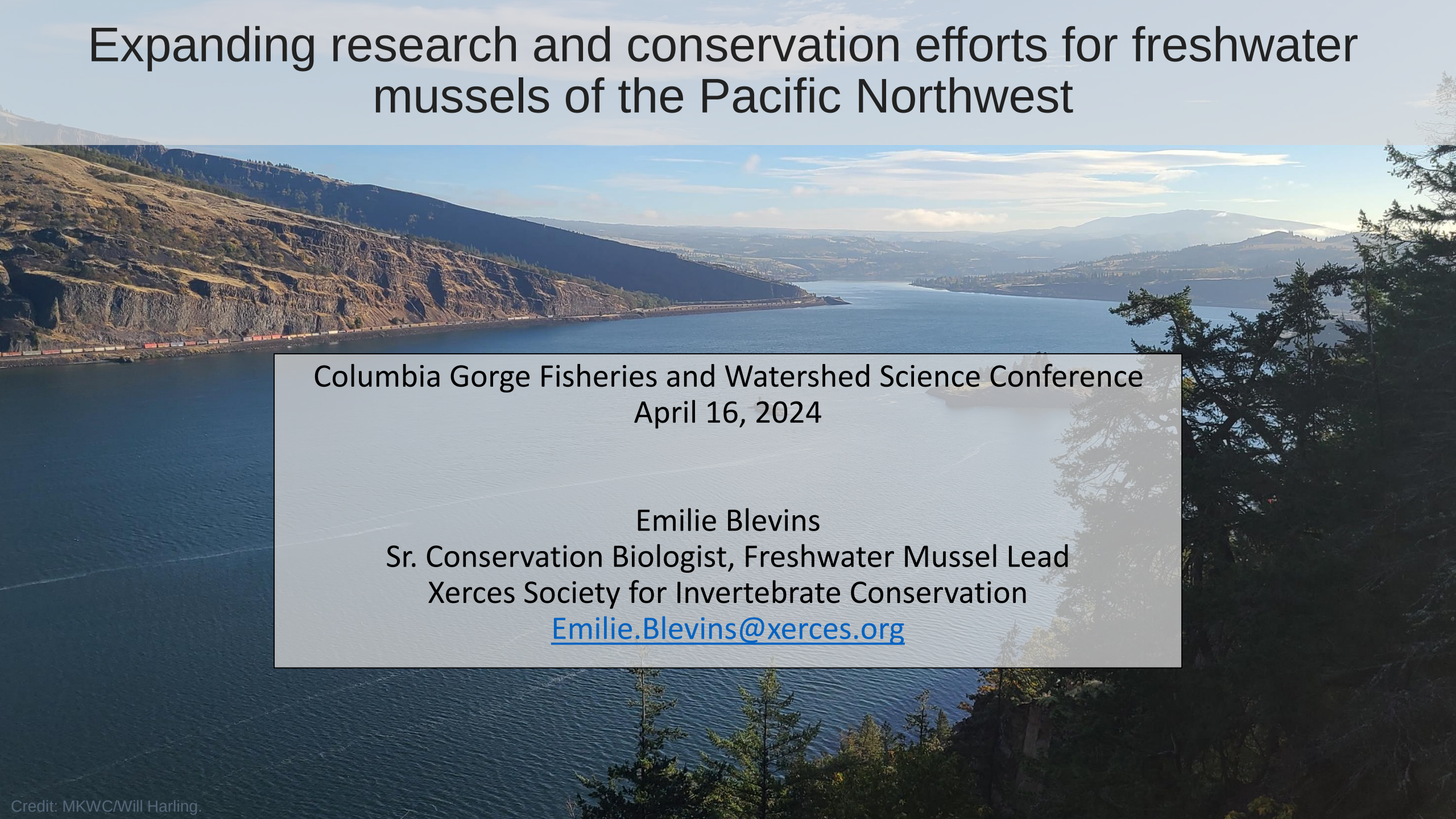
Expanding research and conservation efforts for freshwater mussels of the Pacific Northwest



Columbia Gorge Fisheries and Watershed Science Conference
April 16, 2024

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Credit: MKWC/Will Harling.

Outline

- Freshwater mussels of the PNW
- Status, distribution, and state of resear
- Current efforts (Xerces and partners)
- Needs and future work

Credit: USFWS/Roger Tabor.

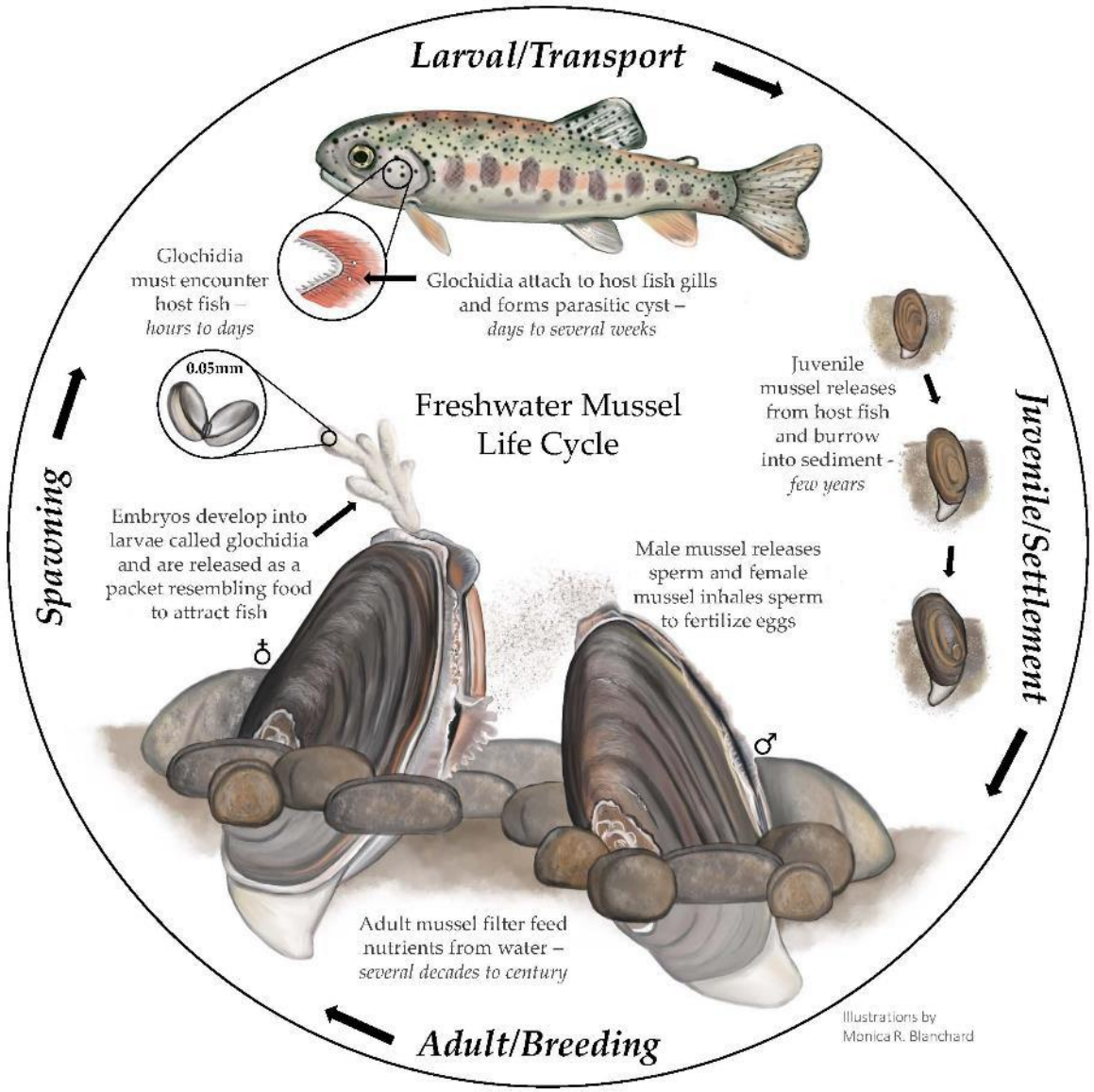
Pacific Northwest Mussels

Western Ridged
(*Gonidea angulata*)

Western Pearlshell
(*Margaritifera falcata*)

Floaters
Genus: *Anodonta*

Credit: Xerces Society.



Credit: Monica Blanchard/WDFW.

A Complex Life Cycle

Ecosystem Benefits

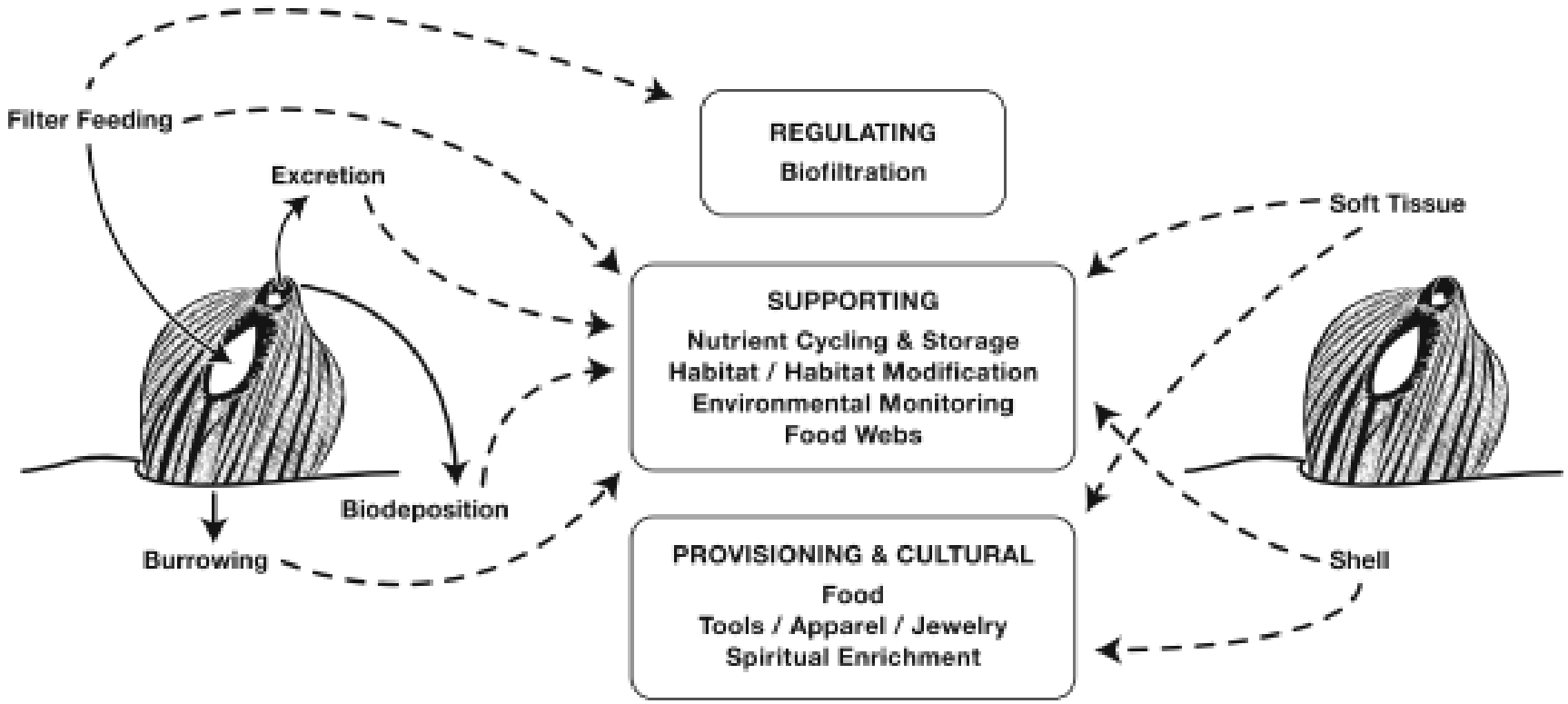
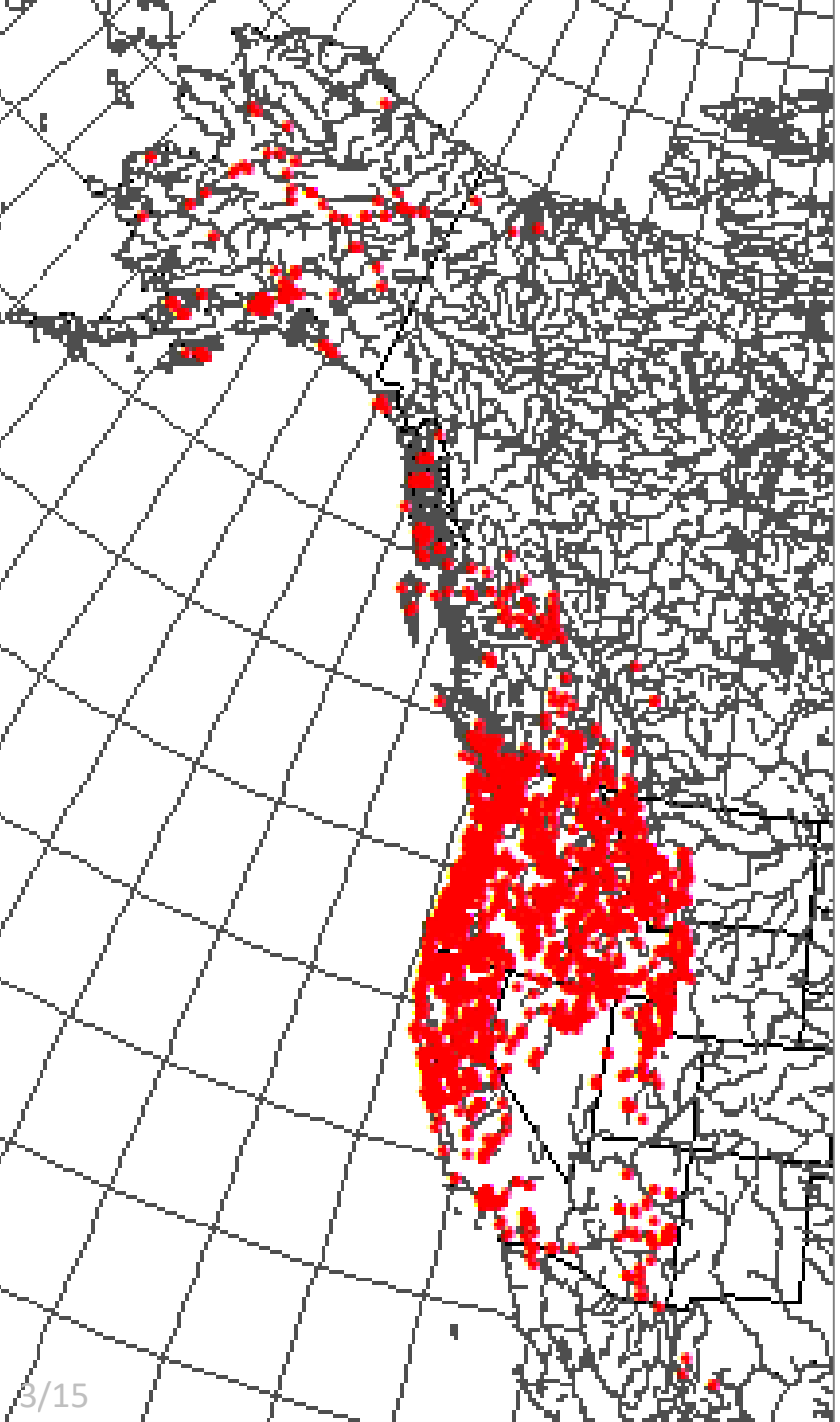


Fig. 1 Mussel tissue and activities that mussels perform can be translated into ecosystem services that are beneficial to humans

Image credit: Vaughn 2017

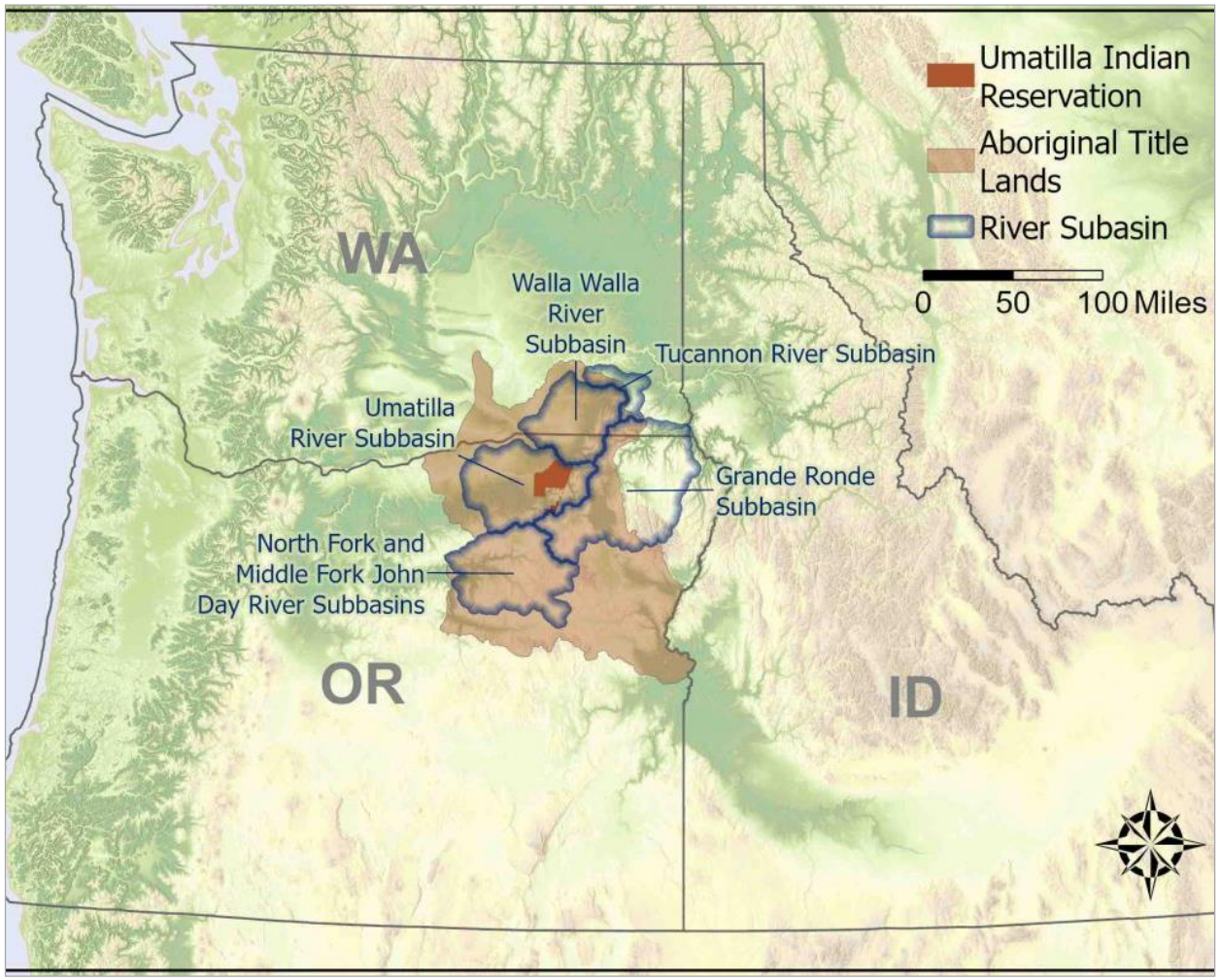


State of Knowledge

- Freshwater mussel location data (historic and recent) is available but limited
- Conservation and management of mussels is limited due to a lack of knowledge and population-level data
- Many unknowns: diet, temperature tolerances, reproductive biology and ecology, recruitment and mortality rates, etc.
- Western ridged mussel data especially important during ESA consideration

CTUIR Freshwater Mussel Research and Restoration Project

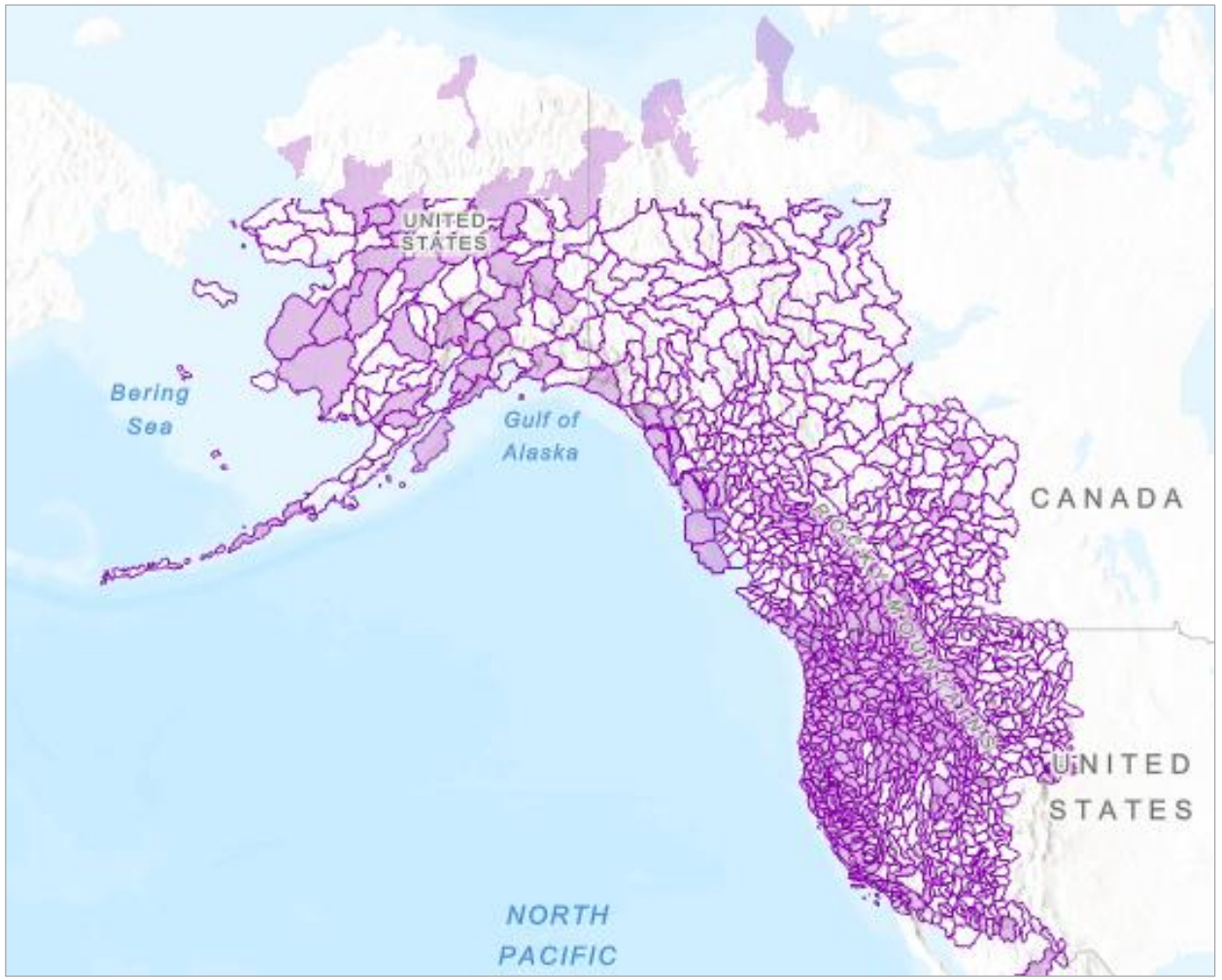
- Dr. Alexa Maine, alexamaine@ctuir.org
- Project initiated in 2002
- Continued field monitoring annually
- Research on:
  - Distribution
  - Population Status
  - Reproductive Biology
  - Genetics/Taxonomy
  - Artificial Propagation
  - Population Restoration
- Master Plan: Freshwater Mussel Conservation, Supplementation, Aquaculture, Restoration, and Research (2022)



Credit: CTUIR 2022.

Western Freshwater Mussel Database

- Collaboration between CTUIR and Xerces, with crowd-sourced data
- Observations spanning traditional knowledge and cultural sites to recent observations or research efforts
- More than 475 HUC8 watersheds with occurrence records
- Used for research and conservation efforts in collaboration with agencies, tribes, universities, and NGOs
- Blevins, E., Jepsen, S., Box, J. B., Nez, D., Howard, J., Maine, A., & O'Brien, C. (2017). Extinction risk of western North American freshwater mussels: Anodonta nuttalliana, the Anodonta oregonensis/kennerlyi clade, Gonidea angulata, and Margaritifera falcata. *Freshwater Mollusk Biology and Conservation*, *20*, 71–88.
- Scully-Engelmeyer, K., Blevins, E., Granek, E. F., & Constable, R. (2023). Freshwater mussel populations in Pacific Coast Watersheds (Oregon, USA): occurrence, condition, habitat, and fish species overlap. *Hydrobiologia*.



Credit: Xerces/CTUIR.

Western North American Freshwater Mussel Visual Survey Protocol Framework (2024)

Visual Survey Protocol Framework for Western North American Freshwater Mussels

Draft Version 1.3

6/20/2023

Next revision date: 2024

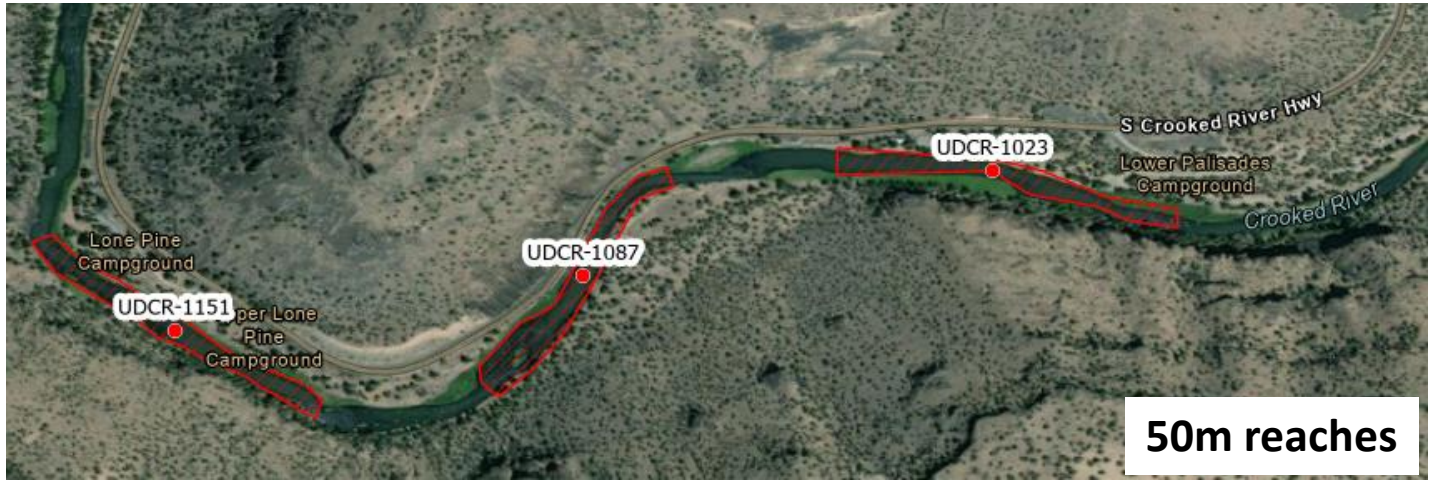
This project is a collaborative effort of the following individuals and organizations. Please direct your questions regarding this document to Emilie.Blevins@xerces.org or one of the following project team members:
Xerces Society for Invertebrate Conservation (Xerces): Emilie Blevins
Bureau of Land Management (BLM): Bryce Frank, Emily Johnson, Scott Miller, Anna Smith, Cody Payne
Confederated Tribes of the Umatilla Indian Reservation (CTUIR): Alexa Maine, Zach Seilo
United States Fish and Wildlife Service (USFWS): John Erhardt, Doug Nemeth, Courtney Newlon
United States Forest Service (USFS): Barbara Adams, Jeff Moss

Suggested citation: Bureau of Land Management. 2023. Draft Visual Survey Protocol Framework for Western North American Freshwater Mussels, Version 1.3.

1 Contents

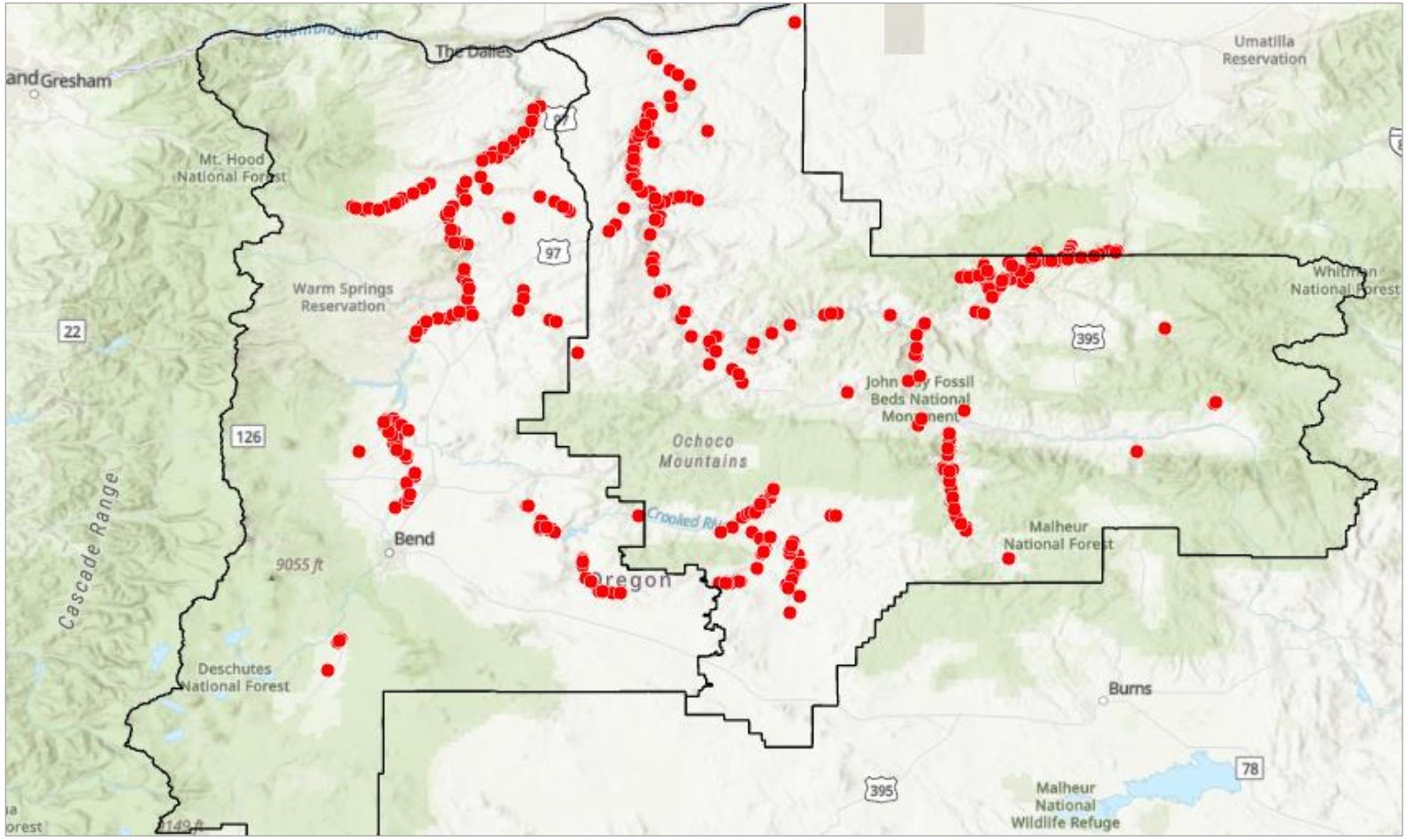
Standardization of Methods

- Encourage collection of comparable data
- Develop minimum quality standards and basic methods
- Provide detailed description of methods for novice surveyors
- Facilitate surveys at a variety of scales (single site, river, watershed, state, etc.)



Credits: USFWS/Courtney Newlon; Xerces Society.

Improving Distribution Data Sets for Management: Central Oregon Mussel Survey Project



- **Multi-year effort of the Prineville BLM District: 2020-2025**
- GRTS design on BLM lands
- Perennial, stream order of 5th or greater (bankfull width 7m+), fish-bearing
- 125 sites sampled for presence/absence
- Further estimates of density at select sites
- Trend analysis at 22 sites (so far), random and purposive

SGCN Mussel Project

ODFW, WDFW, and Xerces

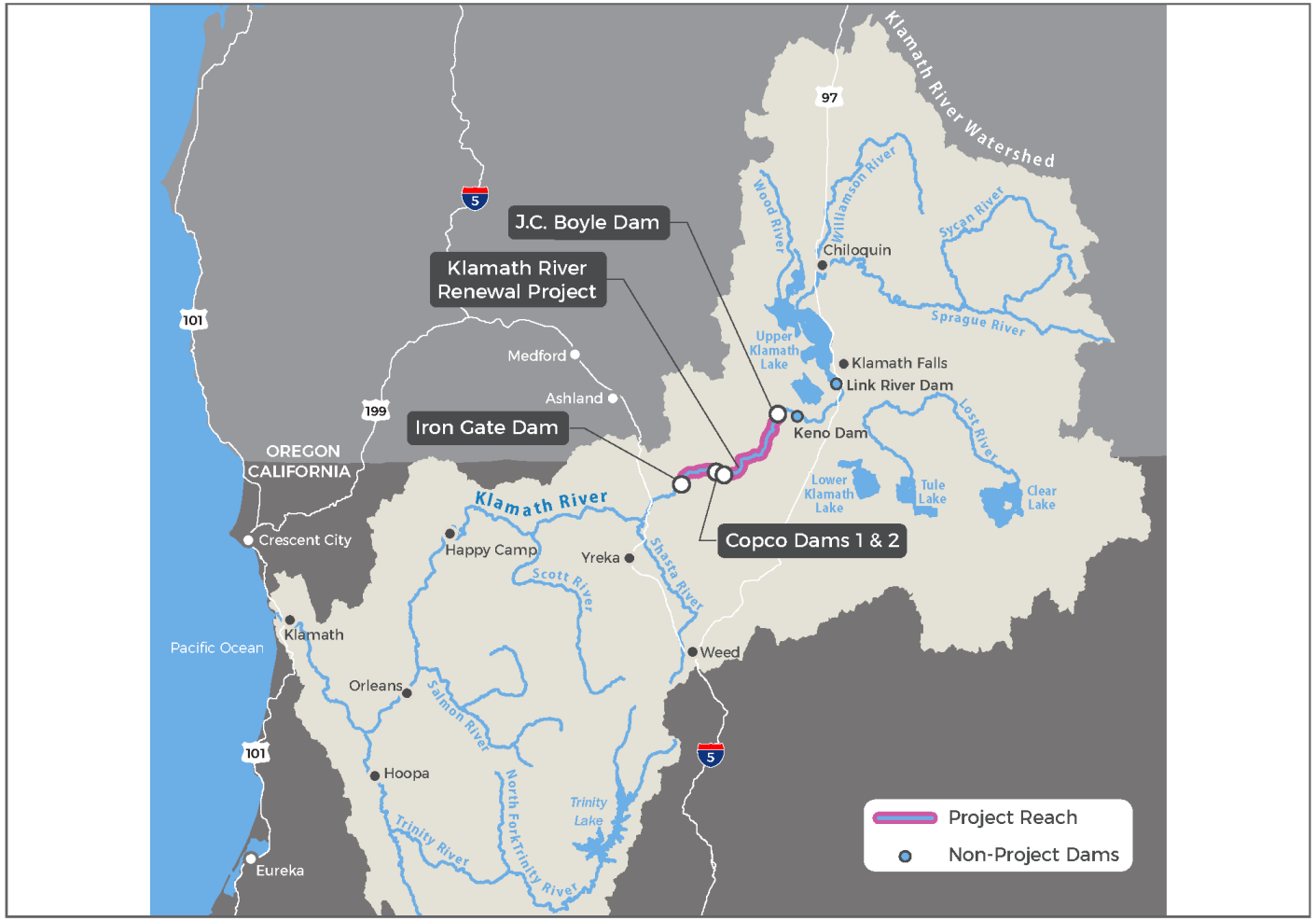
- Improve distribution information (eDNA and visual surveys)
- Establish locations for long-term monitoring
- Develop standardized viability categories and criteria for multiple species
- Improve data sharing and collaboration

Credit: Xerces Society.

Mitigation and Research: Western Ridged Mussels and th Klamath Hydroelectric Project

- Four dams in the hydro project:
  - JC Boyle (1958)
  - Copco 1 (1918)
  - Copco 2 (1925)
  - Iron Gate (1962)

Credit: Xerces Society.



KLAMATH RIVER RENEWAL CORPORATION

www.klamathrenewal.org

Project Vicinity Map

Klamath River Renewal Project

Collection, PIT tagging, and Translocation

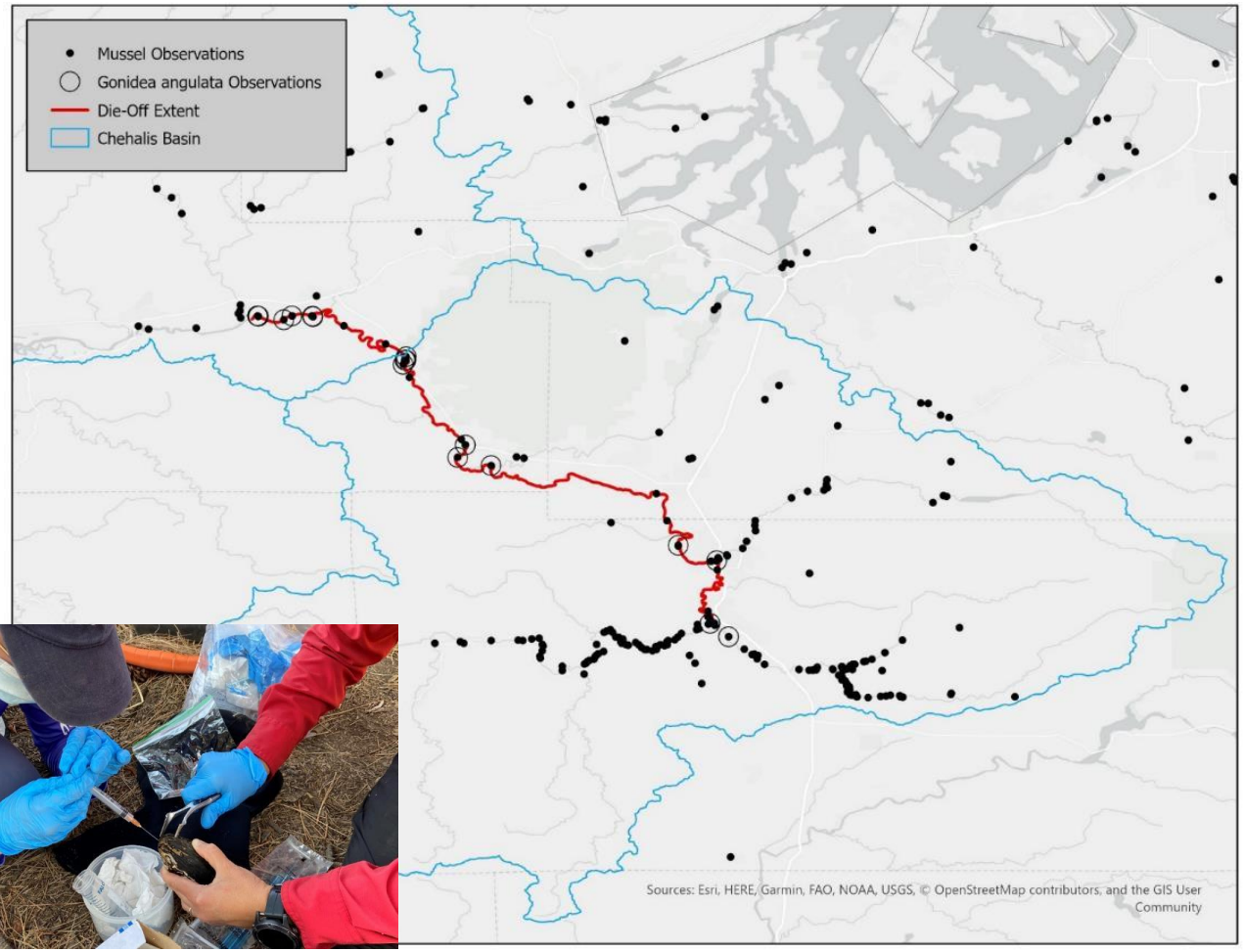
- Accessed 4 known WRM beds
- 6,684 mussels were collected from the 8-mile reach
- 2,349 mussels were PIT tagged and left in their bed or origin to assess impacts of sedimentation post-dam removal
- 4,335 mussels were relocated downstream
- Long-term monitoring to continue through 2034

Mass Mortality Events

Image credit: USFWS/Teal Waterstrat; Xerces Society/Emilie Blevins.

xerces.org

Disease Studies



Credit: Xerces Society; Anna Smith.

- Goldberg, T. L., Blevins, E., Leis, E. M., Standish, I. F., Richard, J. C., Lueder, M. R., Cer, R. Z., & Bishop-Lilly, K. A. (2023). Plasticity, Paralogy, and Pseudogenization: Rhabdoviruses of Freshwater Mussels Elucidate Mechanisms of Viral Genome Diversification and the Evolution of the Finfish-Infecting Rhabdoviral Genera. *Journal of Virology*.

- Richard, J. C., Blevins, E., Dunn, C. D., Leis, E. M., & Goldberg, T. L. (2023). Viruses of Freshwater Mussels during Mass Mortality Events in Oregon and Washington, USA. *Viruses*, *15*.

Needs and Future Work

- Need many more biologists engaged and informed – PNW mussel workgroup and USFWS-led conservation effort
- Expansion of long-term monitoring efforts
- Increased disease/mass mortality research
- Basic biology, life history, and habitat studies
- Applied research into effects of contaminants, river management, invasives, wildfires, etc.

Credit: Xerces Society.

Thank You!

Credit: USFWS/Roger Tabor.