Ph.D. Candidate

Emily Corey

Graduate Academic Unit

Biology

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February 1, 2022

1:30 p.m.

Virtual Defence

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Examining Board:
Dr. Tillmann Benfey (Biology)
Dr. Ben Speers-Roesch (Biological Sciences)
Dr. Joe Nocera (Forestry & Environmental Management)
Dr. Tommi Linnansaari (Biology) Supervisor
Dr. Rick Cunjak (Biology) Supervisor

External Examiner: Dr. Aimee H. Fullerton
Research Fishery Biologist
Northwest Fisheries Science Center

The Oral Examination will be chaired by:
Dr. Patricia Evans, Associate Dean of Graduate Studies

BIOGRAPHY

Universities attended (with dates & degrees obtained):

2013 – present Ph.D. candidate, University of New Brunswick
2010 B.Sc., Biology, University of New Brunswick

Selected Publications:

Corey, Emily, Tommi Linnansaari, and Richard A. Cunjak. High temperature events shape the broadscale spatial distribution of juvenile Atlantic salmon (*Salmo salar*) throughout summer months. Ecology (In Prep).

Corey, Emily, Tommi Linnansaari, Antóin M. O'Sullivan, R. Allen Curry, and Richard A. Cunjak. Quantifying the movement patters of wild juvenile Atlantic salmon (*Salmo salar*) throughout a thermally stressful summer period. Journal of Fish Biology. (In Prep).

O'Sullivan, Antóin M., **Emily Corey**, Richard A. Cunjak, Tommi Linnansaari, and R. Allen Curry. 2021. Salmonid thermal habitat contraction in a hydrogeologically complex setting. Ecosphere 12 e03797. DOI: 10.1002/ecs2.3797.

Corey, Emily, Tommi Linnansaari, Stephen J. Dugdale, Normand E. Bergeron, Jean-François Gendron, Michel Lapointe, and Richard A. Cunjak. 2020. Comparing the behavioural thermoregulation response to heat stress by Atlantic salmon parr (*Salmo salar*) in two rivers. Ecology of Freshwater Fish. 29 50-62. DOI: 10.1111/eff.12487.

Macnaughton, Camille J., David Deslauriers, Erinn L. Ipsen, **Emily Corey,** Eva C. Enders. 2019. Using meta-analysis to derive a respiration model for Atlantic salmon (*Salmo salar*) to assess bioenergetics requirements of juveniles in two Canadian rivers. Canadian Journal of Fisheries and Aquatic Sciences. 76: 2225-2234. DOI: 10.1139/cjfas-2018-0436.

Selected Presentations:

Corey, E., Linnansaari, T., O'Sullivan, A. M., Curry, R. A., and Cunjak, R. A. Fire in the (fishing) hole! Quantifying behavioural thermoregulation of juvenile Atlantic salmon (*Salmo salar*) in a warming river. Atlantic Salmon Ecosystem Forum, Québec City, Québec. March 2019.

Corey, E., Linnansaari, T., Bergeron, N.E., Gendron, J.-F., Lapointe, M., and Cunjak, R. A. (2018). Comparing the behavioural thermoregulation response to heat stress by Atlantic salmon parr (*Salmo salar*) in two rivers. Atlantic Salmon Joint Venture Workshop, Québec City, Québec. March 2018.

Corey, E., Donaher, N., LeBlanc, S., Linnansaari, T., Currie, S.A., and Cunjak, R.A. The effects of multi-day heat stress on wild juvenile Atlantic salmon (*Salmo salar*). Canadian Conference for Fisheries Research (CCFFR). Ottawa, Ontario. January 2015.

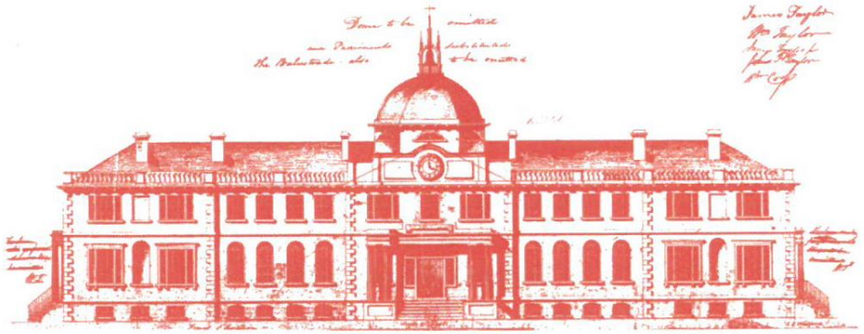
The biological significance of thermal refuges to juvenile Atlantic salmon (*Salmo salar*) in a changing climate

Abstract

The frequency of extreme thermal events is expected to increase under current climate change scenarios. These events may have drastic consequences for many river species, particularly in temperate climates. In recent decades, increasing water temperatures have had an effect on the phenology and life history of Atlantic salmon (*Salmo salar*) within the Miramichi River System, located in New Brunswick, Canada. Juveniles in this river spend 2-4 years in freshwater prior to smoltification and are susceptible to the impacts of increased water temperatures. Juvenile Atlantic salmon are territorial but will abandon territories when water temperatures become unfavourable. In this dissertation, 1+ and 2+ parr are studied over a series of summer periods to examine the *i)* movement patterns over the course of a high temperature event; *ii)* implications of aggregation events on broadscale relative abundance; *iii)* observed behavioural thermoregulation response in the Miramichi and compared to a second temperate, geographically distinct river; *iv)* physiological response of multi-day thermal stress over the course of a thermal event in a controlled setting. To understand how juvenile salmon respond to increasing water temperatures, several studies were conducted using a variety of experimental techniques in both the field and the laboratory.

When seeking refuge, juvenile salmon largely relocated to cool water sources within river reach. However, migrations of several kilometres were detected throughout a particularly warm thermal event (≤ 7.4 km; Tmax = 30.7˚C). In years where aggregations occurred, an increase in relative abundance was observed in reaches containing cool water refuges, with a corresponding decline in abundance in reaches where refuges were lacking. The temperature of the onset of behavioural thermoregulation varied between geographically distinct river systems (27.3 ˚C vs. 28.3 ˚C), indicative of a localized preconditioning response. Exposure to multi-day thermal stress resulted in a cumulative physiological response (HSP70 & ubiquitin) in juvenile salmon, irrelative of diel minimum temperature.

Cool water refuges are important thermal moderators for many ectothermic species, including salmonids. Understanding how species exploit thermal heterogeneity in the landscape will help to inform managers on best practices for protecting and conserving both key species and the critical resources on which they rely.



Home of the School of Graduate Studies, Sir Howard Douglas Hall was designed by J.E. Woolford in 1825 and is the oldest university building in Canada still in use.

The University of New Brunswick recognizes that the university sits on traditional Wolastoqey territory. The river that runs right by our university – the St. John River – is also known as Wolastoq, along which live the Wolastoqiyik -- the people of the beautiful and bountiful river.

UNIVERSITY OF NEW BRUNSWICK

SCHOOL OF GRADUATE STUDIES

ORAL EXAMINATION

Emily Corey

IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY