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821 N Street, Suite 103, Anchorage, AK 99501 / PHONE (907) 279-6519 / FAX (907) 258-6688 / [www.aykssi.org](http://www.aykssi.org)

## PROJECT ABSTRACT

### Examining heat stress during the freshwater migration of adult Pacific salmon

Vanessa R. von Biela<sup>1\*</sup>, Michael P. Carey<sup>1</sup>, Stephen D. McCormick<sup>2,3</sup>, Lizabeth Bowen<sup>4</sup>, Amy Regish<sup>2</sup>, Shannon Waters<sup>4</sup>, Randy J. Brown<sup>5</sup>, Sean Larson<sup>6</sup>, Stan Zuray<sup>7</sup>, Kevin Keith<sup>8</sup>, Merlyn Schelske<sup>9</sup>, and Christian E. Zimmerman<sup>1</sup>

<sup>1</sup>U.S. Geological Survey, Alaska Science Center, Anchorage, Alaska

<sup>2</sup>U.S. Geological Survey, Leetown Science Center, Conte Anadromous Fish Research Laboratory, Turner Falls, Massachusetts

<sup>3</sup>Department of Biology, University of Massachusetts, Amherst, Massachusetts

<sup>4</sup>U.S. Geological Survey, Western Ecological Research Center, University of California, Davis, California

<sup>5</sup>U.S. Fish and Wildlife Service, Fairbanks, Alaska

<sup>6</sup>Alaska Department of Fish and Game, Anchorage, Alaska

<sup>7</sup>Rapids Research

<sup>8</sup>Norton Sound Fisheries Research and Development

<sup>9</sup>Bureau of Land Management, Anchorage Field Office

Marine conditions are a primary driver of interannual and decadal variation in the returns of Pacific salmon (*Oncorhynchus* spp.) to spawning grounds, but differences in freshwater temperatures during spawning migrations can also result in variable mortality (essentially 0% to 100%) with population-level consequences. Freshwater temperatures across Alaska now routinely exceed thresholds associated with heat stress and mortality (> 18 °C) in migrating Pacific salmon. Indeed, mortality among migrating adult Pacific salmon was observed in rivers across western Alaska during the record-breaking warmth of 2019. We examined the prevalence of thermal stress and potential for freshwater mortality in two wild salmon populations, Pilgrim River sockeye salmon (*O. nerka*) near Nome (2014-2016) and Yukon River Chinook salmon (*O. tshawytscha*) across the watershed (2016-2017). Heat stress was identified using heat shock protein 70 (HSP70) from non-lethal sampling of muscle tissue following experimental validation for each species. Migrating Pilgrim River sockeye salmon generally

experienced cool temperatures <18 °C and a heat stress response was only indicated in just 5% of individuals (n = 66). Across the larger Yukon River watershed, river temperatures and heat stress prevalence were higher with variability among locations and years. Overall, heat stress was indicated in 39% (n = 477) of Chinook salmon sampled based on HSP70. Moreover, a gene transcription panel of mRNA suggested a more moderate level of heat stress in an additional 26% of individuals. Together, HSP70 and the gene transcription panel indicated heat stress in 65% of migrating Yukon River Chinook salmon sampled. Heat stress was generally more prevalent in locations and years with warmer water temperatures (e.g., 2016 East Fork Andreafsky River, 2017 Gisasa River, and both years at Rampart Rapids Fish Wheel). Identifying the areas where heat stress is most prevalent in migrating adult Pacific salmon provides actionable science to decision makers.

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