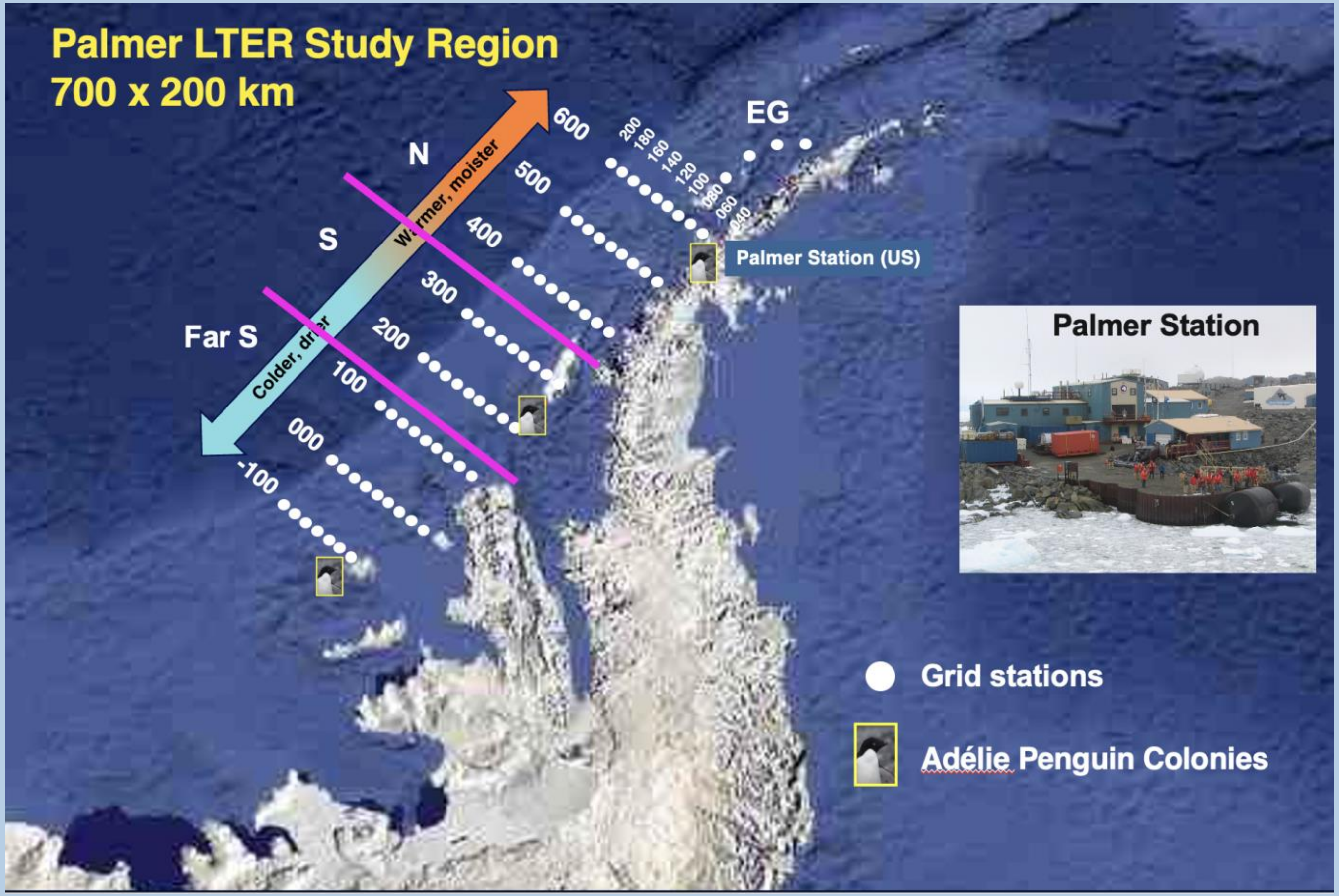
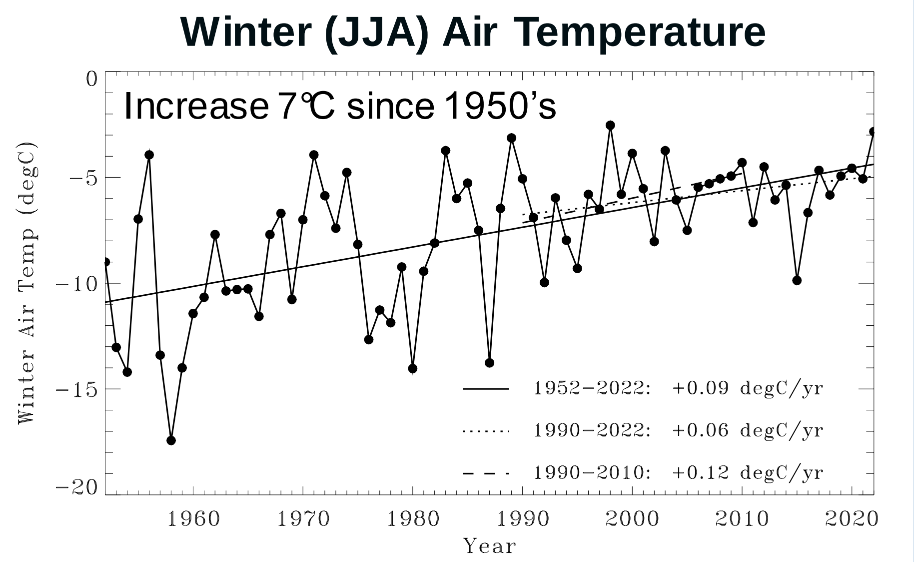
Larval Grey Rockcod: A potential climate change “winner” with implications for the western Antarctic Peninsula food web

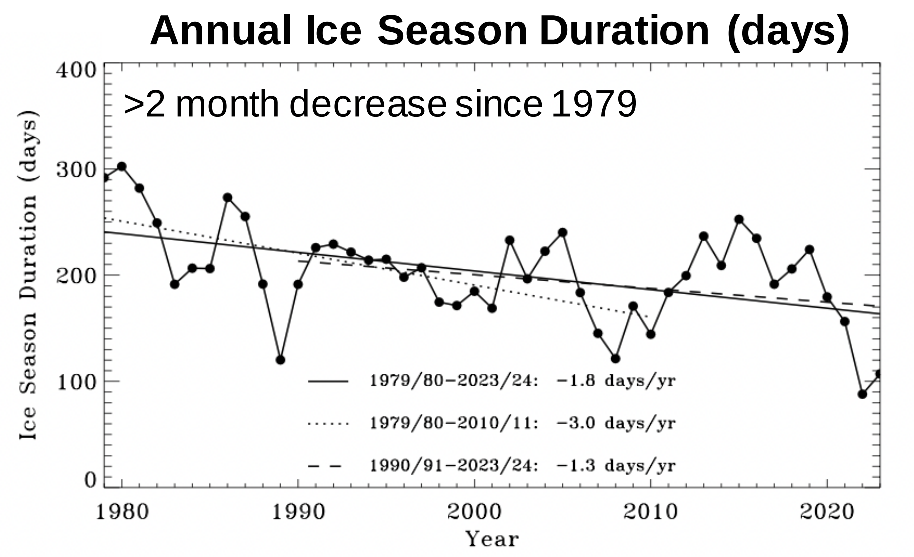
Meredith A. Nolan, Kiera M. Sears, Adena J. Schonfeld, Andrew D. Corso, Deborah K. Steinberg, and Eric J. Hilton

VIMS | William & Mary
Virginia Institute of Marine Science

Western Antarctic Peninsula (WAP)







Sharon Stammerjohn

Grey Rockcod *(Lepidonotothen squamifrons)*

Range: subantarctic islands to the Antarctic Peninsula

Life History:

- Spawn in October
- Hatch in November/December
- <u>Larvae abundant in January/February</u>
- Develop for 2 years before transitioning to benthic habitat

scandposters.com

Andrew Corso

Why are we interested in Grey Rockcod?

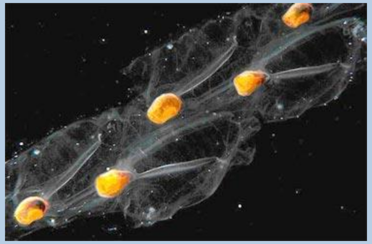
1) Ability to tolerate warmer water

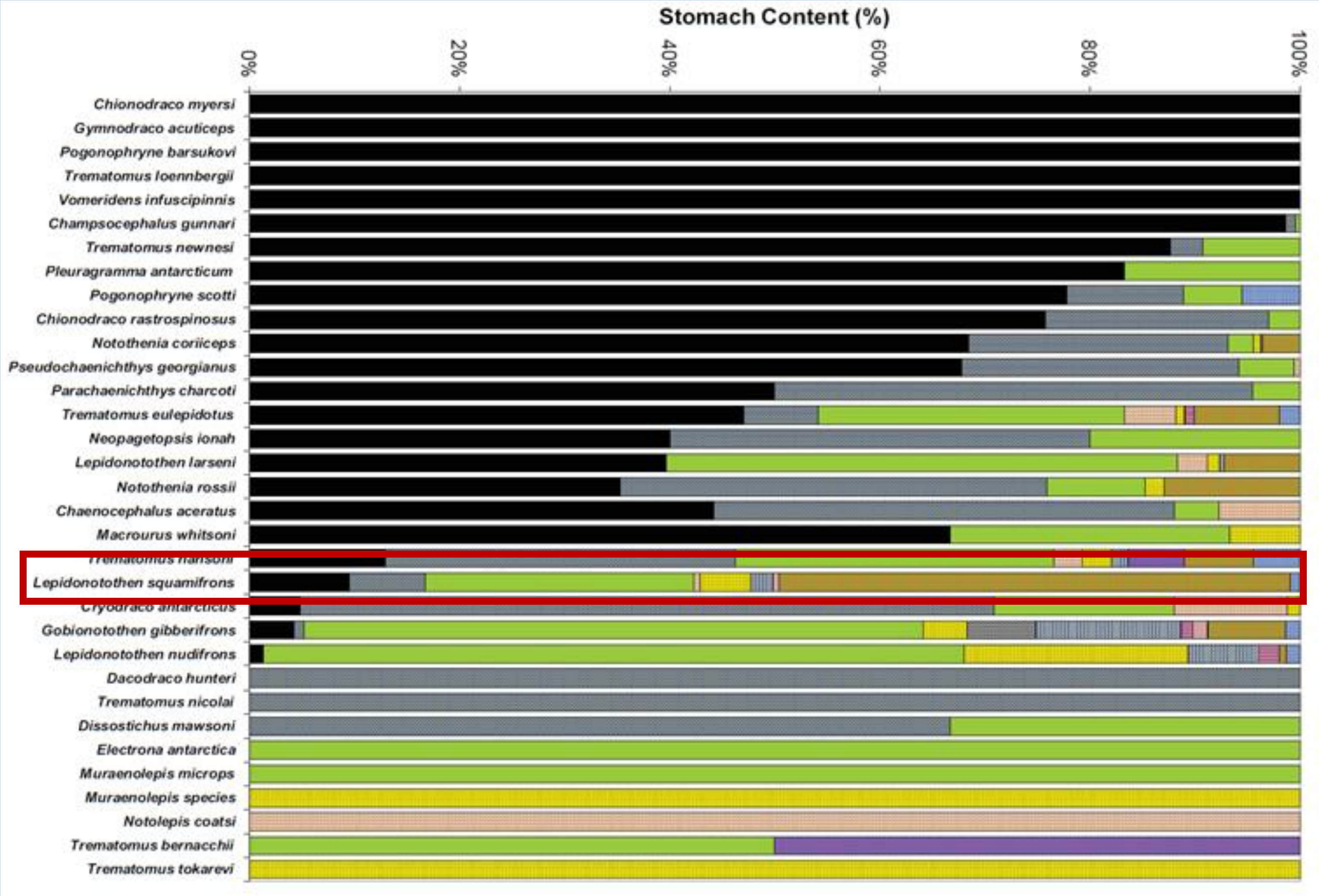
Compensation in cellular respiration (Strobel et al 2013)

Low expression of antifreeze glycoproteins (Miya et al 2016)

2) Diet

Salps are an important part of adult diets





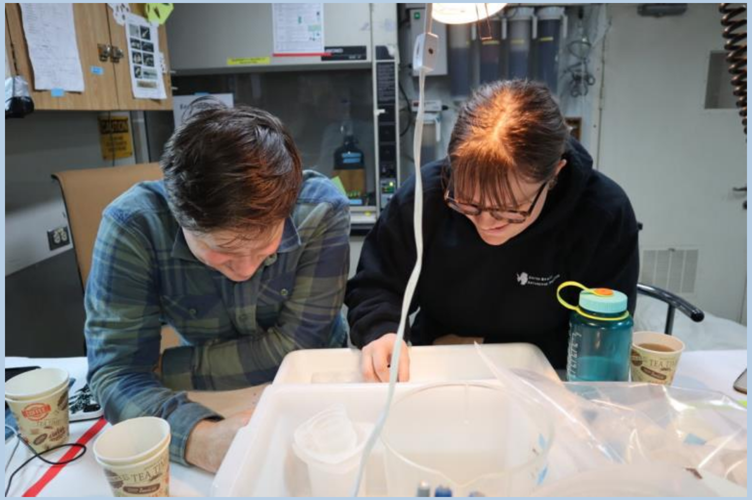
U.S. AMLR 2009 Report

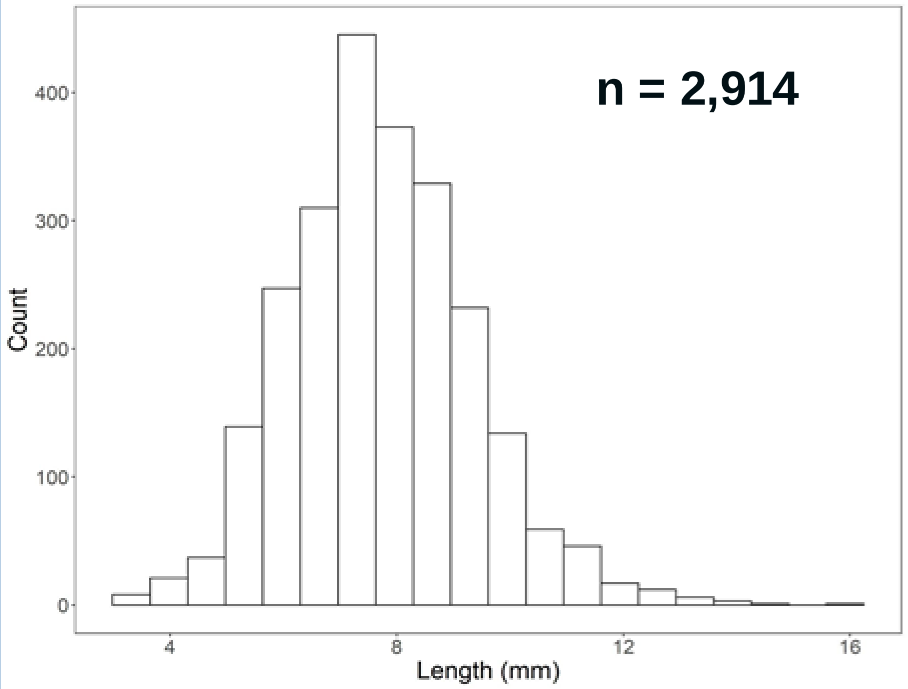
Questions:

1) Are there long-term changes in Grey Rockcod distribution?
2) What are the environmental drivers of abundance?
3) What are the environmental drivers of growth rate?

Collecting and measuring larval Grey Rockcod

Andrew Corso





2-m square frame metro net

700 um mesh

Towed to ~120m

Methods

1) Spatial patterns
   - Mean latitude for 5-year periods

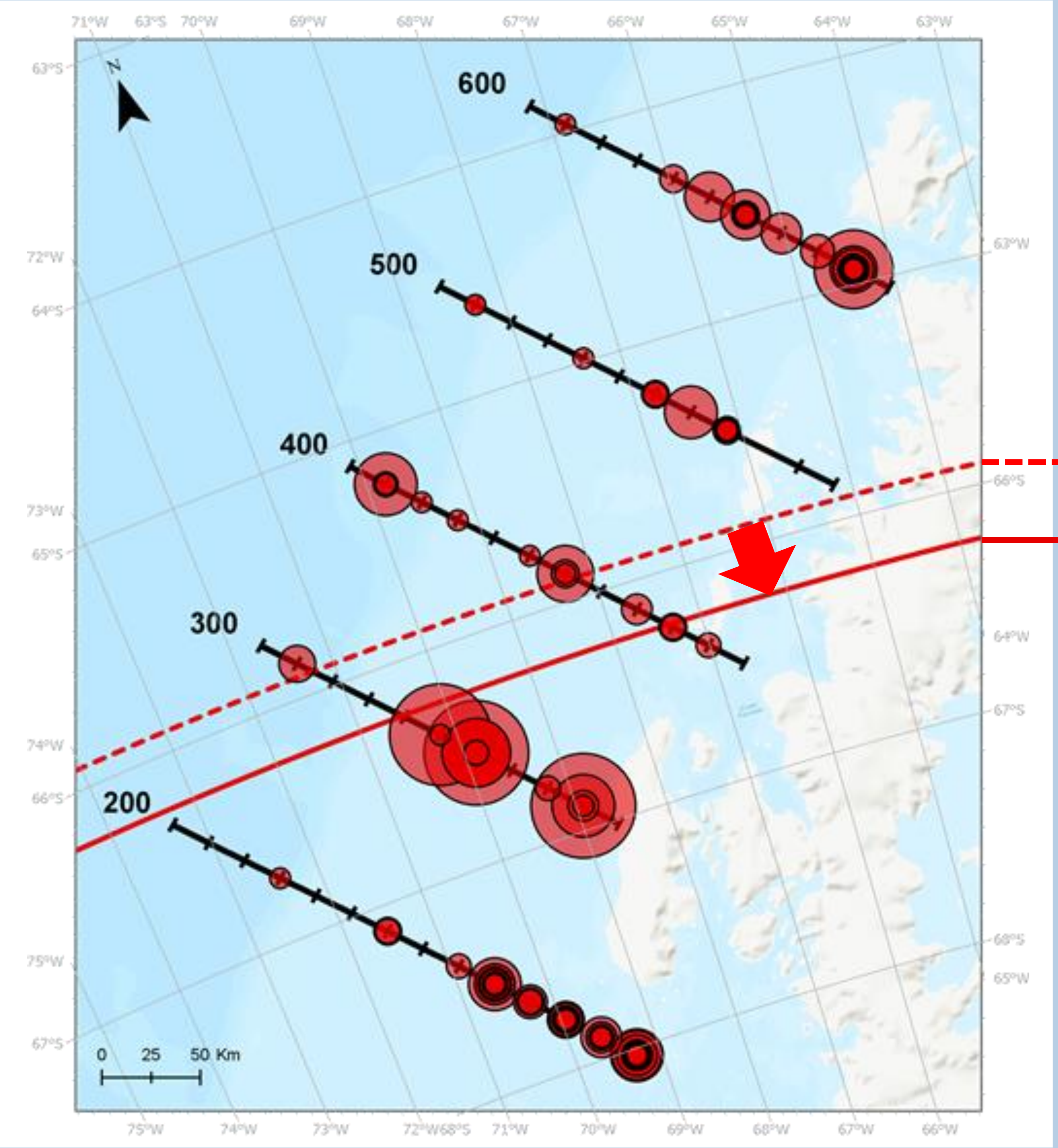
2) Modeling abundance
   - Count data
   - Environmental covariates

3) Modeling growth rate
   - Ordered years by temperature and fit to 3-year time blocks

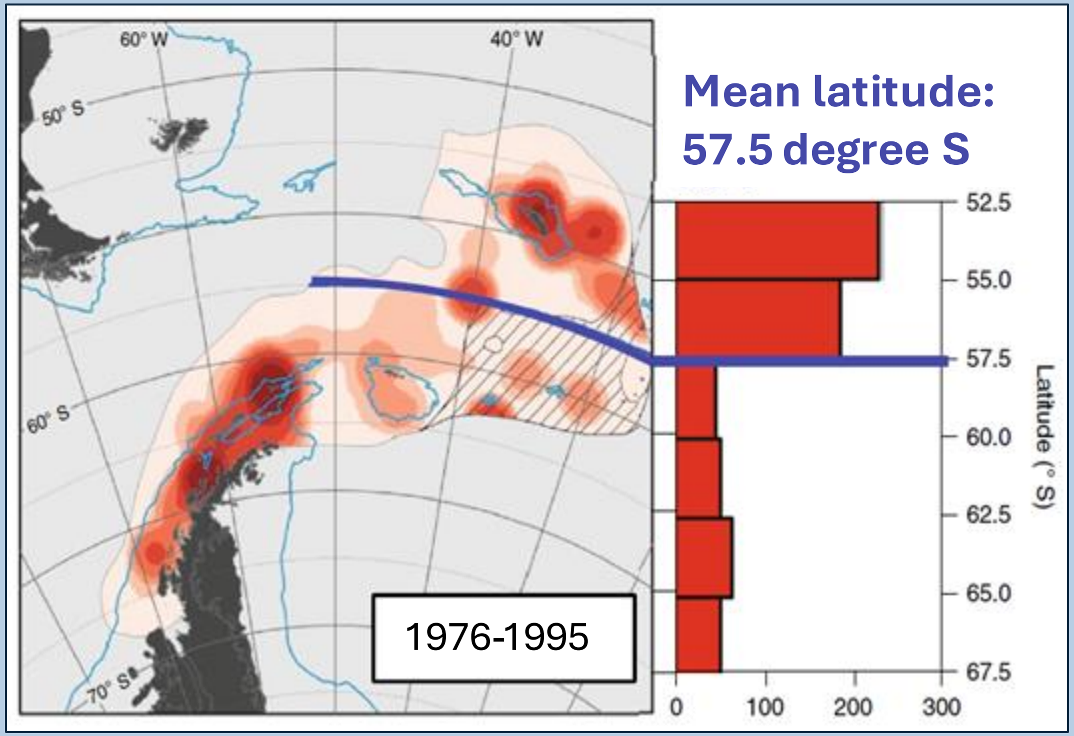
Long-term patterns in distribution (Expansion)

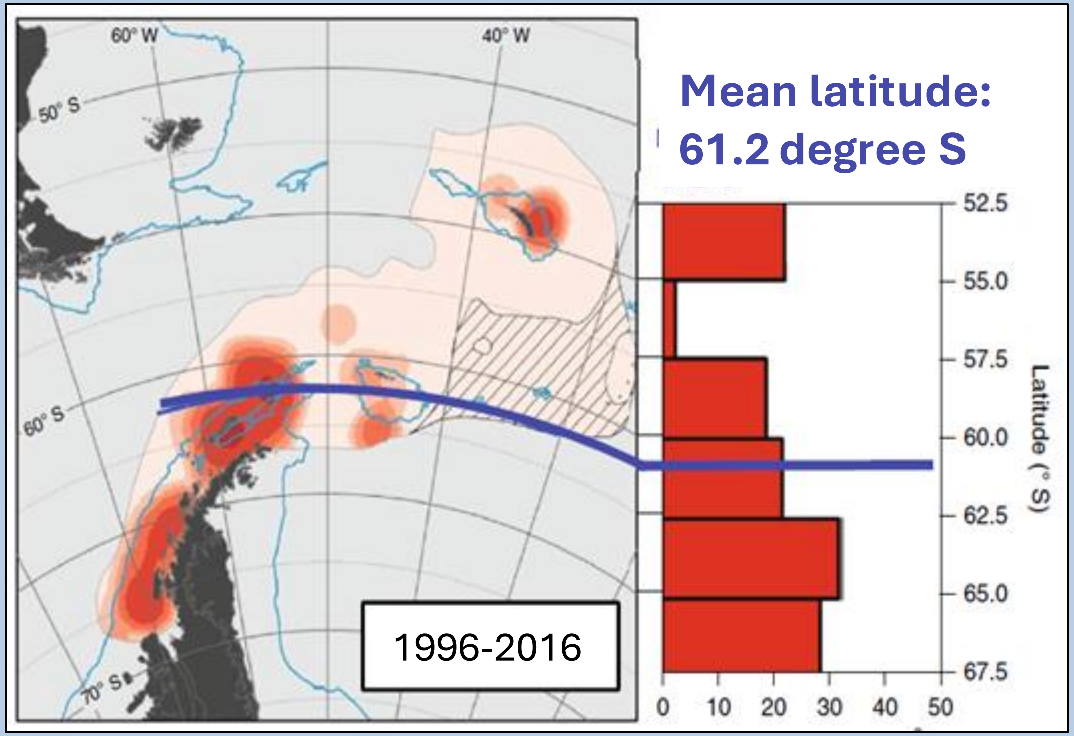
0.01-degree/year latitudinal shift

(~ 37km) from 1993 – 2017



Spatial analysis: Antarctic krill (Contraction)



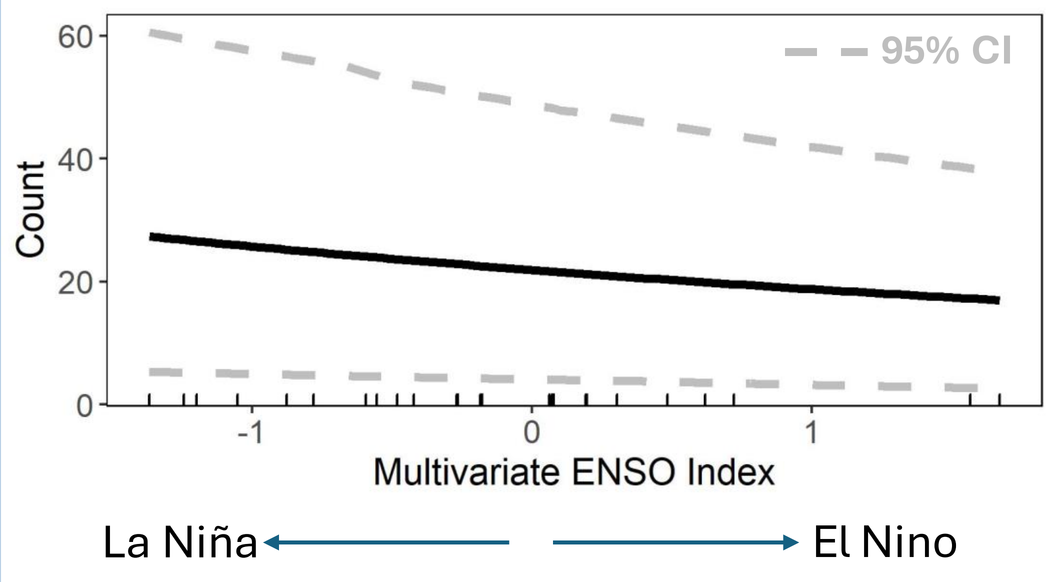


Atkinson et al. 2019

0.09-degree/year latitudinal shift

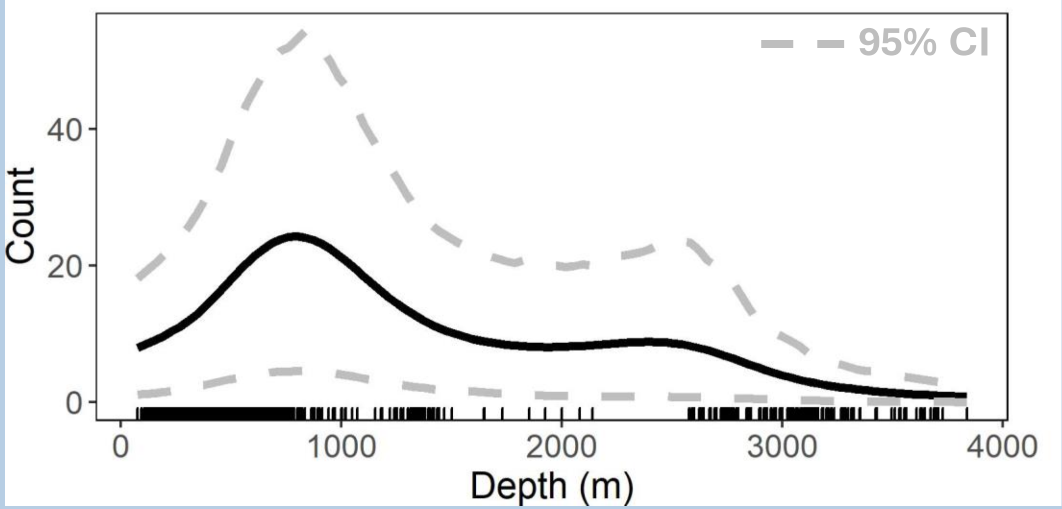
(~415km) from 1976 to 2016

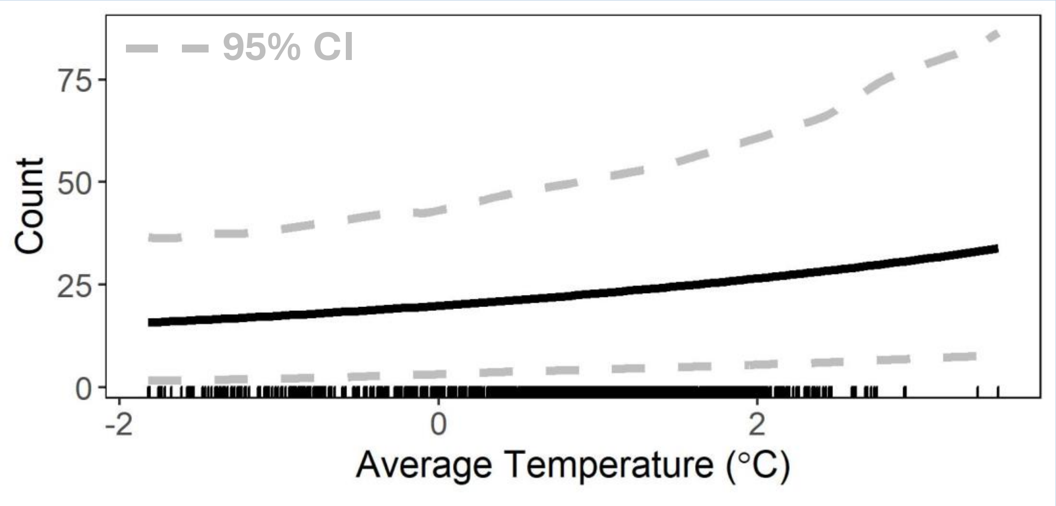
Modeling environmental drivers of abundance



La Niña: warmer air temperatures and wind, loss of sea ice

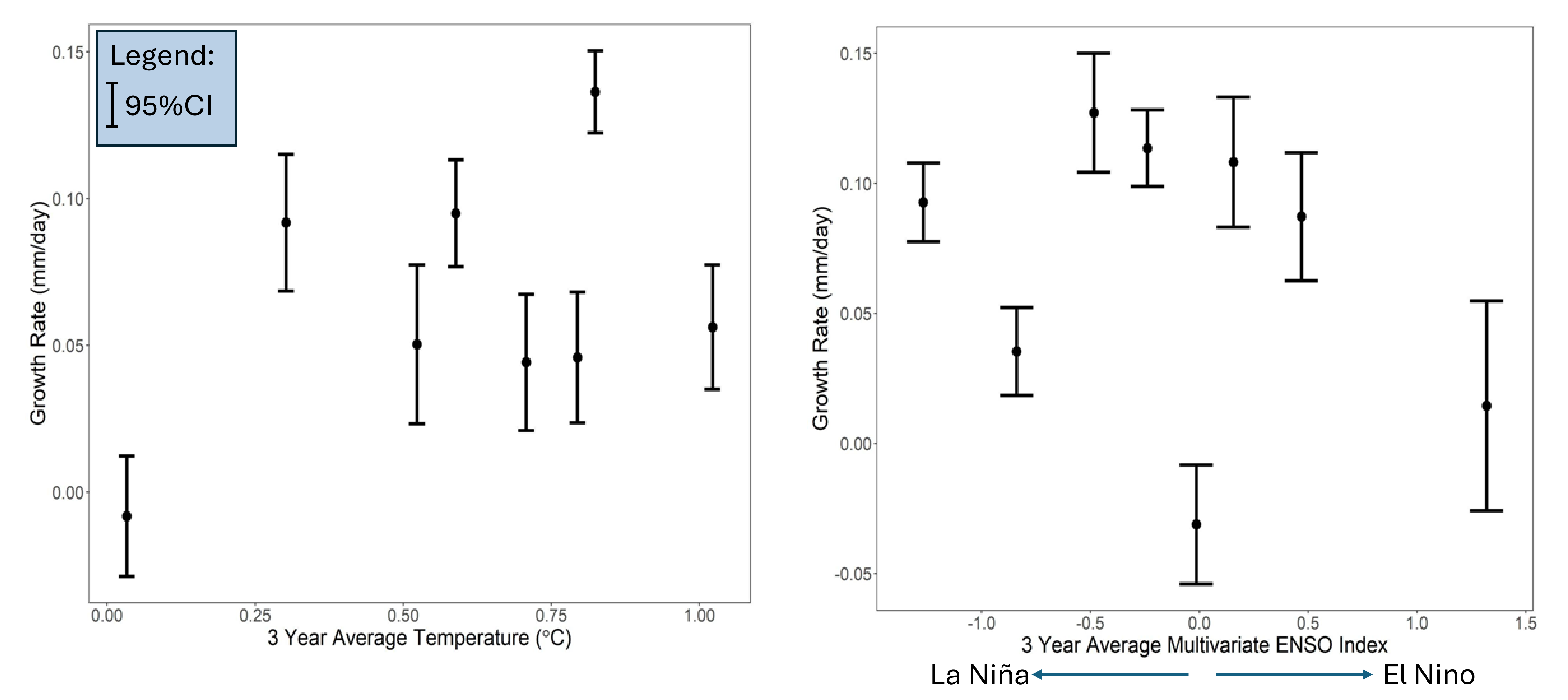
El Nino: cooler air temperatures and wind, promotes sea ice growth





More larvae in shallower depths, warmer sea surface temperatures, and La Niña conditions

Modeling environmental drivers of growth rate



Increased growth rate at higher temperatures and La Niña conditions

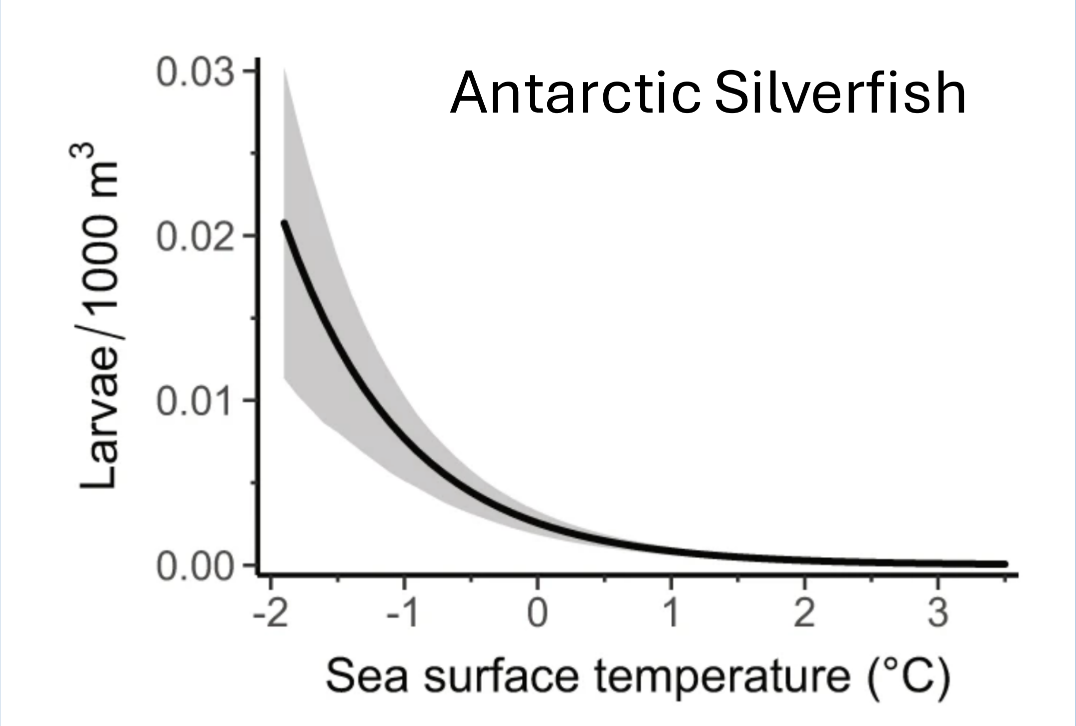
Summary

1) Small poleward shift in mean latitude of Grey Rockcod

2) Increased abundance and growth rate at higher temperatures and La Niña conditions

Conclusions

- Rare find in Antarctic fishes
- Potential climate change “winner”



Corso et al. 2022

Future directions

What is the relationship between temperature and growth rate? What are the mechanisms?

What are the physiological mechanisms that may support tolerance of climate change conditions?

- Heat shock protein analysis

What are the potential food web impacts?

Acknowledgements

- Rob Latour
- Joe Cope, Tor Mowatt-Larssen, Maya Thomas
- PAL LTER collaborators
- Captain and crew of the ASRV Laurence M. Gould