallow marine areas, tidal pools
<i>Ornithobilharzia</i>	Batillariidae	Charadriiformes	Visceral	Global	Marine	Shallow marine areas, tidal pools
<i>Macrobilharzia</i>	Unknown	Suliformes (<i>Anhinga</i>)	Visceral	North America, Africa	Unknown	Unknown if causes dermatitis
<i>Bivitellobilharzia</i>	Unknown	Elephantidae, Rhinocerotidae	Visceral	Africa, Asia	Freshwater	Probably freshwater rivers
<i>Schistosoma</i>	Planorbidae, Lymnaeidae, Pomatiopsidae	Mammalia	Visceral, Nasal	Eurasia, Africa, South America	Freshwater	Mostly eutrophic ponds
<i>Heterobilharzia</i>	Lymnaeidae	Mammalia	Visceral	North America	Freshwater	Marshy areas
<i>Schistosomatium</i>	Lymnaeidae	Rodentia	Visceral	North America	Freshwater	Marshy areas
<i>Bilharziella</i>	Planorbidae	Anseriformes, Gruiformes, Ciconiformes, Podicipediformes	Visceral	Europe	Freshwater	Eutrophic ponds
Species isolated from <i>Haminoea</i>	Haminoeidae	Charadriiformes, Pelicaniformes	Visceral	North America	Marine	Shallow marine areas, tidal pools
<i>Gigantobilharzia</i> ^a	Physidae	Passeriformes	Visceral	North America	Freshwater	Marshy areas, usually with cattails
<i>Dendritobilharzia</i>	Planorbidae	Anseriformes, Gruiformes, Pelicaniformes, Gaviiformes	Visceral	Global	Freshwater	Unknown if reports of dermatitis
<i>Jilinobilharzia</i>	Unknown	Anseriformes (Anatidae)	Visceral	China	Unknown	Unknown if reports of dermatitis
<i>Allobilharzia</i>	Unknown	Anseriformes (swans)	Visceral	Northern Hemisphere	Unknown	Unknown if causes dermatitis
<i>Anserobilharzia</i>	Planorbidae	Anseriformes (geese)	Visceral	Northern Hemisphere	Freshwater	Eutrophic ponds, reservoirs
<i>Trichobilharzia</i>	Lymnaeidae, Physidae	Anseriformes (Anatidae)	Visceral, nasal	Global	Freshwater	Eutrophic ponds, glacial lakes, reservoirs

^a Since *Gigantobilharzia* is not a monophyletic genus, the information listed here is for *G. huronensis* only.

Reported hosts for Swimmer's Itch digeneans in freshwater systems

TABLE 1 Summary of general host use of known genera of schistosomes, reflecting current knowledge, habitat in the definitive host, and broad geographic locality

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To summarize.....

Snail species	Evidence of infections in North America	Evidence of harboring Swimmer's Itch
Faucet snails	✓	✗
Chinese Mystery Snail	✓	✗
Banded Mystery Snail	✓	✗
New Zealand Mudsnail	✓	✗



Faucet Snail



Chinese Mystery Snail



Banded Mystery Snail



NZ Mudsnail

To summarize.....

Snail species	Evidence of infections in North America	Evidence of harboring Swimmer's Itch	Potential to harbor Swimmer's Itch
Faucet snails	✓	✗	Low
Chinese Mystery Snail	✓	✗	Low
Banded Mystery Snail	✓	✗	Low
New Zealand Mudsnail	✓	✗	Low



Faucet Snail



Chinese Mystery Snail



Banded Mystery Snail



NZ Mudsnail

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