Out of the Frying Pan, Into the Fire:

Examining Adaptive Variation Linked to Thermal Stress in Brook Trout

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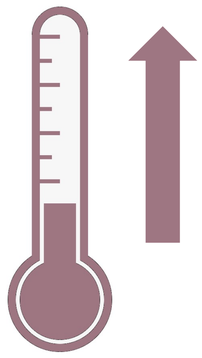
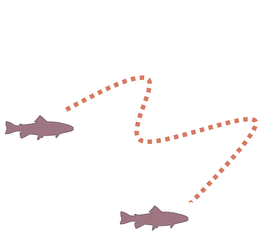
Background

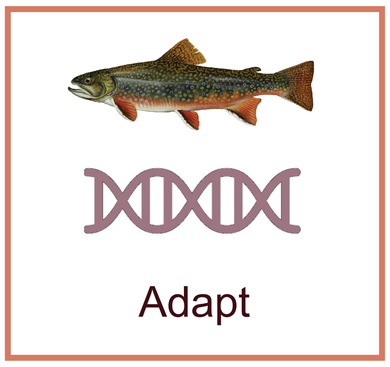
Climate change poses a serious threat to coldwater fishes due to habitat alteration and unstable thermal regimes



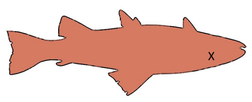
>> Exposure to Stress <<



Move

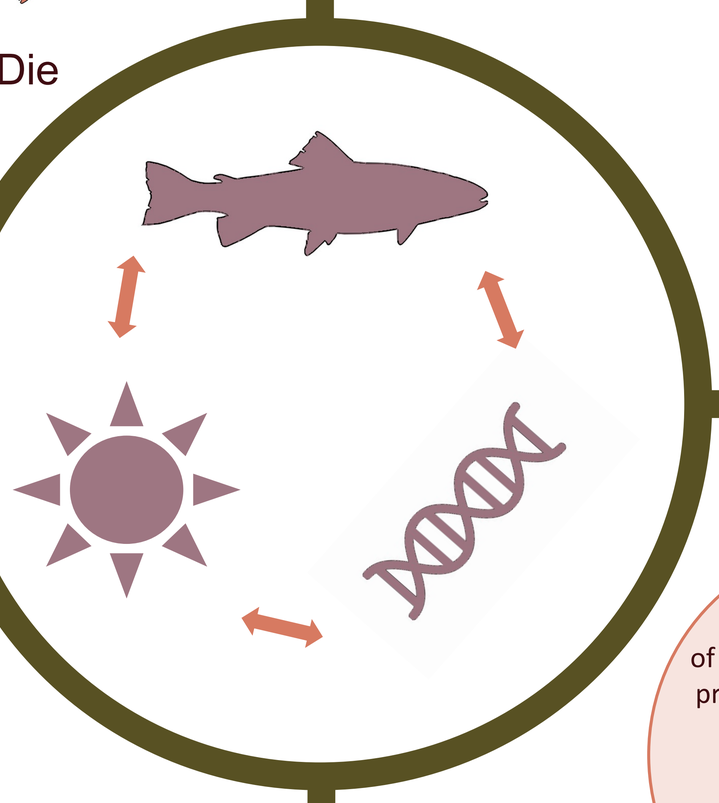


Adapt



Die

Objective:
Examine the underlying genetic variation that enables populations of native brook trout to adapt to thermal stress under climate change



Methods

Single Nucleotide Polymorphisms (SNPs)
DNA sequence variations at a single nucleotide position

Goal 1 - Design and test a custom genetic panel for regions of the brook trout genome significantly associated with thermal tolerance

Genetic panels enable researchers to selectively target regions of interest across the entire genome

Total SNPs 6375

Outlier SNPs: 5221

Thermal SNPs: 1154

Goal 2 – Examine range-wide patterns in adaptive capacity to identify candidate populations for conservation actions

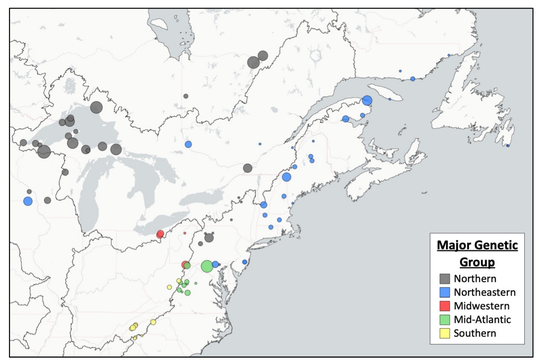


Figure 1. Map depicting locations from which individuals were sampled. Each point represents a single sampling location. Point size corresponds to the number of individuals sampled. Color shows major genetic lineage.

Preliminary Results

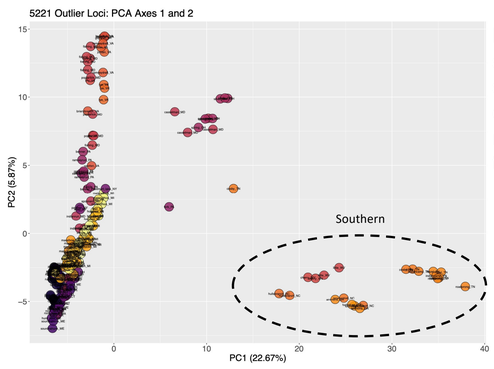


Figure 2. PCA of outlier SNPs shows genetic distinction of the southern lineage, as well as clustering of populations from major genetic groups across the native species range.

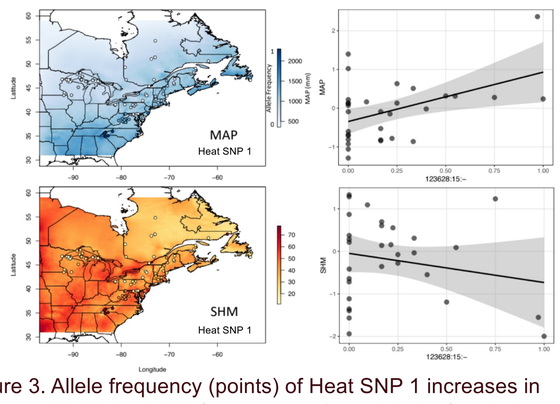


Figure 3. Allele frequency (points) of Heat SNP 1 increases in regions with higher MAP (mean annual precipitation) and decreases in regions with lower SHM (summer heat moisture index).

Figure 4. MDS analysis of thermal SNPs from individuals exposed to acute heat stress shows genetic distinction based on source population thermal regime (red = hot environments, blue = cool environments).

Implications

Assess any population of brook trout and provide a proxy for thermal tolerance

Identify candidate populations for conservation and management actions

Determine which populations may be most at risk of local extirpation

Funding Sources

revive&restore

experiment foundation

ECOLOGY EVOLUTION BEHAVIOR MICHIGAN STATE UNIVERSITY

MICHIGAN STATE UNIVERSITY

TROUT UNLIMITED KALAMAZOO VALLEY CHAPTER

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