Biogeography of Atlantic Salmon (*Salmo salar*) in the Cape Breton Highlands

Oscar Notman-Grobler

Supervised by: Dr. Robert J. Lennox

Background

Atlantic Salmon

- Anadromous salmonid; historically ubiquitous across the North Atlantic
- **Severe declines** in recent decades[1,2]
- Threats to salmon:
  - **climate change, overfishing, spawning habitat degradation, barriers to migration** (i.e. dams) **and genetic introgression from farmed fish** [3]
- High degree of homing; **geographically destinct populations;** local adaptation to their specific region[4]

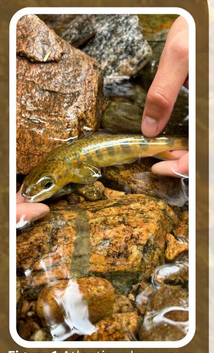

Figure 1 Atlantic salmon parr

Designatable Units (DUs)

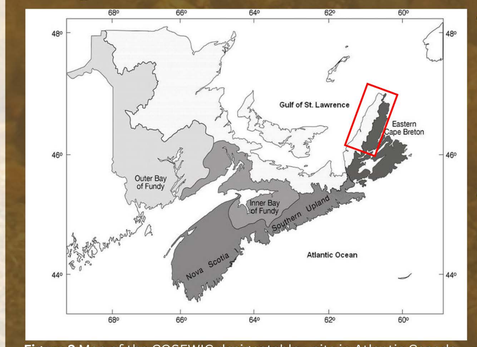

Figure 2 Map of the COSEWIC designatable units in Atlantic Canada. *Photo Credit:* Heather Bowlby

- 2010: COSEWIC divides salmon populations into 16 DUs to recognize and preserve the diversity within wild subpopulations[5]
- Salmon managment differs between DUs depending on the local requirments of the population[5]

Photo Credit: ASF

The Cape Breton Highlands DUs:
Gulf of St. Lawrence Unit:
Conservation Status: Special Concern
Eastern Cape Breton Unit:
Conservation Status: Endangered[5]

The Cape Breton Highlands

- An **understudied** region in Atlantic Canada; data limited to to inacessability
- The exact number of rivers inhabited by salmon in the Highlands is unknown; existing distribution estimates are outdated[6,7]
- **Effective conservation** requires **accurate data** on the distribution and abundance of wild salmon populations

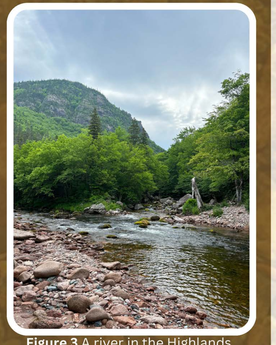

Figure 3 A river in the Highlands

Study Objectives

1. **Update the current distribution data on Atlantic salmon in the Cape Breton Highlands**
2. **Compare the distribution and abundance of salmon between Designatable Units**
3. **Compare the species community assembleges between rivers in both Designatable Units**

Results

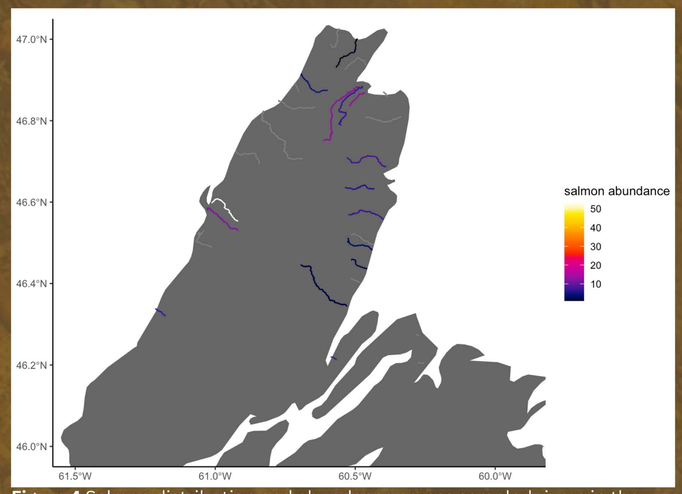

Figure 4 Salmon distribution and abundance across sampled rivers in the Cape Breton Highlands. Grey rivers indicate that salmon were absent

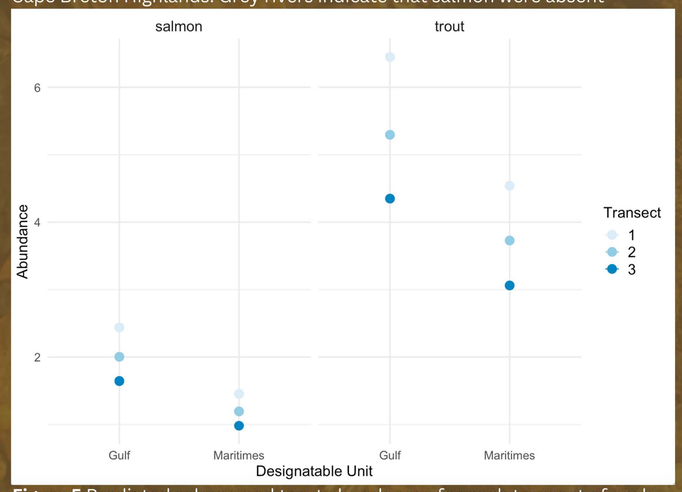

Figure 5 Predicted salmon and trout abundances for each transect of each DU based on a GAM (Poisson distribution), p-value = 0.204

Figure 6 Community composition of Highlands rivers between DUs based on NMDS analysis. Elipses represent each DU at a 95% confidence interval

Methods

Site selection

- 24 rivers selected
- **Criteria:** river size (width and depth), gradient, accessibility to surveyors, even distribution across the area of interest.
- Rivers with limited data from the DFO, Parks Canada, or other published reports were prioritized

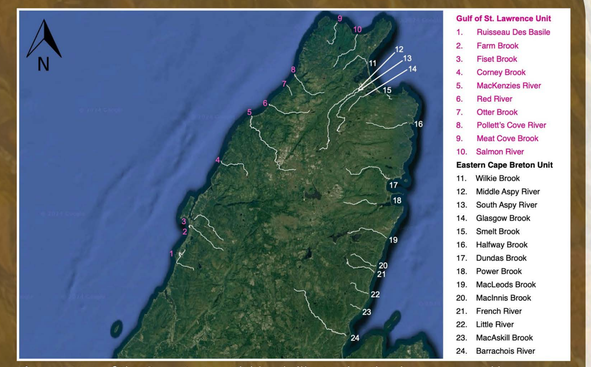

Figure 7 Map of the Cape Breton Highlands illustrating the rivers surveyed in June 2024 (white). The legend indicates the designatable unit in which each river belongs.

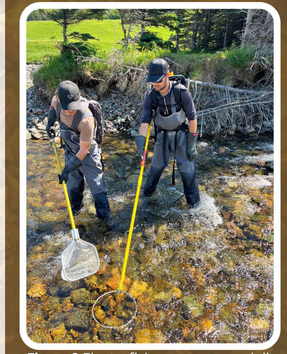

Figure 8 Electrofisher operator and dip netter surveying Polletts Cove River

Field Methods

- 3 transects of ~300 meters were surveyed with electrofisher (**Figure 8**); environmental metrics recorded
- Captured specimens were identified by species and fork length
- Genetic samples (upper caudal fin clippings) were collected from Atlantic salmon

Data Analysis

- NMDS and perMANOVA: compared species assemblages between DUs
- General additive model (GAM; poisson distribution) with ANOVA test: compared salmon abundance between DUs
- General linear model (GLM; Poisson distribution) tested environmental metrics with species abundance to determine predictors of salmon habitat suitability

Discussion

- Of the 24 rivers sampled, **13 systems** supported Atlantic salmon parr
- Population abundance and distribution are **similar** between DUs
- Community assemblages between DUs **similar**, despite diffrences in habitat

Significance

- Effective allocation of conservation resources requires accurate, up-to-date knowledge of the habitats occupied by Atlantic salmon
- In the event of the collapse of salmon stocks in large rivers, smaller systems may be the final strongholds of genetically diverse annaully spawning fish
- This study emphasizes the consideration of small, isolated populations in the broader context of habitat restoration and conservation research

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References