

Integrating Freshwater Mussels with Chesapeake Bay Restoration

STAC Workshop, March 5-6, 2020, Annapolis MD



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The top 10 reasons the Chesapeake Bay Partnership should pay closer attention to mussels...



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The top 10 reasons the Chesapeake Bay Partnership should pay closer attention to mussels

10. Most people don't know much about freshwater mussels...



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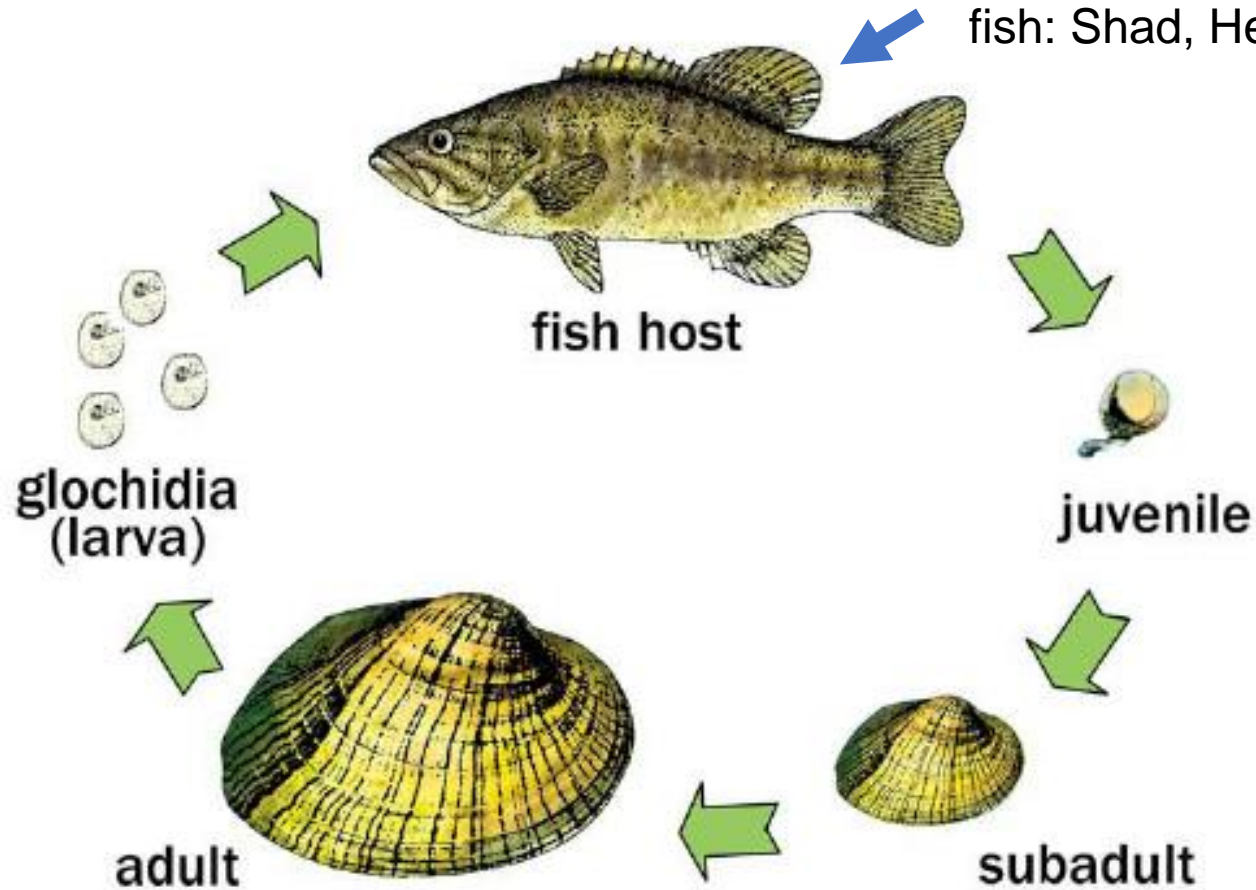
TOP 10 Reasons Mussels should be a priority for
the Chesapeake Bay Partnership



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What is going on here...

Often anadromous
fish: Shad, Herring



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Freshwater Mussel reproductive cycle

9. The Chesapeake Bay Watershed has great mussel biodiversity (maybe not the best but great).

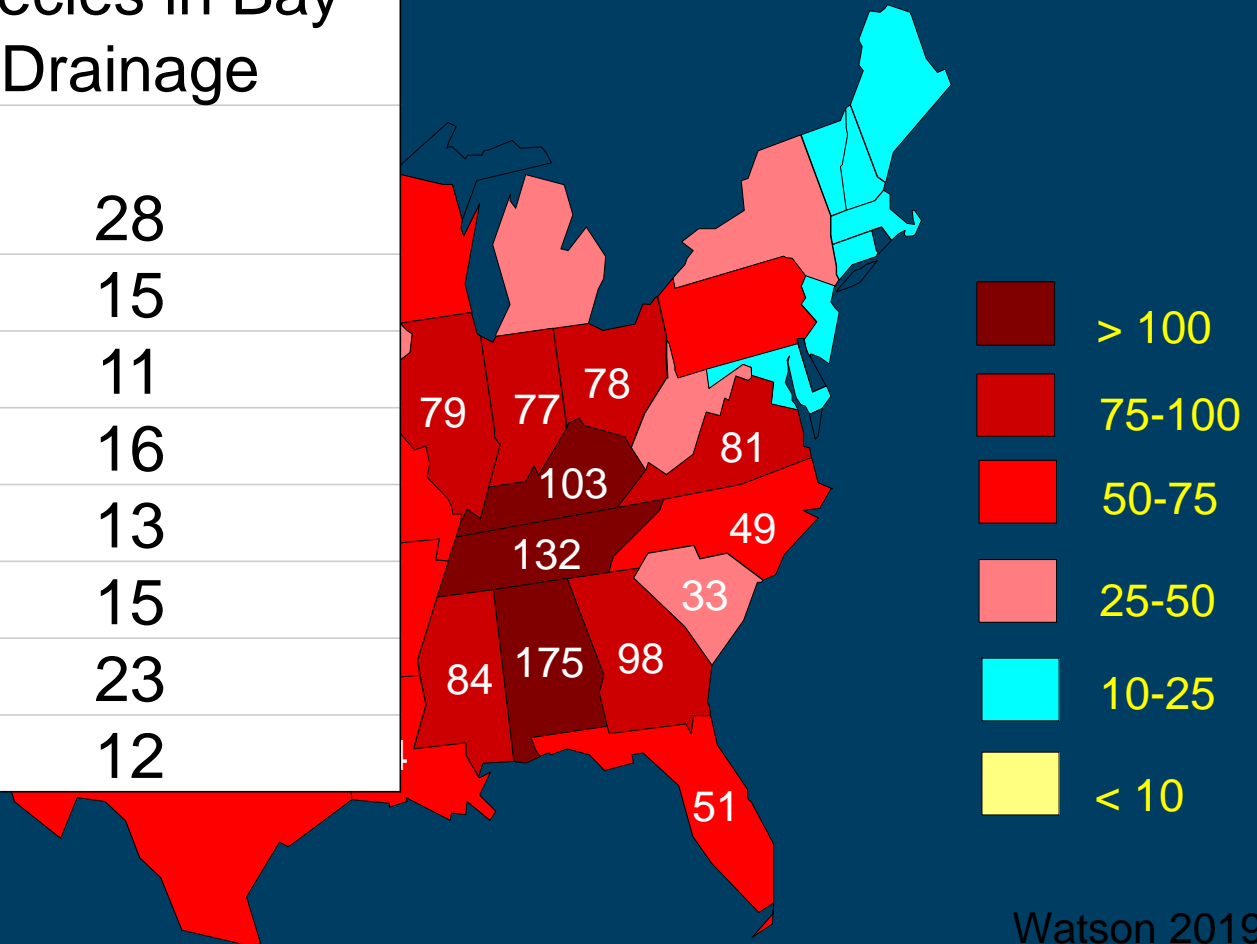


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Number of mussel species by state;

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



Watson 2019

8. Mussels sometimes represent the most sensitive form of aquatic life and can be a focal point for water quality standards; Mussels can be a valuable bio indicators for water quality.



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\$528,379, calculated from the prior collection approved by OMB.

John Moses,

Director, Collection Strategies Division.

[FR Doc. 2013-20458 Filed 8-21-13; 8:45 am]

BILLING CODE 6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

[EPA-HQ-OW-2009-0921; FRL-9810-4]

Final Aquatic Life Ambient Water Quality Criteria For Ammonia—Freshwater 2013

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of availability of final criteria.

SUMMARY: Pursuant to section 304(a) of the Clean Water Act (CWA), the Environmental Protection Agency (EPA) is announcing the availability of final national recommended ambient water quality criteria for the protection of aquatic life from effects of ammonia in freshwater (EPA 822-R-13-001). The final criteria incorporate the latest scientific knowledge on the toxicity of ammonia to freshwater aquatic life. On December 30, 2009, EPA published draft

identified by Docket ID No. EPA-HQ-OW-2009-0921. They may be accessed online at:

- www.regulations.gov: Follow the on-line instructions.
- **Email:** OW-Docket@epa.gov.
- **Mail:** US Environmental Protection Agency; EPA Docket Center (EPA/DC) Water Docket, MC 2822T; 1200 Pennsylvania Avenue NW., Washington, DC 20460.

- **On Site:** EPA Docket Center, 1301 Constitution Ave. NW., EPA West, Room 3334, Washington, DC. This Docket Facility is open from 8:30 a.m. until 4:30 p.m., EST, Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Office of Water is (202) 566-2426.

For additional information about EPA's public docket visit the EPA Docket Center homepage at <http://www.epa.gov/epahome/dockets.htm>.

FOR FURTHER INFORMATION CONTACT: Lisa Huff, Health and Ecological Criteria Division (4304T), U.S. EPA, 1200 Pennsylvania Ave. NW., Washington, DC 20460; (202) 566-0787; huff.lisa@epa.gov.

SUPPLEMENTARY INFORMATION:

I. What are water quality criteria?

EPA's recommended water quality criteria do not substitute for the CWA or regulations, nor are they regulations themselves. Thus, EPA's recommended criteria do not impose legally binding requirements. States and authorized Tribes have the discretion to adopt, where appropriate, other scientifically defensible water quality criteria that differ from these recommendations.

II. What is ammonia and why is EPA concerned about it?

Ammonia is a constituent of nitrogen pollution. Unlike other forms of nitrogen, which can cause eutrophication of a water body at elevated concentrations, the primary concern with ammonia is its direct toxic effects on aquatic life, which are exacerbated by elevated pH and temperature. Ammonia is considered one of the most important pollutants in the aquatic environment not only because of its highly toxic nature and occurrence in surface water systems, but also because many effluents have to be treated in order to keep the concentrations of ammonia in surface waters from being unacceptably high. Ammonia can enter the aquatic environment via direct means such as municipal effluent discharges and the



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EPA finalized ammonia criteria for freshwater mussels in 2013; that apply broadly across the Bay watershed

7. Mussels are shellfish, and the partnership has committed to protecting these organisms.



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FISHERIES GOAL: Protect, restore and enhance finfish, shellfish and other living resources, their habitats and ecological relationships to sustain all fisheries and provide for a balanced ecosystem in the watershed and Bay



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Table 3.1 Summary of topical intersection between threats to freshwater mussels and 2014 Chesapeake Bay Watershed Agreement initiatives

Threat to freshwater mussel populations	2014 Chesapeake Bay Watershed Agreement (CBWA):	Corresponding GIT Engagement	Corresponding GIT workgroup
Hydrologic Connectivity: Dams, Channelization, Culverts all disrupt habitat and potentially prevent fish hosts from reaching gravid mussels and dispersing juveniles	CBWA lays out specific goals for migratory fish populations which include improving hydrologic connectivity .	Vital Habitats	Fish Passage, Fish Habitat Action Team
Climate Change and Hydrologic alteration: Climate change, which is likely to disrupt and alter hydrologic systems represents a threat to mussels and their habitat.	CBWA has a goal to “Increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats , public infrastructure and communities, to withstand adverse impacts from changing environmental and climate conditions .”	Water Quality, Vital Habitats	Fish Habitat Action Team, Climate Change Resiliency
Ammonia (Nitrogen): Ammonia represents the most prominent nutrient impact to mussel populations; In 2013, EPA established Water Quality Criteria to protect sensitive life stages of freshwater mussels.	CBWA and the Chesapeake Bay Total Maximum Daily Loads specifically cite needed nitrogen reductions to improve attainment of Chesapeake Bay water quality standards	Water Quality	Wastewater



Toxics: Freshwater mussels are sensitive to a wide variety of toxic pollutants including PAHs, pesticides, Heavy Metals, and Chloride.

CBWA specifically contemplates addressing **toxics** by establishing a goal to "Ensure that the Bay and its rivers are free of contaminant effects on living resources and human health"

Water Quality

Toxic Contaminant

Habitat Loss: Tremendous losses in habitat have degraded freshwater mussel populations

CBWA established a goal to continually improve effectiveness of fish **habitat** conservation and restoration efforts by identifying and characterizing critical spawning, nursery and forage areas within the Bay and tributaries for important fish and **shellfish**

Sustainable Fisheries

Fish Habitat Action Team

Stewardship: Freshwater mussels lack public awareness that is likely to yield significant shifts in public policy.

CBWA established goals to increase the number and the diversity of local citizen stewards and local governments that actively support and carry out the conservation and restoration activities that achieve healthy local streams, rivers and a vibrant Chesapeake Bay.

Stewardship GIT

Citizen Stewardship, Education



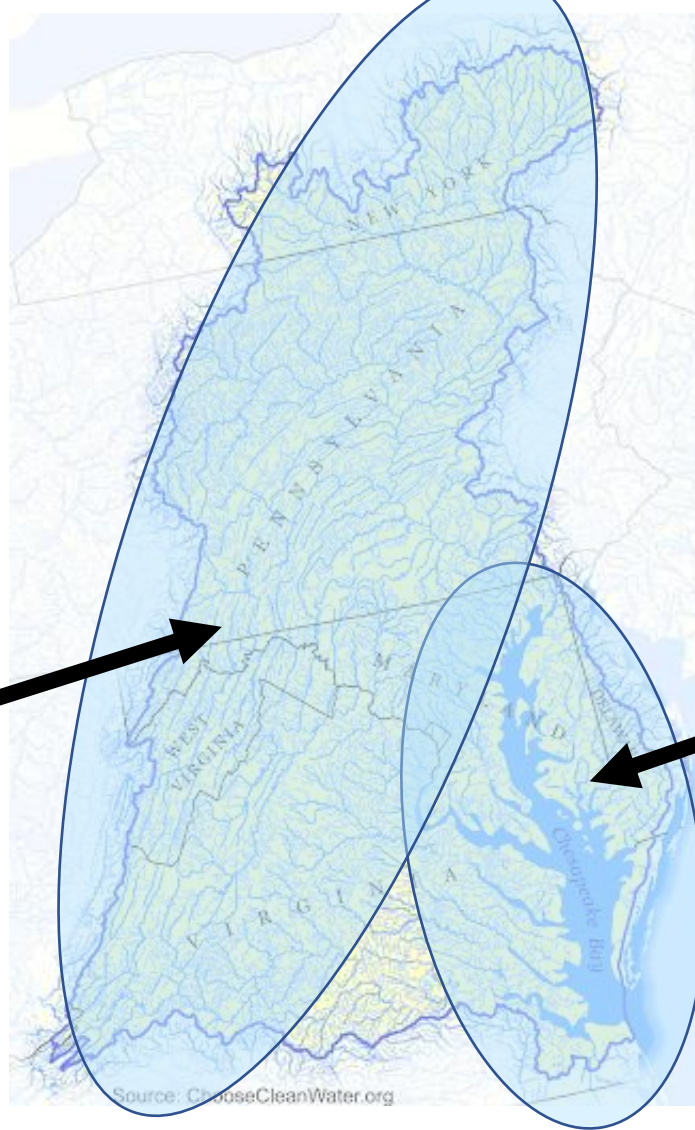
6. Mussels live in freshwater portions of the watersheds where engagement is especially important.



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What's in my back yard?



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IN CBW, You have a better chance of having a
mussel habitat in your backyard than crabs,
oysters or striped bass

5. Mussels provide ecosystem services by filtering water and can enhance denitrification.



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RESTORATION POTENTIAL OF SEVERAL NATIVE SPECIES OF BIVALVE MOLLUSCS FOR WATER QUALITY IMPROVEMENT IN MID-ATLANTIC WATERSHEDS

DANIELLE A. KREEGER,^{1*} CATHERINE M. GATENBY² AND PETER W. BERGSTROM³

¹Partnership for the Delaware Estuary, 110 S. Poplar Street, Suite 202, Wilmington, DE 19063; ²U.S. Fish and Wildlife Service, Lower Great Lakes Fish and Wildlife Conservation Office, 1101 Casey Road, Basom, NY 14013; ³PO Box 504, Saxtons River, VT 05154




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Mussels filter water like oysters- and enhance
denitrification (remove N to atmosphere)

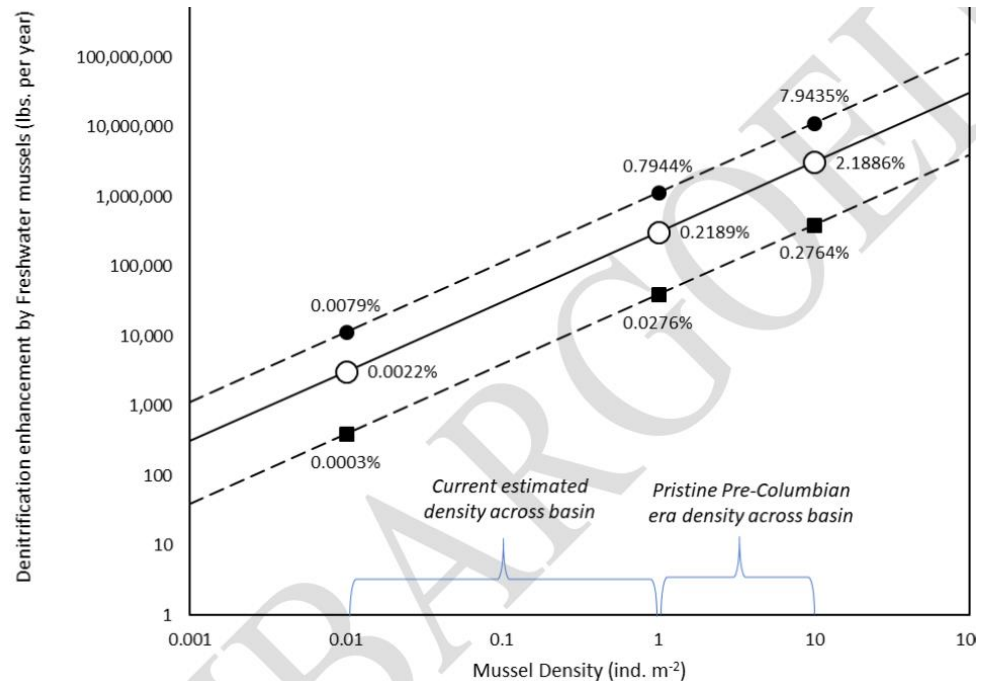
Freshwater mussel densities of 1-10 individual per m² across the Susquehanna watershed would correspond to net denitrification effects ranging from 39,615 lbs. to 11.4 million lbs. nitrogen per year. This corresponds to 0.02% to 7.94% of current nitrogen loads for the Susquehanna River.

Using functional traits to assess the influence of burrowing bivalves on nitrogen-removal in streams

Zachary L. Nickerson  · Behzad Mortazavi · Carla L. Atkinson

Contributions of freshwater mussels (Unionidae) to nutrient cycling in an urban river: filtration, recycling, storage, and removal

Timothy J. Hoellein  · Chester B. Zarnoch · Denise A. Bruesewitz · Jessi DeMartini



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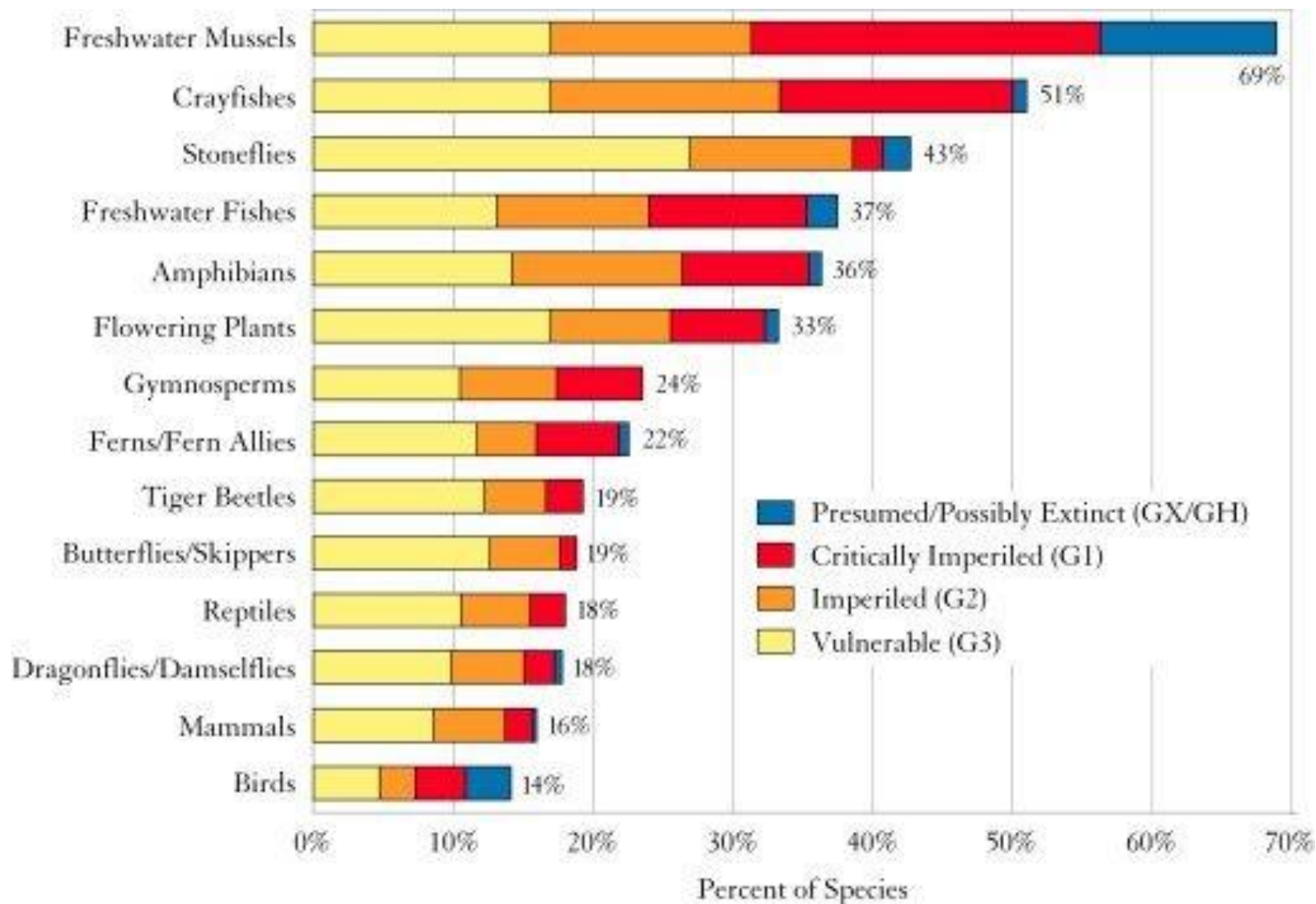
Several recent peer review studies suggest
Mussels Enhance Denitrification

4. Freshwater Mussels are more threatened/endangered than any other class of organisms in the country.



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The MOST CRITICALLY IMPERILED group of organisms

3. Mussels are in serious trouble, in part due to issues that also plague Chesapeake Bay health.



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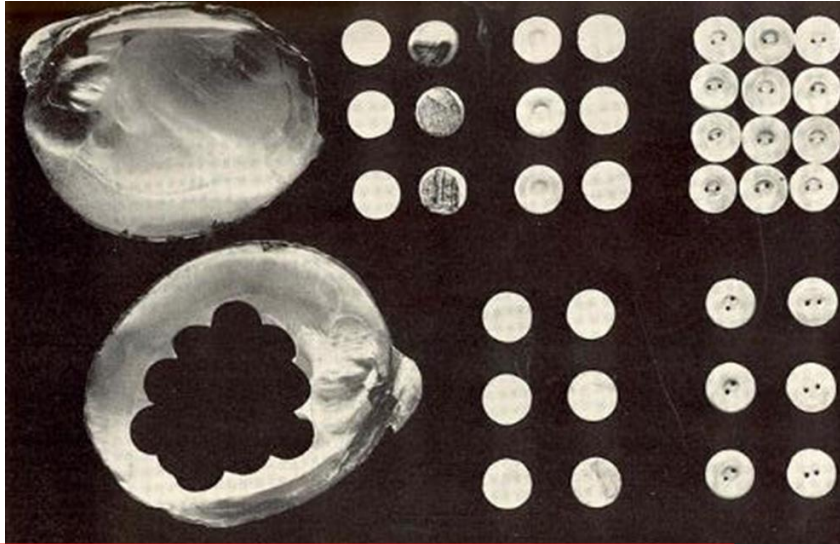


Photo
Credit CBP



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Why are mussels struggling?

2. Mussel propagation has made tremendous strides in the past 10-20 years.



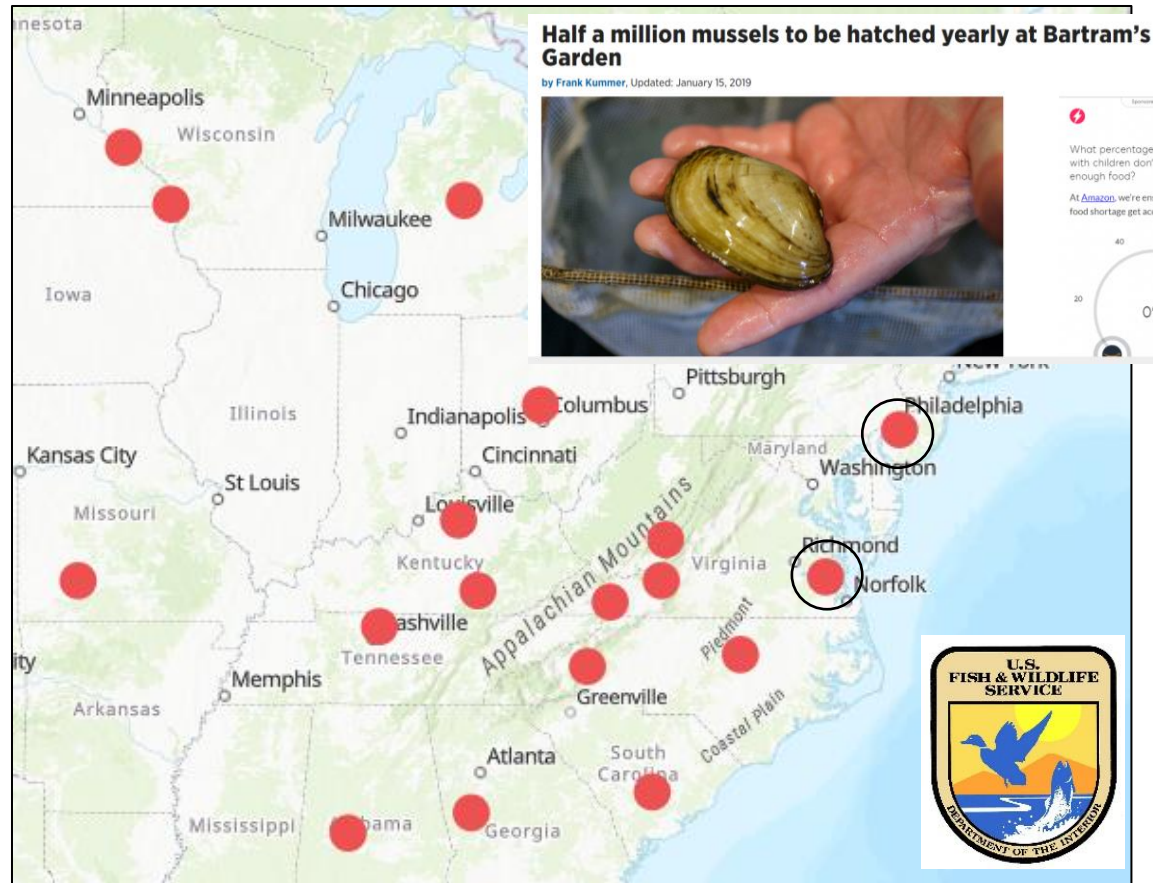
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Current Propagation Facilities

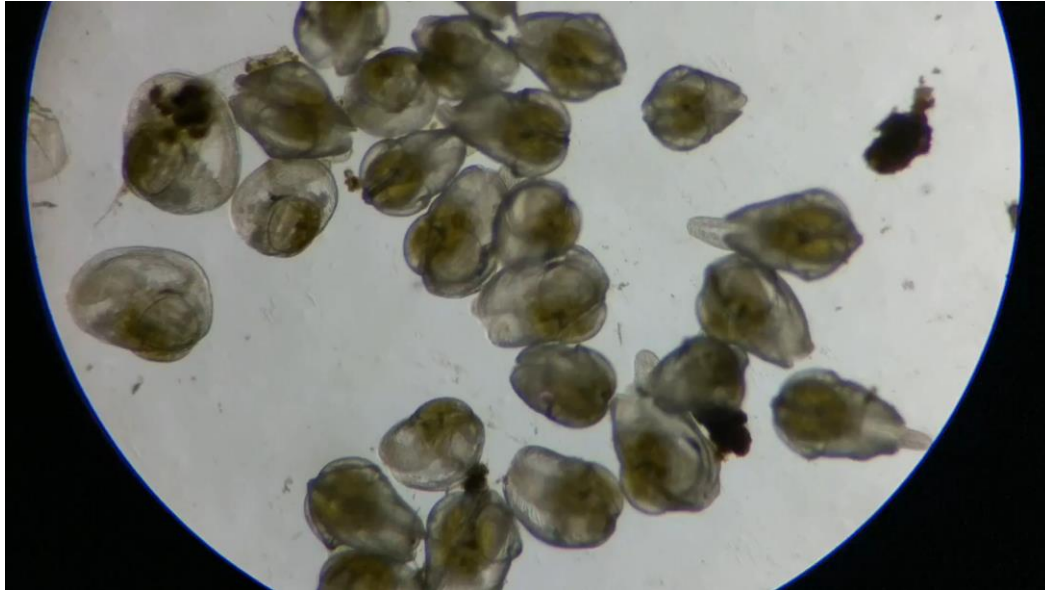
Funding Agency

- 6 State Agency
- 4 University
- 11 Federal Hatcheries
- 1 Zoo
- 1 NGO
- Facility opening in Philadelphia to serve Delaware and Susquehanna



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Hatchery propagation research is making serious strides; orders of magnitude acceleration in past decades



Restoration of some species involves a technique using rabbit serum.



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1. Mussels are captivating!



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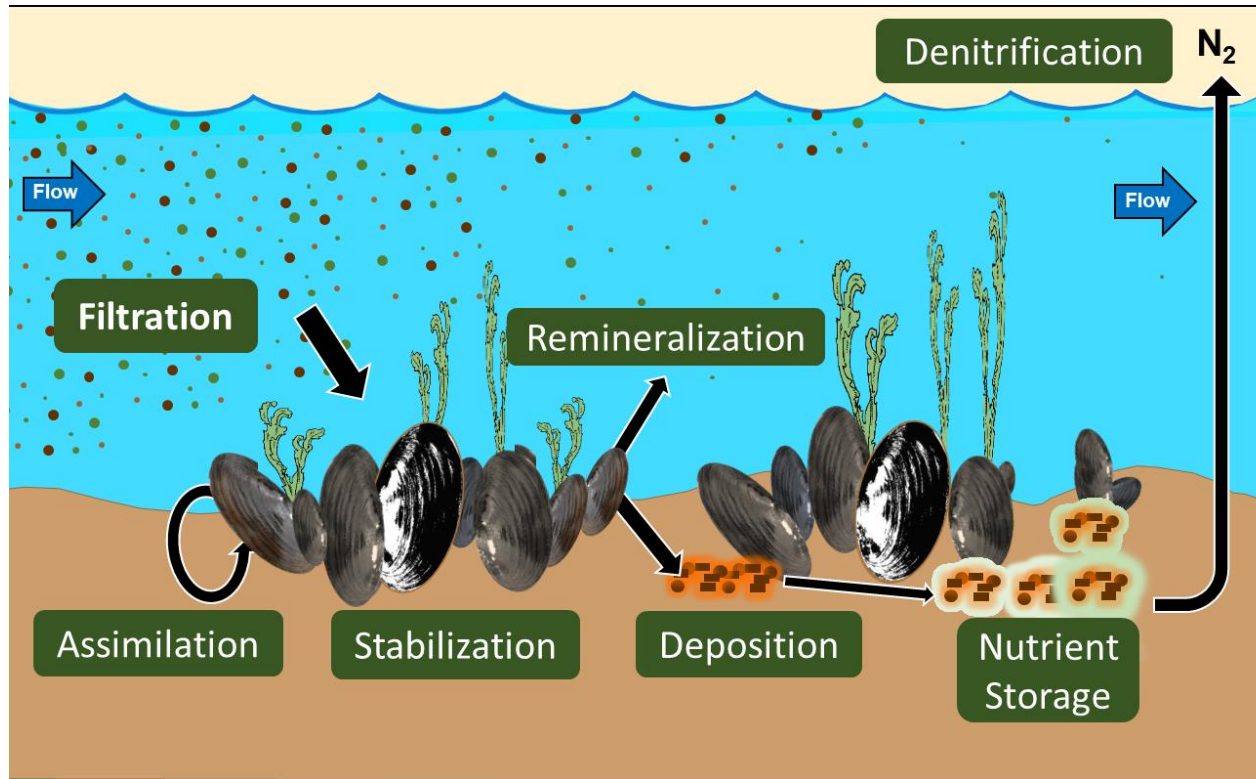
- Research Findings:/Recommendation # 1
- Significant efforts have been made to document mussel populations across the region yet no aggregated database exists which includes this information.
- Recommendation: Compile and analyze existing mussel distribution datasets and aggregate into a sharable form
 - Assessing trends in mussel abundance and diversity.
 - Identifying “hotspots” where mussel protection is most needed.
 - Determining effects of mussel restoration efforts, and whether best management practices are yielding healthy mussel populations.
 - Improving records for considerations in the context of damages.



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We need to track the resource, to
protect and restore

- **Research Finding 2:** Mussels enhance denitrification!
The partnership should support research efforts and consider a BMP Expert panel on this subject.



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Mussels support healthy
waterways

Programmatic Recommendation 1. We encourage the partnership to incorporate mussel considerations across various workgroups and GITs. Specifically:

- Address mussel considerations in the next Fish Habitat management strategies 2-year Work plan
- Incorporate mussel factors into relevant management strategies under the Vital Habitats Goal in the 2014 Chesapeake Bay Watershed Agreement, such as Stream Health, Fish Passage, and SAV.
- **Invest in mussel restoration**; Mussels **historically absent** from NFWF Priority Species (Brook Trout, Black Duck, Herring, Oysters, etc.)
- Chesapeake WILD represents an important opportunity for Mussels

******Workshop to Broaden and Enhance Regional Freshwater Mussel Partnerships in the Chesapeake Bay April 13, 2022
10 AM - 430 PM***



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Programmatic Recommendations

Programmatic Recommendation 2. Tell the story of Mussels to improve engagement on Bay issues in upper portions of the watershed

- *The communications workgroup should feature stories on Freshwater Mussels to engage local stakeholders in non-tidal regions of the Watershed*
- *The Citizen Stewardship Goal Implementation Team and the Chesapeake Monitoring Cooperative should work with freshwater mussel conservation experts to incorporate freshwater mussels into citizen science efforts*
- *The Chesapeake Bay modeling workgroup should include freshwater mussels as part of the co-benefit framework and include these benefits within CAST.*



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The story of mussels is supportive of partnership goals

• Programmatic Recommendation 3. Consider overlap between nutrient mitigation and freshwater mussel restoration

- Explore collaborative opportunities to achieve nitrogen reductions and address new ammonia criteria through the wastewater workgroup .
- The Partnership should consider mussel impacts and benefits related to restoration efforts and should specifically consider mussel protection and restoration in the context of stream restoration.

