

RESTORING FRESHWATER MUSSEL POPULATIONS

Jamie Brunkow // James River Association // jbrunkow@jra.org

Leslie Anne Hammond // York River Steward // leslianne.hammond@yorkriversteward.org

Mikaela Ruiz-Ramón // The Nature Conservancy // m.ruiz-ramon@tnc.org

Joe Wood // Chesapeake Bay Foundation // jwood@cbf.org

WHY IT MATTERS

Freshwater mussels are to the health of rivers and streams what oysters are to the Chesapeake Bay. They are a powerful natural filtration system that can filter up to 15 gallons of water per day and play a critical role in protecting and improving water quality.¹ They can help remove nutrients, sediment, bacteria, and even **per- and polyfluoroalkyl substances (PFAS)** and avian flu from the water column, which benefits downstream communities and ecosystems that rely on clean water to survive and thrive.² They also stabilize streambeds, prevent erosion, and provide food and habitat for many other species of birds and mammals.

Nationwide, freshwater mussels represent the most endangered class of organisms with 65% of species vulnerable to extinction.³ Freshwater mussel populations have been heavily impacted by pollution, disease, the spread of invasive species, loss of stream and river buffers, and dams (see *Reconnecting Rivers*, page 17). Climate change exacerbates pressures by raising water temperatures⁴ and increasing salinity in tidal freshwater segments of rivers.⁵

Virginia is home to over 80 freshwater mussel species from Southwest Virginia to the coast.⁶ This is over a quarter of North America's 300+ species. Further, some spots like the Clinch River, are considered global biodiversity hotspots. Unfortunately, the Clinch River has also seen the largest single loss of endangered species due to a toxic spill in 1998 from which the river system is still recovering.⁷ The Chesapeake Bay and Southern tributaries are also home to valuable and critically endangered mussel populations.

Freshwater mussels also have significant cultural importance for tribal communities as they represent a 'first food' source and were utilized for pottery tempering, jewelry, and other purposes.

Despite their significant ecological and cultural importance, the protection of these animals has been overlooked. Virginia should take action to protect and restore these populations before they are completely gone.

CURRENT LANDSCAPE

Virginia's freshwater mussel restoration landscape is defined by a combination of state and federal investments, agency-driven initiatives, and expanding federal-nonprofit partnerships. Legislation in 2022 funded the **Virginia Department of Wildlife Resources (DWR)** to develop a statewide restoration plan,⁸ strengthening strategic coordination across

watersheds. Legislation in 2023 appropriated \$2 million for hatchery improvements to enhance propagation capacity.

Major initiatives include developing restoration plans, defining and protecting key habitats for mussels, and releasing propagated freshwater mussels. In 2022, Virginia returned the endangered James spinymussel to the mainstem James River,⁹ and in 2026, alewife floaters were reintroduced to the South Anna River,¹⁰ where they had been extirpated for nearly 200 years. Regionally, the Chesapeake Bay Program's adoption of its first freshwater mussel restoration goal in 2025¹¹ marks a major step in formalizing freshwater mussels' role within Bay recovery efforts.

Virginia nonprofit partners working alongside state and federal agencies play an important role in this work and can help bring federal dollars to the Commonwealth. For instance, since 2022, six **Chesapeake Watershed Investments for Landscape Defense (WILD)** grants have been awarded to non-profits in Virginia to address freshwater mussel impacts, bringing over \$1M in federal funding into the Commonwealth.¹² These grants can substantially amplify state efforts, but only if Virginia maintains the staffing, planning, and matching resources needed to fully leverage these funds.

While we've made significant strides to restore freshwater mussels in Virginia, investing additional resources into this work is critical to continuing progress towards protecting these species from extinction.

OPPORTUNITIES

Virginia is a leader in freshwater mussel restoration, and these efforts are supported by a strong network of state agencies, universities, and non-profit partners, yet continued progress will depend on addressing several statewide resource needs.

The Commonwealth's experts—particularly those at facilities such as the **Aquatic Wildlife Conservation Center (AWCC)** and **Virginia Fisheries and Aquatic Wildlife Center (VFAWC)**—have advanced propagation techniques and successfully bred dozens of species, including many federally endangered mussel species. However, the state's broader restoration goals require expanded infrastructure capacity, updated facilities, and modernized equipment to meet increasing propagation targets and ongoing mussel work. Many buildings used for mussel propagation have not undergone significant upgrades in more than two decades, limiting the ability to scale production and fully implement statewide

RESTORING FRESHWATER MUSSEL POPULATIONS

Jamie Brunkow // James River Association // jbrunkow@jrava.org

Leslie Anne Hammond // York River Steward // leslianne.hammond@yorkriversteward.org

Mikaela Ruiz-Ramón // The Nature Conservancy // m.ruiz-ramon@tnc.org

Joe Wood // Chesapeake Bay Foundation // jwood@cbf.org

and basin-specific restoration plans. Strengthening staffing across agencies and partner organizations can enhance the state's ability to conduct propagation, monitoring, and habitat restoration at the pace required to protect declining populations.

Virginia may also need to bolster state funding mechanisms to ensure continuity in research and restoration activities, particularly where federal funding has diminished or fluctuated. Stable investment supports direct implementation costs, long-term planning, and the propagation of threatened species across multiple watersheds. Restoration actions, including those identified in the pending statewide plan, the James River Basin Mussel Restoration Plan, and the Clinch River Mussel Restoration Plan require funding.

Collectively, these opportunities can strengthen Virginia's capacity to restore mussel populations, improve water quality, and sustain the ecological health of rivers across the Commonwealth.

ENDNOTES

1. Wood, J., Bukaveckas, P., Galbraith, H., Gattis, M., Gray, M., Ihde, T., Kreeger, D., R., McLaughlin, S., Hahn, S., & Harvey, A. (2021). *Incorporating freshwater mussels into the Chesapeake Bay restoration effort*. Chesapeake Bay Program Science and Technical Advisory Committee. <https://www.chesapeake.org/stac/wp-content/>
2. Bakshi, B., Bouchard, Jr, R. W., Dietz, R., Hornbach, D., Monson, P., Sietman, B., & Wasley, D. (2023). Freshwater mussels, ecosystem services, and clean water regulation in Minnesota: Formulating an effective conservation strategy. *Water*, 15(14), 2560. <https://doi.org/10.3390/w15142560>
3. Vaughn, C. C. (2018). Ecosystem services provided by freshwater mussels. *Hydrobiologia*, 810(1), 15–27. <https://pecswaterses.com/asset/web/publications/c844c-vaughn.hydrobiologia2017.pdf>
4. Fogelman, K. J., Archambault, J. M., Irwin, E., Walsh, M., Brewer, S., & Stoeckel, J. A. (2023). A review of lethal thermal tolerance among freshwater mussels (Bivalvia: Unionida) within the North American faunal region. *Environmental Reviews*, 31(2), 278–297. DOI: <https://doi.org/10.1139/er-2022-0077>
5. McIver, J. K., Cope, W. G., Bringolf, R. B., Kwak, T. J., Watson, B., Maynard, A., & Mair, R. (2023). Assessing the toxicity of sea salt to early life stages of freshwater mussels: Implications for sea level rise in coastal rivers. *Environmental Toxicology and Chemistry*, 42(11), 2478–2489. <https://doi.org/10.1002/etc.5731>
6. *Virginia's 2015 wildlife action plan*. (n.d.). Virginia Department of Wildlife Resources. <https://dwr.virginia.gov/wildlife/wildlifeaction-plan/wildlife-action-plan-2015/>
7. *Clinch River*. (n.d.). Virginia Department of Wildlife Resources. <https://dwr.virginia.gov/waterbody/clinch-river/>
8. Virginia State Budget. (n.d.). <https://budget.lis.virginia.gov/>
9. *James Spineymussel*. (2022). Virginia Department of Wildlife Resources. <https://dwr.virginia.gov/wildlife/information/james-spineymussel/>
10. Pulliam, A. (2026). *Bringing mussels back to sections of the South Anna River*. Richmond Dispatch. https://richmond.com/news/local/collection_8c04c673-c27d-4285-902c-f3e2666a0ca3.html
11. *Chesapeake Bay Agreement*. (2025). Chesapeake Bay Program. <https://www.chesapeakebay.net/files/documents/CBWA-2025-IV-Final-Facing.pdf>
12. Chesapeake WILD. (n.d.). National Fish and Wildlife Foundation. <https://www.nfwf.org/programs/chesapeake-wild>
13. *James River Basin mussel restoration plan*. (2024, July). The James River Association. <https://thejamesriver.org/wp-content/uploads/2024/07/Mussel-Plan.pdf>
14. *Virginia freshwater mussel restoration strategy: Upper Tennessee River Basin*. (2010, May). Virginia Department of Game and Inland Fisheries. <https://dwr.virginia.gov/wp-content/uploads/media/Virginia-Freshwater-Mussel-Restoration-Strategy-UTRB.pdf>

TOP TAKEAWAYS

Mussels have significant ecological, water quality, and cultural significance and represent the most endangered class of organisms, with 65% of species vulnerable to extinction.

Virginia's ability to successfully propagate and restore populations of mussels has advanced in the past decade, but is threatened by federal cuts to programs and staffing.

Restoration programs and DWR require sufficient state funding for infrastructure, staffing, and restoration to be successful in implementing their mussel restoration programs.