SARA permit final report – Madison Earhart

I collaborated with the Nechako White Sturgeon Recovery Initiative in Vanderhoof, BC to assess thermal tolerance, hypoxia tolerance, and heatwave resilience across multiple life stages of white sturgeon. Nechako white sturgeon embryos and larvae were reared at the University of British Columbia from the first week of June until August when the final experiments were completed. Throughout the summer, all fish were utilized for two different experiments. The first tested the effects of rearing temperature on embryos and yolk-sac larvae at relevant Nechako river temperatures (14, 18, and 21°C). Many different performance metrics and survival were measured throughout the experiment to highlight different thermal thresholds for white sturgeon embryos and larvae. Results indicate 21°C reduced survival when compared to the other temperatures, and had sub-lethal thresholds, or reduced performance, in various traits like metabolism, yolk-sac usage, and growth. However, thermal tolerance was not affected and increased with each acclimation temperature, however thermal plasticity decreased at 21°C highlighting another sub-lethal limit of these larval fish. The implications from this study suggest river temperatures should be held at 20°C or below, as currently mandated, to ensure survival and negate negative phenotypes caused by warm temperatures. This paper has been published in Conservation Physiology:
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The second experiment with Nechako river white sturgeon investigated the effects of the heatwaves experienced by the province in 2021. We subjected juvenile white sturgeon to the temperature profile of the heatwaves by simulating the Nechako river temperatures in the lab. We assessed the tolerance of juvenile white sturgeon from this endangered population to heatwave exposure and how heatwave exposure affects tolerance to additional acute stressors. We measured whole-animal thermal and hypoxic performance and underlying epigenetic and transcriptional mechanisms. Sturgeon exposed to a simulated heatwave had increased thermal tolerance and complete compensation of hypoxia tolerance. This was associated with an increase in mRNA levels involved in thermal and hypoxic stress (*hsp90a, hsp90b, hspP70* and *hif1α*) following these stressors. Global DNA methylation was sensitive to heatwave exposure and rapidly responded to acute thermal and hypoxia stress over the course of an hour. These data demonstrate that juvenile white sturgeon have tremendous resilience to heatwaves, exhibiting improved cross-tolerance to additional acute stressors that is associated with rapid responses in both epigenetic and transcriptional mechanisms.This paper is currently under review and Scientific Reports.