eDNA Shows Fish Diversity in Narragansett Bay Does Not Increase Along a Salinity Gradient

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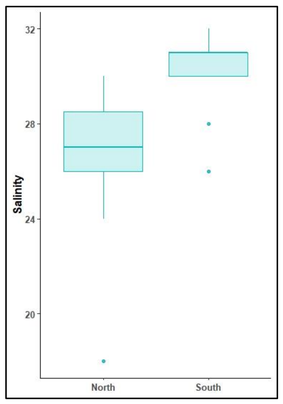
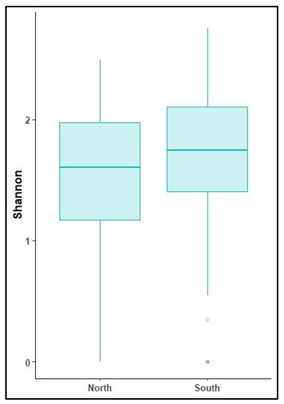
Abstract

The overall goal of this project is to quantify the relationship between salinity and fish diversity using eDNA in Narragansett Bay and highlight the potential for eDNA as a noninvasive sampling method. We also access the impact of season and North-South bay distribution on fish diversity. We hypothesize that as salinity increases along a longitudinal gradient from North to South in the bay (Hess 1976), the diversity of fish species will also increase. Upon analysis of the data, there is no correlation between the salinity gradient and fish diversity. A t-test in RStudio showed that there is no significant relationship between diversity and North or South sample location (p = 0.050875) or diversity and salinity (p = 0.555). Though diversity did not change, community structure did. PCoA plots in ranacapa showed community structure changed between low and mid-high salinity (p = 0.003), North-South bay distribution (p = 0.001), and summer and winter (p = 0.001)

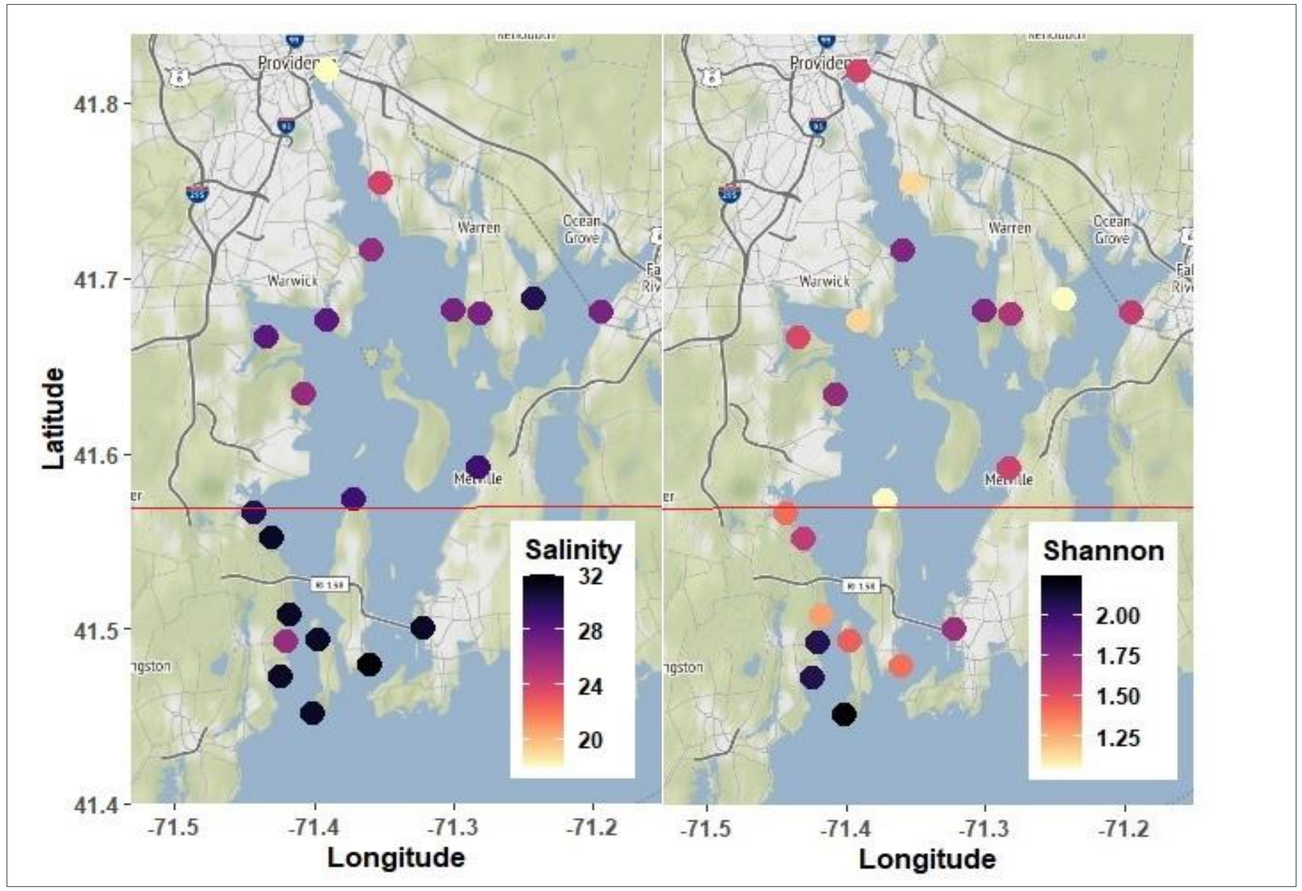
This material is based upon work conducted at a Rhode Island NSF EPSCoR research facility [(URI) Marine Life Science Center and Genomics and Sequencing Center] , supported in part by the National Science Foundation EPSCoR Cooperative Agreement #OIA-1655221

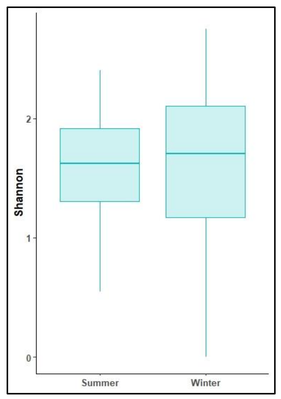


South bay has significantly higher salinity than North bay (p = 2e-16)



No significant difference in diversity between North and South Bay (p = 0.0509)

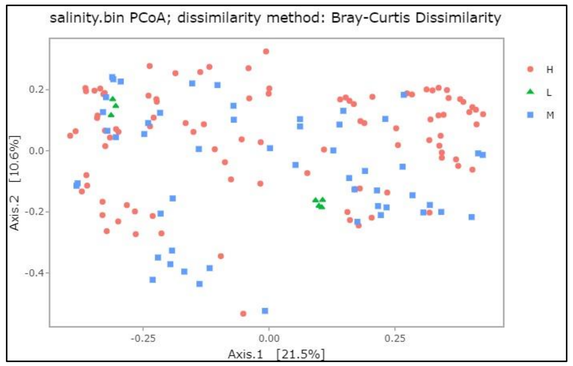




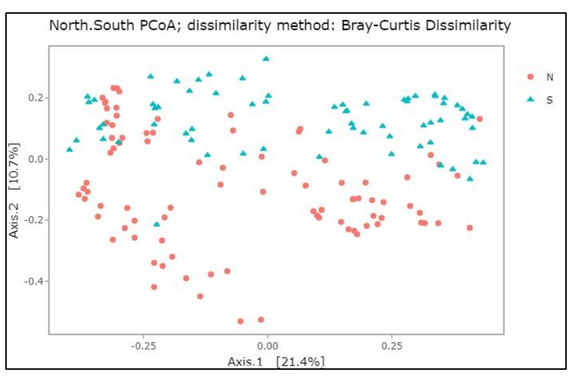
No significant difference in diversity between summer and winter (p = 0.781)

Top 10 Species	
Winter	**Summer**
Atlantic Silverside	Scup
Atlantic Herring	Bay Anchovy
Alewife	Butterfish
Atlantic Menhaden	Longfin Squid
Little Skate	Atlantic Herring
Silver Hake	Atlantic Menhaden
Butterfish	Atlantic Moonfish
Blueback Herring	Weakfish
Spotted Hake	Alewife
American Lobster	Bluefish

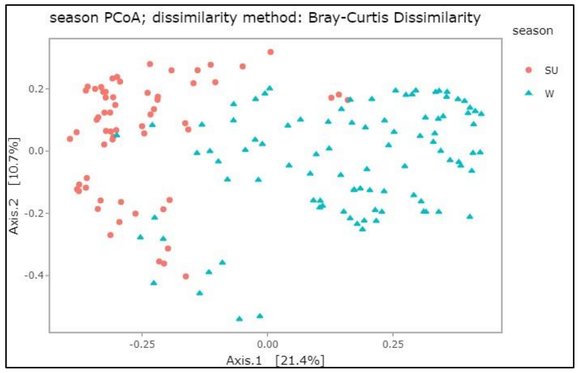
RI DEM top 10 species changes seasonally. Shared species in red.



Salinity (ppt) is grouped low (18-23), medium (24-27) and high (28-32). Medium and high salinity have similar community structure while low differs from both (p = 0.003)



North and South bay have significantly dissimilar community structure (p = 0.001)



Community structure between summer and winter is significantly different (p = 0.001)

Methods

- **Samples collected in whirl packs and filtered with 0.45-micron filter**
- **DNA extracted with Qiagen Dneasy Kit**
- **Amplified 12s mitochondrial gene**
- **PCR amplified and PCR2 barcoded**
- **Generated matrix with ranacapa pipeline**
- **Analysis in RStudio, Excel, and ranacapa**

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Conclusions

Diversity does not increase as salinity increases along a longitudinal gradient. Some possible explanations are low sample size or that other factors such as chlorophyll and human activity have a stronger effect on fish diversity. **Community structure does change with season, North-South bay distribution, and between low and mid-high salinity areas.** Future studies should focus on other factors that could affect diversity and community assemblage, quantify community assemblage along salinity gradients, and sample a wider variety of taxa. The study highlights the importance of quantifying limiting factors for diversity within the Narragansett Bay so the ecosystem can be better protected.

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RI DEM

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