

Taking Advantage of the Cold: Could Winter Be Beneficial for Freshwater Fish?

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Introduction

- Freshwater fish are most commonly understood to be active in the spring, summer, and fall, and dormant in the winter¹
- Winter is associated with negative growth and high mortality¹
- This study highlights the conditions and species for which winter has more positive impacts.



- Highlight how winter can be beneficial for different fish
- Provide direction for future studies
- Predict how climate change will impact overwintering fish

Methods

Focal Categories: Community, Diet, Foraging, Ice Cover, Metabolism, Size, Temperature

Focal Species: Arctic Charr, Atlantic Salmon, Bluegill, Brook Trout, Brown Trout, Coho Salmon, Largemouth Bass, Rainbow Trout

- Looked up key terms such as “Fish AND winter AND mortality” or “Fish AND winter AND size” in google scholar
- Collected papers and sorted into categories and species using abstract
- Determined yes/no/mixed through abstract

Mass vs month

- Made a list of measurements from the main species and organized based on the type of measurement they used
- Looked for studies that reported wet weight (g) on a monthly basis

References

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Definitions

- **Positive:** Maintained or gained mass or energy, high survival
- **Negative:** Lost mass or energy, low survival, increased aggression or competition
- **Mixed:** When a study has both positive and negative effects

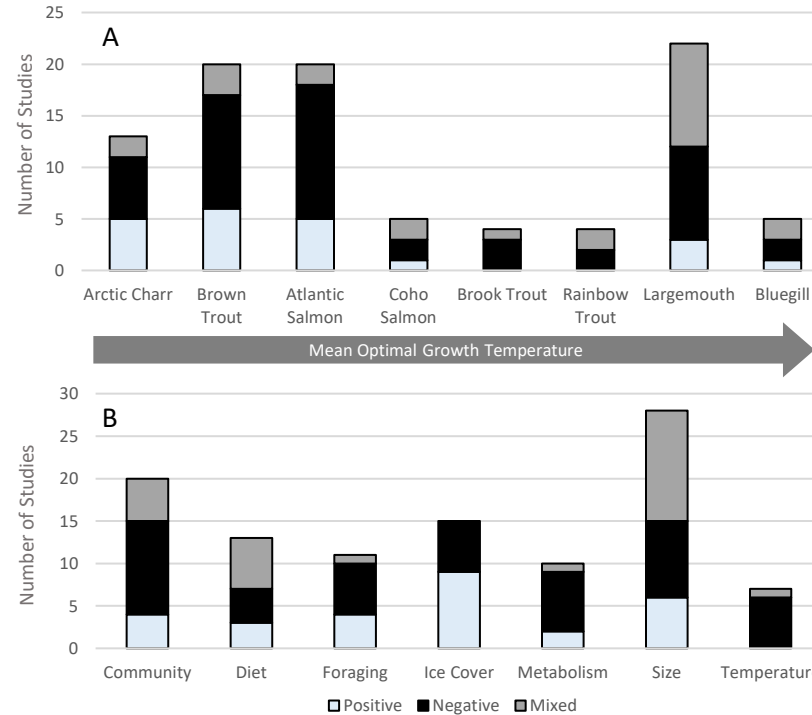


Fig 1. (A) Number of studies with positive, negative, or mixed overwinter results by species organized by mean optimal growth temperature. (B) Number of studies with positive, negative, or mixed results by topic.

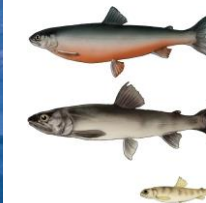
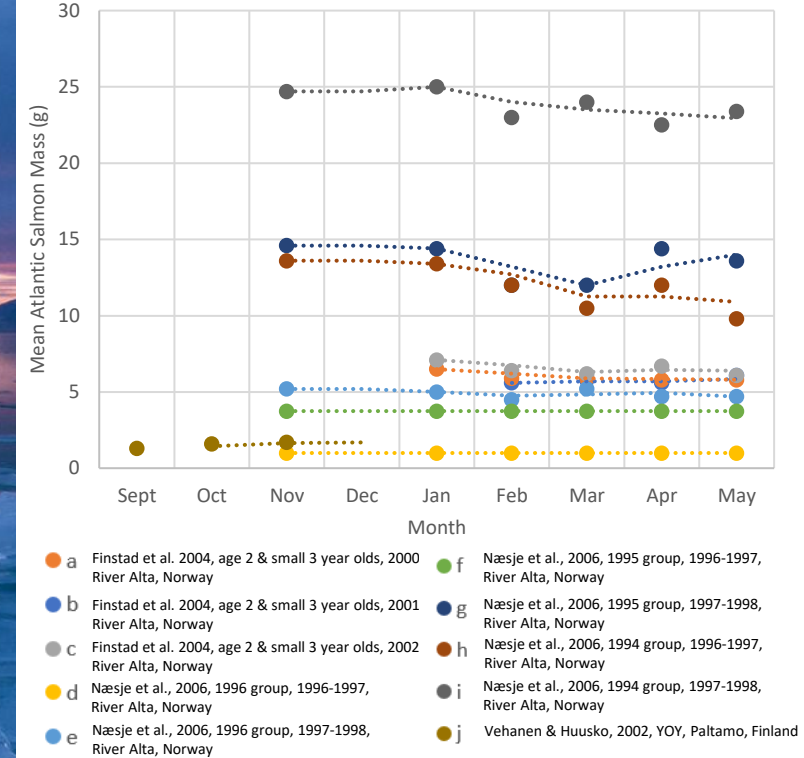
Ice Cover

- Higher levels of daytime foraging under ice cover²
- Lower stress levels, lower energy loss^{3,4}
- Higher survival, not size-dependent⁵
- Positive growth rate^{4,6}



Peter Leopold. Arctic Cod. Institute of Marine Research.

Fig 2. Mean overwinter mass of Atlantic salmon per month



Sigrid Skoglund. Arctic charr morphs. Wiley Open Access.

Size

- Large fish often had higher survival than small
- Mass seemed to decrease more in large fish than small
- Mass might not be a good indicator of overwinter success⁷

Conclusion

- Winter is not inherently bad for freshwater fish, there are many positive results of winter
- Climate change is causing warmer, shorter winters with less ice cover which will have negative consequences for fish³
- Future studies could focus more on the relationship between overwinter survival and ice cover