

## Transboundary eDNA Pilot Sampling Proposal: *Assessing contribution of eDNA to monitoring priority species and climate indicators in two watersheds*

In discussions that emerged at the Cascadia Partner Forum's 2015 *WildLinks* conference, a proposal has formed to build on work presented by Michael Young (National Genomics Center for Wildlife and Fish Conservation, Rocky Mountain Research Station, USFS) in two watersheds in the Cascadia landscape: (1) the Upper Skagit in Washington and British Columbia and (2) the Bridge watershed in British Columbia in the St'at'imc First Nations territory.



Map displaying the Bridge-Seton watershed boundary in pink, transboundary Skagit watershed in orange, and Cascadia Partner Forum boundary in green.

The objectives of the pilot effort are three-fold:

- Produce reliable and precise estimates on the distribution of priority aquatic associated species in these two watersheds and simultaneously lay the groundwork for detecting nonnative species presence to inform management, monitoring, and conservation investments. Both watersheds will include detection of bull trout (*a strong climate indicator species associated with cold water refugia systems, and a priority species of the Cascadia Partner Forum*) as well as one additional high priority species for local managers to inform their ongoing work.
- Build a transboundary community in Cascadia to coordinate the planning and implementation of eDNA-based surveys and sample analyses that can be coupled with species occupancy models

for both of the watersheds, serving as a pilot that can be scaled up to a larger spatial extent in the future. In British Columbia, conduct scoping efforts to identify laboratory needs for samples collected in watersheds on that side of the border if efforts scaled up.

- Provide momentum for expanding range-wide species assessments using eDNA sampling, already underway across the entire interior Columbia River basin in the U.S., to the rest of western North America.

Environmental DNA (eDNA) sampling is a new method that relies on capture of DNA from water samples that is poised to revolutionize the field detection of fish, amphibians, and other aquatic species. Because sample collection is straightforward, fast, and easily done by a single person, it is possible to inventory entire streams for what it would cost to inventory a single reach using conventional fish survey methods. Using sampling and analytical methods optimized by the National Genomics Center for Wildlife and Fish Conservation (NGC) in Missoula, this methodology has achieved 100% detection success of target species across order-of-magnitude changes in stream discharge (Science Briefing, USDA). Application of this tool has confirmed the presence and location of populations of rare native fish species that had not been observed for decades, documented seasonal use of thermal refugia during heat waves, and verified the success of invasive species removals or targeted areas for additional treatment.

For this pilot effort, we propose an individual from the NGCWFC come to Cascadia in the summer of 2016 to train local capacity from NGOs, First Nations, and land managers to collect eDNA samples in these two watersheds to determine the distribution of priority species.

The priority species that will be targeted in this pilot year for each system are:

- Upper Skagit watershed (*bull trout, Dolly varden, harlequin duck*): North Cascades National Park would benefit from eDNA to complement other baseline monitoring in the watershed for these species. For this system a specific marker would need to be created to differentiate the Dolly Varden from bull trout to create effective surveys for presence of each species in the system. Harlequin duck is a sensitive species recognized by North Cascades National Park and a priority species for Washington Department of Fish and Wildlife. Last year during stream surveys in areas previously well occupied by harlequins, not a single nest was detected. There are many climate considerations that could impact the timing and use of the streams by harlequins in the park, but better tools to detect their presence are needed to monitor presence/absence.
- Bridge-Seton watershed (*bull trout, chinook salmon*): The St'at'imc First Nations fisheries departments priority system is the Bridge River/Carpenter Reservoir, which is impacted by BC Hydro. In the Bridge River, the number one issue below the BC Hydro dam is the Chinook salmon. This population has been decimated by the flow regime, hatching out too early and dying. There is ongoing research and base line data with which to compare eDNA results with what we currently know, and to assess what additional value eDNA could add to priority monitoring efforts of the First Nation. Bull trout are present both below and above the dam in this system, while the bull trout above the dam have shown a higher than expected mercury content believed to be related to the gold mining in the valley.

Michael Young will visit the transboundary Skagit watershed system in late June to facilitate training of field crews and additional identified partners. This training over 2 days will include an orientation to eDNA and the landscapes to be covered, field training on collection protocol, and discussion of needs and potential for scaling up work in transboundary Cascadia. In addition to project leads and field technicians from North Cascades National Park and St'at'imc First Nation invitations have and/or will be extended to Mount Baker Snoqualmie National Forest, Upper Skagit Tribes, Okanogan-Wenatchee National Forest,

Upper Columbia Salmon Recovery Board, and Skagit Environmental Endowment Commission International Tech Team members.

Field collection is expected to occur in July 2016. All samples collected in this initial year will be sent to the lab in Missoula for processing, while a scoping effort led by Sue Senger of St'at'imc First Nation will be conducted in British Columbia for development of a sister facility for any future scaled up efforts from this pilot on that side of the border.

**Estimated costs: \$53,600**

- Training – late June in the Skagit watershed. Bring field technicians and additional interested parties in eDNA together for a 2-day training in the field with Michael Young on eDNA collection protocols and discussion. Include discussion of potential future use and scaled up applications in the transboundary landscape.
  - \$600 – Travel for Michael Young, to be covered by the Cascadia Partner Forum
  - \$3000 – Food and lodging for guests during the meeting, requested to be covered by Skagit Environmental Endowment Commission
- Skagit watershed sampling, outside of wilderness (Processing of results as well as development of two new eDNA markers for Dolly Varden and harlequin duck) = \$30,000
  - \$20,000 from Skagit Environmental Endowment Commission, committed
  - \$5000 from Seattle City Light for Dolly varden eDNA marker, to be requested
  - \$5000 needed for development of harlequin duck eDNA marker, to be requested from NPLCC
- Bridge River watershed sampling (all eDNA markers are available for targeted species, budget is for processing of results) = \$20,000
  - \$10,000 from North Pacific Landscape Conservation Cooperative, to be requested
  - \$10,000 committed from St'at'imc First Nation

Significant in-kind donations are being made by St'at'imc First Nations and North Cascades National Park towards travel and capacity of their project leads and field crews in the collection, as well as additional volunteers and individuals interested in the dialogue and effort.