

# Freshwater Mussel Propagation

KEEPING COMMON SPECIES COMMON AT THE URBAN STREAM RESEARCH CENTER



URBAN STREAM RESEARCH CENTER – FOREST PRESERVE DISTRICT OF  
DUPAGE COUNTY

# The Urban Stream Research Center

- ▶ Opened in 2012
- ▶ Superfund Project – USEPA
- ▶ 8.2 miles of river restoration
  - ▶ West Branch DuPage River
  - ▶ Kress Creek (tributary)
  - ▶ 2 Dam removals





# Programs at the USRC

- ▶ Aquatic Species Recovery Program
- ▶ Aquatic Monitoring and Research Program
- ▶ Hines Emerald Dragonfly and Great Plains Mudbug Captive Rearing Program
- ▶ Fisheries and Lake Management Program





# Outreach Opportunities

- ▶ Educational tours provided by Community Engagement Services
  - ▶ 2021
    - ▶ 115 visitors for open house
    - ▶ 78 students on separate fieldtrip dates
  - ▶ 2022
    - ▶ 4 schools
    - ▶ 80 students
    - ▶ More tours scheduled for Fall including open house
- ▶ Tours for local environmental groups provided by USRC staff







Why Care  
About  
Freshwater  
Mussels?

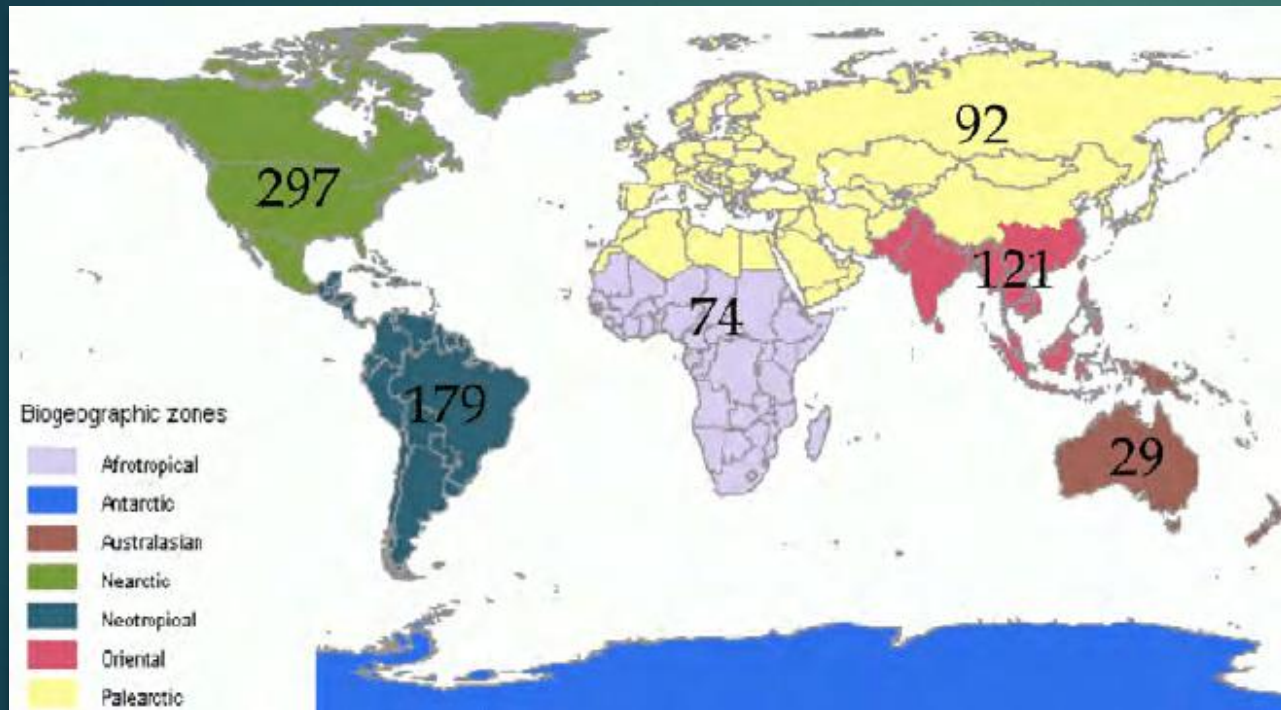


# Provide Ecosystem Services

- ▶ Filter 6 – 20 gallons of water a day
- ▶ Uptake heavy metals, pollutants, chemicals, and pharmaceuticals
- ▶ Diet consists of zooplankton, detritus, bacteria, diatoms, and algae.
- ▶ "they are the livers of the rivers"  
"biological water treatment plants"
- ▶ Provide habitat for other aquatic organisms
- ▶ Stabilize the riverbeds
- ▶ Source of food for other animals
  - ▶ Otters
  - ▶ Raccoons
  - ▶ muskrats



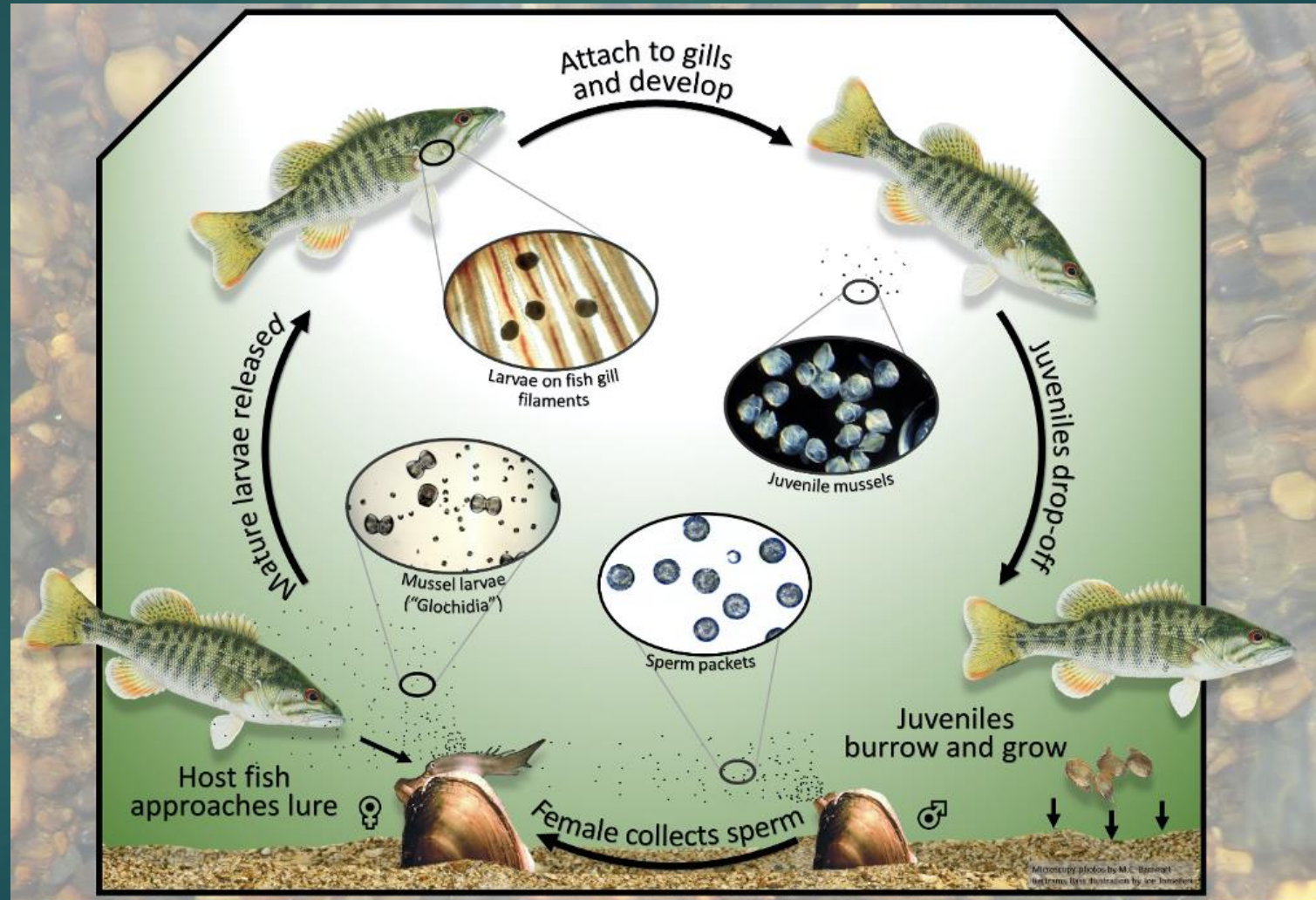
# The Most Imperiled Animal in the World



- ▶ Numbers Declining due to
  - ▶ Pollution
  - ▶ Loss of instream habitat
  - ▶ Dams and impoundments
    - ▶ Loss of fish hosts
  - ▶ Stream channelization
  - ▶ Invasive species
  - ▶ Siltation caused by erosion



# Life Cycle of a Freshwater Mussel





# Larval Attachment Techniques - Lure



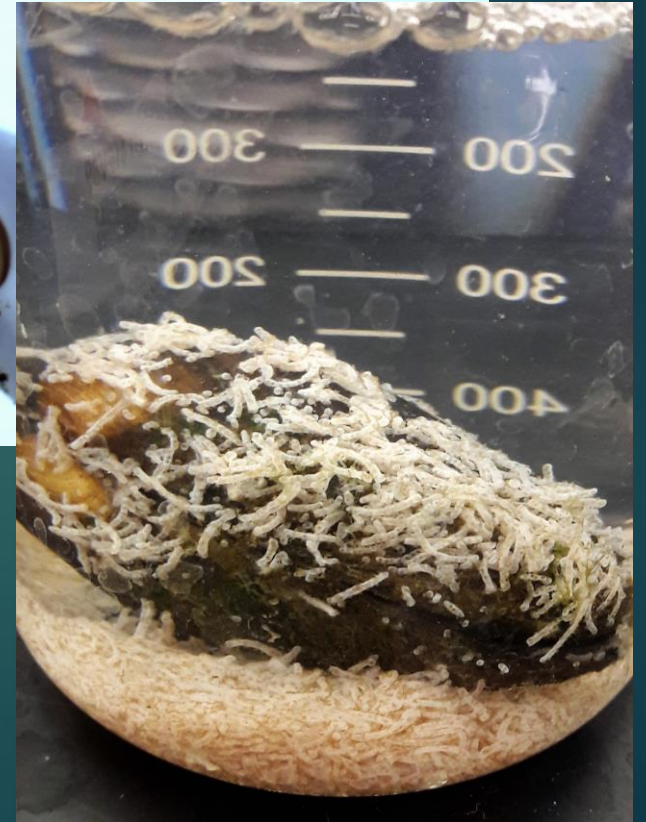
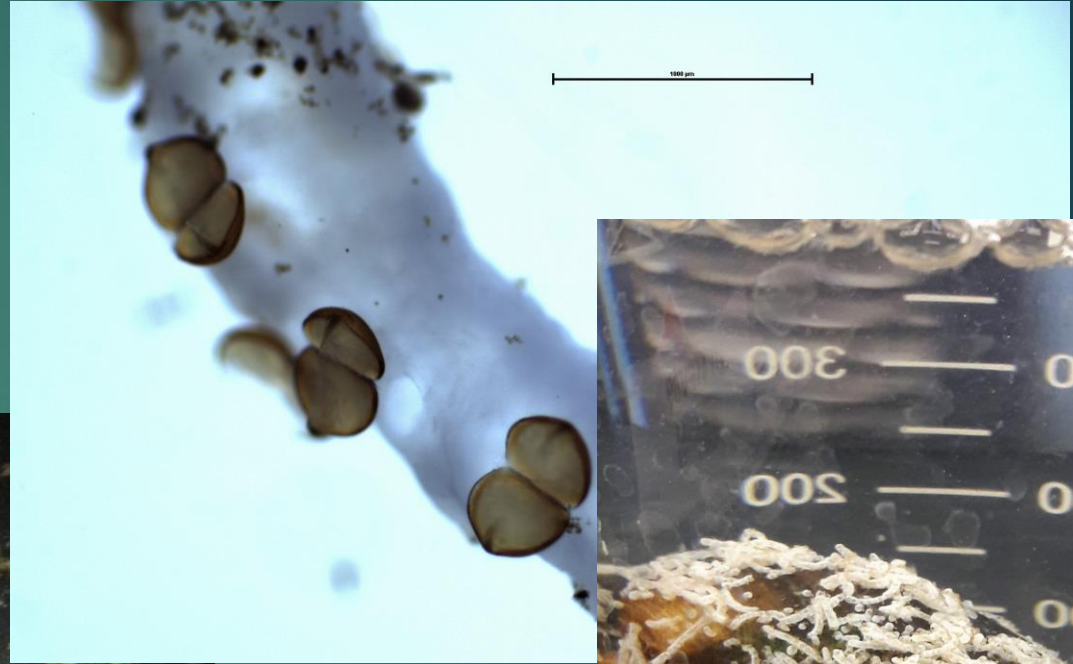
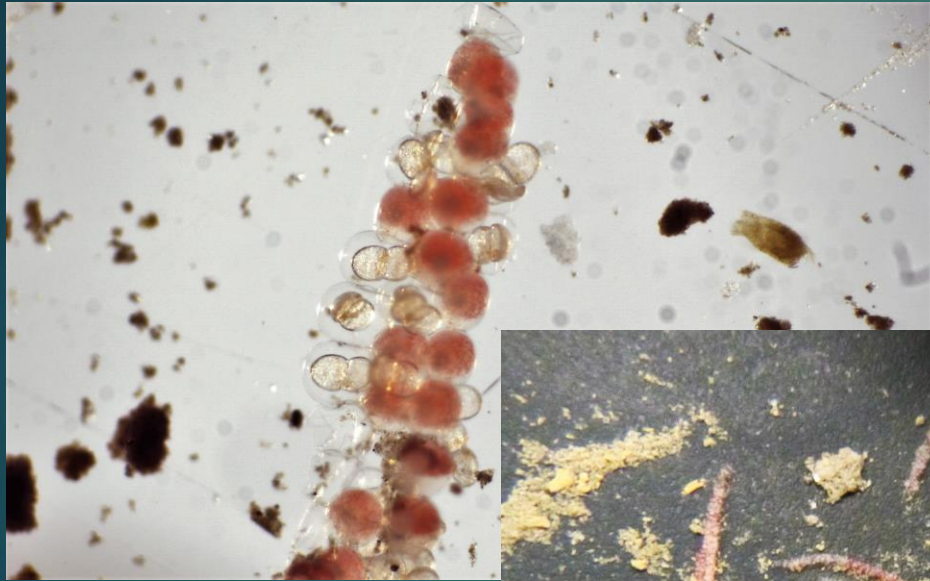
*Villosa iris*  
Swan Creek, Taney Co., Missouri  
Copyright © 1999 Wm. Roston



Black sandshell (*Ligumia recta*)  
Sac River, Missouri  
© M. C. Barnhart 2002



# Larval Attachment Techniques - Conglutinate







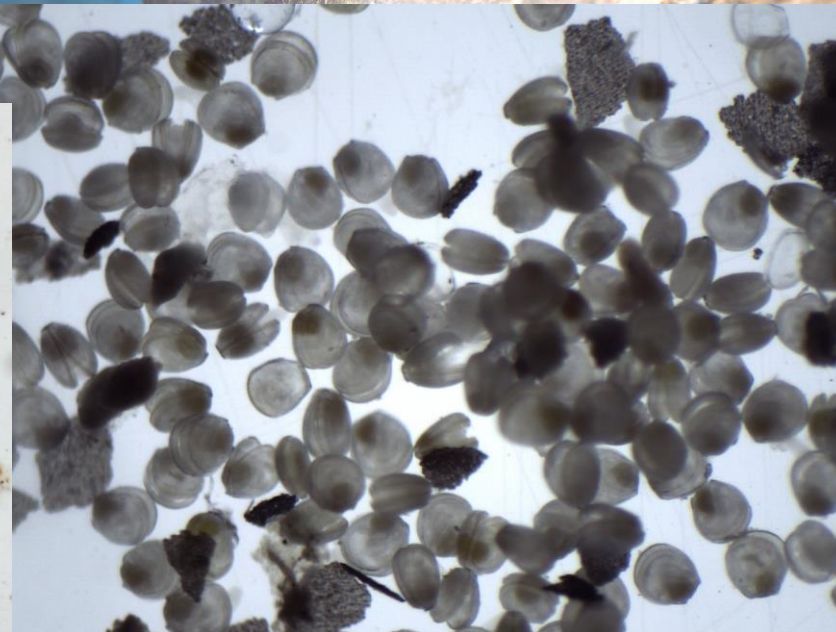
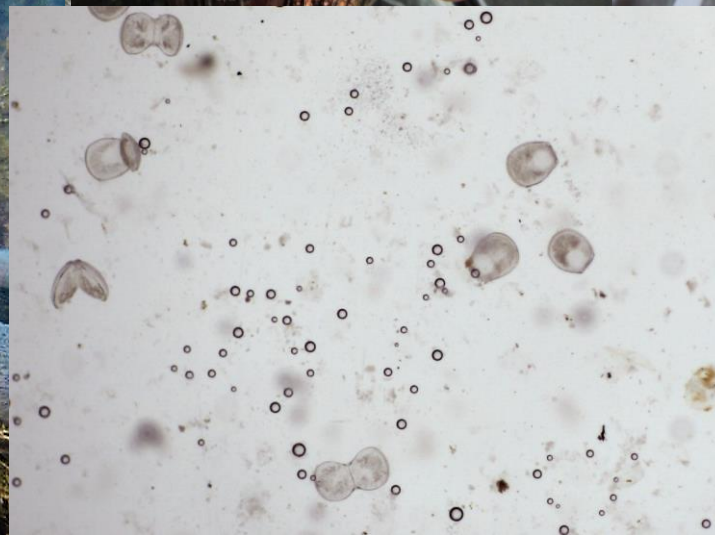
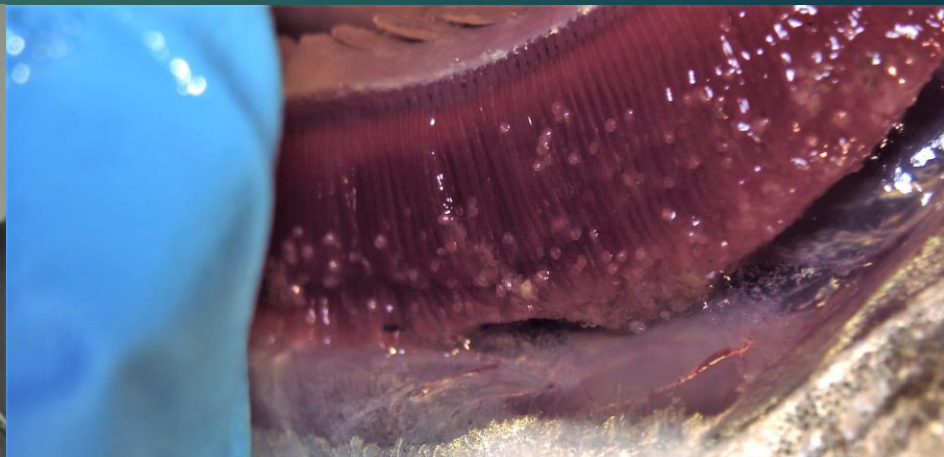
# Why Propagate?

- ▶ .00001% success in wild
- ▶ Propagation successes from 25% - 50%
- ▶ Keep common species common
- ▶ Faster way to reestablish/introduce populations
- ▶ Augment populations to achieve goals of a self sustaining population





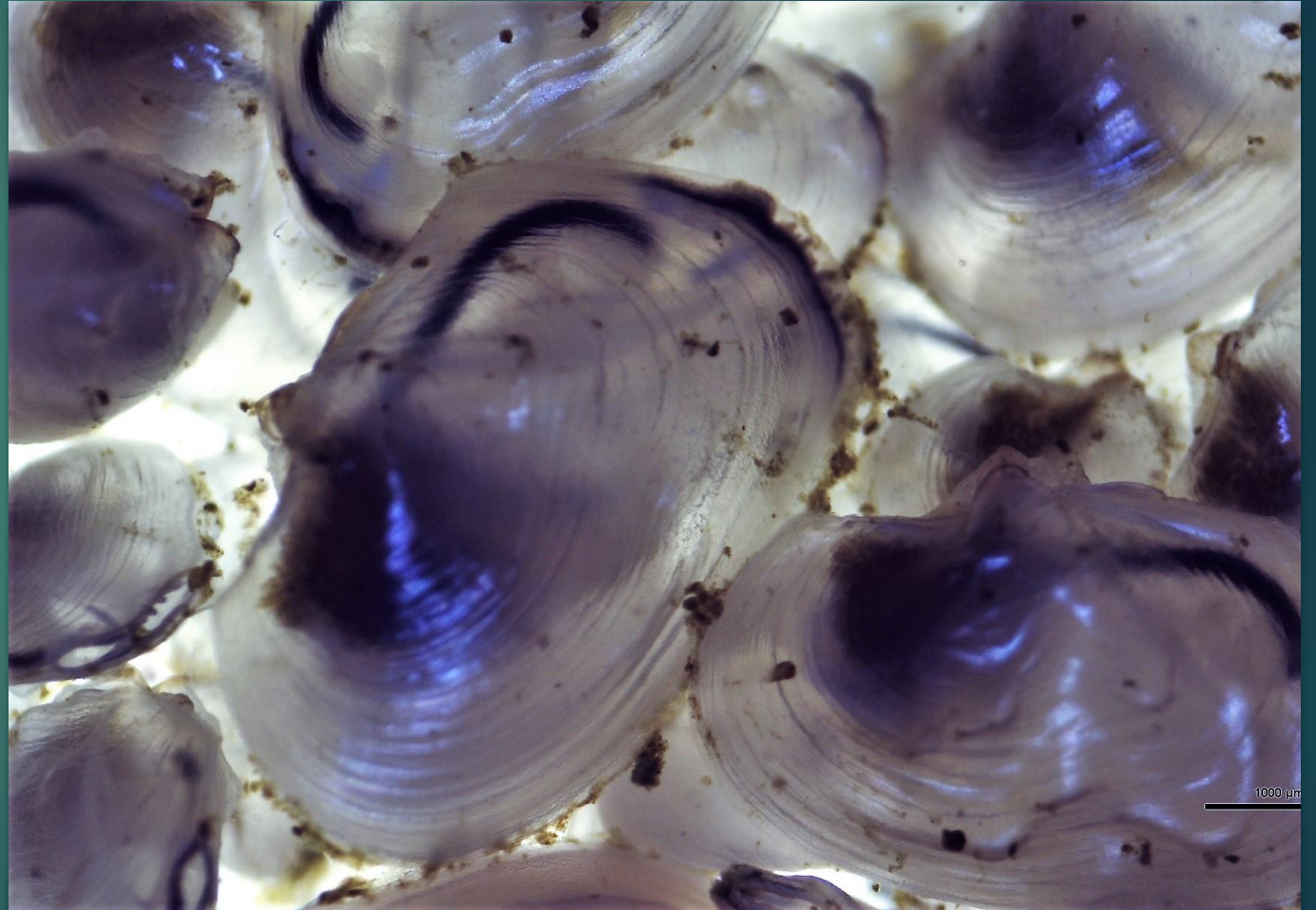
# The Propagation Process





# In Lab Rearing Systems

- ▶ Trough System
- ▶ Beaker System
- ▶ Hruska/ Sediment Boxes
- ▶ Pan System
- ▶ Bucket System
- ▶ Growout System



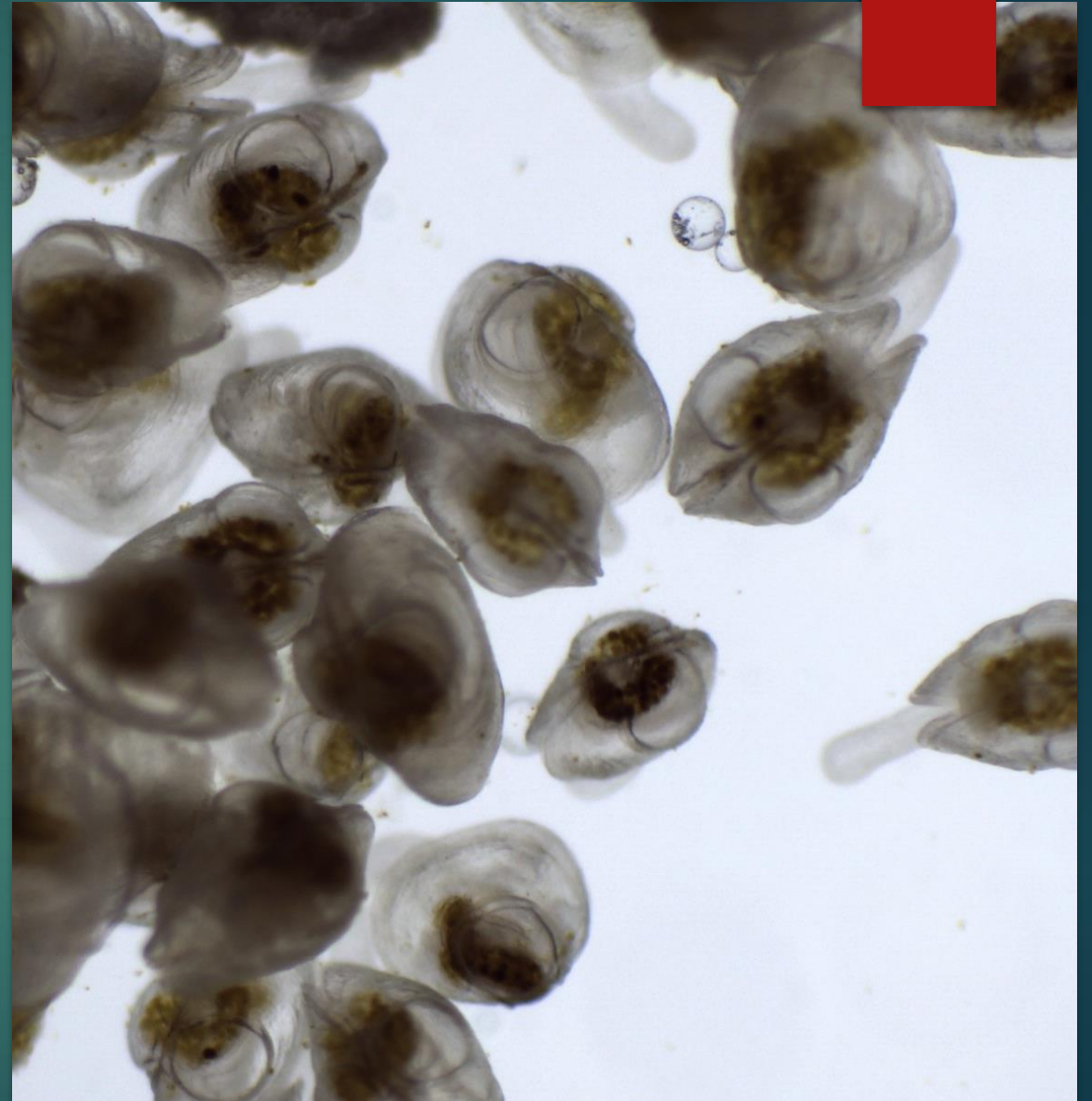


# Trough System



# Trough System

- ▶ Recirculating system
  - ▶ Biofiltration
  - ▶ Temperature controlled
- ▶ Rearing day-old juveniles up to 1mm
- ▶ Algae Diet
  - ▶ Reed mariculture
    - ▶ Nanno 3600, Shellfish Diet, TP 1800
    - ▶ 1:1:1 ratio
    - ▶ 100,000 cells/ml
  - ▶ Fed through dosing pump
    - ▶ Each trough fed individually
- ▶ Well water source
- ▶ Sand based substrate
  - ▶ Ihoke blast media
    - ▶ <math><60\mu\text{m} - 300\mu\text{m}</math>
  - ▶ Increase size with juvenile growth



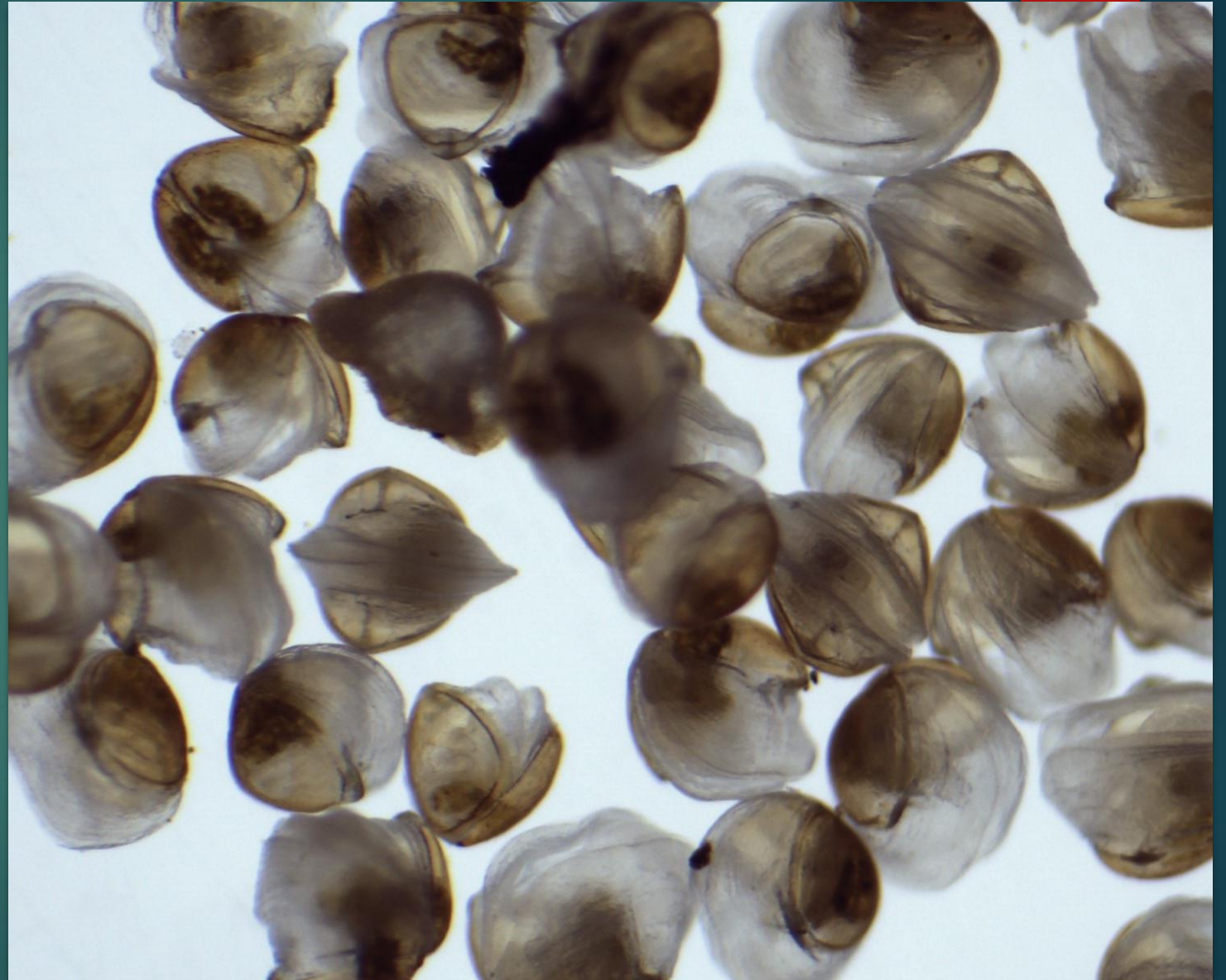


# Beaker System



# Beaker System

- ▶ Pulse flow
  - ▶ Water and algae mixture delivered via motorized ball valve to individual beakers
- ▶ 75% water change every hour
- ▶ Rear day-old juveniles up to 2mm
- ▶ Creek water source
- ▶ Algae Diet
  - ▶ Reed mariculture
    - ▶ Nanno 3600, Shellfish Diet, TP 1800
    - ▶ 1:1:1 ratio
    - ▶ 100,000 cells/ml
- ▶ <200  $\mu\text{m}$  sediment
  - ▶ Unsterilized
  - ▶ Source replaced every 3-4 weeks





# Hruska/ Sediment Box





# Hruska/ Sediment Boxes

- ▶ “shoebox” sized plastic container
- ▶ Lined with 50ml of  $<200\ \mu\text{m}$  sieved sediment
  - ▶ Changed twice a week
- ▶ Creek water source (2000ml)
  - ▶ Changed twice a week with sediment
- ▶ Algae Diet
  - ▶ Reed mariculture
    - ▶ Nanno 3600, Shellfish Diet, TP 1800
    - ▶ 1:1:1 ratio
    - ▶ 100,000 cells/ml
  - ▶ Fed 3 times a week





# Pan System





# Pan System

- ▶ Recirculating system
  - ▶ Biofiltration
  - ▶ Temperature controlled
- ▶ Rearing juveniles from 2 mm – sub-adult size (<20mm)
- ▶ Algae Diet
  - ▶ Reed mariculture
    - ▶ Nanno 3600, Shellfish Diet, TP 1800
    - ▶ 1:1:1 ratio
    - ▶ 100,000 cells/ml
  - ▶ Fed through motorized ball valve
    - ▶ Delivered into sump of system
- ▶ creek water source
- ▶ Sand based substrate
  - ▶ White silica play sand
    - ▶ Sieved down to 300  $\mu\text{m}$  – 500  $\mu\text{m}$
  - ▶ Increase size with juvenile growth





# Bucket System



# Bucket System

- ▶ Recirculating system
  - ▶ Biofiltration
  - ▶ Temperature controlled
- ▶ Rearing juveniles from day old – 2mm.
- ▶ Lampsiline and some ambleminae sp.
- ▶ Algae Diet
  - ▶ Reed mariculture
    - ▶ Nanno 3600, Shellfish Diet, TP 1800
    - ▶ 1:1:1 ratio
    - ▶ 100,000 cells/ml
  - ▶ Fed through motorized ball valve
    - ▶ Delivered into sump of system
- ▶ creek water source
- ▶ Held in chambers made of pvc pipe and coupler
- ▶ Mesh size increases with juvenile growth

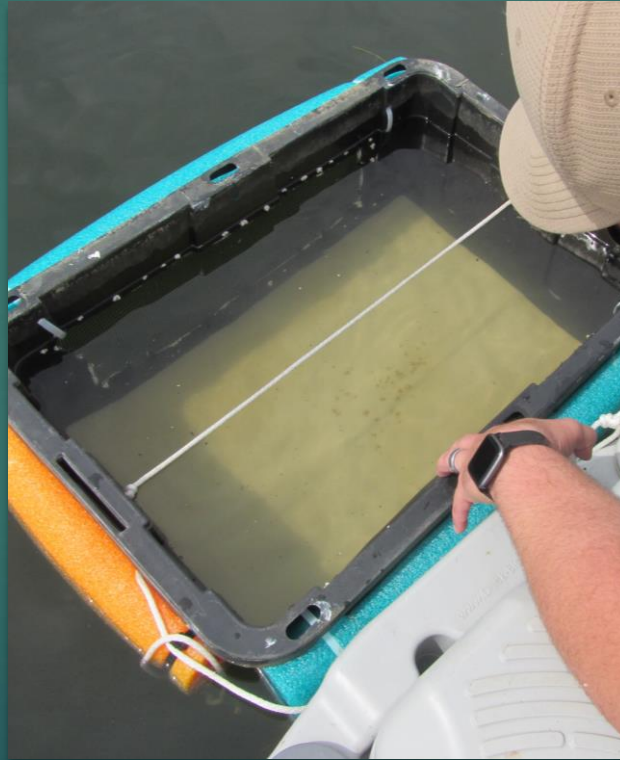








# Outdoor Rearing





# Creekside System

- ▶ Natural wild water
- ▶ Continuous flow
- ▶ Naturally temperature regulation
- ▶ Used for broodstock holding and sub adult growth





# Pond Rearing

- ▶ Natural wild water
- ▶ Naturally temperature regulation
- ▶ Used for juvenile growth at 3-5mm
- ▶ Exponential results during short period of time.
  - ▶ May - October
  - ▶ 5 mm – 35 mm
- ▶ Floating containers and baskets lined with sand substrate
- ▶ Aeration of inner surface by solar powered bubbler





# Pond Rearing





# Release of Mussels

- ▶ 1000 individuals per meter square
- ▶ Mussels tagged for recognition
  - ▶ Glitter
  - ▶ Hallprint
  - ▶ PIT tag (passive integrated transponders)





# Release of Mussels

- ▶ 2017 – 24377 sub-adults (3 species)
  - ▶ 6664 plain pocketbook (*Lampsilis cardium*)
  - ▶ 17621 fat mucket (*Lampsilis siliquoidea*)
  - ▶ 92 white heelsplitter (*Lasmigona complanata*)
- ▶ 2018 – 11 fluted-shell (*Lasmigona costata*)
- ▶ 2019 – 15 creeper (*Strophitus undulatus*)





# Monitoring of Released Mussels

- ▶ Monitored over an initial 3-5 year span
  - ▶ Growth
  - ▶ Survival
  - ▶ Signs of reproduction
    - ▶ Gravidity
    - ▶ Recruitment (5 years after gravidity)





# Released Sub-adult Success

- ▶ ~30% recovery
- ▶ 29 mm to 82 mm over a 4-year period.
- ▶ Signs of reproduction in 3 year old females
  - ▶ Observed inflated marsupial gill
  - ▶ Lure demonstration from burrowed females





# Mussel Species Propagated and Reared at the USRC

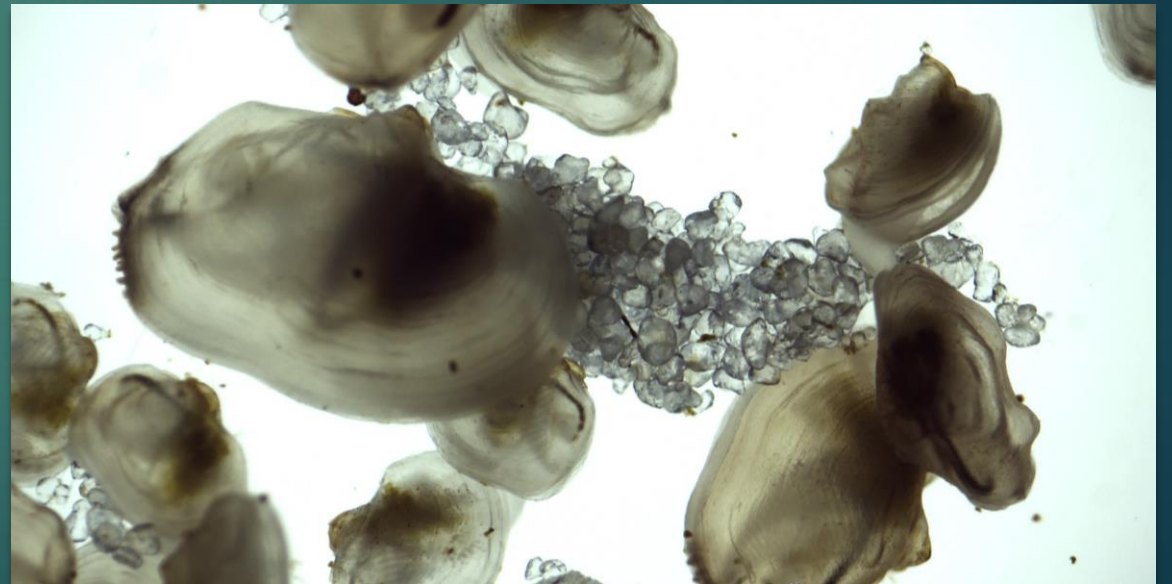
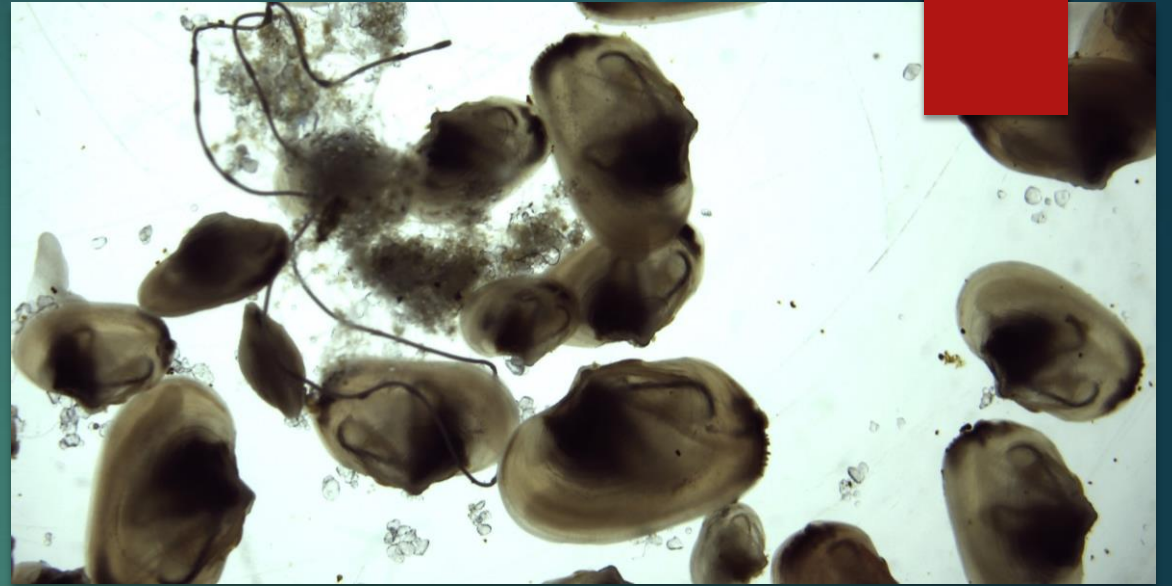
- ▶ Plain pocketbook - 6814
- ▶ Fat mucket – 17,621
- ▶ White heelsplitter - 92
- ▶ Giant floater - 83
- ▶ Creeper - 15
- ▶ Fluted-shell - 11





# Current Year Numbers

- ▶ Plain Pocketbook – 2973
- ▶ Creeper – 57
- ▶ Fluted-shell – 86
- ▶ Elktoe – 54
- ▶ Fat mucket – 374
- ▶ Giant floater - 13061





# Partnerships

- Forest Preserve District of Kane County (mitigation)
- City of Kankakee (mitigation)
- McHenry County Conservation District
- Urban Rivers
- Shedd Aquarium
- Loyola University





# Questions?

