

Oregon and Washington Invasive Mussel Near-Term Action Working Group

Findings and Near-Term Action Recommendations



**Oregon Department
of Fish and Wildlife**



Washington
Department of
**FISH &
WILDLIFE**

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El Dorado Reservoir Zebra Mussel Infestation. Cover Photo by Kansas Department of Parks and Wildlife.

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Findings

Background

Quagga (*Dreissena rostriformis bugensis*) and zebra (*Dreissena polymorpha*) mussels are invasive freshwater mollusks native to Ukraine and Russia that have a history of global invasion and successful establishment outside their native range.

Adult Quagga Mussel Found in the Snake River in Idaho



Adult quagga mussel found in the Snake River during SCUBA surveys in 2023. Photo by Idaho State Department of Agriculture.

Quagga and zebra mussels were first discovered in the United States in the Great Lakes region in the 1980s, thought to have been transported in ballast waters of trans-oceanic ships. Since the late 2000s, they have been spreading throughout the western United States, most recently detected in the Snake River in Idaho. This detection is the first established population of quagga mussels in the Columbia River Basin, although both invasive mussels are regularly intercepted at mandatory watercraft inspection stations.

Zebra and Quagga Mussel Sightings Distribution

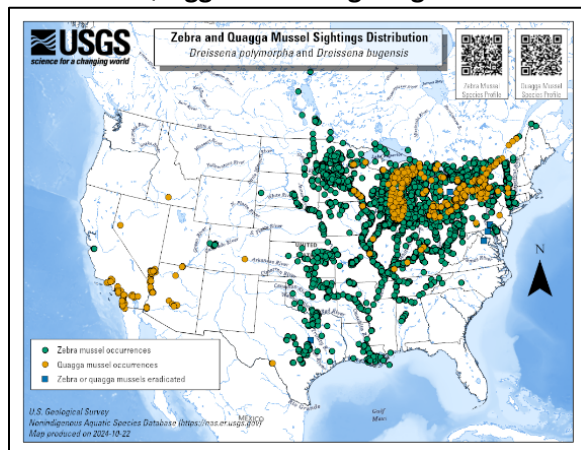
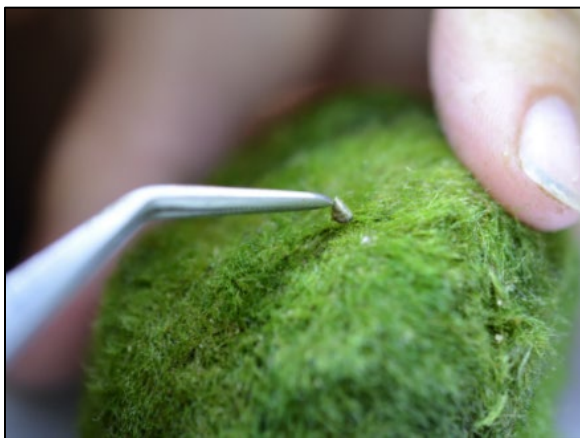


Image by U.S. Geological Survey

As microscopic larvae (veligers) grow, they settle on hard surfaces, becoming adults able to survive out of the water for up to five days in warm, dry weather, and up to 30 days in cool, moist weather. Anything that can move can transport invasive species and human activity can spread invasive mussels during any life stage. Larvae can spread through the movement of contaminated water such as in fish stocking trailers, in live wells and other storage compartments in vessels, in the floats of seaplanes, or in buckets or tanks used for wildfire fighting. Adults are easily spread between waterbodies by watercraft of all types including construction equipment, firefighting equipment, or recreational water equipment. To address these pathways, western jurisdictions and federal agencies have developed and are executing comprehensive and coordinated programs, with legal authorities and partnerships, to prevent the further spread of quagga and zebra mussels, respond to new infestations, and manage existing infestations. However, efforts are varied across state, tribal, federal, and local jurisdictions, with efforts being limited due to capacity and funding.



Marimo moss ball with zebra mussel. Photo by WDFW.

In August 2024, zebra mussel-contaminated aquarium products were found within the State of Washington due to a report from industry. Contaminated Marimo moss balls in Washington were part of more than 26,000 illegally imported to the United States. These moss balls were subsequently shipped to Washington and at least 19 other states, including 2 shipments to the State of Oregon.

An emerging threat, golden mussels (*Limnoperna fortunei*), freshwater mollusks native to China and Southeastern Asia that have a history of global invasion, were detected for the first time in the United States on October 17, 2024, in California. Given their invasive history, potential for establishment in local ecosystems and climate, and risk of introduction through ballast water or recreational vessels, golden mussels pose a significant threat to the Columbia River. A 2018 report estimated that golden mussels cost the Brazilian electricity sector over \$120 million per year due to production and revenue loss. Similar environmental and economic impacts are likely in Washington and Oregon if introduced.



Invasive mussel sniffing canine, Fin, and handler Nick Knauss. Photo by WDFW.

While the states of Oregon and Washington face an imminent threat from invasive mussels, preventative measures and actions impede introduction and establishment. Additionally, increased early detection efforts and rapid response preparedness will ensure quick containment and management actions, while building long-term mitigation capacity will significantly reduce the long-term impacts costs associated with their establishment and spread.

Risk

Cumulatively, the three invasive freshwater mussels are referred to herein as invasive mussels. Once invasive mussels are established, they are anticipated to cause catastrophic ecosystem impacts, outcompeting and impacting habitat for native invertebrates, increasing harmful algal blooms, reducing water quality and altering freshwater food webs. Invasive mussels are anticipated to interfere with salmon recovery and conservation efforts in the Columbia River Basin, growing on fish ladders, screens, juvenile bypass systems and impacting spawning habitat.



Invasive mussels fouling a penstock gate at Davis Dam. Photo by U.S. Bureau of Reclamation.

Invasive mussels can also have direct and indirect economic and safety impacts, fouling raw water infrastructure and boat engines; overtaking docks, buoys, boat hulls, anchors, and beaches; and contributing to disease outbreaks in species that consume them. If they become established in the Columbia River, the annual cost to keep hydroelectric facilities running is anticipated to exceed \$500

million annually. Similar maintenance and mitigation costs are anticipated for other raw water infrastructure, such as irrigation, drinking water, fish passage, and fish hatchery systems.

Imminent threat and readiness

While an eradication effort is underway in the Snake River, the presence of quagga mussels in the Columbia River Basin, and recent establishment of golden mussels in California, has alarmed the region. The states of Oregon and Washington face a shared imminent threat.

Columbia River Basin Interagency [Invasive Mussel] Response Plan (2018).



Image by Pacific States Marine Fisheries Commission.

Significant effort to prevent and prepare for invasive mussels has occurred for many years. Regional efforts include the Pacific States Marine Fisheries Commission led 100th Meridian Initiative Columbia River Basin Team, a regional response plan, Endangered Species Act consultation manual, and policy guidance from organizations like the Pacific NorthWest Economic Region, and Northwest Power and Conservation Council. At the state and Canadian provincial level, jurisdictions create response plans, legal authorities, and maintain programs providing prevention and readiness. Federal agencies such as the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Forest Service, and many others, provide funding and technical assistance. Federal funding often requires non-federal as cost-share, which is a limiting factor for states, tribes, and local agencies.

As one example, a key source of funding for watercraft inspection, monitoring, and rapid response has been the U.S. Army Corps of Engineers' Aquatic Plant Control-Watercraft Inspection and Decontamination (APC-WID) Cost-Share Program. This program originated from the 2014 Water Resources Development Act reauthorization and subsequent biennial reauthorizations. From 2017 to 2024, Pacific Northwest states have leveraged over \$39 million from APC-WID funding. However, less

than 25% of that funding has been leveraged by Oregon and Washington due to the program's required non-federal cost-share component.

Oregon and Washington working group

Due to the imminent threat of invasive mussel introduction and establishment, the Oregon and Washington Departments of Fish and Wildlife convened a working group tasked to identify near-term actions and to assist with the development of findings and recommendations to prevent and prepare for invasive mussels in the shared waters of the Columbia River between Washington and Oregon.

Together, the joint state working group identified highest priority actions and needs to increase prevention and preparedness, functioning as a shared vision and action plan for both jurisdictions.

Recommendations

This report summarizes the working group's recommendations for near-term actions for implementation by both state fish and wildlife departments, in partnership with tribal nations, state invasive species councils, academic institutions, federal agencies, industry, and conservation partners. Also included are long-term actions recommended by the group. Invasive mussels, like all invasive species do not respect legal jurisdictions or authority, requiring all organizations to work together to meet shared objectives to solve the shared problem. While some of these recommendations can be implemented with improved coordination and within existing capacity, many are dependent upon ongoing or additional funding, new resources, tools and technologies.



Near-term action recommendations

The Oregon and Washington Quagga and Zebra Mussel Near-Term Action Working Group convened in October and November 2024, to establish a baseline understanding of the imminent threat posed by invasive mussels and activities taken to date for prevention and readiness. The working group was surveyed to determine priority near-term action themes, followed by a working group meeting to discuss and prioritize specific actions.

Goal 1. Enhance prevention efforts

Prevention is the best approach to managing invasive species, requiring the least funding, and preventing long-term economic, human health, and environmental impacts. The working group recommends that historical prevention efforts be increased, and that new and strategic preventative measures be taken to address the imminent threat facing Oregon and Washington.

Early detection monitoring

Early detection monitoring is critical to enhance prevention efforts. Immediately detecting downstream movement of quagga mussels in the Snake River, or other invasive mussels introduced to waterbodies in Oregon and Washington through human-mediated activities, is key to preventing widespread infestation and impacts. These human-mediated activities may include shipping; movement of aquatic conveyances such as aquatic construction equipment or recreational boats; illegally introduced species in the pet and nursery trade; or species intentionally introduced to harm national security.

Early detection monitoring recommendations

Recommendation 1. The states of Oregon and Washington should expand early detection monitoring efforts to identify new infestations of invasive mussels as early as possible for the purpose of initiating response actions.

Recommendation 2. To focus early detection and monitoring efforts, the states of Oregon and Washington should update and expand waterbody risk assessments. Risk assessments identify likely waterbodies of first introduction and probable downstream or human-mediated spread.

Recommendation 3. Recognizing that tribal nations and raw water industries are anticipated to be heavily impacted, the states of Oregon and Washington should develop new partnerships and invest in capacity building to assist with early detection monitoring.

Watercraft inspection and decontamination

Inspection of aquatic conveyances such as recreational watercraft, aquatic construction equipment, and fish tankers are important regulatory control points for intercepting invasive species-fouled watercraft broadly, including invasive mussels. Both Oregon and Washington have administered mandatory

inspection stations at static locations and roving stations since 2010, and 2007 respectively. Increasing inspection and decontamination efforts is critical to protecting water resources in both states.

Watercraft inspection and decontamination recommendations

Recommendation 1. The states of Oregon and Washington should create additional mandatory check stations at strategic locations and expand coverage at existing stations to intercept vessels moving outside of business hours and peak seasons.

Recommendation 2. The states of Oregon and Washington should deploy additional roving mandatory watercraft inspection stations, targeting high risk areas, or locations of events drawing high numbers of traveling boaters. Additional effort increases prevention of establishment, while also positioning states for containment upon a detection at a watershed or local scale.

Recommendation 3. The states of Oregon and Washington should work with tribal and local governments and industry partners, to increase inspection of other aquatic conveyances such as sea planes, construction equipment, and barges.

Recommendation 4. The states of Oregon and Washington should install self-serve cleaning stations at lower-risk waterbodies, using new technology such as Clean Drain Dry Dispose (CD3) units to educate the public and reinforce preventative action.

Goal 2. Coordinated public awareness

Both jurisdictions educate the public using Clean, Drain, Dry preventative messaging and campaigns such as Call Before You Haul, a hotline generating watercraft movement notices of potentially infested watercraft being moved across the United States. The working group determined a need for consistent messaging and communications products for use across partner organizations coordinated between Oregon and Washington, consistent with other western states and Canadian provinces.

Recommendation 1. The states of Oregon and Washington should develop a communications plan identifying key stakeholders, partners, policy makers and audiences; objectives and measurements for success; challenges; themes and messaging; and products and deliverables. Public outreach initiatives identified in the communication plan should be deployed and amplified by all organizations, such as state invasive species councils.

Recommendation 2. State agencies should develop key talking points and communication tools such as signage, playbooks, brochures to connect with key audiences including policymakers, boaters, anglers, shipping industry, conservation partners, water users, and the public, particularly anglers and boaters.

Recommendation 3. The states of Oregon and Washington should identify and develop relationships with public ambassadors or organizational leads to help deliver messages within key industries, so communications are coming from a trusted non-governmental source.

Recommendation 4. Both states should develop digital communication products that can be easily shared across partner organizations and new signage that can be deployed at key locations such as roadside billboards or gas station kiosks near waterbodies.

Goal 3. Ensure rapid response preparedness

If prevention fails, it is important to initiate rapid response to contain and minimize the spread of invasive mussels, including taking management actions to eradicate or suppress the population where feasible. Recognizing that there is a Columbia River Basin response plan, and both states have initial response plans, there is a need for additional planning and documentation of roles, responsibilities, and processes to ensure quick action.

Ensure capacity, resources and clear roles for rapid response

Recommendation 1. The states of Oregon and Washington should clarify and document roles, responsibilities and decision-making authorities with all jurisdictions having legal authority, including tribal nations, state and federal agencies, and local governments including ports.

Recommendation 2. The states of Oregon and Washington should work with State Legislatures and Governor's Offices to develop a mutually agreeable process for declaring emergencies in shared waters of Washington and Oregon, that include decision support tools with criteria that need to be met for an invasive species emergency to be declared.

Recommendation 3. The states of Oregon and Washington should each establish state Multi-Agency Coordination (MAC) Groups with organizations having legal jurisdiction, response resources, or scientific expertise for the purpose of ensuring successful rapid response, in addition to the ongoing advising of prevention and readiness actions prior to an emergency. State MAC Groups will complement the regional Columbia River Basin MAC Group of response plan signatory agencies.

Goal 4. Build partnerships and facilitate coordination

The working group recognizes no single organization can successfully prevent and respond to invasive mussels in Oregon and Washington. Additionally, invasive species by nature do not respect jurisdictional boundaries and spread downstream and across jurisdictions given time. To be effective, both states must develop and maintain partnerships and coordinate across jurisdictions prior to and during an invasive mussel emergency.

Recommendation 1. The states of Oregon and Washington should reaffirm a regional commitment to addressing invasive mussels through participation in updating of the 100th Meridian Initiative Columbia River Basin Interagency Invasive Species Response Plan: Dreissenid Mussels, signed by state governors in 2008.

Recommendation 2. The states of Oregon and Washington should make efforts to engage tribal nations, other Columbia River Basin states, and local jurisdictions, promoting the 100th Meridian Initiative

Columbia River Basin Interagency Invasive Species Response Plan: Dreissenid Mussels, and encourage those organizations to formally sign on to the response plan as signatory jurisdictions.

Recommendation 3. The states of Oregon and Washington should increase partnership and capacity building with organizations who have a role in prevention and response to invasive mussels. Additional partnerships and capacity building should focus on tribal nations, industry, and conservation partners.

Goal 5. Invest in Research

Conduct research on distribution, detection and mitigation

The working group recognizes that additional research is needed to increase prevention and readiness, with specific focus on understanding spread and likely areas of first establishment. The working group recognizes that first detection requires optimization of early detection monitoring, combining risk models of downstream spread with human-mediated activities, and vulnerable areas and infrastructure. It is understood that with all effort, ultimately Oregon and Washington will be infested by invasive mussels, and mitigation systems for infrastructure will be required. Mitigation may take years of planning, permitting, and have a high cost, meaning planning should occur now.

Recommendation 1. The states of Oregon and Washington should develop risk models to predict potential introduction of invasive mussels and the likelihood of spread. Models should consider environmental factors as well as vulnerable infrastructure such as irrigation systems, fish hatcheries, fish passage, and shipping.

Recommendation 2. Despite all prevention efforts, it is likely that Oregon and Washington will experience some level of invasive mussel infestation in the future. Mitigation and management are likely to take years of planning and permitting and are anticipated to come with a high cost. Prevention efforts can help delay future invasive mussel infestations, giving time for organizations to plan. In the event that prevention efforts fail and an infestation takes place, existing prevention infrastructure can be utilized to contain areas of infestation to prevent rapid spread.

Recommendation 3. The states of Oregon and Washington should develop a model funding pathway, such as a grant program, to cost-share funding for installation and management of mitigation systems for consideration by state legislatures and federal funding agencies.



Long-term action recommendations

Prevention and readiness are ongoing needs. The group developed long-term action recommendations that should be implemented in time.

Goal 1. Enhance regulatory efforts

Recommendation 1. The states of Oregon and Washington should increase law enforcement action at mandatory watercraft inspection stations, improving compliance with state laws and creating new partnerships with state and local law enforcement agencies as force multipliers.

Recommendation 2. The states of Oregon and Washington should survey western states and provinces to identify penalties for not complying with mandatory watercraft inspection stations, to identify and recognize needs for increased penalties, as well as identifying and creating incentives for boaters to comply with state laws.

Recommendation 3. The states of Oregon and Washington should increase consistency in state laws, simplifying and harmonizing requirements within both jurisdictions.

Goal 2. Ensure rapid response readiness

Recommendation 1. The states of Oregon and Washington should develop inspection procedures and response plans for infrastructure and facilities such as fish hatcheries to ensure activities don't unintentionally spread invasive mussels. Assessment and best practices of other pathways for introduction and spread, such as pet and nursery sales, and in-water construction are also needed.

Recommendation 2. The states of Oregon and Washington should emphasize, fund, and partner with organizations to develop harmonized and coordinated site-specific response plans for waterbodies and watersheds at the local level with tribal nations, local governments, and partners.

Recommendation 3. The states of Oregon and Washington should emphasize the need for and hold regular response exercises, of region, state, and site-specific response plans, in addition to holding training workshops and drills for functions and roles, such as Multi-Agency Coordination (MAC) Groups, containment systems, or mock treatments.

Recommendation 4. Recognizing that endangered species are of high concern to performing a chemical treatment of invasive mussels, the states of Oregon and Washington should work with industry and federal permitting agencies to develop new containment technologies to contain invasive mussels during treatment or to protect populations of endangered species from negative effects from chemical treatments.

Goal 3. Support long-term management

Recommendation 1. The states of Oregon and Washington should continue to support and/or develop new local funding programs to build and maintain capacity of key response partners, including tribal nations, local governments, or industry.

Recommendation 2. The states of Oregon and Washington should lead efforts with federal permitting agencies to evaluate site-specific response plans and begin consultation prior to an invasive mussel emergency. Both states should work with regional governments and federal agencies to develop a programmatic consultation process with federal permitting agencies.

Goal 4. Invest in research

The working group determined several areas that will make long-term prevention, response, and mitigation efforts more strategic and effective. Research priorities include:

- *Biocontrol and genetic research:* Research into genetic interventions or biological controls could support long-term control and mitigation efforts should invasive mussels become established in Oregon and Washington.
- *Autonomous sampling:* Research could help reduce the amount of staff resources needed to sample waterbodies or reach new areas. It could also help shift from DNA to RNA sampling which is better at determining the presence of live organisms.
- *Coatings:* Research could help to develop new anti-fouling coatings that can be applied to in-water infrastructure to prevent biofouling should invasive mussels become established.
- *Economic impacts:* An economic study would help emphasize the impacts of invasive mussels on shipping, recreation, agricultural production, food security, irrigation, navigational locks, fish passage, fish hatcheries and salmon recovery investments in the Columbia River. It would also help to understand the long-term costs of mitigation systems and ongoing maintenance and operations costs.
- *Social science:* Research could help to understand human behavior and motivations around prevention measures and public acceptance, allowing the states of Oregon and Washington to tailor outreach and prevention approaches to be more strategic and effective.
- *Human Health and Culture Impacts:* Consequences to agriculture, irrigation, and hydroelectric and drinking water infrastructure pose a risk to human health, particularly for those already living in at-risk communities. Changes in water quality, habitat degradation, and threats to investments in salmon recovery threaten the public and tribal communities and treaty protected resources. Studies would help emphasize the impacts of invasive mussels on human health and culture and how those impacts could be managed or mitigated.

Conclusion

The imminent threat posed by invasive mussels to the states of Oregon and Washington necessitates immediate and collaborative action. Both states also recognize that achieving long-term goals will require ongoing resources and staged solutions. The findings and recommendations outlined in this report provide a roadmap for Oregon and Washington to enhance prevention efforts, strengthen rapid response capabilities and build capacity and coordination amongst all allies.

Key takeaways:

- **Prevention is paramount:** Invasive mussels are now established in the Snake River in Idaho, but prevention is still critically important to preventing further spread and reducing negative impacts to the economy, food security, water resources and infrastructure, native species, and ecosystems. Early detection monitoring, watercraft inspection and decontamination, and public awareness campaigns are critical to preventing the further establishment of invasive mussels.
- **Rapid response is essential:** Regional and state response plans are in place, but should be reaffirmed, improved, and practiced. Clear roles, responsibilities, and coordinated communications and skilled execution of response plans are necessary to contain and treat infestations.
- **Partnerships are powerful:** Partnerships between people and organizations are our greatest strength. Many relationships are long standing-yet additional partnerships are needed to face this imminent threat. Collaborative efforts among tribal, state, federal, and local agencies, as well as industry and conservation organizations, are essential to address this shared challenge.
- **Research and innovation are vital:** The longer we can prevent this problem, the more time we have to find new solutions and innovative approaches to improve our collective work. Increased investments in research will lead to breakthroughs in early detection, control, eradication, and long-term mitigation techniques.

By implementing these recommendations, the states of Oregon and Washington will significantly reduce the risk of invasive mussel spread and establishment, protecting the economic, ecological, and cultural health, for all who rely on its shared waters. To be effective in preventing invasive species, it will take everyone working together toward shared objectives. Many thanks to all partners who contributed to this report and for their commitment to working together to safeguard our shared waters.

