Time series analysis of *Calanus finmarchicus* and *Centropages typicus* abundance with respect to the converging time frequencies in multiple climate mechanisms in the Gulf of Maine

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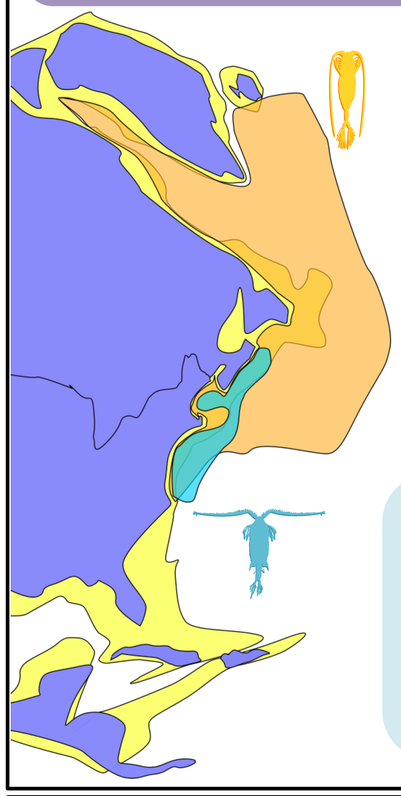
1. The Question

Is rapid warming in the Gulf of Maine altering physical/chemical and decadal zooplankton abundance relationships for *Calanus finmarchicus* and *Centropages typicus*?



Calanus finmarchicus
- Spring/Summer
- Large-bodied
- Full of Lipids
- Subarctic Ecosystems
- Fall/Winter Diapause
- Linked to right whale calving index and cod stock crashes

VS

Centropages typicus
- Fall/Winter
- Small-bodied
- Reproduction is historically driven by food availability
- Thrives in warm water with a thermocline

3. Methods

Time series analysis models allow for investigating *de-seasonalized* variance at a monthly resolution.

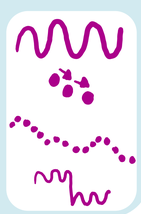
SARIMA

Seasonal

Auto **R**egressive

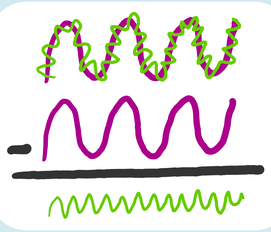
Integrated

Moving **A**verage



Removing Season Structure

Residuals from a SARIMA fit are calculated for abundance, temperature, and salinity.

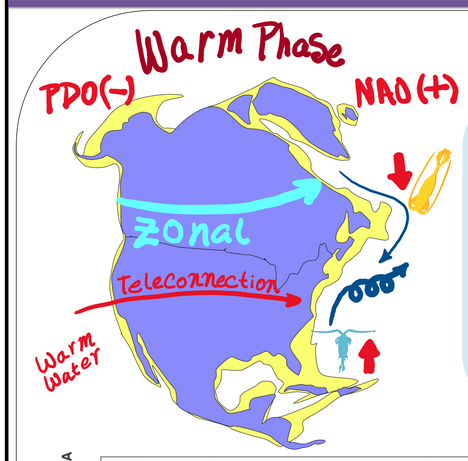


Fitting Co-predictors

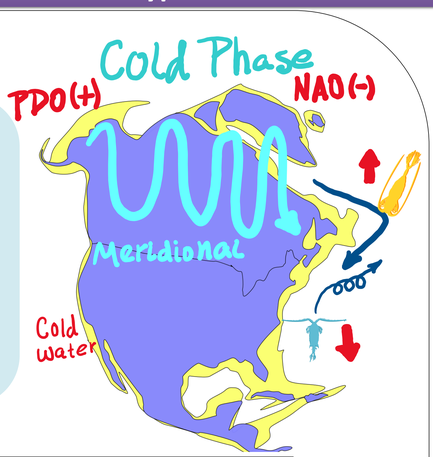
Stepwise variable removal to select the best fit model was preformed on *t-values* below one until lowest AIC value was obtained.

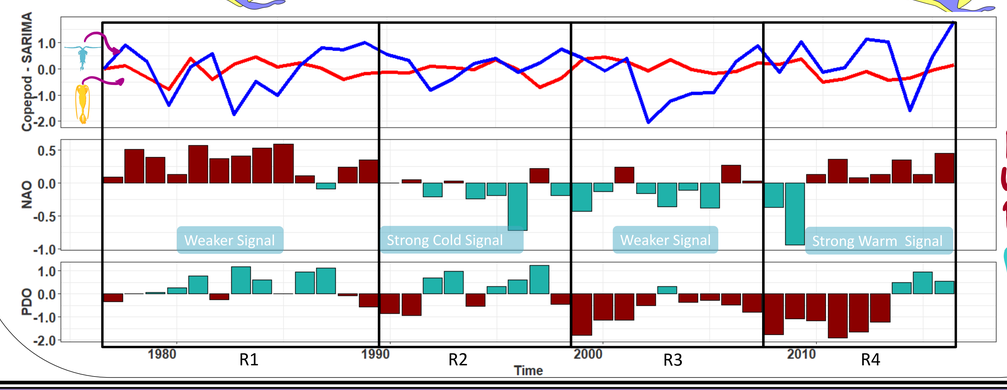
$$t\text{-Value} = \frac{Coeff}{Std.\ Err.}$$

2. Hypotheses

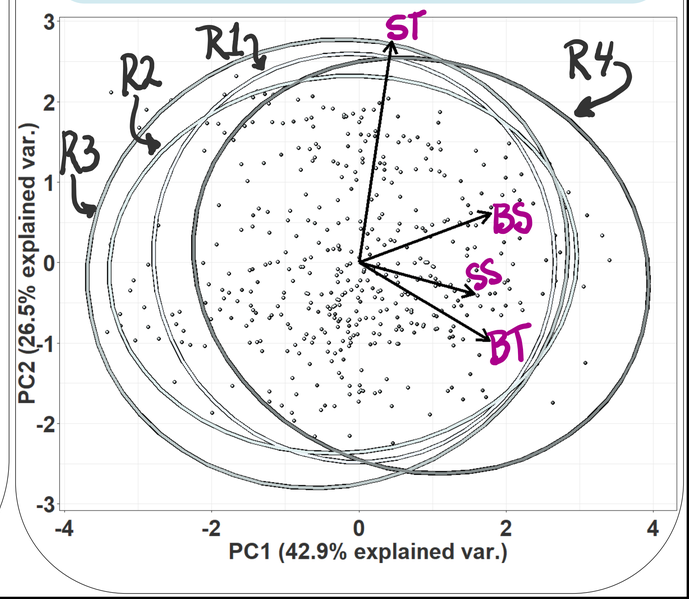


Hypothesis 1: *Calanus finmarchicus* and *Centropages typicus* abundance will have ***inverse*** relationships with zonal (warm) and meridional (cold) conditions.

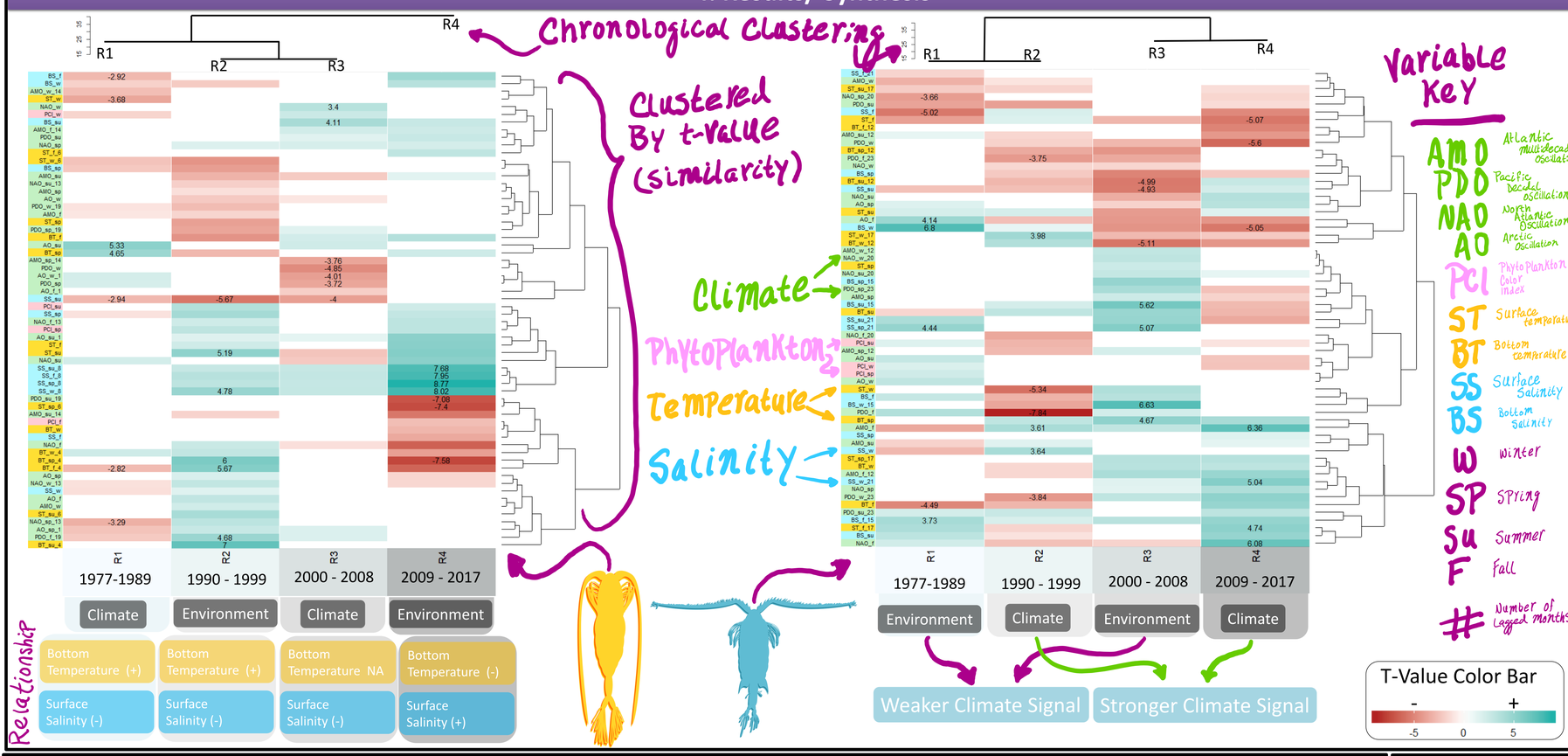




Hypothesis 2: Trends in species abundance in R4 will **diverge** from previous regimes given that environmental conditions in the 4th regime ***depart*** from conditions in the first 3.



4. Results/ Synthesis



6. Conclusion

Results from this study put recent ecosystem change into the context of historic decadal trends and highlight a potential shift from local scale to global scale ecosystem drivers.

Hyp 1: Drivers for *Calanus finmarchicus* and *Centropages typicus* inversely shift between regimes that are dominated by environmental and climate variables. This corresponds with periods of *strong* and *weak* climate signals.

Hyp 2: Drivers of *Calanus finmarchicus* during the 4th regime significantly diverge from the first three regimes.

This regime was dominated by significant increases in *bottom temperature* and *surface salinity*; *Calanus finmarchicus* are at the extent of their ecological niche and are more sensitive environmental change now.

Contact Me

Session: PC14A: Climate Impacts on Marine Species
Time: Monday, 17 Feb. 2020; 16:00 - 18:00

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References and acknowledgements

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