Pyrosoma atlanticum Grazing in the Southern California Current Ecosystem

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Introduction

- *Pyrosoma atlanticum* (Figure 1) is the most widespread and common species of pyrosome, which are colonial pelagic tunicates growing to higher abundance in the California Current Ecosystem (CCE) since 2014[2,3] (Figure 2).
- Previous research in the northern CCE found that *P. atlanticum* expansion significantly decreased phytoplankton standing stock[4].
- To measure phytoplankton consumption, pigments such as chlorophyll *a* (chl-*a*) and phaeopigments can be used.

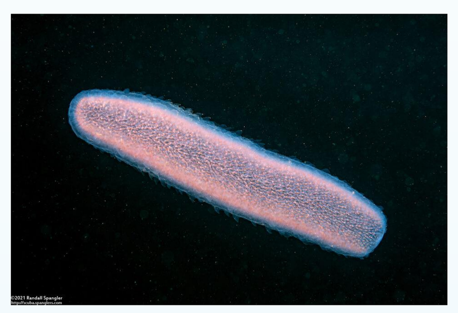

Figure 1. Image of a pyrosome[1], which typically ranges from 5 – 8cm long with a translucent pink or yellow color. Water is filtered from the outside of the colony to the inside through a mucous membrane.

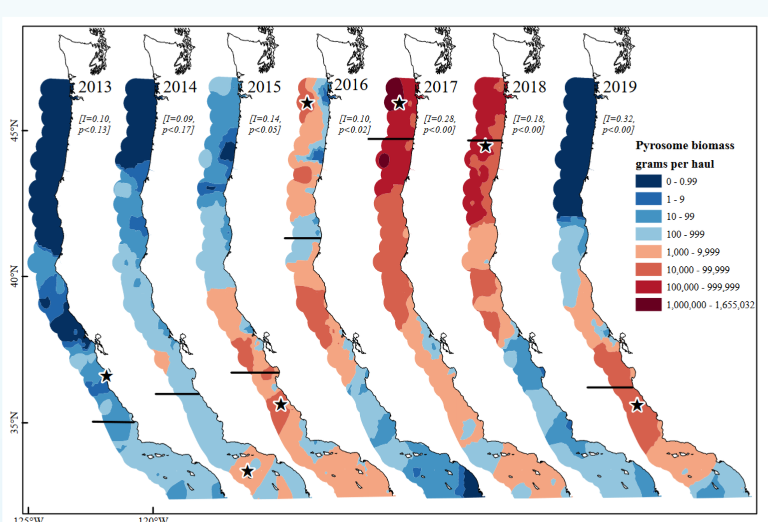

Figure 2. Pyrosome wet weights from 2013-2019 in the CCE, the black line is where the mean biomass occurred, the star is the station with the greatest catch, and an *I* value between 0-1 suggests spatial clustering[2].

Methods

- *P. atlanticum* colonies were collected aboard the R/V Roger Revelle using oblique bongo tows in the CCE during July/August 2021 (Figure 3).
- Daytime and nighttime tows were conducted between 0800-1100h and 2100-2300h.
- Pyrosomes were measured, cut into equal parts, and weighed for wet weight.
- Half the sample was dried and weighed for dry weight and prepped for stable isotope analysis
- The remaining half of the sample was sonicated and chl *a* was extracted in acetone
- Extracted samples were read for chl *a* and phaeopigments with a Turner 10AU fluorometer.

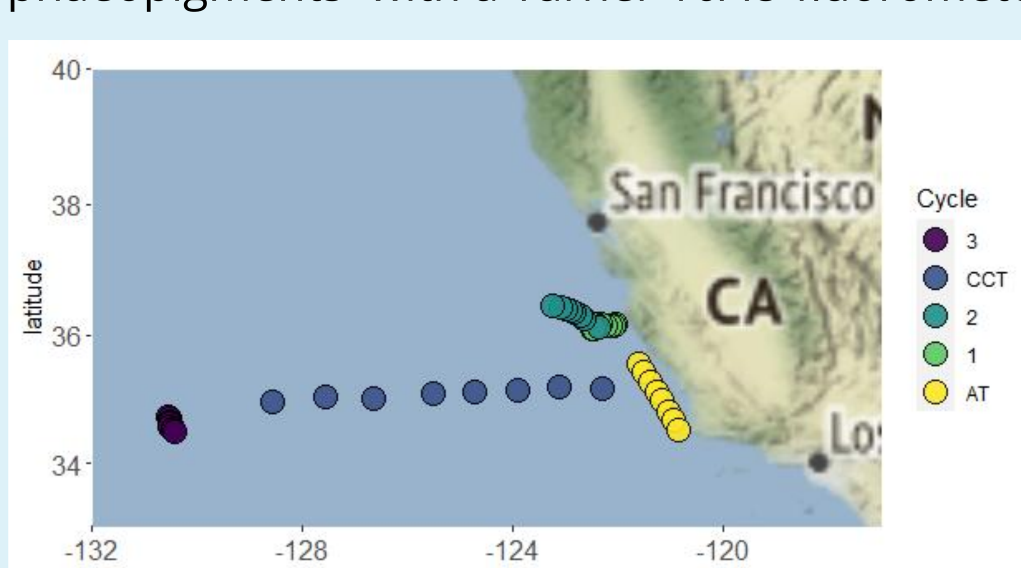

Figure 3. Map of the CCE-LTER cruise. CCT is the California Current Transect, and AT is the Alongshore Transect.

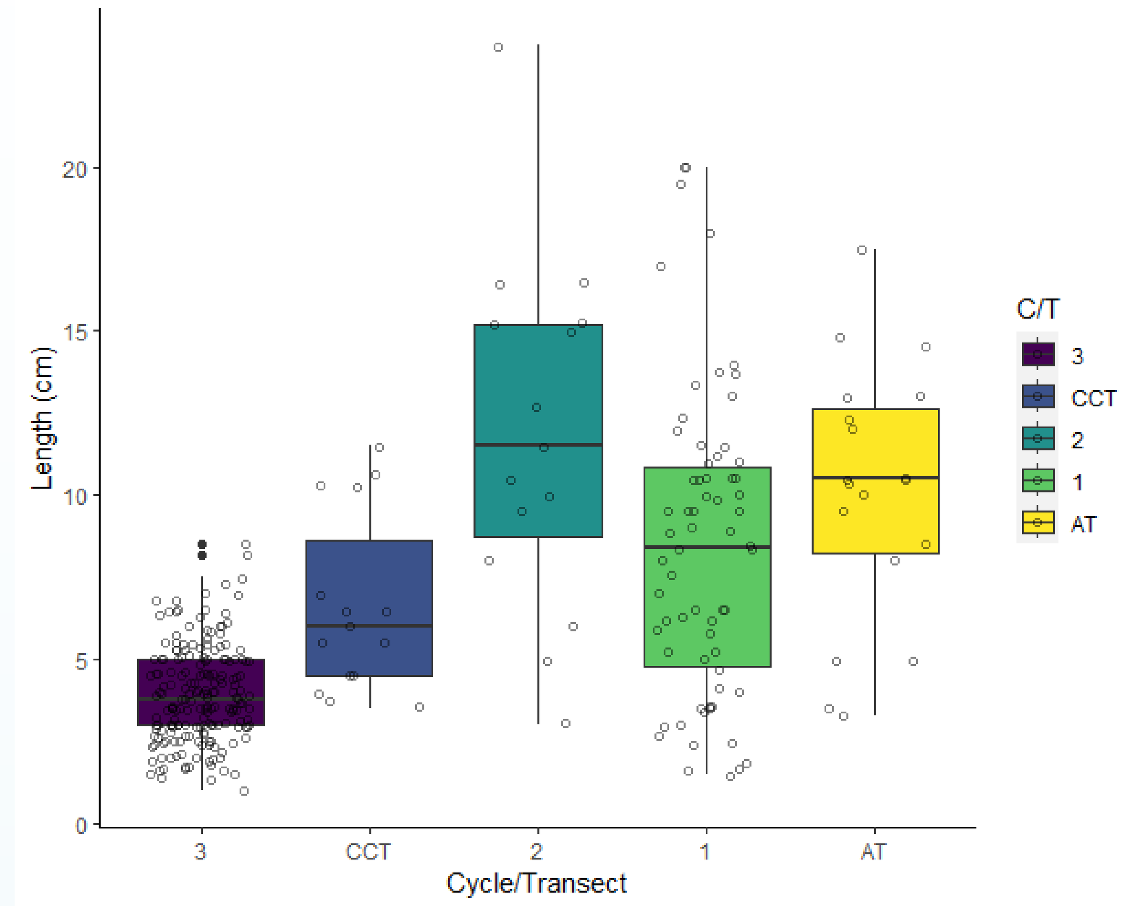

Figure 4. Median (± SE) colony length for every cycle and transect, colored according to the cruise map — Cycle 3 is purple, the CCT is dark blue, Cycle 2 is turquoise, Cycle 1 is green, and the AT is yellow.

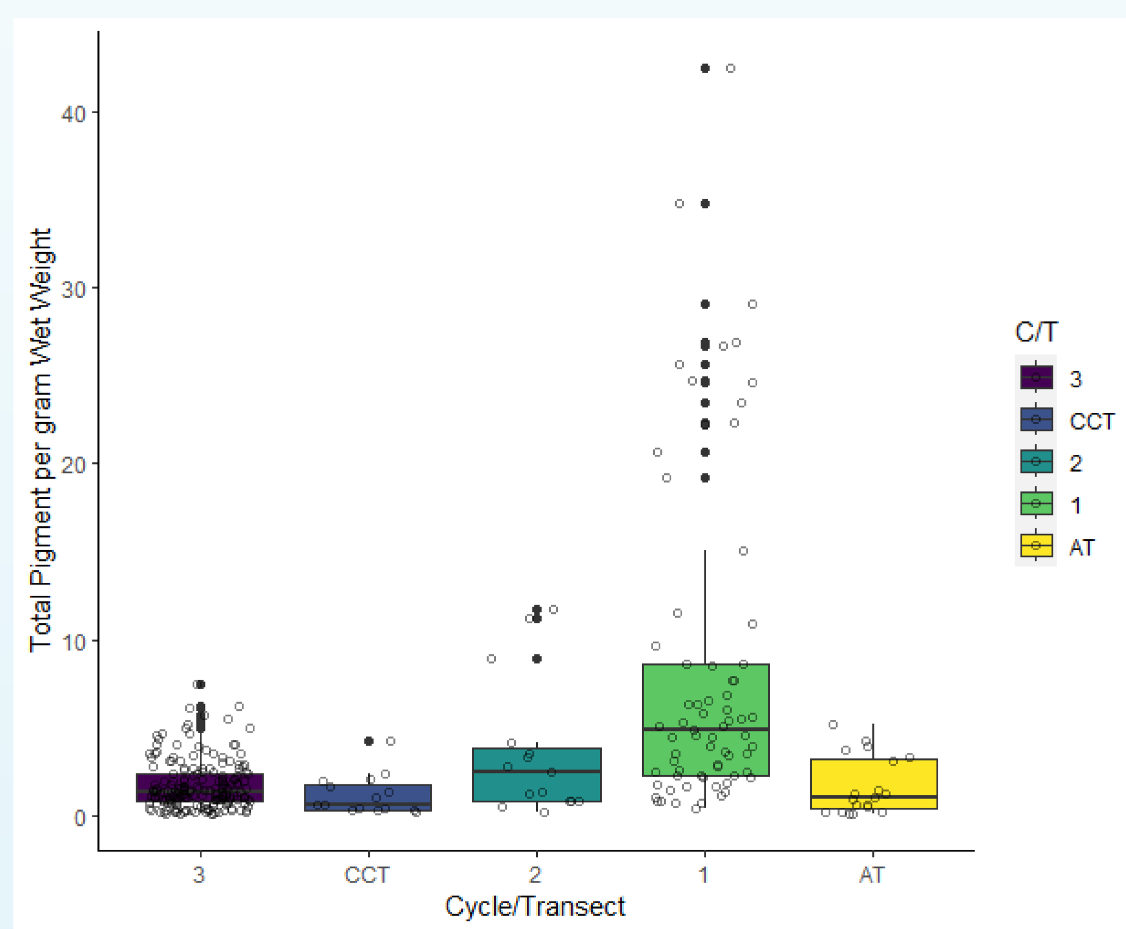

Figure 5. Median (± SE) total pigment normalized by wet weight for each cycle and transect. Colors same as in Fig. 1.

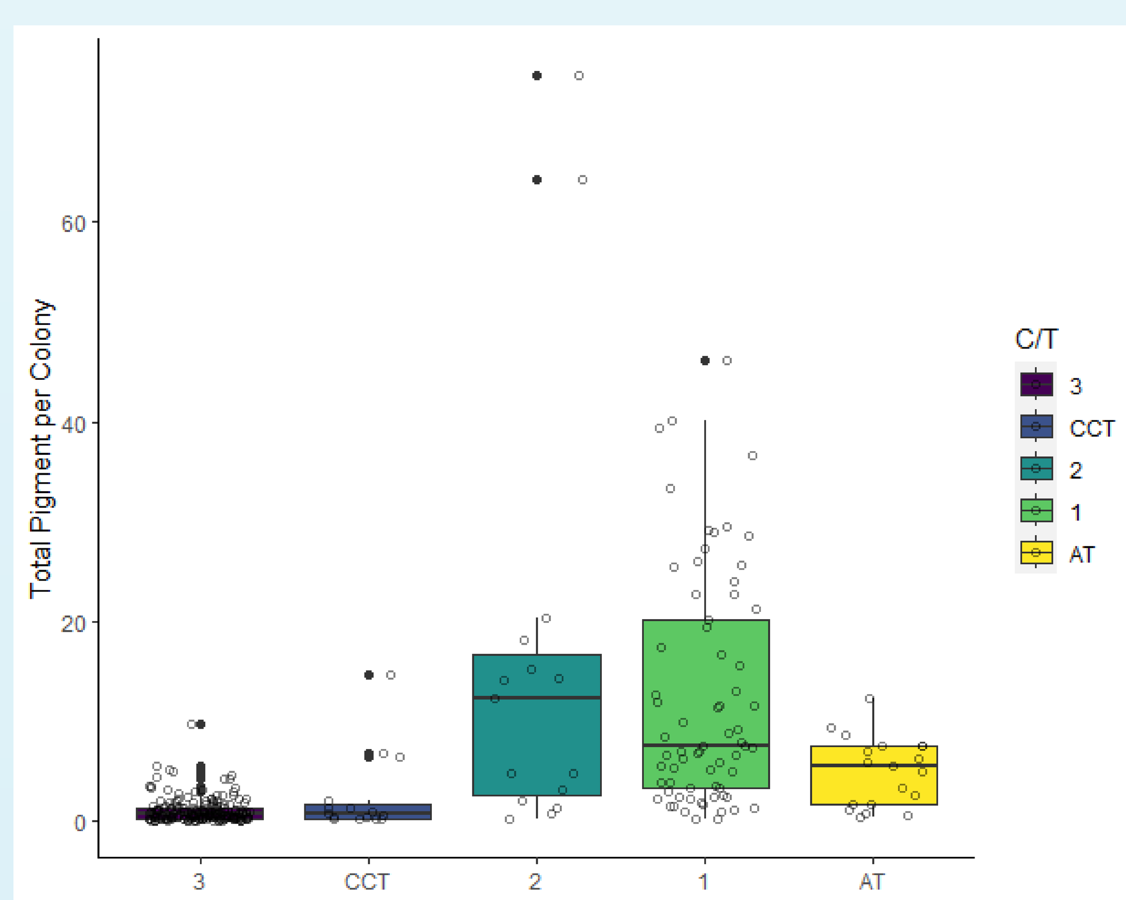

Figure 6. Median (± SE) total pigment per pyrosome colony, a function of total pyrosome wet weight and pigment per gram wet weight, for every cycle and transect. Colors same as in Fig. 1.

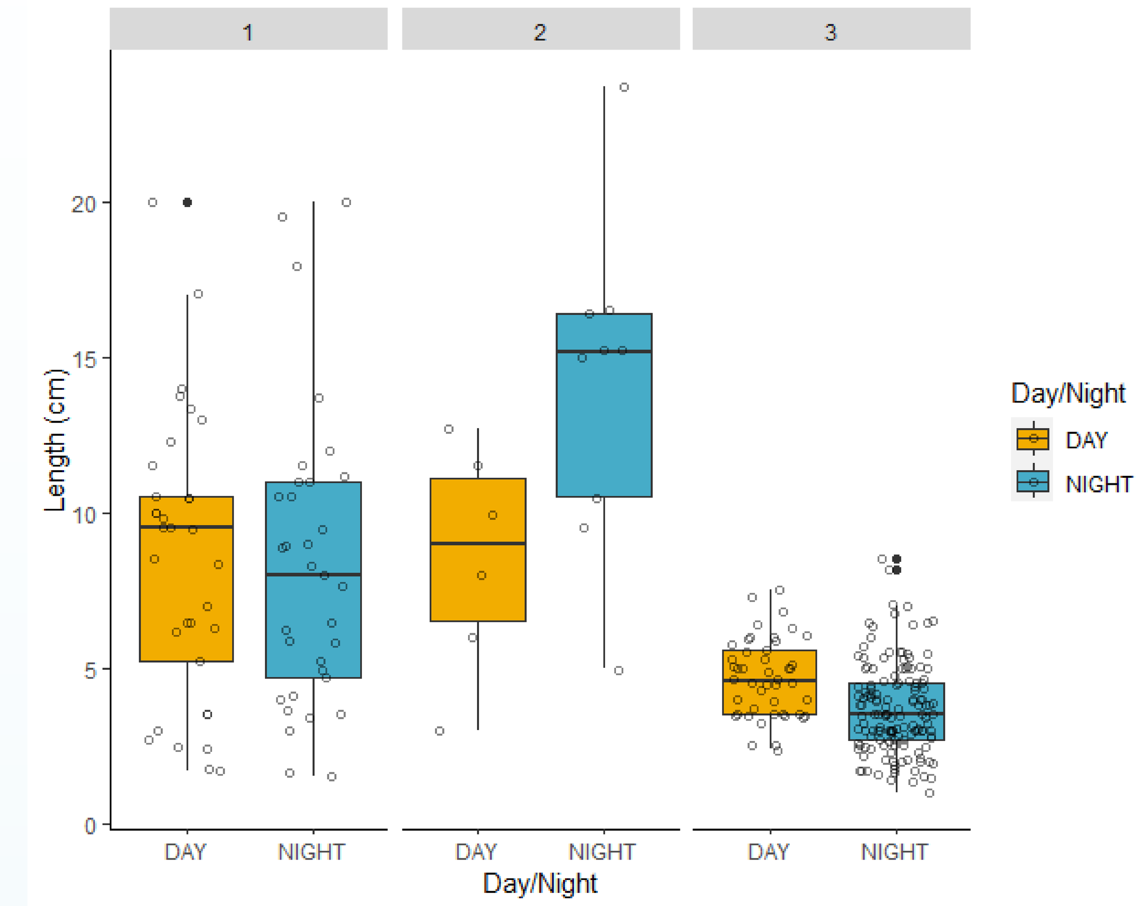

Figure 7. Median (± SE) colony length for every cycle by day and night. Day hauls are orange, night hauls are blue. Transects were done throughout the day and are not represented here.

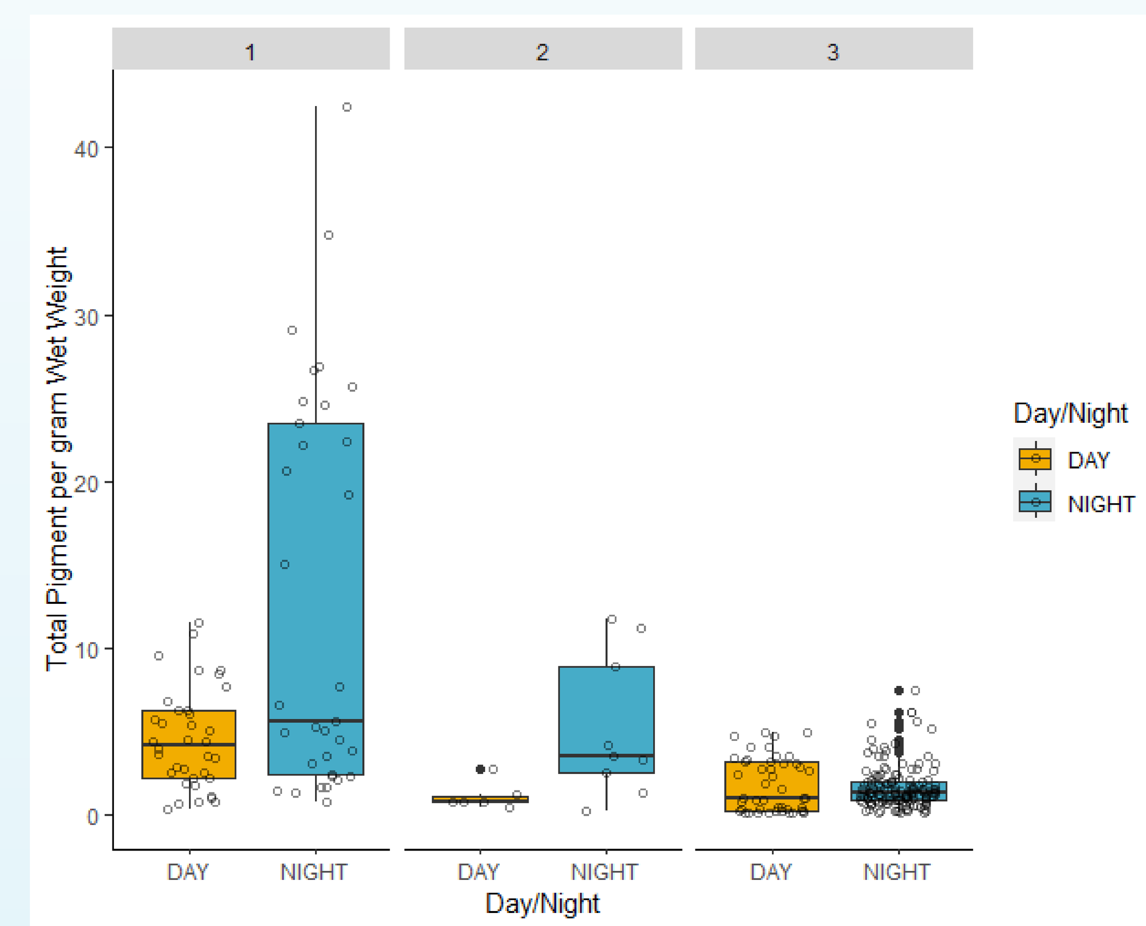

Figure 8. Median (± SE) total pigment per gram wet weight for Cycles 1-3. Colors same as in Fig. 6.

Results

- Pyrosomes in the offshore Cycle 3 were shorter (Kruskal-Wallis, p <0.05) than those from the nearshore cycles and the transects (Figure 4).
- Cycle 1's pigment normalized by wet weight is significantly greater (Kruskal-Wallis, p <0.05) than the closely located Cycle 2, plus Cycle 3 and the transects (Figure 5).
- Cycle 3's total pigment per colony, derived from pigment per gram wet weight and colony wet weight, is less (Kruskal-Wallis, p <0.05) than Cycles 1 and 2 (Figure 6).
- Cycle 2 pyrosomes (Kruskal-Wallis, p <0.05) are larger in night hauls than day hauls (Figure 7).
- More pigment per gram wet weight (Kruskal-Wallis, p <0.05) is found in Cycle 1 day tows than night tows (Figure 8).

Discussion

- Length varies significantly based on location, coastal upwelling may sustain larger colonies, oligotrophic waters likely limit colony growth.
- In addition to longitude and latitude, factors such as temperature, salinity, and sunlight may impact phytoplankton consumption
- Length impacts phytoplankton consumption; shorter pyrosomes consume less overall.
- Pyrosome diel vertical migration (DVM) may influence length of pyrosomes found in hauls and pyrosome phytoplankton consumption.

Future Directions:

- Stable isotope analysis on samples will observe $\delta^{13}C$ for consumption of primary producers and $\delta^{15}N$ for trophic level.
- These observations will impact research to convert gut pigment into grazing rate per day and estimate the grazing impact of the SCC pyrosome population.
- Continued research is crucial, as the range expansion of gelatinous zooplankton is significantly changing the diet of commercially and ecologically valuable fishes[5] (Figure 9).

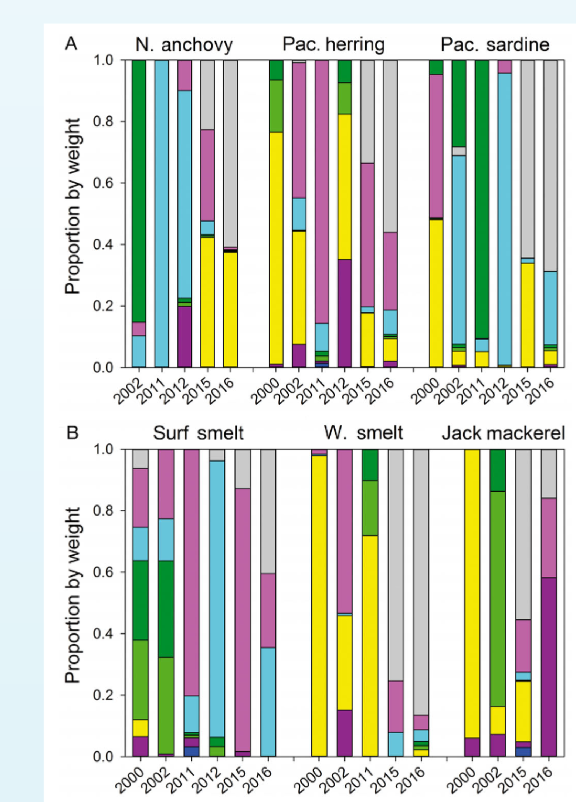

Figure 9. Diet composition of major, dominant forage fishes in the CCE in June by year, colored by major taxonomic groups. Grey blocks represent gelatinous zooplankton. Fish diets exhibit a large increase in the fraction of gelatinous zoo-plankton between 2014 and 2015, likely due to an anomalously warm mass of water in 2014 (the "Blob") which could have resulted in pyrosome range expansion[4].

References

1. "Image 2021-01-31a-a42764" by Randall Spangler under CC BY-NC 4.0
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