

Effect of Increasing Temperature on Parasite Diversity in Puget Sound

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Introduction

- Parasites are very diverse and ecologically important:
 - indicator of biodiversity + trophic interactions
- Climate change can alter parasites ability to survive, transmit, and develop
- Little is known about how warming is affecting parasite diversity
- Research question: How is parasite diversity changing as temperature increases?
- Hypothesis: parasite diversity declines with warming → changing host immunity + parasite temperature sensitivity



Methods

Data Collection

- 8 Puget Sound fish species: hake, herring, perch, pollock, ratfish, rockfish, smelt, and sole
- Fish specimens from fish collection at Burke Museum
- Data extracted: year, species, length, location, surface temperature, and parasite count by taxon
- Lab procedure: parasitological dissection

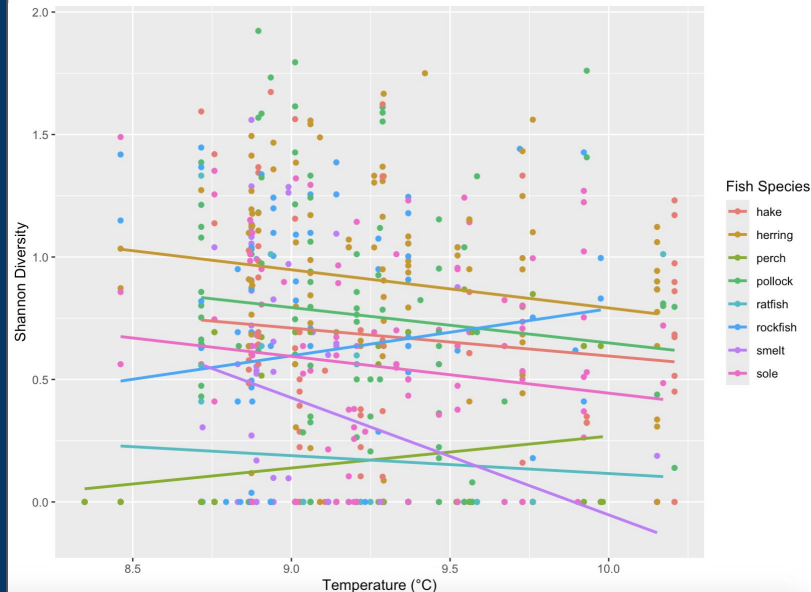
Data Analysis

- Tool: R
- Calculating diversity
 - Used Shannon Diversity index (richness + evenness)
- Linear regression: Shannon Diversity ~ temp + species + length
 - Covariates (species + length) to control for host differences

Results

Main Finding: In most fish species (all but rockfish and perch), increasing temperatures resulted in significantly negative trends in their parasite diversity.

- Effect of temperature: estimate = -0.11, $p = 0.001$
 - Greatest decrease in parasite diversity seen in Smelt
- Adjusted $R^2 = 0.292$ → The model explains 29% of variation in diversity
- Fish species differ greatly in baseline diversity: ↑ herring and ↓ ratfish and perch
- Length positively associated with diversity: estimate = 0.0018, $p < 0.001$



$$\text{Model: Shannon Diversity}_i = \beta_0 + \beta_1(\text{temp}_i) + \beta_2(\text{fish species}_i) + \beta_3(\text{length}_i)$$

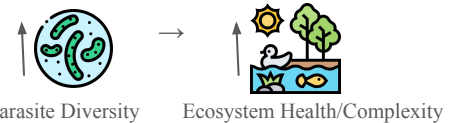
Discussion

Possible Mechanisms

1. Temperature-sensitive parasite life stages
2. Host immune changes (from innate to specific immunity)
 - a. Alters parasite survival on host
3. Change in host behavior (Feeding patterns + habitat range)
 - a. Decreased exposure to parasites

Importance

- Some parasites thrive under warmer conditions, others decline → species-specific response
- Loss of parasite diversity → signal of disrupt in ecosystem



Limitations

- Possible sampling bias and unmeasured environmental covariates

Future Research

- Examine change in specific parasites and additional environmental stressors

Conclusion

Main Takeaway

- Warming temperatures result in declining parasite diversity in Puget Sound fish

Importance

- Understanding parasite-host interactions is essential for detecting environmental changes as marine environments continue to warm