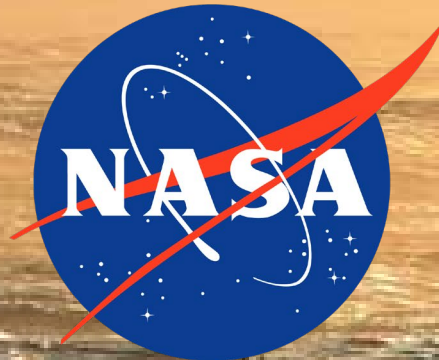
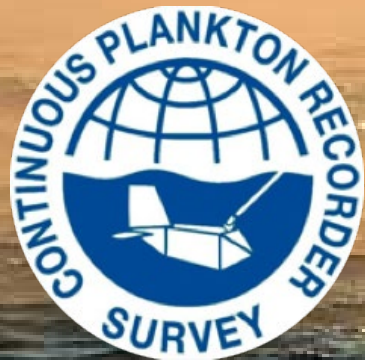


# Influence of Temperature and the 2014-2016 Heat Wave on Regional Zooplankton Community Structure in the eastern North Pacific

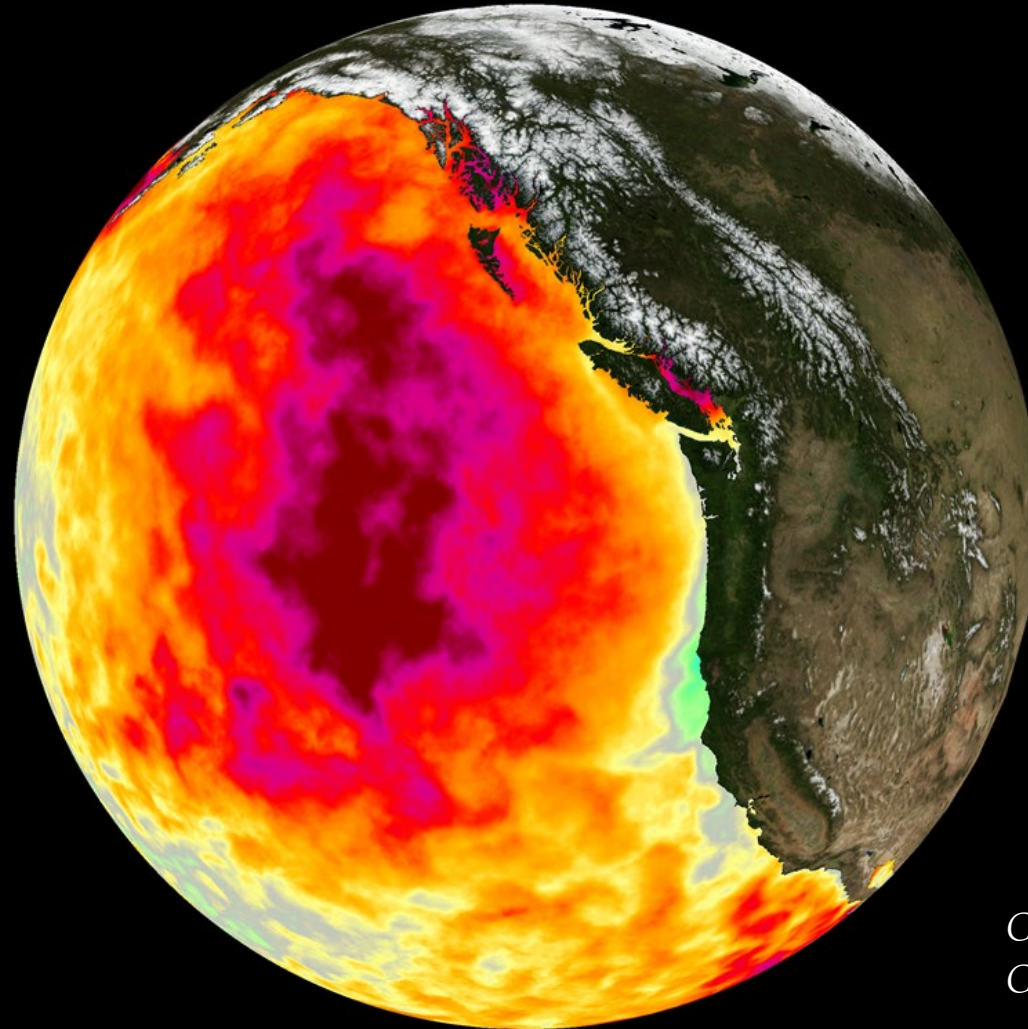
Brian Hoover<sup>1</sup>, Marisol García-Reyes<sup>1</sup>, Sonia Batten<sup>2</sup>, Chelle Gentemann<sup>3</sup>, Kathleen Dohan<sup>3</sup>, Lauren Ashlock<sup>4</sup>, William Sydeman<sup>1</sup>



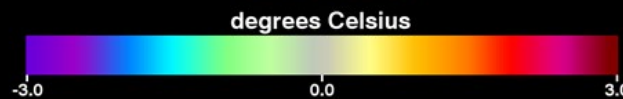
<sup>1</sup> Farallon Institute; <sup>2</sup> Continuous Plankton Recorder Survey; <sup>3</sup> Earth and Space Research; <sup>4</sup> University of Vermont

# SST Anomaly: May 2015

Sea Surface Temperature Anomaly (SSTA)  
May 2015



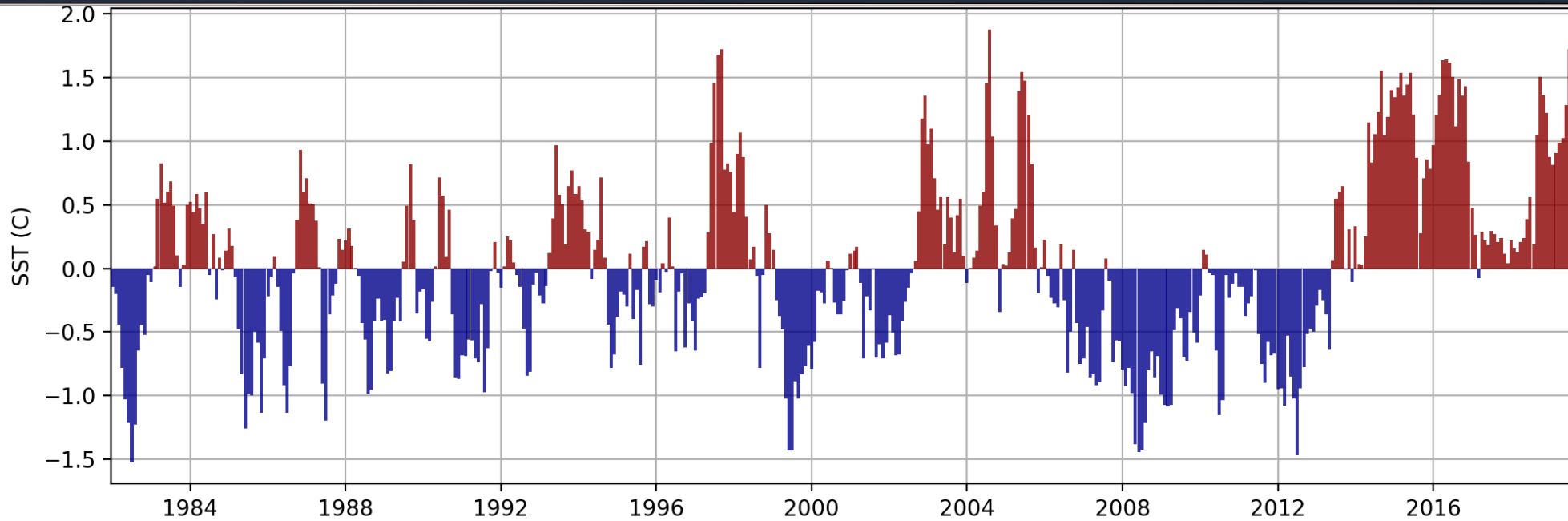
*Chelle Gentemann and JPL PO.DAAC:  
Charles Thompson and Jeffery Hall.*



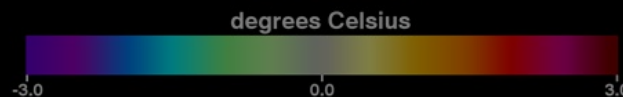
# SST Anomaly: May 2015

Sea Surface Temperature Anomaly (SSTA)  
May 2015

Gulf of Alaska SST Anomaly Time Series



[github.com/python4oceanography/PICES-tools](https://github.com/python4oceanography/PICES-tools)

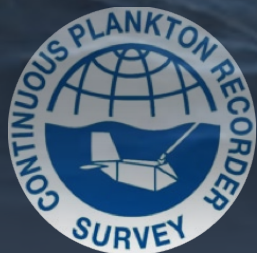


# Hypothesis & Methods...

**BASELINE:** What is the baseline zooplankton community pattern in Northeast Pacific (NEP)?

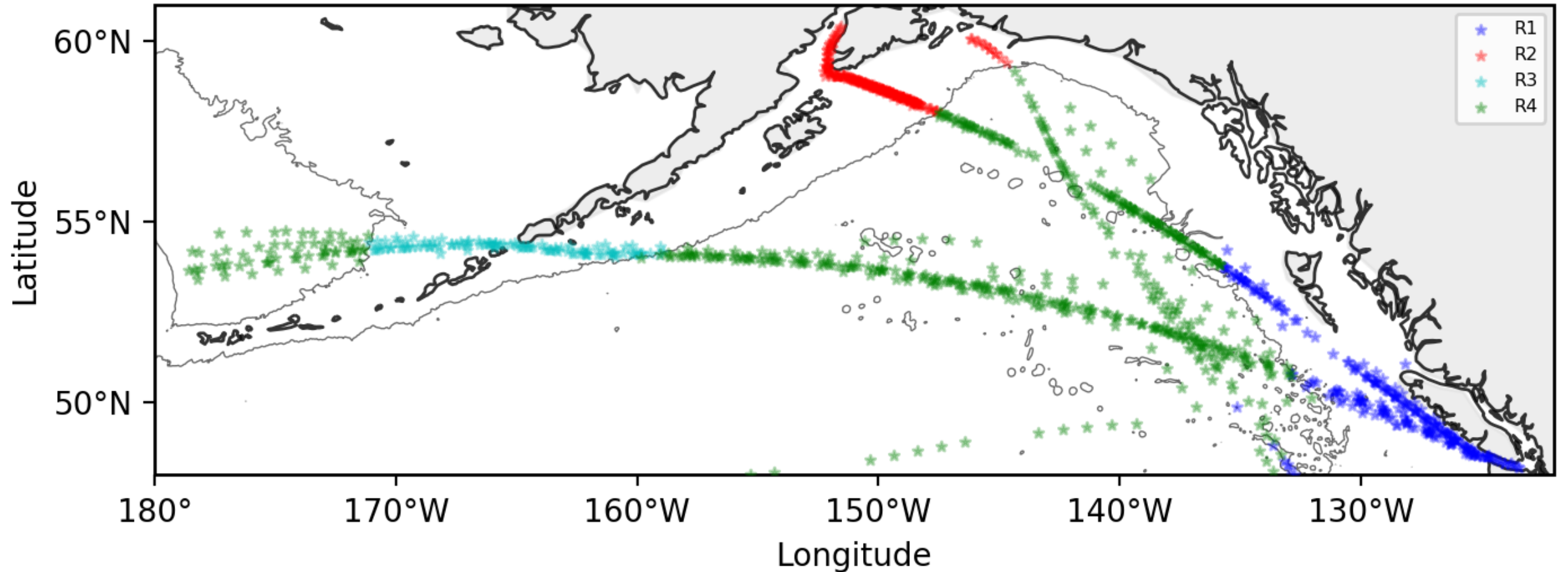
**HYPOTHESIS:** Zooplankton communities in NEP are spatially persistent across years of varying condition, including 2014-16 heat wave.

**APPROACH:** Analysis of 17 years' (2000 - 2016) of zooplankton assemblage data in the NEP, provided by Continuous Plankton Recorder Survey (CPR).



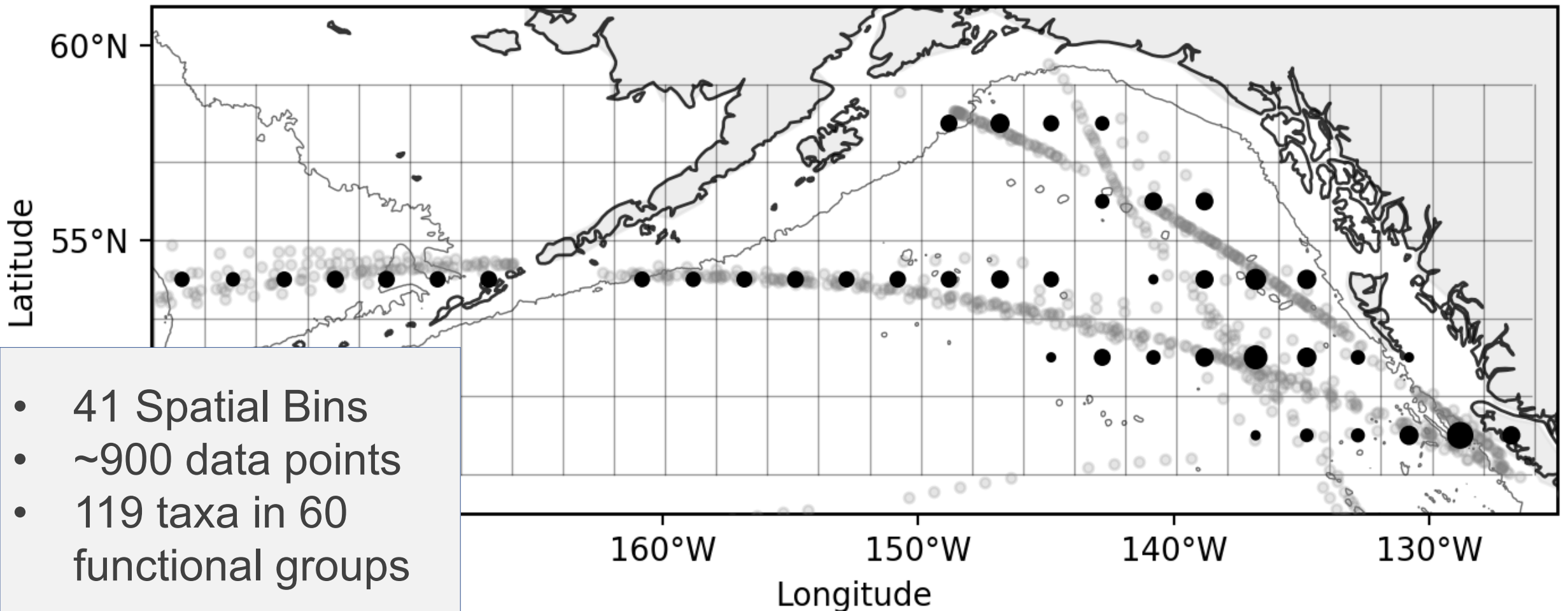
# Continuous Plankton Recorder

- South-North & East-West transects
- Summer: May 15 – Aug. 16



# CPR transects: 2000 - 2016

Zooplankton data summarized within 41 two \* two degree grid cells



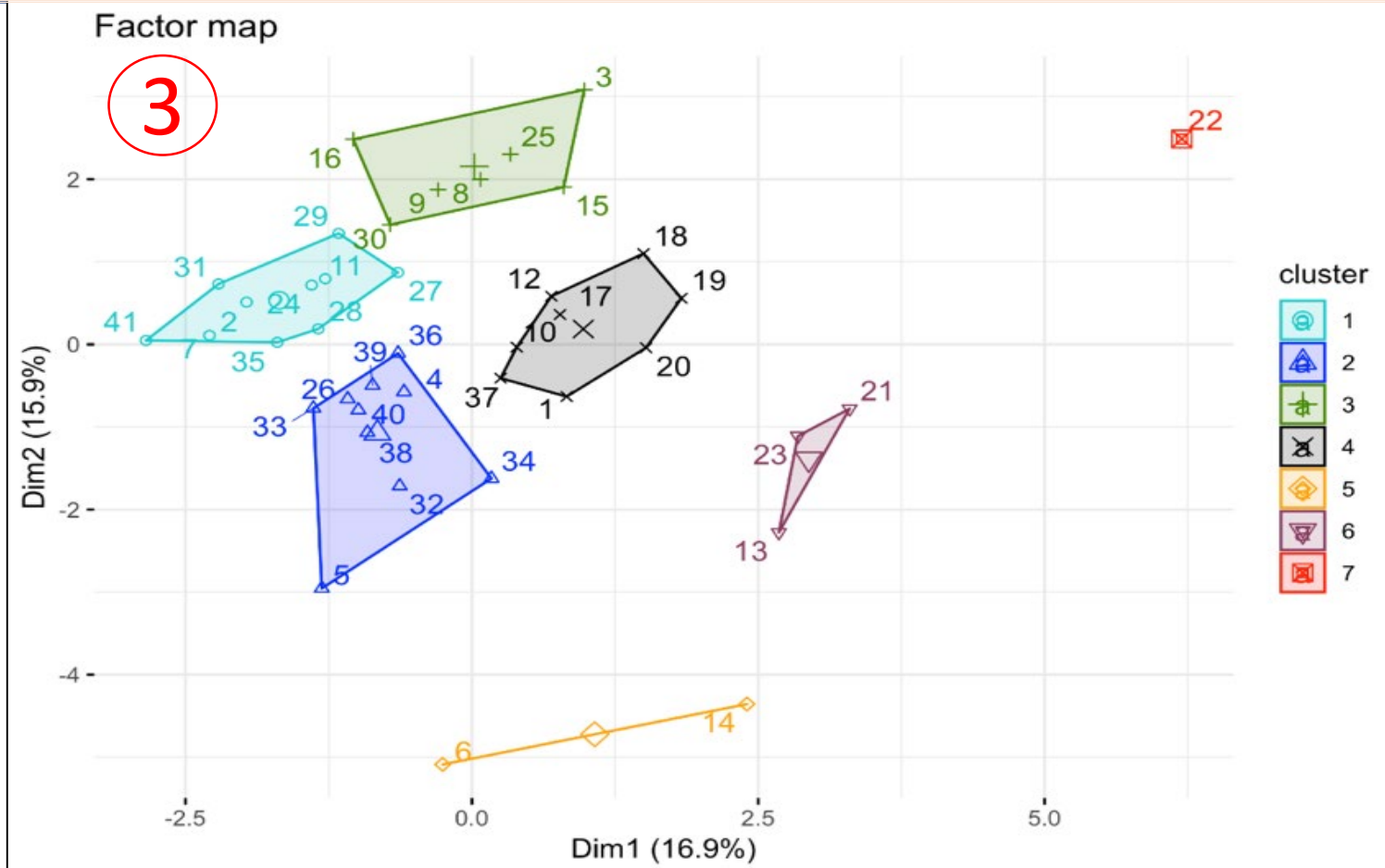
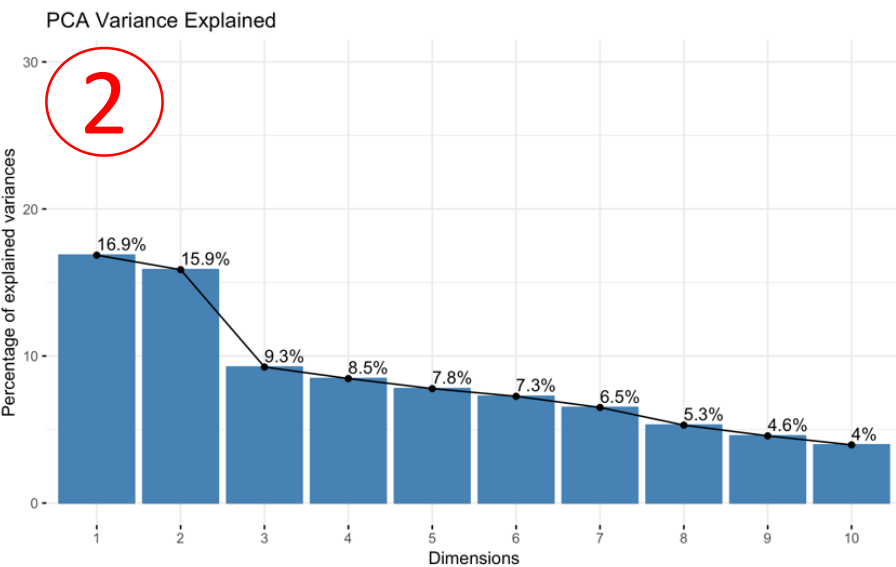
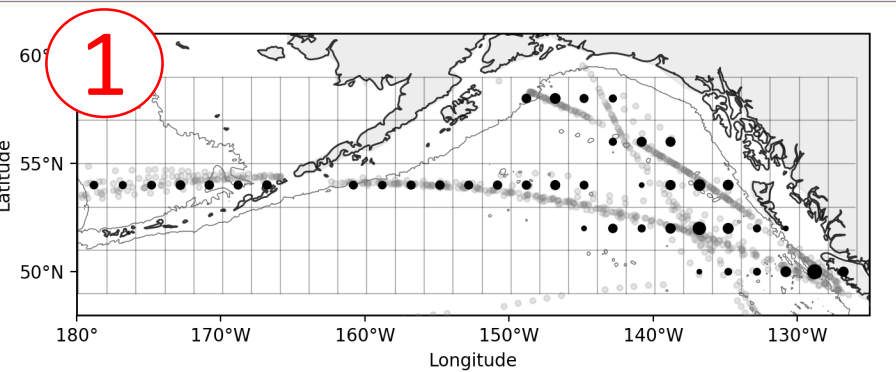
# Processing Data

18 dominant zooplankton taxa retained from 100+ identified taxa

Taxa	Functional group
<i>N. plumchrus flemingeri</i>	Large, cold-water grazing copepods
<i>E. bungii</i>	
<i>N. cristatus</i>	
<i>M. pacifica</i>	
<i>C. marshallae</i>	
<i>A. longiremis</i>	Small neritic copepods
<i>C. abdominalis</i>	
<i>C. pacificus</i>	Medium widespread copepods
<i>Pseudocalanus</i> spp.	Small widespread copepods
<i>Oithona</i> spp.	
<i>Clione</i> spp.	
<i>L. helicina</i>	Pteropods
Salpidae	Gelatinous filter-feeders
Appendicularia	
Siphonophores	
Euphausiacea	Large diel migrators
Hyperiididae	Amphipods
Chaetognaths	Arrow worms, predators of small copepods

# Methods to Determine Community Spatial Patterns

- 1) Binning the data in spatial grid
- 2) Initial detrending using Principle Component Analysis
- 3) Hierarchical cluster analysis applied to first 2 PC loadings (HCPC)



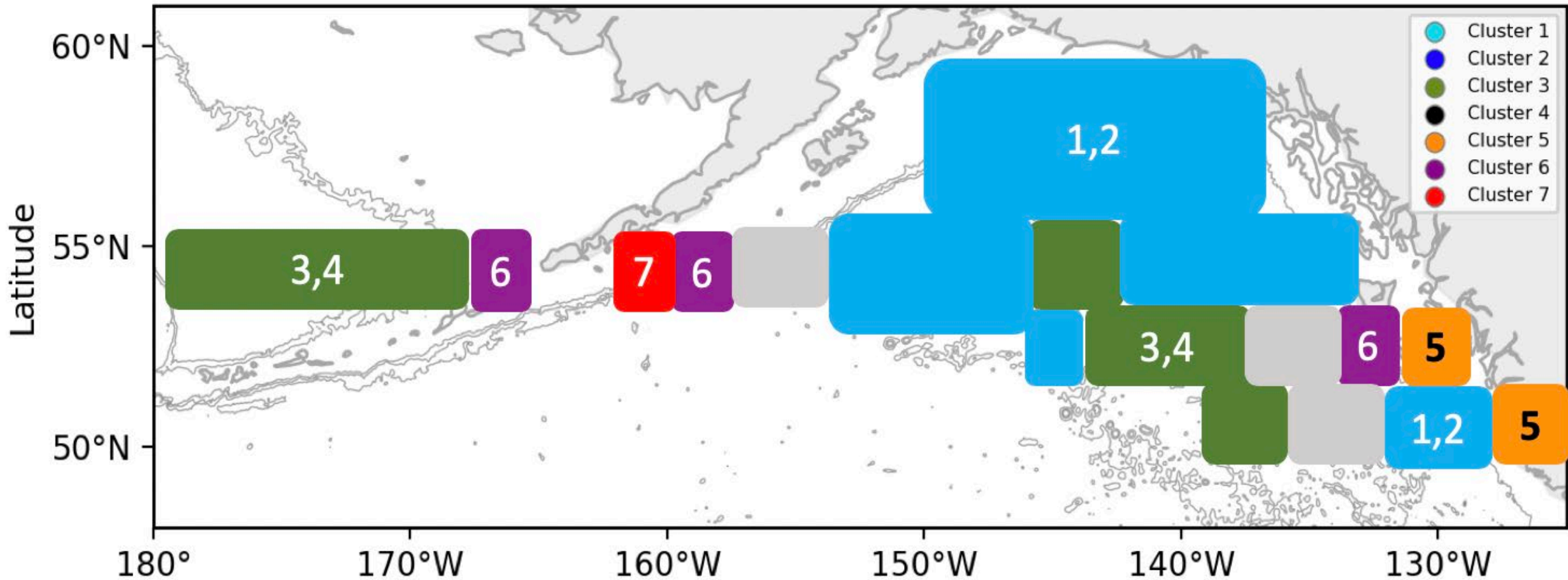


**-** Central gyre

**+** Aleutians & Pacific current

**+** **+** Coastal sites

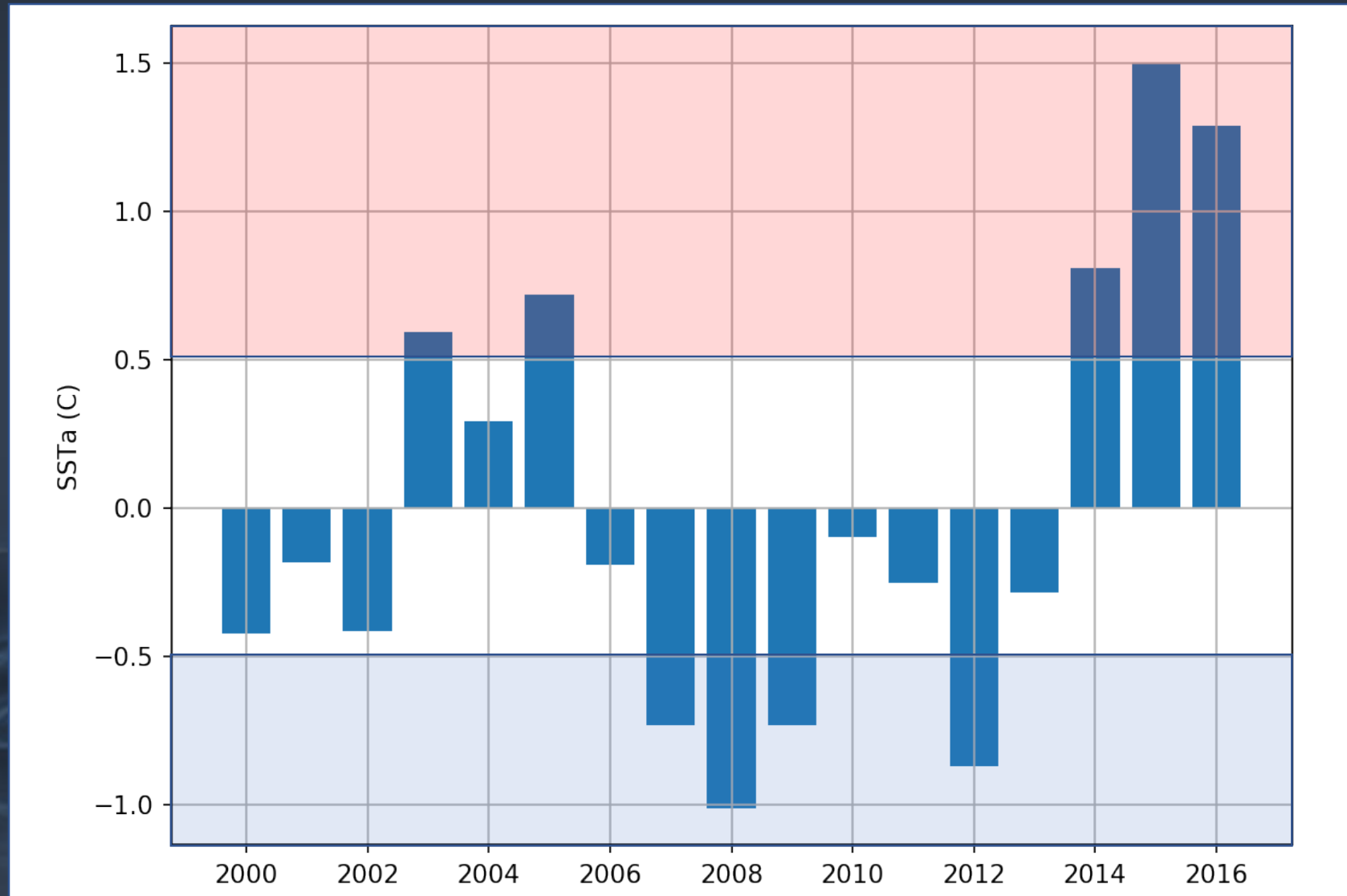
**+** Unimak



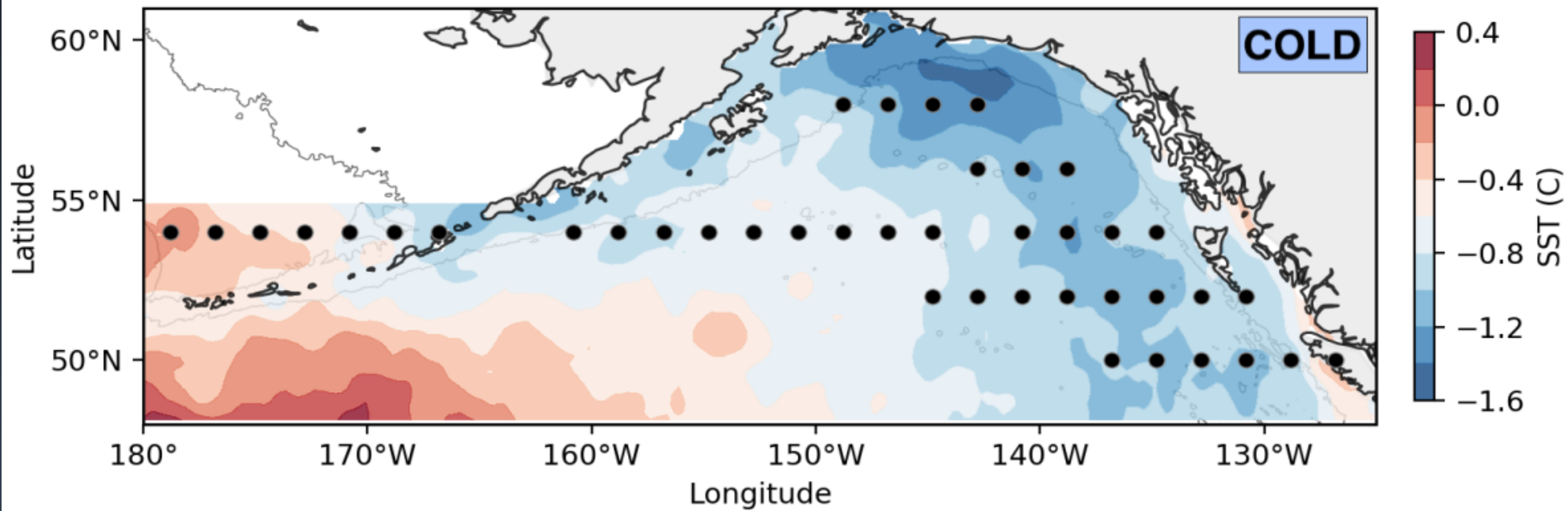
# Are Community Patterns Persistent?

## Defining Temperature Anomalies

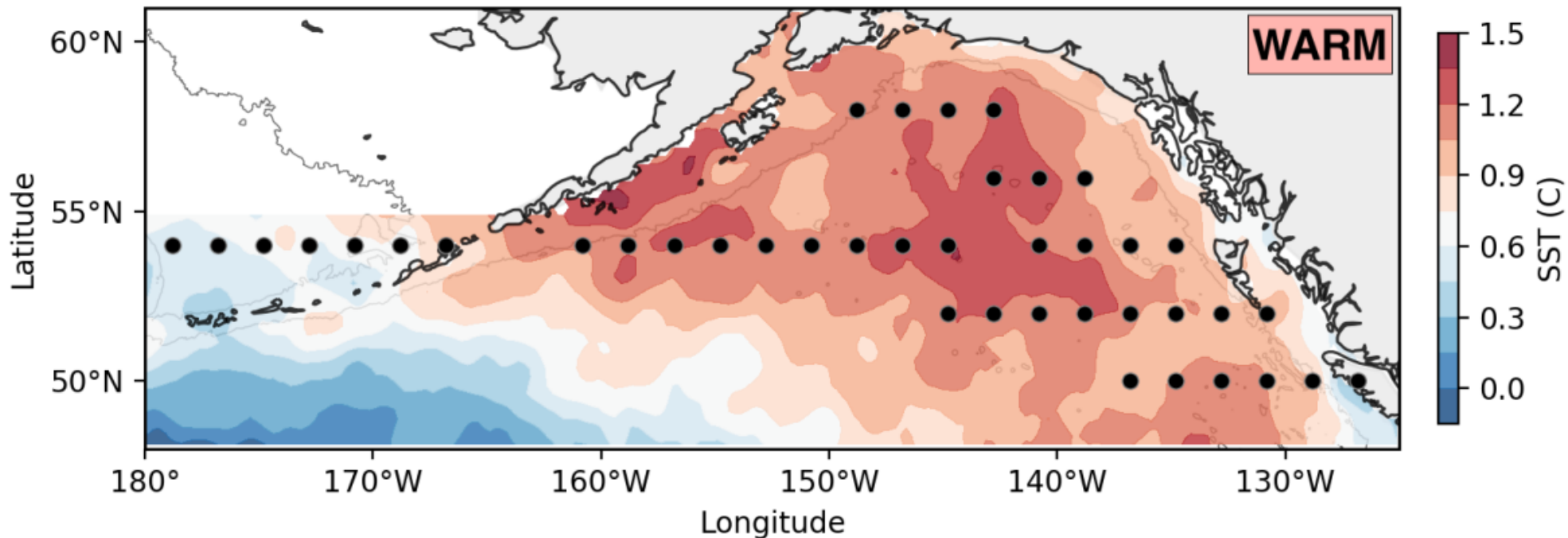
> 0.5°C  
WARM  
- 2003  
- 2005  
- 2014  
- 2015  
- 2016



< 0.5°C  
COLD  
- 2007  
- 2008  
- 2009  
- 2012



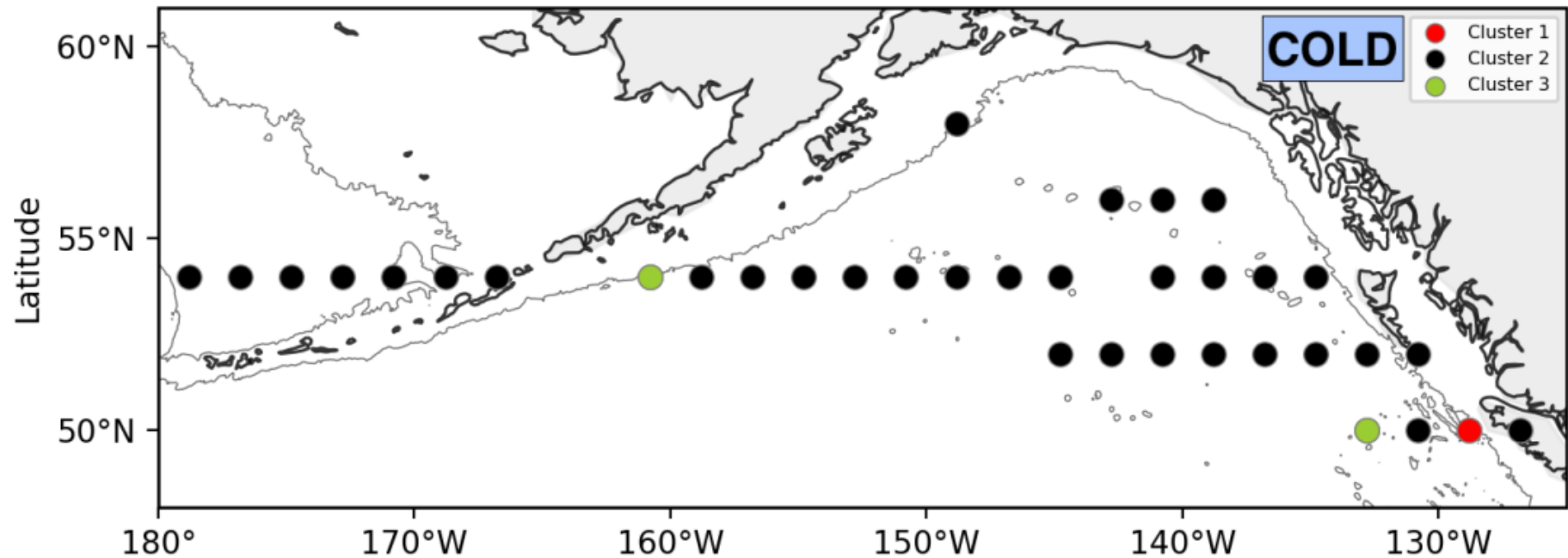
< 0.5°C  
COLD  
 - 2007  
 - 2008  
 - 2009  
 - 2012



> 0.5°C  
WARM  
 - 2003  
 - 2005  
 - 2014  
 - 2015  
 - 2016

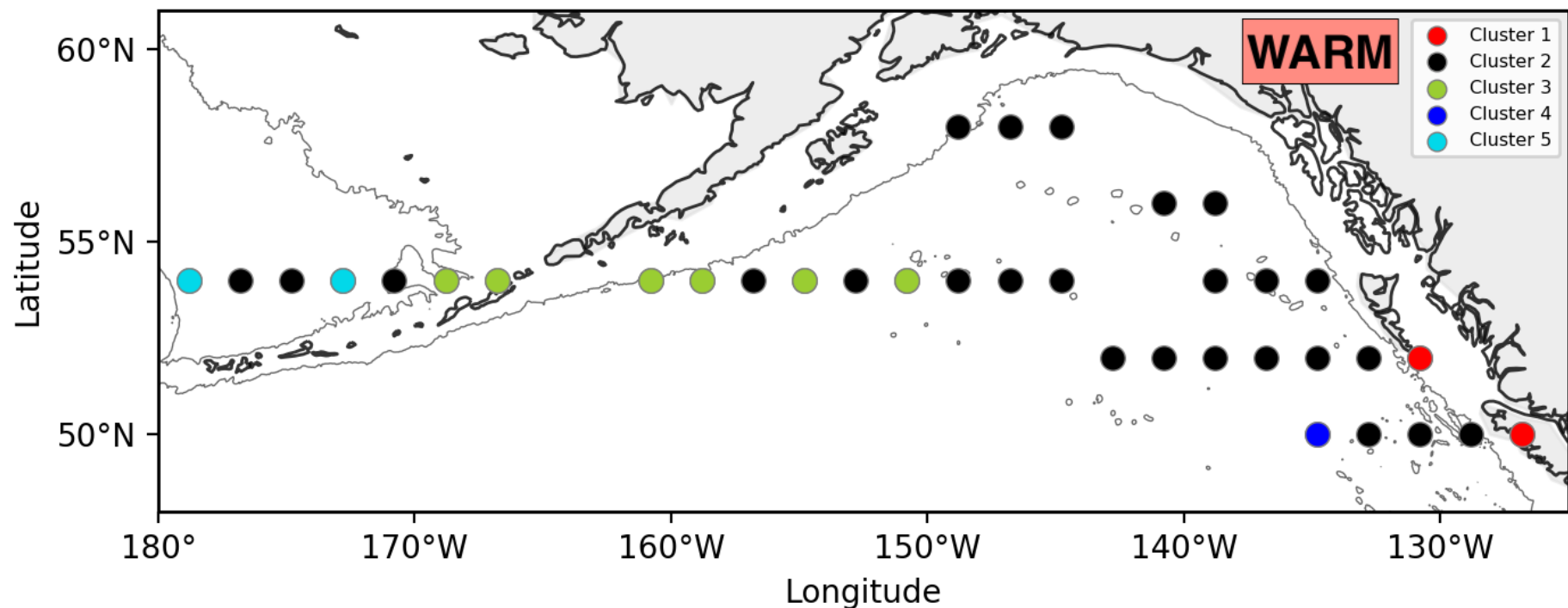
# COLD

- 3 clusters, little variation.
- Unique clusters are in Unimak and coastal sites.



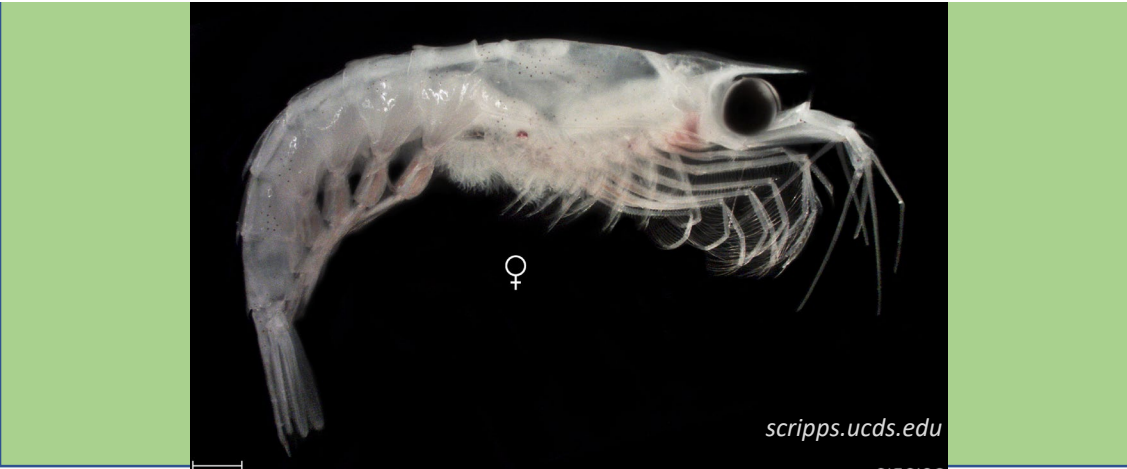
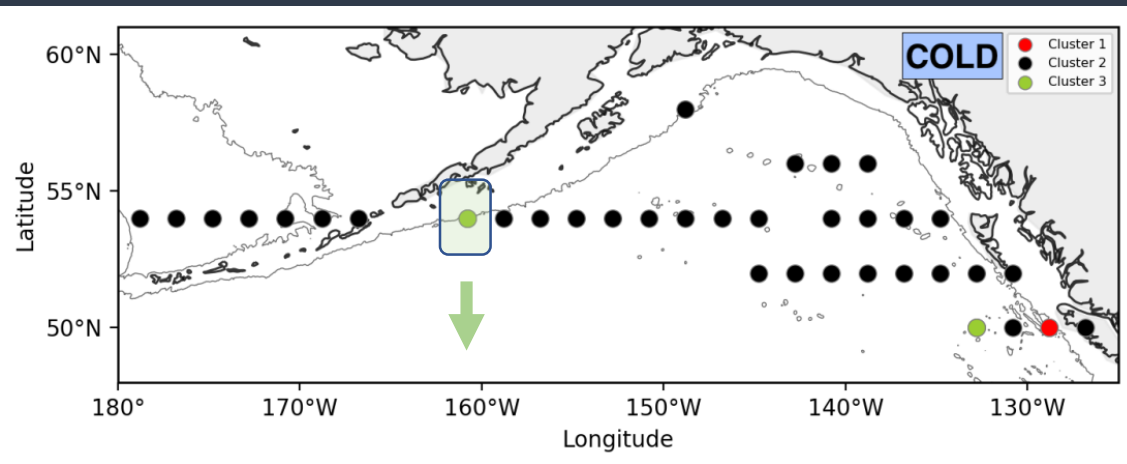
# WARM

- Aleutian signal spreads
- More pronounced coastal effect
- Additional cluster in the Bering Sea and the south GOA



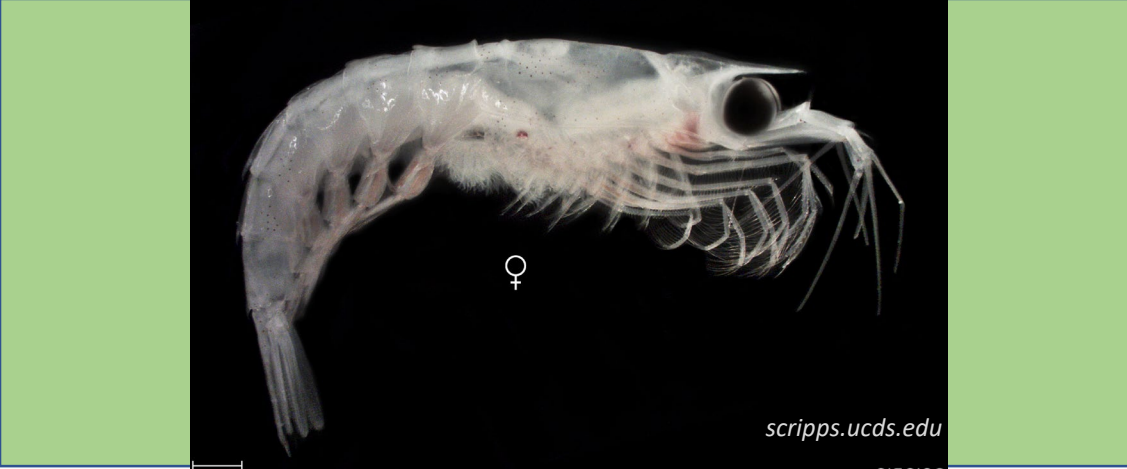
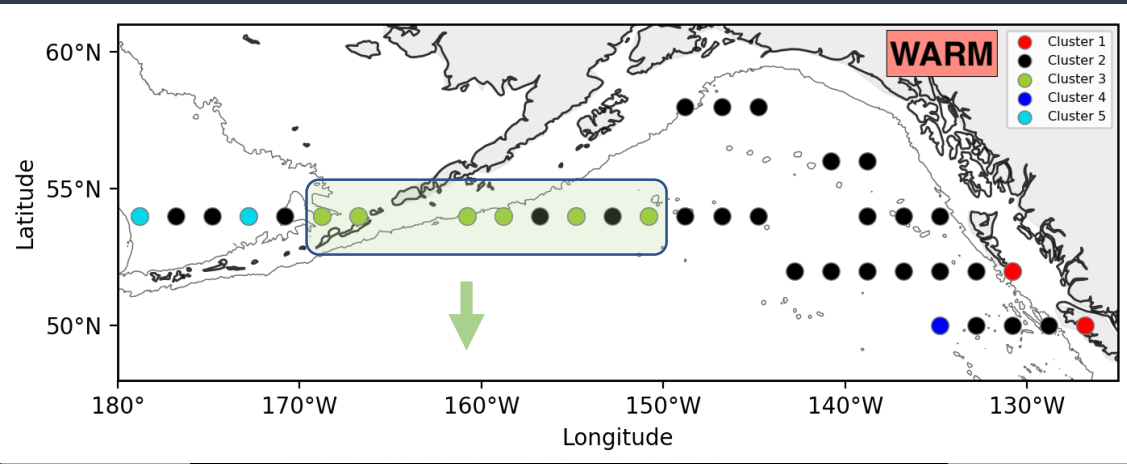
# Why does this matter?

Shifts in the zooplankton community assemblage alter the energetic structure of the food base

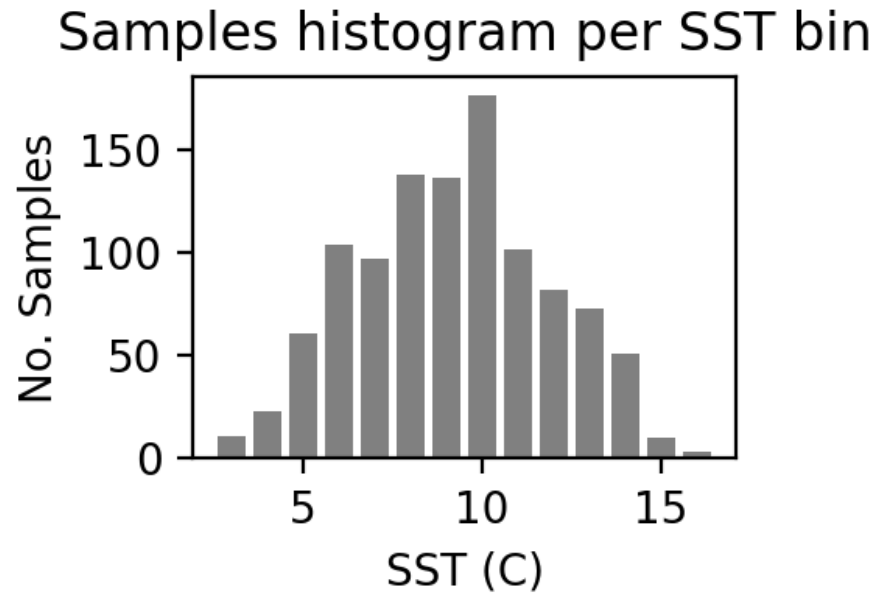
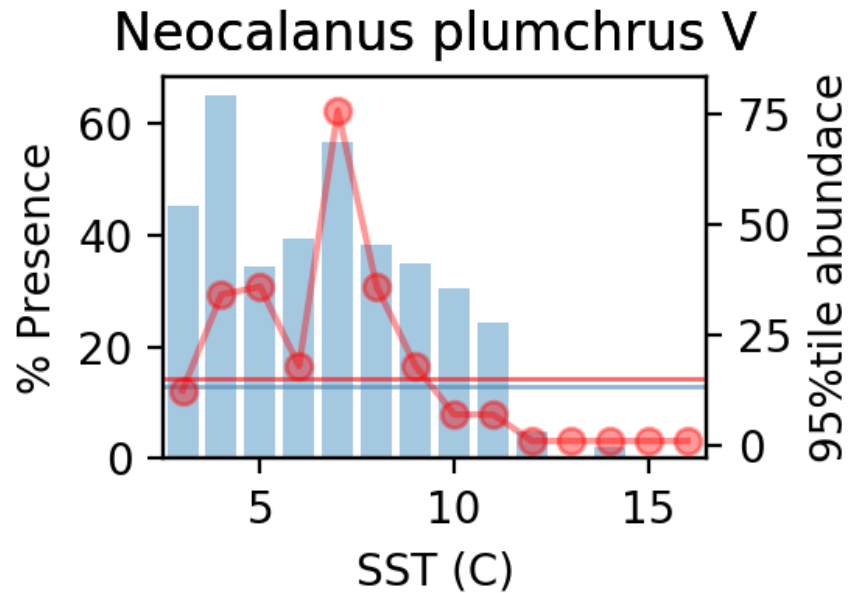
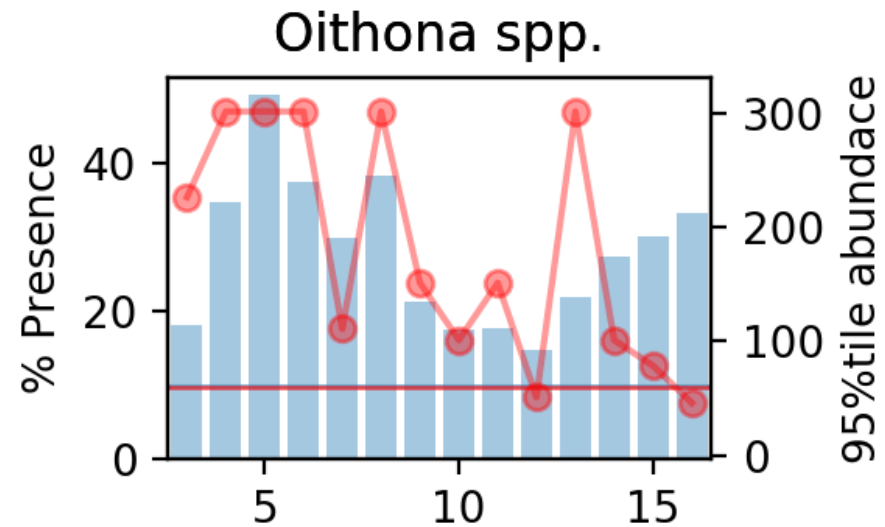
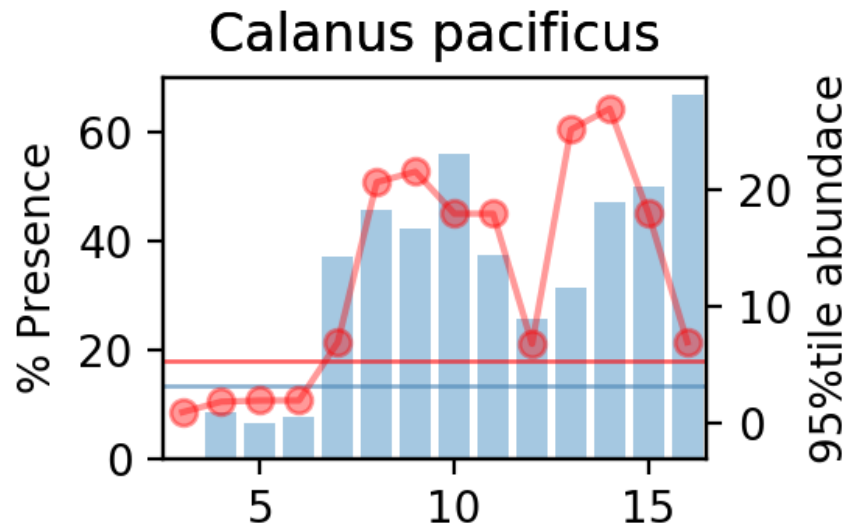


# Why does this matter?

Shifts in the zooplankton community assemblage alter the energetic structure of the food base



# Species-specific relationships (Lauren Ashcroft)



# Summary

HYPOTHESIS: Zooplankton communities in Northeast Pacific (NEP) are spatially persistent across years of varying condition

RESULTS:

- 1) Spatial shifts in coastal communities (Unimak and BC) associated with thermal anomalies
- 2) Spatial persistence in central and northern gyre
- 3) No study wide thermal effect on community assemblage, but significant structuring effects of Region (Bering vs. GOA;  $p = 0.012$ ) and Temp. \* Region ( $p = 0.04$ )



# Acknowledgements

