

Project Title: Assessing Kuskokwim salmon with environmental DNA

Investigator(s): Erik Schoen, Principal Investigator, Research Assistant Professor
University of Alaska Fairbanks, International Arctic Research Center

J. Andrés López, Co-Principal Investigator, Associate Professor
University of Alaska Fairbanks, Museum of the North & College of Fisheries and Ocean Sciences

Kevin Whitworth, Co-Principal Investigator, Fisheries Biologist
Kuskokwim River Inter-Tribal Fish Commission

Sean Larson, Co-Principal Investigator, Kuskokwim Area Research Biologist
Alaska Department of Fish and Game, Division of Commercial Fisheries

Project Period: January 1, 2023 – December 31, 2025

Study Location: Kwethluk, George, and Takotna river weirs within the Kuskokwim River Watershed

Abstract: Declining salmon runs have caused severe hardship in subsistence communities within the Arctic-Yukon-Kuskokwim (AYK) region. Monitoring salmon abundance in spawning tributaries is essential to managing sustainable fisheries and providing harvest opportunities while avoiding overfishing less productive populations. The abundance of adult salmon returning to six Kuskokwim River tributaries is currently monitored annually with weirs, and additional spawning areas are indexed with aerial surveys. Less than half of the total Chinook salmon escapement in the Kuskokwim River basin is currently monitored, and not all projects are successfully operated every year, due in part to cost and logistical difficulties. Here, we propose to develop and validate a complementary approach to salmon assessment using the amount of DNA shed by salmon into the water as an indicator of abundance. Our objectives are (1) to develop and validate an approach for assessing salmon escapement using environmental DNA (eDNA) and compare its accuracy among three contrasting tributaries, and (2) to develop practical recommendations for eDNA-based monitoring of salmon abundance, based on tradeoffs between cost and accuracy. Field crews will filter water samples within spawning tributaries at three weir projects during 2023 and 2024. We will analyze these samples in the laboratory to measure species-specific DNA concentrations using quantitative polymerase chain reaction. We will fit statistical models to predict daily salmon passage using eDNA concentrations and environmental covariates. Finally, we will develop practical recommendations for cost-effective eDNA sampling using sensitivity analysis and simulation. The long-term vision of this project is to build local capacity to support cost-effective monitoring of fish populations throughout the AYK region by communities and management agencies. Developing a complementary tool and building capacity in community-based and agency-led monitoring programs are important steps towards expanding monitoring, conserving salmon populations, and sustaining subsistence fisheries in the face of a changing environment.