AN ASSESSMENT OF THE EFFECTS OF CLIMATE CHANGE ON JUVENILE FISH ASSEMBLAGES IN THE MULLICA RIVER-GREAT BAY ESTUARY

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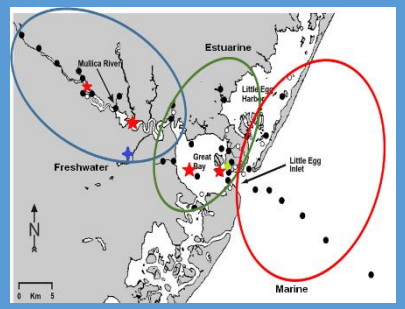
Introduction

Climate change is predicted to drive poleward shifts in species range as temperatures increase. Estuarine fishes of the US East Coast are important but challenging study organisms for observing these range shifts. While they track local climate velocities and are sensitive to temperature changes, they can be highly migratory and may use estuarine habitats facultatively. We examined the effects that climate change had on the fish assemblage caught within the Mullica-Great Bay ecosystem during summer and fall months over time.

Methods

Environmental data was collected via the Jacques Cousteau National Estuarine Research Reserve's System Wide Monitoring Protocol. Biological data was collected via the Rutgers University Marine Field Station's Long Term Otter Trawl Program

Environmental data was averaged by season. Trawl sites were grouped by halozone (Estuarine, Marine, Freshwater)



A principal components analysis (PCA) was performed on biological data. A canonical correspondence analysis (CCA) was performed using both biological and environmental data. PCA trends were regressed against year for all three halozones

Results

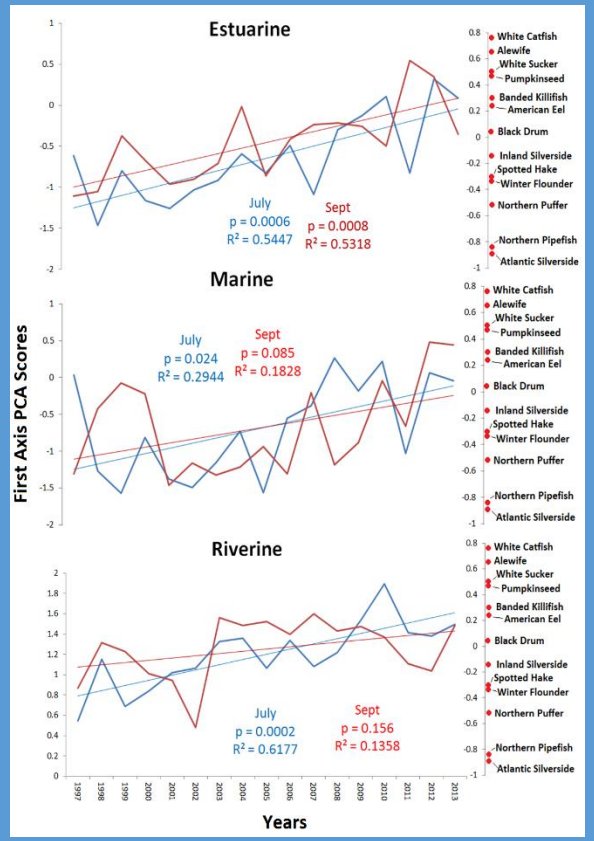


Figure 1 First-axis PCA scores for the three halotypes; Marine, Estuarine, and Freshwater. The right axis displays a selection of the loadings and names of species affecting the sample scores. This analysis included the entirety of the fish assemblage dataset, ranging from 1997-2013.

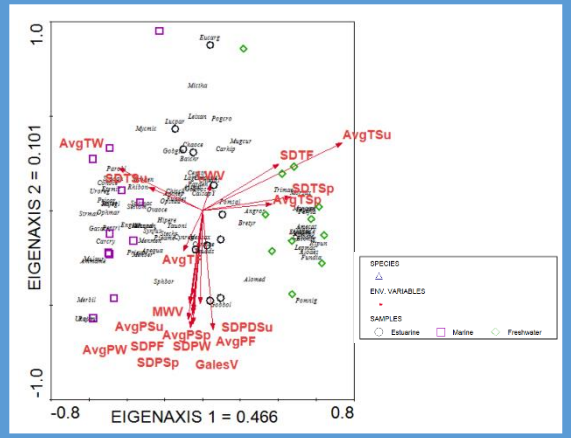


Figure 2 CCA biplot of species vs. environmental variables and halozones across the entire study system. Vectors point in the direction of increasing abundance relative to other species and stations. Longer vectors show stronger trends.

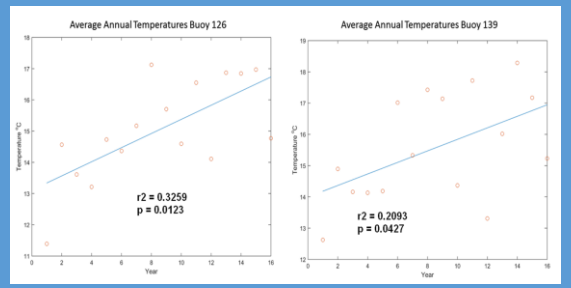


Figure 3 Average annual temperatures for each data logger within the system from 2002 to the current year for each of the four SWMP loggers along with lines of best fit. Temperatures have changed significantly within the bay over time. Locations of loggers are marked with red stars on the map to the left.

Conclusions

There has been a significant change in the Mullica River-Great Bay fish assemblage's composition over the period of the study.

Shifts are most significant in the Estuarine and Freshwater environments, particularly in the September assemblage. This could indicate a phase lag in results.

Changes in average summer water temperatures explained the greatest variation of changing fish assemblages.

A high correlation between winter and summer water temperatures suggests that winter temperatures are also important.

The overall assemblage shift in the assemblage is most influenced by the abundance of freshwater species, indicating the importance of freshwater input and changes in local watershed conditions in determining assemblage composition.

Acknowledgments

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