Alberta Conservation Association
2007/08 Project Summary Report

Project name: *Winter Instream Flow Needs*

Project leader: Kevin Fitzsimmons

Primary ACA staff on this project: Kevin Fitzsimmons and Chad Judd

Partnerships:

Alberta Environment
Alberta Sustainable Resource Development
University of Lethbridge

Key findings

- Brook trout liver glycogen (energy) varied with fish size in the pre-winter (October to November) season.
- Brook trout liver glycogen did not vary significantly with fish size post-winter (April) and instead reached a baseline level of ~20 mg/g.
- Liver glycogen is likely too variable and insensitive for effective evaluation of winter instream flow needs (IFN) for trout.

Introduction

In Alberta, rapid growth and development has placed great demands on the province's water resources. Combined with decreased stream flows from receding glaciers and droughts, this increased demand may limit water supplies in many parts of the province. The challenge of balancing increased water demand with uncertain or decreasing supply is to define how much water is needed in a regulated stream to maintain or restore communities and processes that would normally occur in an unregulated stream (Annear et al. 2004). Such instream flow needs (IFN) have commonly been determined by habitat based approaches that couple stream hydraulics with fish species habitat requirements. The end result is the determination of minimum stream flows for a given fish species. Determining winter IFN is problematic, as quantifying what habitat is available and what habitat is being used by fish can be very difficult under winter ice conditions. Habitat switching triggered by deviations from natural flow regimes can deplete fish glycogen (energy) reserves and increase mortality of individuals. In the current study, we assessed the efficacy of a physiologicalbased approach in determining winter IFN using fish liver glycogen levels. Our approach was to compare pre- and post-winter liver glycogen levels in brook trout (*Salvelinus fontinalis*) in both regulated and unregulated rivers.

Methods

We obtained brook trout for this study from 11 sites in the Bow River drainage upstream of Calgary. Five sites were located on the Kananaskis River, a regulated stream with highly variable discharge, one site was located on the outflow of Spray Lakes Reservoir where stream flows have been stabilized year-round and the remaining five sites were on streams with natural (unregulated) flows. We collected pre-winter samples in October and November and post-winter samples in April using a backpack electrofisher. The first 30 brook trout captured at a study site were euthanized by concussion, immediately flash frozen and sent for liver glycogen analysis in Dr. Alice Hontella's laboratory at the University of Lethbridge. Glycogen analyses were conducted according to methods described in Bleau et al. (1996) and Levesque et al. (2002).

Results

Our data indicates that brook trout liver glycogen in the pre-winter sampling period varies with fish size, with smaller fish having higher glycogen than larger fish (Figure 1). In contrast liver glycogen did not vary significantly with fish size during the post-winter sampling period. In general, liver glycogen was lower during the post-winter sampling than in the pre-winter period and liver glycogen levels varied more among smaller fish than in larger fish (Figure 1). We observed no clear effect of flow regulation on post-winter brook trout liver glycogen levels as liver glycogen appeared to reach a lower baseline (~20 mg/g) at almost all sites. Our evaluation was complicated by the variability in liver glycogen and our relatively low catch rates at regulated sites in the spring.

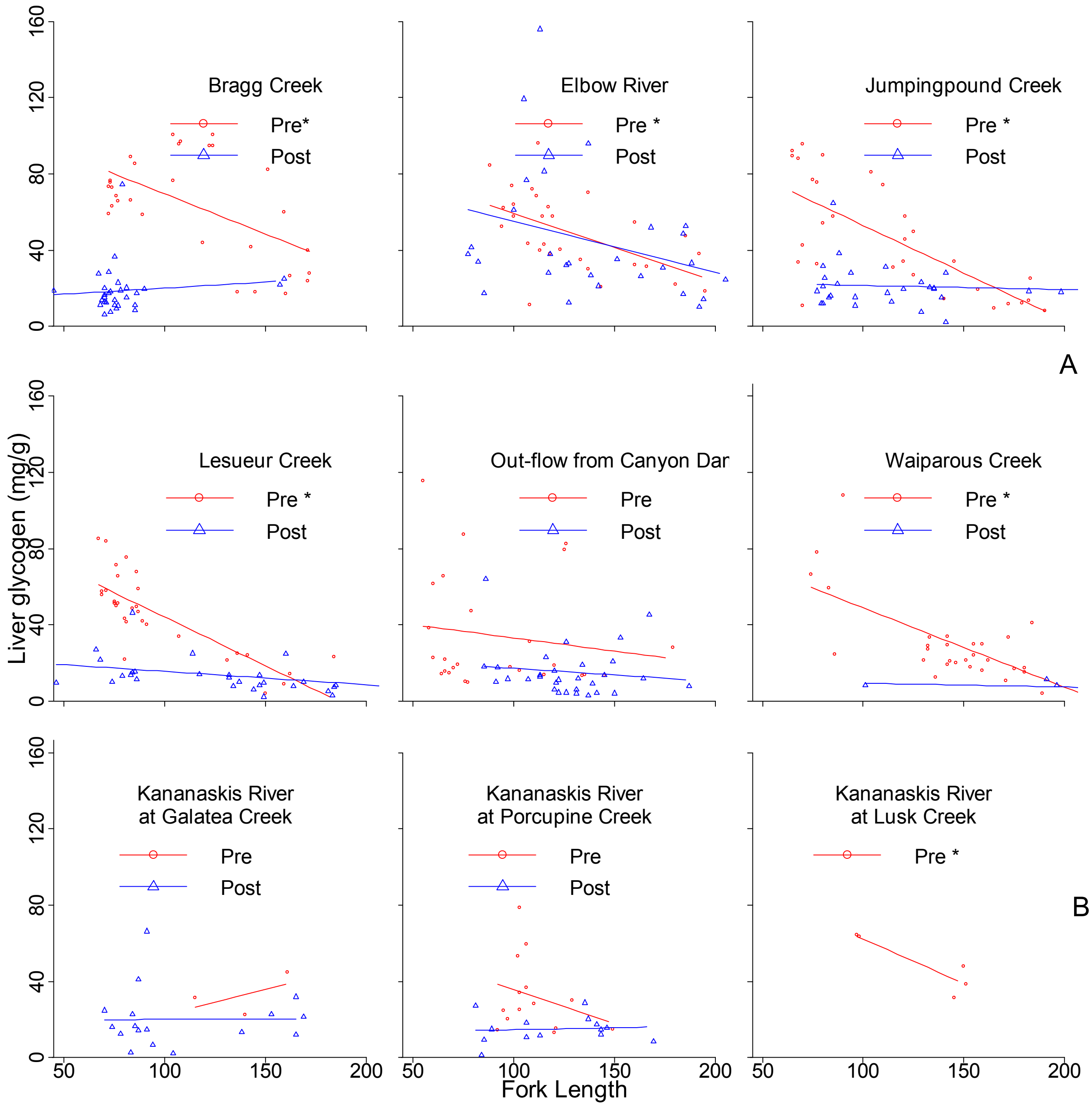

Figure 1. Relationship between pre- and post-winter liver glycogen and fish length at natural/ stable flow (A) and regulated/variable flow (B) sites.

Conclusion

Based on the results of this project, we conclude liver glycogen is likely too variable and insensitive for effective evaluation of winter IFN. The relatively low brook trout catch rates we observed in spring at our regulated flow sites along the Kananaskis River suggest evaluation of sub-lethal effects may not be necessary in some systems as few fish successfully overwinter in these streams.

Communications

- Results have been summarized in progress and final reports and distributed to partners.
- A presentation summarizing preliminary results was given to project partners.

Literature cited

Annear, T., I, Chisholm, and H. Beecher. 2004. Instream flows for riverine resource stewardship (revised edition). Cheyenne, Wyoming, Instream Flow Council.

Bleau, H., C. Daniel, G. Chevalier, H. van Tra, and A. Hontela. 1996. Effects of acute exposure to mercury chloride and methylmercury on plasma cortisol, T3, T4, glucose and liver glycogen in rainbow trout (*Oncorhynchus mykiss*). Aquatic Toxicology 34: 221-235.

Levesque, H.M., T.W. Moon, P.G.C. Campbell, and A. Hontela. 2002. Seasonal variation in carbohydrate and lipid metabolism of yellow perch (*Perca flavescens*) chronically exposed to metals in the field. Aquatic Toxicology 60: 257-267.

Water withdrawal for snow making at a local ski hill. (Photo: Kevin Fitzsimmon).

Local ski hill using water from Bow River to provide snow for what would otherwise be a snow-free slope. (Photo: Kevin Fitzsimmon).