



Phenology in a Changing Environment: Ecological Forecasts of Albemarle Sound/Roanoke River Striped Bass Stock Migration



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Introduction

- Climate change can cause shifts in season timing (phenology) of fish migrations.
- Albemarle Sound/Roanoke River (A/R) stock is the southern most spawning population of striped bass (*Morone saxatilis*) on the east coast.
- A/R stock and Chesapeake Bay have seasonal closures of the fishery to protect large migrating female striped bass.
- Striped bass are anadromous, meaning they spawn in freshwater and the larger (>35 inches) adults migrate to the ocean after spawning.
- The migration of striped bass can vary by up to a month in the Albemarle Sound and Chesapeake Bay (Peer and Miller, 2014, Rulifson 1993, Callihan 2014).

Study Goals:

- Understand the trends in interannual variability in A/R stock spawning phenology.
- Create an ecological forecast to model striped bass migration timing, based on environmental variables, fisheries independent egg survey data and catch data.

Data Sources:

- Daily egg surveys of striped bass spawning in the Roanoke River extending between 1959-1993 (Hassler, 1981; Rulifson, 1993). Reports have not been digitized until this project.
- Creel survey at Weldon, NC, near major spawning grounds.

Results

How does spawning seasonality change annually?

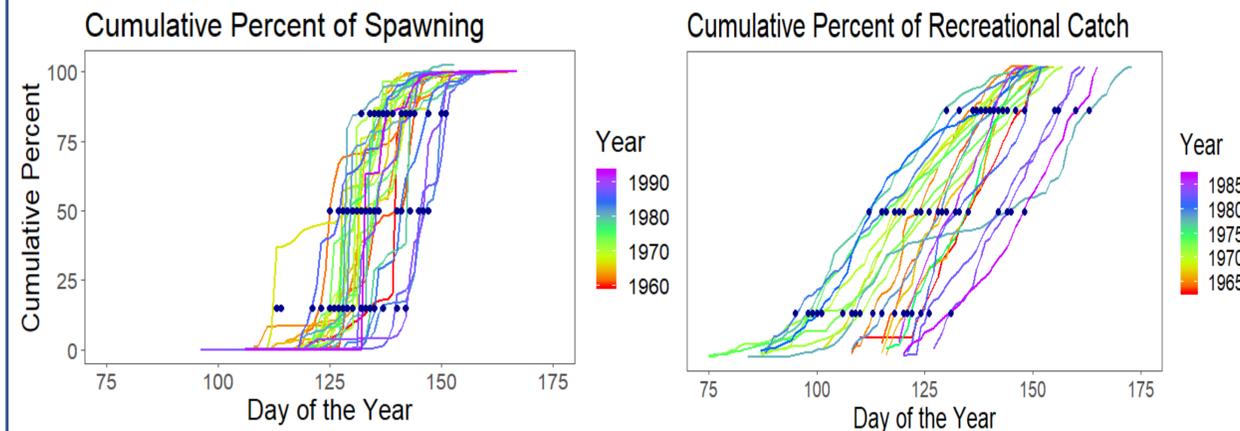


Figure 1: Cumulative percent of egg abundance and creel survey catches. Points represent beginning, peak and end of the spawning season.

How does spawning seasonality change over time? How does the spawning season change between survey types?

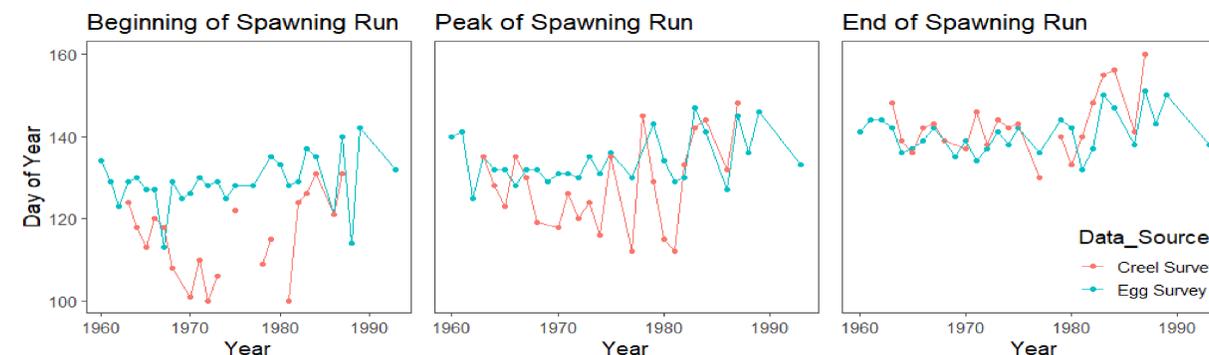


Figure 2: Points are 15, 50 and 85% of cumulative percent to represent beginning, peak and end of the spawning season.

How does the duration of the spawning season change over time?

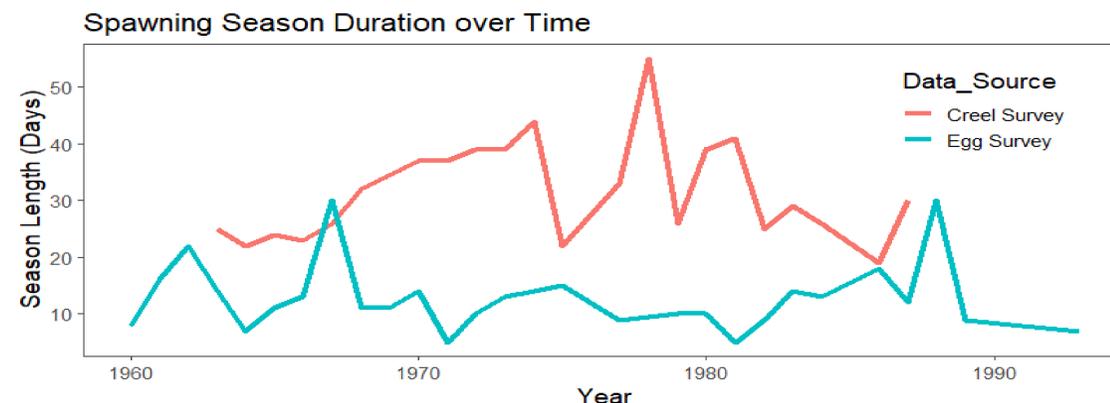


Figure 3: Spawning season duration is defined by the distance in days between the beginning (15%) and the end (85%) of the spawning season.

Methods

- Spawning seasonality is measured in by cumulative percent of spawning with 15%, 50%, and 85% of spawning marking the beginning, peak and end of the season, respectively.

Ecological Forecasting Model:

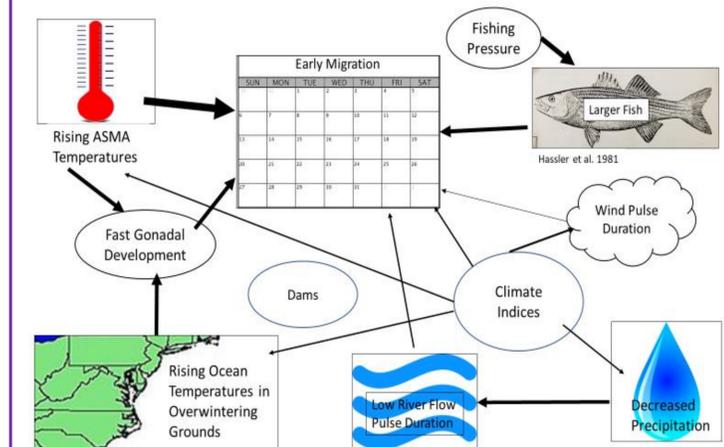


Figure 4: This conceptual diagram represents the environmental and biological variables that will be used to for the ecological forecast. The arrows represent relationships that would lead to an early spawning event. The arrow width signifies magnitude of the relationship.

Future Directions:

- Collect eggs to validate forecast results
- Project future changes in phenology of A/R stock under different climate change scenarios
- Survey anglers to gauge usage of forecast
- Install temperature loggers into Albemarle Sound to fill gap in water temperature data and DO for the sound

References:

- Callihan, J. L., C. H. Godwin, and J. A. Buckel. 2014. Effect of demography on spatial distribution: Movement patterns of the Albemarle Sound–Roanoke river stock of striped bass (*Morone saxatilis*) in relation to their recovery. *Fishery Bulletin* 112(2-3):131-143.
- Peer, A. C., and T. J. Miller. 2014. Climate change, migration phenology, and fisheries management interact with unanticipated consequences. *North American Journal of Fisheries Management* 34(1):94-110.