

- Project Title:** Biomarkers of mortality risks in Yukon Chinook salmon
- Investigator(s):** Vanessa R. von Biela, U.S. Geological Survey Alaska Science Center  
Lizabeth Bowen, U.S. Geological Survey Western Ecological Research Center  
Amy M. Regish, U.S. Geological Survey, Eastern Ecological Science Center  
Randy J. Brown, U.S. Fish and Wildlife Service  
Jayde A. Ferguson, Alaska Department of Fish and Game, Division of Commercial Fisheries  
Stephen D. McCormick, U.S. Geological Survey, Eastern Ecological Science Center  
Stan Zuray, Yukon River Subsistence Fisher and independent researcher  
Michael P. Carey, U.S. Geological Survey Alaska Science Center  
Zachary Liller, Alaska Department of Fish and Game, Division of Commercial Fisheries  
Christian E. Zimmerman, U.S. Geological Survey Alaska Science Center
- Project Period:** January 1, 2023 to December 31, 2025
- Study Location:** Yukon River watershed
- Abstract:** Premature mortality of spawning adult Pacific salmon (*Oncorhynchus* species) can strongly influence population dynamics and thwart escapement-based management if individuals entering the river frequently die prior to spawning. Heat stress and *Ichthyophonus* disease have been identified as probable drivers of premature mortality in Yukon River Chinook salmon and likely contributors to low abundance. We will leverage a multiagency study focused on *Ichthyophonus* using lethally collected heart tissue beginning in summer 2022 as a rare opportunity to investigate *Ichthyophonus* and heat stress jointly in the same individuals. This proposal seeks funds to (1) estimate heat stress prevalence using previously validated biomarkers (HSP70 protein and gene transcription) to provide a more comprehensive premature mortality risk index that combines heat stress and *Ichthyophonus* and (2) investigate feasibility of using skeletal muscle tissue gene transcripts (mRNA of select genes) to differentiate individuals with clinical *Ichthyophonus* disease from those without *Ichthyophonus* or with mild, subclinical infections unlikely to compromise survival. We previously validated the use of non-lethal muscle biopsies to assess heat stress and hypothesize that mRNA profiles of salmon genes may also correlate to clinical *Ichthyophonus* disease because the disease is associated with cardiac damage and reduced swimming stamina that likely affect skeletal muscle. If biomarkers of clinical *Ichthyophonus* disease exist in muscle tissue, then a single non-lethal muscle biopsy punch could be used to index premature mortality risk in future years. This proposal represents an important step toward integrating drivers of freshwater mortality in a multiple stressors framework.