

The influence of resident taxa on the spatial ecology of the coral *Pocillopora aliciae*

Christopher Cooney, Will Figueira, Ezequiel M. Marzinelli, Brigitte Sommer



THE UNIVERSITY OF
SYDNEY



Photo Sian Liddy



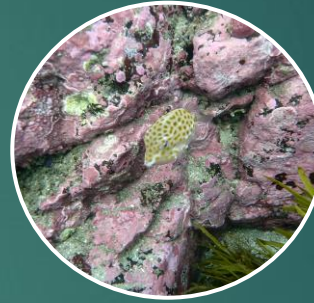
NSW temperate reef ecosystems



Encrusting corals



Biofilms CCA & Turfing algae



Sponges & Ascidians



Barrens



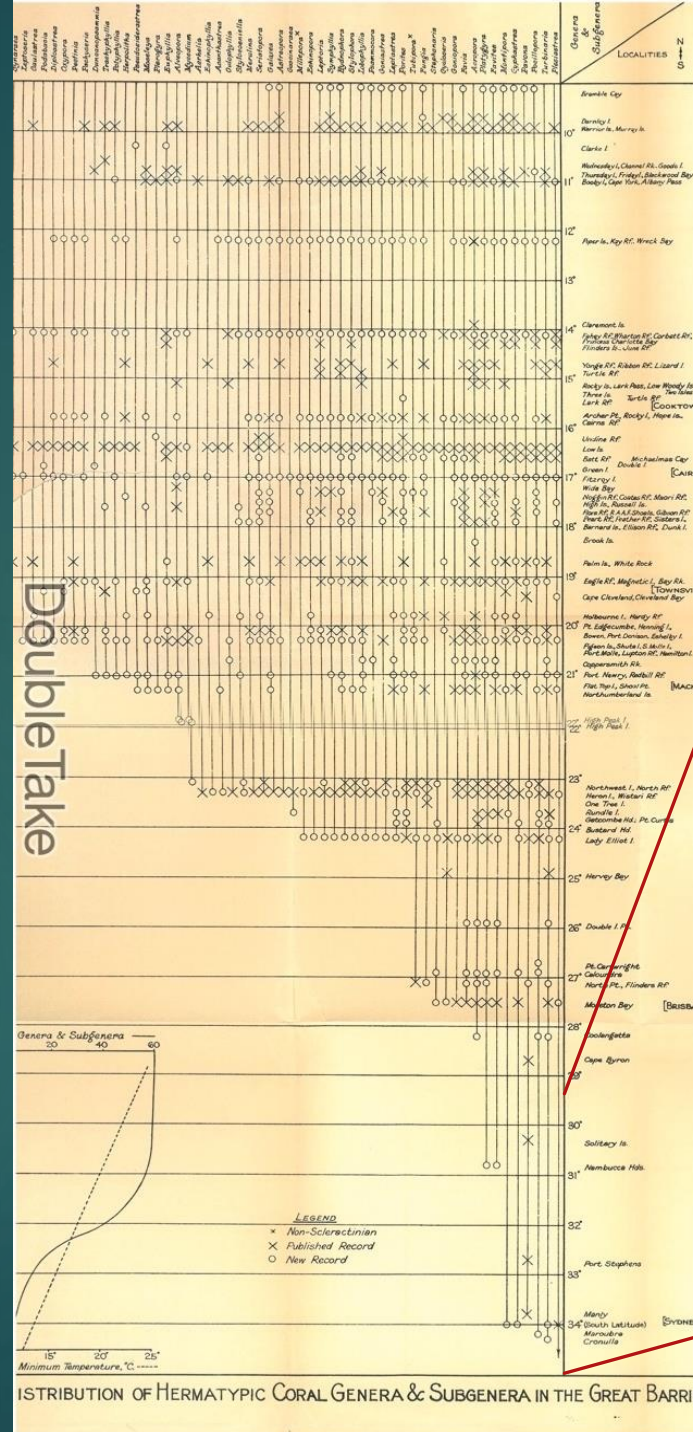
Kelp & Macroalgae

Pocillopora aliciae

- ▶ Subtropical - temperate coral
- ▶ Brooder -> released larvae are ready to settle
- ▶ Planktonic larval competency of up to 20 days



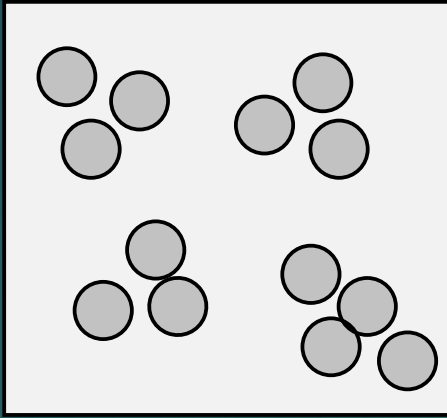
P. aliciae returns to Sydney reefs



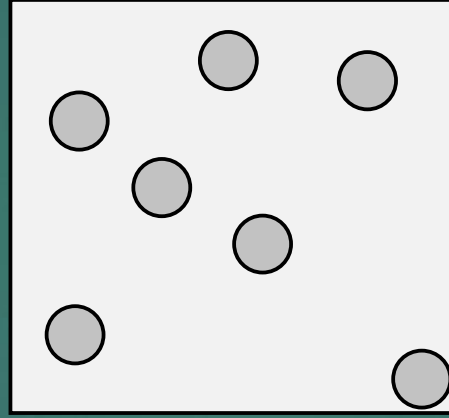
Wells, J.W., 1955. A survey of the distribution of reef coral genera in the Great Barrier Reef region

Spatial patterns

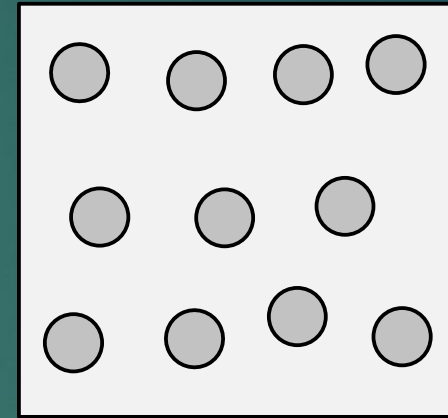
Clustered



Random



Overdispersed



Above

Theoretical

Below

Question

1. What is the spatial pattern of the coral?

Hypothesis

1. The spatial pattern of coral will not fit the pattern of complete spatial randomness

Data collection

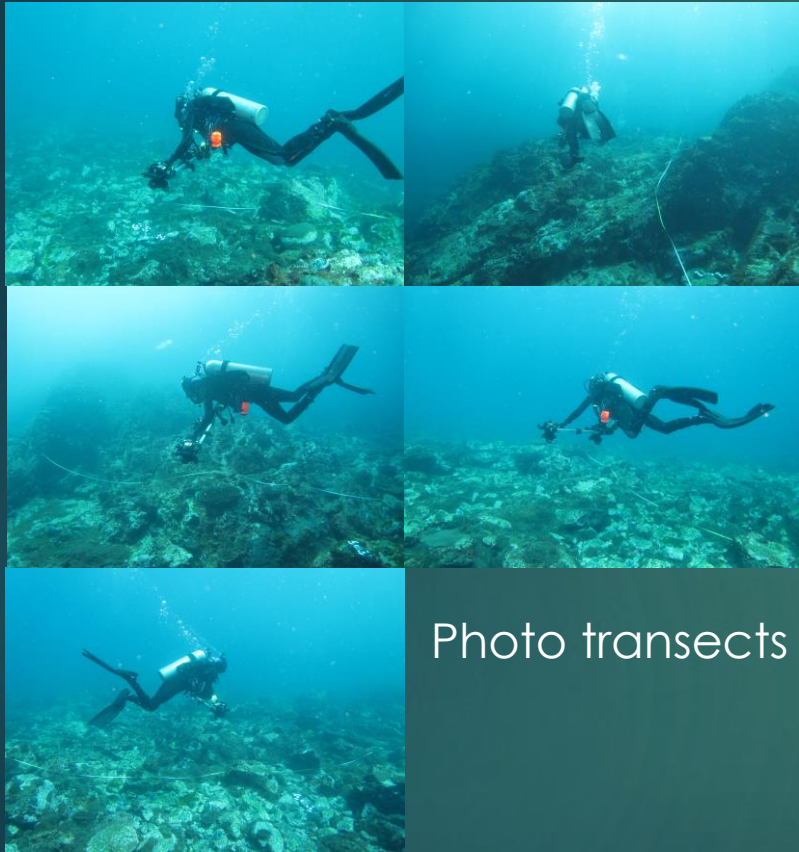


Photo transects

Photos supplied by
Brigitte Sommer

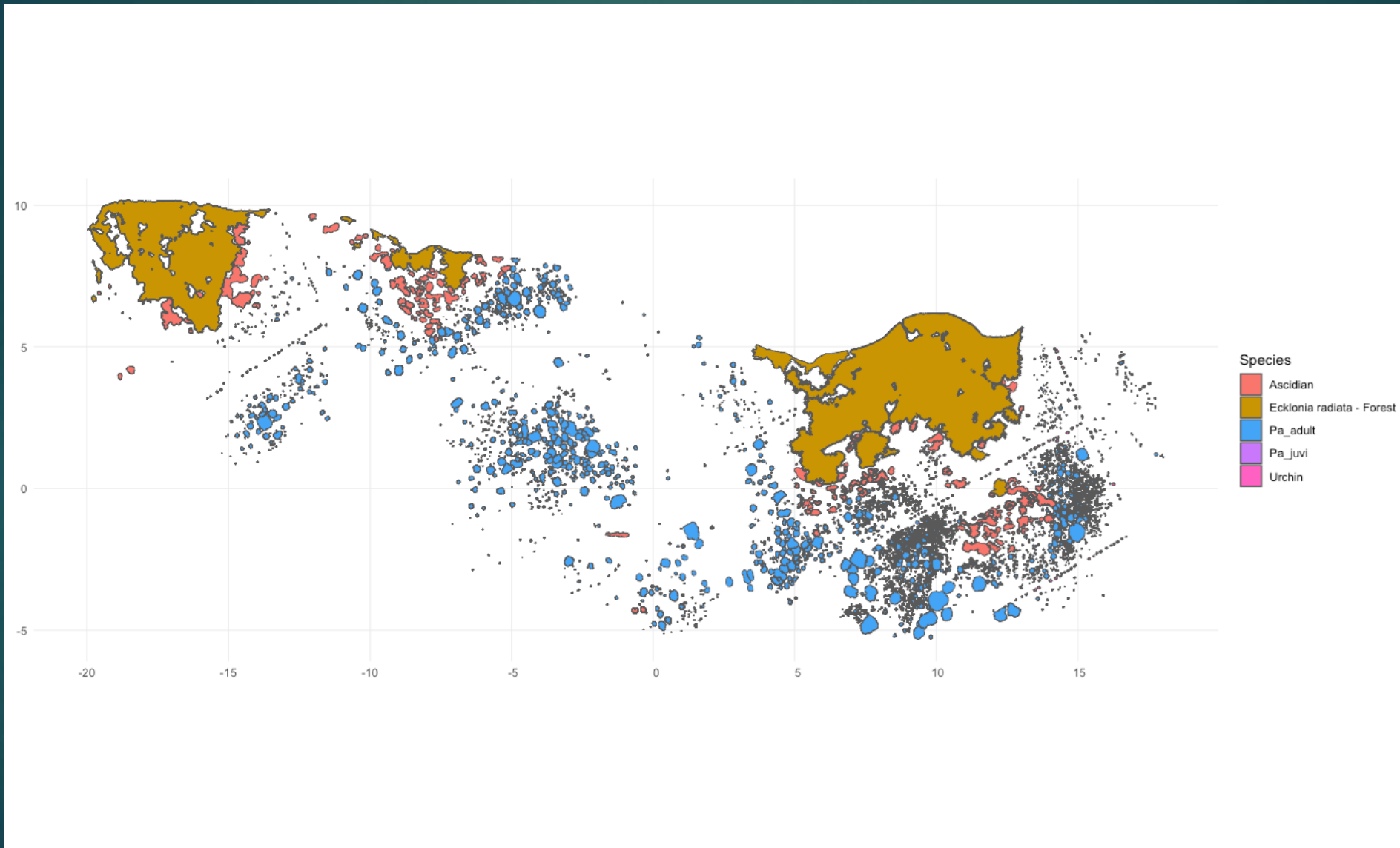


Structure through motion
processing



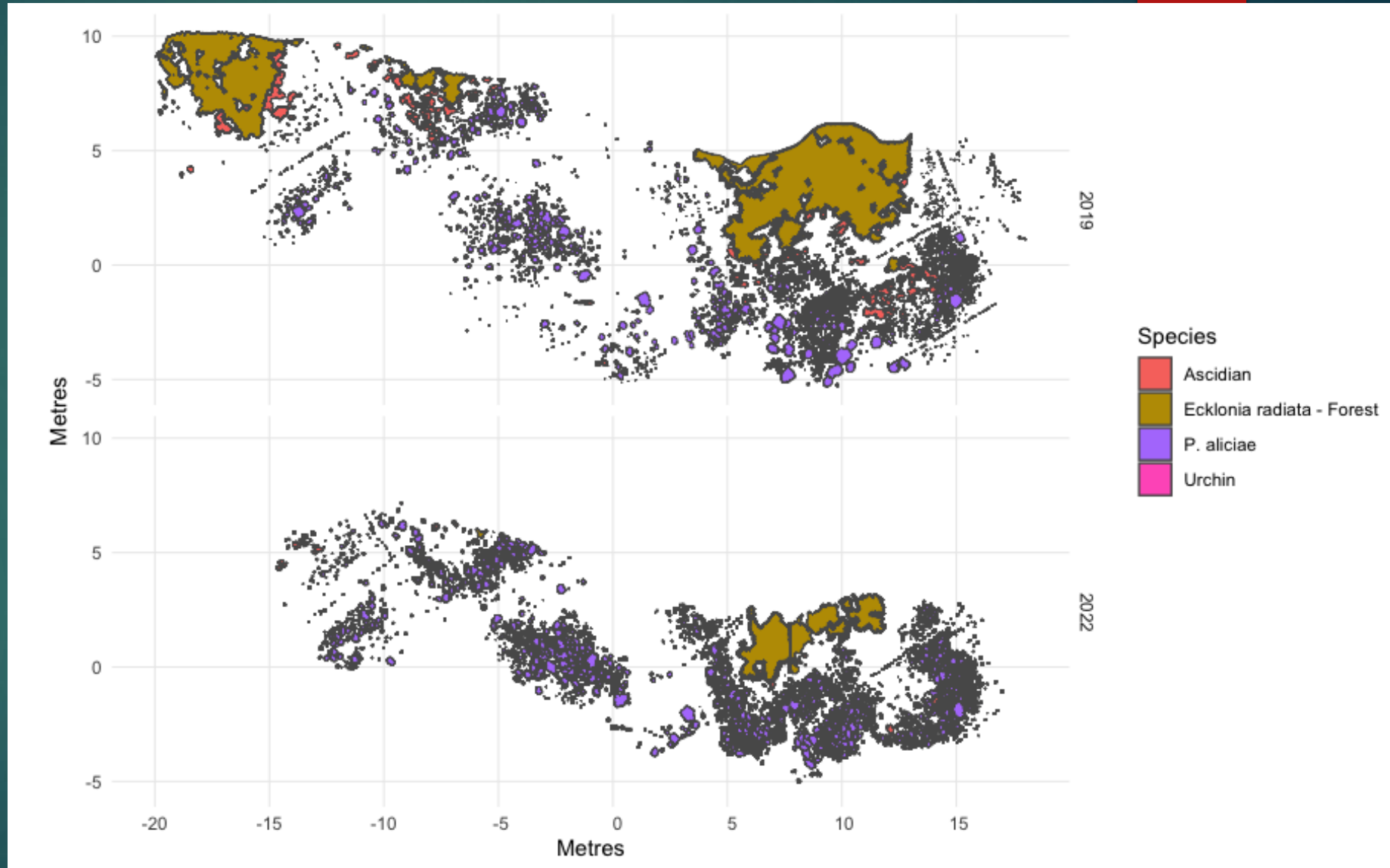
Orthomosaic

Data processing

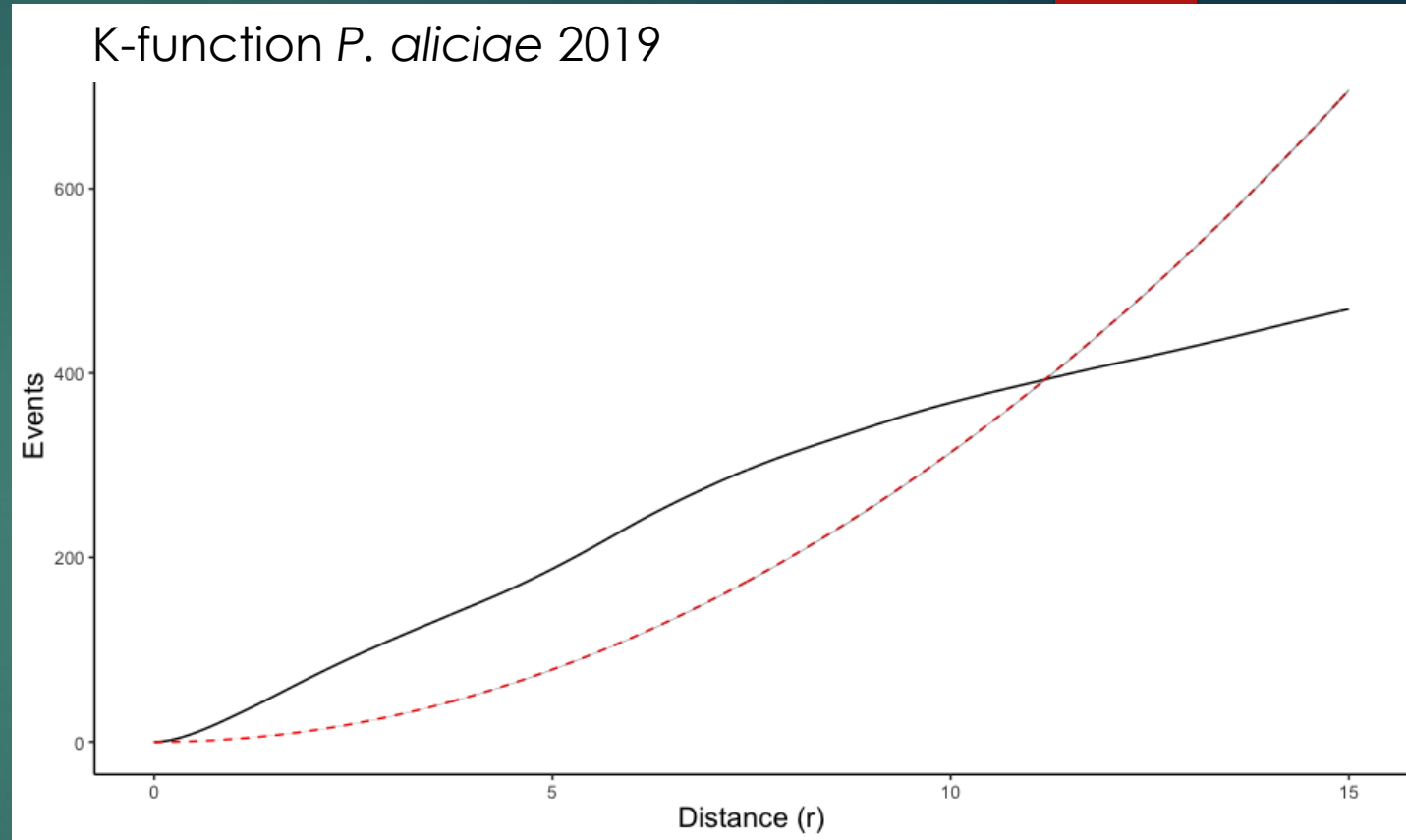
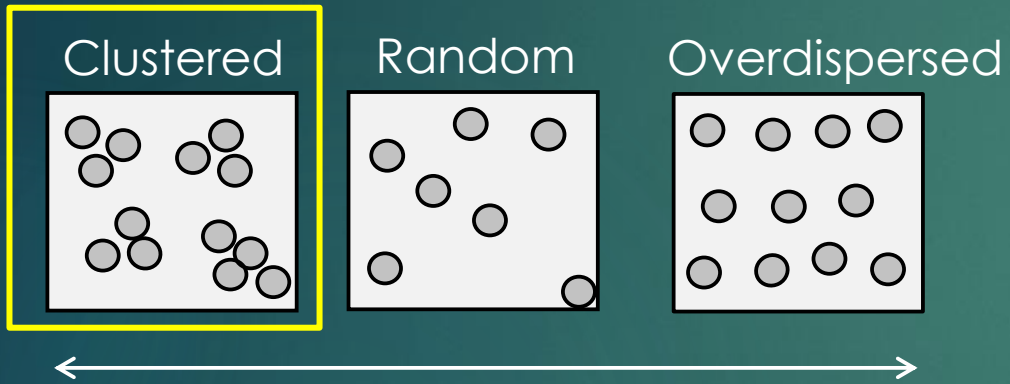


The data

- ▶ 2 Maps
- ▶ 2 Years
- ▶ 7985 individual corals between them



Is *P. aliciae* clustered?



2019 (Monte-Carlo test, $p=0.02$)

2022 (Monte-Carlo test, $p=0.02$)



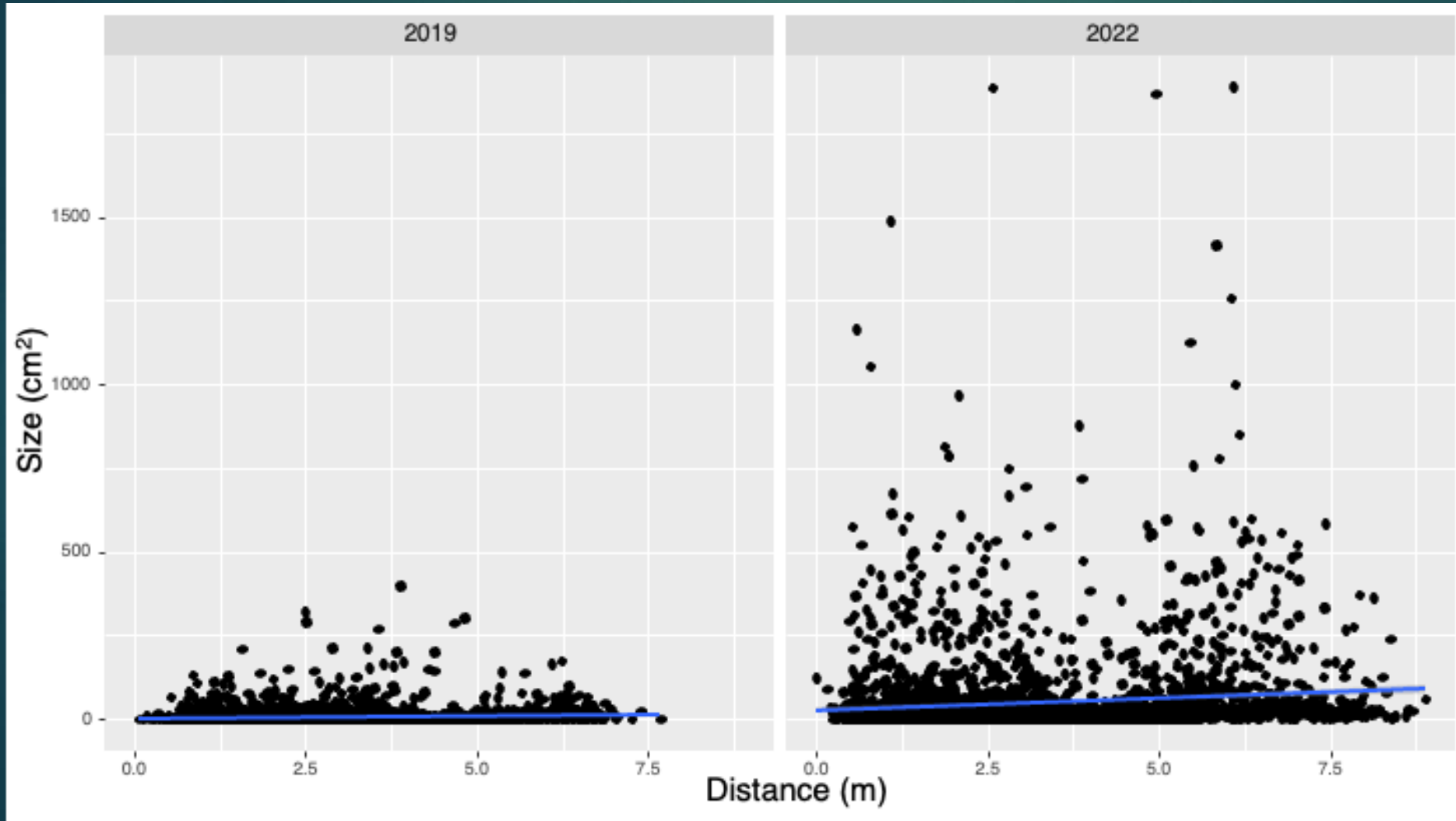
Question

2. What is driving this spatial pattern?

Hypothesis

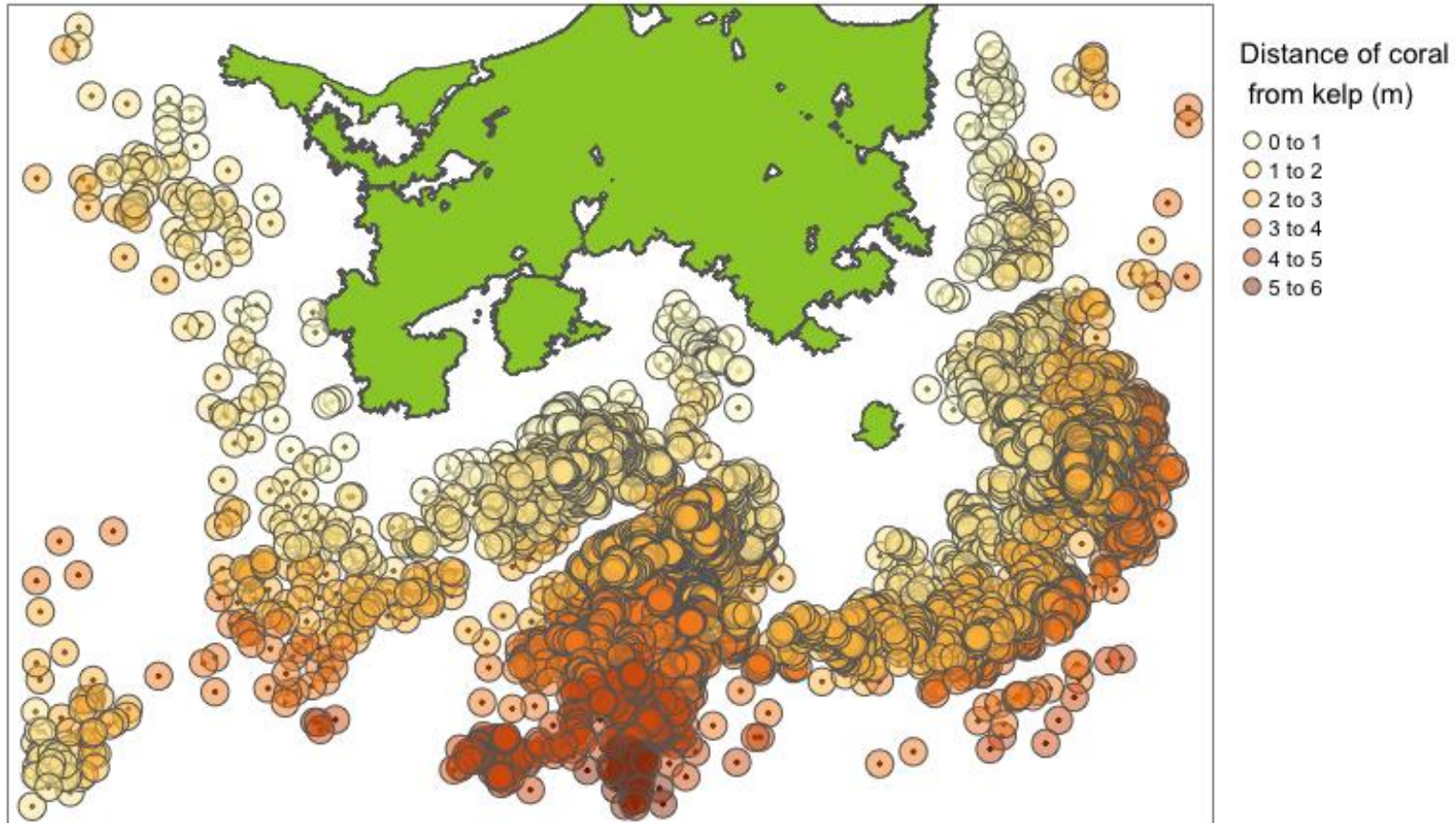
2. Kelp and coral compete for space

Is size of coral dependent on distance from kelp?

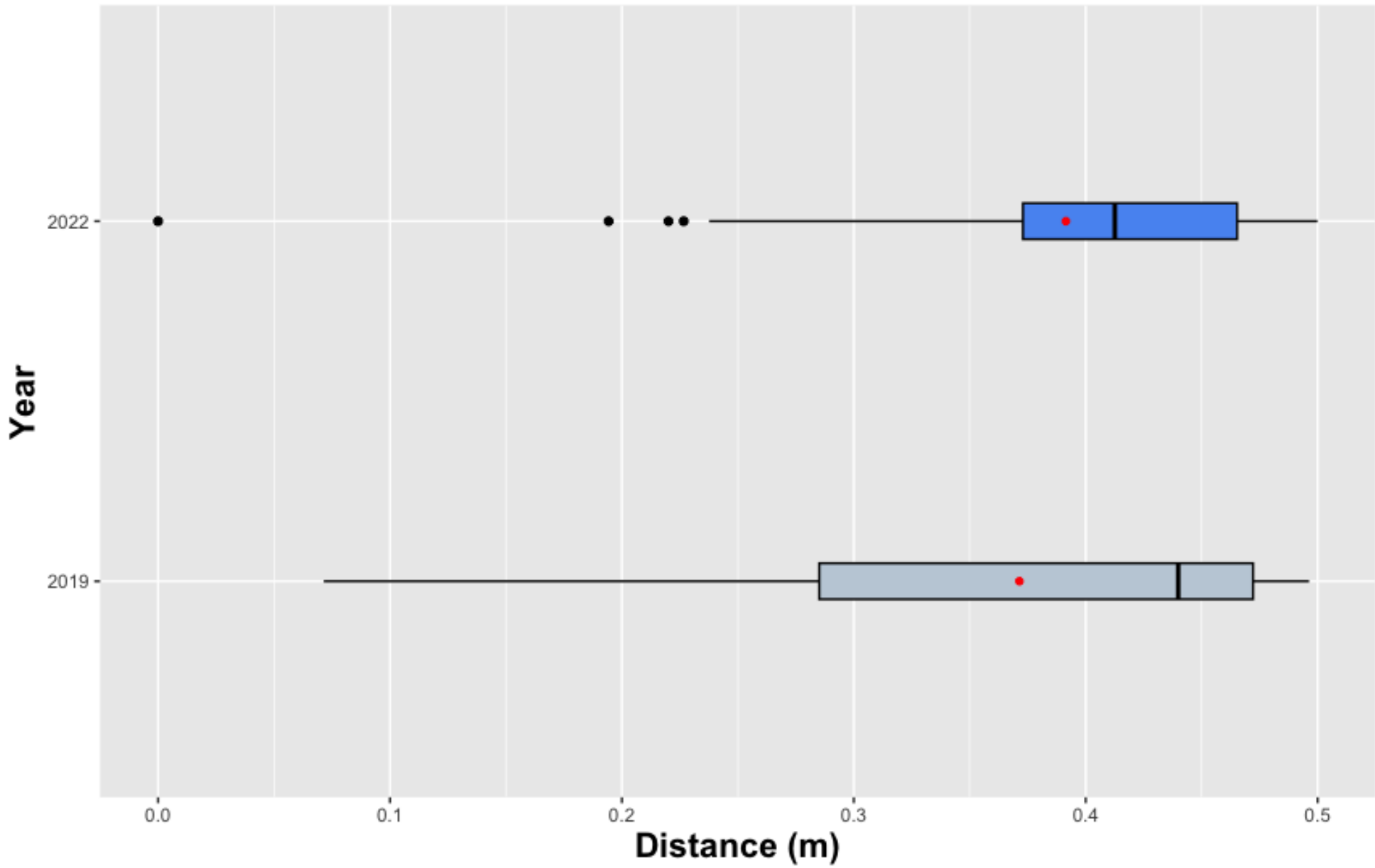


Coral minimum distance to kelp

2019 transect



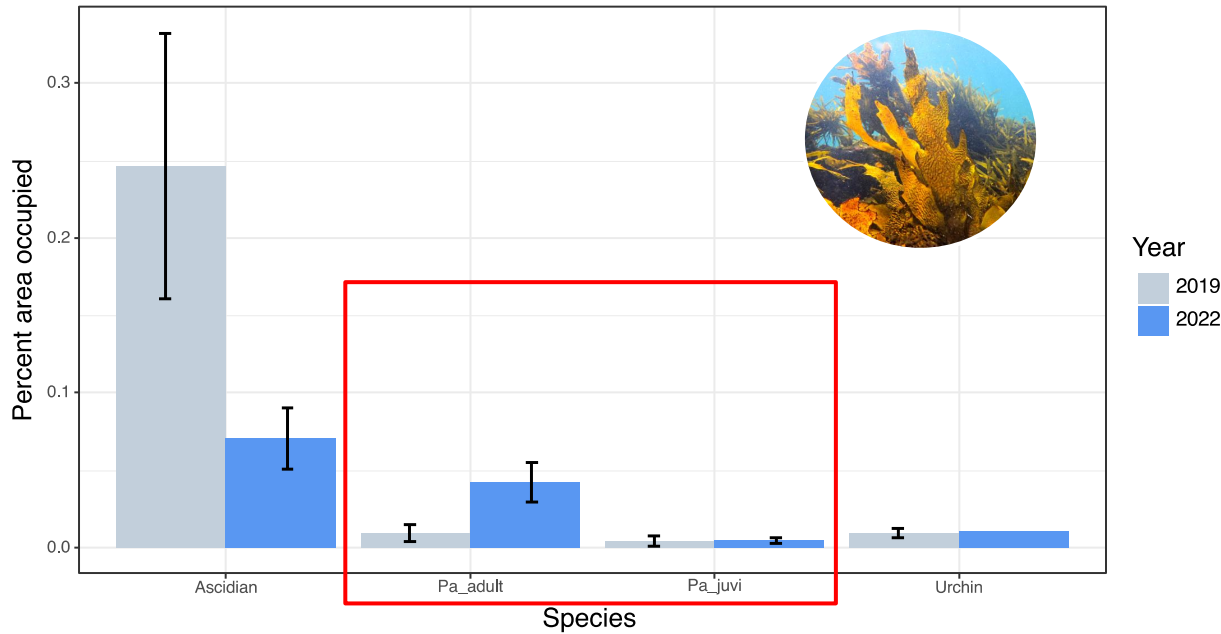
Coral minimum distance from kelp



What are the area neighbourhood relationships?

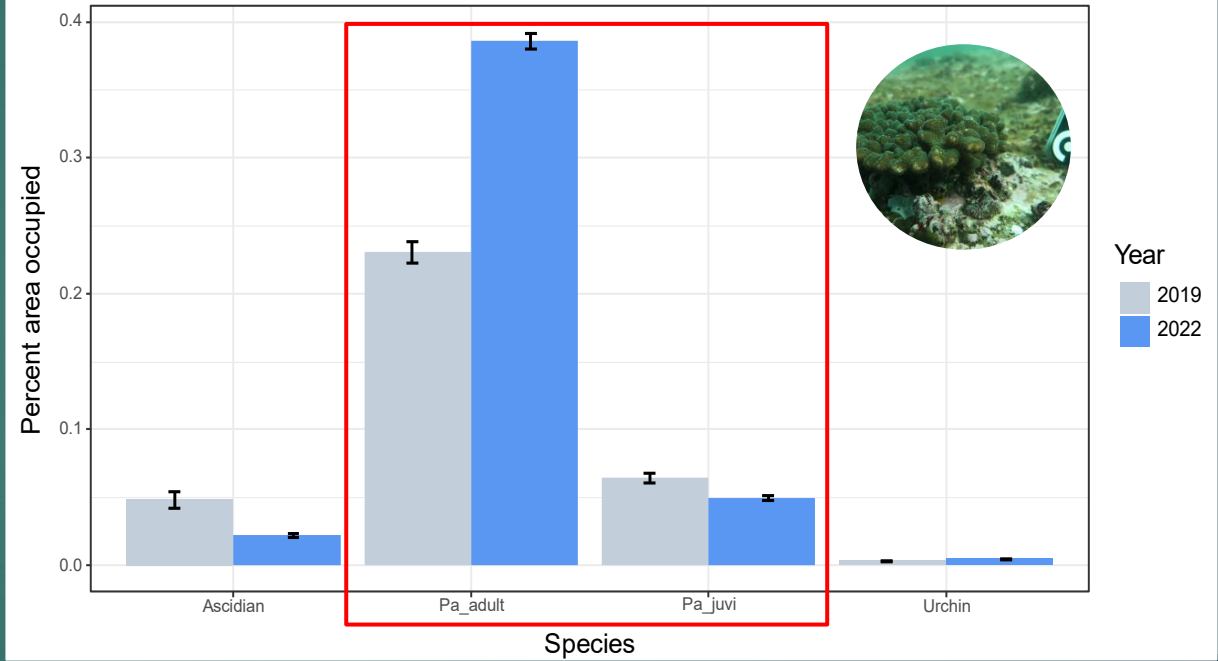
Kelp

E. radiata 50cm buffer



Coral

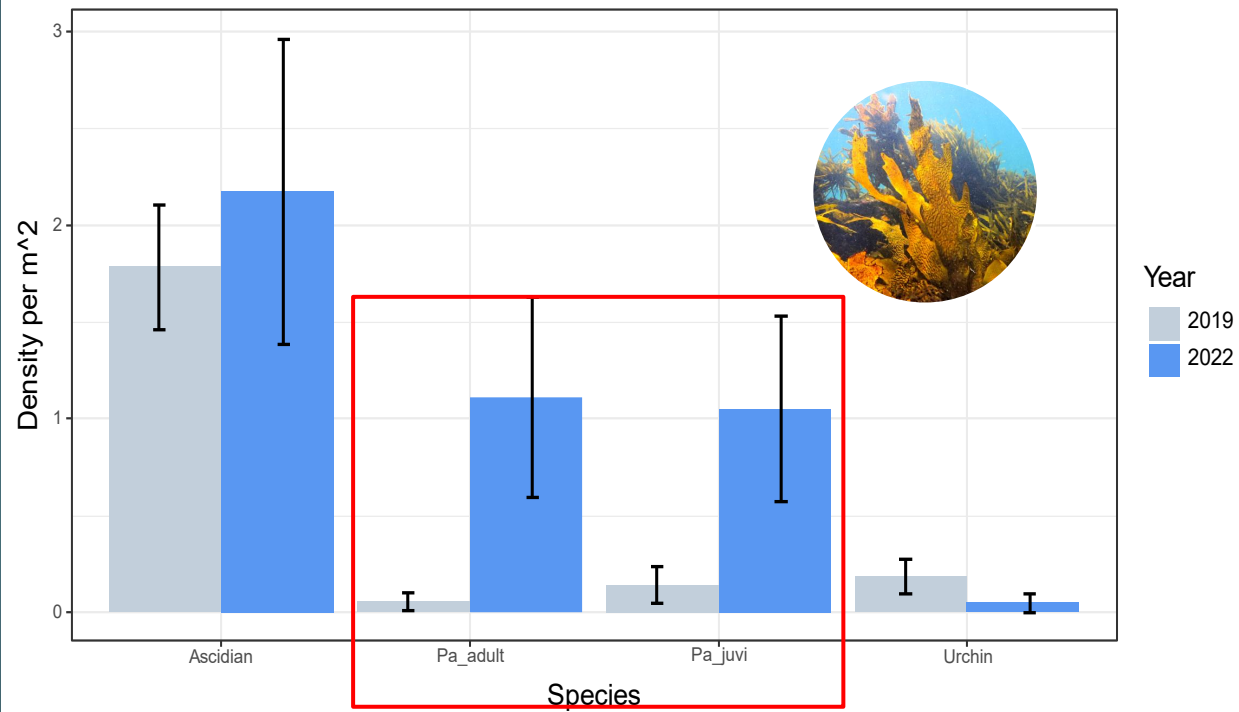
P. aliciae adult 50cm buffer



What are the count neighbourhood relationships?

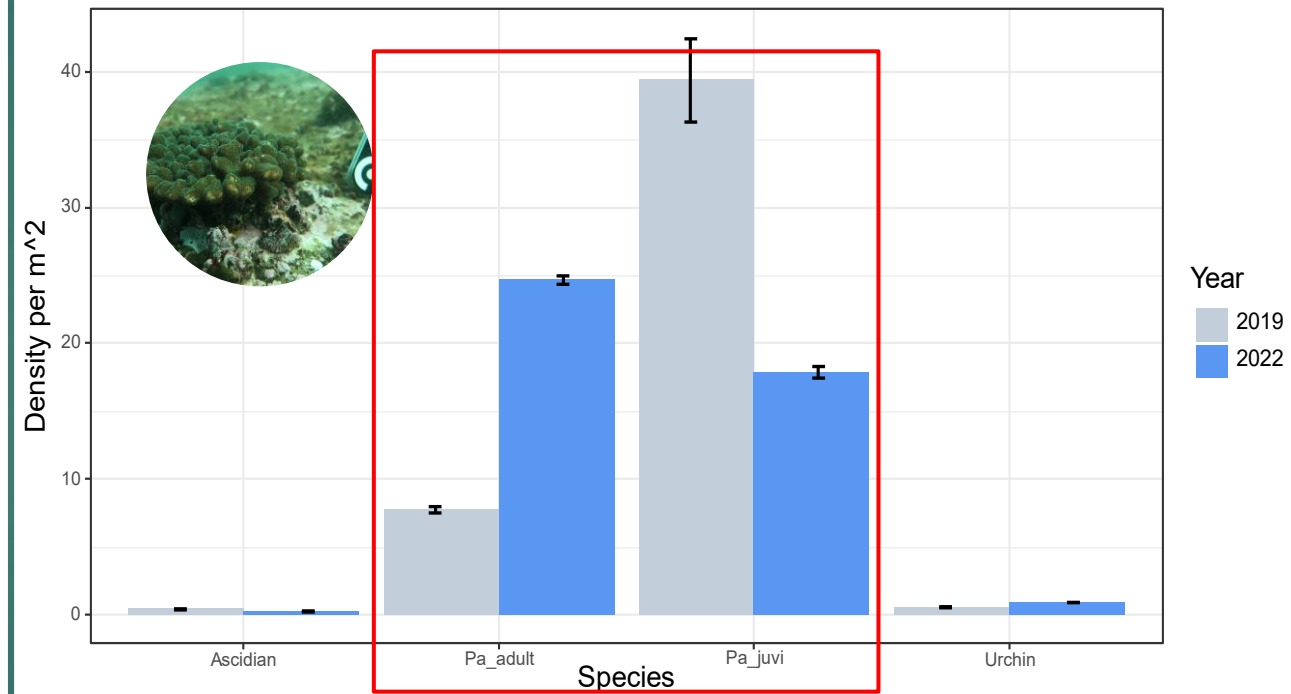
Kelp

E. radiata 50cm buffer



Coral

P. aliciae adult 50cm buffer



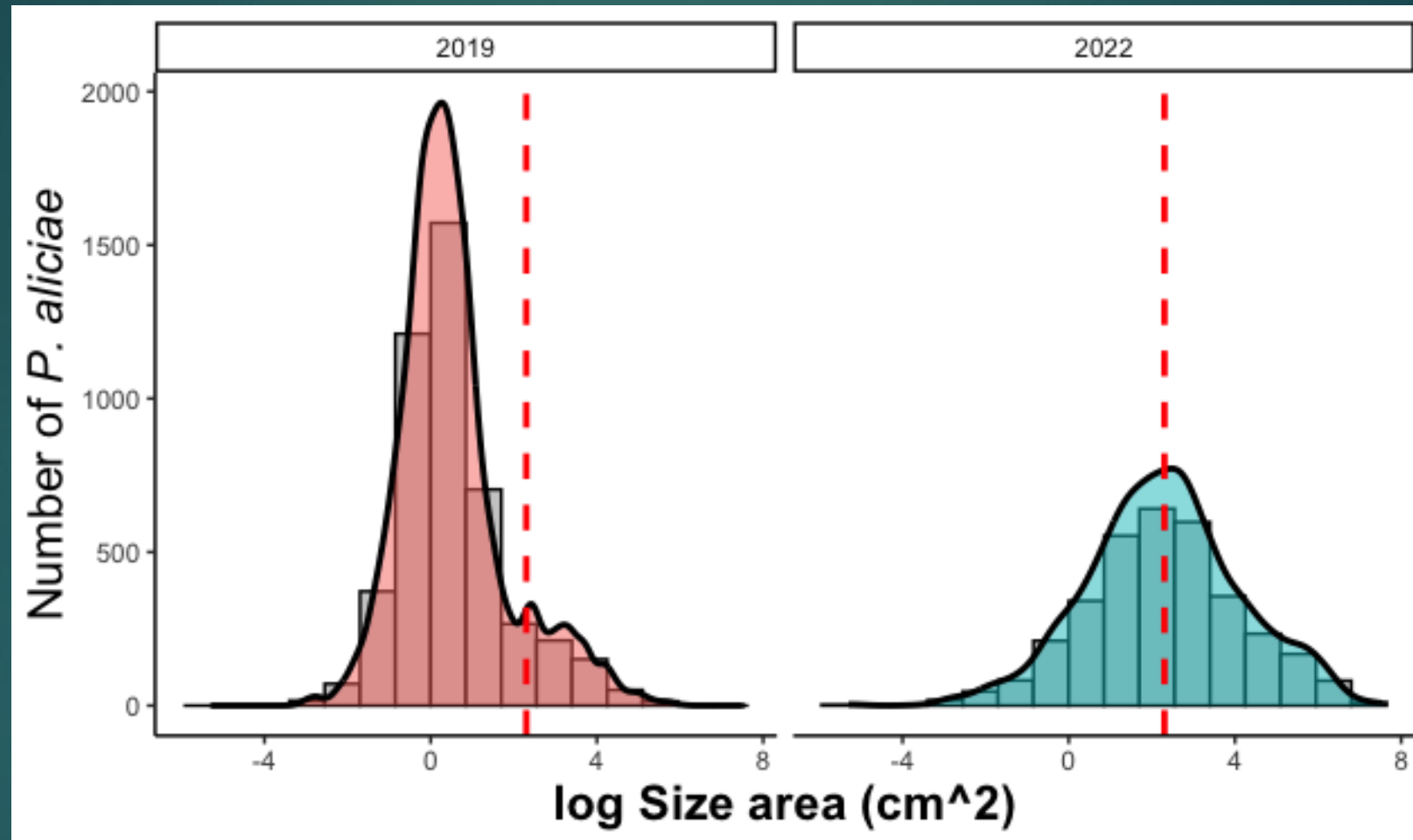
Question

2. What is driving this spatial pattern?

Hypothesis

3. The brooding reproduction of the coral drives the spatial pattern

Is the population size structure different?



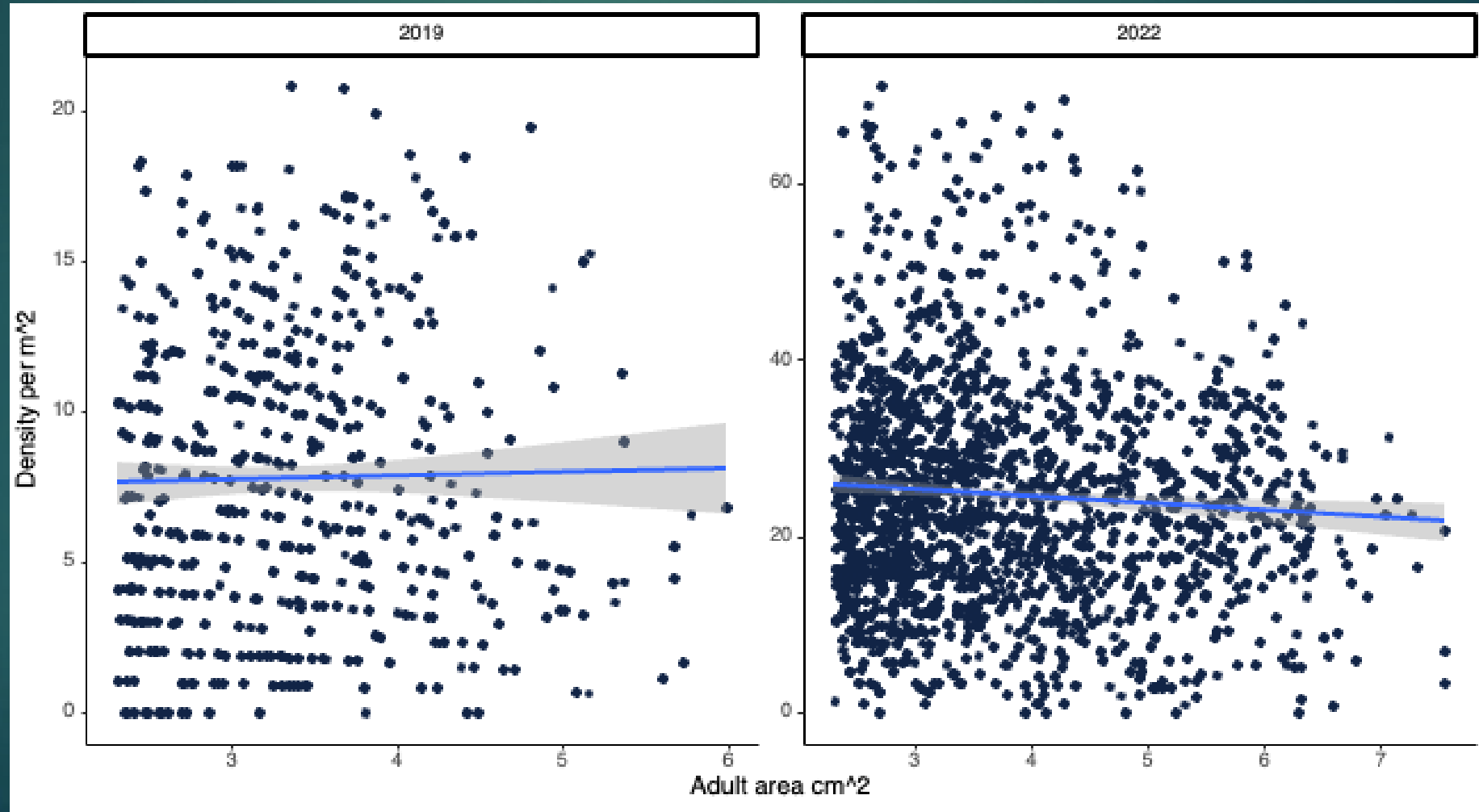
(D = 0.5212, p-value < 2.2e-16)



What are the coral conspecific relationships in relation to size?



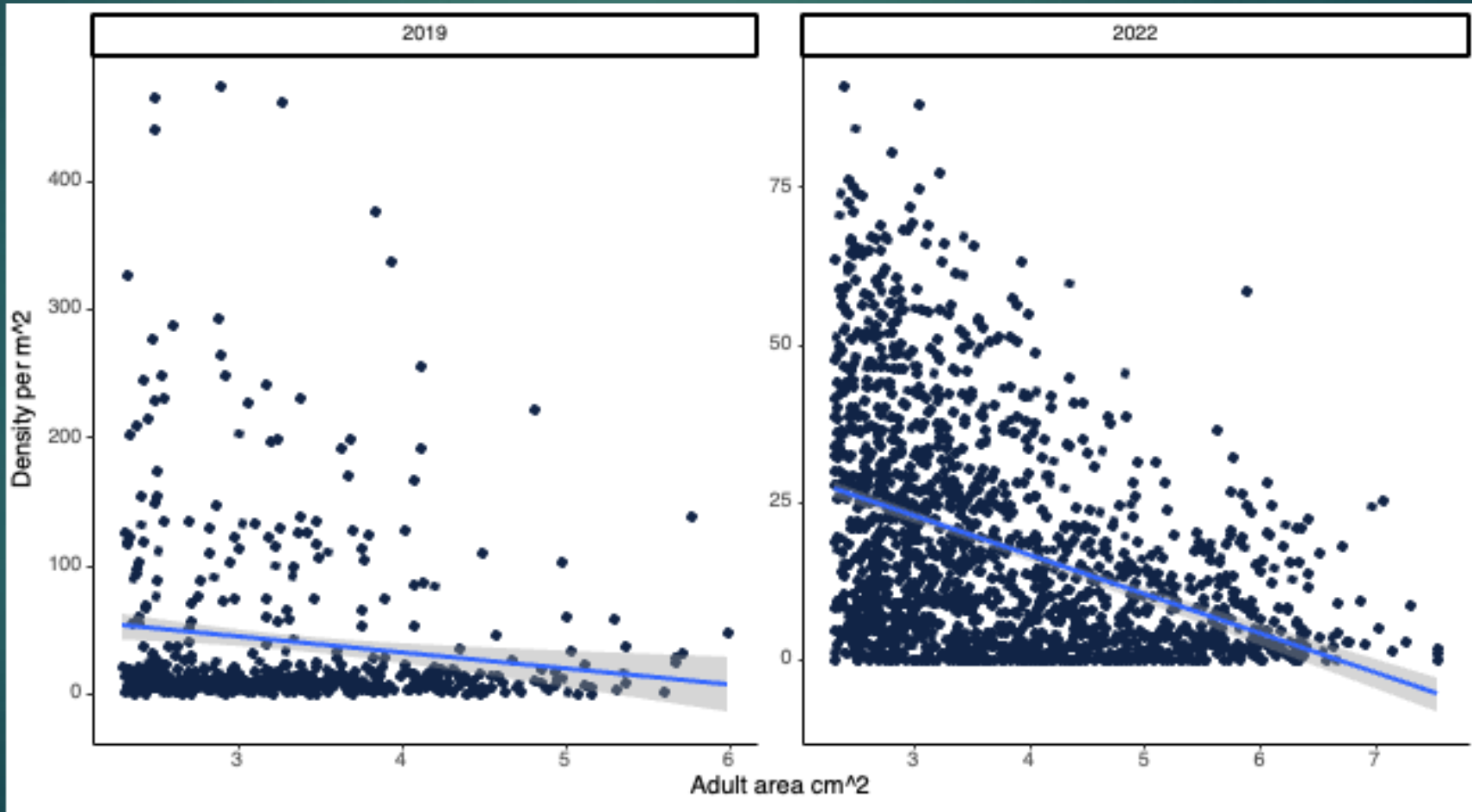
Adult to adult



What are the coral conspecific relationships in relation to size?



Adult to Juvenile



Summary

- ▶ Non-random spatial pattern of coral
- ▶ Data suggests direct heterospecific exclusion
- ▶ We observe a transition from high recruitment event to a maturing population
- ▶ Conspecific interactions change with coral size



Thank you!!

Any Questions?

Thanks to:

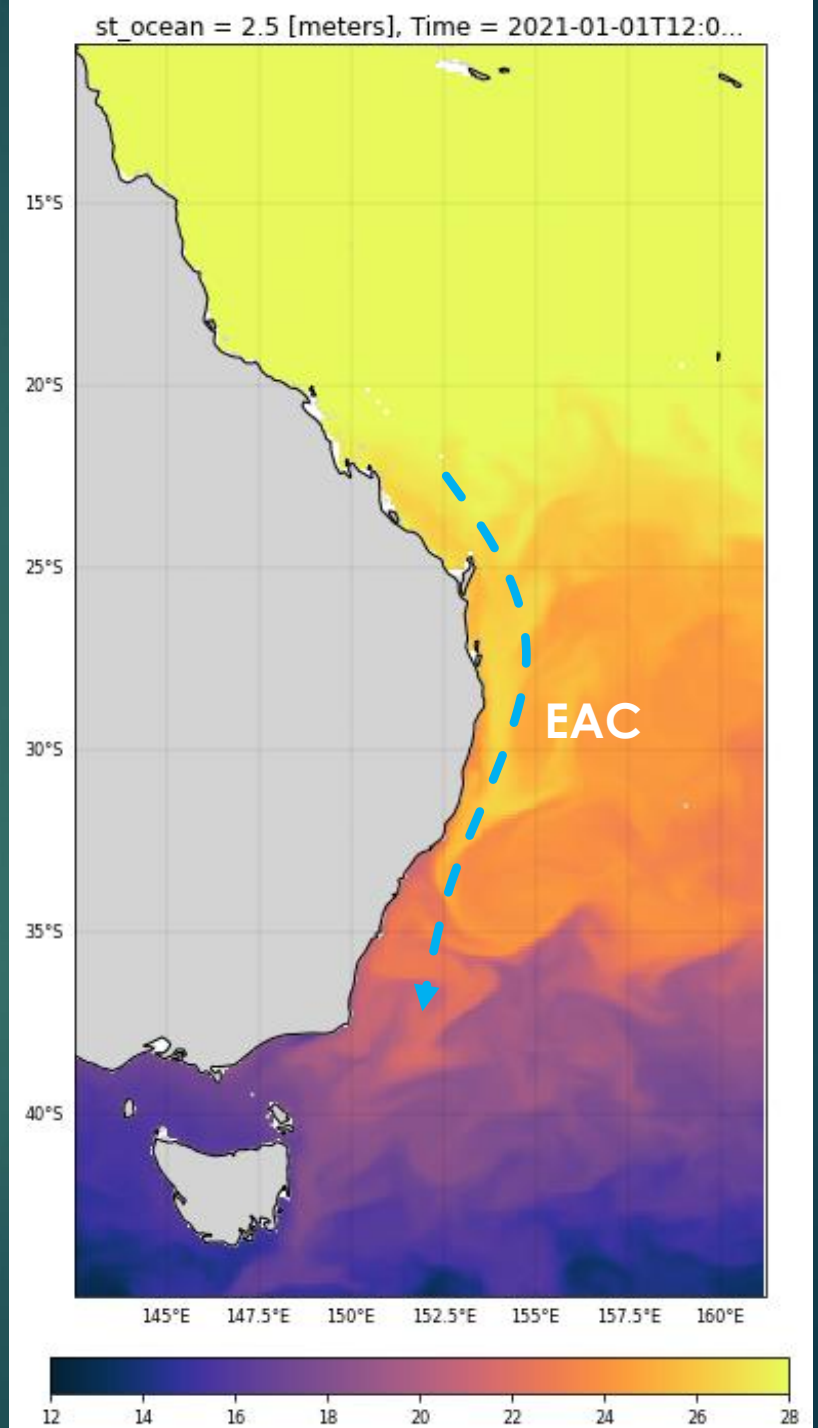
Alex McGrath
Emily McLaren
Chris A. Pine
IMB Lab



Email: christopher.cooney@sydney.edu.au

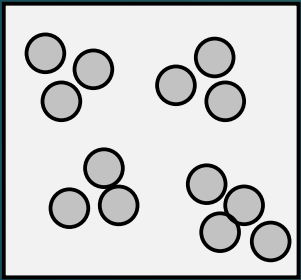
Climate change and boundary Currents

- ▶ Strengthening boundary currents¹
- ▶ Increasing subtropical and tropical supply¹
- ▶ The reorganisation of ecosystems from cool to warm-affinity species²

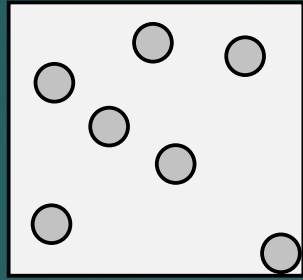


Kelp to coral relationship

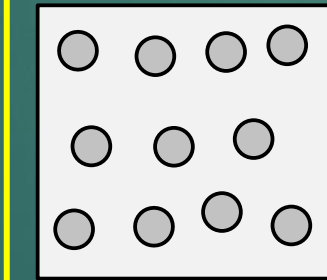
Clustered



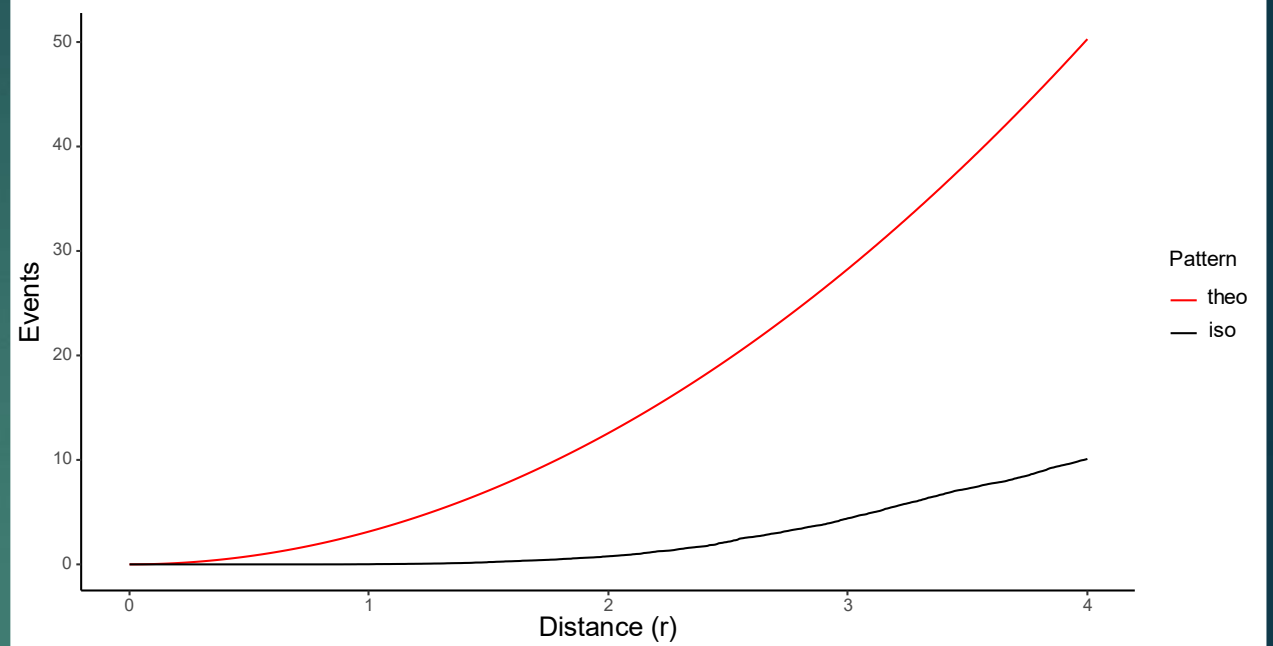
Random



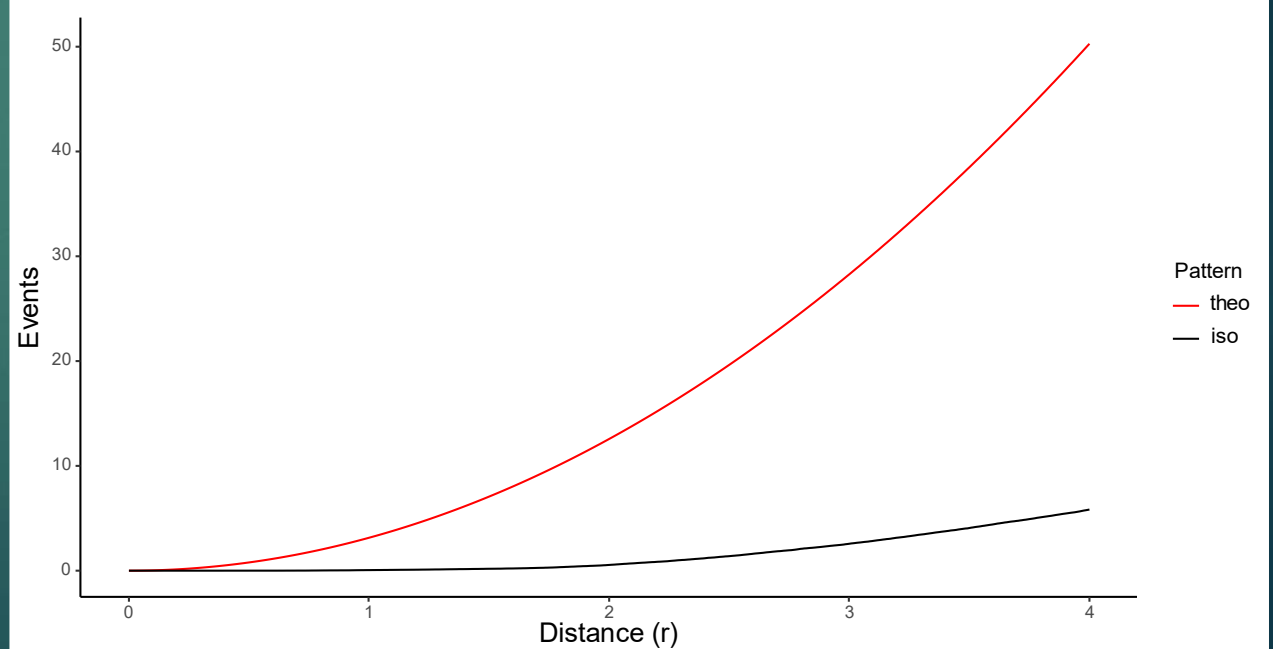
Over-dispersed



Kcross *E. radiata* – *P. aliciae*, 2019



Kcross *E. radiata* – *P. aliciae*, 2022



Ecological importance

- ▶ Insight into the positive and negative interactions between subtropical and temperate species
- ▶ Provides an important basis for experimental design
- ▶ Generates data needed to predict the structure of temperate reefs under climate change scenarios