

1 July 2021

Journal of Great Lakes Research

Dear Editor:

Please consider our manuscript entitled “Effects of warming winter embryo incubation temperatures on larval cisco (*Coregonus artedii*) survival, growth, and critical thermal maximum” for review as a full-length article.

We experimentally tested the effects warming winter incubation temperatures have on the survival, growth, and critical thermal limit of cisco larvae from lakes Superior and Ontario. Our key findings were that 1) cisco larvae survival and growth were negatively impacted from warming incubation temperatures and 2) larvae from Lake Superior had a greater magnitude of change from the coldest to warmest incubation temperatures than Lake Ontario cisco in all traits examined. Our results suggest that larval cisco survival from both populations could be greatly reduced from warming winter incubation conditions, and that early-life stage cisco from Lake Superior may possess a narrower ability to acclimate to and cope with increasing winter water temperatures from climate change than cisco from Lake Ontario.

Re-establishing native species, including cisco, in the Great Lakes is an active area of research. Key uncertainties associated with cisco restoration include understanding the role the environment plays in the development of phenotypes and the extent of plasticity within populations. Our results highlight the potential effects of climatic warming on cisco populations and the importance of integrating natural habitat preferences into hatchery propagation programs to ensure offspring are set up for success upon reintroduction. Currently, many coregonine hatchery facilities around the Great Lakes do not incubate embryos under natural lake thermal conditions (i.e., cold water temperatures,  $< 4.5^{\circ}\text{C}$ ). We expect this paper to be well-received based on extensive coregonine restoration and conservation efforts underway throughout North America and Eurasia.

All authors contributed to the study conception and funding acquisition. Material preparation, data collection, and data analysis were performed by Taylor Stewart (TS). The first draft of the manuscript was written by TS and all authors commented on subsequent versions of the manuscript. All authors read and approved the final manuscript.

This research has not been previously published and is not under consideration at any other journal. Our submission has been posted on a preprint server (bioRxiv.org) and we agree to update the preprint link with a link to our JGLR submission if it is accepted. Thank you for your time and consideration. Please do not hesitate to contact me with any further questions. We look forward to your response.

Sincerely,



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