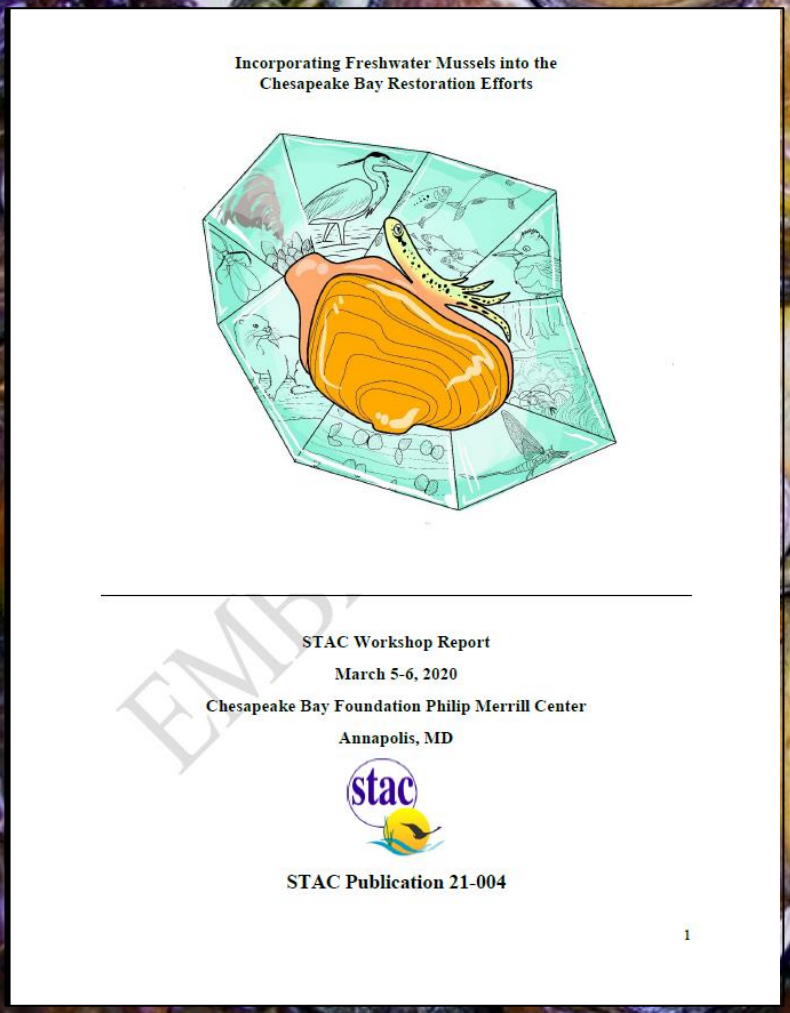
Hidden Treasures of our waters: Freshwater Mussels



Incorporating Freshwater Mussels into the Chesapeake Bay Restoration Efforts

STAC Workshop Report

March 5-6, 2020

Chesapeake Bay Foundation Philip Merrill Center

Annapolis, MD

STAC Publication 21-004

1

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Rachel Mair, US Fishing and Wildlife Service
Shawn McLaughlin, National Oceanic and Atmospheric Administration
Simeon Hahn, National Oceanic and Atmospheric Administration
Tom Ihde*, Morgan State University

- The Life of a Freshwater Mussel
- Mussels do good things
- Threats
- What can we do?

Native Saline Species

Blue Mussels
Mytilus edulis

Atlantic Ribbed Mussels

Non-native freshwater

Zebra and quagga mussels (*Dreissena*)

Corbicula

Native Freshwater Species

“Freshwater mussels” (Unionoida)

Fingernail and pea clams (Sphaeriidae)

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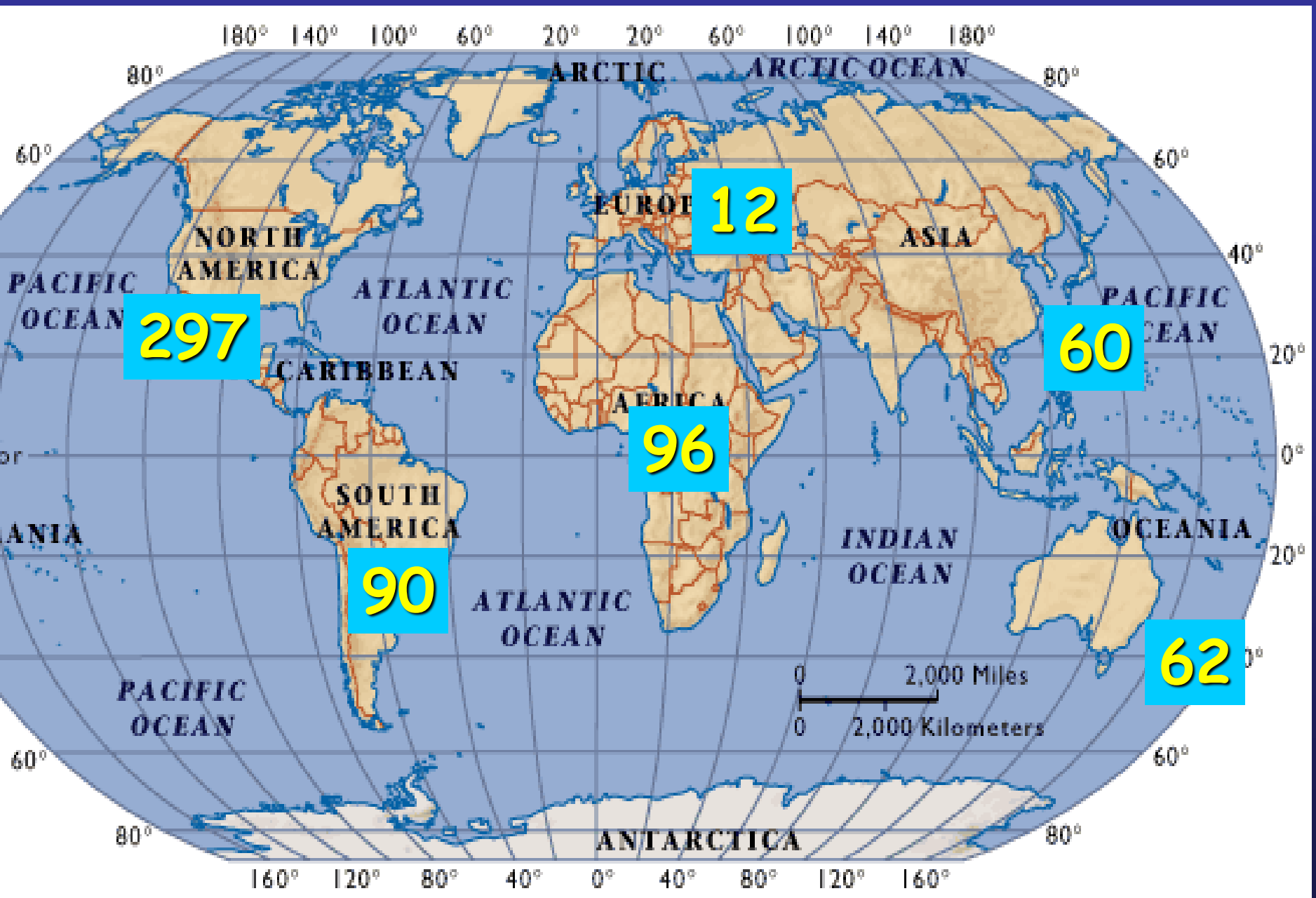
Which mussels are we talking about?

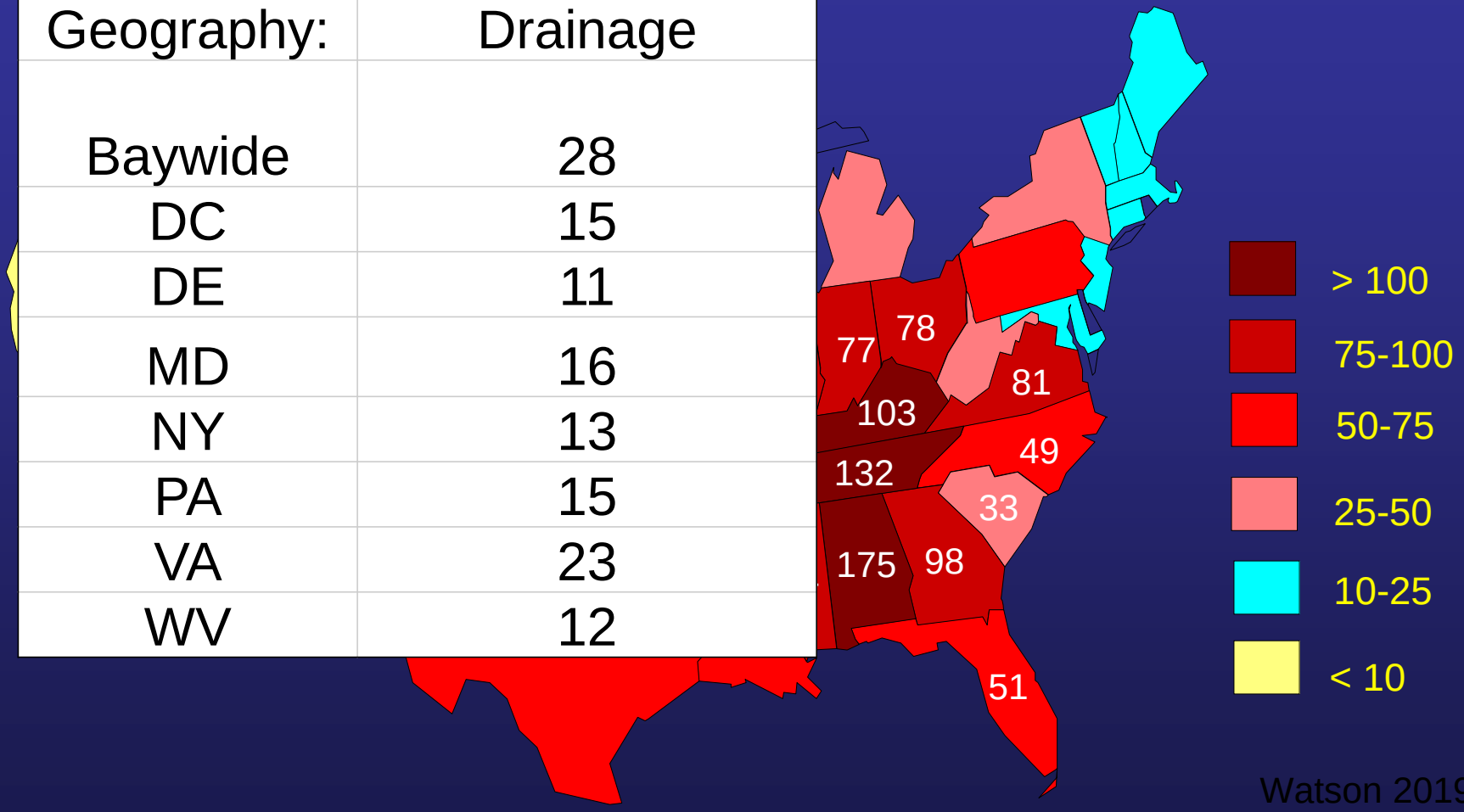
Mussel Distribution Worldwide



Watson 2019

Number of mussel species by state;

Geography:	Species in Bay Drainage
Baywide	28
DC	15
DE	11
MD	16
NY	13
PA	15
VA	23
WV	12



Watson 2019

Why such diversity in the south east?

Genus	Species	Common Name	Federal Status	VA	MD	DC	DE	WV	PA	NY	James	York	Rapp.	Pot.	Susque.
Alasmidonta	*heterodon*	Dwarf Wedgemussel		YES	YES	YES	YES	NO	YES	NO	YES	YES	YES	YES	YES
Alasmidonta	*undulata*	Triangle Floater		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Alasmidonta	*varicosa*	Brook Floater		YES	YES	YES	YES**	YES	YES	YES	YES	NO	NO	YES	YES
Alasmidonta	*marginata*	Elktoe		NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	YES	YES
Anodontoides	*ferussacianus*	Cylindrical Papershell		NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	YES
Elliptio	*complanata*	Eastern Elliptio		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Elliptio	*congaraea*	Carolina Slabshell		YES	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	NO
Elliptio	*fisheriana*	Northern Lance		YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES
Elliptio	*Icterina*	Variable Spike		YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
Elliptio	*lanceolata*	Yellow Lance		YES	YES	NO	NO	NO	NO	NO	YES	YES	YES	YES	NO
Elliptio	*producta*	Atlantic Spike		YES	YES	NO	NO	NO	NO	NO	YES	YES	YES	YES	NO
Elliptio	*roanokensis*	Roanoke Slabshell		YES	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO
Elliptio	*angustata*	Carolina Lance		YES	NO	YES	NO	NO	NO	NO	YES	YES	YES	YES	NO
Fusconaia	*masoni*	Atlantic Pigtoe		YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
Lampsilis	*cardium/ovata*	Pocketbook		YES	YES	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
Lampsilis	*cariosa*	Yellow Lampmussel		YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES
Lampsilis	*radiata*	Eastern Lampmussel		YES	NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES
Lasmigona	*compressa*	Creek heelsplitter		NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES
Lasmigona	*subviridis*	Green Floater		YES	YES	YES	YES**	YES	YES	YES	YES	YES	YES	YES	YES
Leptodea	*ochracea*	Tidewater Mucket		YES	YES	YES	YES	NO	NO	NO	YES	YES	YES	YES	YES
Ligumia	*nasuta*	Eastern Pondmussel		YES	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES	YES
Margaritifera	*margaritifera*	Eastern pearlshell		NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES
Pleurobema	*collina*	James Spinymussel		YES	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO
Pyganodon	*cataracta*	Eastern Floater		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pyganodon	*grandis*	Giant floater		NO	NO	NO	NO	NO	NO	YES*	NO	NO	NO	NO	YES*
Strophitus	*undulatus*	Creeper		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Utterbackia	*imbecillis*	Paper Pondshell		YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
Utterbackiana (previously Anodonta)	*implicata*	Alewife Floater		YES	YES	YES	YES	NO	YES	NO	YES	YES	YES	YES	YES
	: Endangered		Bay Waters	VA	MD	DC	DE	WV	PA	NY	James	York	Rapp.	Pot.	Susque.
	: Threatened	TOTAL:	28	23	16	15	11	12	15	13	18	18	18	21	18

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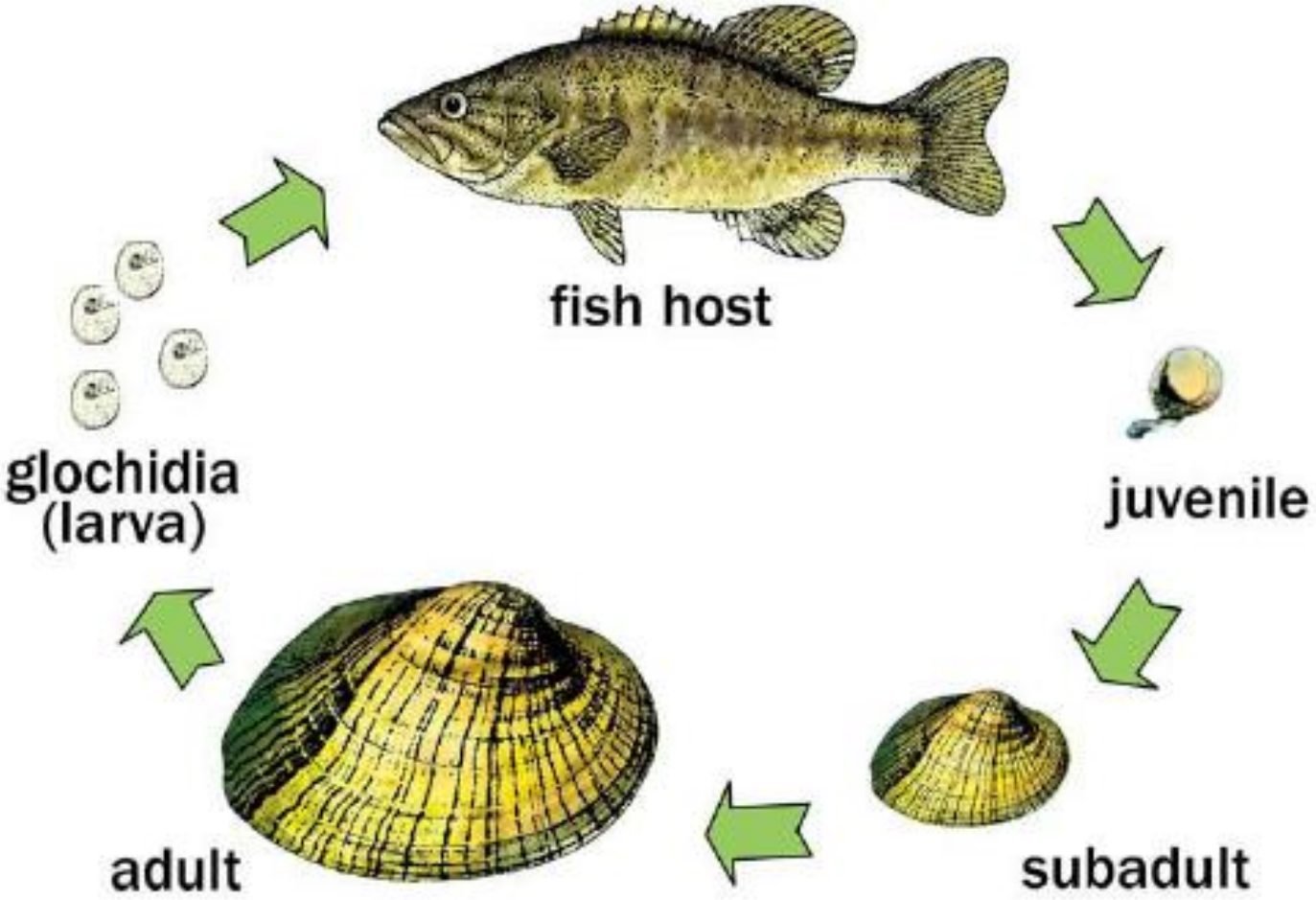
What is going on here...


fish host
juvenile
subadult
adult
glochidia
(larva)

What's in my back yard?

Mussel habitat is ubiquitous across freshwater…

SO, In the Bay Watershed, more people have mussel habitat in their backyard than crabs, oysters or striped bass

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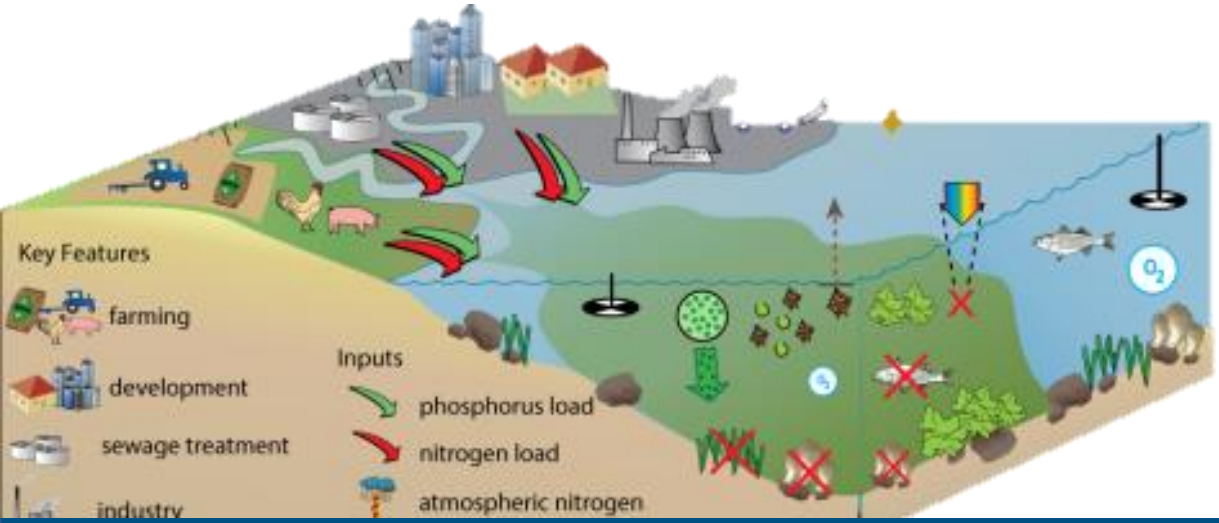
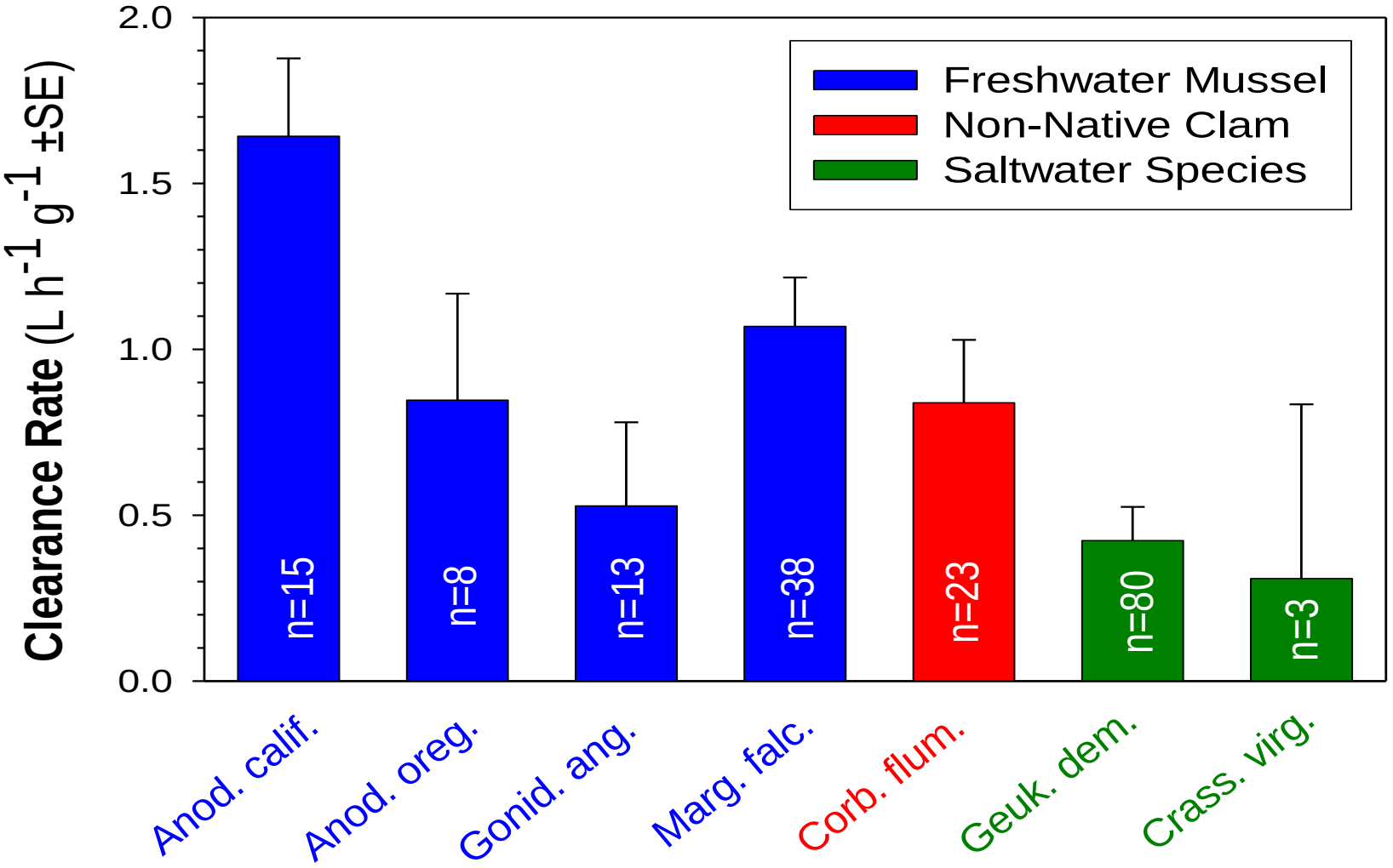
Point #1 Mussels are Cool and are an opportunity for engagement

Mussels do good things!




Time Lapse: Brian Watson

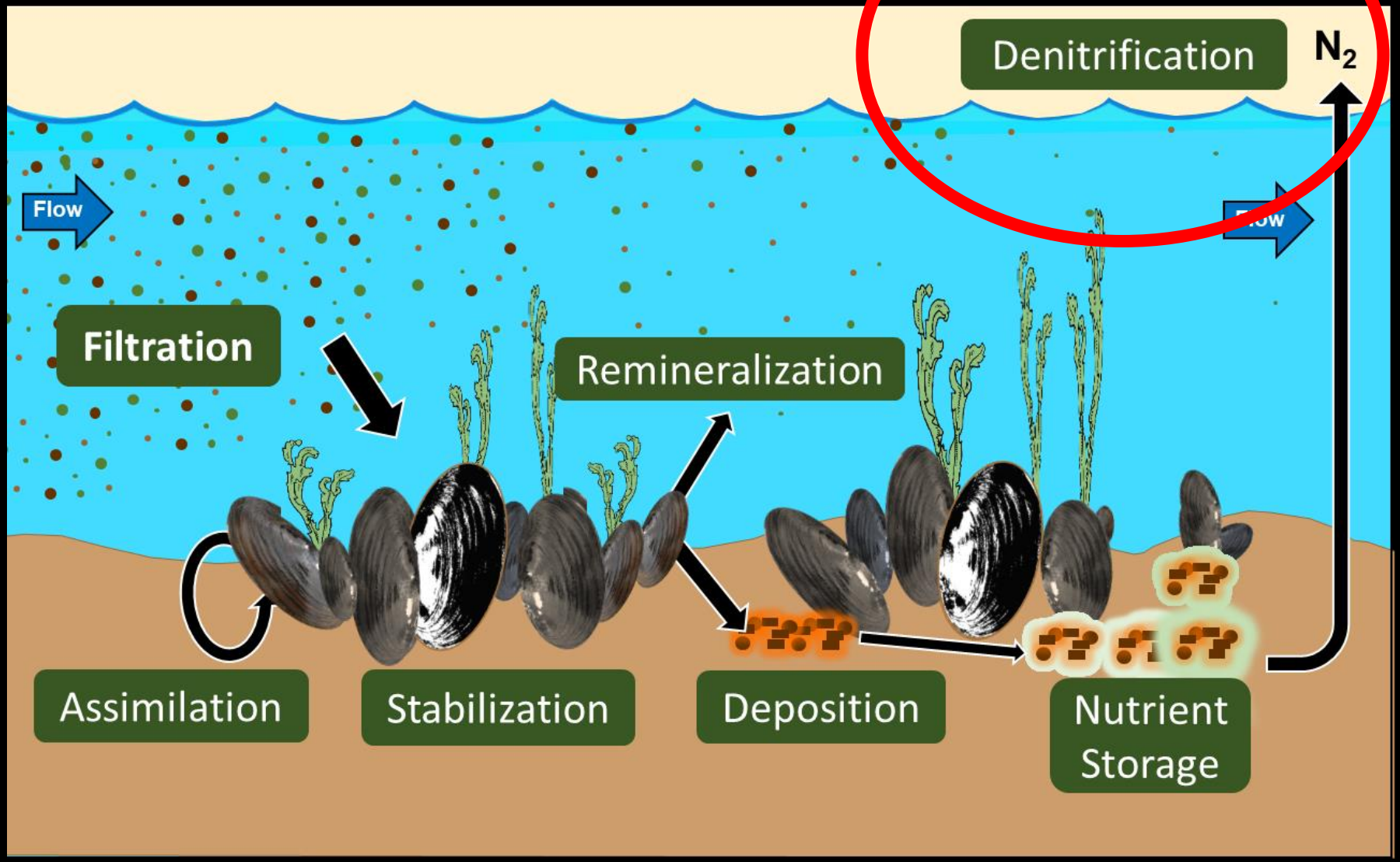
How Fast do mussels filter water?



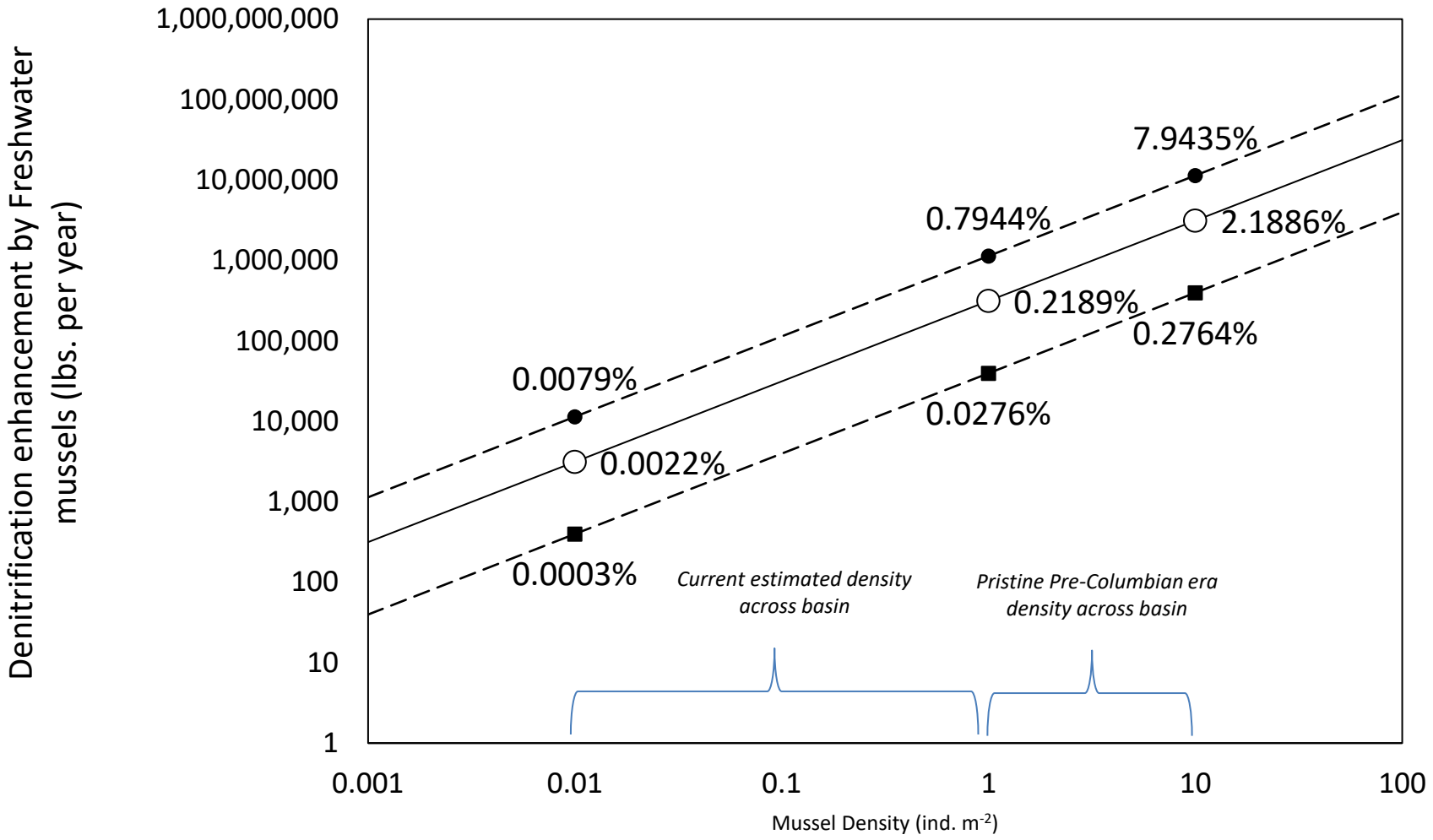
7 Species: 0.3 - 1.6 L/hr/g

Partnership for the DELAWARE ESTUARY

Effects of Mussel Beds



Kreeger et al. 2018. J. Shellfish Res.



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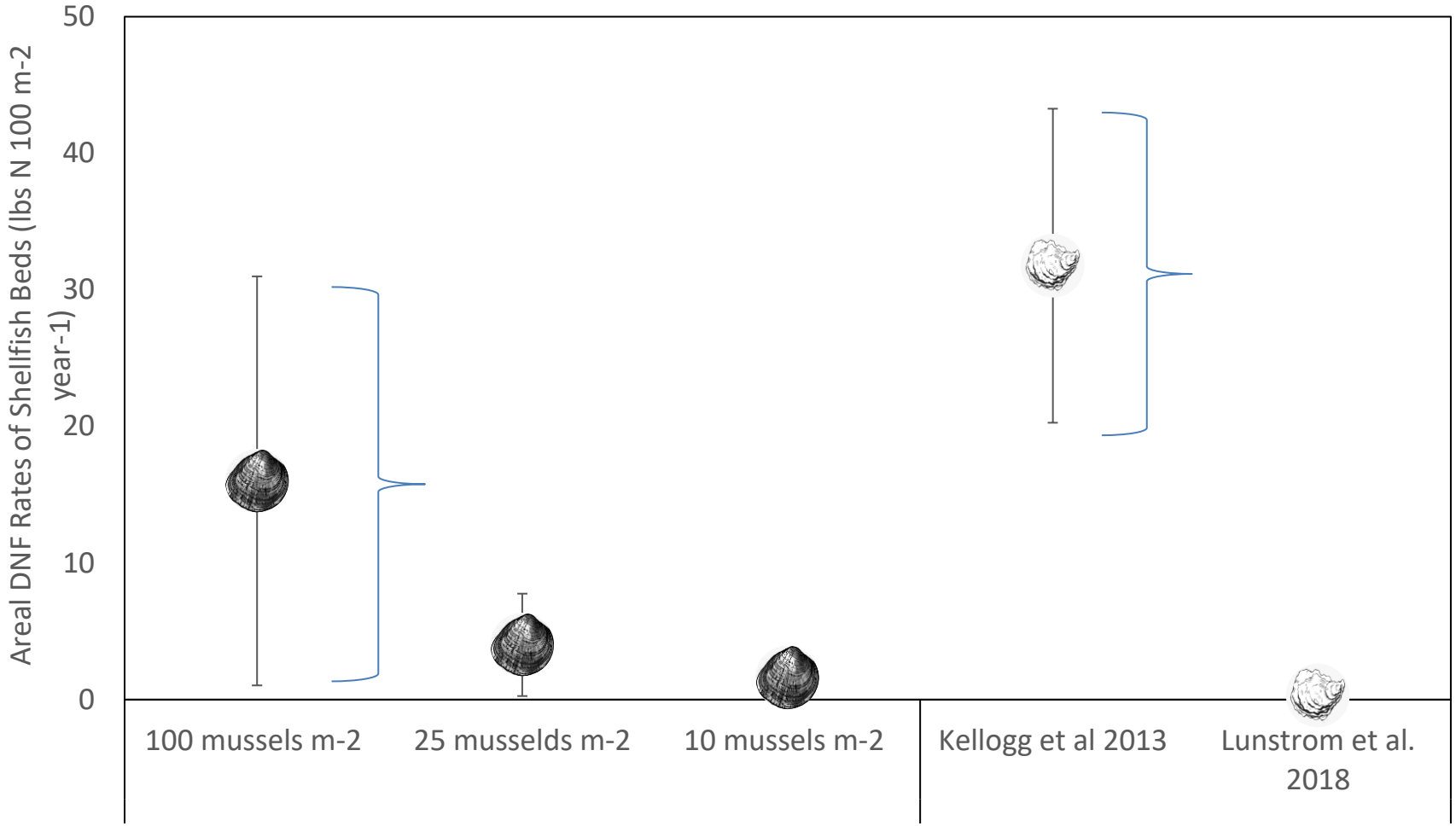
What proportion of Nitrogen loads can Mussel Denitrification offset?



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Dense mussel beds could be important to local waters

Wildlife Food Source

Habitat for Animals and Plants

Indicators of Water Quality

- Long lived
- Sessile
- Sensitive early life stage
- Hg, Zn, Cu, Cl, Ammonia

EARTH ISLAND JOURNAL

An Earth Island Institute Publication

SUBSCRIBE DONATE NEWSLETTER

THE LATEST MAGAZINE ARCHIVE ABOUT

Fracking Chemicals Dumped in Allegheny River a Decade Ago Still Showing Up in Mussels

New study shows that strontium is making its way into the food chain

KRISTINA MARUSIC

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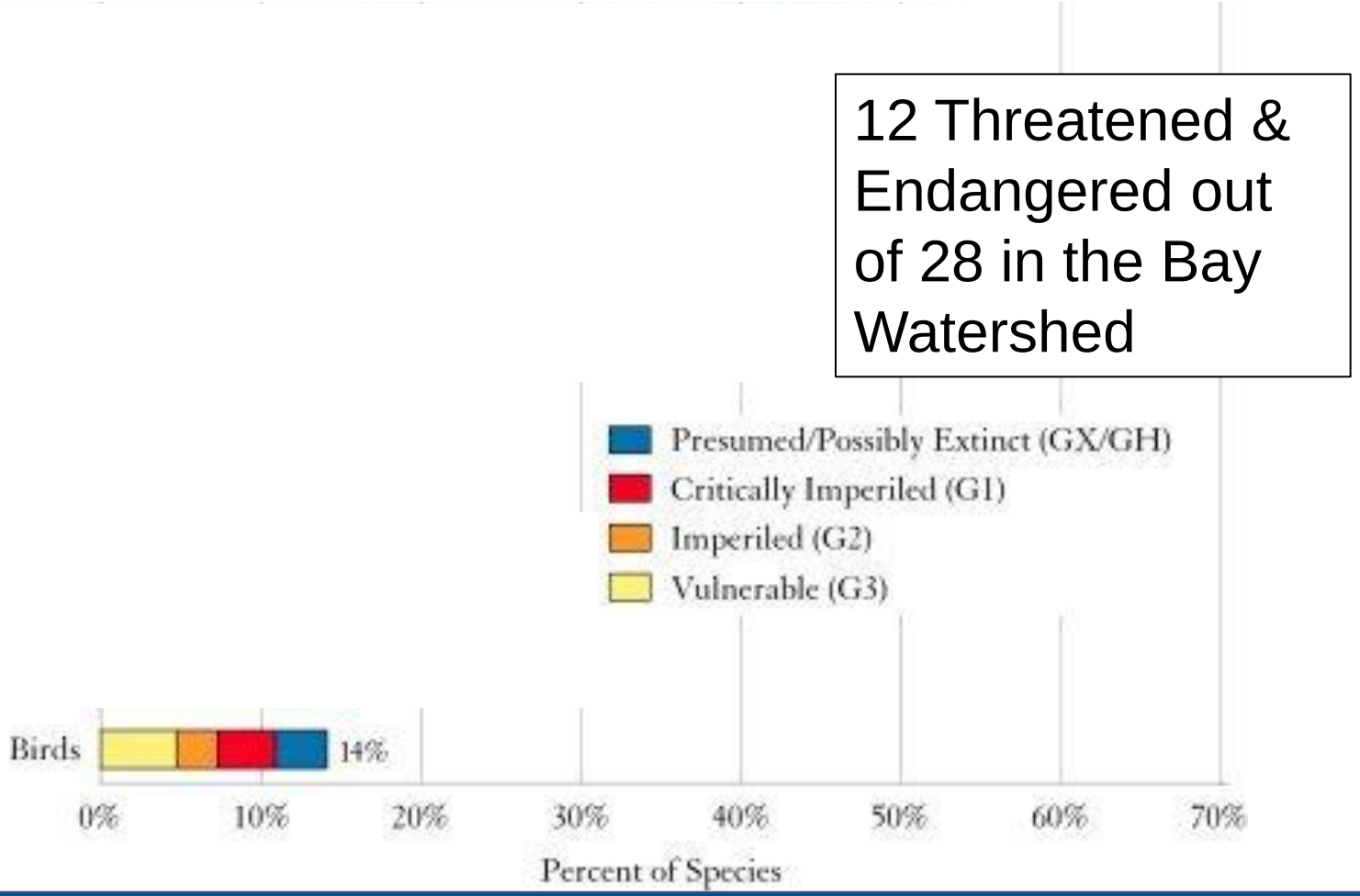
Point # 2: Mussels are helpful

12 Threatened & Endangered out of 28 in the Bay Watershed



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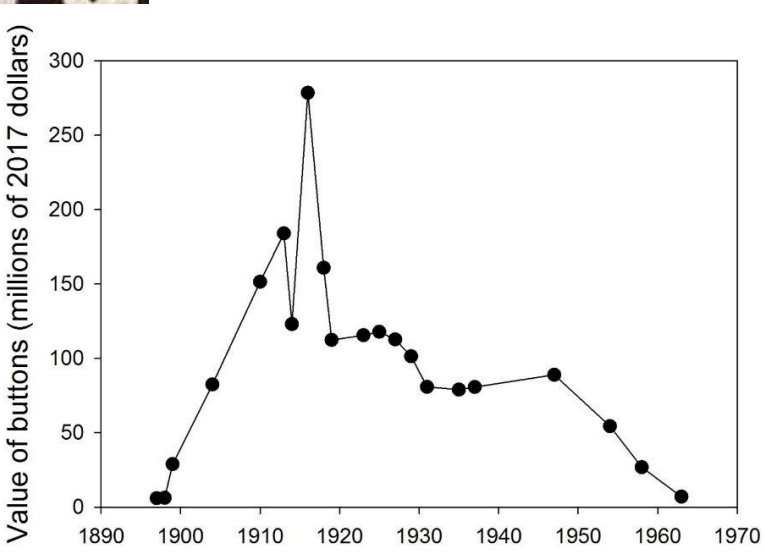
Mussels are in trouble

Shells used to produce buttons in the pre-plastic era

•Total value of buttons (1893-1963) in US ~$6 billion

Johann Boepple, the man who launched the U.S. industry of making buttons from freshwater mussel shells, died of an infection resulting from cutting his foot on a mussel called the pink heelsplitter.



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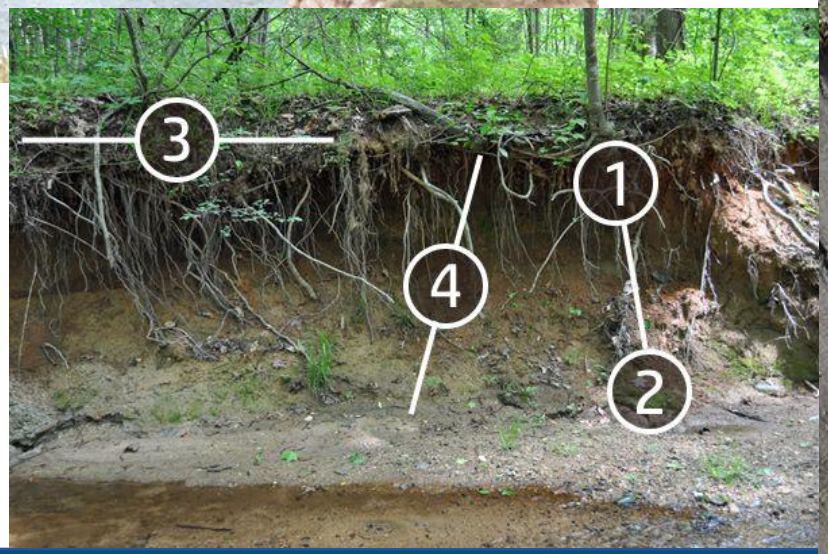
Mussel shells used for buttons in the pre-plastic era

Dams can prevent host fish from reaching upstream habitat; which prevents some freshwater mussels from completing their life cycle.

Dams cause other major disruptions as well…



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Many of our waterways are no longer suitable habitat for mussels

- Freshwater mussels are sensitive to degraded water quality
  - Ammonia- New standards established by EPA in 2013; have not been fully implemented in any bay watershed state.
  - Chlorides (Road Salt)
  - Herbicides and Pesticides
  - Sediment/ turbidity
  - Temperature
  - pH
- Disease and other factors play a role as well

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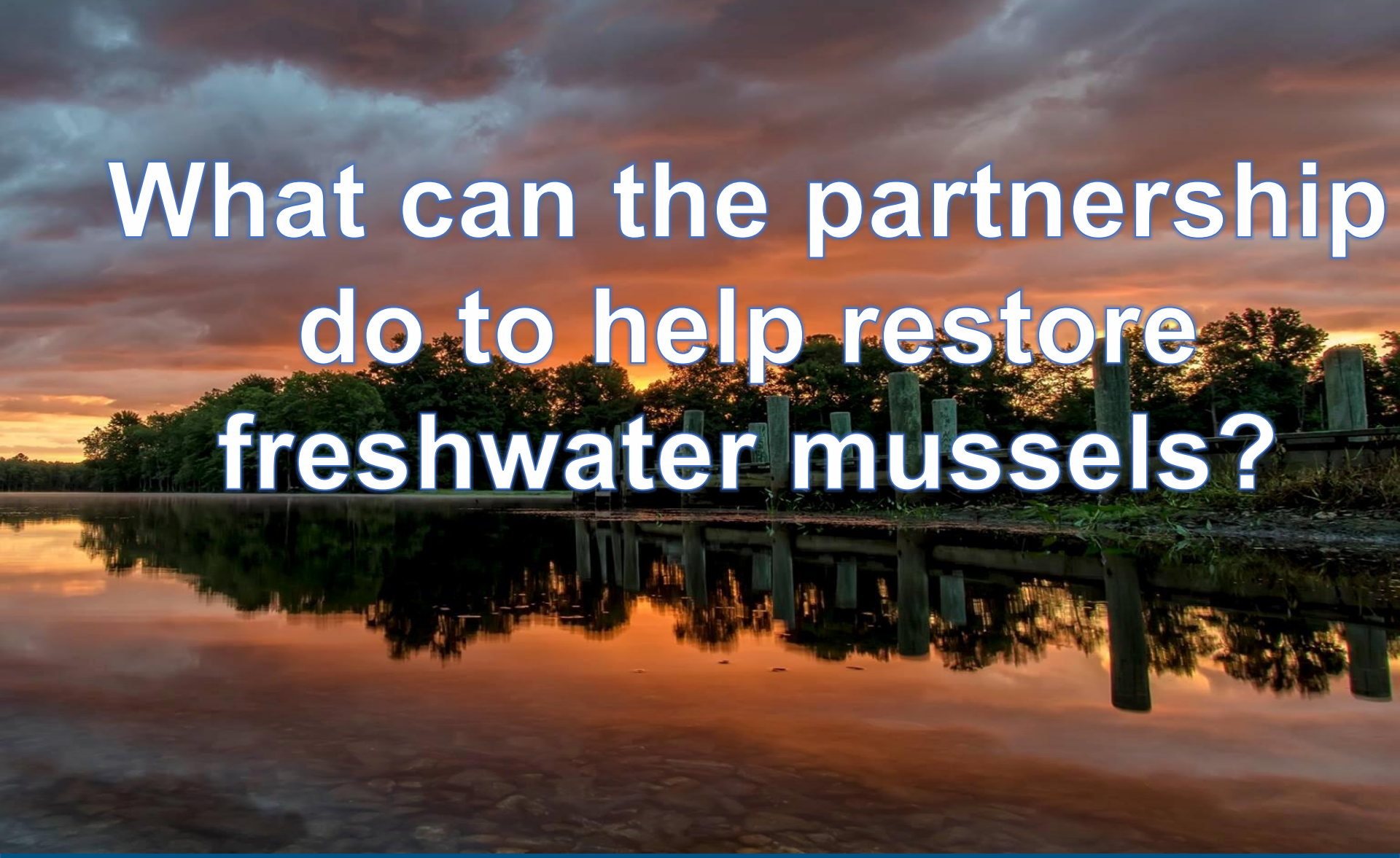
Point 3: Mussels are in trouble



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NOAA

CHESAPEAKE BAY OFFICE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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2005

Non-native oyster research

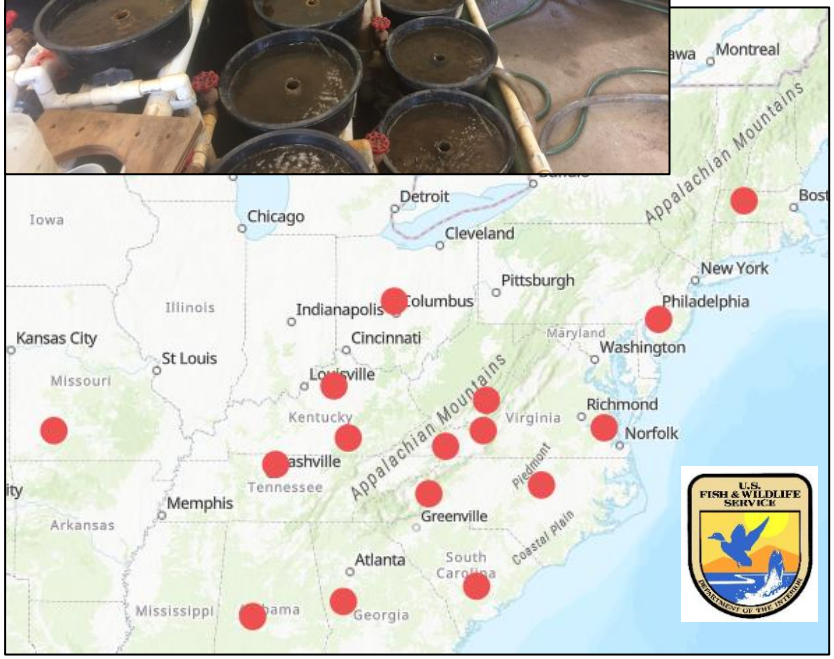
Due to dramatic declines in Chesapeake Bay native oyster populations (*Crassostrea virginica*), the states of Maryland and Virginia considered an introduction of a non-native oyster species, *Crassostrea ariakensis*, to their tidal waters including the Chesapeake Bay and Atlantic coastal bays. *C. ariakensis* appeared to be more resistant to the diseases that have devastated the native oyster population, and appeared to grow faster. *C. ariakensis* can grow much more quickly than does the native oyster. Some hoped that this Asian oyster would be able to revitalize the oyster industry and improve water quality in the Bay.

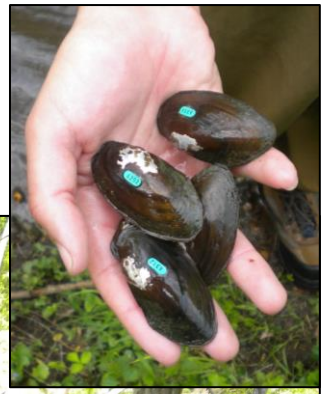
In response to the proposal by Maryland and Virginia to introduce reproductive *C. ariakensis* into the Chesapeake Bay, the U.S. Congress directed the U.S. Army Corps of Engineers, in cooperation with NOAA, the Environmental Protection Agency, and U.S. Fish and Wildlife Service, to prepare a programmatic Environmental Impact Statement (PEIS). Although the federal government was not directly involved in the plan to introduce *C. ariakensis* into the Bay, Congress deemed that the potential effects of an introduction were significant enough to require a PEIS.

Because at that time there was insufficient information to fully evaluate the effects the introduction of the Asian oyster might have on the Bay ecosystem, a summary of research needs was prepared by the Environmental Protection Agency, U.S. Fish and Wildlife Service, and NOAA to identify the largest gaps in knowledge about what effects an introduction of *C. ariakensis* might have. Federal resource agencies, environmental groups, and scientists concerned about the possible risks associated with a

Photo: Jackie Shannon; CBF

Freshwater Mussel Propagation is advancing





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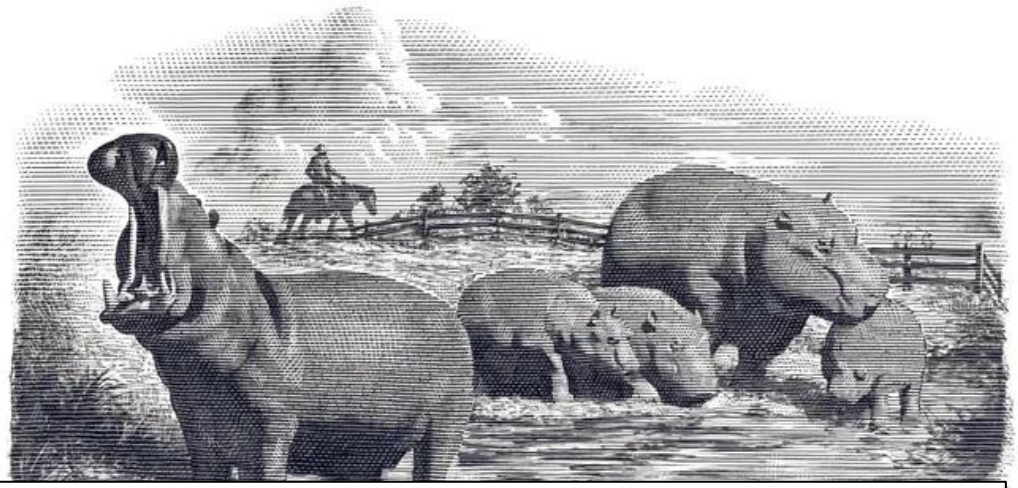
The rate of Mussel propagation has exponentially increased



The American Hippo…?

Blue Catfish

SO: Before restocking, ecologist ask some complicated questions?

- Are we (negatively) influencing genetics?
- Does restocking one species negatively impact another?
- What do we do when there is no historic record?
- What if there are no mussels present?

Our new ability to propagate mussels is a great new tool – but there are some important questions

Important to remember mussels left for a reason…

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Forested Buffers are the most common prescribed need for mussel habitat in State Wildlife Action Plans

- Historically Funding has been predominantly mitigation based, but…

U.S. Fish & Wildlife Service

The Chesapeake WILD Program

Conserving a National Treasure

Nicholas A. Tonelli CC

Background

The largest estuary in the nation, a corridor for migrating American shad and striped bass, a nursery for juvenile fish and blue crab, and the birthplace of Old Bay Seasoning: the Chesapeake Bay is a national treasure.

But by the late 20th century, pollution and mismanagement had taken a toll on this system. In response, Congress authorized the creation of the Chesapeake Bay Program to lead collaborative goal-driven restoration and protection efforts. Since its

Conservation Service, U.S. Army Corps of Engineers, the Governors of the Chesapeake Bay states (Virginia, West Virginia, Maryland, Delaware, Pennsylvania, and New York), the Mayor of the District of Columbia, the Chesapeake Bay Commission, fish and wildlife joint venture partnerships, and other public agencies and organizations. However the Service will seek input and participation from an even broader range of partners and stakeholders, building upon the strong collaboration and strategic work already underway in the basin.

build upon coalitions that are already in place and learn what efforts are underway, and examining exiting data, plans, and strategies.

- We are looking to an existing framework for regional conservation partnerships, known as joint ventures, as a model for ours. Joint ventures set clear, measurable goals, are flexible and inclusive, and leverage partner resources and contributions to design and implement successful landscape-scale conservation initiatives.
- While there are no supporting appropriations with which to establish

New funding on the Horizon !?!?

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3 D replicas

Summary of points

1. Mussels are Awesome- and engaging, and widespread.
2. Mussels provide real ecosystem services, including denitrification, like oysters
3. Mussels are severely imperiled
4. There are new and exciting opportunities for restoration
5. Mussels are a part of the Bay Resource and we should work to protect them.

- STAC Report:
- https://www.chesapeake.org/stac/document-library/incorporating-freshwater-mussels-into-the-chesapeake-bay-restoration-efforts
- Chesapeake WILD information:
- https://www.chesapeakeconservation.org/wp-content/uploads/2021/03/Chesapeake-WILD-Program-Fact-Sheet.pdf

Mussel Lure videos:

- https://themeanderingscientist.com/2016/11/29/the-freeloading-lifestyle-of-fresh-water-mussels/

- https://www.youtube.com/watch?v=I0YTBj0WHkU