# The Seasonality of Juvenile Arctic Char (*Salvelinus alpinus*) Energetics in the Canadian Arctic

**Larissa B. Scatamburlo*, Emily P. Williams, Shira Berkelhammer, Augustus Snyder, Matthew Gilbert**
**Institute of Arctic Biology and Department of Biology and Wildlife, University of Alaska Fairbanks**

## Background

- Arctic char (*Salvelinus alpinus*) are facultatively anadromous fish[1]
  - Anadromous adult Arctic Char move to sea during summer to feed but spawn and overwinter in freshwater where they commonly do not feed[2]
  - Conversely, juvenile (<3-6 YO) Arctic char don't access the ocean with high food availability but remain in less productive freshwater environments year-round

## Objectives

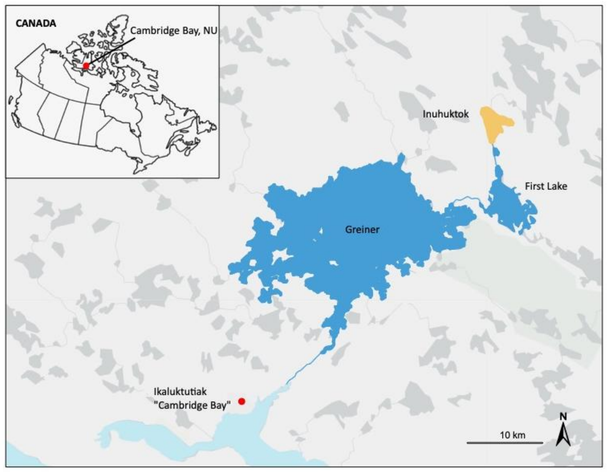
**Describe the seasonal energetics of juvenile Arctic char relative to strong seasonality observed in adults**

**Assess corresponding seasonal changes in organ sizes that relate to feeding rates and energy conservation**

## Methods

**Sampling and fieldwork:**

- Juvenile Arctic char sampled as part of an ongoing study on seasonal thermal energetics physiology in the Arctic.
- Study site: Inuhuktok, Cambridge Bay Area of Nunavut, Canada
- Winter 2024-2025, and summer 2025
- Measured body, ventricle, liver, stomach, pylorus, intestine, and whole gut mass and intestine length

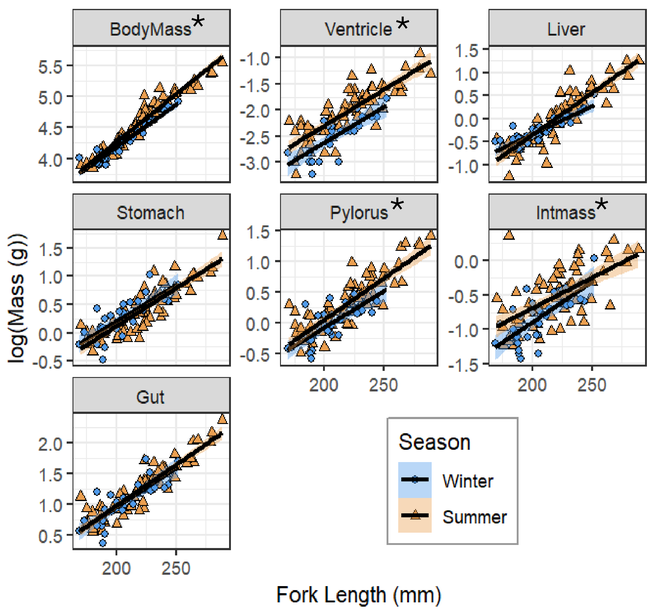



**Data Analysis:**

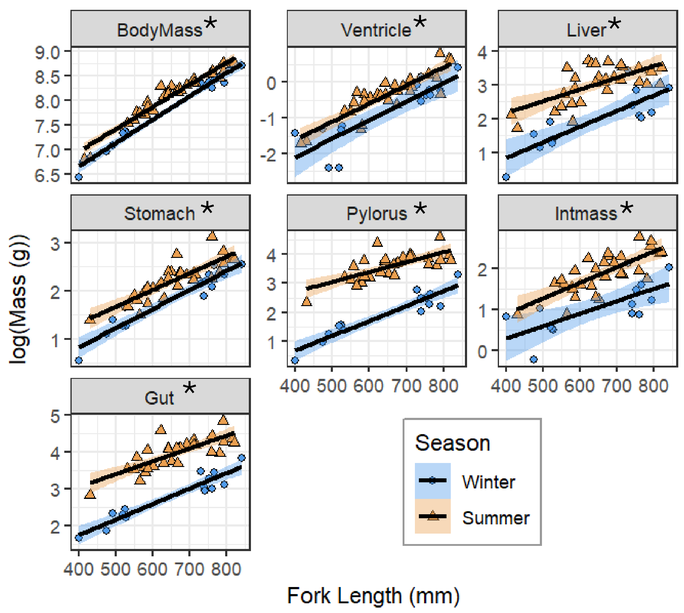
- Body and organ masses assessed as a function of fork length and season (winter vs. summer)
- Data was analyzed with either Linear or Generalized Linear Models (if assumptions not met)
- Models constructed with and without interaction between fork length and season
  - Lower AIC value indicated most appropriate model
- Model estimated marginal means normalized to winter for seasonal comparisons
- Adult data incorporated from a previous study for comparison
- Statical analysis and graphs made in R studio

## Results

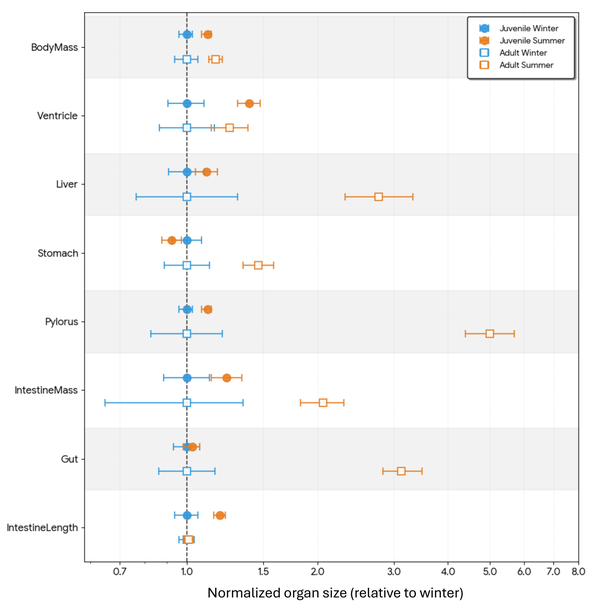
### Juvenile Arctic Char



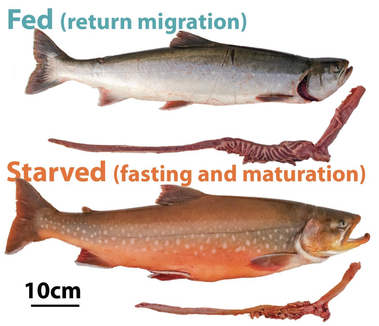

### Adult Arctic Char




### Seasonal comparison




1) Juvenile Arctic char body mass, ventricle (heart), pylorus, and intestine mass were larger in summer than winter at a common fork length, but liver, stomach, and gut mass did not differ between seasons
2) Adult Arctic char had larger organs in summer compared to winter at a common body length with the greatest differences found in digestive organs
3) Results indicate that juvenile Arctic char exhibit relatively minor seasonal differences in organ sizes while adult Arctic char expresses much larger seasonal fluctuations



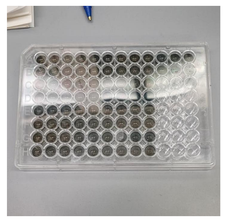

## Discussion

1) Adult Arctic char expressed clear reductions in gut and liver weights from summer to winter, corresponding with their well-researched exploitation of favorable marine feeding conditions in summer and limited feeding in winter
2) Juvenile Arctic char organ size did not vary to the same extent across seasons suggesting year-round feeding in freshwater as they are non-migratory
3) Combined these results indicate distinct winter energy management strategies for juvenile and adult Arctic char

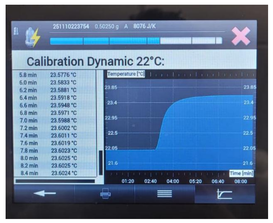
## Next Steps

- Quantify protein, fat, and energy content
- Analyze seasonal changes in metabolic demand and temperature use (Shira Berkelhammer)

**Protein Quantification Assay**



**Calorimetry Assesment**




References
1) Jobling, M., et al.. (1993). Feeding, growth and environmental requirements of Arctic charr: a review of aquaculture potential. *Aquaculture international*, *1*(1), 20-46. 1(1), 20–46.
2) Mulder, I. M., et al. (2018) Winter movement activity patterns of anadromous Arctic charr in two Labrador lakes. *Ecology of Freshwater Fish*, *27*(3), 785–797.
3) Gilbert, et al.. (2026). Metabolic plasticity facilitates a high-latitude life of feast and famine in Arctic char. *bioRxiv*, 2026-02.

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