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Stuck in Hot Water: Environmental Conditions Affecting Mysid Populations

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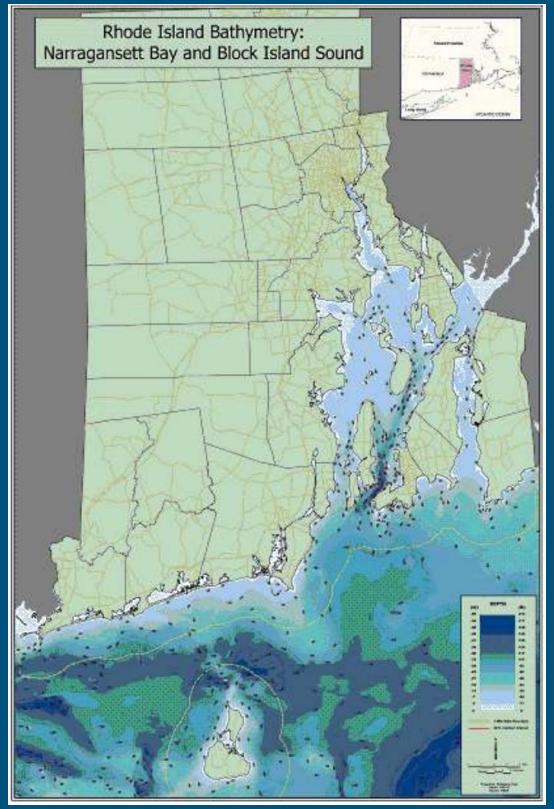
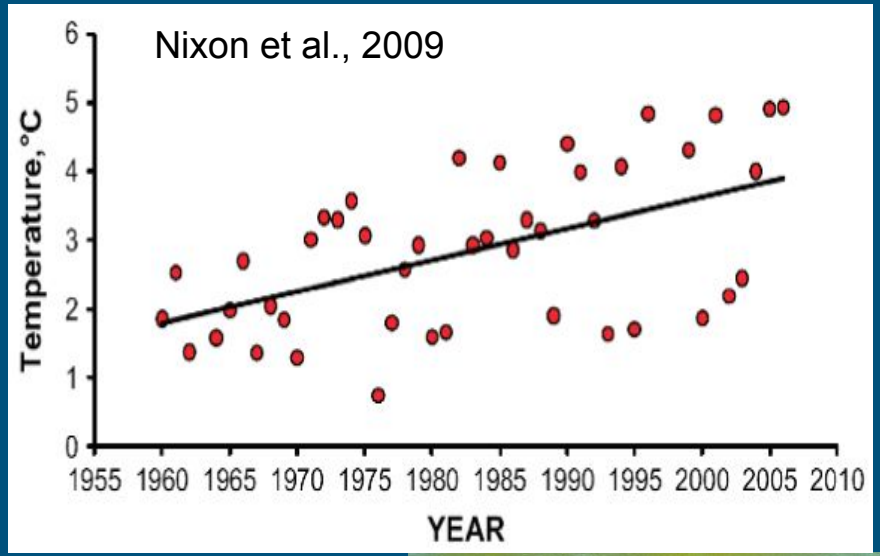
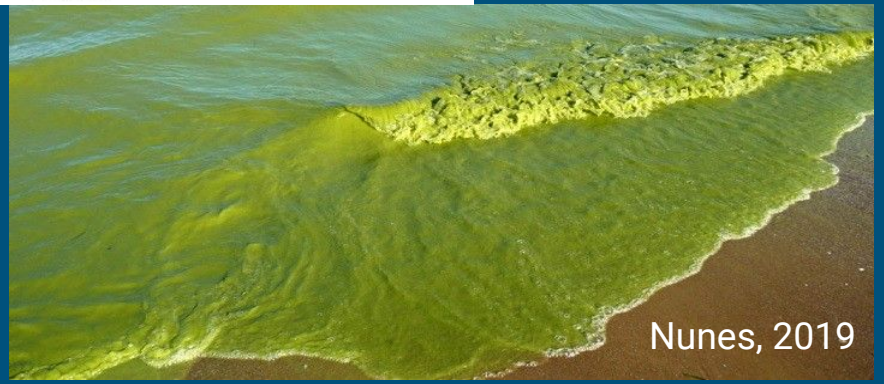
Background information

Narragansett Bay



Rhode Island Wildlife Action Plan, 2015





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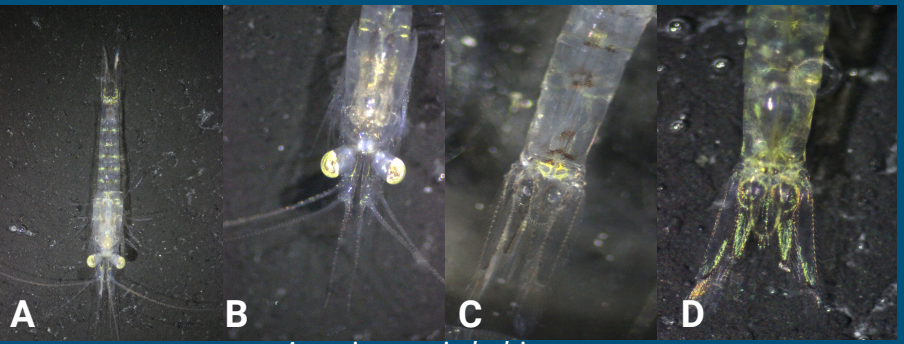


Americamysis bahia

Blue fish
Pomatomus saltatrix

Black Sea Bass
Centropristis striata

Opossum shrimp
Americamysis bahia

Goals:

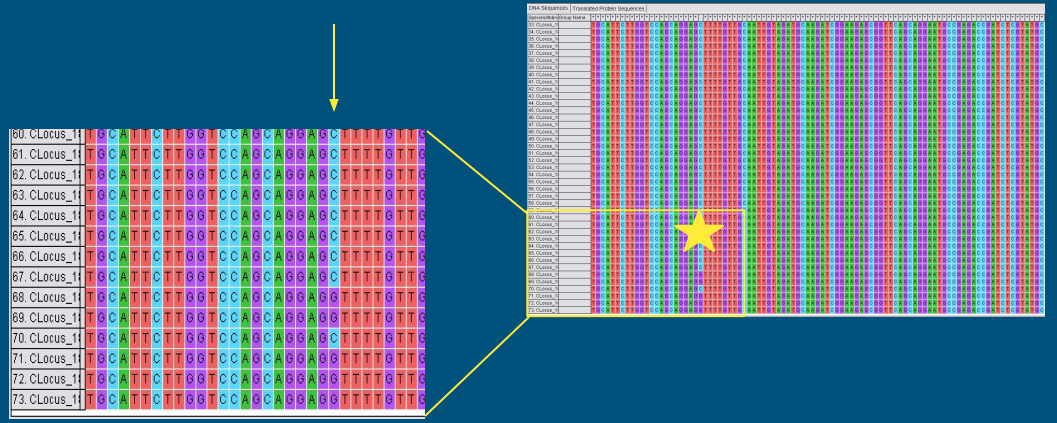
1) Determine the minimal genetic variability for these mysids to survive in their environments by studying the mysid genome.

2) Discover how much stress (metabolic and physiological changes) is caused by changing environmental variables. (Temperature, Salinity, pH values, and DO values)

Field Methods

- Collecting samples from RI coasts
  - Extending our collection sites to MA and CT
- Determining baseline conditions
- Establishing stable conditions in lab culture
  - Feeding mysids *Artemia* eggs

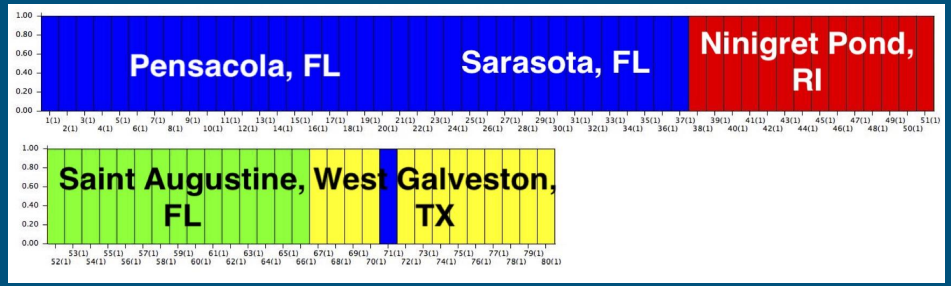
Molecular Methods

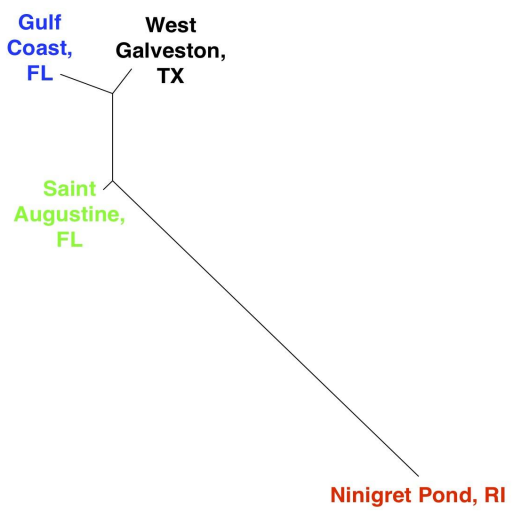


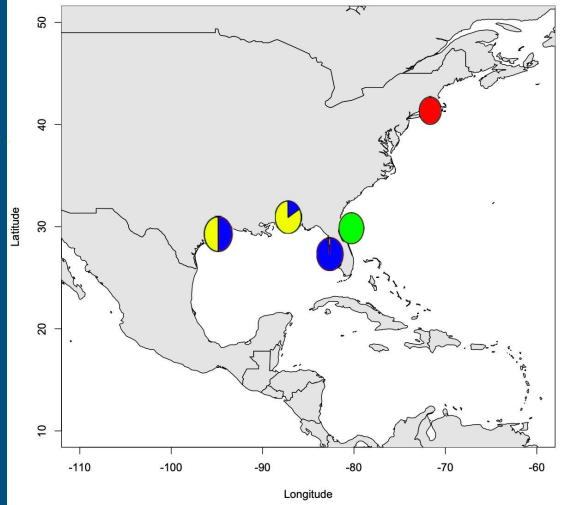
- Database with two million sequences to find SNP’s
- Screen them with MEGA to identify variable sites
- Finding new loci: D3 Fluidigm
- Fluidigm and Structure and R runs Analysis
  - 96 new loci
    - Screened to see which loci worked
    - Fluidigm geographic analysis
  - Combined with 96 old loci

Data Analysis

- Use R statistical and landscape and ecological associations packages - LEA (Frichot & François, 2015) and Structure software (Pritchard, 2009)
- Genetic Cluster algorithms for population analysis and neighbor joining trees for genetic distance
- Geographical analysis of population structure (François, 2016)







Environmental Methods

- Measure abiotic factors on a daily basis
  - Temperature, salinity, pH, DO
- Manipulate environmental variables
- Measure levels of macromolecules in mysids (proteins, lipids and sugars) in order to assess levels of bioenergetic stress

Conclusions

- Drastic water temperature changes in Rhode Island is already happening.
  - We need to take action as bacteria and toxic algae blooms are already affecting aquatic species and causing other negative effects.

- We initially believed that the two species of *Americamysis* were going to compete when their distributions overlapped in Rhode Island, however, information gathered by genetic markers and morphological characteristics indicates that they seem to be interbreeding. This can potentially result in adaptation to the changing environmental conditions.

- Temperature, salinity, pH, and dissolved oxygen are known to impact bioenergetics.
  - Quantification of macromolecules in mysids will allow us to determine how these environmental changes impact their homeostasis

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References

François, Olivier. "Running structure-like population genetic analyses with R." R tutorials in population genetics, U. Grenoble-Alpes (2016): 1-9.

Frichot, Eric, and Olivier François. "LEA: An R package for landscape and ecological association studies." Methods in Ecology and Evolution 6.8 (2015): 925-929.

Najjar, R. G. et. al. 2000. The potential impacts of climate change on the mid-Atlantic coastal region. Cli. Res. 14: 219–233. https://www.int-res.com/articles/cr2000/14/c014p219.pdf

“Ocean Temperature.” *Ocean Temperature and Rhode Island's Climate Challenge*, http://www.riclimatechange.org/changes_temperature_ocean.php

Nunes, Rachel. *Algae, High Bacteria Levels Close Local Ponds*. 10 July 2019, https://patch.com/rhode-island/narragansett/algae-high-bacteria-levels-close-local-ponds

Saraiva, A. S. et al. 2020. Strategies of cellular energy allocation to cope with paraquat-induced oxidative stress: Chironomids vs Planarians and the importance of using different species. Science of the Total Environment 741:140443. https://doi.org/10.1016/j.scitotenv.2020.140443

Verslycke, T., & Janssen, C. R. 2002. Effects of a changing abiotic environment on the energy metabolism in the estuarine mysid shrimp Neomysis integer (Crustacea: Mysidacea). *Journal of Experimental Marine Biology and Ecology, 279*(1-2), 61-72. doi:10.1016/s0022-0981(02)00339-8

Weisse, T., Rudstam, L.G. Excretion and respiration rates of *Neomysis integer* (Mysidaceae): effects of temperature, sex and starvation. *Hydrobiologia* 178, 253–258 (1989). https://doi.org/10.1007/BF00006032