

# Mapping Aquatic Biodiversity in Washington using Environmental DNA

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Washington  
Department of  
**FISH &  
WILDLIFE**

# WDFW Aquatic Biodiversity Project



Redside shiner



Western pearlshell mussel



Reticulate sculpin

- Led by Native Aquatic Species Unit (Inland Fish Program)
- Covers large number of freshwater fish and shellfish
  - 50 species of native freshwater fish
  - Four freshwater mussel groups
  - Over 20 are Species of Greatest Conservation Need (SGCN)
  - Several State Sensitive and Candidate Species
  - Federal listing, petitions

Problem: Limited data available to inform management decisions

- State Wildlife Action Plan (SWAP)
- Lacking statewide database

# WDFW Aquatic Biodiversity Project

## Methodology: Environmental DNA (eDNA)

- Detects genetic material in water to identify species presence/ absence.
- Systemic, standardized sampling for statewide coverage.
- DNA Metabarcoding to identify multiple species from a single sample.
  - Understand community composition and biodiversity
  - Detect unexpected species

Outcomes: New Data System and Interactive Map



Torrent sculpin



Speckled dace



Western ridged mussel

# eDNA in the Field



WDFW staff demonstrating eDNA collection at a Dungeness River sampling site. (WDFW photo).

## Sampling Protocol

1. Set up eDNA collection station.
2. Draw water through a fine filter to capture DNA fragments.
3. Carefully transfer filter to avoid contamination.
4. Multiple samples are collected at each site.
5. Collect attribute data at multiple points.

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3. Carefully transfer filter to avoid contamination.
4. Multiple samples are collected at each site.
  1. Control Samples (Field Blanks) to detect contamination
  2. Replicate field samples across locations (e.g., upstream/downstream)
5. Collect attribute data at multiple points.

# eDNA in the Field



WDFW staff demonstrating eDNA collection at a Dungeness River sampling site. (WDFW photo).

## Sampling Protocol

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3. Carefully transfer filter to avoid contamination.
4. Multiple samples are collected at each site.
5. Collect attribute data at multiple points.
  1. Equipment readings
  2. Environmental: Water Chemistry, River Widths, Habitat Observations

# eDNA in the Lab

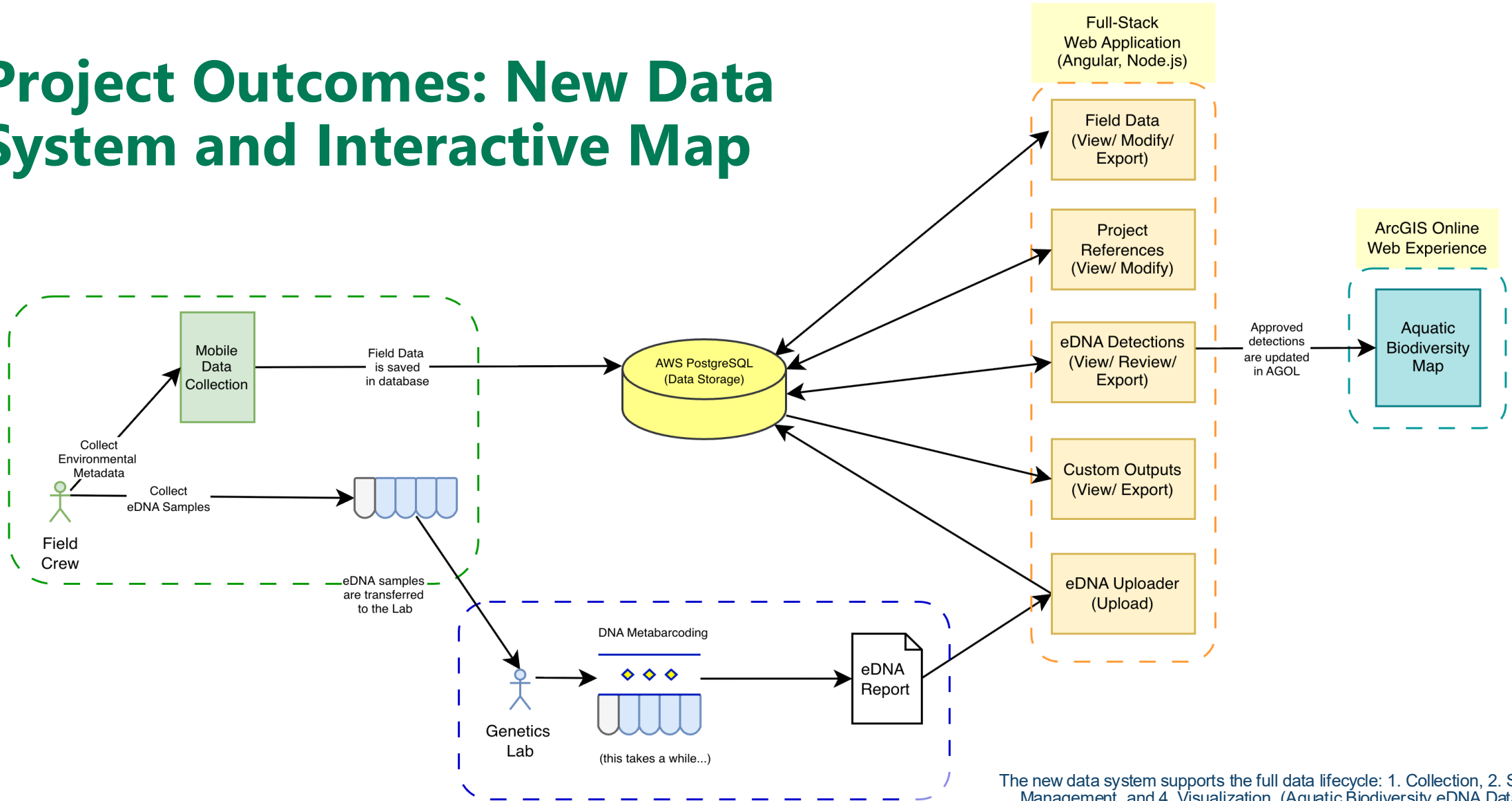
## DNA Metabarcoding to identify multiple species from a single sample

- Understand community composition and biodiversity
- Targeted Genetic Markers to identify species groups
  - MiFish: fish-specific marker
  - Cytochrome Oxidase I (COI): Broad 'universal' marker for diverse taxa
- Broad taxonomic coverage: Non-native fishes, aquatic invertebrates, amphibians
  - Example from 2024 COI data

Group	Unique species
Fishes	57
Amphibians	9
Birds	91
Mussels	2
Insects	1710
Mammals	67
Snails and slugs	15

Metabarcoding results indicating broad taxonomic coverage of fish and non-fish species, taken from a 2024 COI report. (WDFW Native Aquatic Species Unit).

# Project Outcomes: New Data System and Interactive Map



The new data system supports the full data lifecycle: 1. Collection, 2. Storage, 3. Management, and 4. Visualization. (Aquatic Biodiversity eDNA Data System).

# Internal Use Cases

## Data System

- Internal, WDFW Staff
- Centralized information
  - Non-natives, ESA Listed
  - Invasive Species

## Interactive Map

- Public-facing
- A statewide atlas for fish and shellfish distributions and habitat use

Watershed	Scientific Name	Common Name	Genetic Marker	Stream Discharge (m <sup>3</sup> /s)
Wenatchee	<i>Prosopium williamsoni</i>	Mountain Whitefish	MiFish	1.44144
Willapa Bay	<i>Percopsis transmontana</i>	Sand Roller	MiFish	1.23420
Wenatchee	<i>Oncorhynchus clarkii</i>	Cutthroat Trout	COI	0.14616
Willapa Bay	<i>Oncorhynchus mykiss</i>	Rainbow Trout	MiFish	0.01357
Willapa Bay	<i>Oncorhynchus mykiss</i>	Rainbow Trout	MiFish	1.54752
Wenatchee	<i>Salvelinus confluentus</i>	Bull Trout	MiFish	1.15432
Wenatchee	<i>Oncorhynchus mykiss</i>	Rainbow Trout	COI	1.53934
Wenatchee	<i>Oncorhynchus mykiss</i>	Rainbow Trout	COI	1.44144
Wenatchee	<i>Prosopium williamsoni</i>	Mountain Whitefish	MiFish	4.37976
Wenatchee	<i>Rhinichthys cataractae</i>	Longnose Dace	COI	1.77549
Wenatchee	<i>Oncorhynchus mykiss</i>	Rainbow Trout	COI	4.37976
Wenatchee	<i>Oncorhynchus mykiss</i>	Rainbow Trout	MiFish	2.24246
Wenatchee	<i>Salvelinus fontinalis</i>	Brook Trout	COI	0.61820
Willapa Bay	<i>Oncorhynchus mykiss</i>	Rainbow Trout	MiFish	1.54752
Willapa Bay	<i>Oncorhynchus clarkii</i>	Cutthroat Trout	COI	1.54752

Internal WDFW eDNA tool to guide monitoring, management, and restoration planning. (Aquatic Biodiversity Data System).

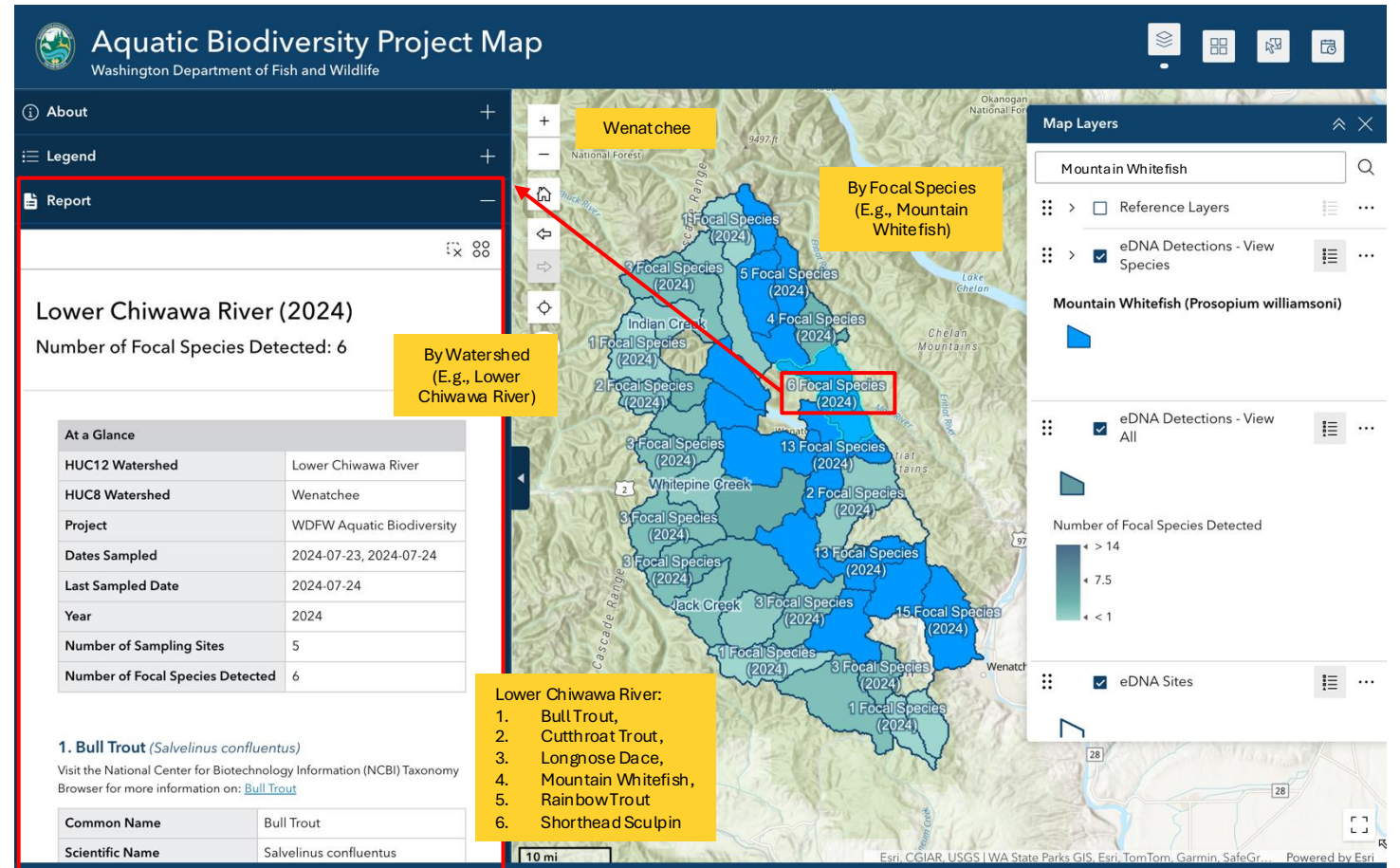
# External Use Cases

## Data System

- Internal, WDFW Staff

## Interactive Map

- Public-facing
- A statewide atlas for fish and shellfish distributions and habitat use
- Guide management, restoration planning, targeting, or avoiding areas with certain species



Public-facing eDNA map to guide monitoring, management, and restoration planning. (Aquatic Biodiversity Project Map).



# Aquatic Biodiversity Project Map

Washington Department of Fish and Wildlife



About +

Legend -

## eDNA Detections - View All



Number of Focal Species Detected



## eDNA Sites

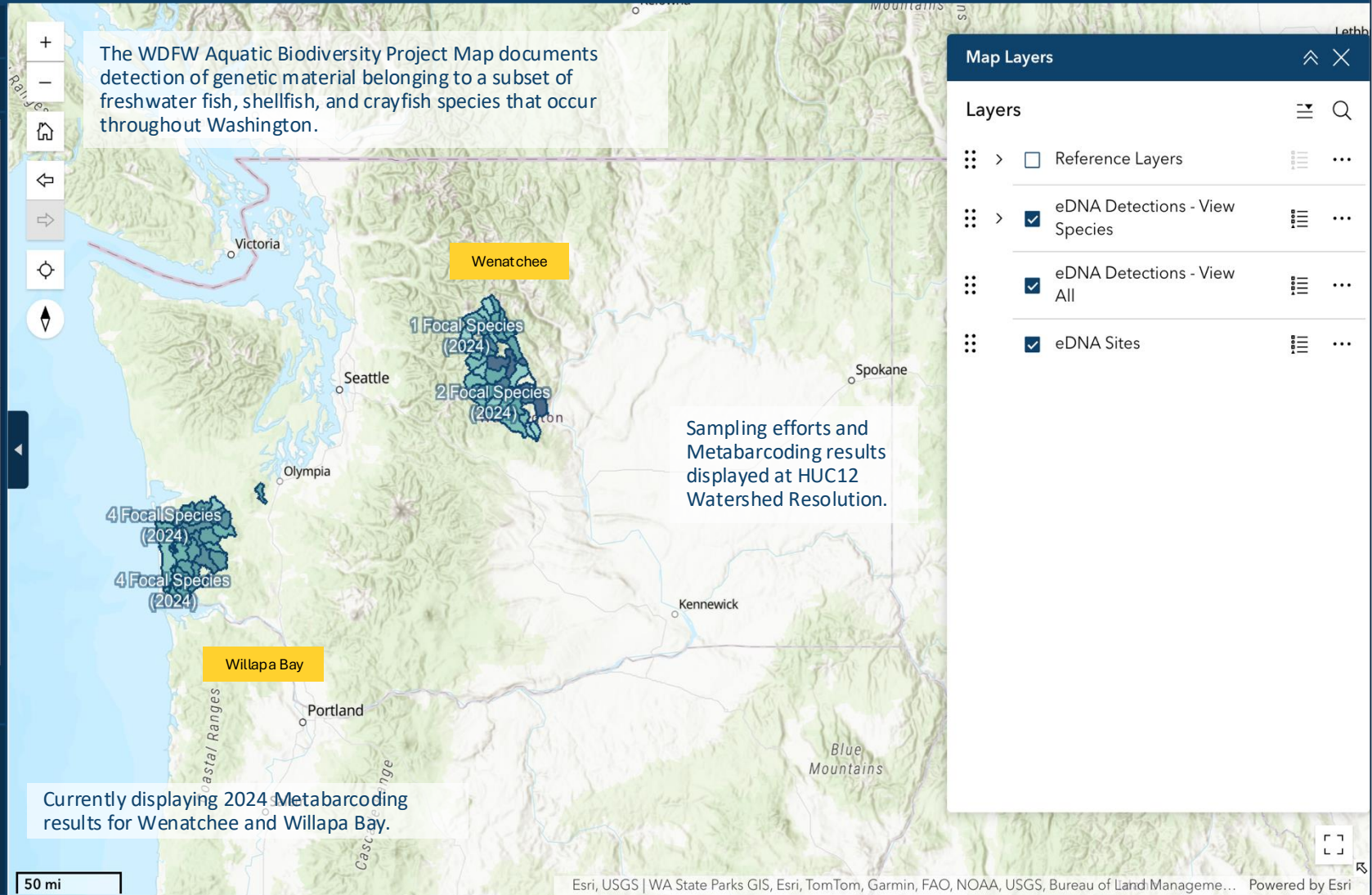


## World Hillshade

World\_Hillshade

Report +

The WDFW Aquatic Biodiversity Project Map documents detection of genetic material belonging to a subset of freshwater fish, shellfish, and crayfish species that occur throughout Washington.



Sampling efforts and Metabarcoding results displayed at HUC12 Watershed Resolution.

Currently displaying 2024 Metabarcoding results for Wenatchee and Willapa Bay.

## Map Layers

Layers

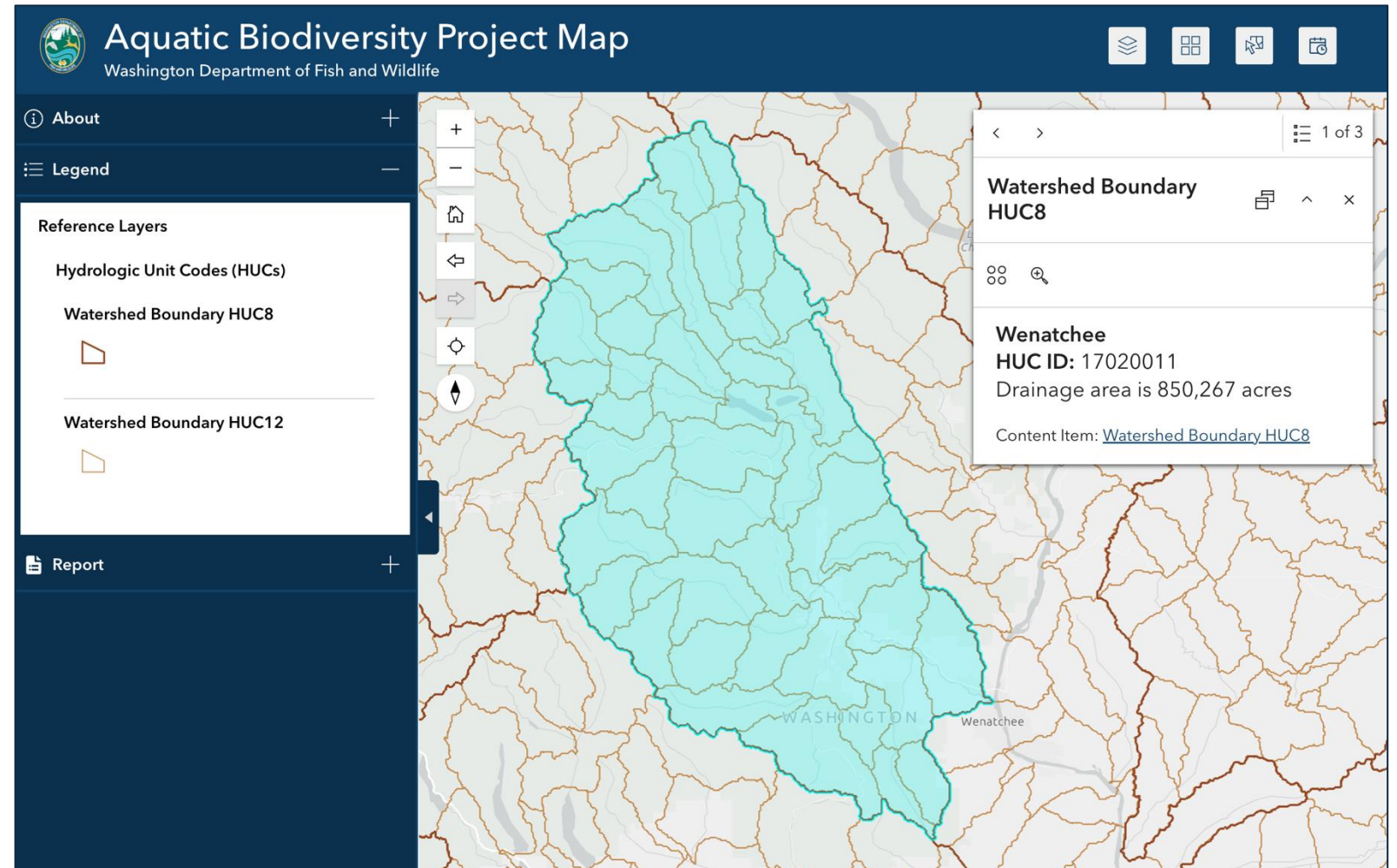
- Reference Layers
- eDNA Detections - View Species
- eDNA Detections - View All
- eDNA Sites

# HU Watershed Resolution

## Hydrologic Units (HU)

- HUC8 Data Collection
  - Sub-basin resolution
- HUC12 Data Visualization
  - Sub-watershed resolution

Understand community composition and biodiversity



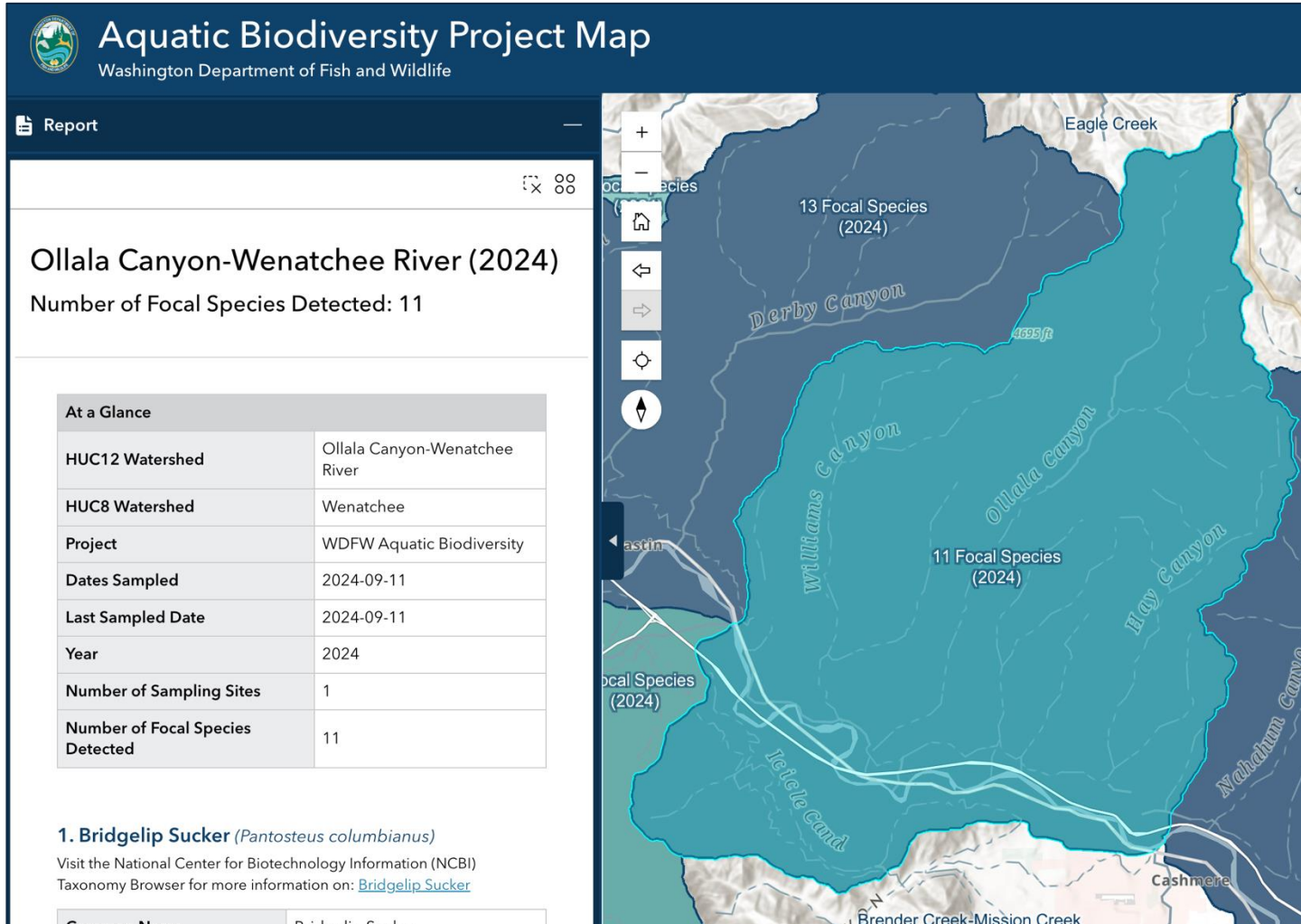
eDNA sampling efforts and detection results are displayed at the HUC12 watershed resolution. Aquatic Biodiversity Project Map.

# Interactive Data Exploration

The screenshot displays the 'Aquatic Biodiversity Project Map' interface from the Washington Department of Fish and Wildlife. The map shows various eDNA detection sites across Washington, with labels such as 'Wenatchee', 'Rock Creek', 'Waddell Creek', and 'Willapa Bay'. Each site is labeled with the number of focal species detected in 2024. A legend on the left indicates the number of focal species detected, with a color scale from light blue (< 1) to dark blue (> 14). The 'Map Layers' panel on the right shows several layers, including 'Reference Layers', 'eDNA Detections - View Species', 'eDNA Detections - View All', and 'eDNA Sites'. The 'About' and 'Legend' buttons are highlighted with red boxes. The 'Report' button is also highlighted with a red box. The 'Map Layers' panel is also highlighted with a red box. The 'Map Layers' panel shows the following layers:

Layer Name	Checked	Group
Reference Layers	<input type="checkbox"/>	Context (Group)
eDNA Detections - View Species	<input checked="" type="checkbox"/>	Focal Species (Group)
eDNA Detections - View All	<input checked="" type="checkbox"/>	Species Richness
eDNA Sites	<input checked="" type="checkbox"/>	Base Layer eDNA Sampling Effort

The WDFW Aquatic Biodiversity Project Map documents detection of genetic material belonging to a subset of freshwater fish, shellfish, and crayfish species that occur throughout Washington.



The Feature Info widget is used to report Species Richness at the HUC12 watershed resolution. Aquatic Biodiversity Project Map.

# Expert Reviewed Detections

## Focal Species

- 50 species of native freshwater fish
- Four freshwater mussel groups
- Over 20 are Species of Greatest Conservation Need (SGCN)
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Manually approved by Subject Matter Experts



# Aquatic Biodiversity Project Map

Washington Department of Fish and Wildlife

## Report

### 1. Bridgelip Sucker (*Pantosteus columbianus*)

Visit the National Center for Biotechnology Information (NCBI) Taxonomy Browser for more information on: [Bridgelip Sucker](#)

Common Name	Bridgelip Sucker
Scientific Name	<i>Pantosteus columbianus</i>
NCBI TaxID	<a href="#">244772</a>
Sequencing Strategy	Metabarcoding
Genetic Markers	COI

### 2. Chiselmouth (*Acrocheilus alutaceus*)

Visit the National Center for Biotechnology Information (NCBI) Taxonomy Browser for more information on: [Chiselmouth](#)

Common Name	Chiselmouth
Scientific Name	<i>Acrocheilus alutaceus</i>
NCBI TaxID	<a href="#">67537</a>
Sequencing Strategy	Metabarcoding
Genetic Markers	COI, MiFish

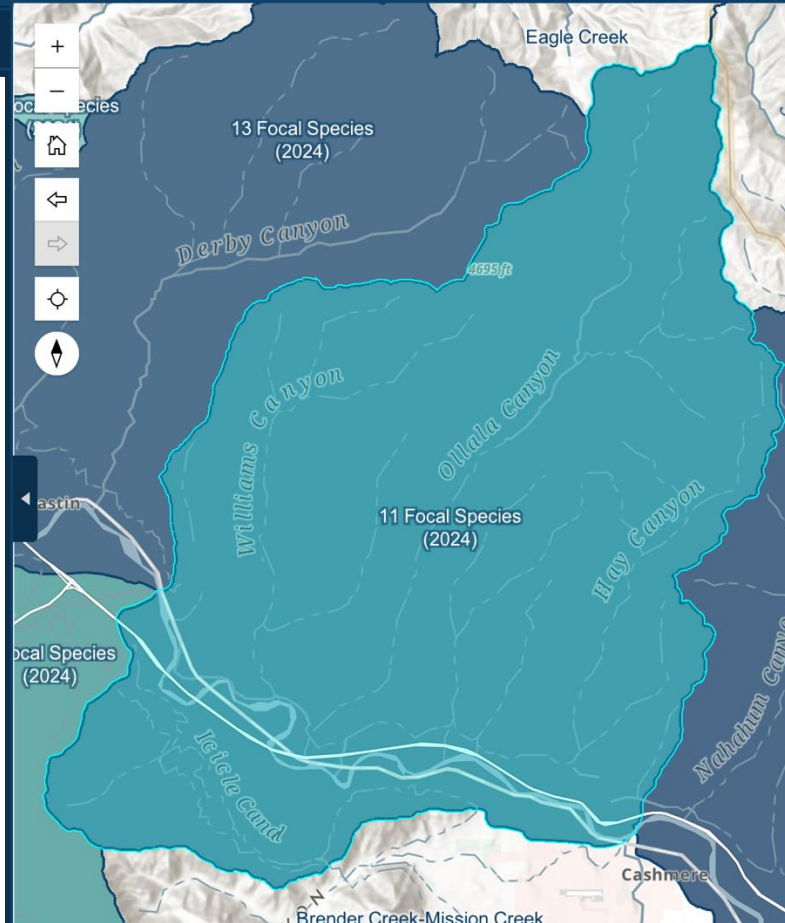
### 3. Cutthroat Trout (*Oncorhynchus clarkii*)

Visit the National Center for Biotechnology Information (NCBI) Taxonomy Browser for more information on: [Cutthroat Trout](#)

Common Name	Cutthroat Trout
Scientific Name	<i>Oncorhynchus clarkii</i>
NCBI TaxID	<a href="#">30962</a>
Sequencing Strategy	Metabarcoding
Genetic Markers	COI, MiFish

### 4. Largescale Sucker (*Catostomus macrocheilus*)

Visit the National Center for Biotechnology Information (NCBI) Taxonomy Browser for more information on: [Largescale Sucker](#)



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# Aquatic Biodiversity Project Map

Washington Department of Fish and Wildlife

Report

## 9. Redside Shiner (*Richardsonius balteatus*)

Visit the National Center for Biotechnology Information (NCBI) Taxonomy Browser for more information on: [Redside Shiner](#)

Common Name	Redside Shiner
Scientific Name	<i>Richardsonius balteatus</i>
NCBI TaxID	<a href="#">86930</a>
Sequencing Strategy	Metabarcoding
Genetic Markers	COI, MiFish

## 10. Torrent Sculpin (*Cottus rhotheus*)

Visit the National Center for Biotechnology Information (NCBI) Taxonomy Browser for more information on: [Torrent Sculpin](#)

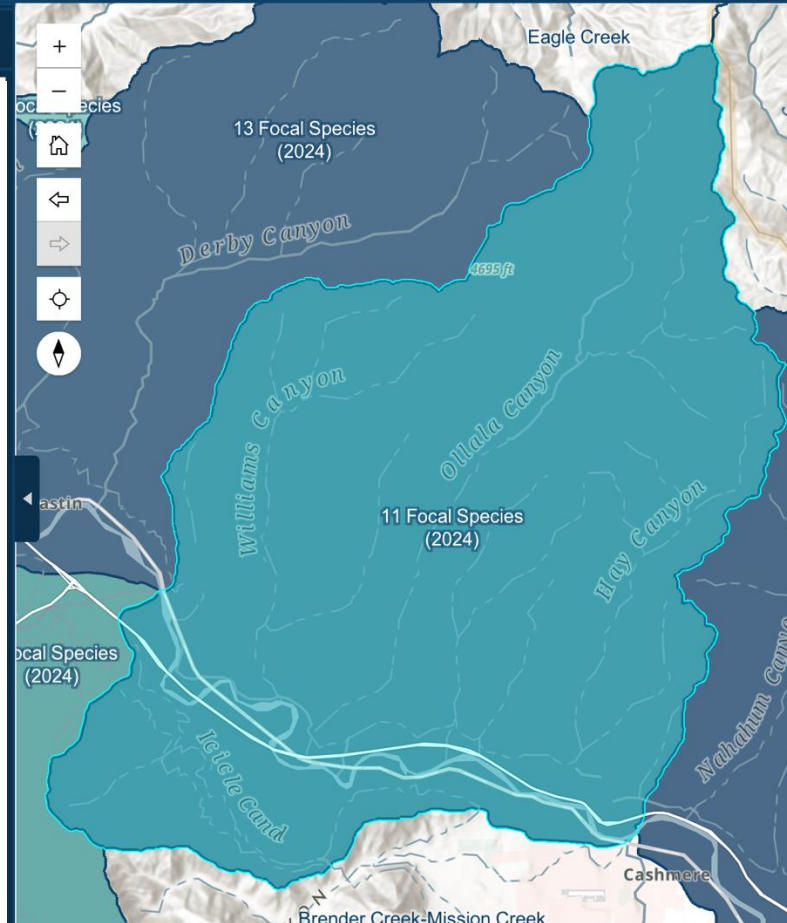
Common Name	Torrent Sculpin
Scientific Name	<i>Cottus rhotheus</i>
NCBI TaxID	<a href="#">214921</a>
Sequencing Strategy	Metabarcoding
Genetic Markers	MiFish

## 11. Western Pearlshell Mussel (*Margaritifera falcata*)

Visit the National Center for Biotechnology Information (NCBI) Taxonomy Browser for more information on: [Western Pearlshell Mussel](#)

Common Name	Western Pearlshell Mussel
Scientific Name	<i>Margaritifera falcata</i>
NCBI TaxID	<a href="#">52361</a>
Sequencing Strategy	Metabarcoding
Genetic Markers	COI

The following site was sampled: WEN\_073



# Expert Reviewed Detections

## Focal Species

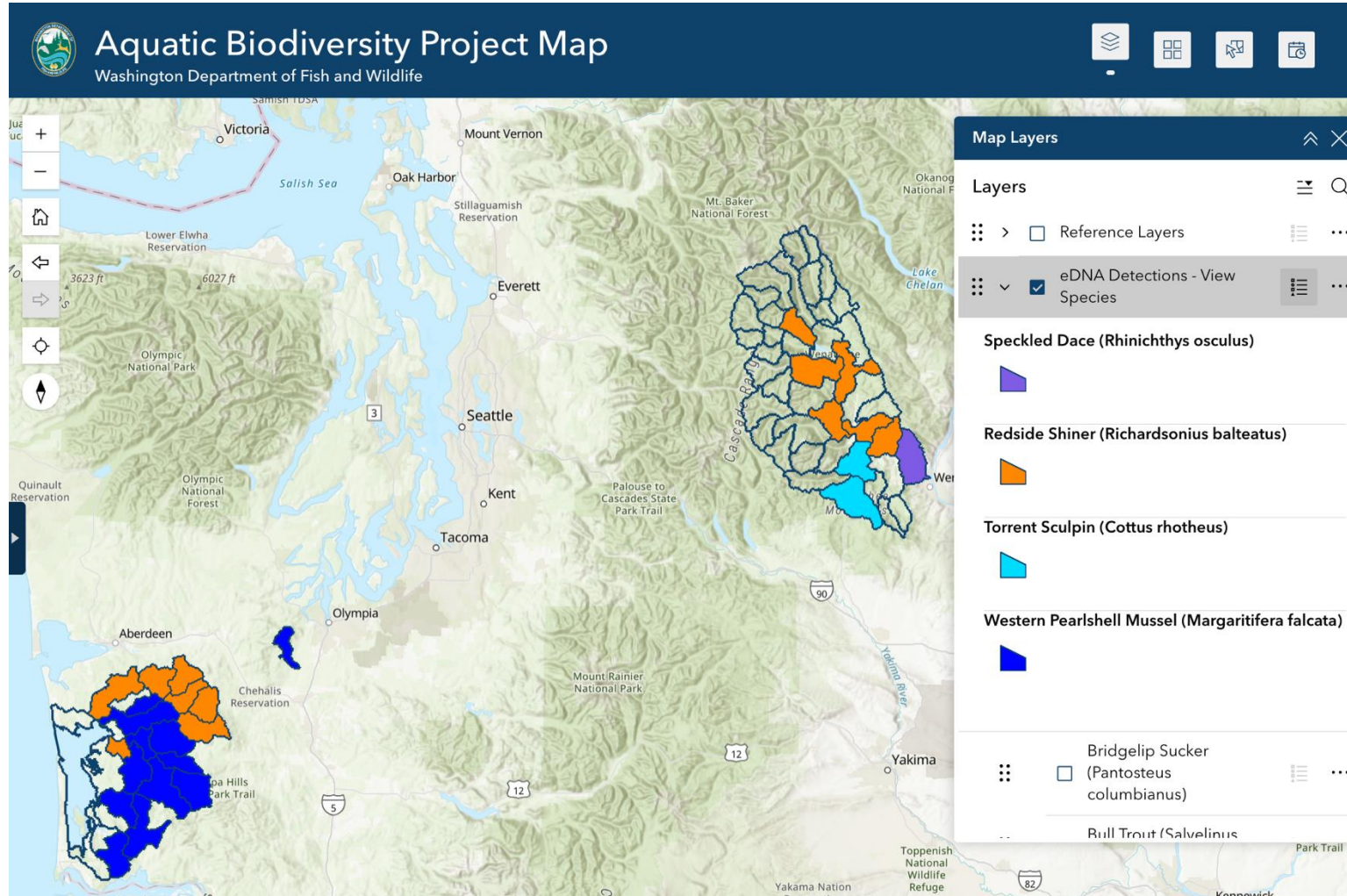
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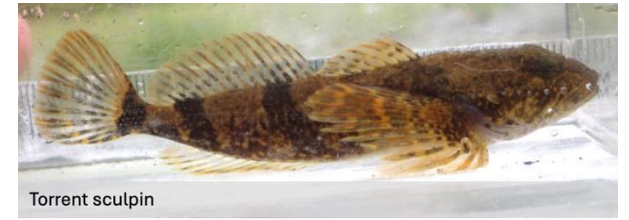
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# Visualizing Focal Species



eDNA detections for Speckled Dace, Redside Shiner, Torrent Sculpin, Western Pearlshell Mussel. Aquatic Biodiversity Project Map.



# Next Steps

- Map will be released in summer 2026
- Cover the state over 7-year cycle
  - 2024: Willapa Bay and Wenatchee
  - 2025: Yakima and eastern Olympic Peninsula
  - 2026: North Cascades and Southeast WA
- Distribution maps showing spatially continuous probability of occupancy
  - Compare fish occupancy among species
  - Illustrate species richness
  - Evaluation and compare detection probabilities
  - Describe species-habitat relationships



eDNA samples being collected on the Dungeness River for Inland Fish Program's Aquatic Biodiversity Project. WDFW Photo.



# Questions?

Database or Map: [Allison.Ying@dfw.wa.gov](mailto:Allison.Ying@dfw.wa.gov)  
WDFW Aquatic Biodiversity Project: [inland@dfw.wa.gov](mailto:inland@dfw.wa.gov)

Request this information in an alternative format or language at [wdfw.wa.gov/accessibility/requests-accommodation](https://wdfw.wa.gov/accessibility/requests-accommodation),  
833-885-1012, TTY (711), or [CivilRightsTeam@dfw.wa.gov](mailto:CivilRightsTeam@dfw.wa.gov).