Assessing Arctic Grayling Relative Abundance and Distribution Through Environmental DNA Analysis

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We acknowledge the Alaska Native nations located on the traditional lands of the Dena people of the lower Tanana River from which we collected our environmental samples from.

Grayling and eDNA

- Arctic Grayling (*Thymallus arcticus*) freshwater species
  - Broad distribution across Alaska
  - Opportunistic feeders; wide diet variety
  - Follow spawning salmonid to feed
  - Not an important species for subsistence harvest
  - Popular for sport fishing; various colors and sizes
- Environmental DNA analysis
  - Potential source of information of distribution, abundance, and ecology
  - qPCR (quantitative Polymerase Chain Reaction) strategy for extracted DNA to determine relative amount of species specific DNA
- **Will we find an abundance of Arctic Grayling DNA in the Chena River during the salmon spawning season?**

Image 1. Greg Beutler fly fishes for Arctic Grayling off Chena Hot Springs Road, close to the North Fork sample site.
Photo:John Fillmore

Methods

- Collected water samples with Citizen Science Sampler
  - 7 locations on 3 separate days: 3 samples each sample site
- Isolated DNA from filters
- Prepared DNA for quantification
- Processed species specific assay with PCR
- Processing samples through qPCR machine (qTOWER3 84)

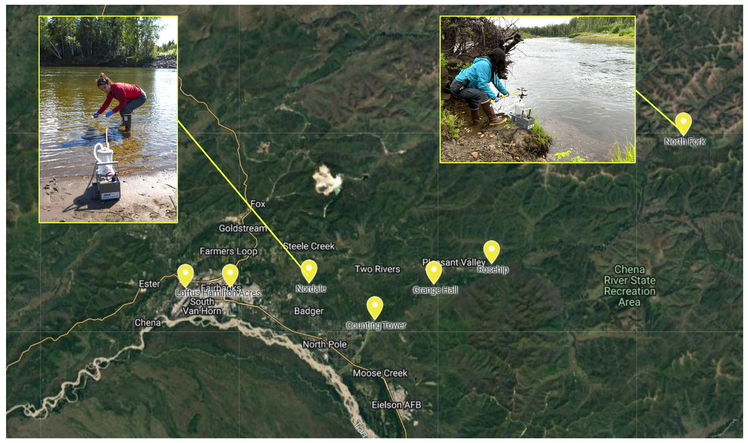


Image 2. **Chena River Sample Sites:** North Fork, Rosehip, Grange Hall, Moose Creek Counting Tower, Hamilton Acres, Loftus and Nordale.
Photos: Maggie Harings, UAF

Image 3. Water sample filters before eDNA extraction

Image 4. Extracting DNA from filters
Photo: Alice Bailey, UAF

Table 1. DNA from tissue samples

Thymallus arcticus	**Arctic Grayling**
Coregonus autumnalis	**Arctic Cisco**
Oncorhynchus keta	**Chum Salmon**
Prosopium cylindraceum	**Round Whitefish**
Dallia pectoralis	**Alaska Blackfish**
Cottus cognatus	**Slimy Sculpin**
Oncorhynchus tshawytscha	**Chinook Salmon**
Oncorhynchus mykiss	**Rainbow Trout/ Steelhead**
Coregonus sardinella	**Least Cisco**

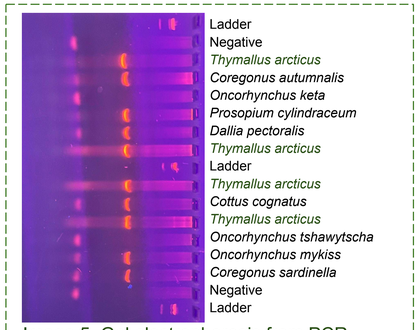
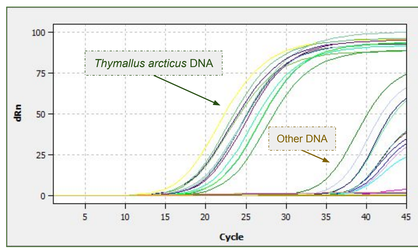


Image 5. Gel electrophoresis from PCR



Species	Ct Values
Thymallus arcticus	14.97 - 17.31
Oncorhynchus keta	38.1
Oncorhynchus mykiss	38.65
Oncorhynchus tshawytscha	36.52
Prosopium cylindraceum	32.95

Figure 1. qPCR with tissue sample DNA

Preliminary Analysis

- Tested assay specificity with tissue samples from Arctic Grayling and closely related/unrelated species (Table 1).
- High DNA concentrations of most salmonids indicate amplification during PCR (Image 5) and qPCR (Figure 1 & Table 2).
- qPCR indicates DNA concentrations of Chena River samples too low to amplify (Figure 2).

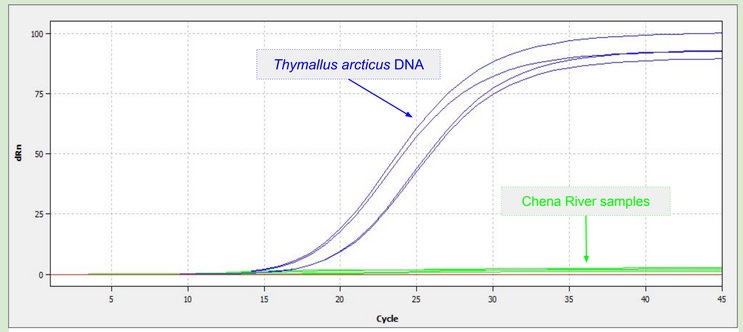


Figure 2. qPCR results of Arctic Grayling vs.Chena River eDNA samples.

Discussion

- Latest qPCR analysis indicates eDNA sample concentrations are too low to amplify.
- Next Steps:
  - Further testing assay (Rodgers, et al) with known DNA concentrations to develop level of detection for Arctic Grayling.
  - Data configured in relation to Chum and Chinook salmon eDNA spawning periods
- qPCR method may become a complementary technique in the field of assessing relative quantities of species over time and space.

Sources

Rodgers, T.W., Olson, J.R., Klobucar, S.L. et al. Conservation Genet Resour (2018) 10: 859. https://doi.org/10.1007/s12686-017-0883-1

Schoen, E. R., Sellmer, K. W., Wipfli, M. S., López, J. A., Ivanoff, R., & Meyer, B. E. (2022). Piscine predation on juvenile salmon in sub-arctic Alaskan rivers: Associations with season, habitat, predator size and streamflow. *Ecology of Freshwater Fish*, 31, 243– 259. https://doi.org/10.1111/eff.12626

Acknowledgements

BLaST is supported by the NIH Common Fund, through the Office of Strategic Coordination, Office of the NIH Director with the linked awards: TL4GM118992, RL5GM118990, & UL1GM118991. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. UAF is an affirmative action / equal employment opportunity employer and educational institution: www.alaska.edu/nondiscrimination.

Research reported in this publication was supported by the National Institute Of General Medical Sciences of the National Institutes of Health under Award Numbers UL1GM118991, TL4GM118992, or RL5GM118990. The content is solely the responsibility of the authors and does not necessarily represent
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