



New Project Proposal

# Characterize Distribution, Status & Genetic Differences in Freshwater Mussels



Recovering Freshwater Mussels

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# Purpose

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## **Provide critical information on the status of freshwater shellfish**

- **Necessary to recover functioning salmonid ecosystems in rivers impacted by dams**
- **Necessary to protect traditional ceremonial and subsistence uses by Indian tribes**
- **Identified as a priority for management in the Umatilla Subbasin Summary**



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# Why Is This Important?

- **Restoring mussels is part of restoring salmon. Mussels were once an important component of the freshwater salmonid ecosystems in the Umatilla and elsewhere in the Columbia Basin that has been lost or threatened by dams**
- **Mussels are an important traditional source of food and shells for Native Americans**
- **Tribes and federal agencies would like to recover mussels in areas where they have been extirpated but little scientific knowledge is available to guide those recovery efforts**



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# Relationship to Fish & Wildlife Program

- Addresses Actions 15.1-15.3 in Umatilla Subbasin Summary
- Consistent with goal “*to recover and preserve the health of native fish injured by hydropower system*” (Section 10, *Fish and Wildlife Program*)
- Consistent with priority for “*weak, but recoverable, native populations*” and projects that “*also provide benefits for wildlife and/or anadromous fish*” (Section 10)
- Called for by guidelines that programs involving artificial propagation (including transfers) need “*a thorough and comprehensive approach to conserving genetic diversity*” and “*a plan for conserving genetic diversity*” (Section 7 &10)



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# What Do We Know?

## Six Endemic Species:

Western pearlshell  
*Margaritifera falcata*



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# What Do We Know?

## Six Endemic Species:

Western ridgemussel  
*Gonidia angulata*



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# What Do We Know?

## Six Endemic Species:

**Oregon floater**

*Anodonta oregonensis*



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# Status



## Six Endemic Species:

Western pearlshell  
*Margaritifera falcata*

Western ridgemussel  
*Gonidia angulata*

Oregon floater  
*Anodonta oregonensis*

California floater  
*Anodonta californiensis*

Willamette floater  
*Anodonta wahlametensis*

Western floater  
*Anodonta kennerlyi*

	Regional		Umatilla River Presence	
	(Williams et al. 1993)	(Frest and Johannes 1995)	Historical	Extant
Western pearlshell <i>Margaritifera falcata</i>	Unknown		✓	Extinct?
Western ridgemussel <i>Gonidia angulata</i>	Unknown	Sensitive	✓	Extinct?
Oregon floater <i>Anodonta oregonensis</i>	Unknown		✓	Extinct?
California floater <i>Anodonta californiensis</i>	Unknown	Threatened	✓	Extinct?
Willamette floater <i>Anodonta wahlametensis</i>	Unknown	Endangered		
Western floater <i>Anodonta kennerlyi</i>	Unknown			



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# Relationship with Salmon

- **Mussels use salmon as hosts during one phase of their life history**
  - **Glochidia attach to fish gills**
  - **Attachment is host specific**
  - **Glochidia metamorphose into juveniles and then drop off**
- **Mussels filter water of particulates and reduce silt in salmon streams**





# Causes of Mussel Decline

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- **Dams**
- **Siltation from poor forestry and agricultural practices**
- **Pollution**
- **Loss of specific fish hosts**



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# Importance to Tribes

**Mussels were an important source of food and shells**

- **Often collected during salmon fishing or when river conditions were favorable**
- **Use has declined in recent years**
- **Harvest remains a reserved treaty right**



*Umatilla Encampment,  
early 1900s*



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# Importance to Tribes



**Archeological  
record of harvest  
goes back over  
10,000 years**



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# Recovery Efforts

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**Efforts might include improving habitat and reseeding it by transplantation or aquaculture**

**Little scientific information is available to guide recovery efforts, including**

- **Surveys of distribution and status**
- **Knowledge of habitat and physiochemical characteristics affecting distribution and abundance**
- **Local adaptation that might affect successful transplantation**

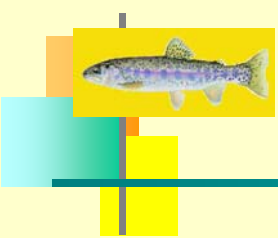


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# Study Objectives

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- **Determine the distribution and status of freshwater mussels in the Umatilla River**
- **Identify the macrohabitat and physiochemical factors controlling distribution and abundance of freshwater mussels**
- **Test whether genetic differences may exist among aggregations of western pearlshell mussel, *Margaritifera falcata*, from different streams in the Columbia River**



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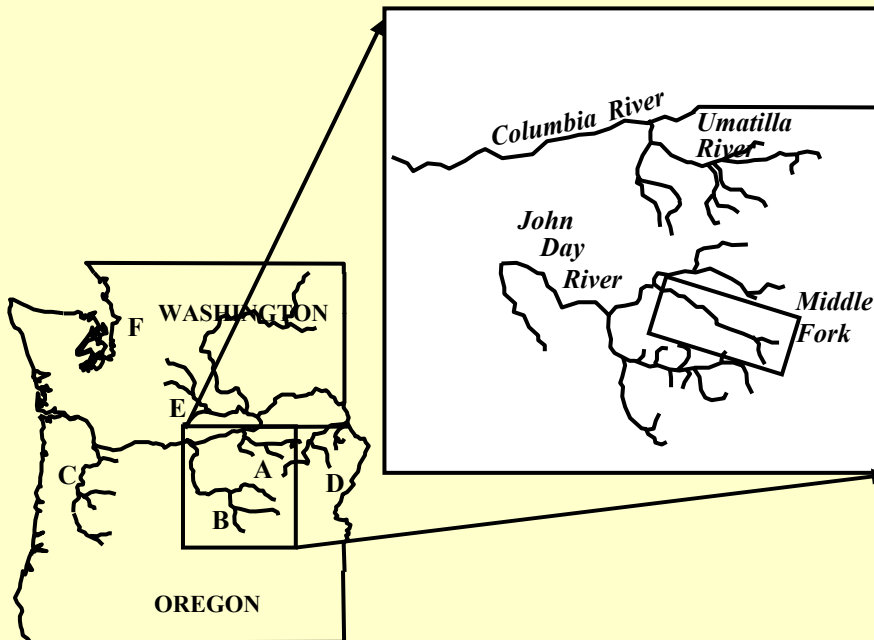
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# Objective 1: Distribution and Status

**Scope:** a systematic, qualitative survey of mussel densities in the Umatilla and Middle Fork John Day rivers



- **Study Reaches:**  
Every 4 km in main stem  
Every 2 km in tributaries
- **Count mussels in seen in 1 hr**  
along latitudinal transects
- **Collect sample for aging**
- **Categorize by relative abundance**  
(e.g., none, low, moderate, high)



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## Objective 2: Habitat Factors

**Scope:** Model of habitat factors controlling mussel distribution and abundance. *H<sub>0</sub>: No relationship*

- Post stratify reaches (Objective 1) based on relative abundance
- Quantify mussel density in selected 0.25 m<sup>2</sup> quadrants
  - Adaptive cluster sampling (low abundance reaches).
  - Convention random sampling (high abundance reaches)
- Measure habitat variables (e.g., water quality, channel morphology, sediment) at each site
- Describe relationships using multivariate logit model or discriminant analysis



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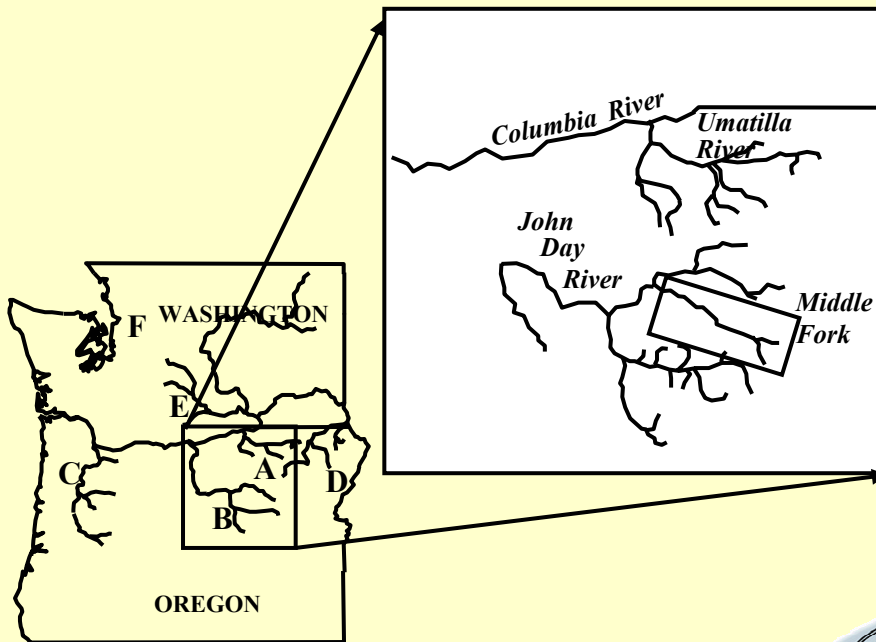




## Objective 3: Genetic Variation

**Scope:** Test for genetic population structure in *M. falcata*.

*H<sub>0</sub>:* No genetic differences among geographic aggregations



- 50-60 individuals from five aggregations (see map) & a different species
- 6-8 microsatellite DNA loci
- Mitochondrial DNA variation



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# Objective 4 & 5: Final Report & Publication

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**Scope:** Share information with managers and scientific community

- Report to funding agency
- Present results at regional and national meetings
- Make results available on Internet
- Submit genetic data and tissues to NBS archive
- Publish in peer-reviewed journals
  - *Journal of Shellfish Research*
  - *Transactions of the American Fisheries Society*
  - *North American Journal of Fisheries Management*



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# Products

- **Map of relative mussel density** at 80 locations in Umatilla and Middle Fork John Day rivers and an assessment of status
- **Test of a qualitative systematic survey method** that could be used to assess and monitor mussel status elsewhere in the Columbia Basin
- **Predictive model** of macrohabitat and physiochemical factors controlling mussel abundance that could be used to survey mussels in other subbasins.
- **Knowledge of geographical genetic differences** that might be important in the choice of brood stocks for mussel transplants or reseedling



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