

# Variation of Plankton in Australian Coastal Waters with El Niño Southern Oscillation

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# Acknowledgement of Country

We would like to acknowledge the Traditional Owners and their custodianship of the lands on which we meet, work, and play.

We would also like to acknowledge the Traditional Owners of the land and sea country which the IMOS data used in this project has been collected from and processed.

We pay our respects to their Ancestors and their descendants, who continue cultural and spiritual connections to Country.

We recognise their valuable contributions to Australian and global society.

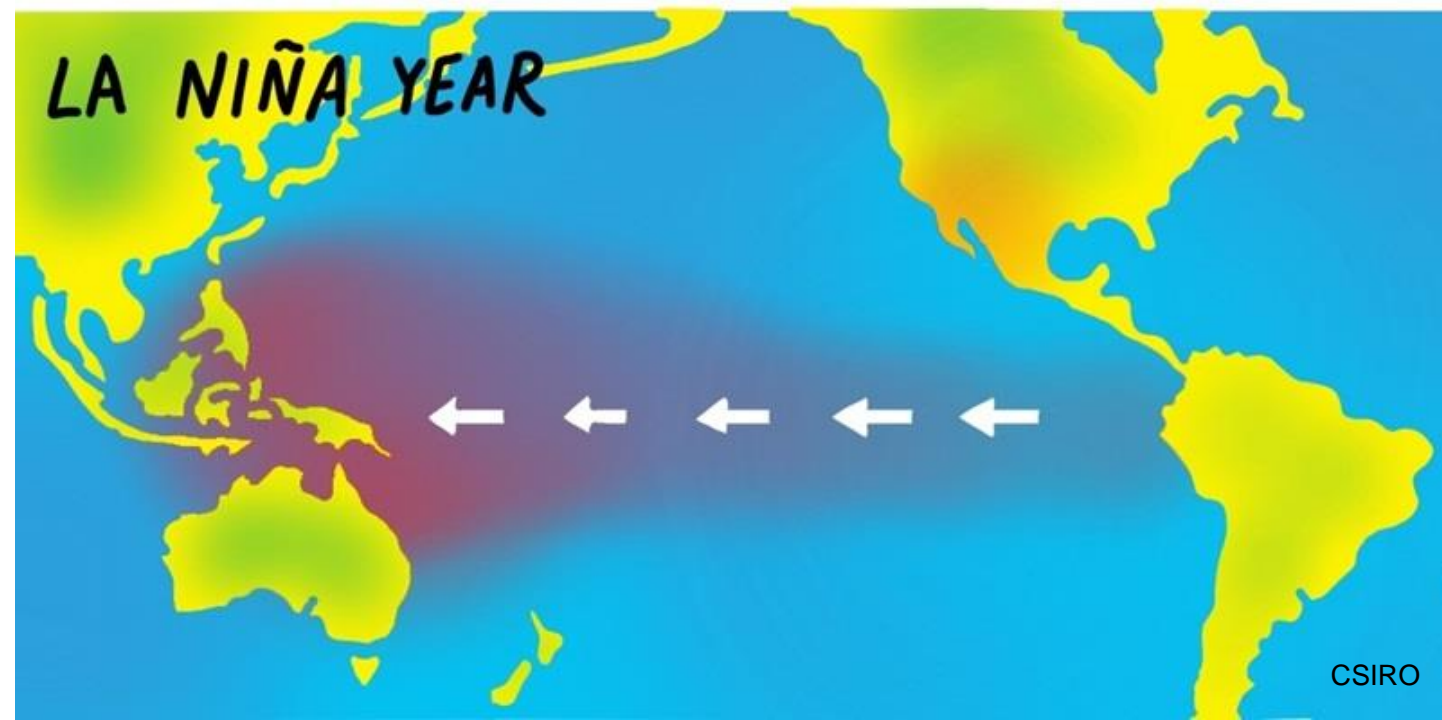
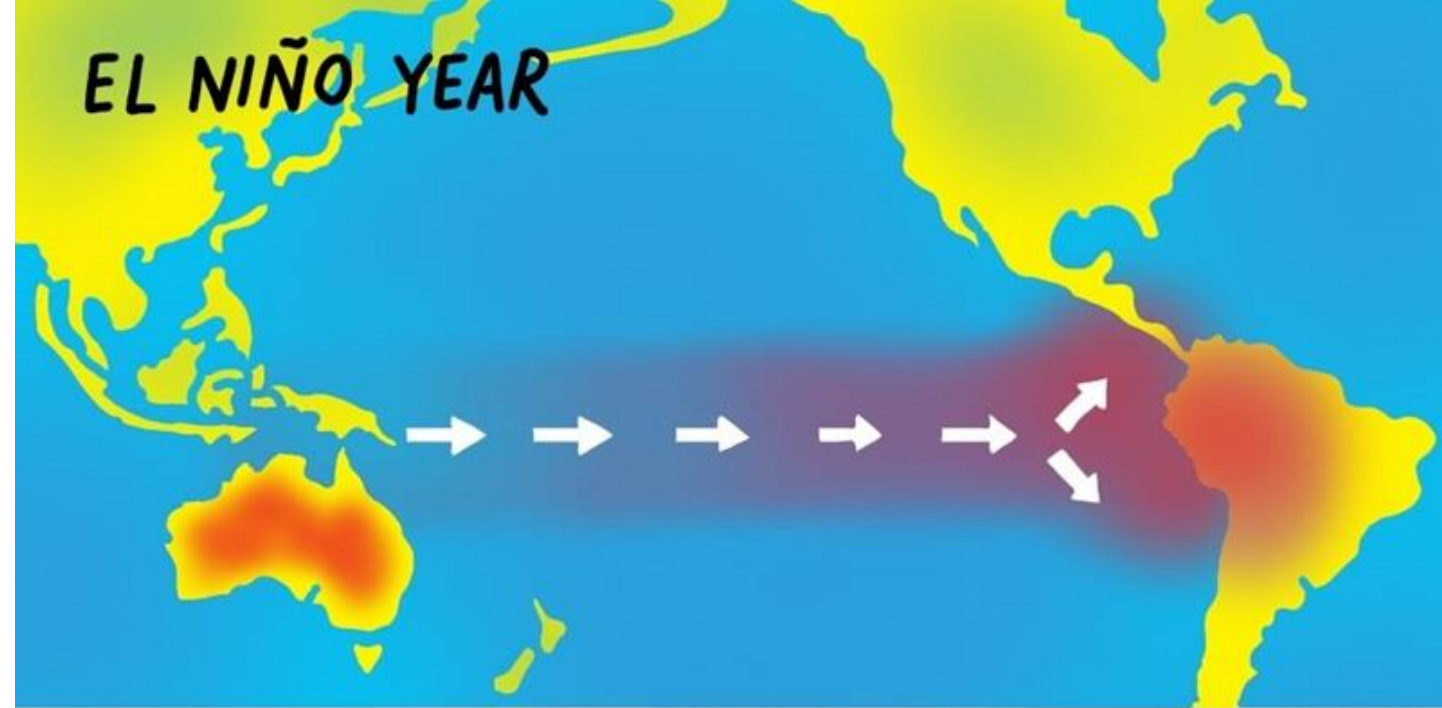
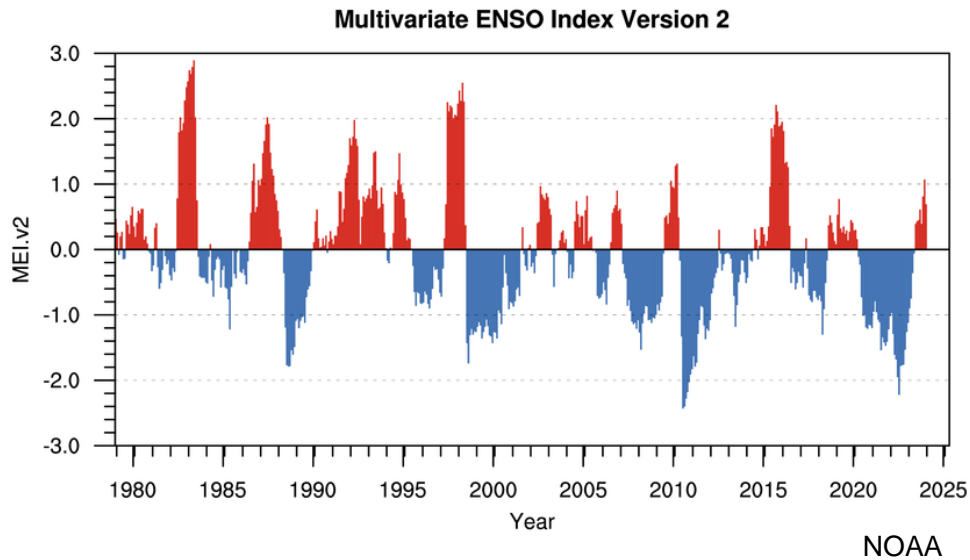
**Always has been, always will be.**

*The Brisbane River pattern from A Guidance Through Time  
by Casey Coolwell and Kyra Mancktelow.*

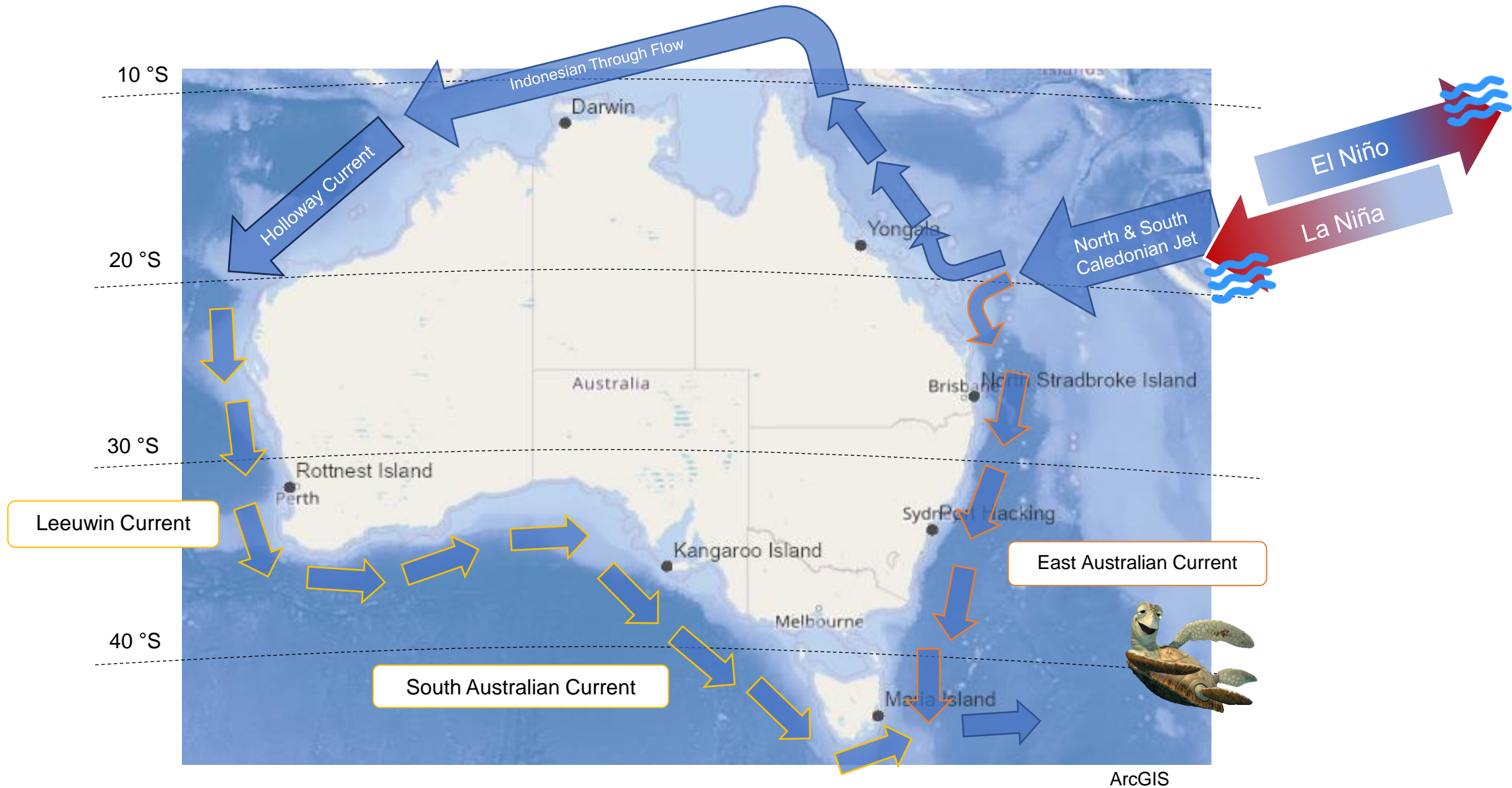


# El Niño Southern Oscillation

- World's largest climate teleconnection
- Movement of warm waters across the Pacific Ocean
- Affects climate on both sides of the Pacific



# Oceanography of Australia



# Zooplankton



Essential Ocean Variable (EOV)  
(Lindstrom et al, 2012)



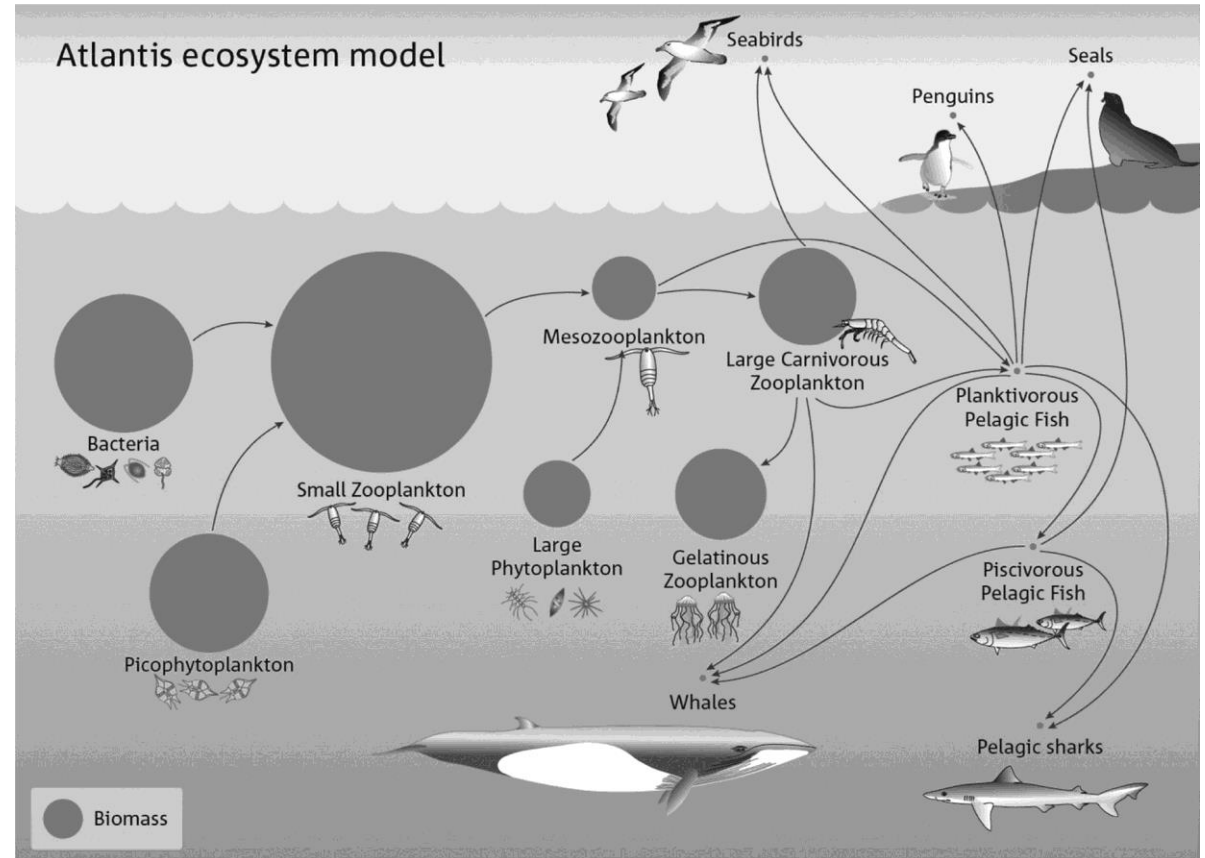
Large proportion of the ocean's biomass  
(Bar-On and Milo, 2019)



Primary consumers of the marine food web  
(Lalli and Parsons, 1997)



Important for fisheries and tourism  
(Suthers et al., 2019)



Suthers et al., 2019

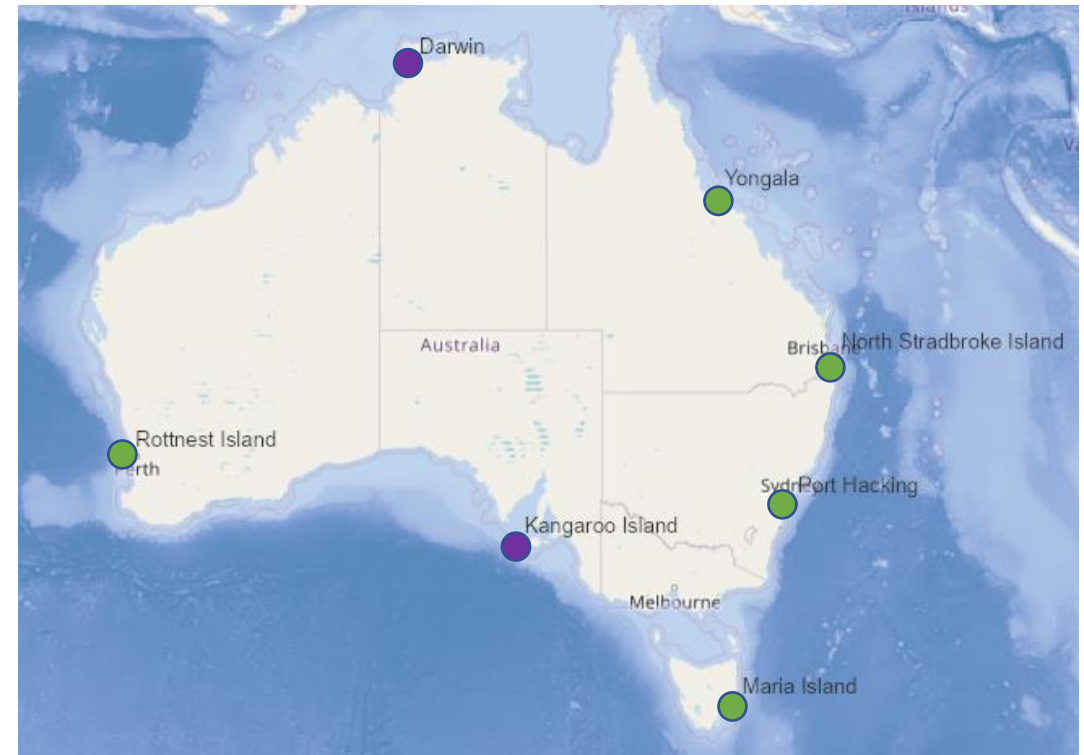
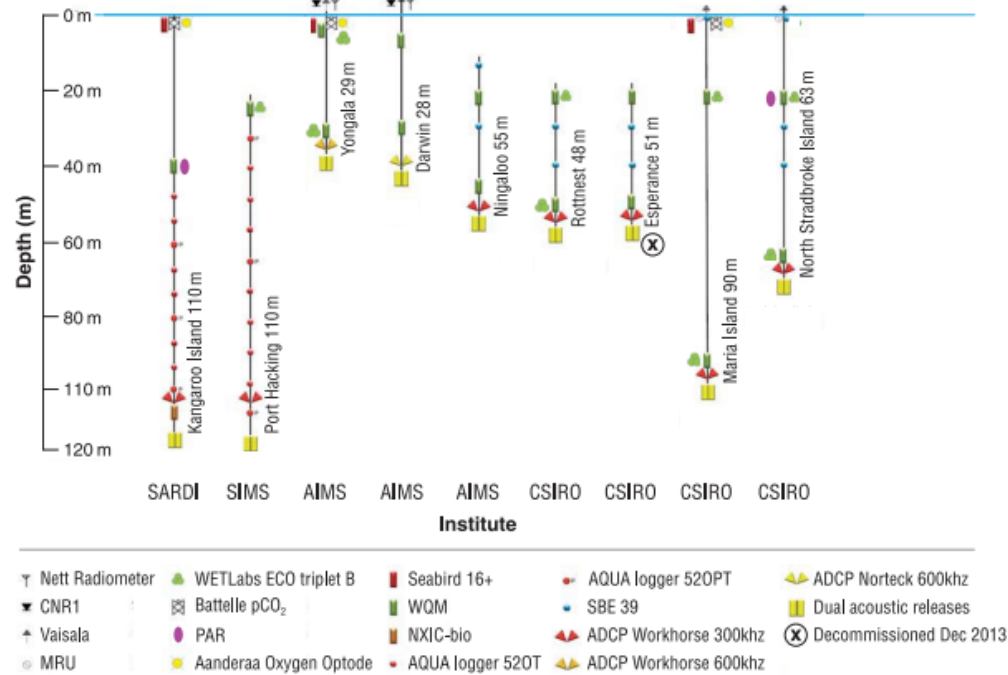


# How do plankton in Australian coastal waters respond to ENSO?

- Does ENSO have an equal effect on all of Australia's coastal waters?
- La Niña has been shown to decrease biomass and increase biodiversity in Western Australia (Richardson et al., 2020; Feng et al., 2013)
  - Is this true for **ALL** of Australia?

# The IMOS National Reference Stations: Australia's time-series

- Currently 7 active stations
  - Esperance and Ningaloo stations have been decommissioned.



- Seasonal Sampling
- Monthly Sampling

# Methods

- Publicly available on the Australian Ocean Data Network (AODN)
- Multivariate ENSO Index.v2 (MEI.v2) used as indicator of ENSO intensity and phase
- Univariate approach to assess variation of biomass with ENSO
  - GLM
- Multivariate approach to assess community composition
  - nMDS, PERMANOVA, and homogeneity of variance test



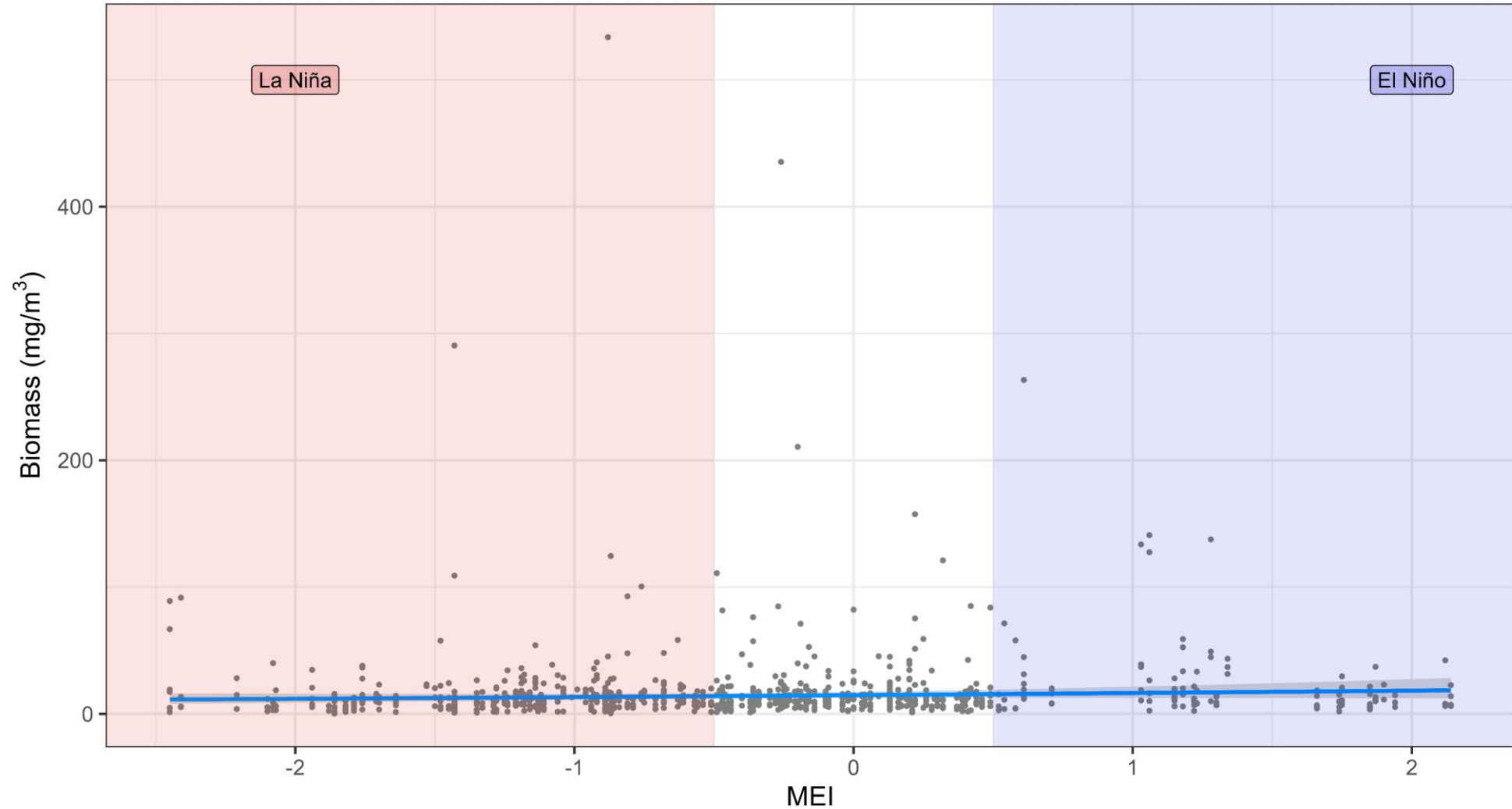
NRS dataset used:



Mark Tonks

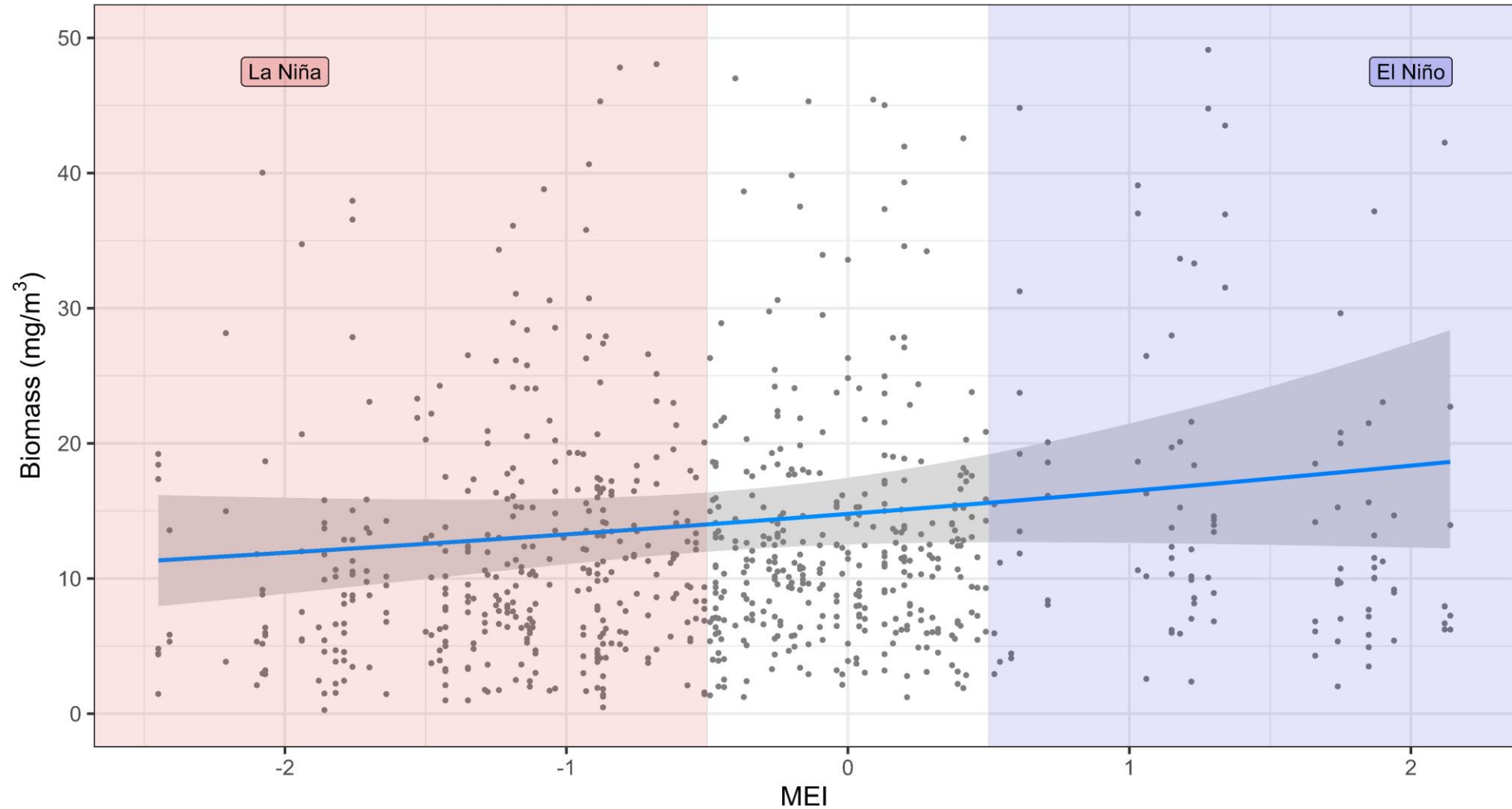


# Zooplankton biomass increases with MEI value



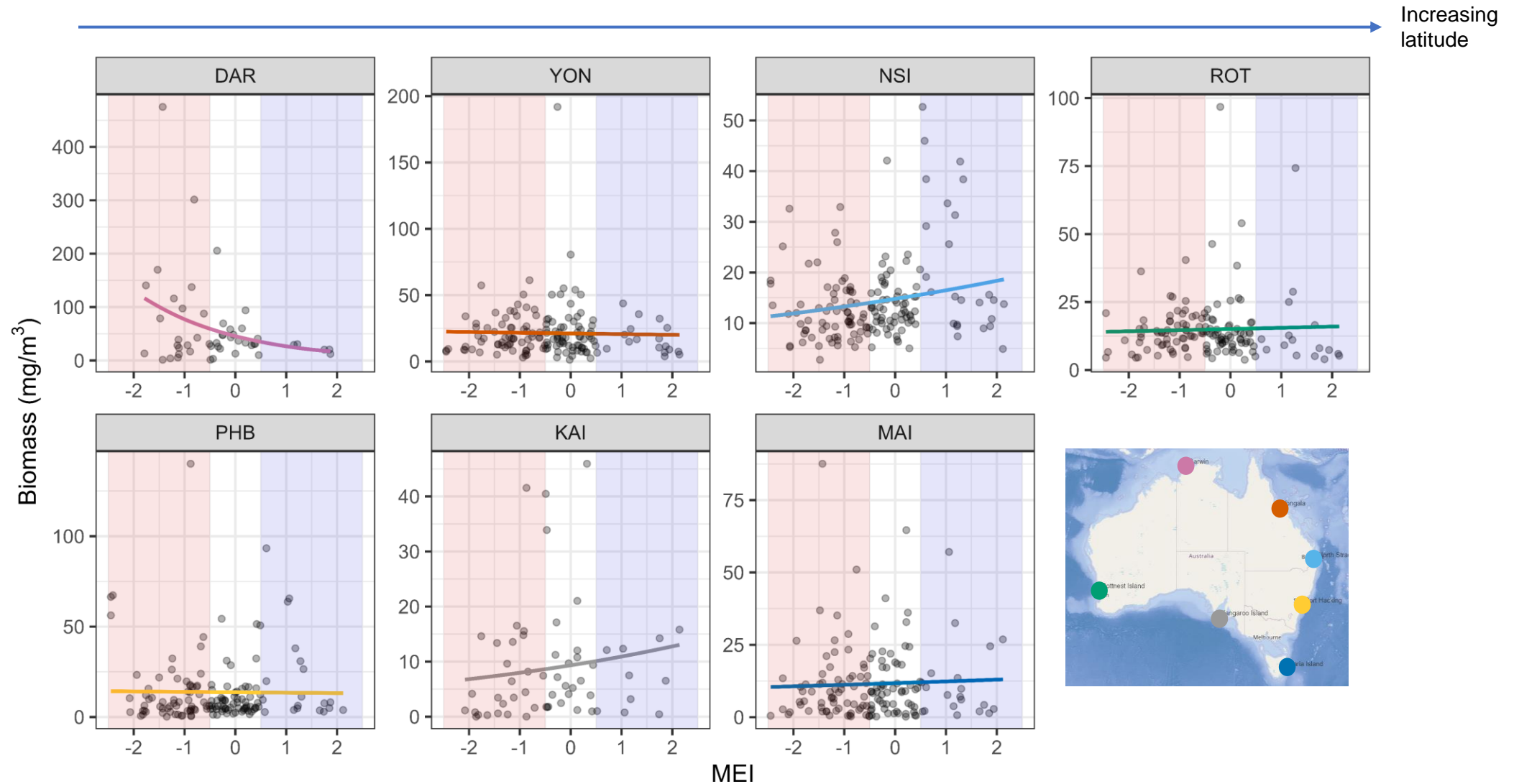
$$\text{Biomass} \sim \text{MEI} + \text{Station} + \text{MEI}:\text{Station}$$

# Zooplankton biomass increases with MEI value



$$\text{Biomass} \sim \text{MEI} + \text{Station} + \text{MEI}:\text{Station}$$

# ENSO affects zooplankton biomass at each station differently



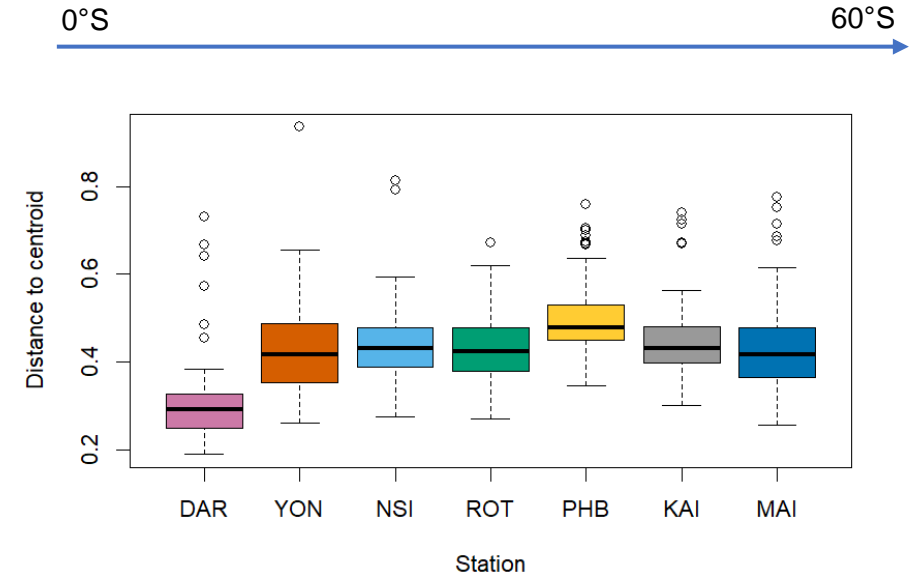
$$\text{Biomass} \sim \text{MEI} + \text{Station} + \text{MEI}:\text{Station}$$

# Location is the main driver of distinction in copepod communities



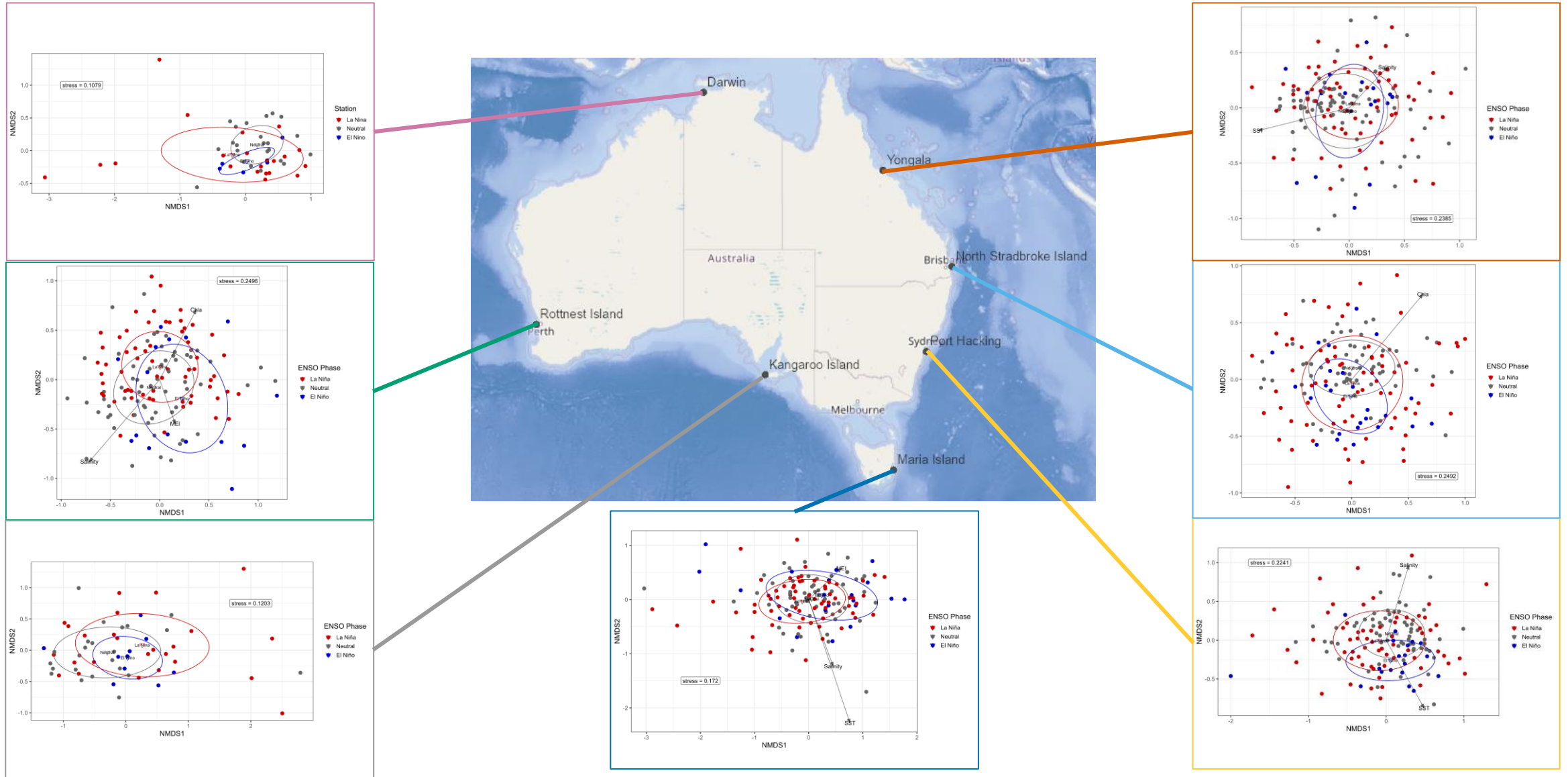
Station

- DAR
- YON
- NSI
- ROT
- PHB
- KAI
- MAI

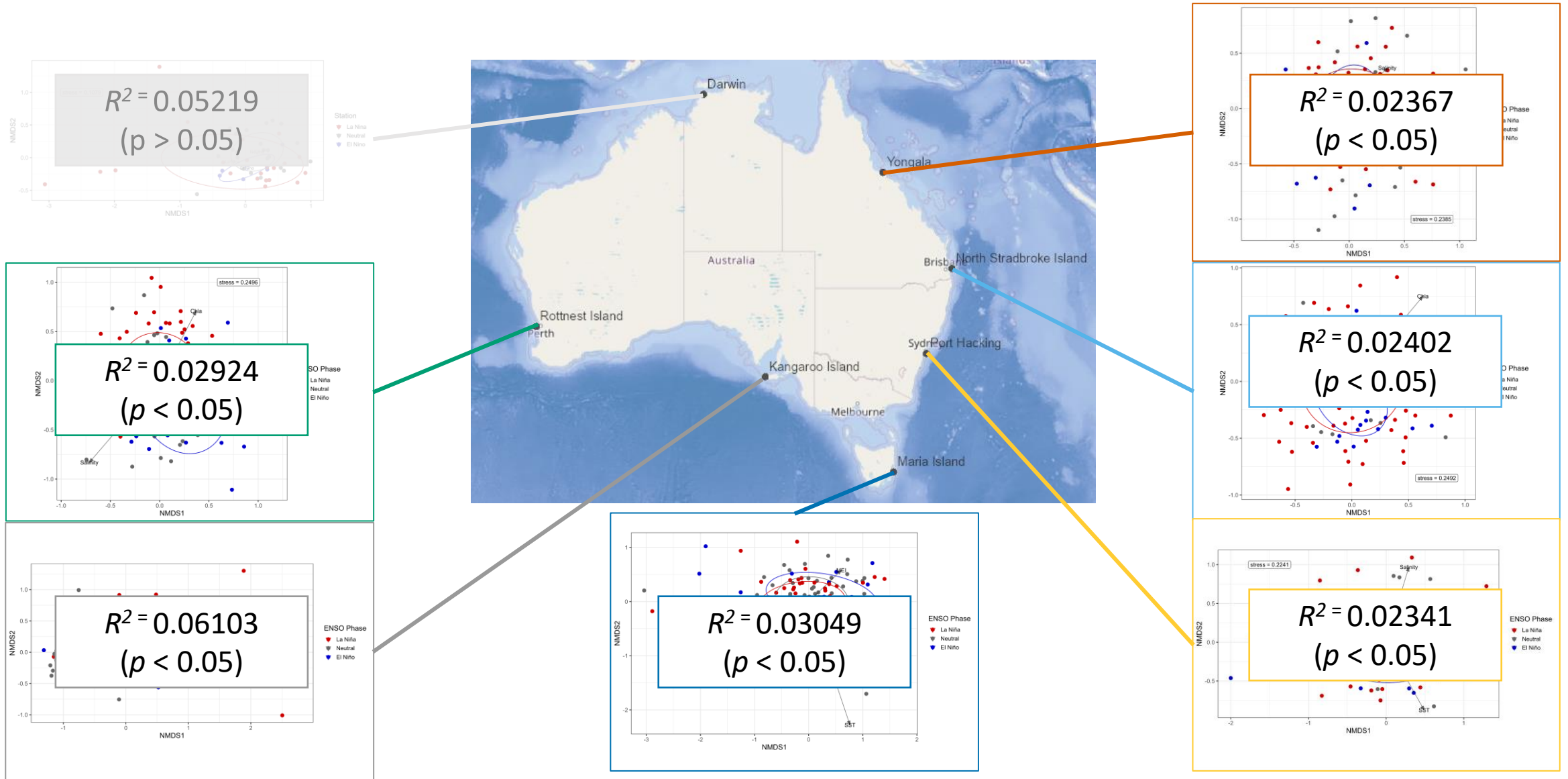


- Overlaps in the s.d. of some stations
  - Maria Island is distinct from mainland communities
- Darwin had the lowest variation, Port Hacking the highest ( $p < 0.05$ )

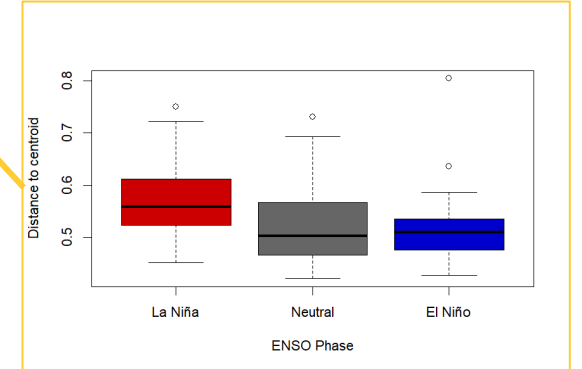
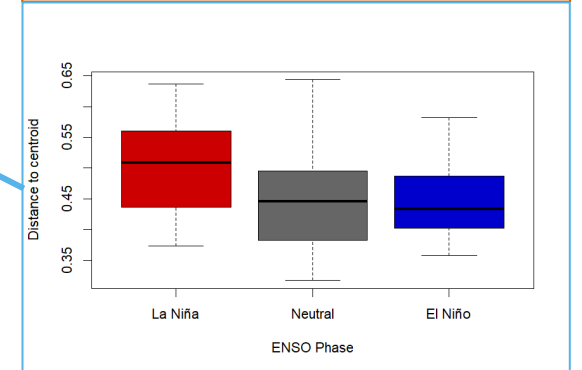
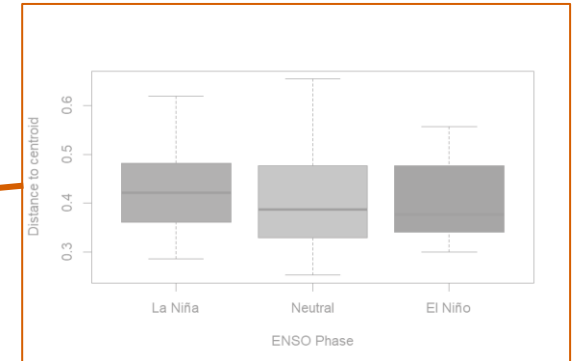
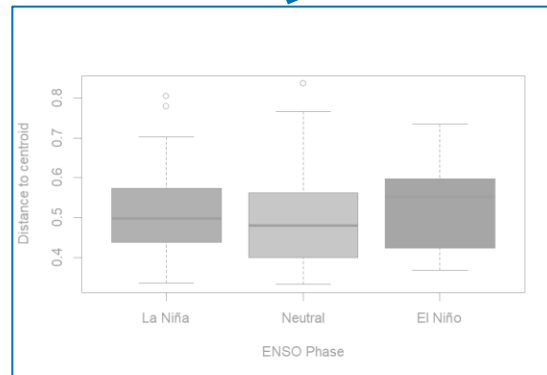
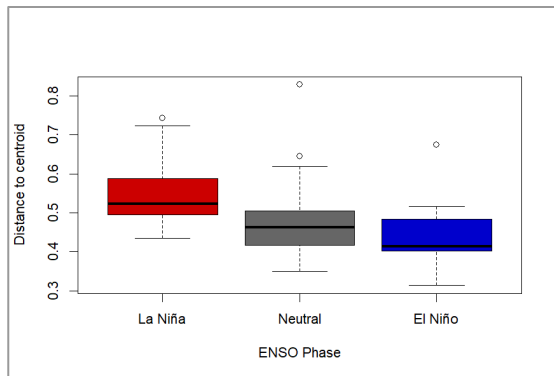
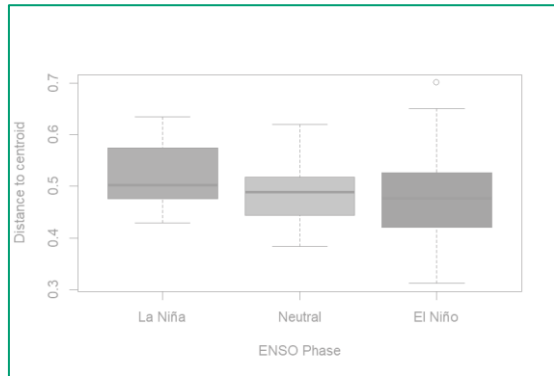
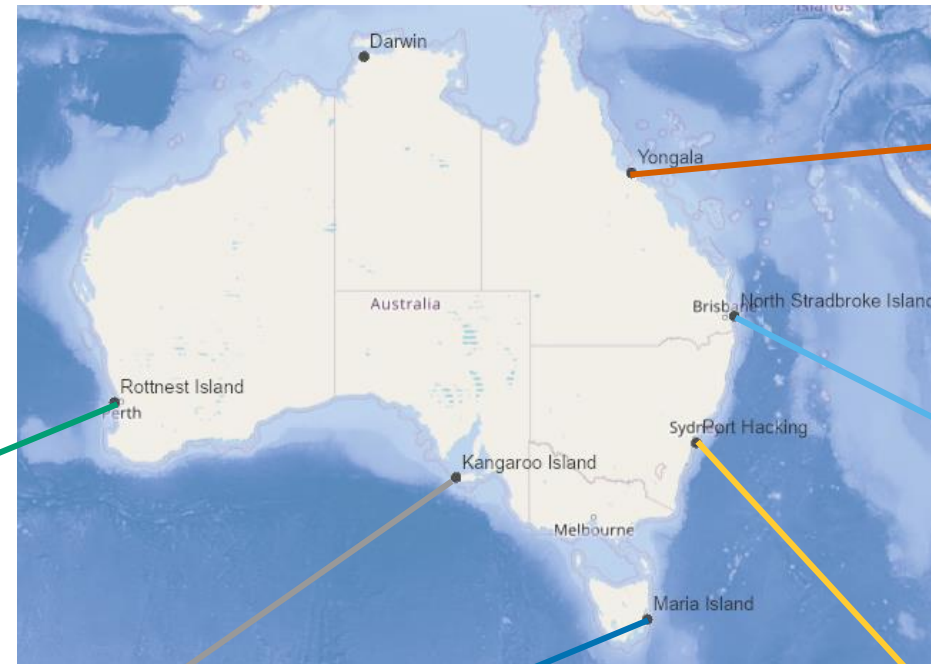
# A small but significant amount of community variation is driven by ENSO



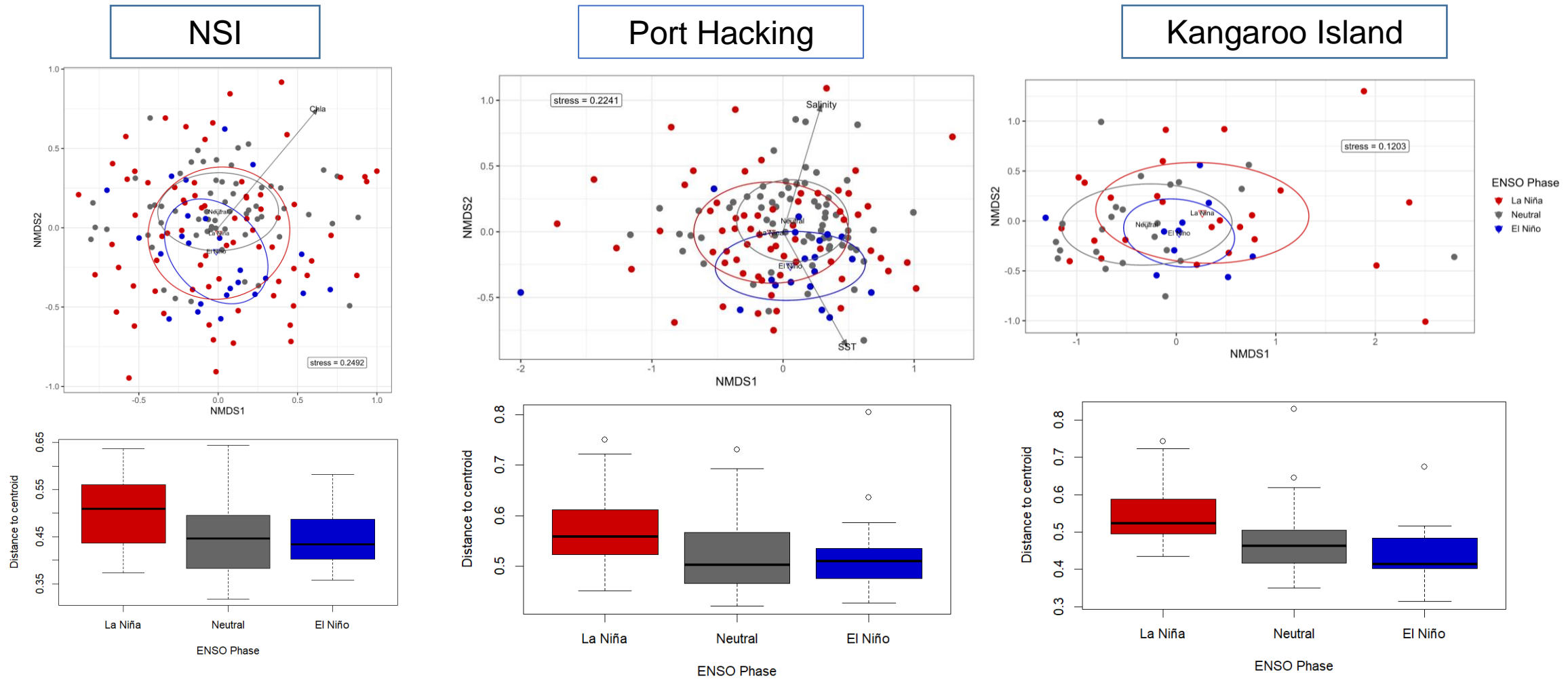
# A small but significant amount of community variation is driven by ENSO



# Three stations showed higher community variation during La Niña



# Higher variation in copepod communities during La Niña





# Key Findings

- ENSO is a key driver in Australian coastal zooplankton biomass and copepod community variation
- Context is key
  - Effect of ENSO is not universal across all of Australia's coastal areas
  - Understanding the local conditions of a time-series is pertinent
- Importance of time-series
- A lesson in the possibilities of climate change
  - Climate teleconnections like ENSO provide an insight into the potential impacts of climate change

# Where to from here?

- Do these results hold up for Australian coastal phytoplankton?
- Explore other climate teleconnections
  - SAM, IOD
- Lags between environmental changes, phytoplankton, and zooplankton in the context of Australia
- Addressing effects of climate change on Australian zooplankton



# Thank you!



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AUSTRALIA

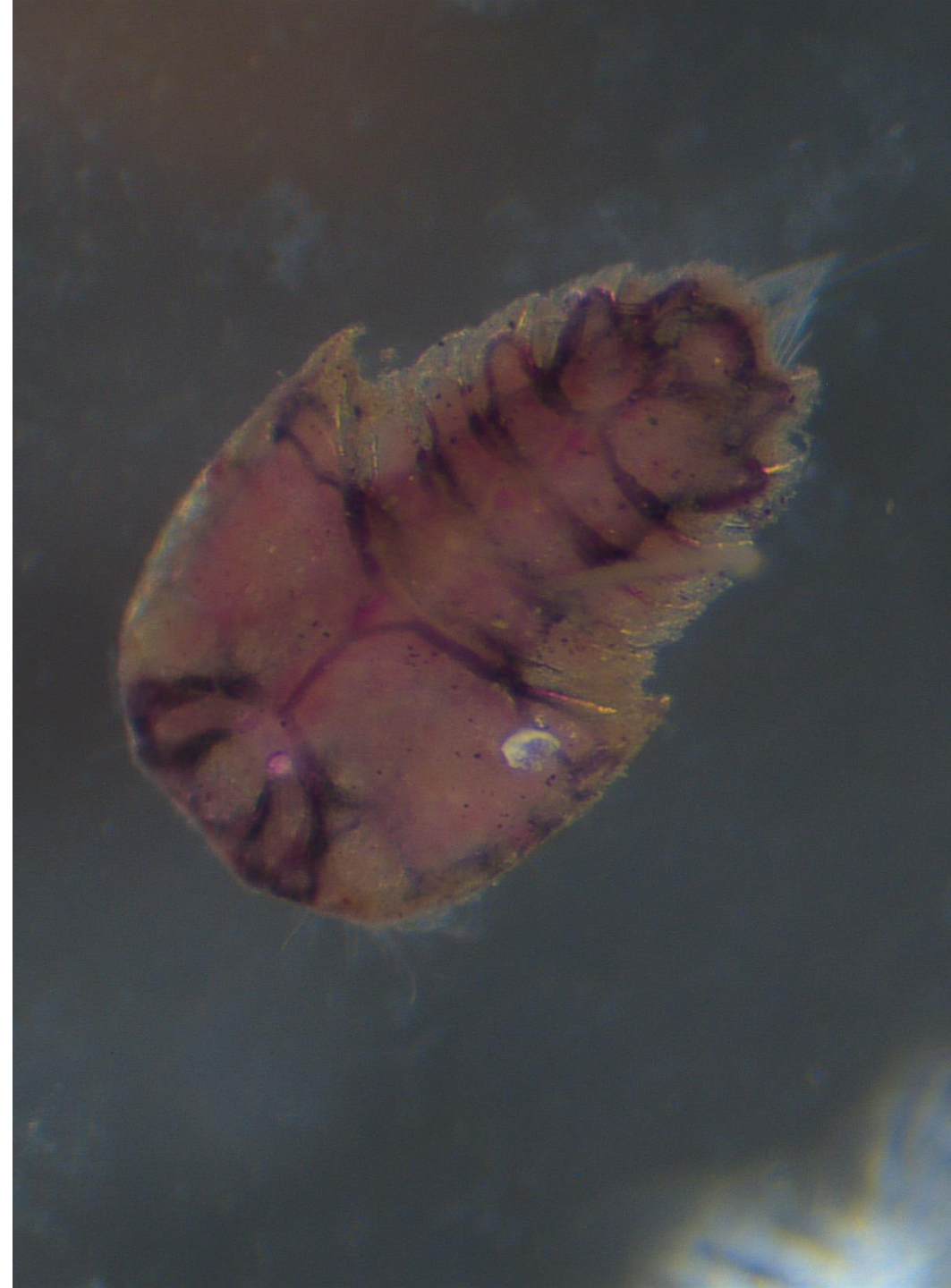


IMOS  
Integrated **Marine**  
**Observing** System

*Australia's Integrated Marine Observing System (IMOS) is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS). It is operated by a consortium of institutions as an unincorporated joint venture, with the University of Tasmania as Lead Agent.*

I am currently looking for PhD opportunities and would love to continue working with zooplankton!

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