Changes in jellyfish (Chrysaora melanaster) biomass and distribution in response to anaomalous climate shifts in the Bering Sea

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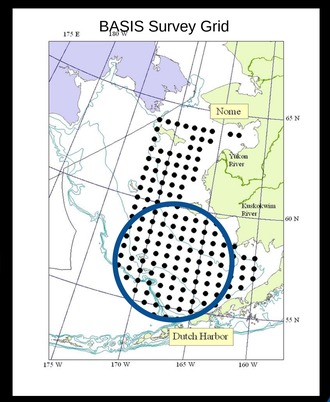
Introduction

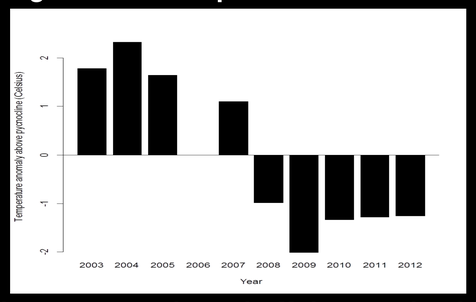
The eastern Bering Sea has recently undergone periods of anomalously warm and cold sea temperature states. The ecosystem response to these anomalous states suggests that sustained warming in the eastern Bering Sea will lead to reduced fitness and recruitment of groundfish resources. Previous research on Northern sea nettle (*Chrysaora melanaster)* indicates that their biomass in the Bering Sea is increasing, and that they may directly compete with walleye pollock *(Theragra chalcogramma)* for prey resources. We examine biomass, abundance, and habitat characteristics (temperature, salinity, chlorophyll-*a*, and bottom depth) for possible associations between the dominant macro-jellyfish species, Northern sea nettle (*Chrysaora melanaster)* and age 0-1 walleye pollock during warm years (2004, 05, 07) and cool years (2008-2012) in the eastern Bering Sea. All data was supplied by the annual BASIS (Bering-Aleutian Salmon International Surveys) surface trawl surveys (see Map).



Methods

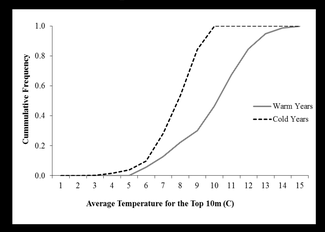
The Modified version of the three step Perry and Smith (1994) approach:

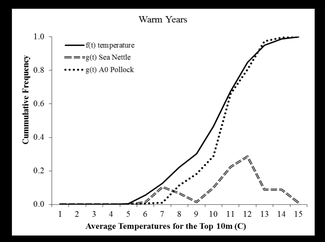
- Step 1. Develop the general frequency distribution by creating their empirical cumulative distribution functions (cdf).
- Step 2. Examine the variables with the jellyfish catches.
- Step 3. Statistically compare the cdf's to determine the strength of the comparison.

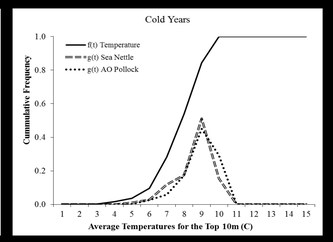


Warm/cold assignment was based off the South Middle domain, a highly productive and oceanographically variable area that best captures the seasonal occurrences of SEBS during our survey. Data for these anaomlies only include mean temperature values from stations above the pycnocline that were sampled for at least 5+ years. (data provided by Lisa Eisner). Figure Provided by Ellen Yasumishi.

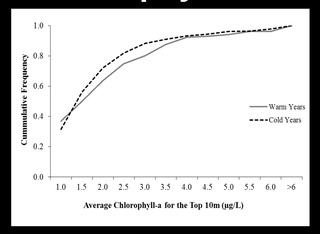
Temperature

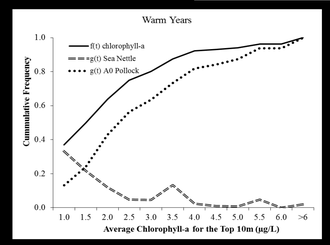


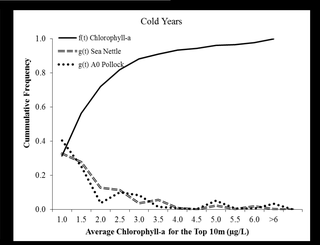




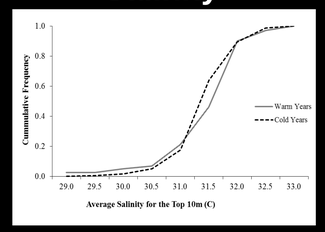
Chlorophyll-a

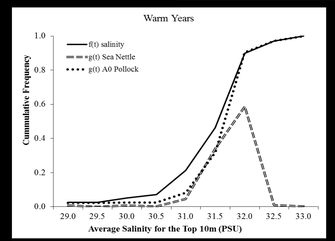


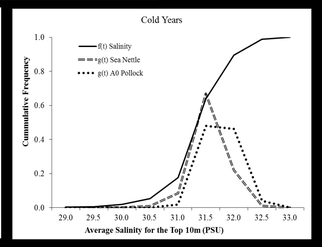




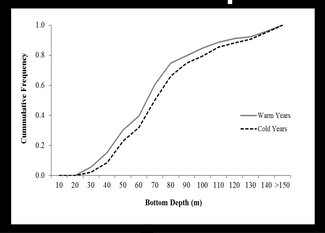
Salinity

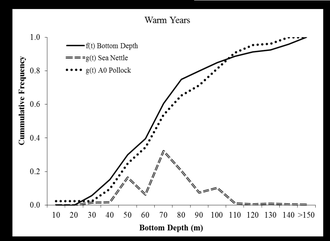


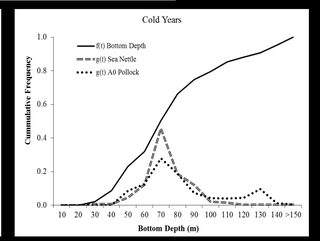




Bottom Depth







Above Figures. Cumulative distribution functions for temperature, salinity, chlorophyll-a, and bottom depth for warm and cold years. Top plot for each variable is the comparison between warm (2004, 2005, 2007) and cold (2008-2012) years, bottom two are comparison with variable, fish and jellyfish for each pooled set of years.

Results

No significant associations were observed in cold or warm years with any oceanographic variable or bottom depth for Northern Sea Nettle . As well as in cold years for Age 0 Pollock.

•Age 0 pollock was significantly associated in warm years with:

- Warmer than average temperatures
- Higher than average salinities
- Deeper than average bottom depths

Variable	Sea Nettle		A0 Pollock	
	Warm	Cold	Warm	Cold
Temperature (°C)	0.34	0.63	0.05	0.47
Salinity (PSU)	0.39	0.87	0.04	0.74
Chl-a (µg/L)	0.11	0.32	0.06	0.89
Bottom Depth (m)	0.42	0.95	0.03	0.77

Table. P-values resulting from the differences in the cdfs for each species during warm and cold years.

Conclusions

• Our initial results indicate that age 0-pollock does not target similar oceanographic characteristics as Northern Sea Nettle. But we do see that the two species distributions overlap, indicating some type of association.

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