

# PROPAGATION FOR CONSERVATION OF COMMON FRESHWATER MUSSELS IN AN URBAN STREAM SYSTEM:



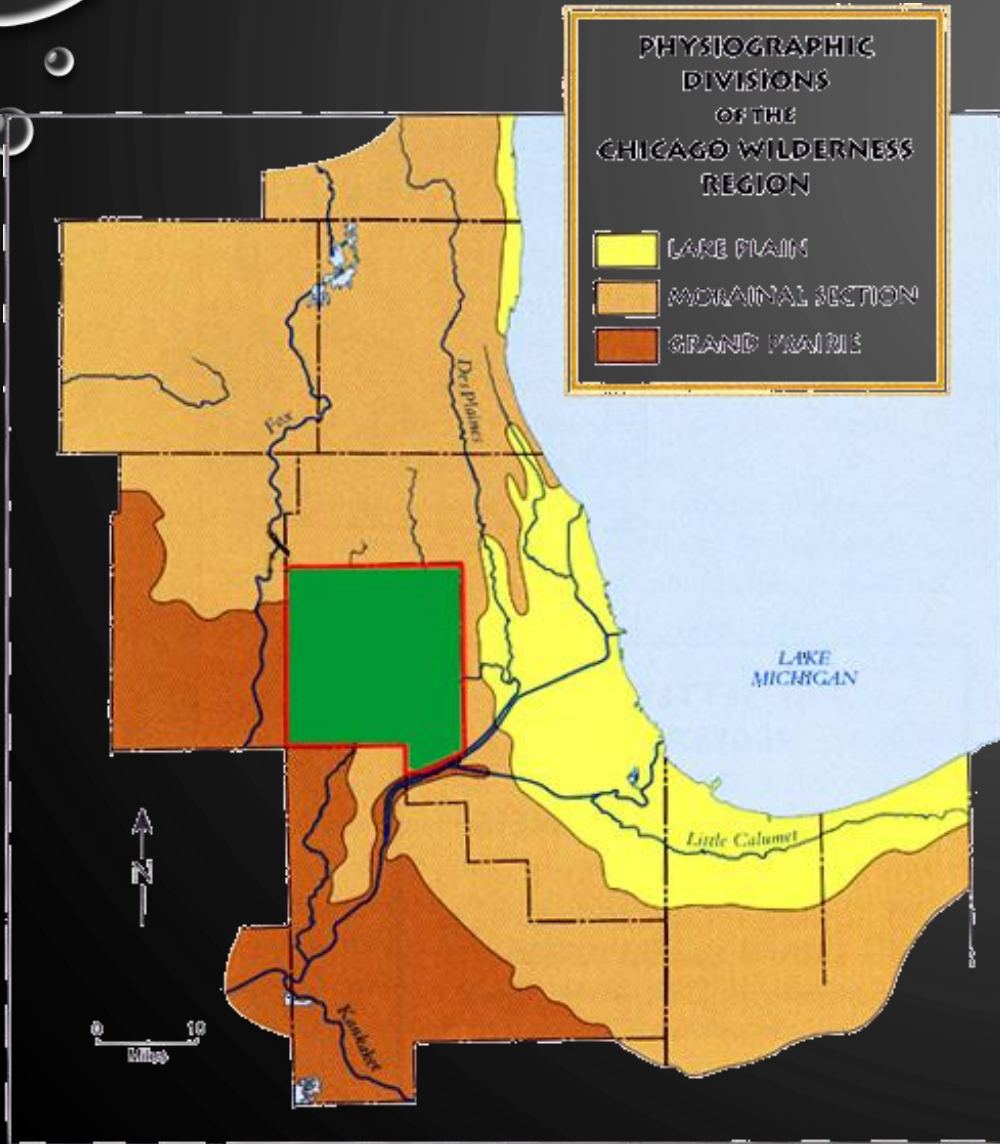
what do they do and why should I care ?

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Research Center Coordinator



34<sup>th</sup> ANNUAL ILMA-LAKES CONFERENCE  
MARCH 14-16 2019

# DuPage County



324 sq. miles

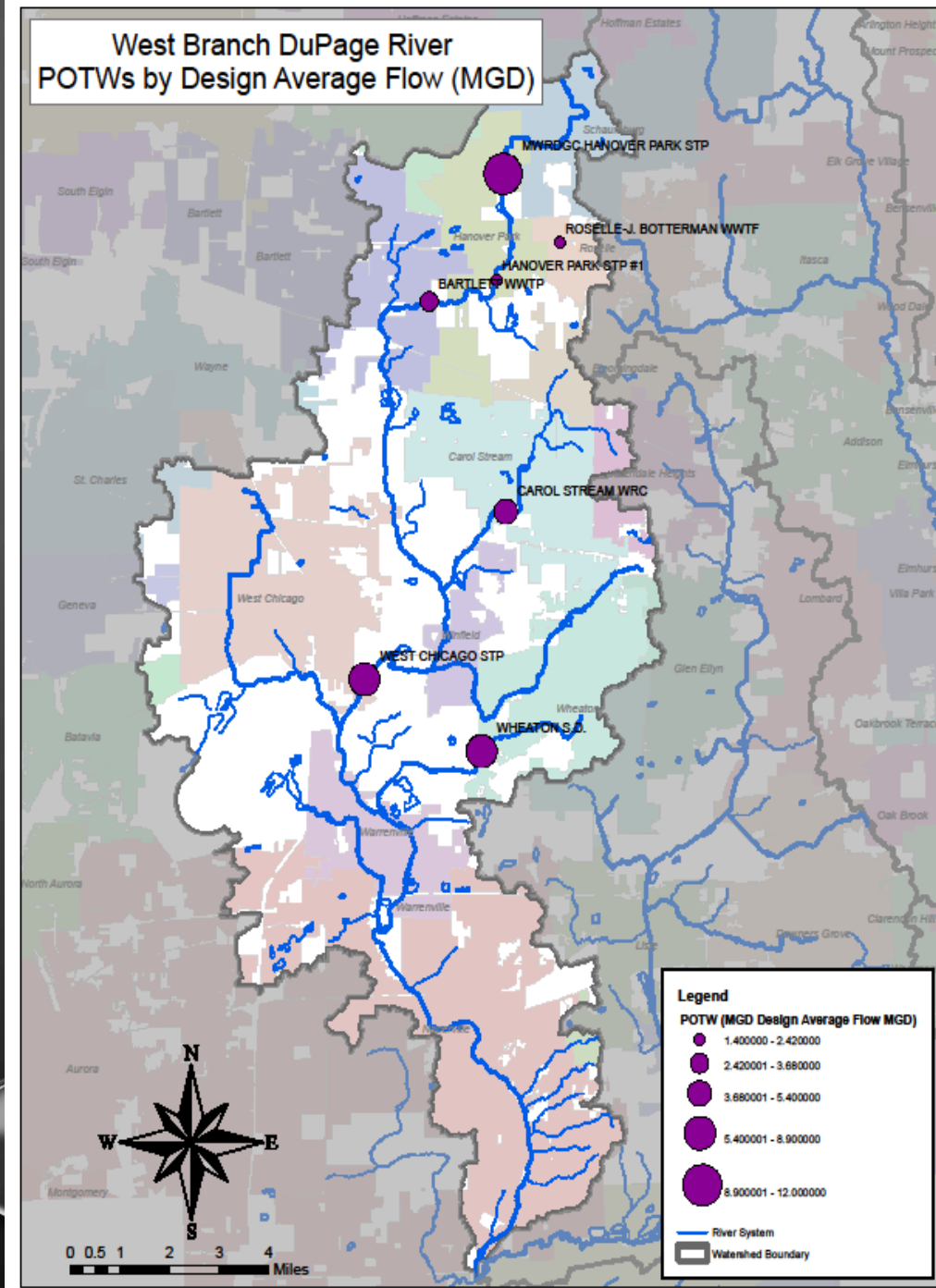


**DuPage County Forest Preserves**  
26,000 acres  
>11 % of total county

West Branch DuPage River and tribs  
Sub-watershed ~ 95 sq. miles  
in DuPage County

Des Plaines River Basin

Graphic Courtesy of the DRSCW.



**OPENED IN 2012**

**BLACKWELL FOREST PRESERVE**

**Urban Stream Research Center, Warrenville, Il.**



**Aquaculture Facilities Permit # 893-262-568**

**3 full time staff**

**2 seasonals in summer**

# Opportunity Presented Itself

USEPA Superfund River Clean-up  
2003-2012.

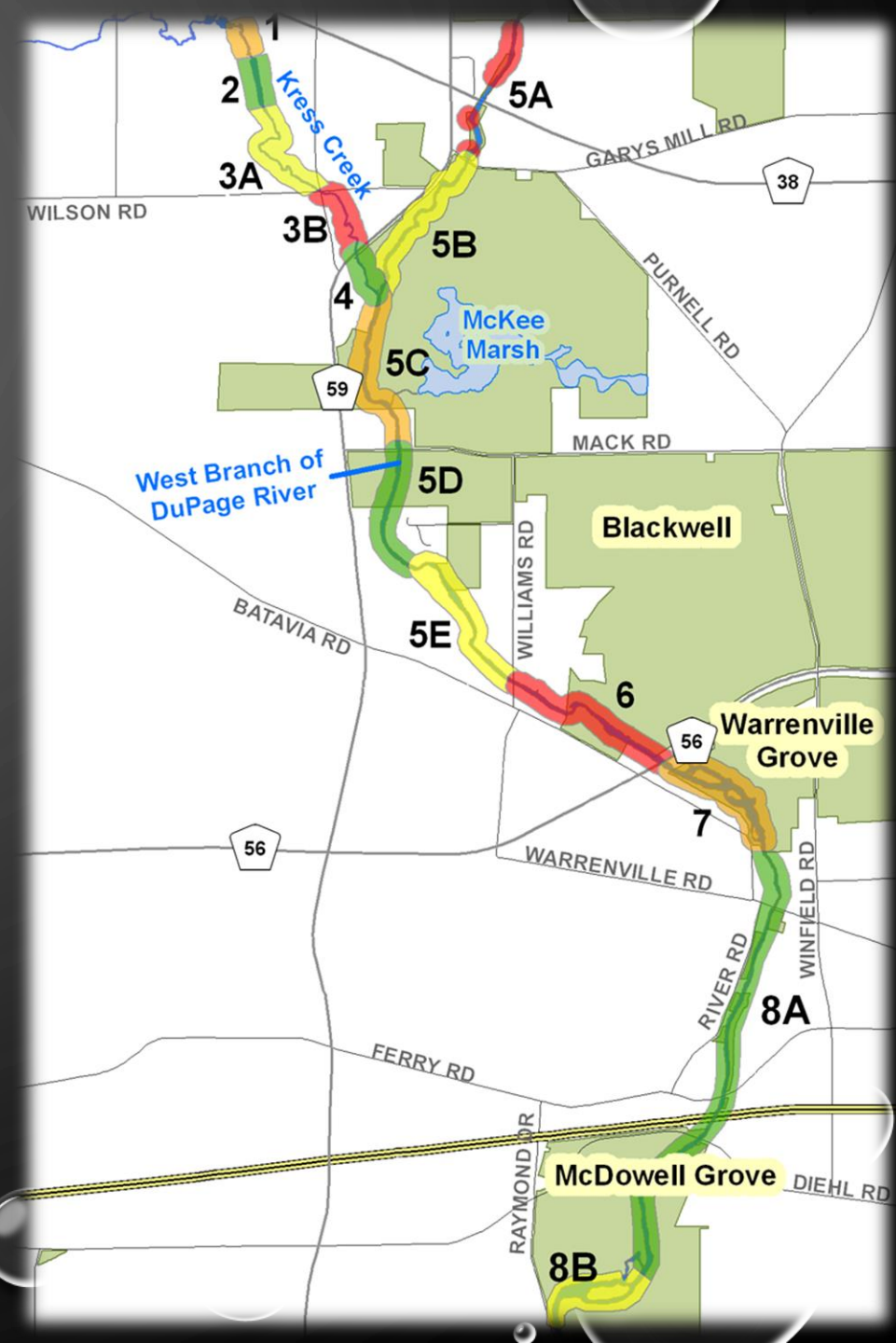
Kerr-McGee Kress Creek/West Branch of DuPage River Region 5 Superfund

Site EPA ID# ILD980823991

8.2 miles of :

Kress Creek and West Branch DuPage River  
Remediation of low level radioactive Thorium

Restoration / Naturalization of the Stream Bed,  
Bank and Floodplain



# FRESHWATER MUSSELS



Plain pocketbook  
Fatmucket  
White heelsplitter  
Giant floater  
Cylindrical papershell  
Paper pondshell  
Wabash pigtoe  
Creeper  
Lilliput


Historically, 12 mussel species were known to occur above the 3 dams in the West Branch (INHS). 9 live common mussel species have been found.

- LOW POPULATION NUMBERS
- LOW RECRUITMENT

# FISH



- LOW DIVERSITY



**200 acres of wetlands**  
**500,000 plugs**  
**Created over 70 riffles**  
**2 of the 3 dams removed**  
**Over 10 miles of stream**

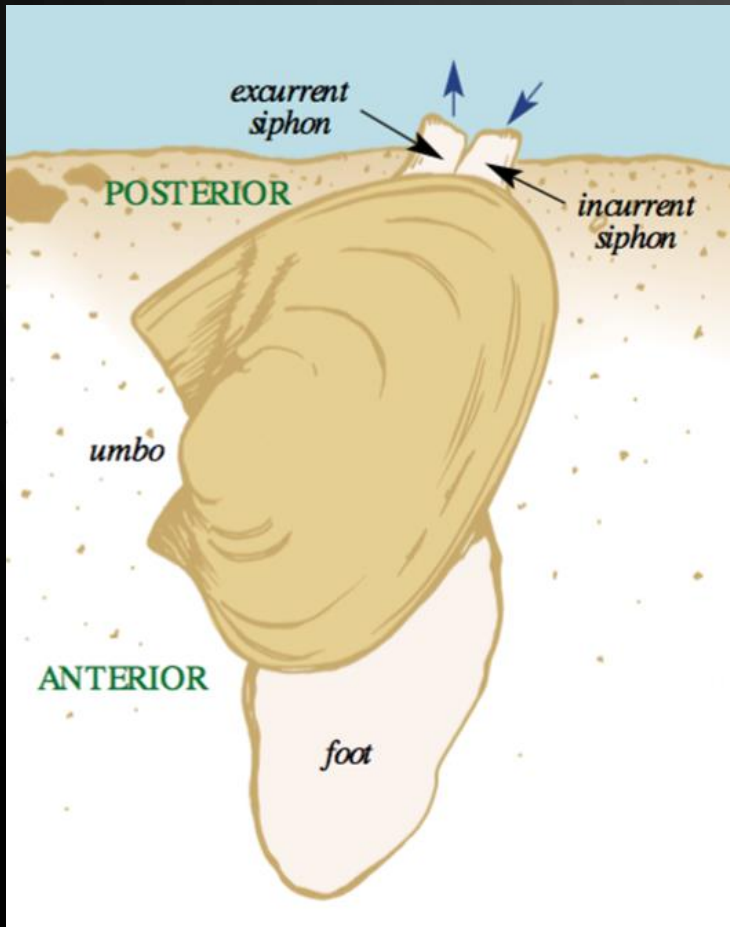
**The River has a Rhythm. In a Healthy River Valley**

The background is a dark gray gradient with several faint, concentric circles centered in the middle. In the corners, there are clusters of realistic, 3D-rendered bubbles of various sizes, some overlapping, with highlights and shadows that give them a glassy appearance.

# Brief Status



- **Freshwater mussels are bi-valved mollusks. They are filter feeders of suspended materials in the water column and bed material.**



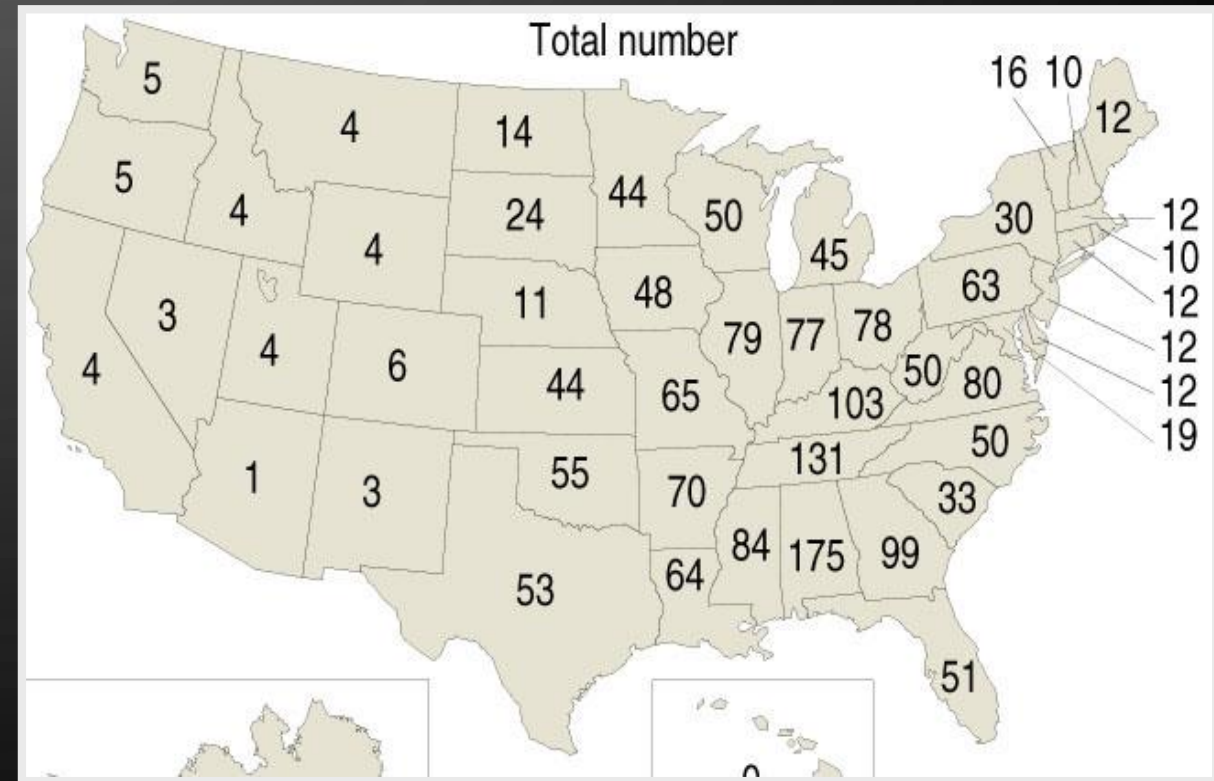
- They are beautiful and mysterious

- **Phylum: Mollusca**
- **Class : Bivalvia (with oysters, scallops and clams)**
- **Order: Unionoida**
- **Family: Unionidae**



North America is home to approximately one-third of the world's freshwater mussel species.

Over 74% of the known 300 species in the U.S. are threatened, endangered, extirpated, or already extinct.



In Illinois, ~ 80 species are historically known to occur. 53 of the 80 species are extirpated, are listed at the state level (E & T), or have unstable populations.

Illinois Natural History Survey



# Conservation Status

Extinction rates in freshwater ecosystems appear to be five times higher than terrestrial and tropical rainforests

## I.1 GLOBAL CONSERVATION STATUS 3

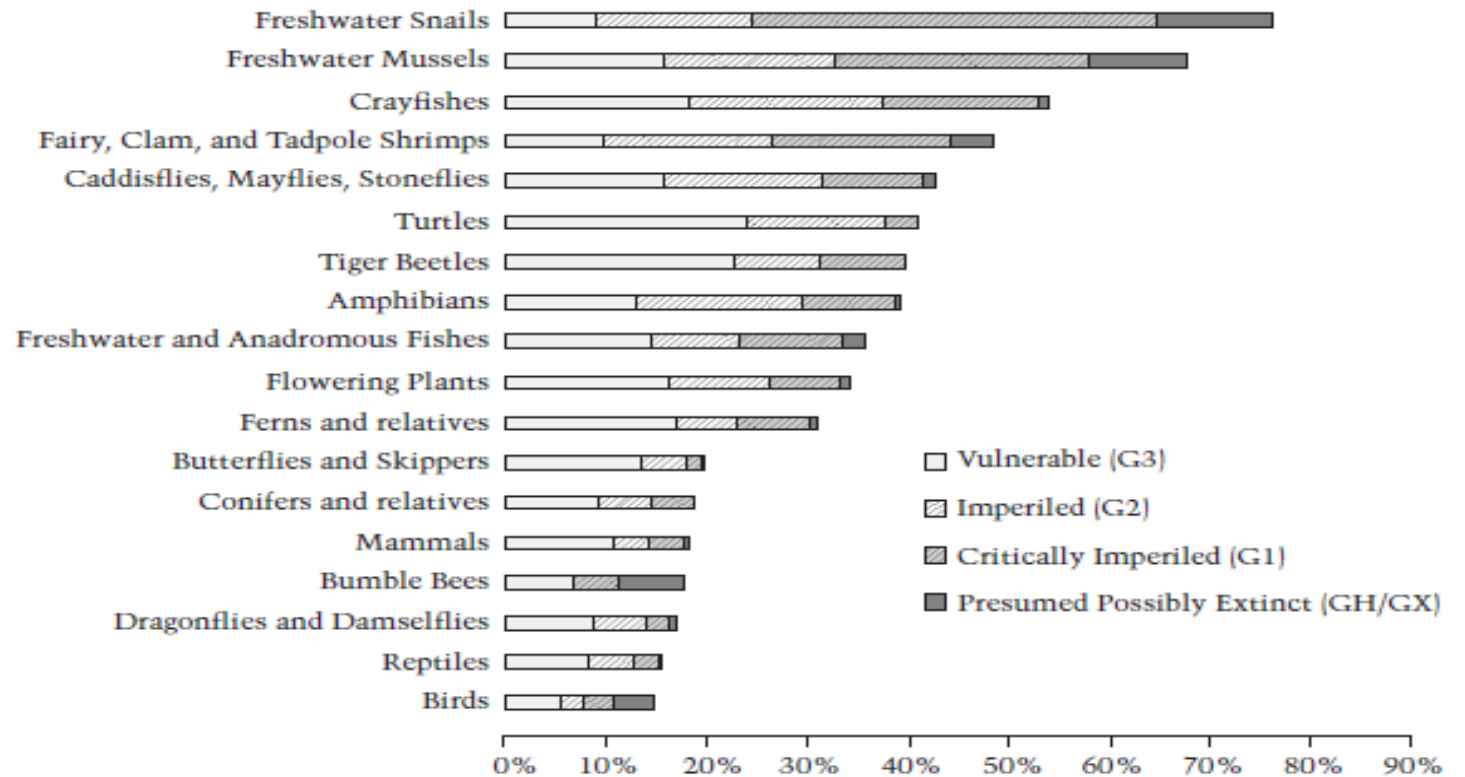


FIGURE I.2 Percentage of species listed as vulnerable, imperiled, critically imperiled, and presumed possibly extinct by faunal and floral group in North America. The figure clearly shows that freshwater species are more imperiled than their terrestrial counterparts. Graphic courtesy of NatureServe and adapted by Kristin Simanek, USFWS.

# Freshwater mussels are the most imperiled faunal group in North America and the world



Dr. Barnhart photo



and in grave danger of extinction.

The image features a dark gray background with several translucent, realistic-looking bubbles of various sizes scattered in the corners. The bubbles have highlights and shadows, giving them a three-dimensional appearance. The central text is in a clean, white, sans-serif font.

**What do they do and Why should I care**

# Ecological Value and Function

# Provide Ecosystem Services



Pump water to feed and breathe, in and out. They filter out suspended particles in the water and sediments from 6 gal. a day depending on their size and species up to 20 gal. a day. Oysters filter feed ~50 gal. day/ bivalved Buddha

Food: varies by species, age, where the mussel lives and temp.. *Detritus, phytoplankton, zooplankton, diatoms, algae, bacteria* (even *E. coli*).

Process nutrients/ nitrogen and phosphorus

Uptake heavy metals, pollutants, chemicals, and pharmaceuticals.

***BIOLOGICAL TREATMENT PLANTS !***

The image features a dark gray background with several translucent, realistic-looking bubbles of various sizes scattered in the corners. The bubbles have highlights and shadows, giving them a three-dimensional appearance. The text is centered in the middle of the frame.

**What do they do and Why should I care**



# Ecological Value and Function

# Provide Ecosystem Services



*ROCKS WITH GUTS*

**BUT- WOULD YA EAT EM NOW??**

When in abundance :

- much higher biomass
- potential to regulate biogeochemical cycling, food web management and water quality in streams to a greater extent than any other fauna.
- Provide critical habitat for a wide array of aquatic organisms.
- As benthic burrowers, stabilize the river bottom and sediments, ↑ water and oxygen penetration, release nutrients and provide through pseudofeces.
- They are food for animals like muskrats, raccoons, otters, diving ducks, and certain fish; even early humans ate them.

The image features a dark gray background with several translucent, 3D-rendered bubbles of various sizes scattered in the corners. The bubbles have highlights and shadows, giving them a realistic, glassy appearance. The text is centered in the middle of the frame.

**What do they do and Why should I care**

# Biological Indicators of Water Quality



**Exceptionally vulnerable to water pollution and degradation of the aquatic ecosystem. Since mussels are sensitive to environmental changes, they are good water quality indicators.**

**As glochidia ( larvae) and juveniles:**

**Sensitive to copper, ammonia, sodium & potassium chloride, sulfate, nickel/ other metals, alachlor and don't function on Prozac**

Declines in the numbers and diversity of mussels in our waterways are attributed to a variety of human disturbances

- Dams/ impoundments
- Channelization and dredging
- Siltation from erosion
- Water pollution- point/non-point
- Loss of in-stream habitat/ Host fish
- Development of tributary corridors
- Commercial harvesting and
- Introduced invasive species



Which makes  
freshwater  
mussels

Not happy clams



*"I'm not happy."*

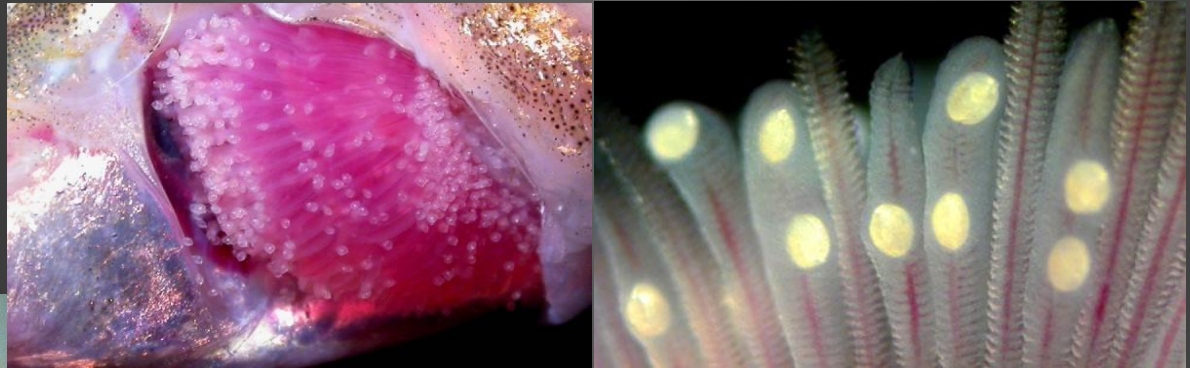
Freshwater Mussels  
have an *Amazing* and *Complicated*  
Reproductive Life Cycle



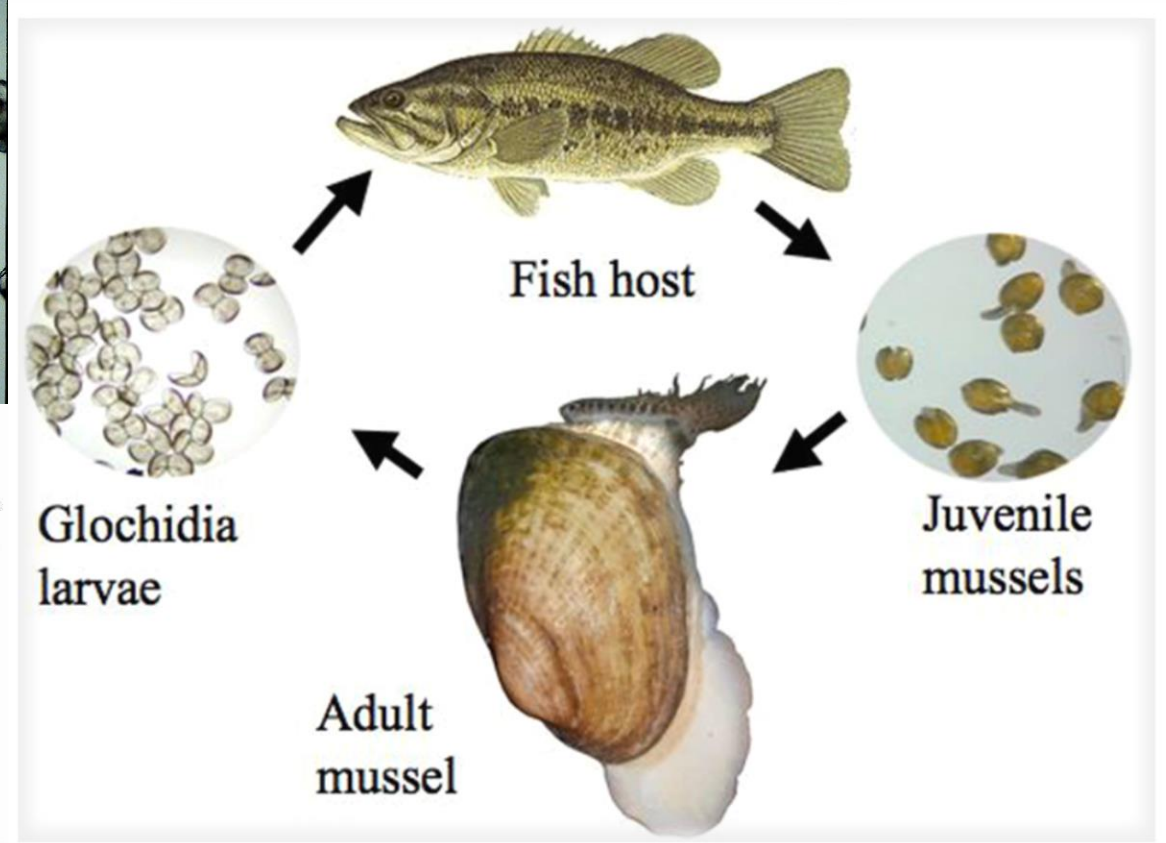
# Glochidia are Obligate Parasites on Fish as a Host

*In the wild only .00001%  
Grow to adulthood*

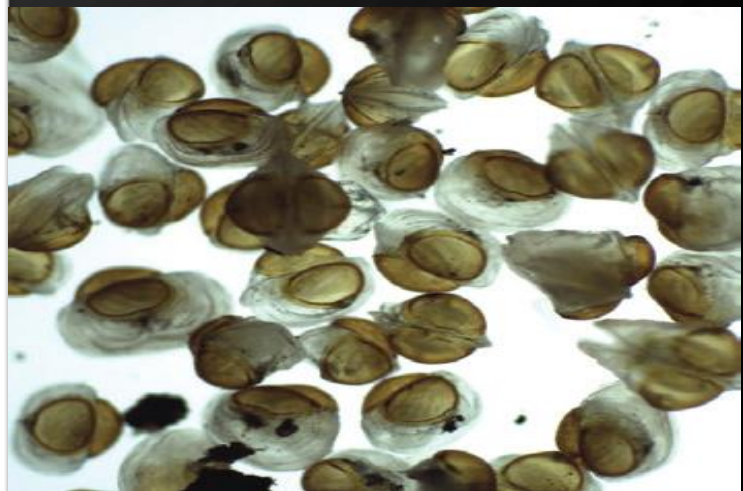
'Infection'



transportation



transformation





*So, how does a fairly stationary female mussel  
attract a fish host?*

*Through an Evolved Strategy*





# FISH LURES

minnow mimic, egg mass  
crayfish



Plain pocketbook

*Lampsilis cardium*

Host fish: Small and largemouth bass, tiger salamander, green sunfish, bluegill, yellow perch, white crappie, sauger, and walleye



Rainbow

*Villosa iris*

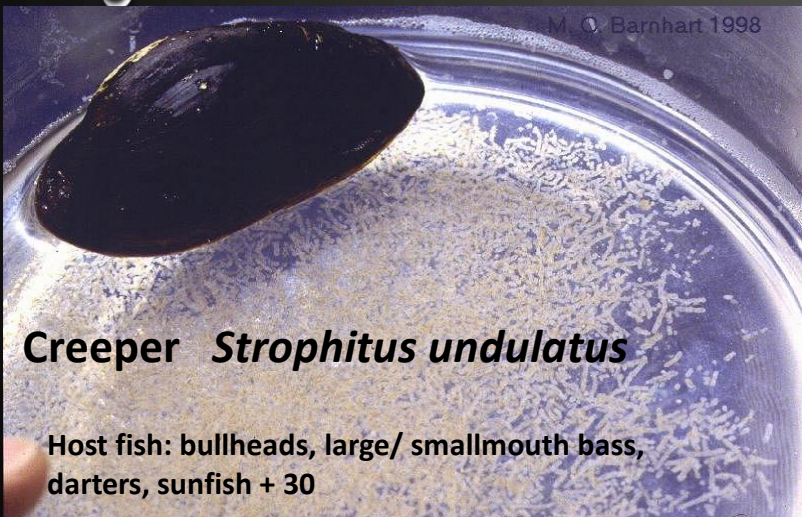
Host fish: mottled sculpin, rainbow darter, + 7



Host fish: walleye, sauger, rock bass, central stoneroller, carp +11

# CONGLUTINATES

The Net, Leg-hold, Pelagic Drift strategy



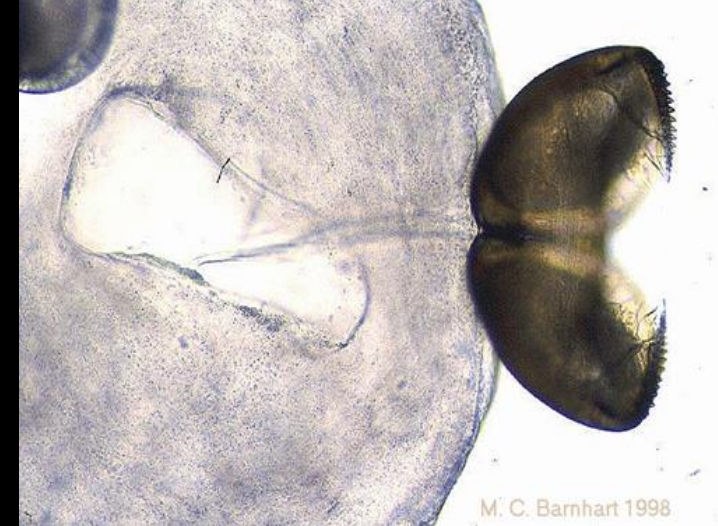
**Creeper** *Strophitus undulatus*

Host fish: bullheads, large/ smallmouth bass, darters, sunfish + 30



➤ The glochidia of some mussels are attached to long filaments or in long mucus strands to form nets. When a fish swims into a net, the larvae attach to its fins or gills

➤ Some species release the glochidia within unfertilized egg 'rods' that bounce along the bottom of the river and are eaten or released on threads to attach to the fish



**Wabash pigtoe** *Fusconaia flava*

Host fish: Bluegill, white and black crappie, creek chub



Mimic bloodworms



# CONGLUTINATES

## Bait strategy



M. C. Barnhart 1998



Ovisacs mimic worms

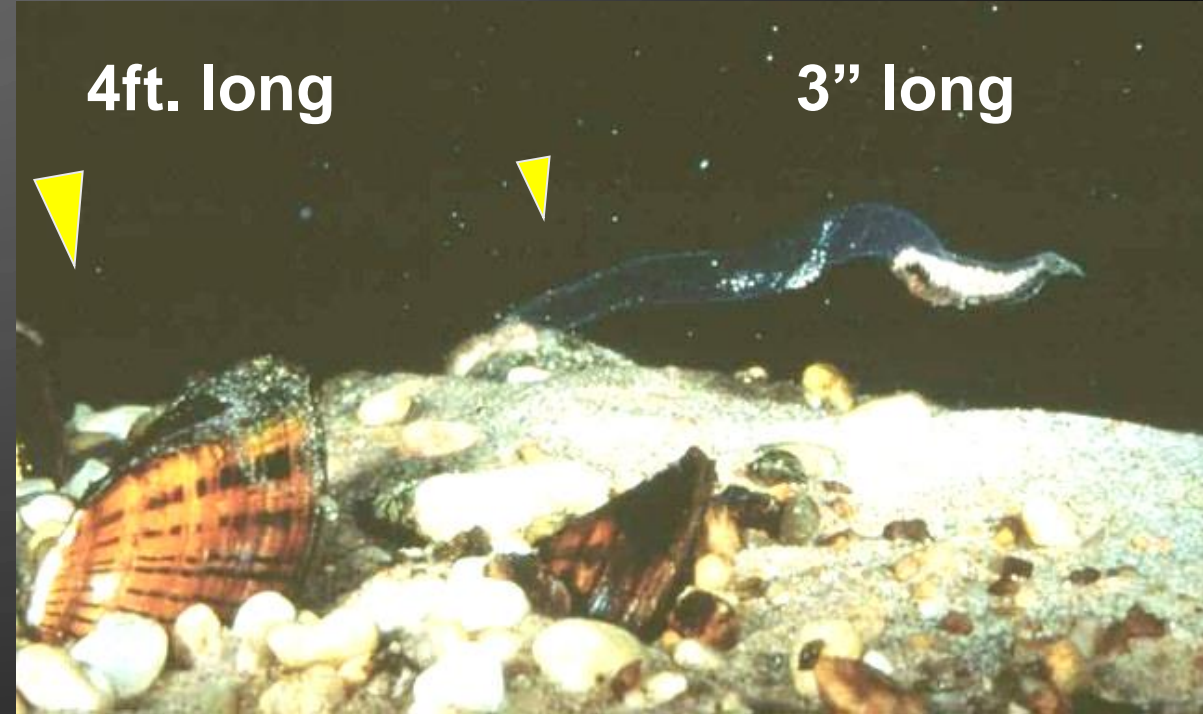


© M. C. Barnhart 2000

Ovisacs mimic black fly larva



## Super conglutinate lure discovered in 1994



Shinyrayed pocketbook *Lampsilis subangulata*



# FISH SNAPPERS

# Epioblasma spp.



**Snuffbox**



**Northern riffleshell**

**½ of species are extinct or endangered**

Host: logperch, small non-game fish



The background is a dark gray gradient. In the top-left and bottom-right corners, there are several realistic water droplets of various sizes, some overlapping, with highlights and shadows that give them a three-dimensional appearance.

# Why Propagate for Aquatic Conservation?

# QUESTIONS CONSIDERED BEFORE STARTING A FRESHWATER MUSSEL PROPAGATION PROGRAM

**Why?** Is this the best strategy?

Do we have a propagation and species restoration plan?

Is there suitable stocking and release sites?

Population objectives ? Stocking numbers, etc.

How do we measure success?

Will Broodstock be adversely Impacted?

Is this a Re-Introduction or Augmentation?

How about genetic concerns? Ecological concerns?

Do we have staff and facility?

Do we have permits?

Is there a plan for data management, reporting, monitoring?

# Propagation for Restoration and Conservation

- Intent #1

- To keep common species common in an urban stream system

Plain pocketbook  
Fatmucket  
White heelsplitter  
Giant floater  
Cylindrical papershell  
Paper pondshell  
Wabash pigtoe  
Creeper  
Lilliput



# Propagation for Restoration and Conservation

## INTENT #2.

- Augment and restore the native mussel assemblage community and the ecosystem health and services they provide





# Propagation for Restoration and Conservation

## INTENT #3

- Establish wild, self-sustaining populations with recruitment over time



**DesPlaines River watershed**  
**Fox River watershed**

The image features a dark gray background with several translucent, realistic-looking bubbles of various sizes scattered in the corners. The bubbles have highlights and shadows, giving them a three-dimensional appearance. The central text is in a bold, white, sans-serif font.

# LAB PROPAGATION PROCESS

# COLLECTION OF GRAVID FEMALE BROODSTOCK



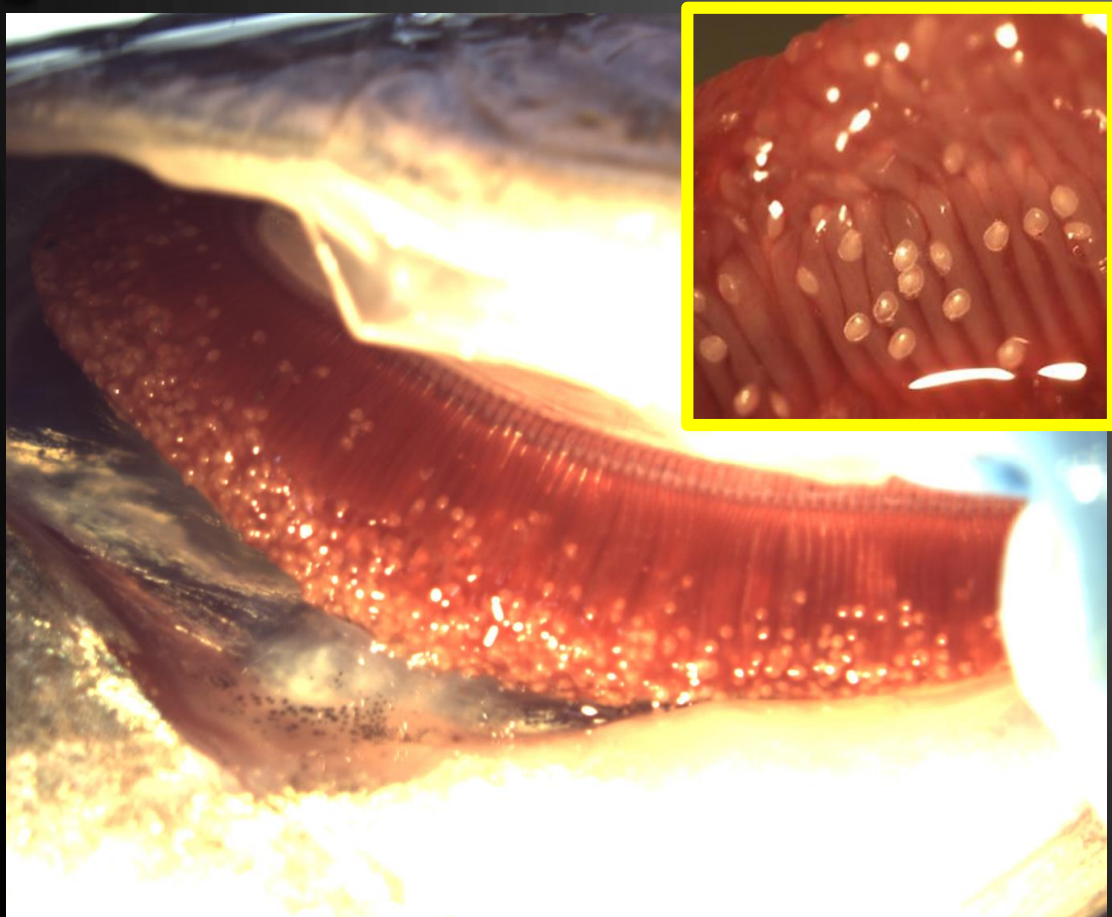
Plain Pocketbook (*Lampsilis cardium*)

# HARVEST OF GLOCHIDIA



Plain Pocketbook (*Lampsilis cardium*)

**COLLECT KNOWN HOST FISH  
INOCULATION OF HOST FISH**



**COLLECTION OF METAMORPHOSED  
JUVENILE MUSSELS**



# FISH HOLDING TANKS AND RACEWAYS LARGE AND SMALL FOR PROPAGATION



02/10/2019

5,000 SQUARE FEET



02/10/2019 22:09



02/10/2019 22:10

# REARING SYSTEMS IN THE LAB

**DOWNWELLING BUCKETS**



**PAN / SAND**



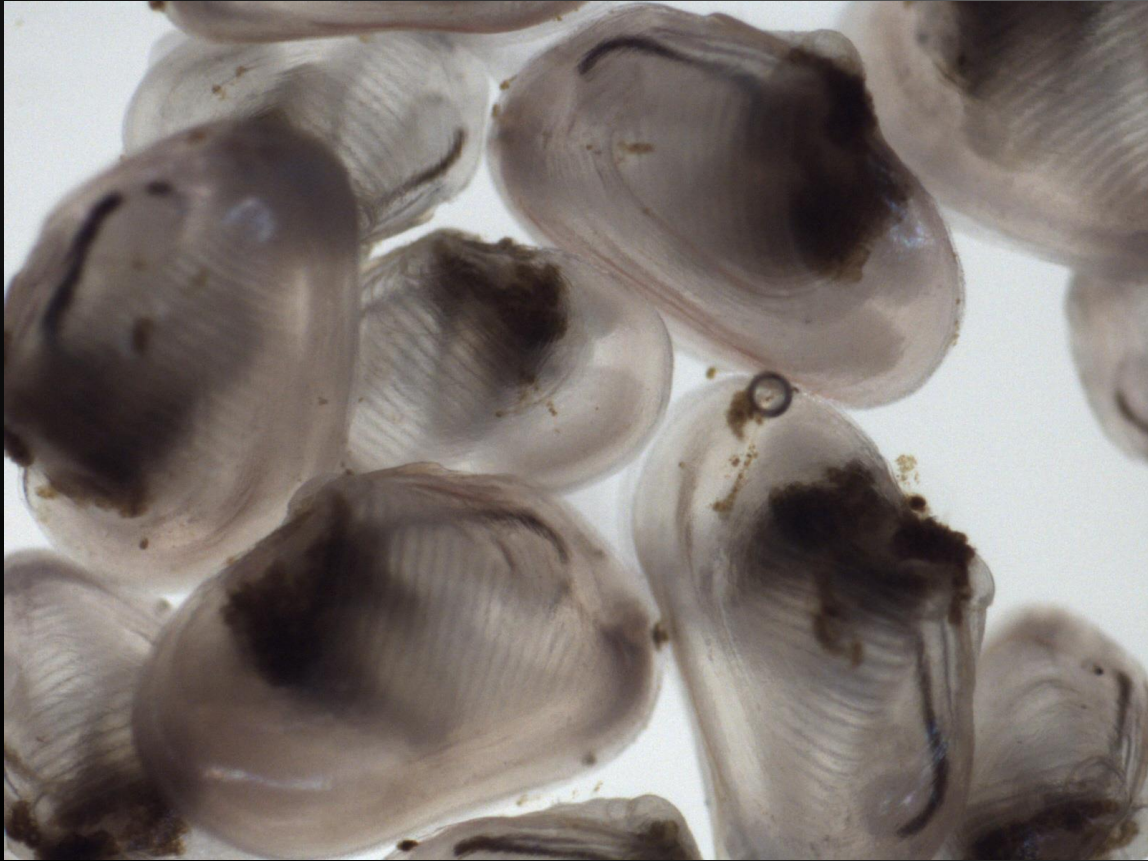
**TROUGH / SAND**



**HRUSKA BOXES/ SEDIMENT**



# REARING OF JUVENILE MUSSELS



CREEK/WELL WATER / FED SUPPLEMENTAL ALGAE DIET

1 MM



10MM



# Growth in the Lab

5MM



20MM



2016



# Outdoor Wild Water Rearing Systems

Floating pond baskets and containers



Creekside flow through



# WILD WATER GROWTH

PLAIN POCKETBOOK- *LAMPSILIS CARDIUM*

2016

MUSSELS WENT IN POND AT 3MM IN MAY

1 MONTH LATER : 10 MM



MUSSELS REMOVED AFTER 4

MONTHS/OCT. 35 MM



**PLAIN POCKETBOOK**  
*Lampsilis cardium*



**6,664 > 25MM TAGGED AND RELEASED**

**2016-2017**

**FATMUCKET**  
*Lampsilis siliquoidea*



**17,621 >25MM TAGGED AND RELEASED**

**WHITE HEELSPLITTER**  
*Lasmigona complanata*



**92 > 25MM tagged and released**

# FROM POND WILD WATER TO LAB FOR TAGGING



HALLPRINT 1,928

PIT TAG 1,929

BEDAZZLED 20,520

TOTAL 24,377



TAGGABLE SIZE FOR SUB-ADULT RELEASE  $\geq 25\text{MM}$

2017

# GETTING READY FOR RELEASE TO THEIR FOREVER HOME



# SITE RELEASE



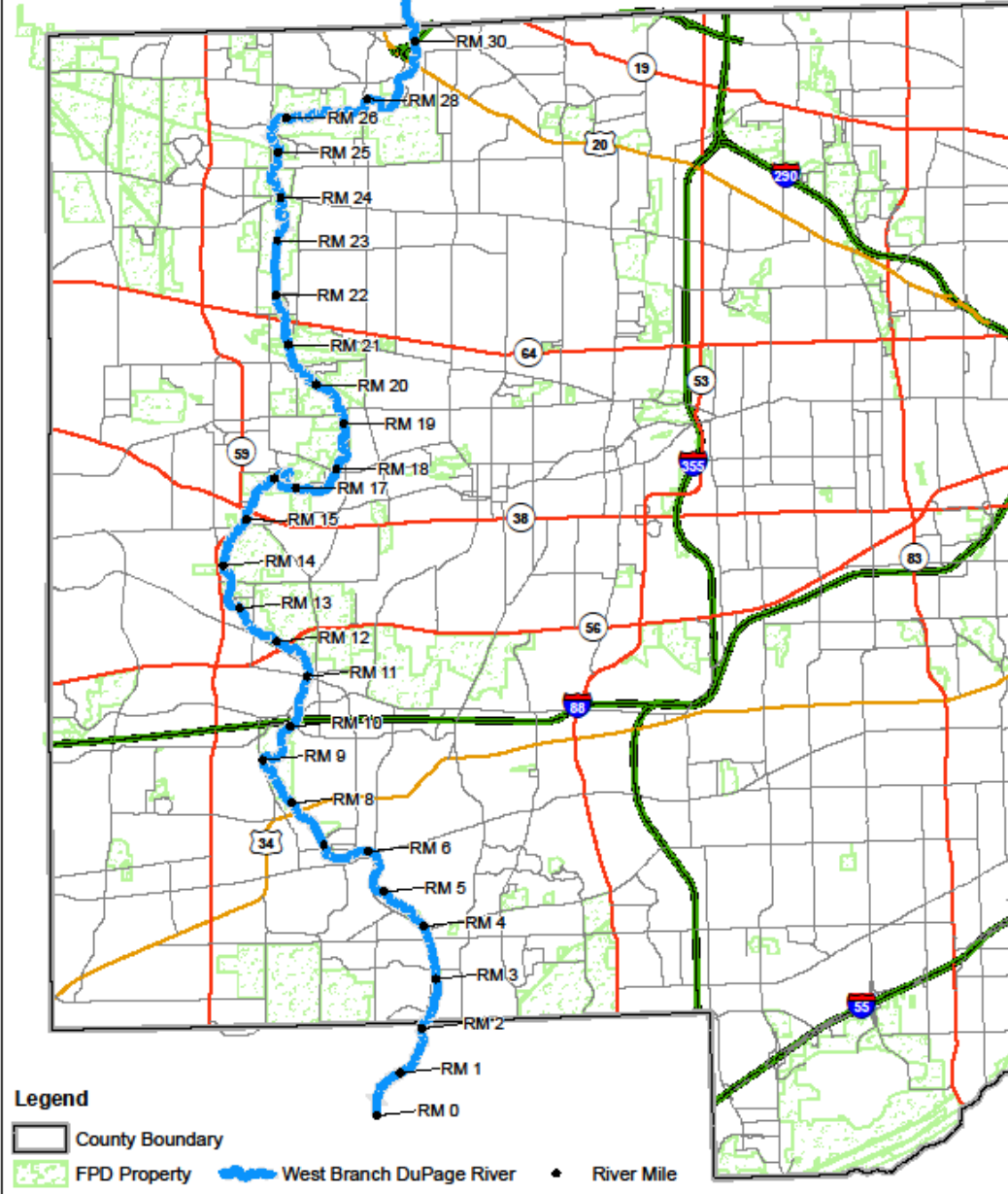
20 / 1 METER SQ  
QUADRATS



2 PIT tags  
2 Hallprint  
21 Glitter  
Per quadrat  
Per species

# Map of DuPage County and West Branch DuPage River

River Miles



# RIVER MILE MAP WEST BRANCH DUPAGE RIVER

2017 -RELEASE SITES BETWEEN RM 24- RM 6  
1-3 SITES PER RIVER MILE (18 Miles)

EACH SITE ~ 500-1,000 SUB-ADULTS OF  
ONE OR TWO LAMPSILIS SPECIES

## ECOSYSTEM SERVICE

*24,377 mussels x 6 gal. a  
day = 146,262 gal. of water  
filtered each day*

# ***MONITORING PLAN***

## **The Big Fat Mussel Experiment**

### **Year 1 /2018: PIT tag presence using a Biomark underwater antenna**

Over 65% PIT tagged/Plain pocketbooks  
Over 74% PIT tagged/ Fatmuckets  
were 'pinged' over 37 sites

Most size class 60-70mm  
All doubled in size from release





# **MONITORING PLAN**

**2019**

**Year 2:** Re-Capture Mussels using a 3- Random Start Design 1/4 m<sup>2</sup> quadrat with bag

- assess community/ habitat/ size

**Year 3:** Assess what monitoring design works

**Year 4- 5:** Do it again- look at sexual distribution

**Year 10:** Recruitment



TO DATE: 2016-2019

**PROPAGATED 8 SPECIES**

- Plain pocketbook
- Fatmucket
- White heelsplitter
- Flutedshell *Fox River watershed*
- Creeper *Fox River watershed*
- Mucket *Fox River watershed*
- Wabash pigtoe
- Giant floater

**SUCCESS WITH 5 SPECIES**

- Plain pocketbook
- Fatmucket
- White heelsplitter

**Creeper**



**Flutedshell**



*There is no crying in mussel propagation*



**FUTURE: CHALLENGES! INFANCY! EXPERIENCE!**

**You don't value and protect what you don't know is there**

**Nature is not someplace else- its right here – outside your door**

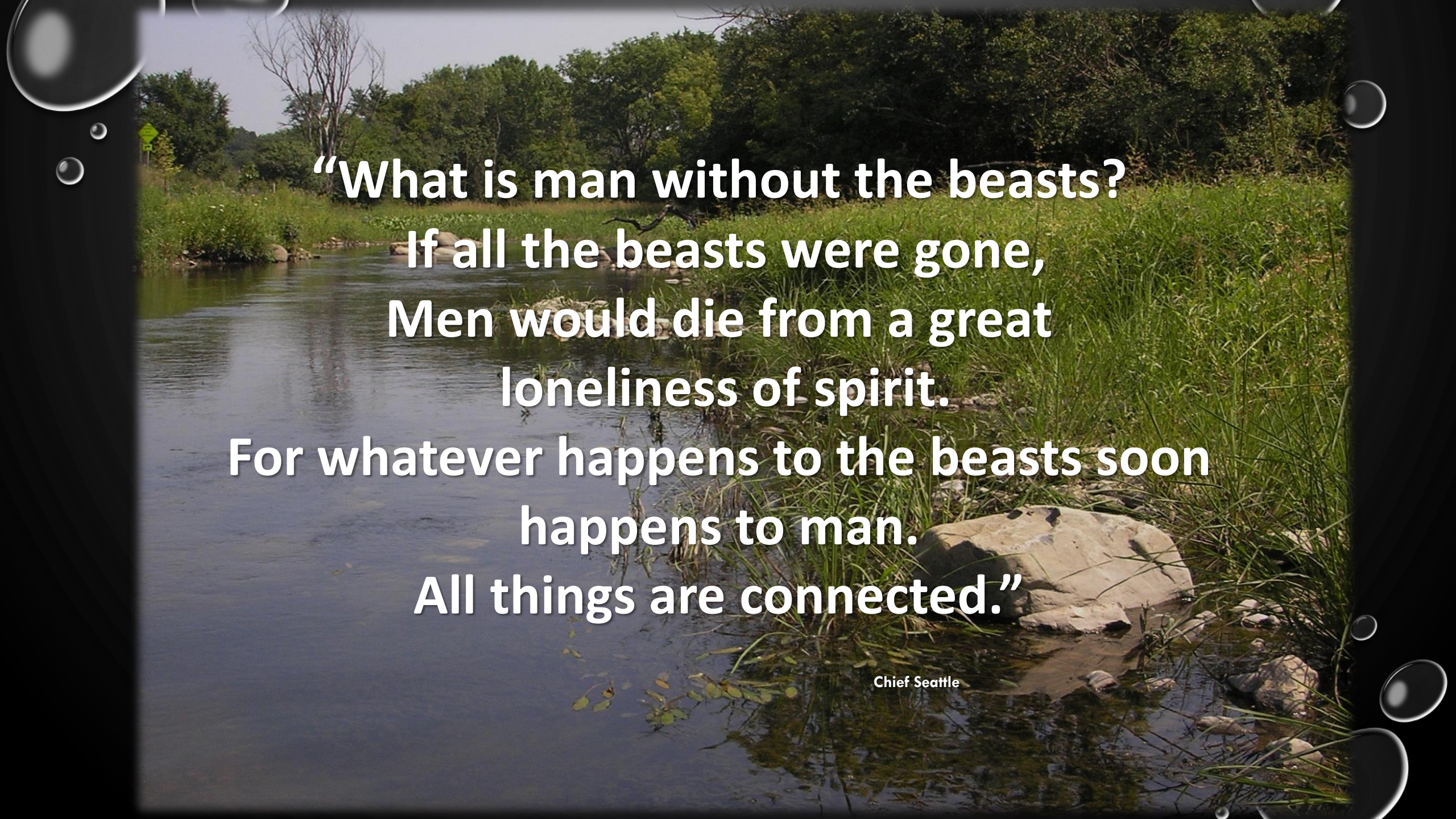
**PARTNERS and EMOTIONAL SUPPORT**

**McHenry County Conservation District**

**Kane County Forest Preserve District**

**Illinois Natural History Survey (INHS)**

**Illinois Dept. of Natural Resources (IDNR)**

A scenic view of a river flowing through a lush green landscape. The river is in the foreground, with several large rocks scattered along its banks. The water is calm, reflecting the surrounding greenery. In the background, there is a dense line of trees under a clear sky. The overall atmosphere is peaceful and natural.

**“What is man without the beasts?  
If all the beasts were gone,  
Men would die from a great  
loneliness of spirit.  
For whatever happens to the beasts soon  
happens to man.  
All things are connected.”**

Chief Seattle

# QUESTIONS?

