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Variations in Morphometric Condition of Larval Mojarra (*Eucinostomus sp.*) as a Function of Temperature, Zooplankton, and Seasonality

ABSTRACT

We analyzed the morphometric condition of larval Mojarra (*Eucinostomus* sp.) collected from the Beaufort Inlet, NC. These condition measurements will be compared to environmental varibles which the fish experience. We want to test that when zooplankton is abundant, there will be better body condition of larval fish. We will test to see if morphometric condition of fish will decrease due to stress caused by winter temperatures. Lastly, we want to see if Mojarra will be more affected by temperature compared with Atlantic croaker since Mojarra are normally located at more southern locations. These measurements will allow us to use ratios between different body lengths and widths to see if there is an increase or decrease in condition due to environmentally caused stress.

BACKGROUND

- The success of fisheries is determined by recruitment. Recruitment is the number of young adult fish entering the fishery each year after completing juvenile stages. Recruitment can vary by several orders of magnitude and can be unpredictable from year-to-year. This high variability influenced in oceanic conditions experienced by fish larvae can have strenuous effects. While larval abundance has been recorded past three decades in Beaufort NC, variations in larval abundance have not been consistently related to recruitment for many fisheries species.

Figure 1. The target genus shown above are commonly known as Mojarra or Silver Jenny .

Long Term Research Objectives

- By studying how environmental factors affect larval fish condition, we may be able to better anticipate when a high or low recruitment year occurs since condition affects larval fish growth and survival. Knowledge about how the environment affects fish condition can then be used to provide fishery managers with an early warning about changes in the productivity of a fishery.

METHODS

Larval Morphometric Measurements:

- 2017 larval samples from May-November were measured. More samples have been collected since then and will be useful in future analyses.
- Morphometric measurements were acquired using Image Pro Premier software using images taken with a Lumenera microscope camera
- Regressions were conducted to compare measurements of fish length and measurements of body height or width. MATLAB was then used to calculate residuals from these regressions. Positive residuals indicated that the individual was in good condition.

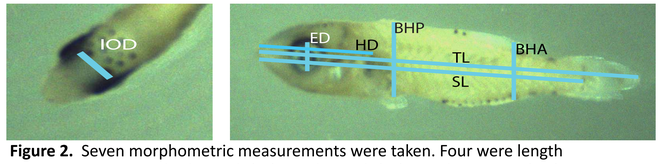

Figure 2. Seven morphometric measurements were taken. Four were length measurements: Standard Length (SL), Total Length (TL), Head Diameter (HD), Eye Diameter (ED). Three were condition measurements: Body Height at the Pectoral Fin and Anus (BHP, BHA), Interorbital Distance (IOD).

Zooplankton Abundance:

- Zooplankton was collected using a 500 micron-mesh plankton. Abundances were calculated by averaging the volume of two tows.

Temperature Data:

- Collected with a YSI EXO water quality sensor along with other potentially important data (salinity, dissolved oxygen).

RESULTS

Temperature and Zooplankton Data

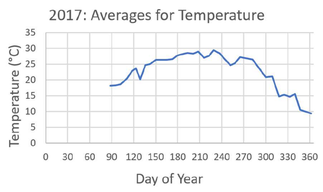

Figure 3. Temperature averages of top 2 meters.

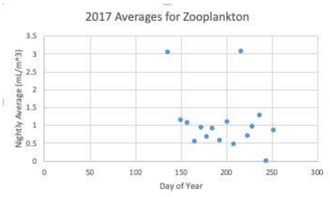

Figure 4 . Displacement volumes were used as a proxy for zooplankton abundance.

Patterns in Morphometric Measurements across the Year

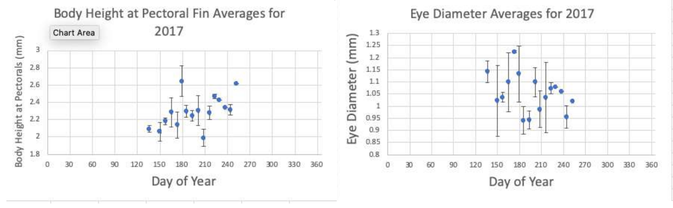

Figure 5.Body Height at the Pectoral fin (BHP) and Eye Diameter (ED) plots showing lots of variation across the year in morphometric measurements. Both of these graphs are representative of variation in the other five measurements (BHA, HD, IOD, SL, TL). During days 0-136 and 252-365, no Mojarra were collected in the sample. Day 229, 237 and 252 did not have a calculated standard error since there was only one larval fish collected that day.

Morphometric Body Condition Residuals

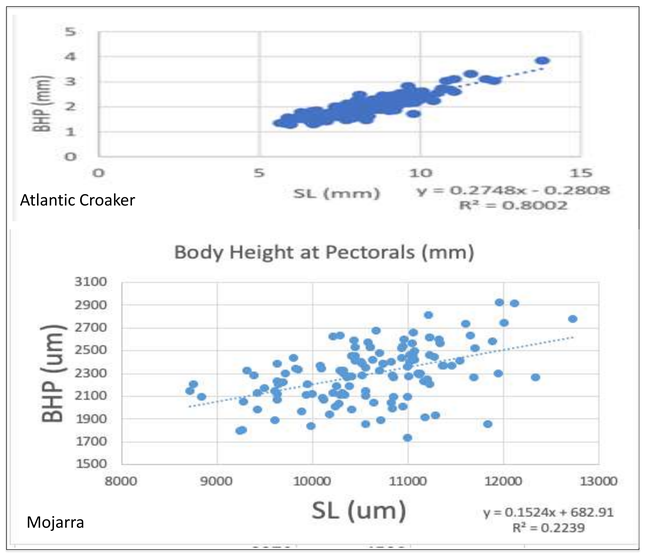

Figure 6. Residuals for the body height at the pectoral fin and the standard length are shown above for both the Atlantic Croaker (top) and the Mojarra (bottom). The p-value for the Atlantic Croaker shown above is 3.22x10^92 and the rest of the residuals for the croaker follow this trend. The p-value for the Mojarra is 1.9313x10^08 and shows no trend with highly variable residuals.

CONCLUSIONS & FUTURE STEPS

- After considering how morphometric condition varies nonlinearly as a function of fish size, we detected a subtle, but statistically significant, relationship where cooler temperatures were associated with declines in condition. Variation in the residuals for the Mojarra shown to not be significant in all cases even though there is a large sample size of 127. This could be because of human error while measuring, a less zooplankton supply leading to more variable growth in Mojarra, or other some other factor.
- Future steps for this study would be to run the different variables through principal component and multivariate analyses. These analyses home in on significant variables and magnify important, possibly hidden relationships. We could do a multi-species comparative approach to see if synchronous weekly trends in morphometric condition exist. Extending the time series into the future using samples obtained from Beaufort inlet since 2017 to produce clearer and broader trends on larval condition throughout consecutive years. Significant findings in the future could help inform fisheries management by providing information on the relationship between larval condition and recruitment.

REFERENCES
Willis, J. (2011). Modelling swimming aquatic animals in hydrodynamic models. *Ecological Modelling*, 222(23–24), 3869–3887. https://doi.org/10.1016/j.ecolmodel.2011.10.004