

# Drivers of Species Community Dynamics in Pamlico Sound: a Multivariate Approach

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## Introduction

Myriad forces from rising water temperatures to increased fisheries pressures can alter community assemblages in estuaries. These complex systems are characterized by dynamic interactions among both biotic and abiotic factors. To effectively manage estuaries, a better understanding of the intricate factors driving community dynamics is necessary. Unlike other major estuarine systems, the aquatic community of the Pamlico Sound has not been described using multivariate approaches, which serve to digest the massive amounts of data available, in both numbers of variables and length of the time series. Such analyses provide novel understanding of the most important drivers of community change. Non-metric multidimensional scaling (NMDS) was used to compare annual and seasonal communities across time and identify factors most important in regulating species assemblages. Large changes have been seen across the time series, which resulted in notably different communities.

## Data and Methodology

### Trawl data

- North Carolina Division of Marine Fisheries P195 Trawl Survey (fisheries independent)
- Covers Pamlico Sound, Neuse River, Pamlico River, and Pungo River (hereon referred to as Pamlico Sound)
- Conducted in June and September (Summer and Fall)
- Using data from 1987-2019

### Non-metric Multidimensional Scaling (NMDS)

- Selected the 20 most common species to represent the community
- These 20 species make up 98.8% of the total summer catch by count, so we are confident they are representative of larger community change
- Summer data display clearer community transitions and more robust trends

## Implications & Directions

Sequential years exhibited strong similarity in community structure. However, during a transitional period between 1997 and 2001 the annual species assemblage exhibited greater variation during a period of AMO phase transition.

Shifting abiotic characteristics may catalyze increased dominance by other species and groups (ex. Pinfish, generalists, elasmobranchs, warm-adapted species).

Distinct communities were evident ( $p < 0.01$ ) between summer and fall, while differences among sampling strata, representing habitats, were non-significant.

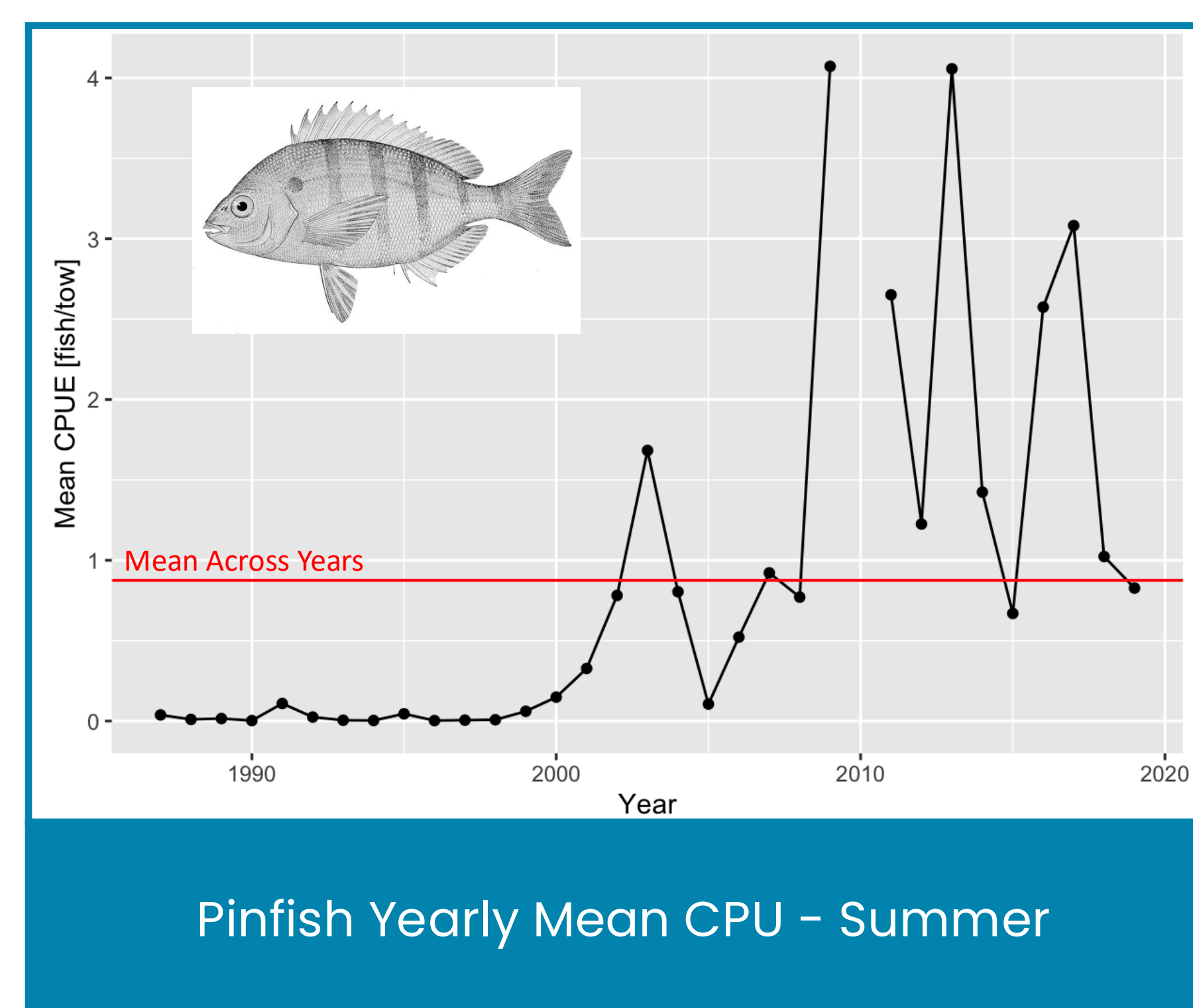
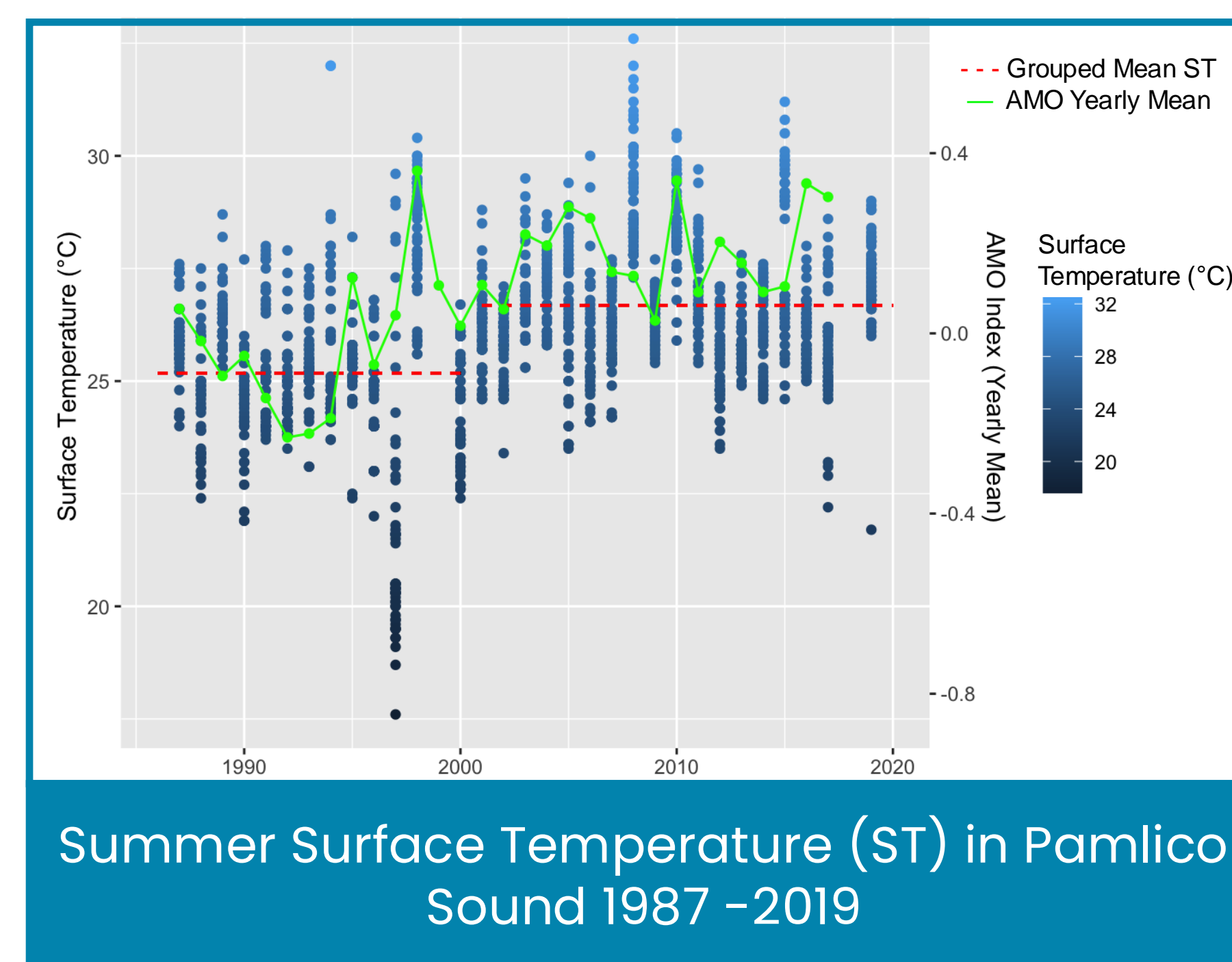
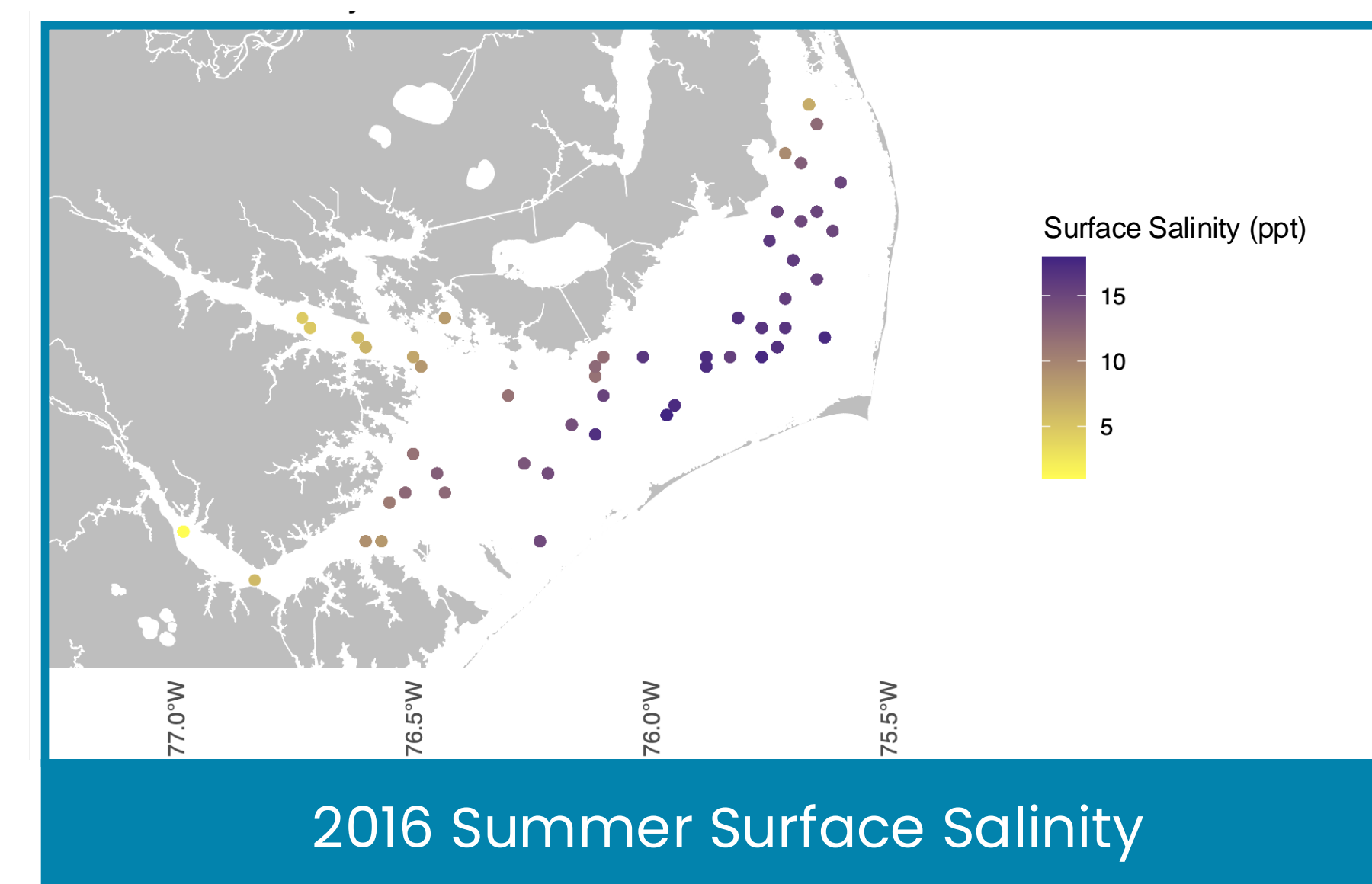
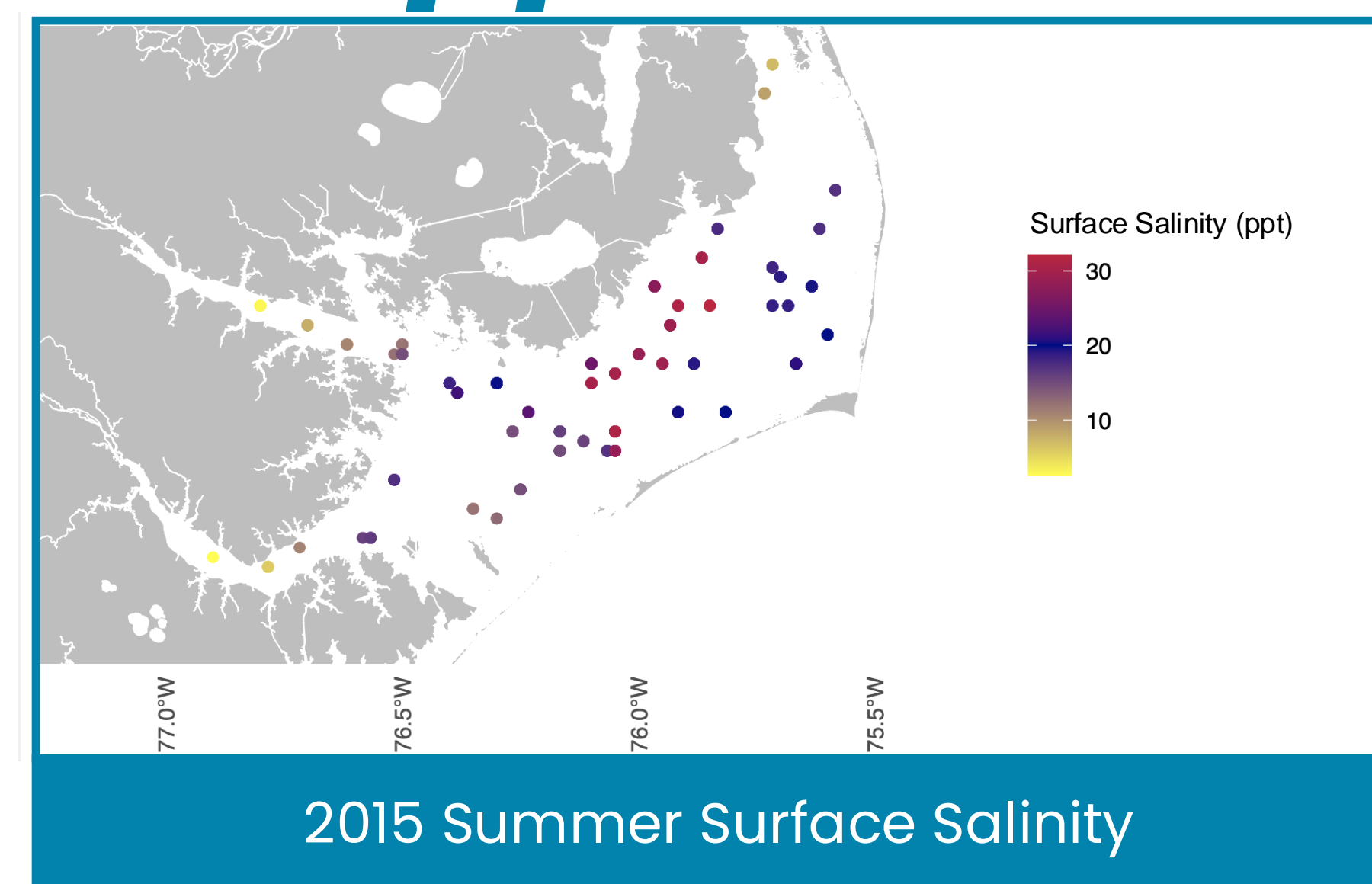
Additional statistical testing will isolate year groupings and which species consistently correlate with the larger community change.

More environmental variables can be applied to the biological data, better explaining drivers of changes in species abundance and assemblage.



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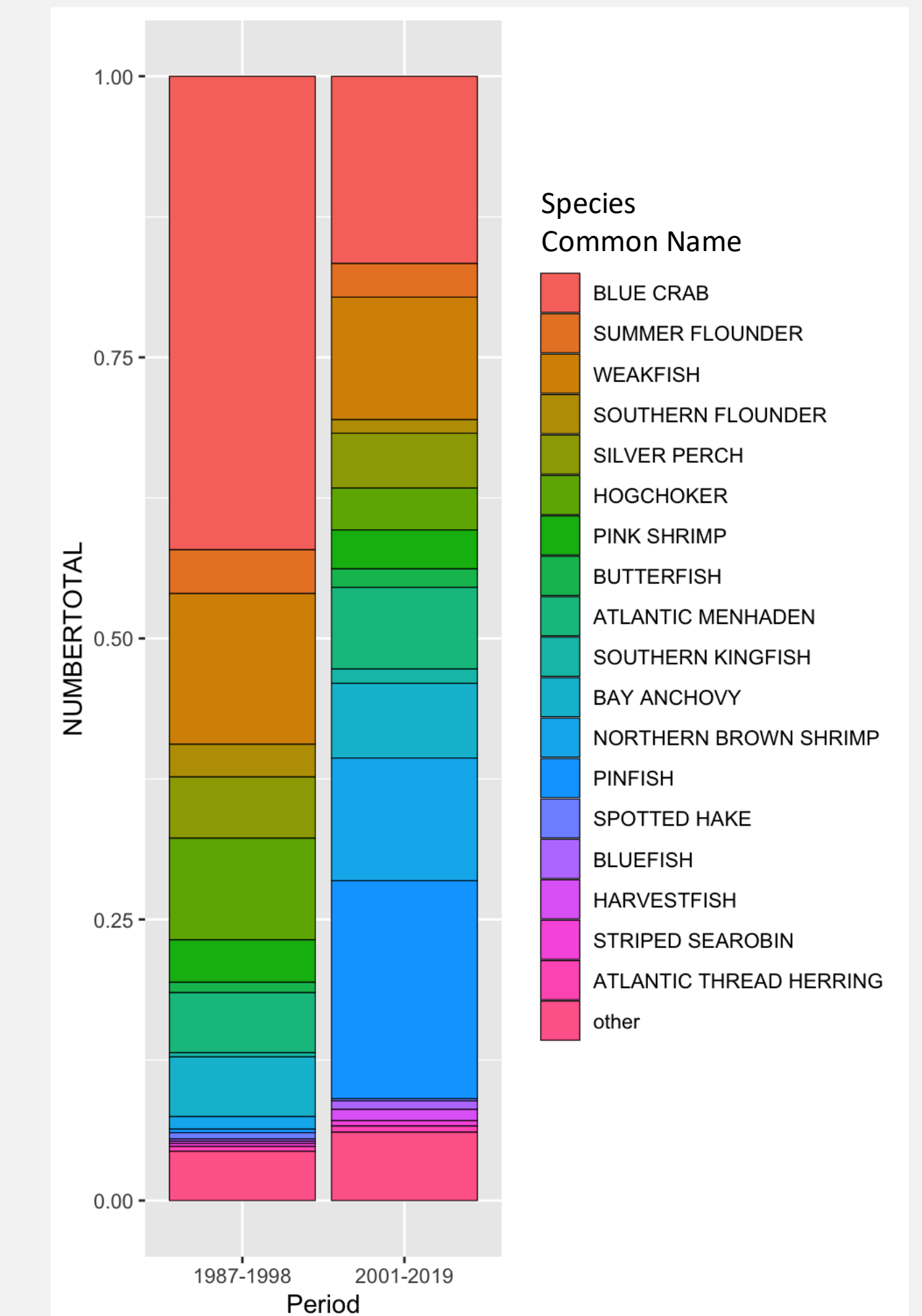
**Acknowledgments**  
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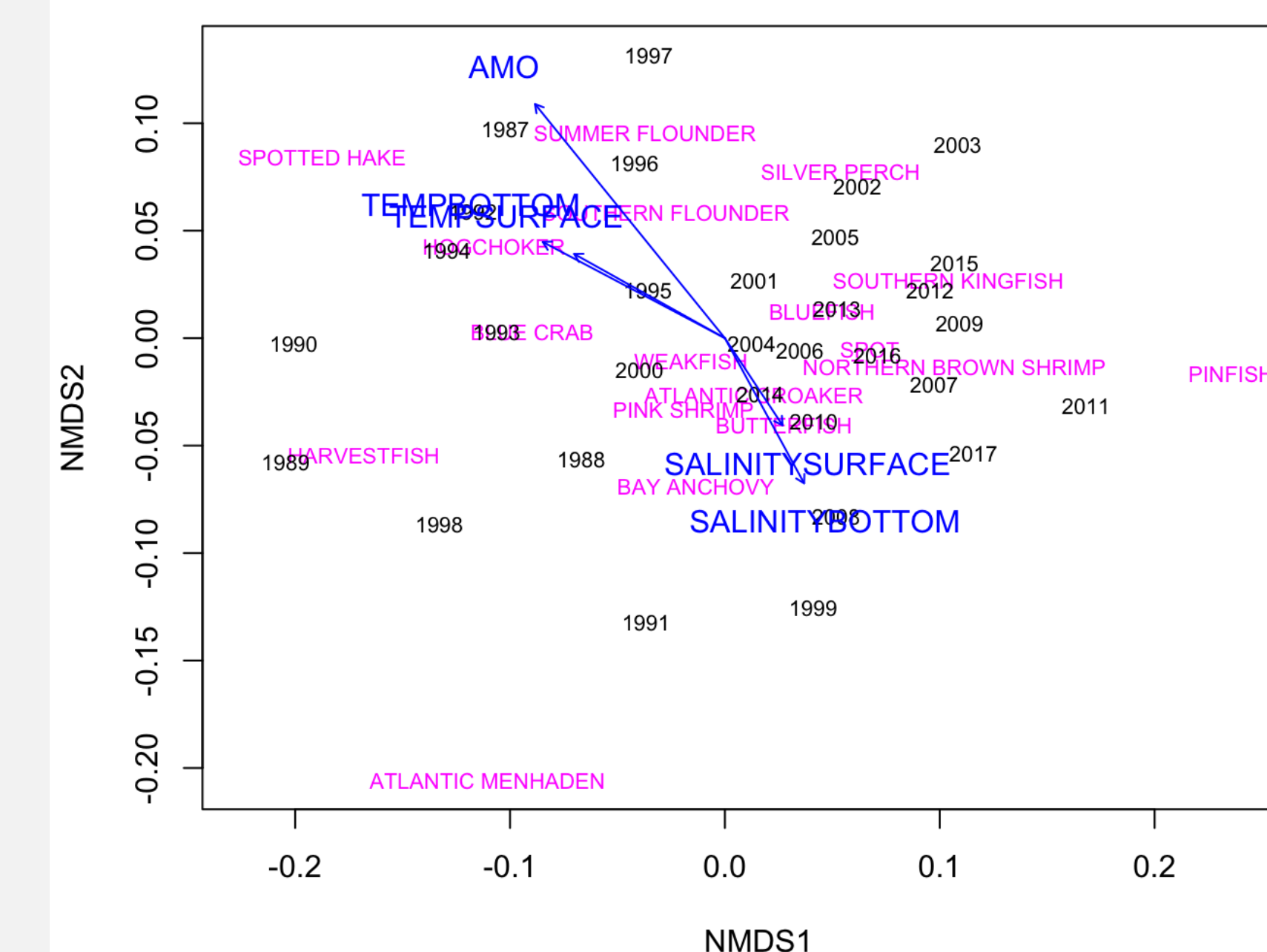
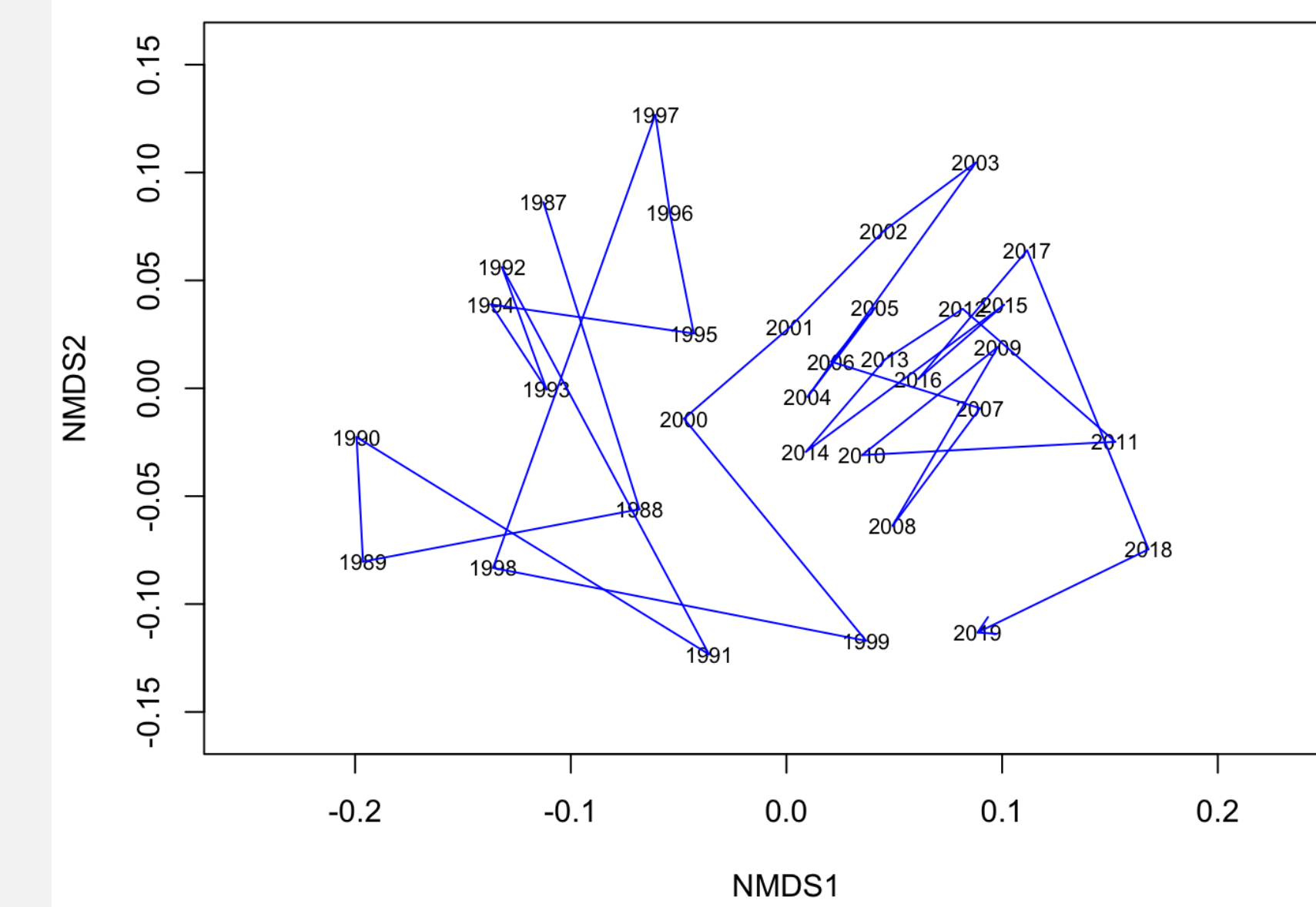
With shifting climatic factors and anthropogenic pressures species historically less present in the Pamlico Sound may be driving community change and establishing dominance.

## Preliminary Findings

The 18 most common species by frequency of occurrence, omitting Spot and Atlantic Croaker (together >75%) so other species can be scrutinized, show massive changes in certain species between periods, including Pinfish.



Shift in summer Pamlico Sound species assemblage (1987-2019)



Interannual variability is strong, so even closely related years can have vastly different species compositions, however, sequential years are often more related.

Pinfish are one species highly associated with community composition in more recent years. (longer variable vectors explain more variability)

Of environmental variables, the Atlantic Multidecadal Oscillation explains most variation across communities (years).

Feedback, ideas, suggestions, and comments are greatly appreciated!

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