



Salmon Summit 2025

Reconnecting Habitat, Restoring Rivers, Recovering Salmon

Poster Presentations

Active Channel Mapping in the Puget Sound

Natalie Furness, GIS Specialist, WWU; Dr. Aquila Flower, Professor, WWU; Ben Bruggen, GIS Analyst, WarthoGIS; Finley Bell, Graduate Student, WWU; Emily Bradford, Graduate Student, WWU; Anthony Tulloch, Graduate Student, WWU

In partnership with Puget Sound Partnership, WWU and WarthoGIS are delineating active channel polygons across WRIAs in the Puget Sound area using LiDAR and aerial imagery. The intent of this project is to identify the edge of stream riparian zones where woody vegetation begins for riparian restoration, fish habitat analysis, or other similar analyses. Data polygons from this project are publicly available as each WRIA is completed.

Assessing the efficacy of artificial substrates as settlement habitat for crabs in the Padilla Bay estuary

Maggie Brenneman: Research Assistant, Padilla Bay National Estuarine Research Reserve
Nicole Burnett: Environmental Specialist, Padilla Bay National Estuarine Research Reserve

Crabs possess a planktonic larval stage, after which they settle on the benthic floor. In previous studies, a variety of artificial substrates, such as plastic turf and hog's hair filters, have been used to monitor settling crabs. In this study, we conducted an experiment to assess the efficacy of different artificial substrates as settlement habitat for crabs in Padilla Bay, WA. Experimental treatments (n=3 per treatment) included 5 artificial substrates in plastic mesh baskets: hog's hair filter, aquamesh filter, oyster cultch, two plastic turf squares sandwiched together, and one plastic turf square with the blades facing up, as well as a basket control and unmanipulated bare sediment. These artificial substrates were deployed in randomized order along a transect in the high intertidal zone (~1.7 m MLLW) every two weeks from April to October 2025. Results showed that overall, aquamesh and oyster cultch collected the most crabs; this includes individuals that settled and those that recruited post-settlement. These results have broader implications for using artificial substrates to assess settlement of both native and invasive crabs.

Hyporheic Upwellings, Cool-Water Refuge, and Hope for Chinook Salmon

Sydney Jantsch, Restoration Scientist, Lummi Natural Resources

Cold water and quality habitat are key to salmon survival. Much time, effort, and funding are dedicated to habitat restoration, yet there is limited data to assess the effectiveness of these efforts. The Lummi Nation Natural Resources Restoration Division conducted a study that evaluated the success of salmon habitat restoration on the South Fork Nooksack River. This project aimed to support threatened early Chinook salmon and assess the success of restoration efforts in reducing stream temperatures. Researchers evaluated the effectiveness of different types of engineered log jams (ELJs) in creating localized upwellings of shallow, subsurface flow to provide cool-water refuge for salmon. Response variables included streambed topography, hyporheic exchange, stream temperature, and fish use. Results show that adult salmonids prefer ELJ-formed pools over other habitats; however, hyporheic upwellings at the head of these pools do not always lead to cooler temperatures in the deepest part of the pool. Results also suggest that building ELJs downstream of forested meander bends on the adjacent side of the river can play an important role in providing cool-water refuge by increasing cool hyporheic upwellings. The long-term goal of this study was to



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inform the design of future restoration projects, supporting the recovery of salmon populations threatened by climate change, so that this once-abundant resource can continue to enrich the local culture, economy, environment, and beyond.

Integrated Fish Passage: A Kenney Creek Success Story

Ben Floyd, P.E., Engineering Supervisor, Bridge & Hydraulics Division, Whatcom County Public Works; Pat Flanagan, Principal, Indicator Engineering, PLLC; John N. Thompson, L.E.G, Senior Salmon Recovery Planner, Natural Resource Division, Whatcom County Public Works

The Whatcom County Public Works Fish Passage Program is dedicated to restoring access to historically available anadromous salmonid habitats. Kenney Creek at North Fork Road was the top priority county barrier in the North Fork Nooksack. The barrier consisted of a 5' diameter metal culvert under 22+ feet of fill and a fishway installed to compensate for the perched culvert. While some steelhead and coho could pass upstream, chinook, chum, pink, coastal cutthroat and other native riverine fishes, had limited, if any, access to over 4 miles of habitat. The culvert was severely undersized and easily blocked by woody debris; high flows regularly exceeded the culvert's capacity causing an impoundment and the potential for catastrophic roadway embankment failure.

A temporary bridge provided emergency, residential, and forestry access. The culvert, embankment, and fishway were replaced with a 115' bridge, a roughened channel, and instream large wood. The bridge is sized for large floods under climate change while allowing for natural movement of water, wood, sediment, and wildlife. Construction was completed fall 2025; site restoration is set for late winter to spring 2026.

Companion riparian restoration and instream wood placement projects by project partners the Whatcom Land Trust and Nooksack Salmon Enhancement Association will further enhance instream and riparian habitat quality in the now accessible reach.

Little Squalicum Estuary: If you build it, they will come...

Sara Brooke Benjamin, MSc, City of Bellingham, John Rombold, PhD, Salish Sea Research Center at Northwest Indian College, Devin Flawd & Zoë K. Lewis, Lummi Natural Resources, Kathryn L. Sobocinski, PhD, Western Washington Department, Danielle Rapoza, Herrera Environmental Consultants, Marysia Smith, City of Bellingham

Over the past 150 years, Bellingham Bay has lost ~282 acres of aquatic land as the result of historical dredging, filling, and shoreline modification activities, drastically reducing estuarine habitats available to fish and other wildlife, especially those juvenile salmonids who rely on estuaries for rearing. The Little Squalicum Estuary project mitigates these losses by restoring tidal and sedimentary processes, improving fish passage, and returning saltmarsh, mudflat and estuary habitats where historical wetlands have been lost. Completed in early 2024, this project restored 4.85 acres of coastal habitat including a 2.4-acre estuary. The project also removed a fish passage barrier at the mouth of Little Squalicum Creek. Post-project monitoring and observations have confirmed that the estuary is already serving its purpose by providing habitat for target species. After construction, bird species observed in the estuary have included Purple Martin, Belted Kingfisher, Bufflehead, Common Merganser, Hooded Merganser, Common Goldeneye, Pied-billed Grebe, Ring-necked duck, Killdeer, Spotted Sandpiper, Great Blue Heron and even establishment of a new heron colony nearby. In November 2024, eDNA samples collected at the mouth of the new estuary gave a strong signal for Longfin Smelt with values 100 - 200x times greater than typically seen from a marine sample that tests positive



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for Longfin Smelt. In April and May of 2024 and 2025, beach seines collected juvenile Chum, Coho, and Chinook salmon, as well as Shiner Perch, Staghorn Sculpin, and other estuarine species.

Pepin Creek Relocation in Lynden

Pat Flanagan, Hydraulic Engineer, Indicator Engineering PLLC; Mark Sandal, Programs Manager, City of Lynden

Pepin Creek, aka Double Ditch, is being relocated to improve instream habitat and fish passage, eliminate barriers, improve sustainability, improve roadways and reduce urban flooding. The relocation project is led by the City of Lynden to vastly improve a creek that has historically been managed as a stormwater system in undersized roadside ditches. The ditches have required routine maintenance, provide poor habitat and little to no riparian zone, have numerous aging culvert barriers and result in relatively frequent urban flooding. The City has begun to relocate Pepin Creek in phases working towards a conceptual plan of about 1-mile of relocated creek and 4 new road crossings. In 2025 the City constructed phase 2 of the project, bringing the total construction to date of 1600-ft of new channel with 2 new bridges. A 75-ft creek corridor with a 45-ft floodplain has been routed through the existing developed City to provide riparian zone, floodplain and ample channel width for improved habitat. The constructed channel sections feature pools and glides designed to self maintain using strategically placed wood and channel bends. Future phases will regrade downstream to increase floodplain and eliminate fish passage barriers, and continue upstream with a broader floodplain and riparian zone. The relocated channel will decrease temperature through riparian zones and groundwater, create floodplain habitat, improve instream flow diversity through established pools and large wood.

Refining watershed hydrology model data inputs through sap flux measurements in the South Fork Nooksack River watershed: Pilot Study and Future Work

Maggie Taylor, Nooksack Indian Tribe Natural Resources Department Staff

Future climate projections suggest that the PNW will experience warmer annual air temperatures combined with drier summers that will continue to exacerbate low streamflows, drought, and high stream temperatures in the Nooksack River watershed during summer months. Of particular concern are declining late summer streamflows, and it is imperative to the Nooksack Tribe to restore flows to levels that can sustain viable salmonid populations in perpetuity. The Tribe has conducted research on the impacts of legacy land use and climate change on streamflow and watershed health. We initiated a data collection system that was used for data validation of hydrologic modeling with the Distributed Hydrology Soils and Vegetation Model (DHSVM) and the Visualizing Ecosystem Land Management Assessments (VELMA). Studies suggest that dense forests may reduce the amount and duration of snow storage, while young forest stands consume more soil water for transpiration compared to mature trees, thereby impacting summer streamflows. However, previous research has not sufficiently quantified the water use of trees of different ages and their impacts to watershed hydrology. To fill this data gap, a recent pilot study, conducted in collaboration with representatives from academia, non-profits, private consultants, and tribes, successfully deployed sap flux (a proxy for evapotranspiration) and soil moisture sensors on trees in a controlled setting. The next step is to deploy a similar set of instruments in two transects in commercial forest stands representing young (~20-year-old) and older (>80-year-old) Douglas fir (*Pseudotsuga menziesii*) trees in the South Fork Nooksack River watershed.



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Skookum Edfro Phase 3 Instream Restoration Project – Recent FEMA Regulatory Changes Causing both Geomorphic and Ecological Impacts to the Project. SF Nooksack River, Washington

Alex Levell, Lummi Nation Natural Resources Department

In 2021, a major pre-spawn mortality (PSM) event in the SF Nooksack River killed over 2,400 adult early chinook salmon and was declared a disaster (LIBC #2101-159). Since then, the Lummi Nation Natural Resources Department (LNR) estimates PSMs have affected about 1/3 of returning chinook annually, with most deaths in the Skookum Reach.

The project's goal is to restore and protect spawning, rearing, and holding habitat to support self-sustaining salmon at harvestable levels while avoiding added flood or erosion risks. Key actions include engineered log structures to form deep pools with cover and excavation of side channels and banks to improve habitat and geomorphic function.

FEMA floodplain rules require that structures in a 100-year floodplain not raise base flood elevations (BFEs) or else receive a conditional letter of map revision (CLOMR). To comply, ~9 acres of riparian habitat must be excavated, exporting over 60,000 CY of material, adding over \$2M in project costs. Federal ESA compliance and CLOMR are expected by 2026, with construction targeted for 2027 after review delays.

Land ownership adds complexity. Excavation areas belong to the Whatcom Land Trust, whose board had concerns, while WA DNR Aquatics also raised issues. Negotiations may yield a Boundary Line Agreement.

This project highlights regulatory hurdles since FEMA's 2020 rescindment of the Fish Enhancement Structures in Floodway Policy. We will present constraints, engineering solutions, stakeholder engagement, lessons, and next steps.