



Native Freshwater Mussels: The Coral Reef of the St. Croix

CENTER FOR AQUATIC MOLLUSK PROGRAMS

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Wednesday, April 22nd, 2020

Research
Survey and Monitoring
Propagation and Restoration



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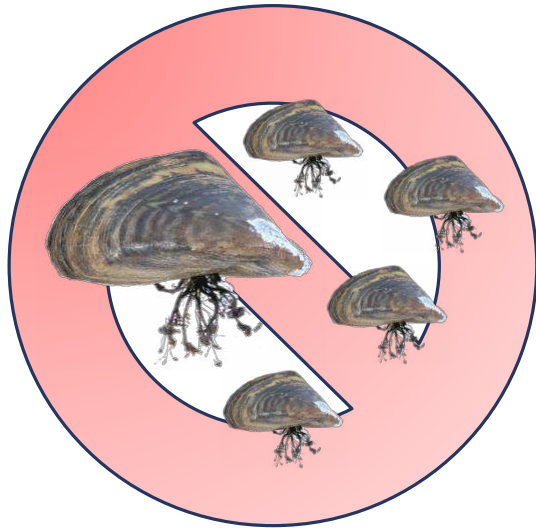


Freshwater Mussels

- WHY ARE THEY IMPORTANT
- UNIQUE LIFECYCLE
- CENTURY OF LOSS
- DNR MUSSEL PROGRAM

Invasive Mussels Vs. Native Mussels

Zebra and Quagga Mussels



Harmful Invasive Species

- Clog irrigation intakes and other pipes
- Compete with and smother native species
- Damage boat motors

Native Mussels

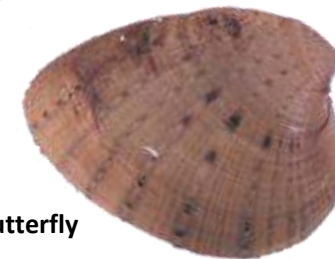
Vs.



Plain pocketbook

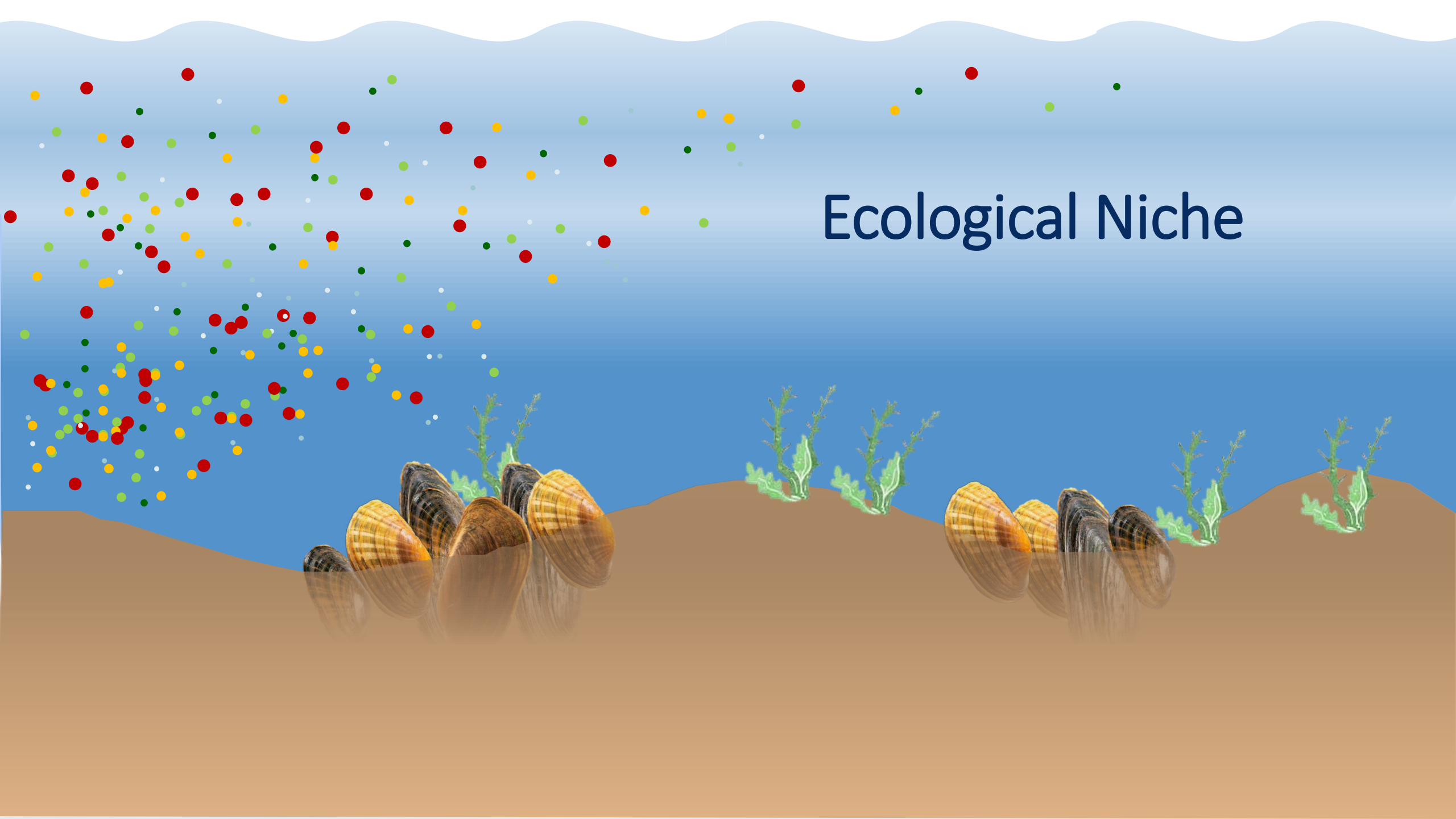


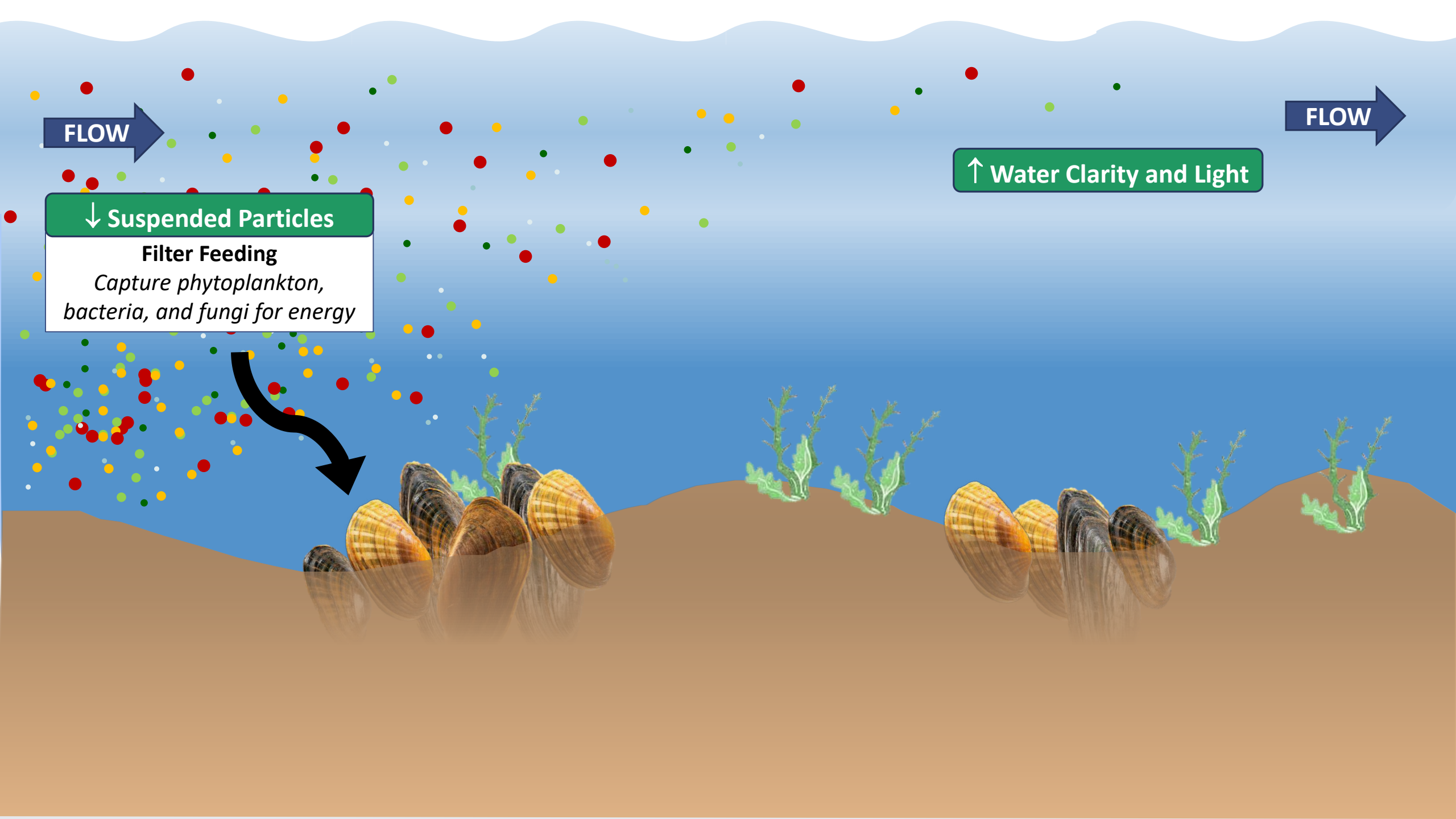
Spike



Butterfly

Ecological Niche





FLOW

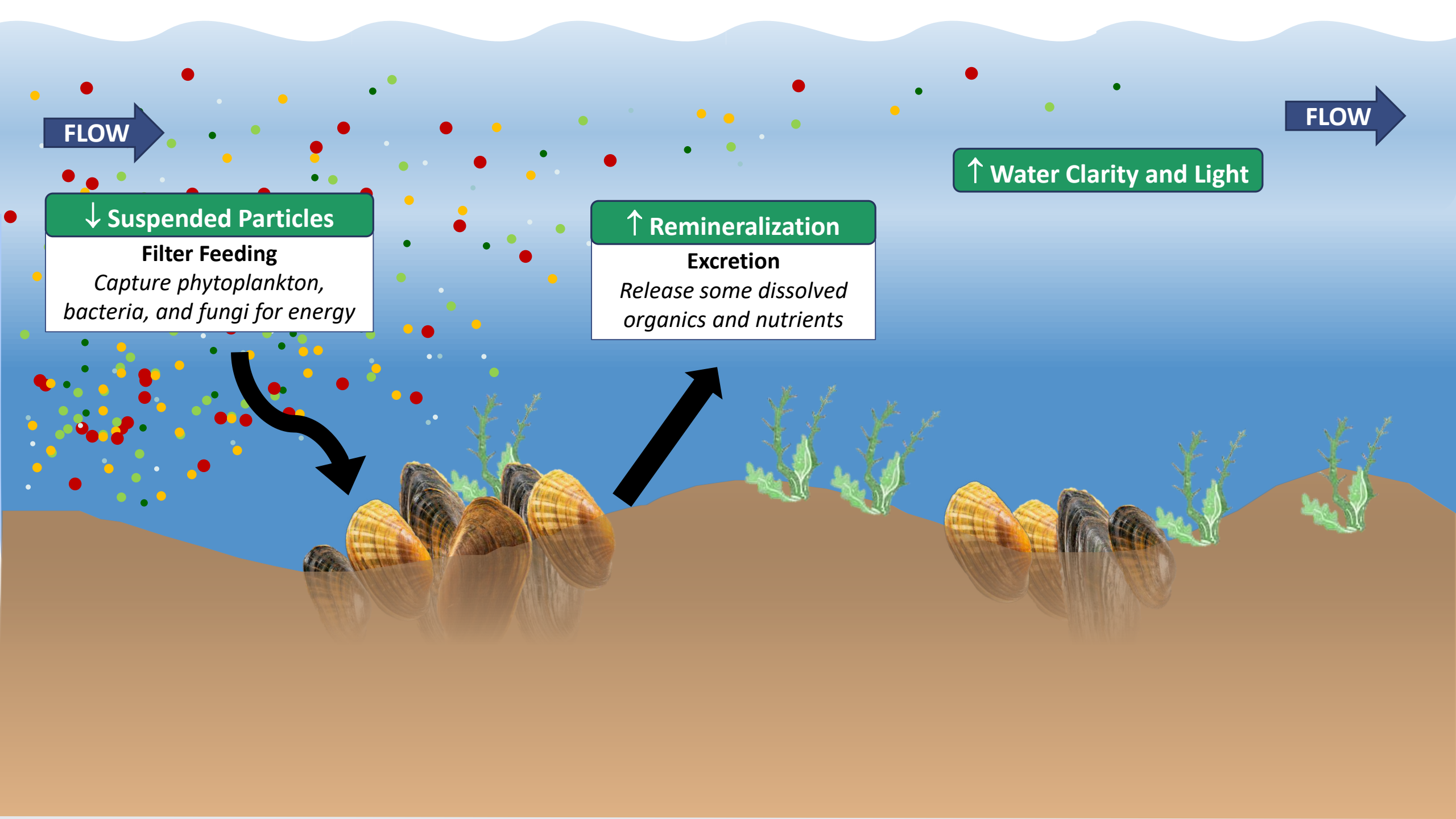
↓ Suspended Particles

Filter Feeding

*Capture phytoplankton,
bacteria, and fungi for energy*

↑ Water Clarity and Light

FLOW



FLOW

↓ Suspended Particles

Filter Feeding

*Capture phytoplankton,
bacteria, and fungi for energy*

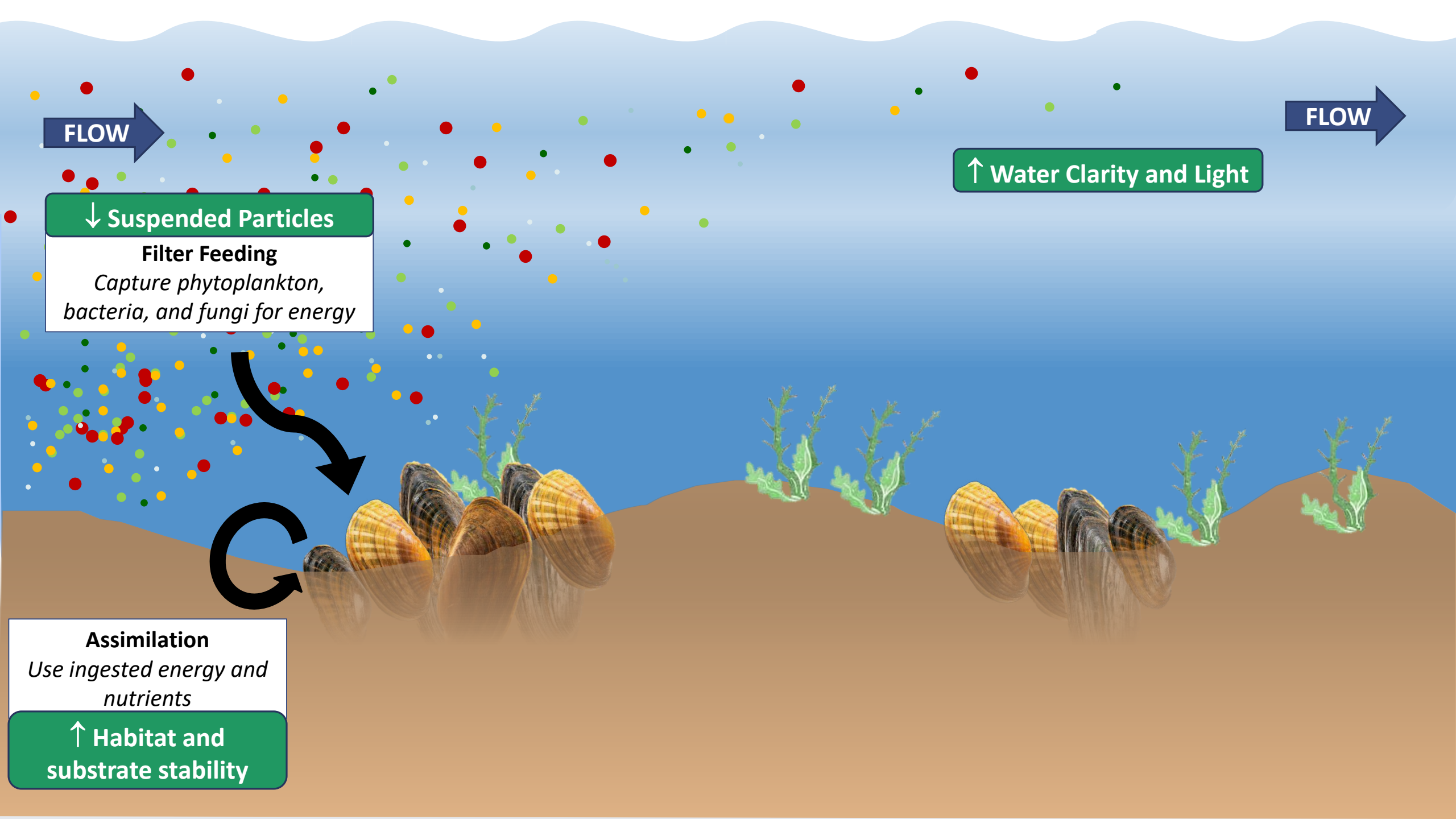
↑ Remineralization

Excretion

*Release some dissolved
organics and nutrients*

↑ Water Clarity and Light

FLOW



FLOW

↓ Suspended Particles

Filter Feeding

*Capture phytoplankton,
bacteria, and fungi for energy*

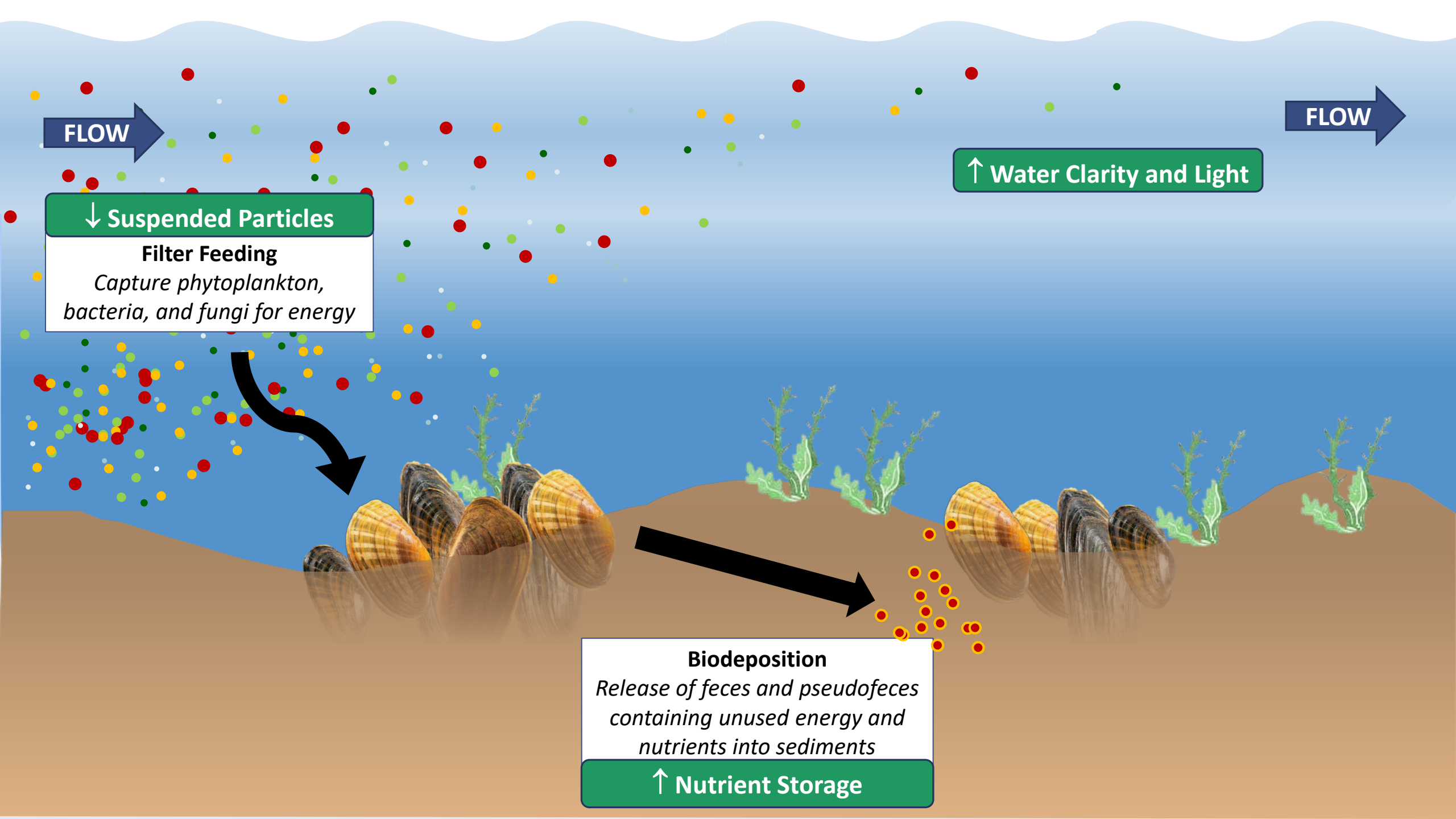
Assimilation

*Use ingested energy and
nutrients*

↑ Habitat and
substrate stability

↑ Water Clarity and Light

FLOW



FLOW

↓ Suspended Particles

Filter Feeding

*Capture phytoplankton,
bacteria, and fungi for energy*

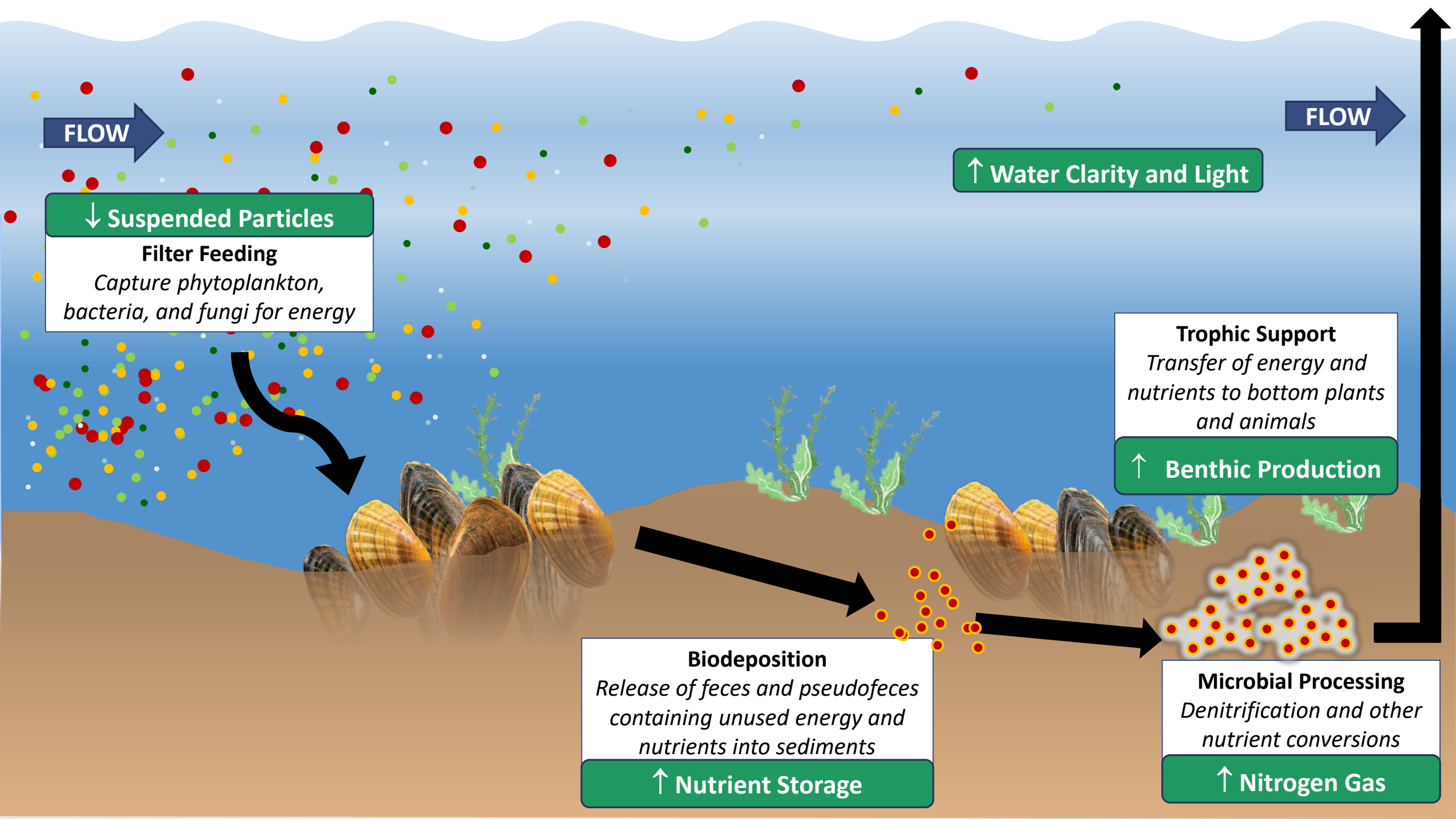
FLOW

↑ Water Clarity and Light

Biodeposition

*Release of feces and pseudofeces
containing unused energy and
nutrients into sediments*

↑ Nutrient Storage



FLOW →

FLOW →

↓ **Suspended Particles**

Filter Feeding
Capture phytoplankton, bacteria, and fungi for energy

↑ **Water Clarity and Light**

Trophic Support
Transfer of energy and nutrients to bottom plants and animals

↑ **Benthic Production**

Biodeposition
Release of feces and pseudofeces containing unused energy and nutrients into sediments

↑ **Nutrient Storage**

Microbial Processing
Denitrification and other nutrient conversions

↑ **Nitrogen Gas**

Ecosystem Engineers

- Mussels share energy with benthic organisms
- Aggregations of mussels create habitat – they are habitat

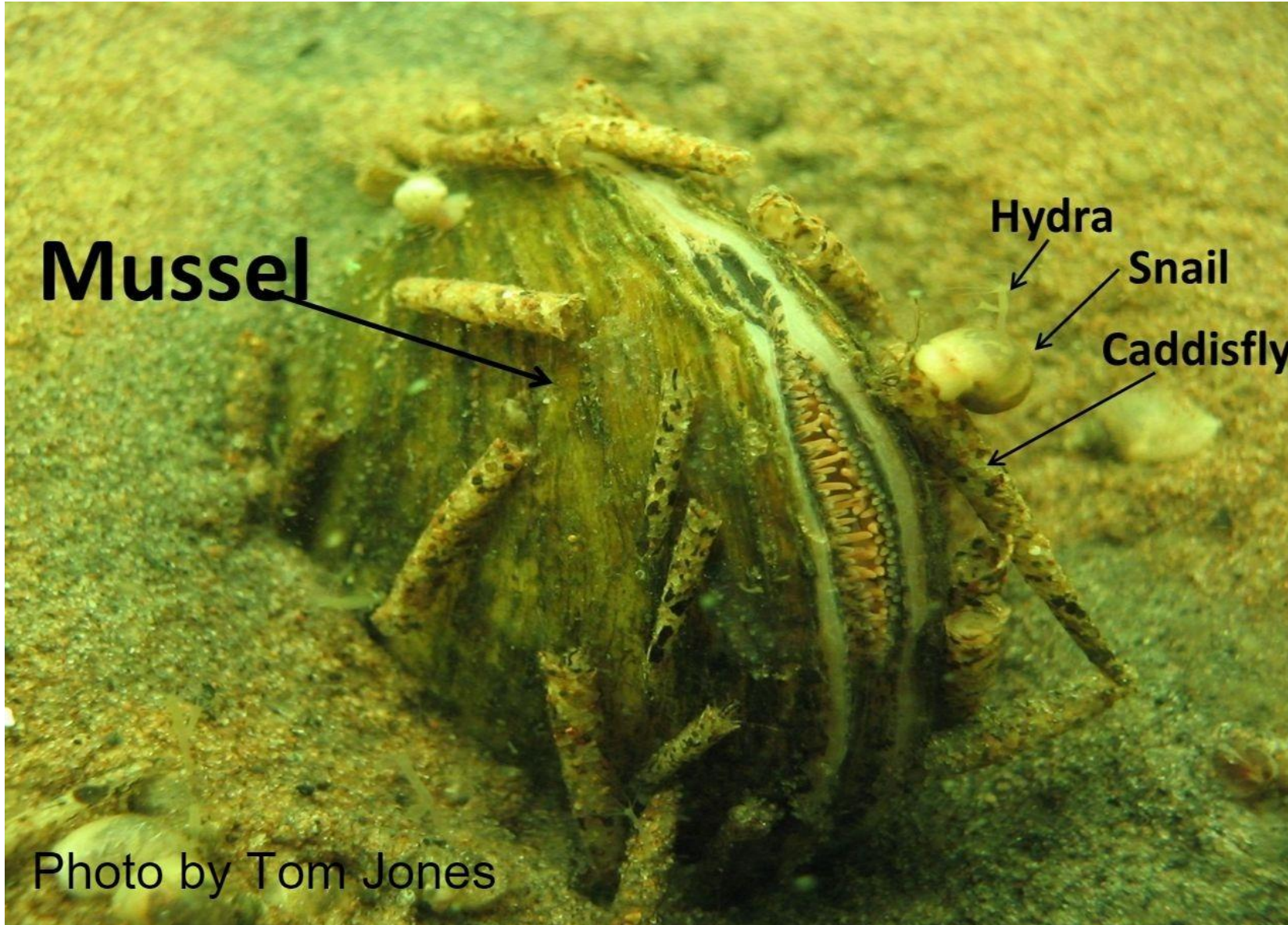
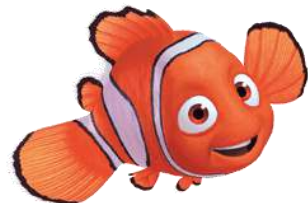


Photo by Tom Jones

Fish Love Mussel Beds

- Fish are attracted to this food source
- Fish serve as hosts to mussels
- A positive feedback loop is created that perpetuates the mussel bed
- **An aquatic version of a coral reef**

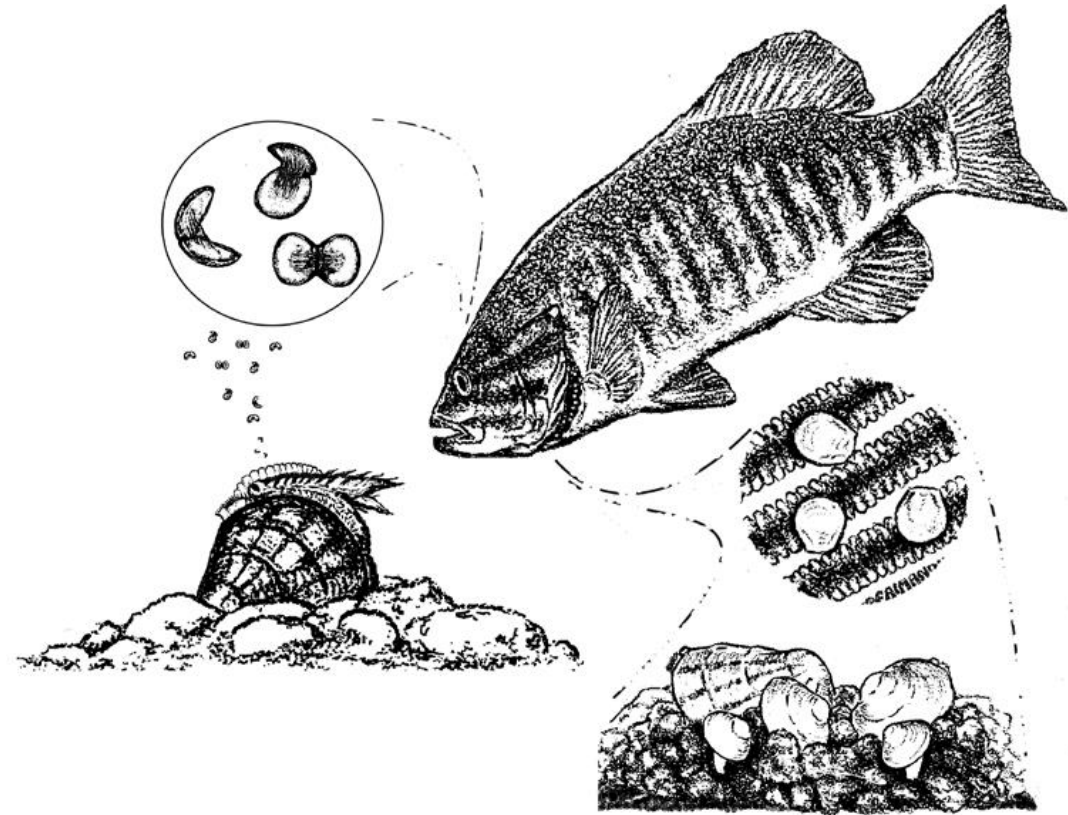


Mussel bed at foot of Lake Pepin, Mississippi River

Mussel Life History

Life cycle

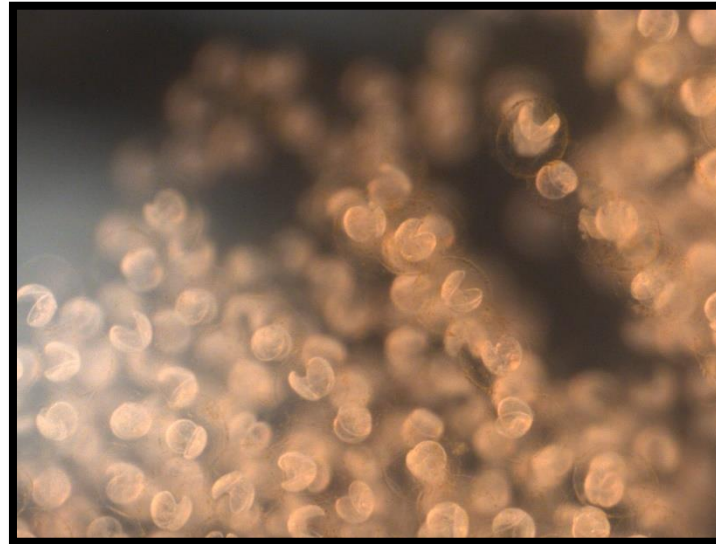
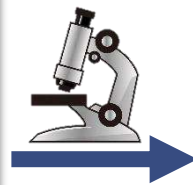
- Temporary **obligate** parasites
- Dispersal (primary function)



Mussel Life History

Life cycle

- **Glochidia:** larvae
- **Conglutiantes:** packets of larvae



Mussel Life History

Life cycle

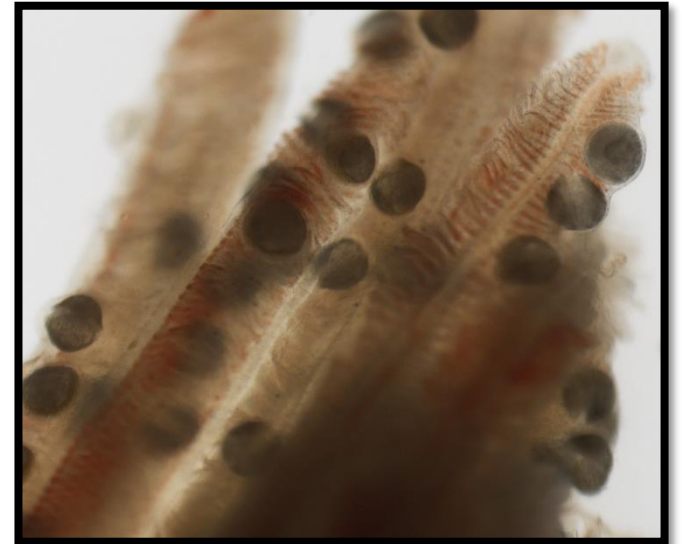
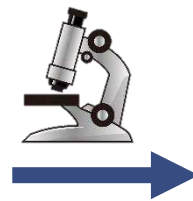
- 14-30 days attached to a fish



Mussel Life History

Life cycle

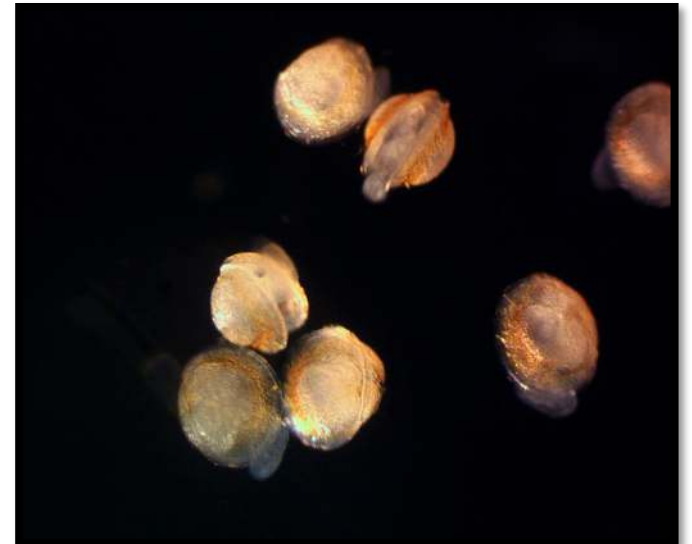
- 14-30 days attached to a fish



Mussel Life History

Life cycle

- **Fun Fact:** While adult mussels primarily feed by filtering, juveniles use their foot to help eat



Mussel Life History

Large Range of variation among species:

- Host associations
 - **Generalists** – Larvae transform on a variety of fish species

Threeridge



Giant floater



Rock pocketbook



Flutedshell



Mussel Life History

Large Range of variation among species:

- Host associations
 - **Generalists** – Larvae transform on a variety of fish species
 - **Specialists** – Larvae transform on a specific group of fish or just one species

Monkeyface



Minnows

Pink heelsplitter



Drum/ Sheephead

Purple pimpleback



Catfish

Hickorynut



Sturgeon

Higgins eye



Predator Fish

Mussel Life History

Large Range of variation among species:

- Host associations
 - **Generalists** – Larvae transform on a variety of fish species
 - **Specialists** – Larvae transform on a specific group of fish or just one species
- Host infection mechanisms
 - **Conglutinates**



Wabash Pigtoe

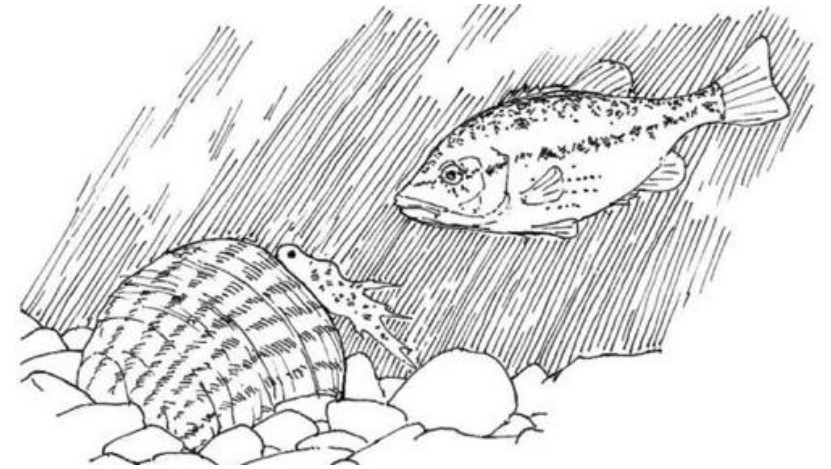


Spectaclecase

Mussel Life History

Large Range of variation among species:

- Host associations
 - Generalists
 - Specialists
- Host infection mechanisms
 - Conglutinates
 - Lures



Plain Pocketbook



Purple Watryback



Winged Mapleleaf



Fragile papershell

Nocturnal Behavior

Day



Night



Plain pocketbook

Fat Mucket

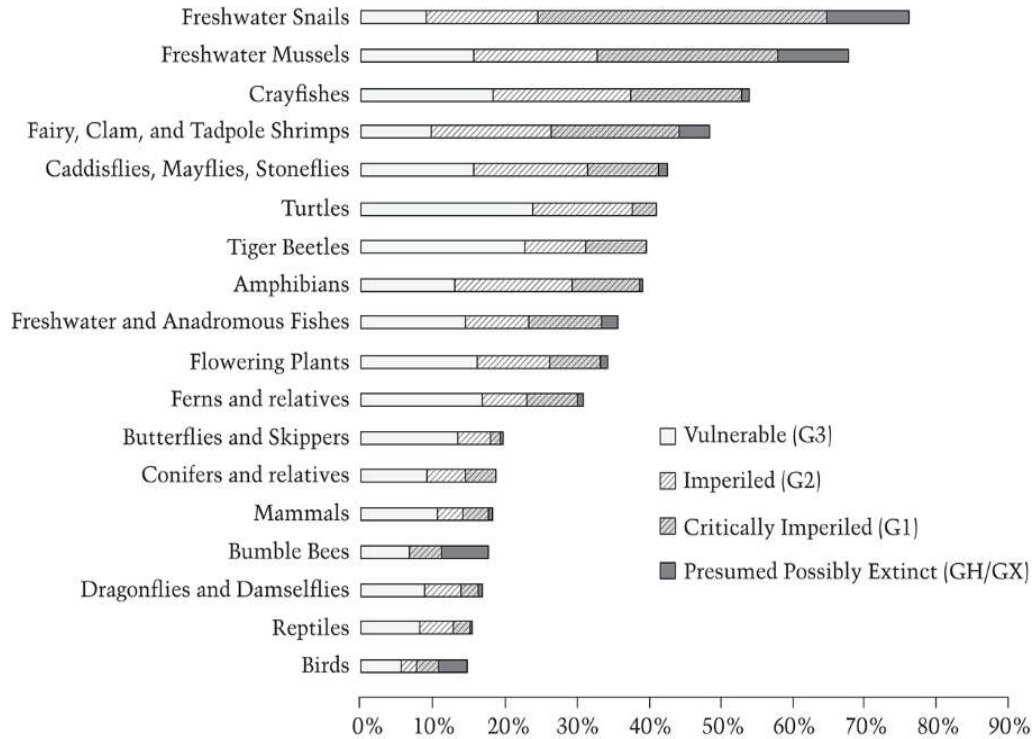
Black Sandshell

Photos taken by MN DNR staff in the St. Croix River at Interstate Park

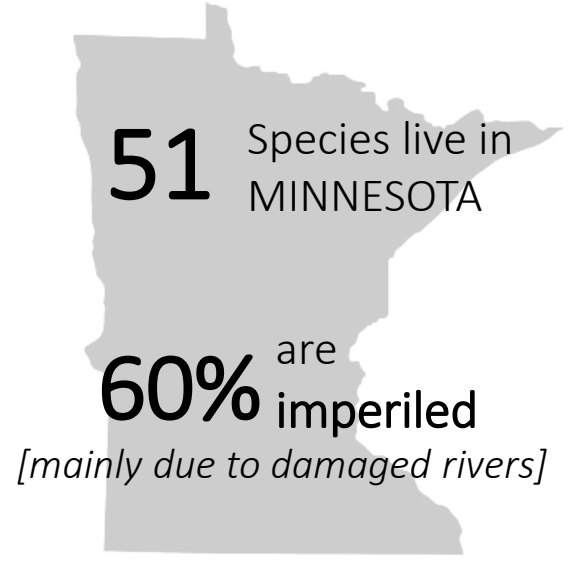
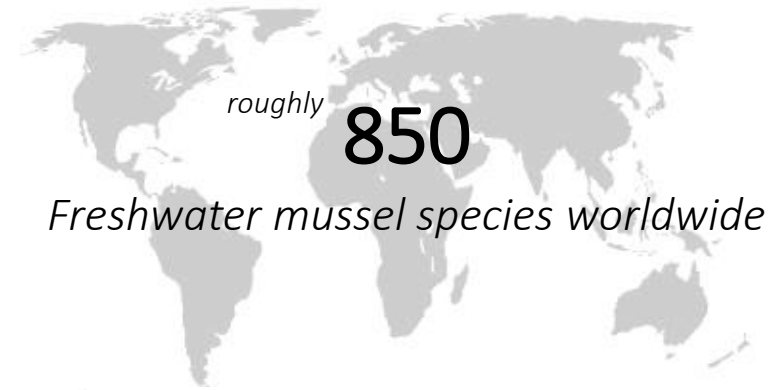
Catching a Host



One of the most imperiled aquatic groups



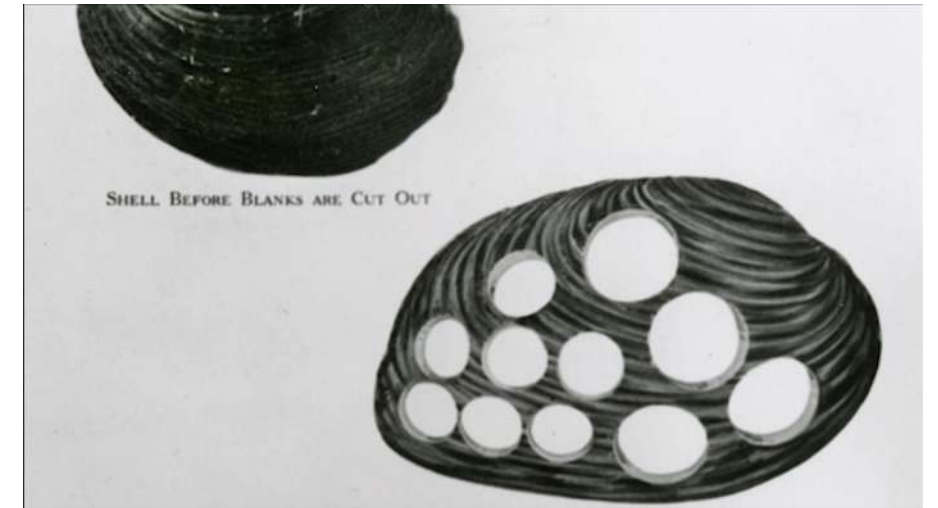
Patterson et al. (2018). *Freshwater Mussel Propagation for Restoration*. Cambridge University Press.



Pearl Button Industry



Harvesting mussels through the ice on the Mississippi River in Iowa (1889-1899)



Shells after blanks are cut out





Pollution and Sedimentation



Sewage mats on the Mississippi (May 1933)

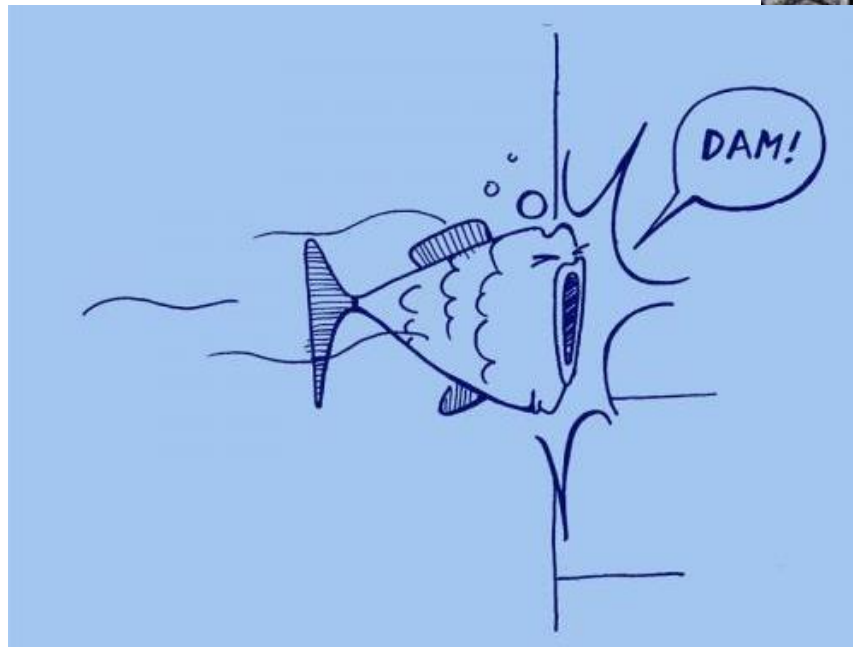


Unstable rivers lead to increased sedimentation within our rivers



Construction of Dams

- Fish Passage is impeded by the construction of dams



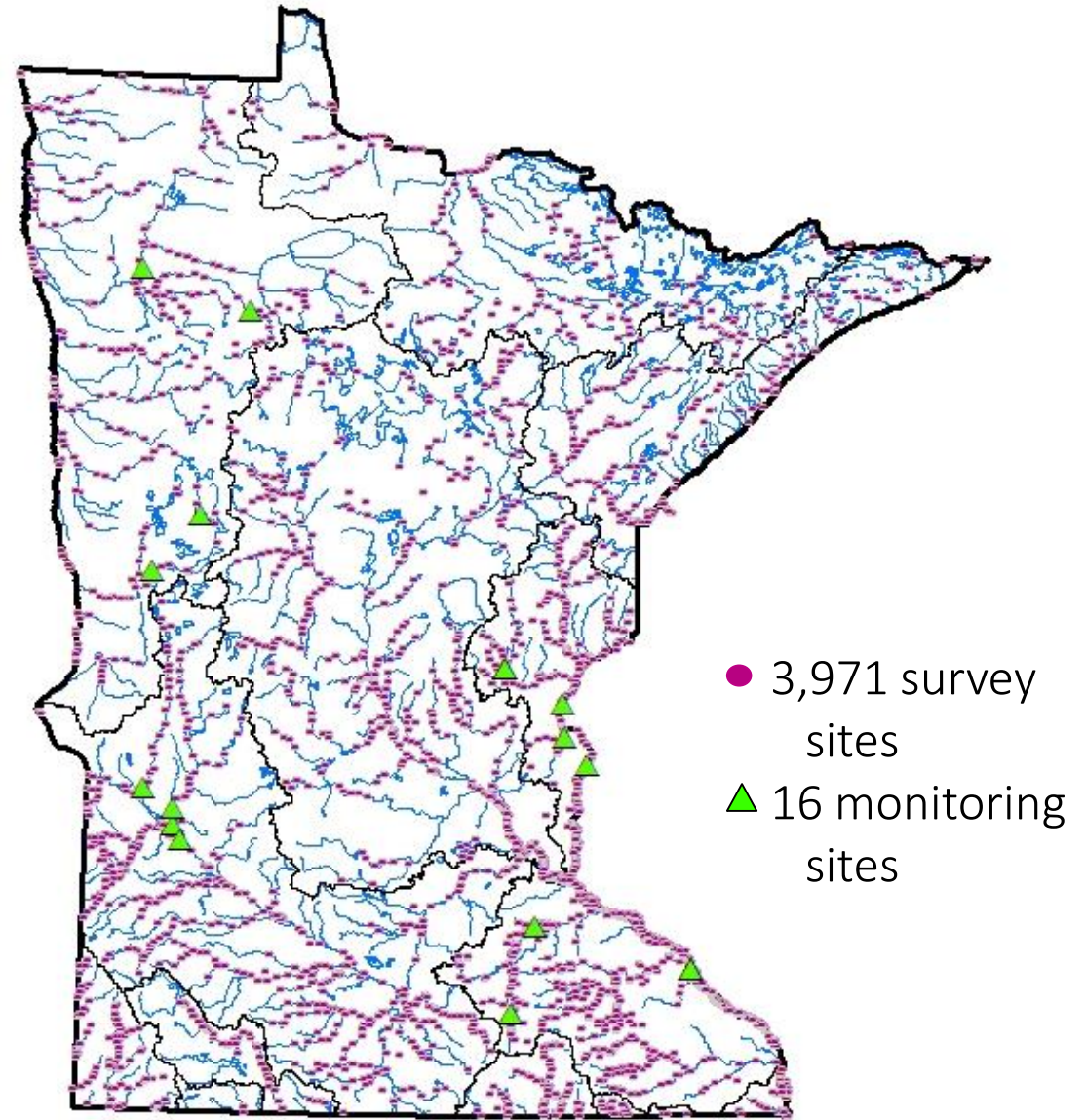
CAMP's Objectives

- Restore historic mussel species aggregations in select rivers and streams
- Reestablish self-sustaining mussel populations to **delist state endangered and threatened species**
- Engage and inform the public about the importance of aquatic ecosystems and the unique role that mussels play in benefiting people



Survey and Monitor

- Gather data on mussel abundance and health statewide



Survey and Monitor

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- Survey across Minnesota to establish mussel status



Survey and Monitor

- Gather data on mussel abundance and health statewide
- Survey across Minnesota to establish mussel status
- Monitor key habitat areas and restoration sites

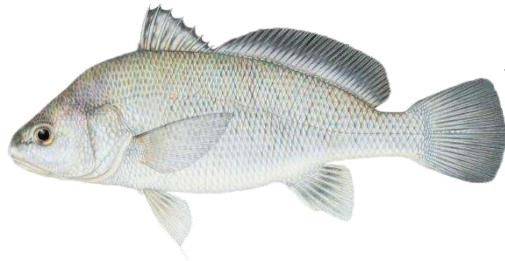


Research: Host Identification and Life History

- Reproductive cycle and timing
- Host attraction and larval infection mechanisms
- Host relationships
- Our lab has contributed to host fish identification for 20 species



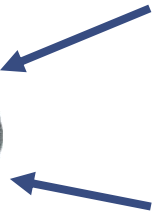
Pink heelsplitter



Deertoe



Butterfly



20⁺ year host enigma resolved at CAMP

- Spectaclecase



20⁺ year host enigma resolved at CAMP

- Spectaclecase



20⁺ year host enigma resolved at CAMP

- **Spectaclecase**

- Fish
- Mudpuppies
- Crayfish
- Several Insects

Species	Genera	Families	# Fish
74	51	24	584



20⁺ year host enigma resolved at CAMP

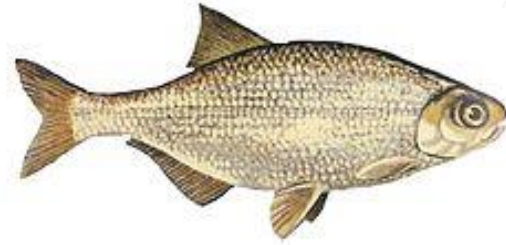


100+ year old Spectaclecase?
Host eliminated by dam in 1907

20⁺ year host enigma resolved at CAMP

- **Spectaclecase**

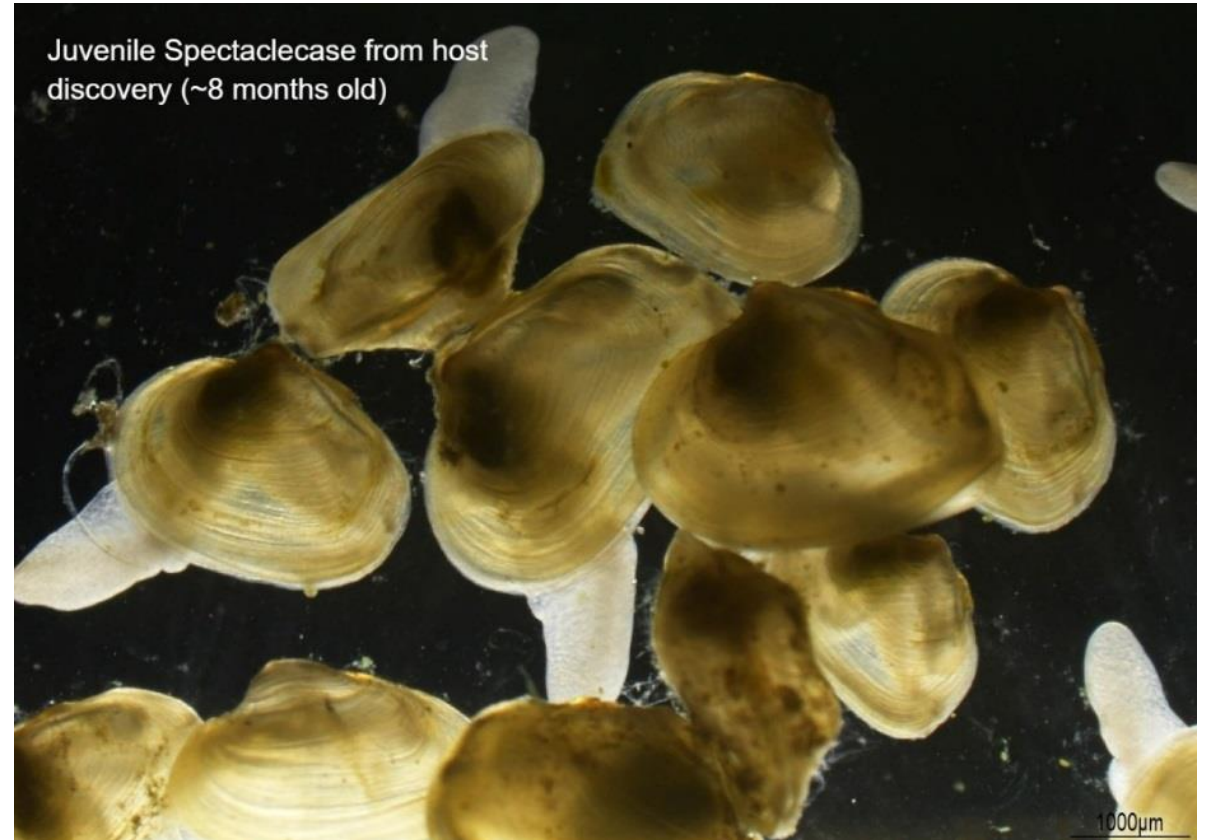
- Goldeye
- Mooneye



20⁺ year host enigma resolved at CAMP

- Spectaclecase

- Goldeye
- Mooneye



Laboratory Propagation and Rearing

- Goal is to re-establish important ecosystem goods and services provided by mussels
- Help state listed species recover
- Currently propagating and rearing seven species from three watersheds



Survey

Monitoring

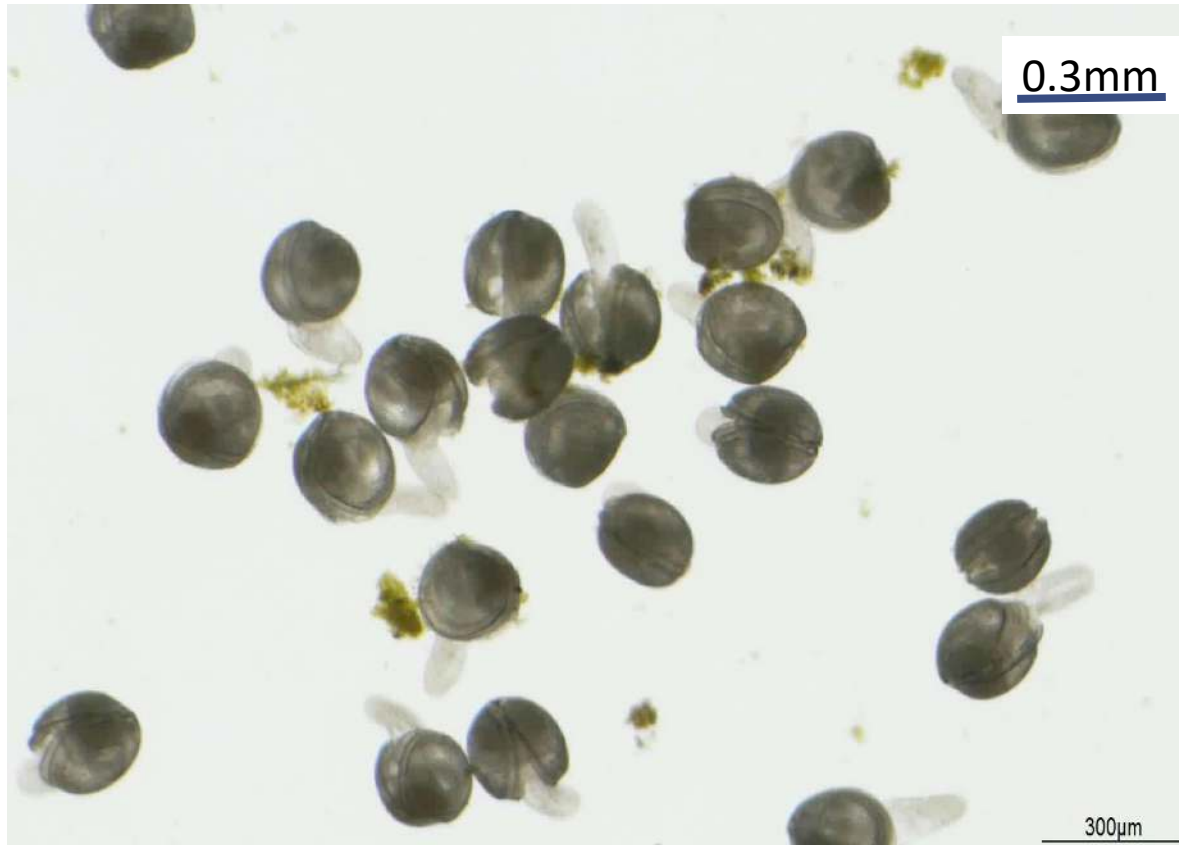
Research

Propagation

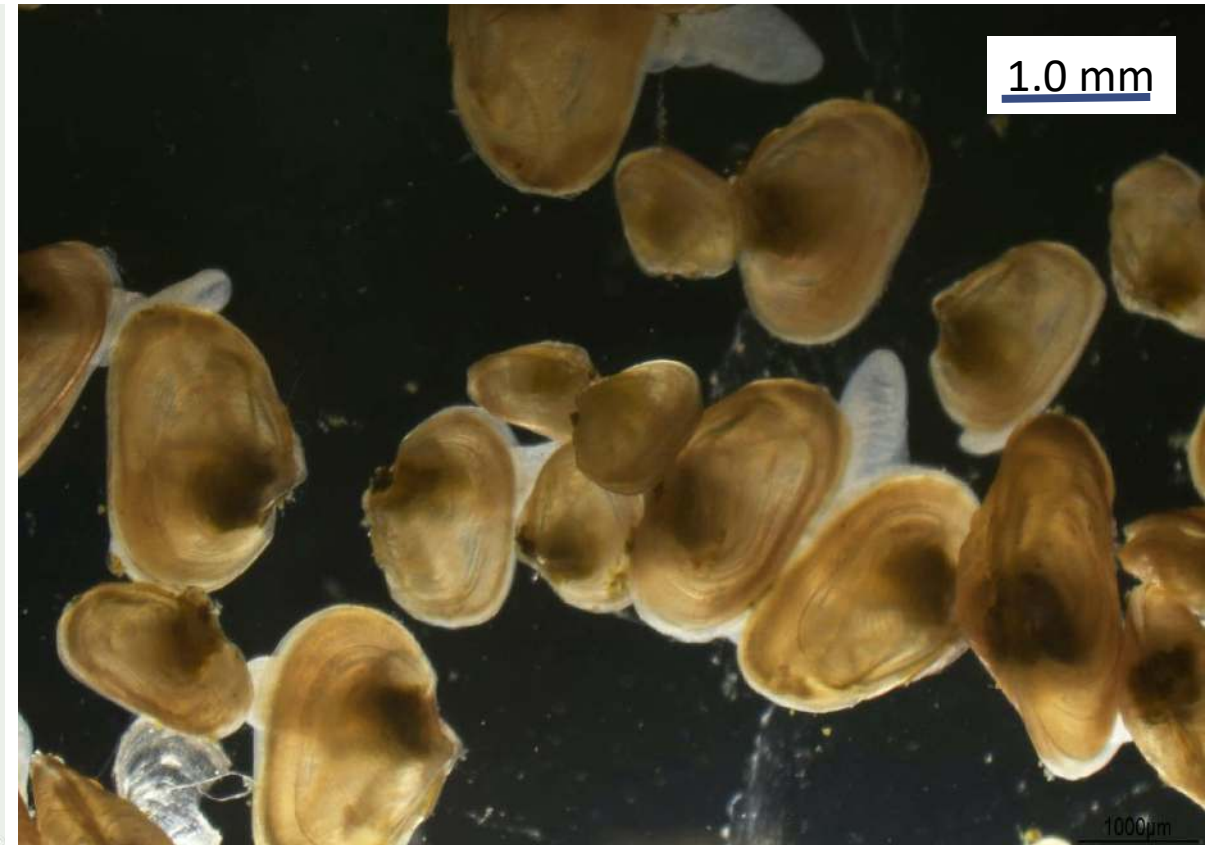
Restoration

Snuffbox juveniles (Federally Endangered)

Day 0



Day 92 / 13 weeks



Survey

Monitoring

Research

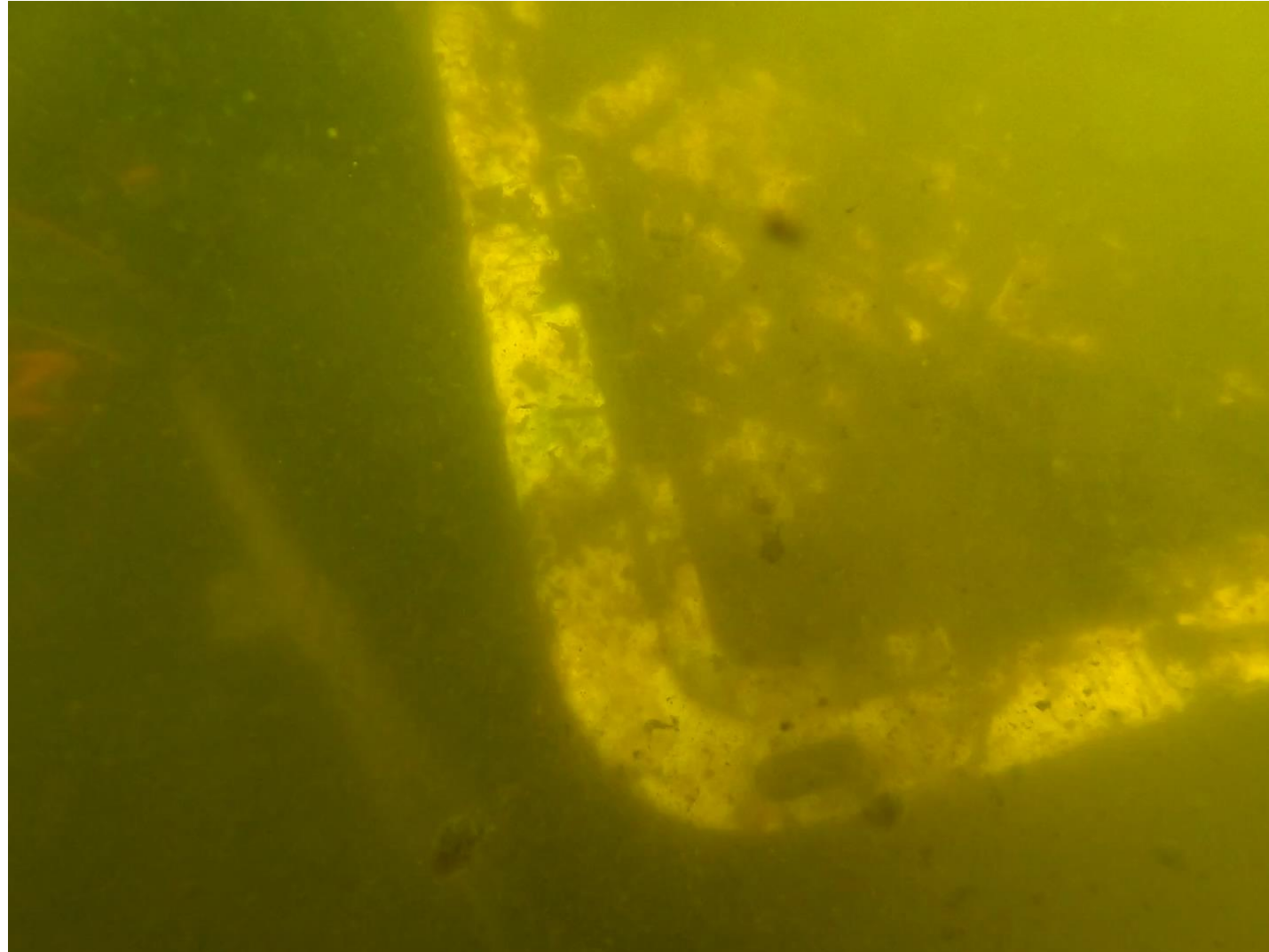
Propagation

Restoration

Outdoor Rearing

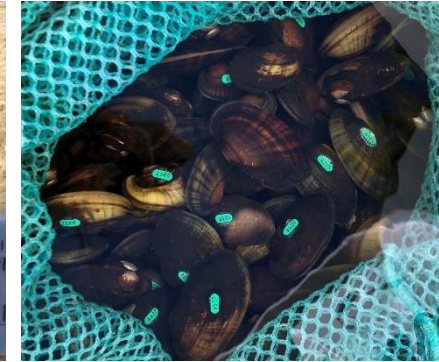


Checking Totes



Releasing Mussels

- Laboratory based propagation began in 2016
- In 2019, almost 2,500 juvenile mussels were released in the Cedar River near Austin, and Mississippi River near Hidden Falls



Survey

Monitoring

Research

Propagation

Restoration

Future Mussel Work in Minnesota

- Expand propagation and restoration to more species and streams
- Include mussels in stream restoration projects
- Include mussels in watershed assessments and monitoring

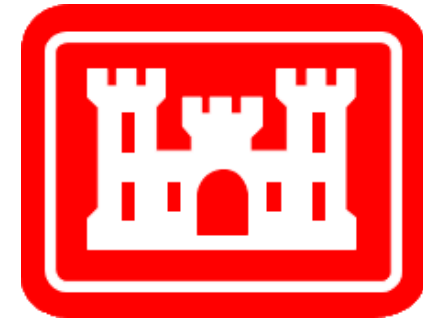


You Can Get Involved

- Wisconsin Mussel Monitoring Program - The Wisconsin Aquatic
- Iowa Mussel Blitz
- iNaturalist
- Minnesota Mussel Newsletter



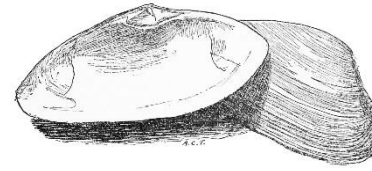
Funding provided by



With collaborative support from:



The Mussel Program Staff



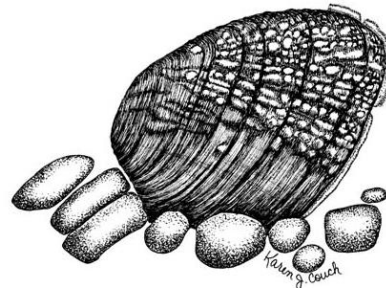
Bernard Sietman, left
Mike Davis, right



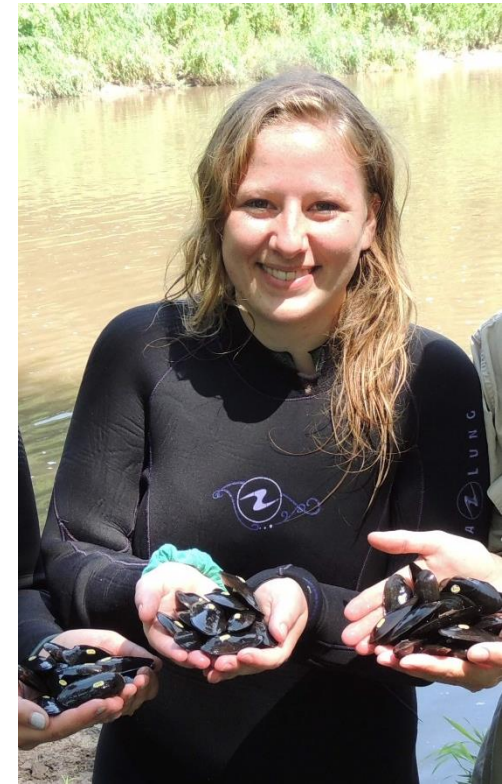
Madeline Pletta



Lindsay Ohlman



Zeb Secrist



Anna Scheunemann

