

Vermilion River Mussel Projects – from reintroductions to dam removal



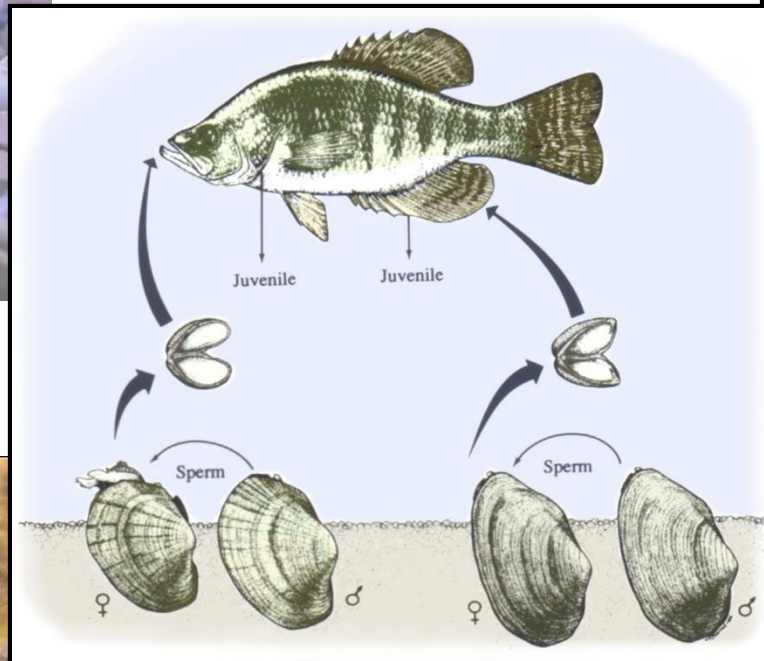
Jeremy S. Tiemann, Alison P. Stodola
Sarah A. Douglass, & Kevin S. Cummings

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 [@jayhawktiemann](https://twitter.com/jayhawktiemann)

Freshwater mussel life cycle

Cool critters - mean mothers



Importance of Mussels

- Biomass can exceed all other benthos by an order of magnitude



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- **Natural biological filters**



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- **Effects on density and community structure**



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- Effects on density and community structure
- **Water quality indicators**



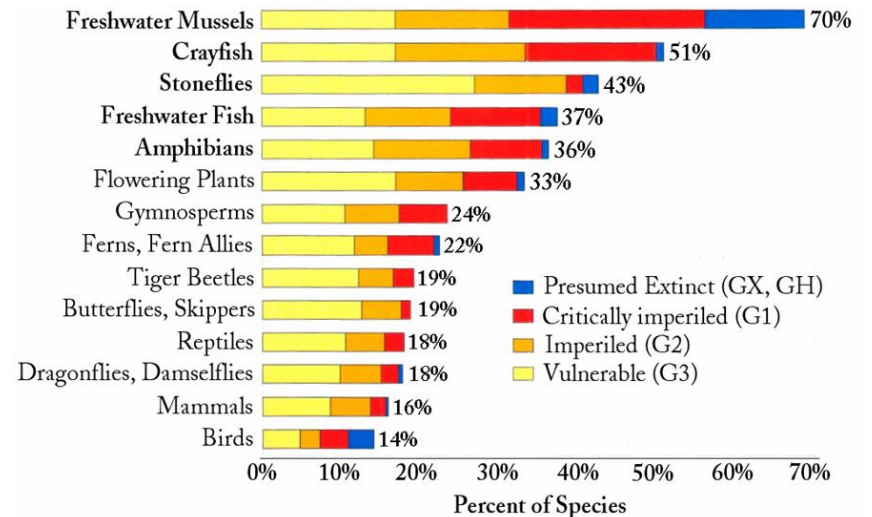
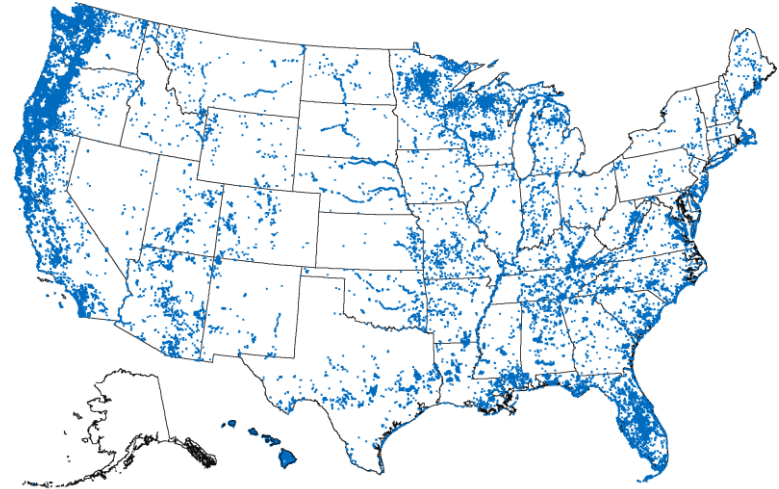
Importance of Mussels

- Biomass can exceed all other benthos by an order of magnitude
- Natural biological filters
- Food for fish & wildlife
- Effects on density and community structure
- Water quality indicators
- **Economic significance**



Importance of Mussels

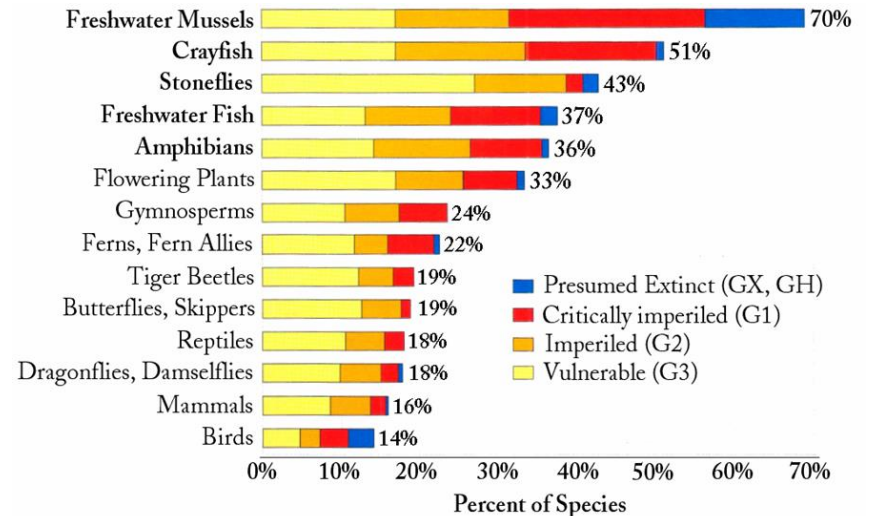
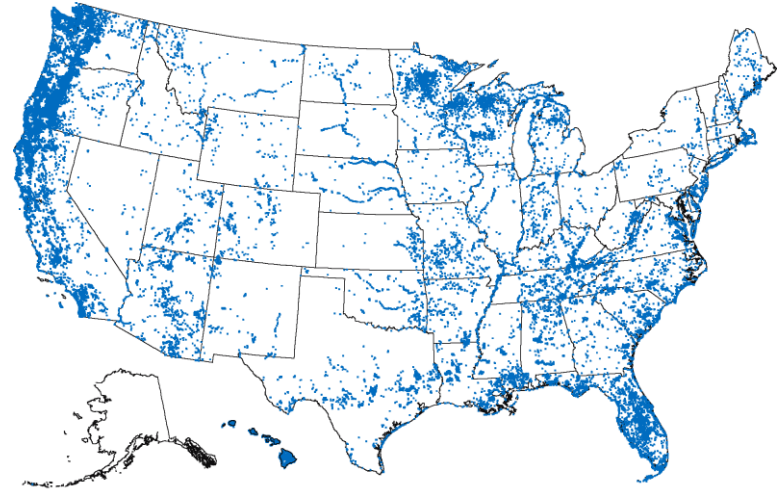
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- Natural biological filters
- Food for fish & wildlife
- Effects on density and community structure
- Water quality indicators
- Economic significance
- **Conservation status**



(Stein, et al. *Precious Heritage*)

Importance of Mussels

- Conservation status
 - Various pots of monies for conservation work
 - NRCS
 - State agencies
 - USFWS



(Stein, et al. *Precious Heritage*)

Reasons for the Decline of Freshwater Mollusks

- **Siltation**



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Reasons for the Decline of Freshwater Mollusks

- Siltation
- **Channelization**



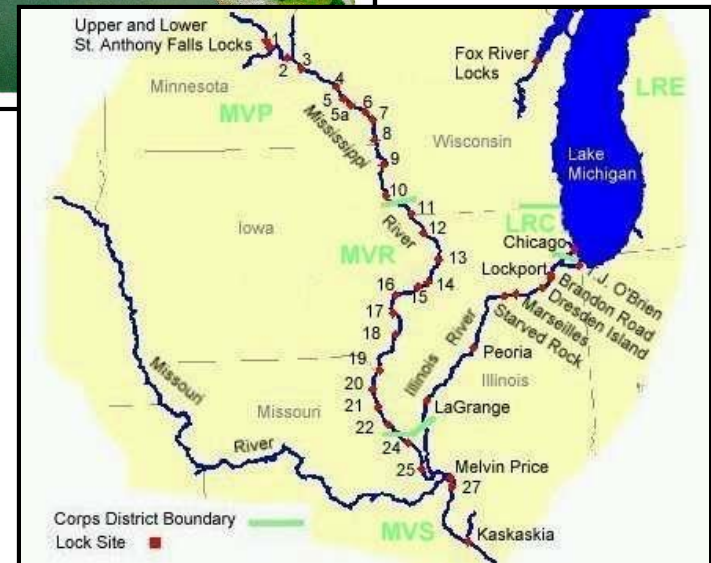
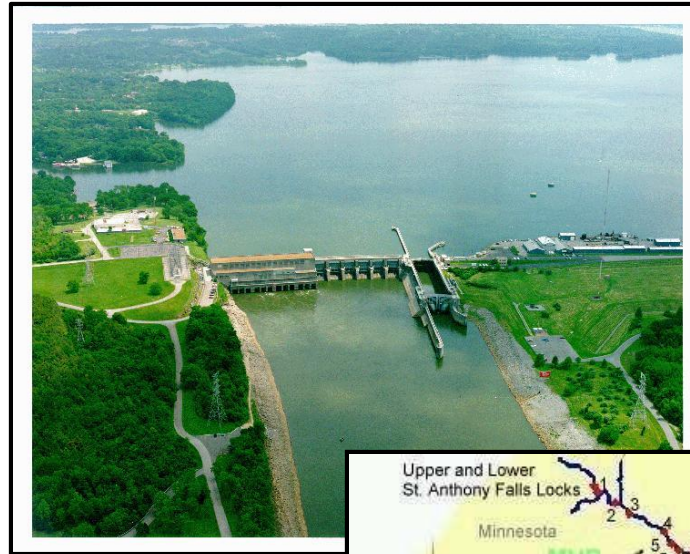
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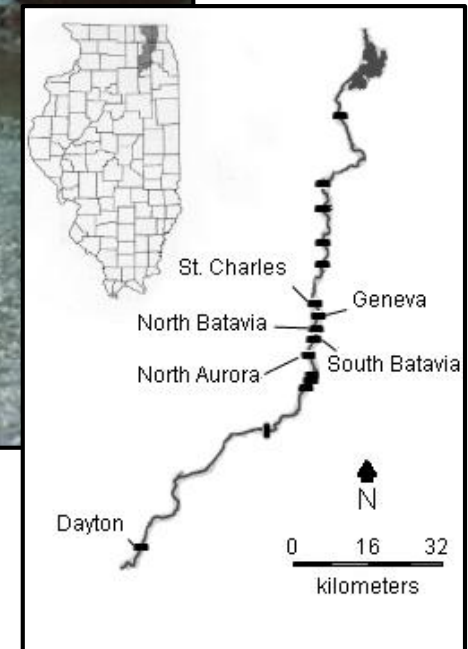
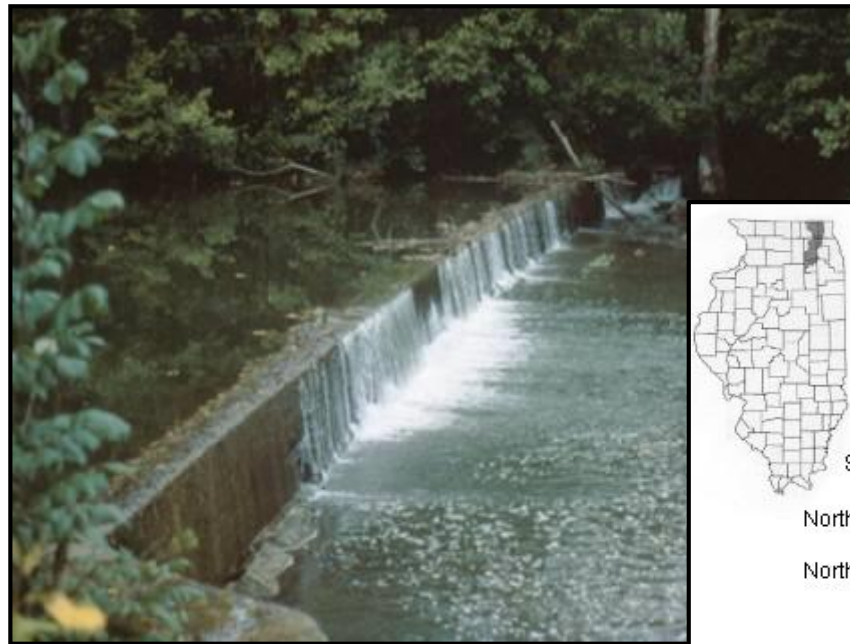
Reasons for the Decline of Freshwater Mollusks

- Siltation
- Channelization
- **Dams**



Reasons for the Decline of Freshwater Mollusks

- Siltation
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Reasons for the Decline of Freshwater Mollusks

- Siltation
- Channelization
- Dams
- **Agriculture**



Reasons for the Decline of Freshwater Mollusks

- Siltation
- Channelization
- Dams
- Agriculture
- **Chemical pollution**



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Reasons for the Decline of Freshwater Mollusks

- Siltation
- Channelization
- Dams
- Agriculture
- Chemical pollution
- **Mining (and fracking???)**



Reasons for the Decline of Freshwater Mollusks

- Siltation
- Channelization
- Dams
- Agriculture
- Chemical pollution
- Mining
- **Hydrology**



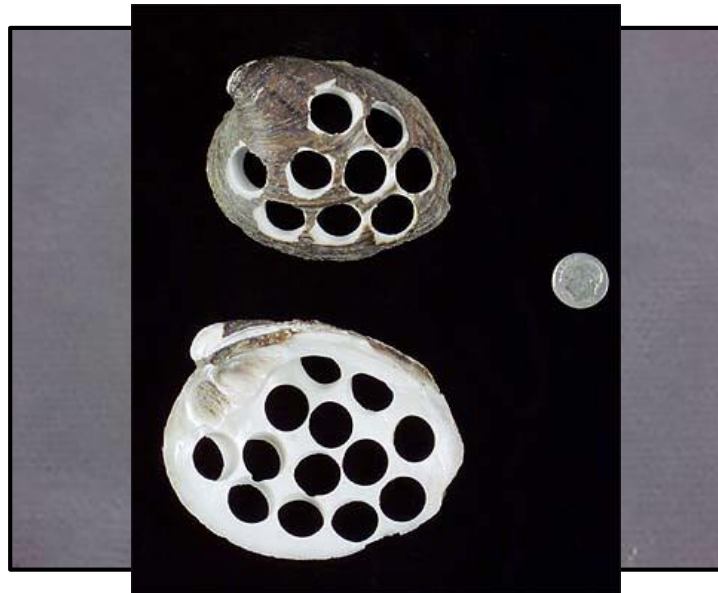
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- Siltation
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- Dams
- Agriculture
- Chemical pollution
- Mining
- Hydrology
- **Construction**



Reasons for the Decline of Freshwater Mollusks

- Siltation
- Channelization
- Dams
- Agriculture
- Chemical pollution
- Mining
- Hydrology
- Construction
- **Over harvesting**

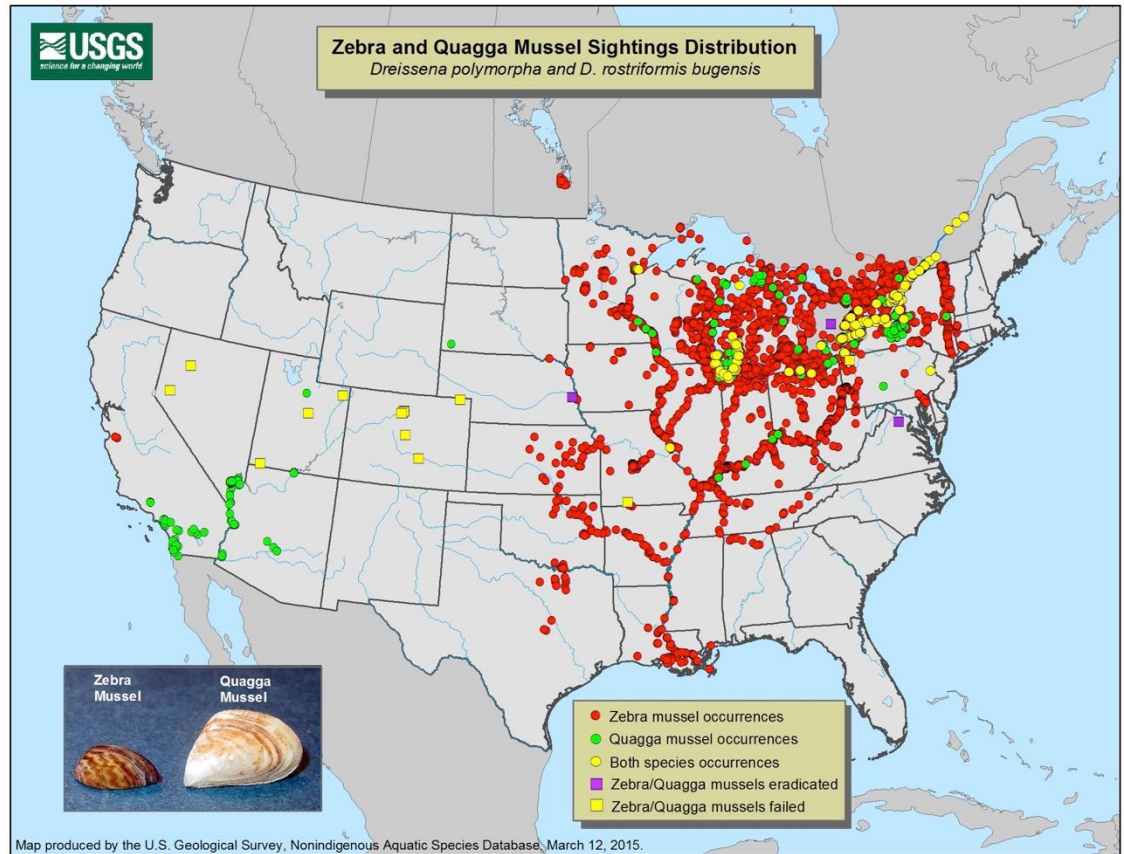


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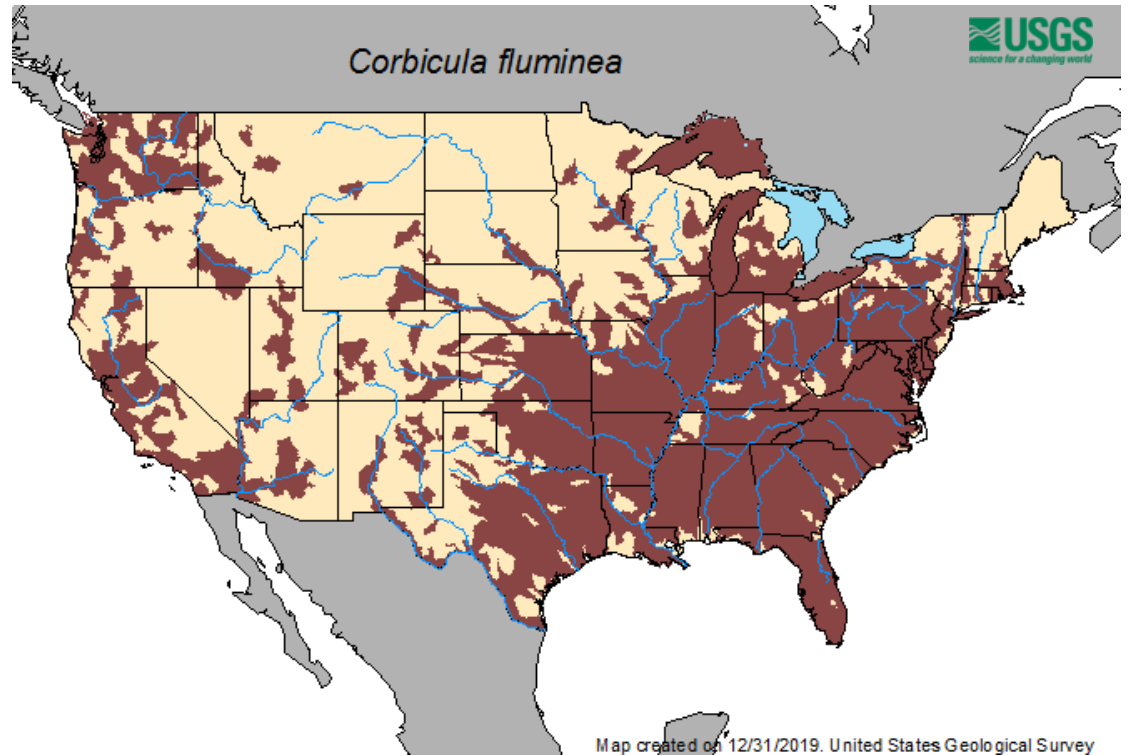
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- Over harvesting
- **Exotics**



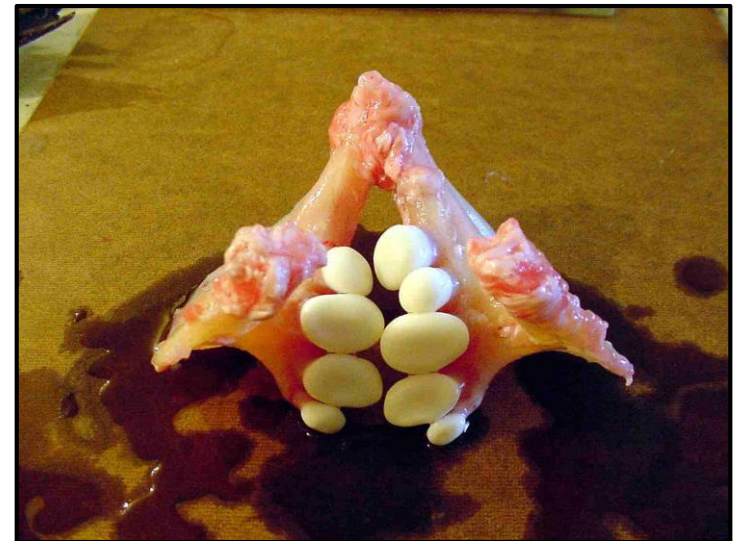
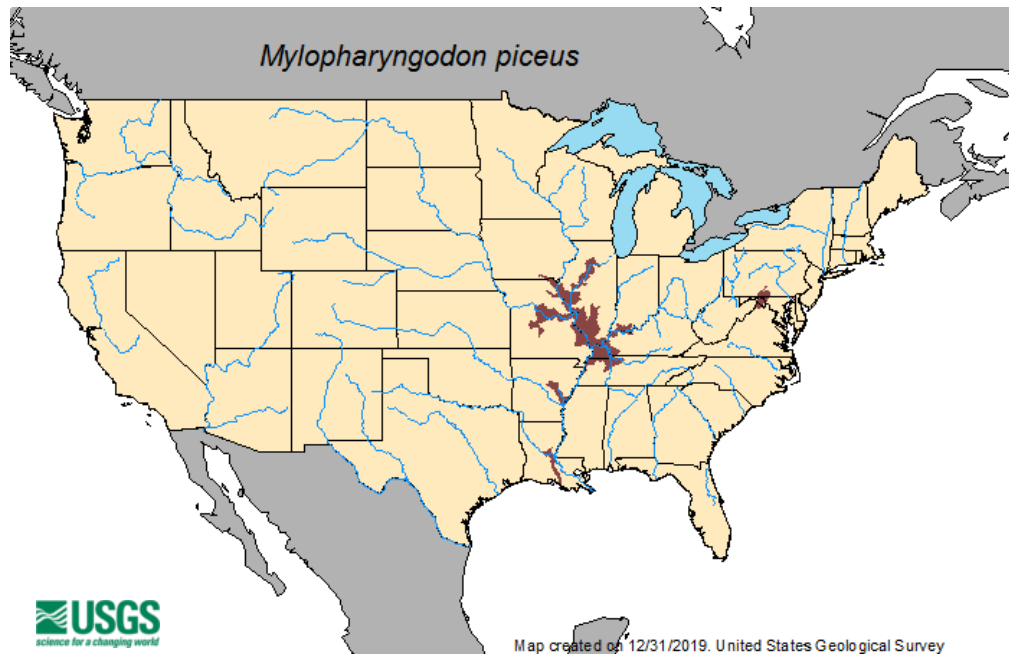
Zebra Mussels



Asian Clams



Black Carp



Pharyngeal Teeth

Reasons for the Decline of Freshwater Mollusks

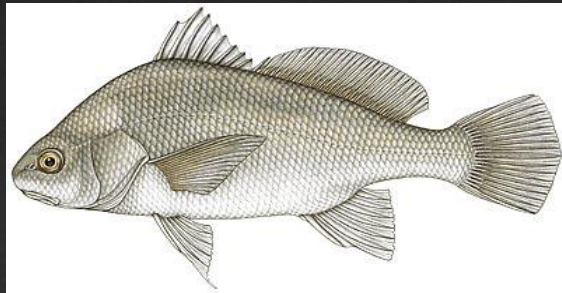
- Siltation
- Channelization
- Dams
- Agriculture
- Chemical pollution
- Mining
- Hydrology
- Construction
- Over harvesting
- Exotics
- **Reduction in host fishes**



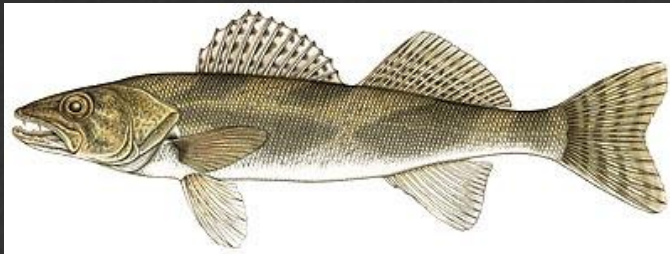
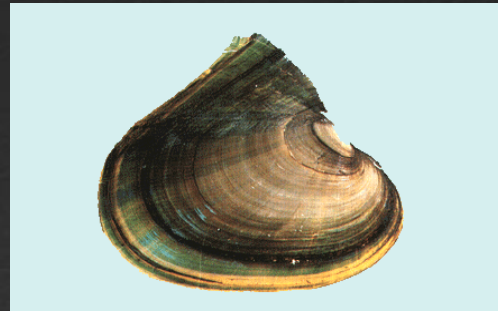
As go the fishes, so go the mussels



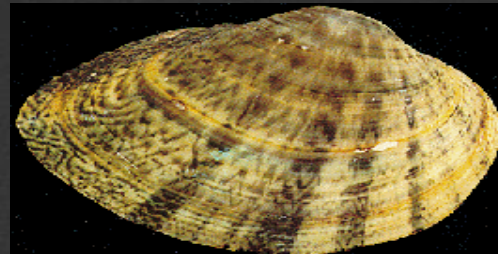
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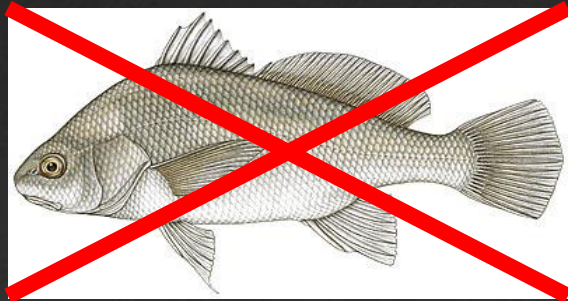
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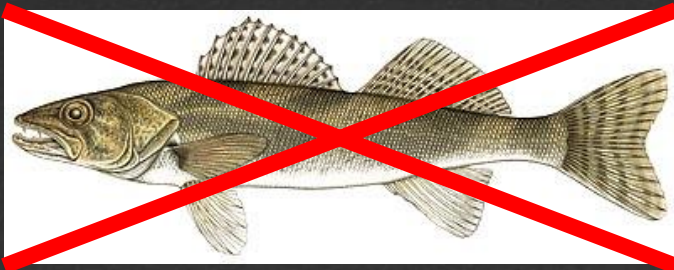
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North America Mussel Richness (~350 Species)

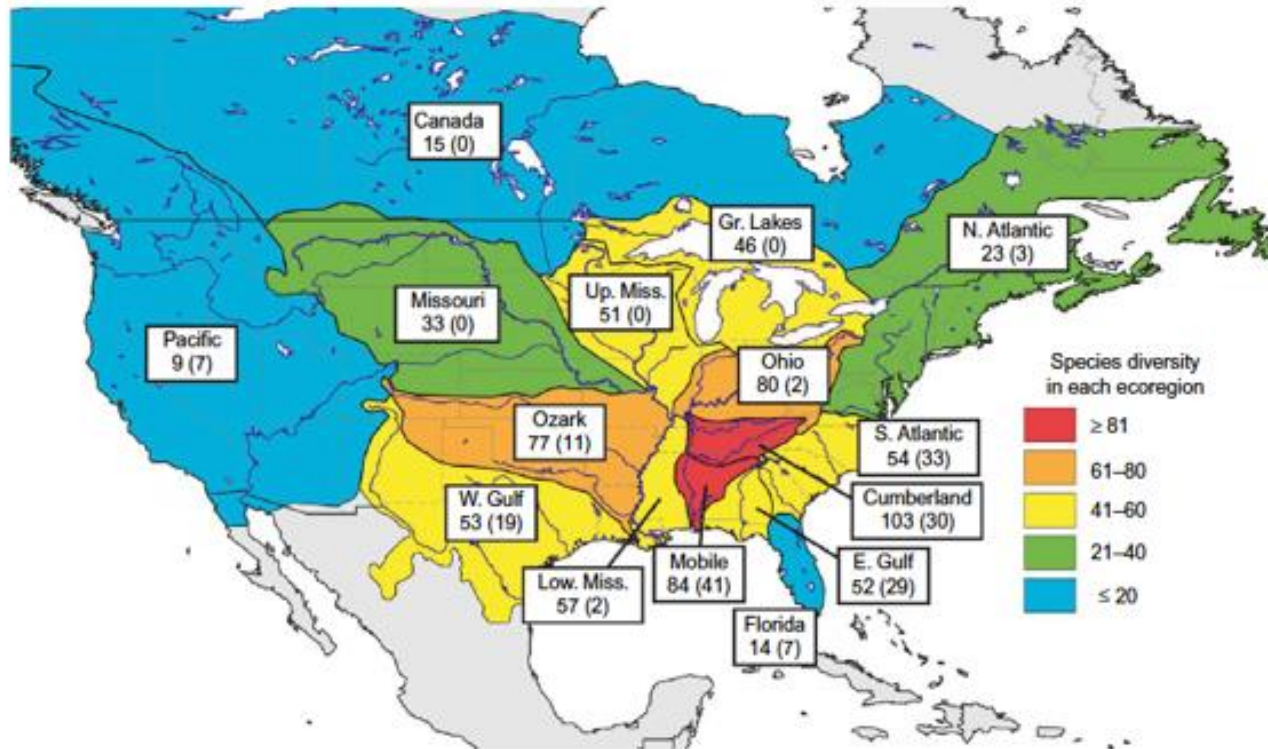


FIGURE 11.38 Freshwater ecoregions of North America, showing the species diversity (endemism) of each region. Adapted from Parmalee & Bogan (1998), Watters (2000), and various other literature sources.

North America Mussel Status (~350 Species)

according to FMCS/AFS

- Extinct 29
 - Endangered 107
 - Threatened 60
 - Vulnerable 72
-
- **TOTAL 268 (74%)**
 - Currently stable 92 (26%)



USFWS (official)

Endangered = 75

Threatened = 14

Vermilion River of the Wabash

Basin facts

- 4,000 km² watershed in “corn desert”
- Substrates = sand, gravel & cobble
- 100+ fish species, including 14 darters
- 45 species of freshwater mussels
- One of the “highest quality streams” in Illinois (Smith 1968)
 - Illinois’ only National Scenic River
 - ORBFHP Priority Watershed
- ~200,000 people live in basin (largest cities = Urbana & Danville)



Problems of the Vermilion River basin

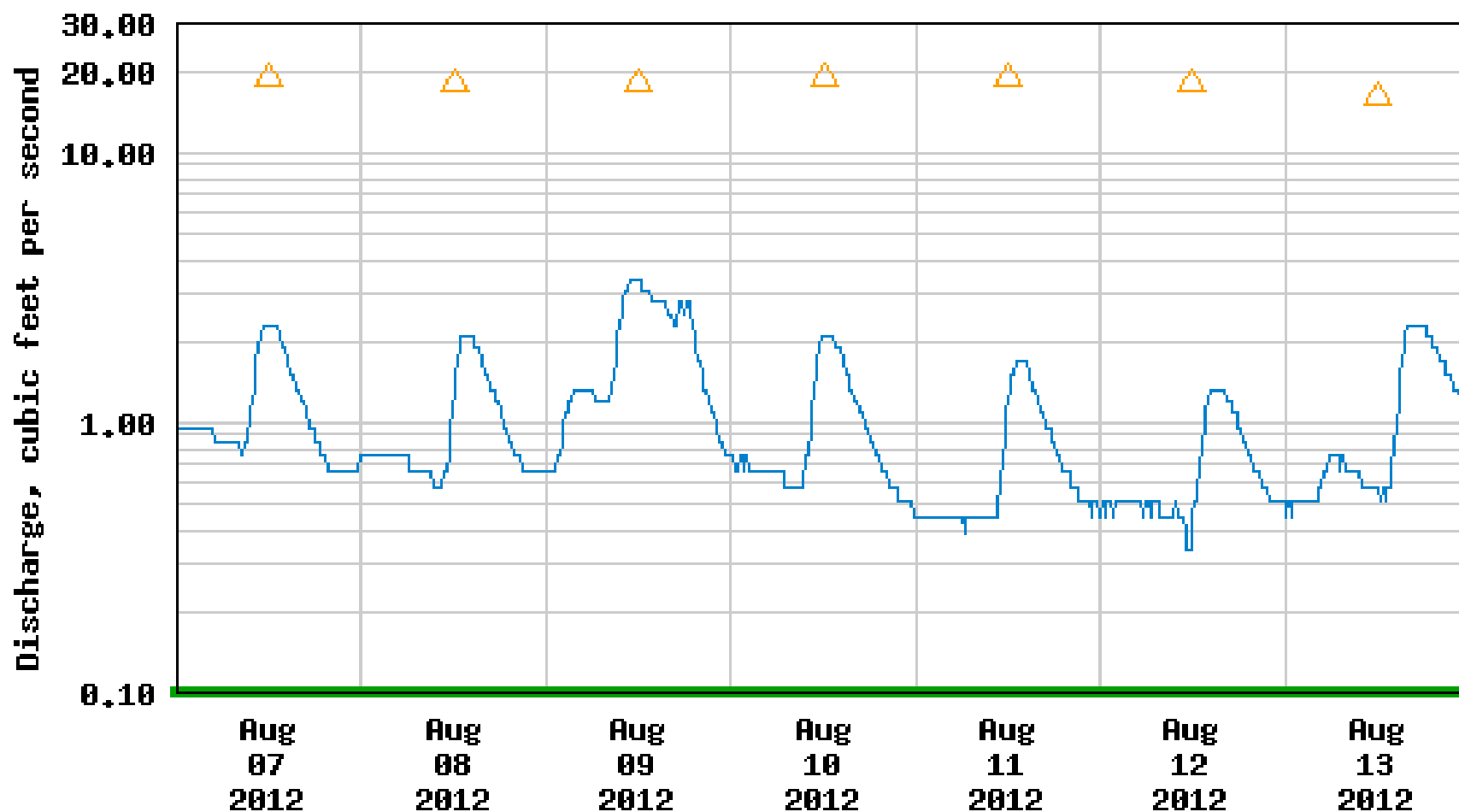
- Impoundments (4 dams... well, now 2!!!)
- Sedimentation
- Water quality degradation
- Stream dredging & channelization
- Channel destabilization
- Invasive species (*Corbicula*)
- Reduction in host fishes
 - 15 threatened & endangered species
- Future threats - coal and selling of water



Problems of the Vermilion River basin



USGS 03336900 SALT FORK NEAR ST. JOSEPH, IL



Reintroduction of the Federally-Endangered Northern Riffleshell and Clubshell



Northern Riffleshell (*Epioblasma rangiana*)



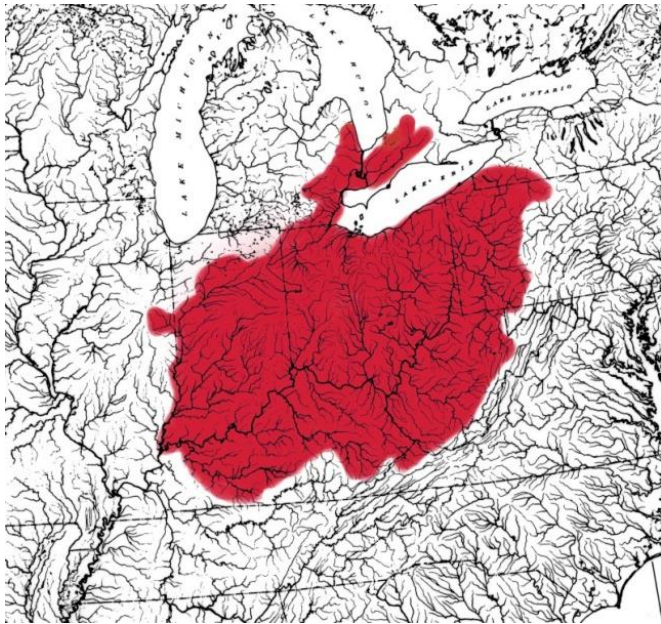
Habitat – Medium to large rivers in clean riffle areas with sand, gravel & cobble

Historical Range – Ohio River and Lake Erie drainages

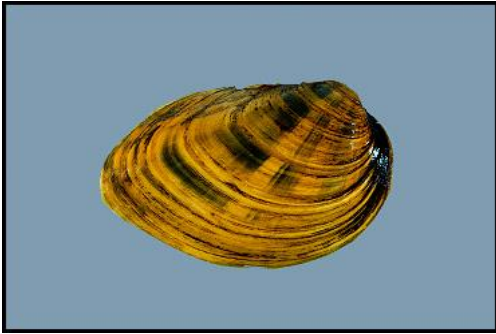
Current Distribution

- Reproducing in Ohio & Pennsylvania
- Extant in Kentucky, Indiana(?), Michigan, West Virginia & Ontario
- Extirpated from Illinois

Host fishes – various darters



Clubshell (*Pleurobema clava*)



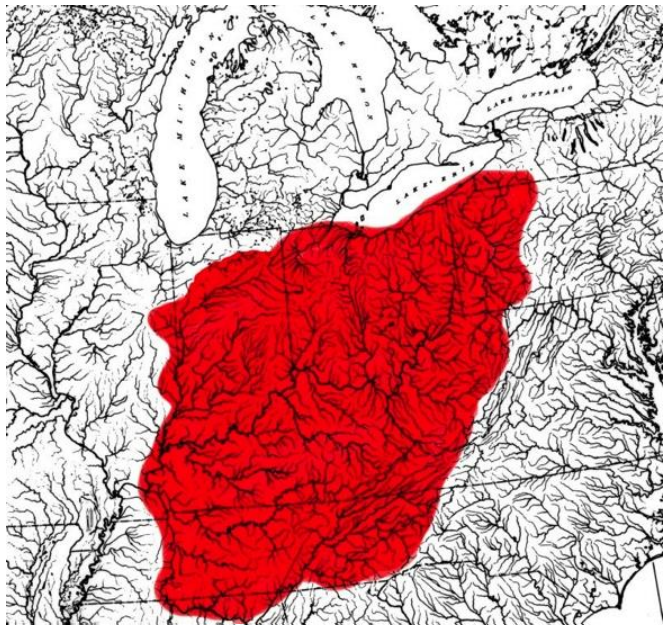
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Historical Range – Ohio River and Lake Erie drainages

Current Distribution

- Reproducing in Indiana, Kentucky, Michigan(?), Ohio, Pennsylvania & West Virginia
- Extant in Illinois(?) & New York(?)
- Extirpated from Alabama & Tenn.

Host fishes – darters, minnows, or suckers



Northern Riffleshell and Clubshell



Status – Federally Endangered
(~95% range reduction!)

Threats – several compounding factors*

- Dams
- Siltation
- Industrial pollution
- Dredging & channelization
- Exotics (e.g., zebra mussels)

* Other issues

- Short life spans & low fecundity
- Sampling (e.g., bury in substrate)



Clubshell and Northern Riffleshell Recovery Plan

(written in 1994)

Objective: Establish viable populations in 10 separate river basins throughout its range via augmentations and reintroductions

- Vermilion River selected as a pilot to assess translocation success



Clubshell and Northern Riffleshell Recovery Plan

Translocation

U.S. Hwy 62 bridge over Allegheny River replaced in 2018

- Estimate take = 20,000 Northern Riffleshell & 30,000 Clubshell!!!



Game Plan

- Select sites based on suitable habitats (e.g., free-flowing riffles) with diverse mussel fauna and high densities of host fishes
- Stock at densities similar to Allegheny River (~ 5 indiv/m²)

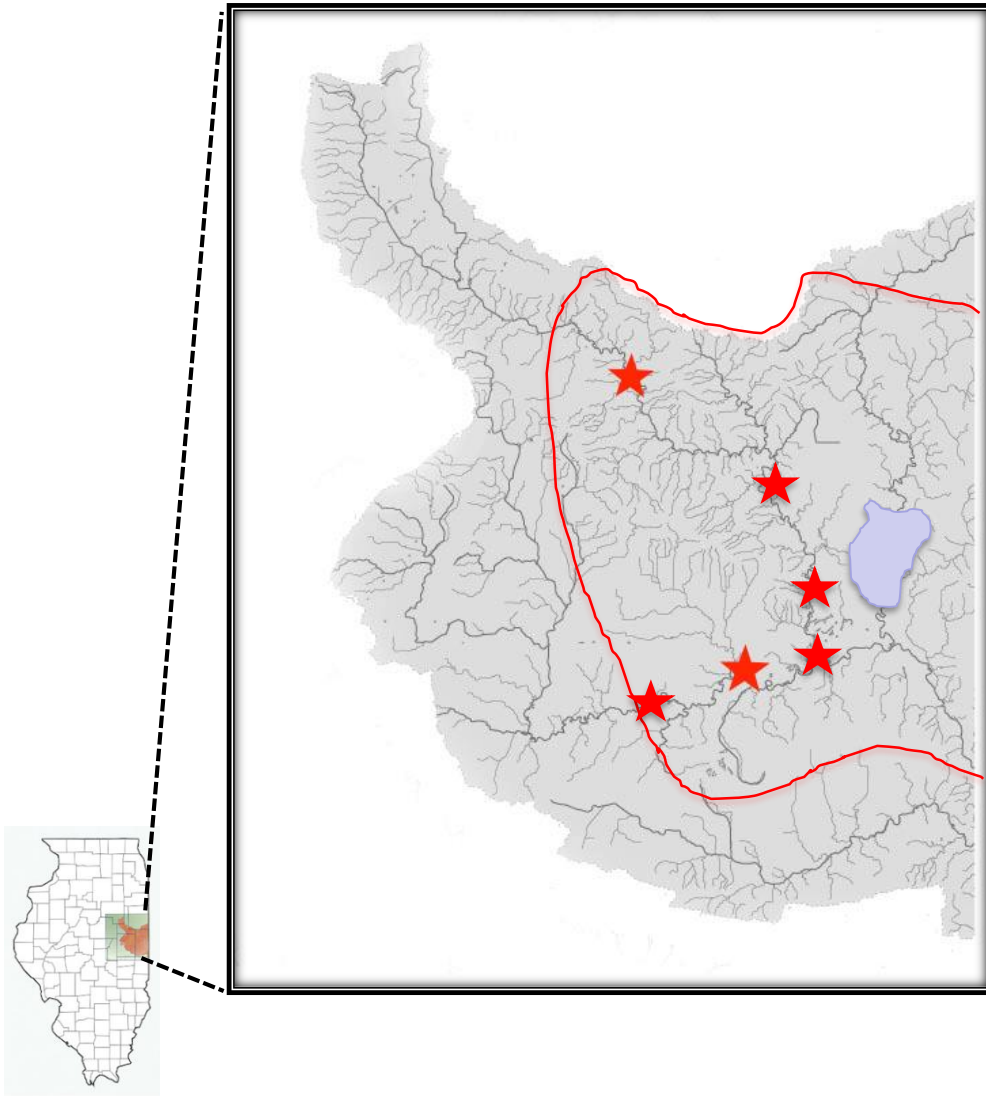


© M. C. Barnhart 2005



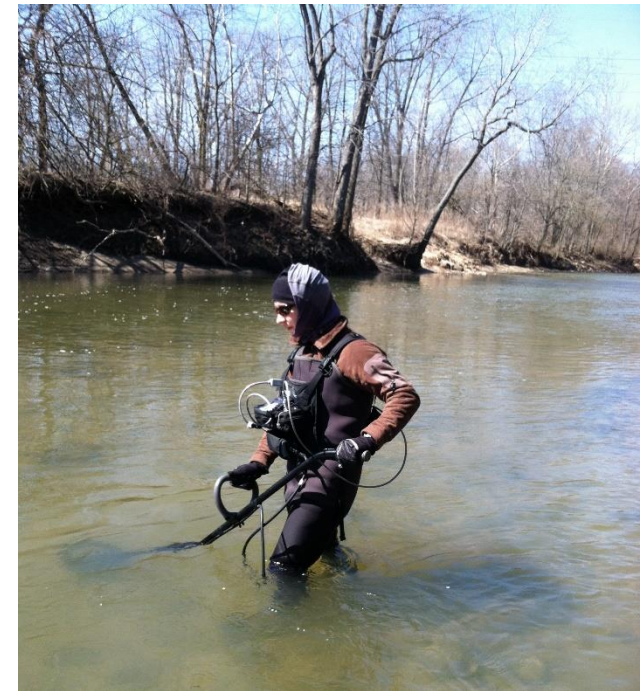
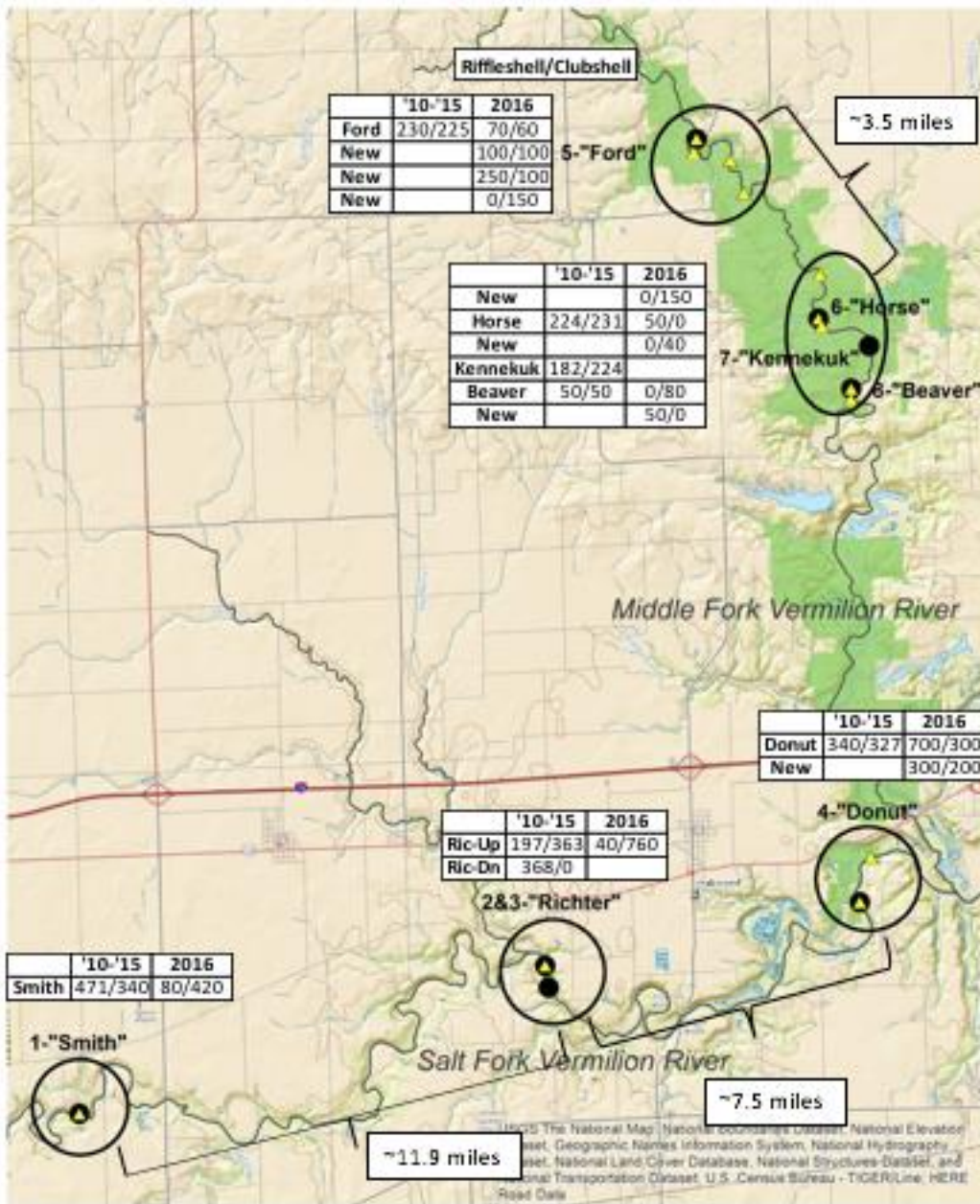
G.T. Watters

Site Selection – The Future is Looking Bright



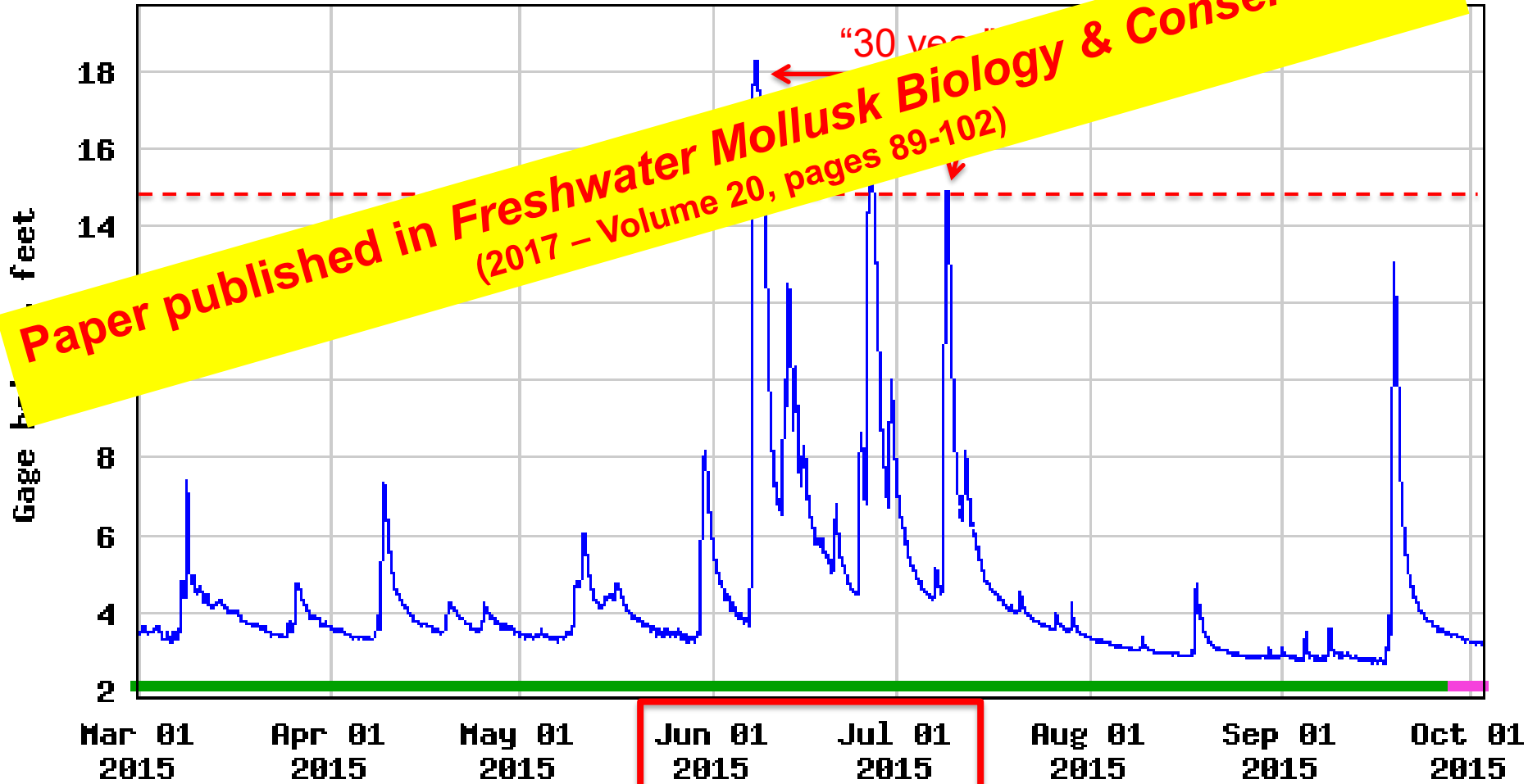
The Vermilion River basin?

What went where and when?



What is the biggest threat to survival?

USGS 03336900 SALT FORK NEAR ST. JOSEPH, IL



Objective - How can we find tags more efficiently?

Rigged to personal watercraft



Objective - How can we find tags more efficiently?



Objective - How can we find tags more efficiently?



Damn those dams - their effects on stream ecosystems

“Of all the aquatic habitat alterations, dams and their impounded waters are the leading cause of decline and imperilment of mussels”
– Williams et al. (1993) - *Fisheries*



Dam(n) problems

- Changes in stream habitats
 - Upstream – convert free-flowing habitats to lake habitats



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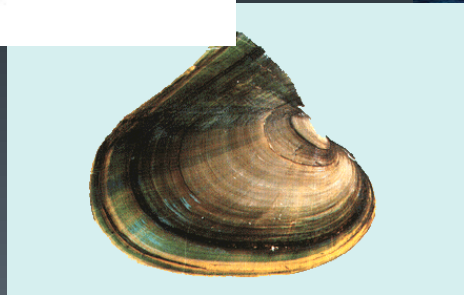
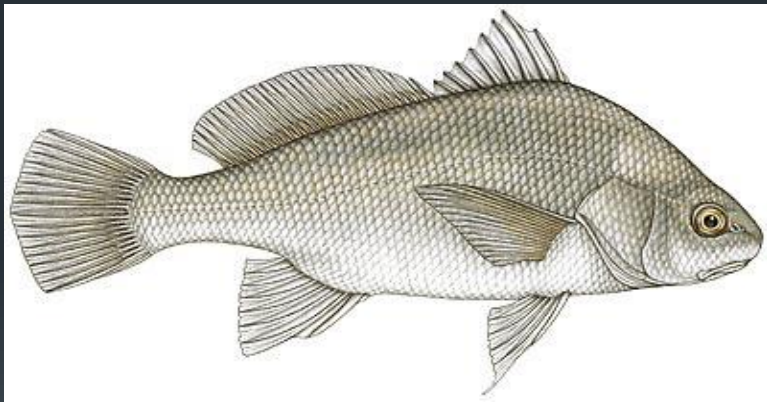
Dam(n) problems

- Habitat changes + reduced migration = altered communities
 - Reduced & fragmented populations for many groups



Dam(n) problems

- Physical barrier = altered spawning runs
 - Dams impede fish and mussel movement



Dam removal

- In the last 75 years, ~1,150 dams have been removed in U.S.
 - Quinn's 2006 - **Dam Safety Initiative**
 - >20 dams have been removed in Illinois thus far
 - More to come!!!



Photo credit: IDNR

Danville Dam



**DAM
REMOVAL**
UNDER CONSTRUCTION BY
STATE OF ILLINOIS
DEPARTMENT
OF
NATURAL RESOURCES
OFFICE OF WATER RESOURCES

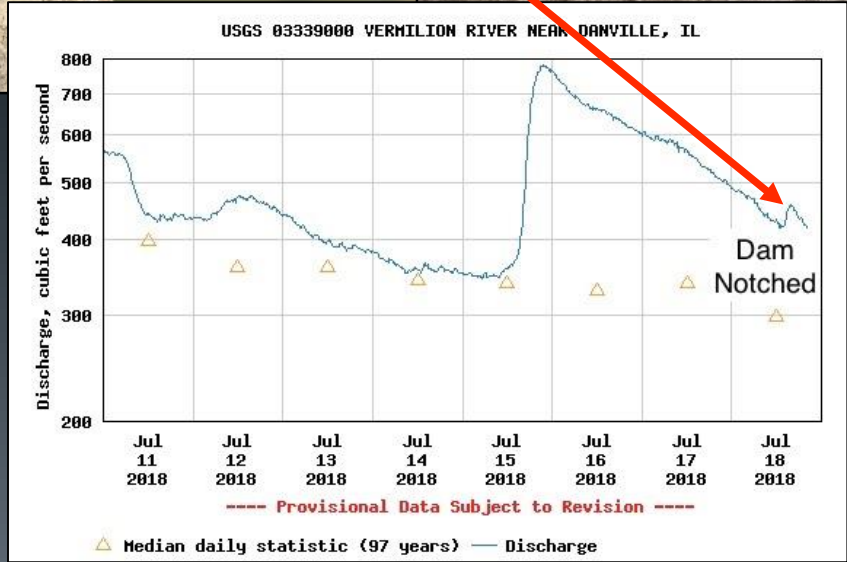
PROPERTY OF
CITY OF DANVILLE
**NO UNAUTHORIZED
MOTORIZED VEHICLES
OF ANY KIND
ALLOWED
BEYOND THIS POINT**
CODE OF ORDINANCES
CHAPTER 97.12 H 2,3,9



Danville Dam



Danville Dam



Danville Dam impounded area



Danville Dam – mussels

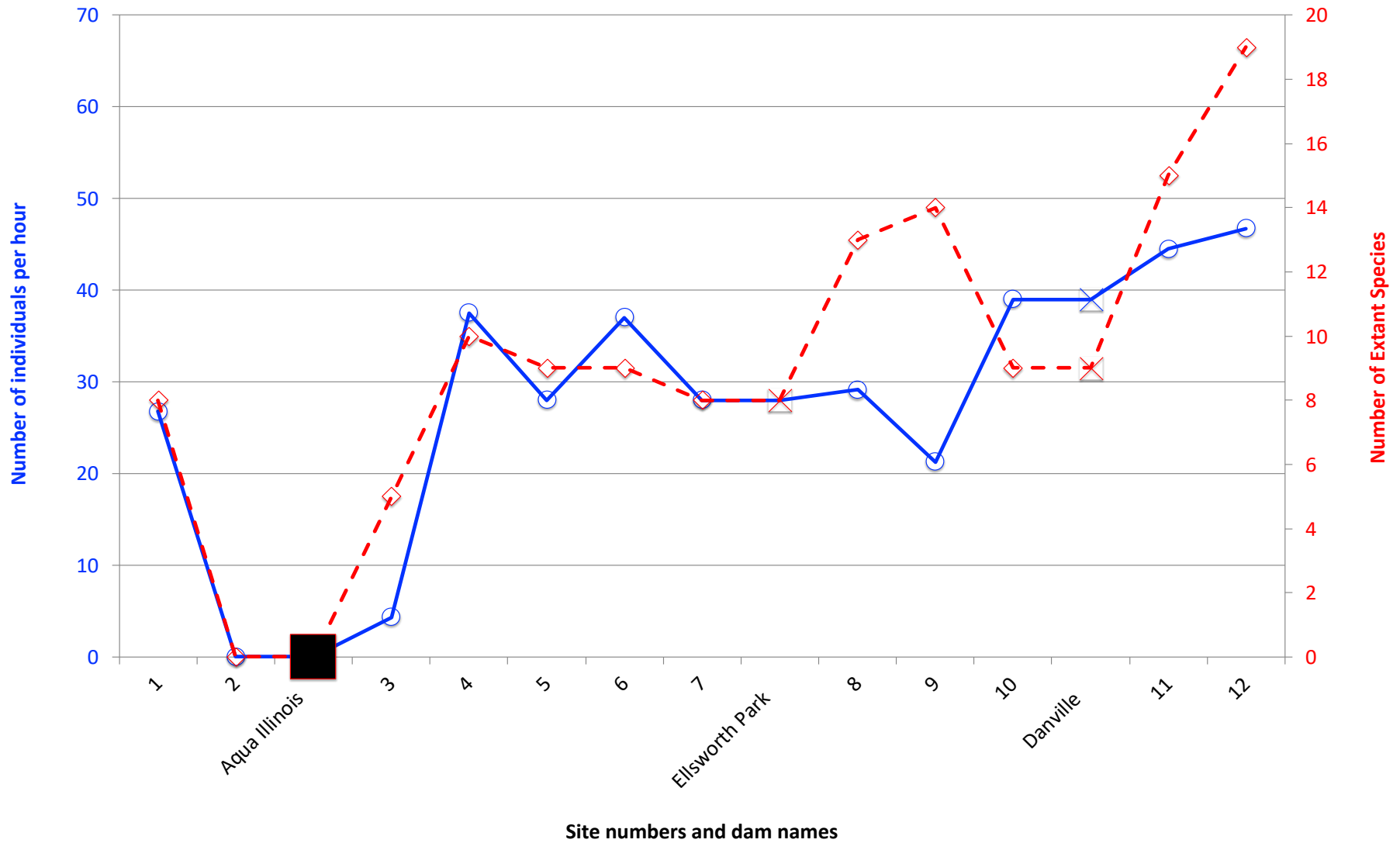


Stats (8 sampling events)

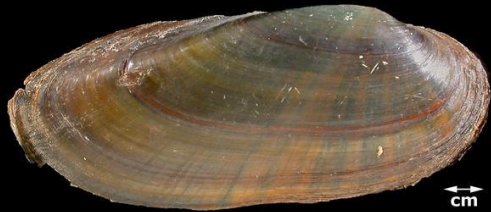
- 905 individuals live
- 23 species live
- 106 individuals dead



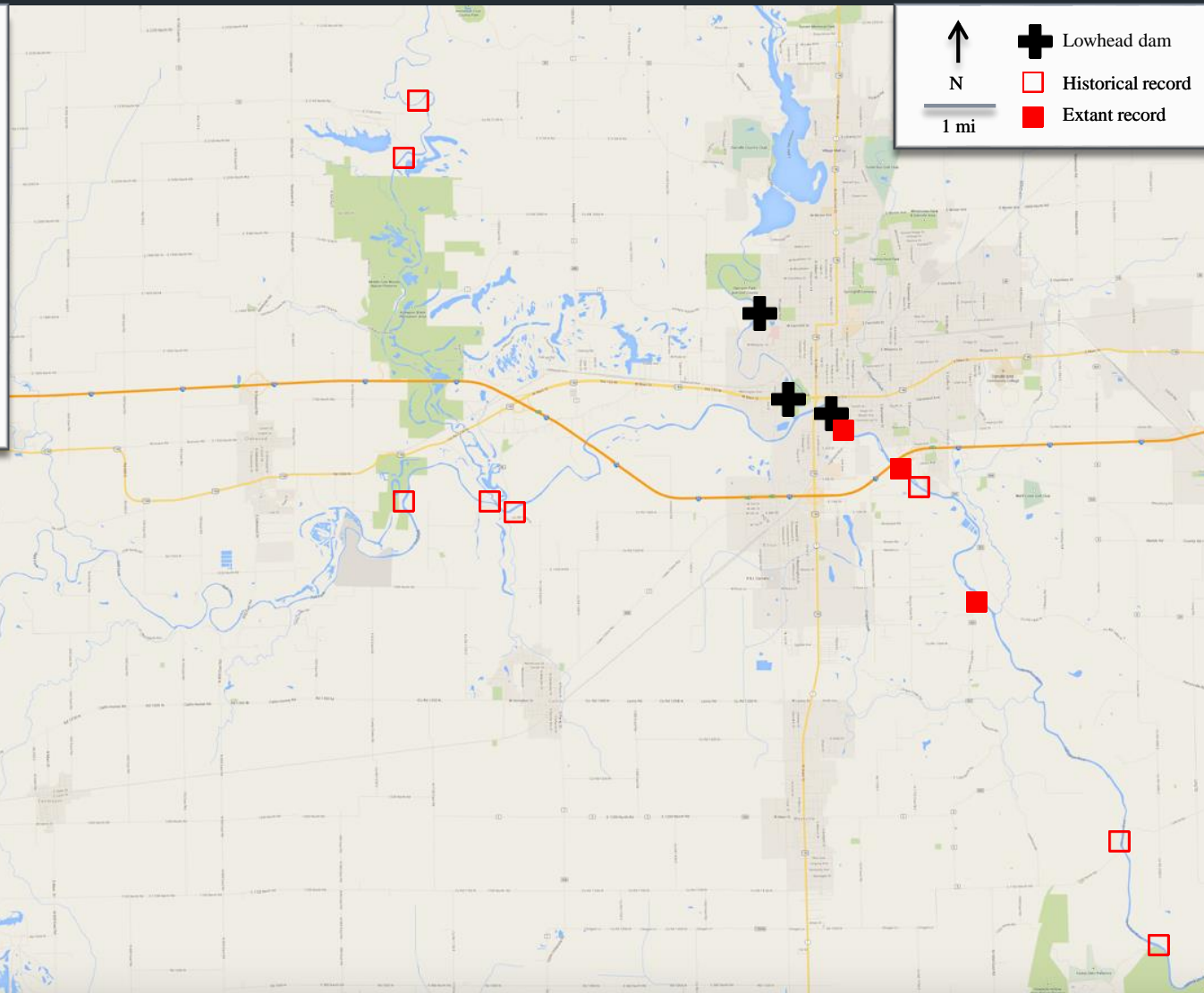
Danville removal benefits



Danville dams study – mollusks



Black Sandshell, *Ligumia recta*
Status: State-threatened
Hosts: *Sander*, *Lepomis*, and
Micropterus sp.



Dam removal benefits

- Safety / improved recreation



Photo credit: Jason Lindsey

Dam removal benefits

- Safety
- Improve fisheries



Photo credit: Bob Clouser

Dam removal benefits

- Safety
- Improve fisheries
- Return stream to natural state



Photo credit: Robert Shaw

Northern Riffleshell “Honey-hole” Allegheny River, Pennsylvania



Robert Szafoni
Rich Lewis
Tom Heavisides
Mary Kay Solecki
Anne Mankowski
Terry Esker
Nathan Grider
Sheldon Fairfield
Jon Hott
Trent Thomas

Joseph Kath
Robert Schanzle
Jessica Riney
Roger Jansen
Kelly Neal
Tyson Dallas
Samantha Wassenhove
Jody Shimp
Scott Shasteen
Ann Holtrop

Illinois Nature Preserves Commission
Illinois Endangered Species Protection Board
Illinois Wildlife Preservation Fund

**Illinois Nat. Hist. Survey + Univ. of Illinois
D.S. Fish & Wildlife Service**

Christine Mayer
Patty Morrison
Rachel Mujaworski
Kristen Lunn
Drew Becker
Amber Andress
Nathan Finkert
Jeff Stein

Robert Anderson
Angela Boyer
Jon Duvvarek
Mike Coffey
Craig McReek
Ron Stoddard
Steve Buck

Champaign County Forest Preserve District



Freshwater Mollusk Conservation Society

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<http://molluskconservation.org>

