



THE UNIVERSITY OF  
MELBOURNE



# Prioritizing management options for kelp recovery and overabundant urchins

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*Transplanted juvenile E. radiata sporophytes at Pt. Linley.*

*Tristan D. J. Graham*

# Background



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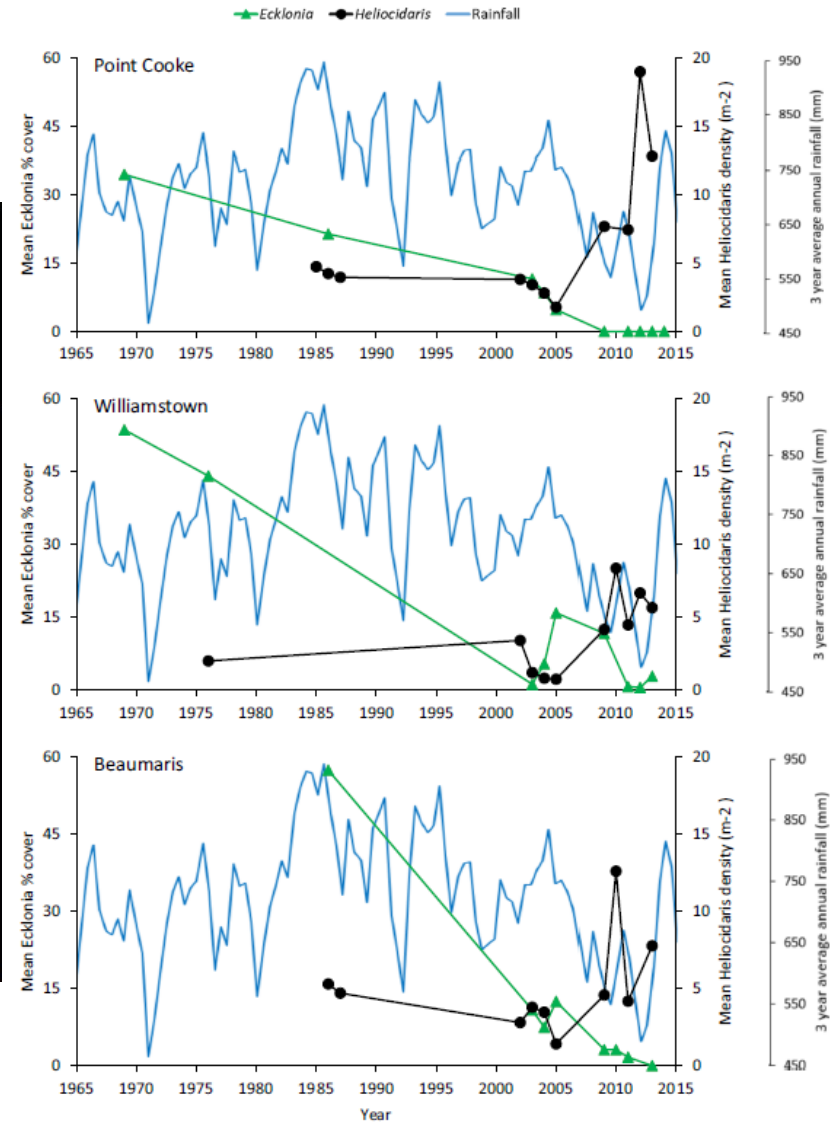
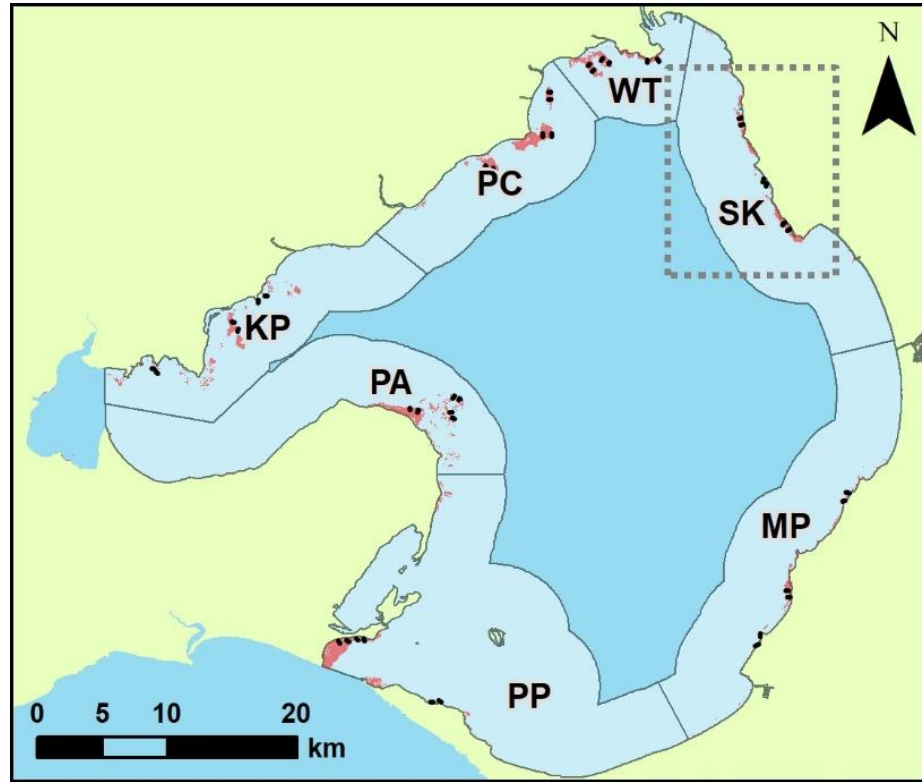
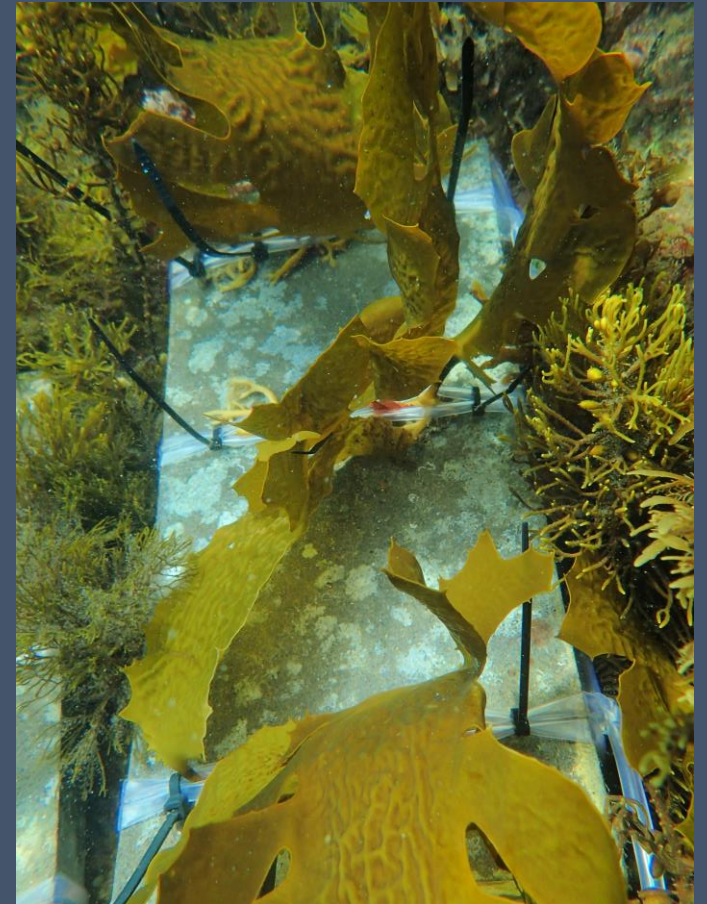


Figure from: Carnell & Keough 2019.



Let's restore



# But first ...

- Expensive
- High failure rate
- Remove stressors
- Target management actions
- Consider urchins in the design
- Cost recover

Perhaps we can utilize the urchin fishery

# Commercial urchin fishery PPB

- W&B 2003 was 1<sup>st</sup> (and only) stock assessment
- Quantified urchins in the Bay
- Identified relationships between urchin density, presence of vegetation, and urchin quality.
- Recommended a TACC of 60T

Research to develop and manage the sea urchin fisheries of  
NSW and eastern Victoria

D.G. Worthington and C. Blount

Cromulla Fisheries Centre,  
P.O. Box 21, Cromulla, NSW, 2230  
Australia



FRDC Project No. 1999/128

October 2003

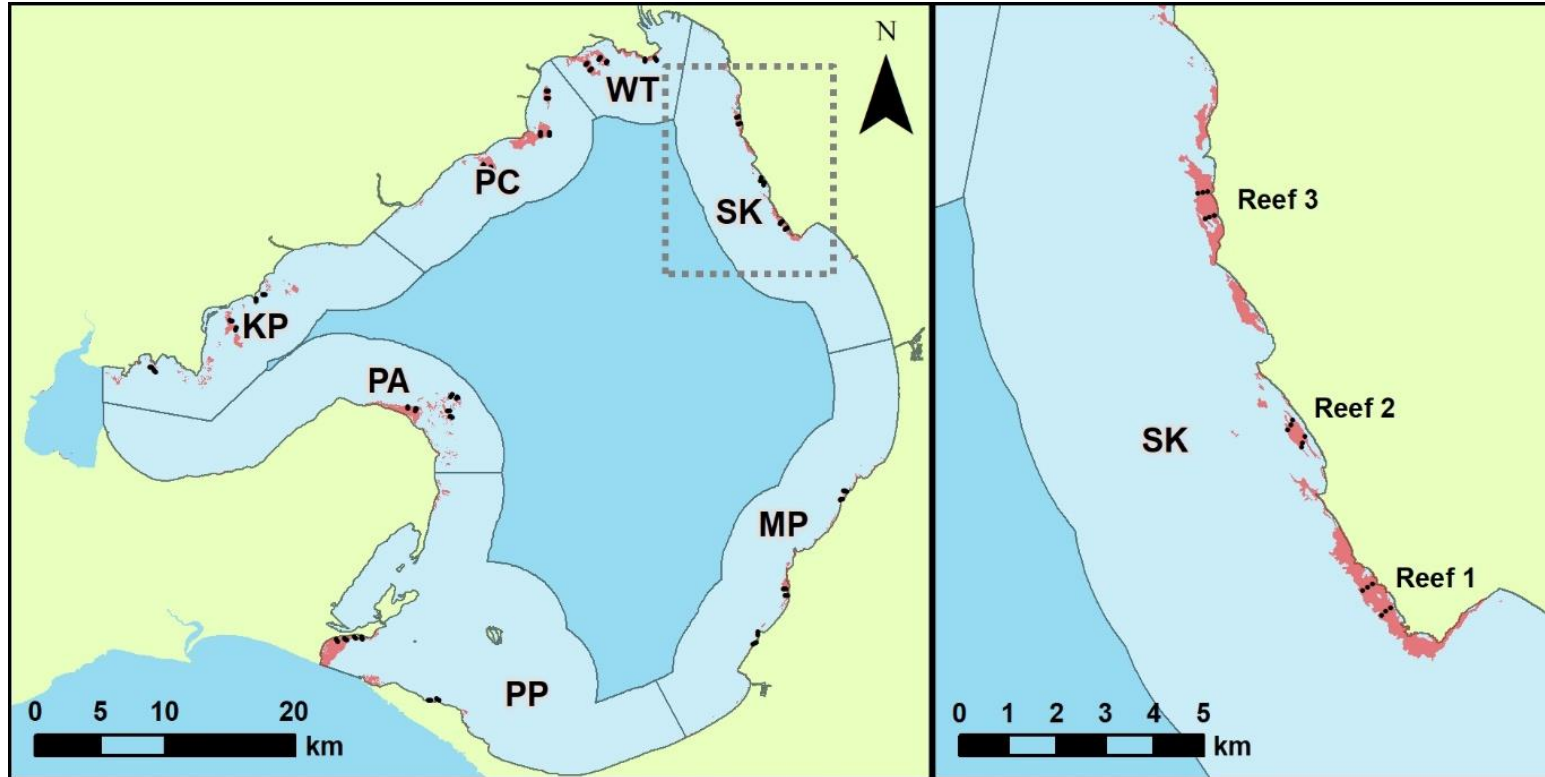
NSW Fisheries Final Report Series  
No. 56  
ISSN 1440-3544

# Survey design

## Aims:

1. Provide a second, independent stock assessment
2. Confirm original findings
3. Extend to include information relevant to kelp restoration

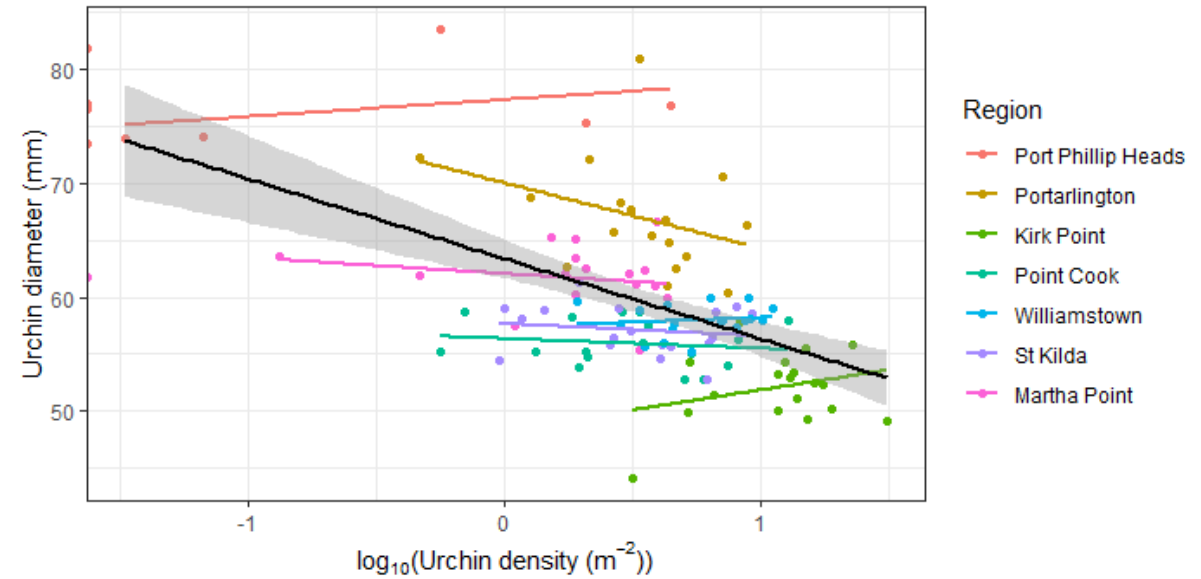
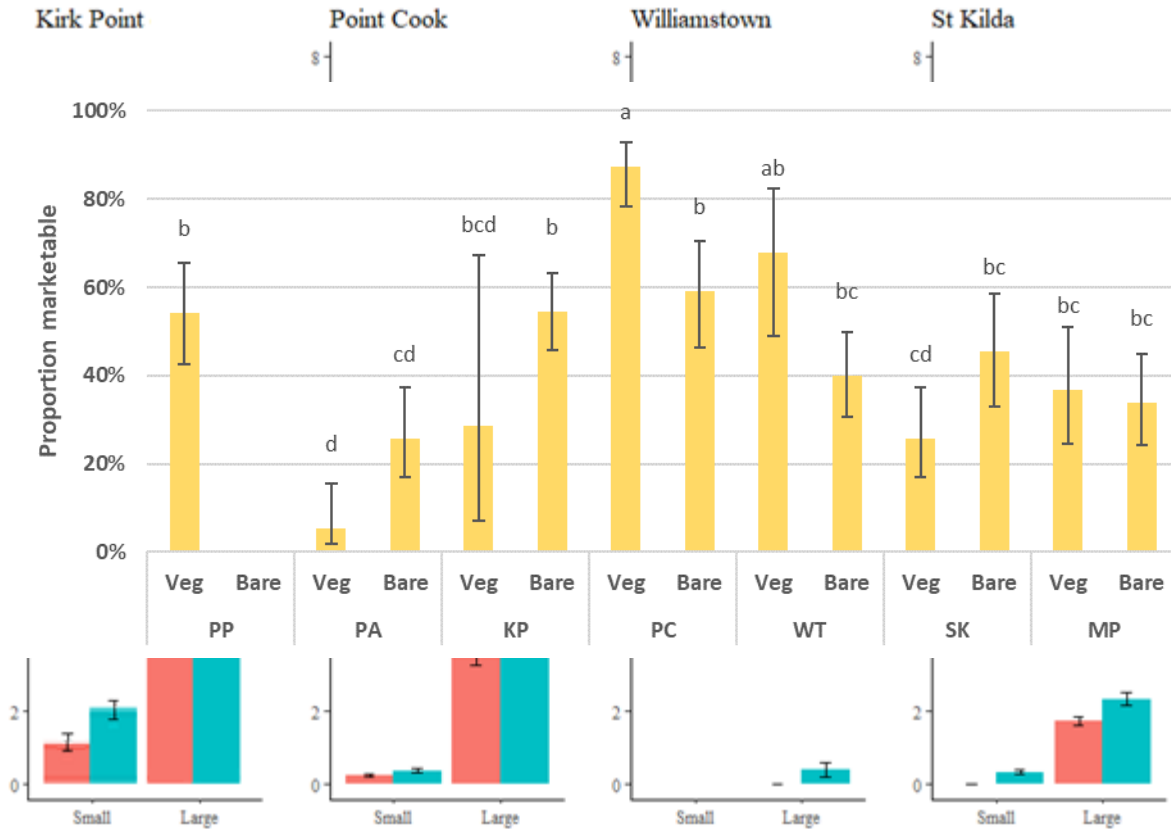
# Survey design



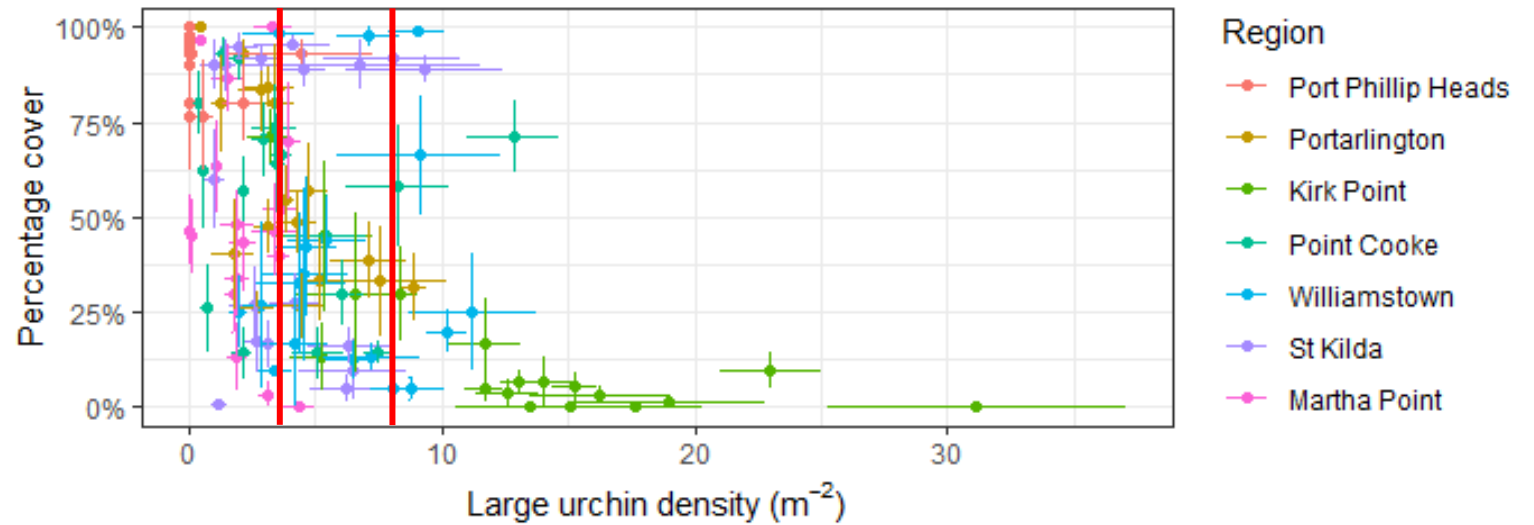
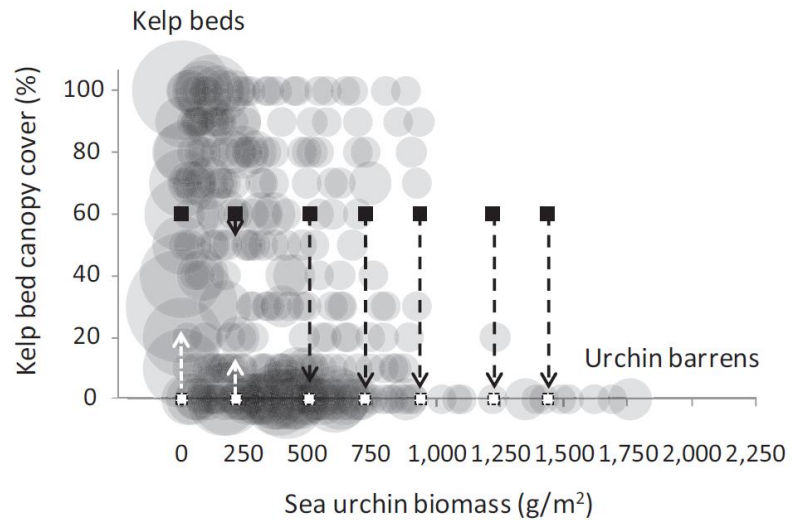
- Reef state
- Urchin density
- Roe quality



# Comparison to previous urchin survey

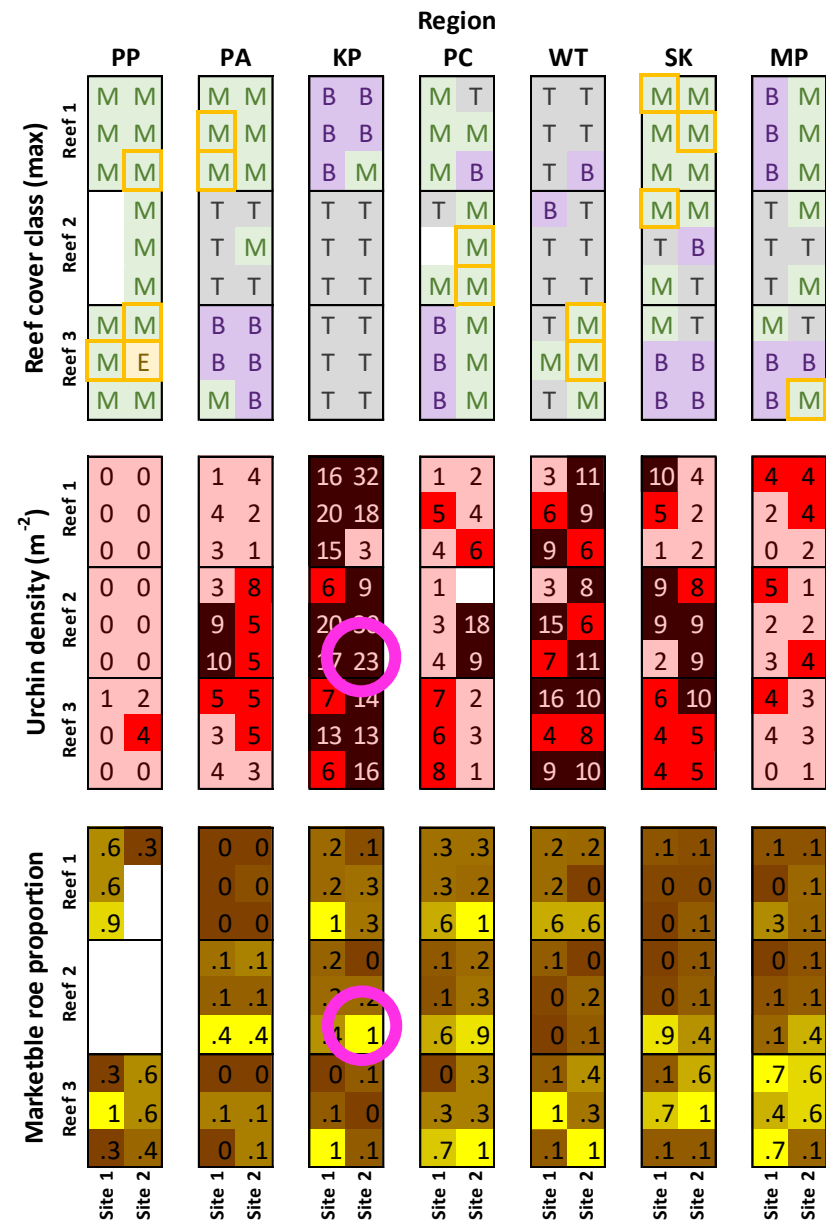


# Urchin density thresholds

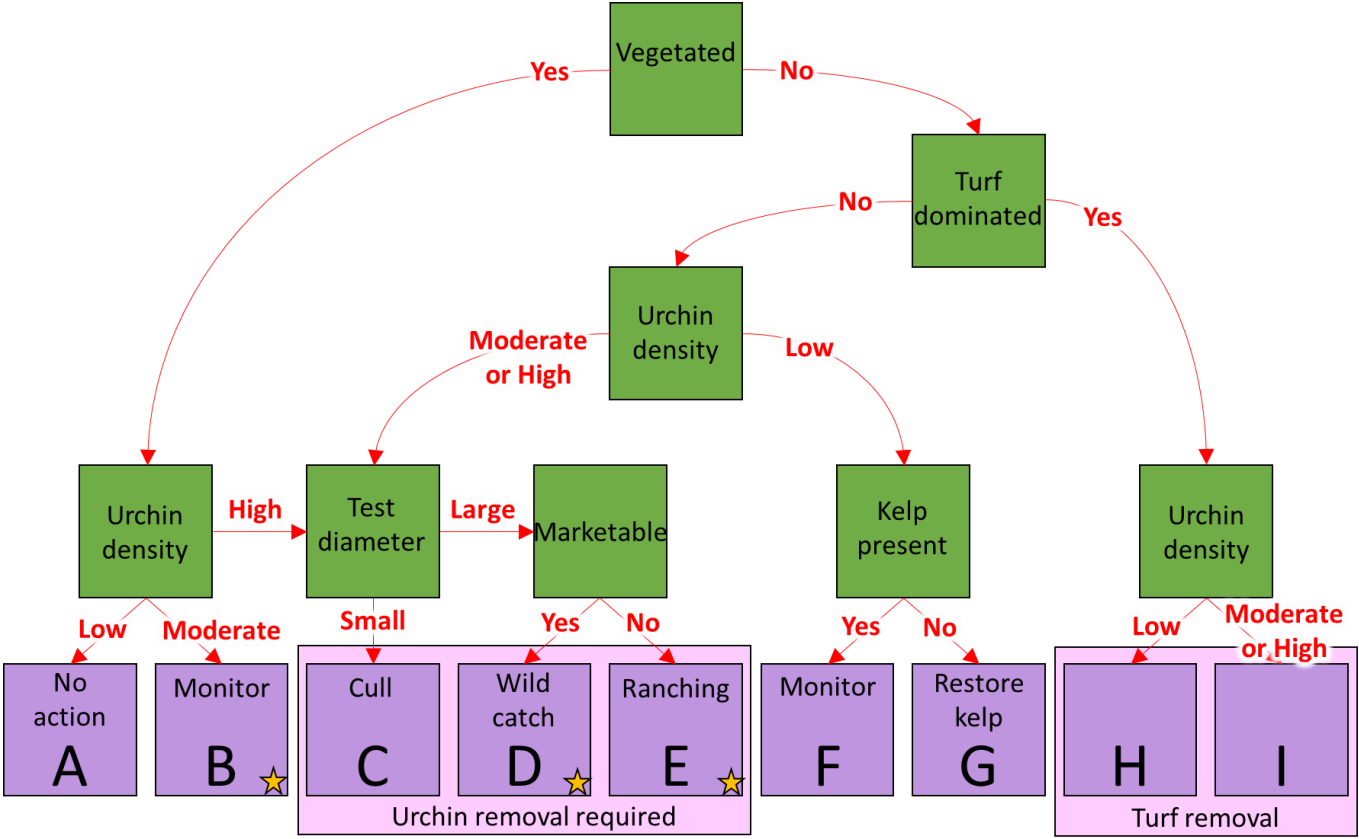


Ling, S. D., Kriegisch, N., Woolley, B., and Reeves, S. E. (2019)

# Results

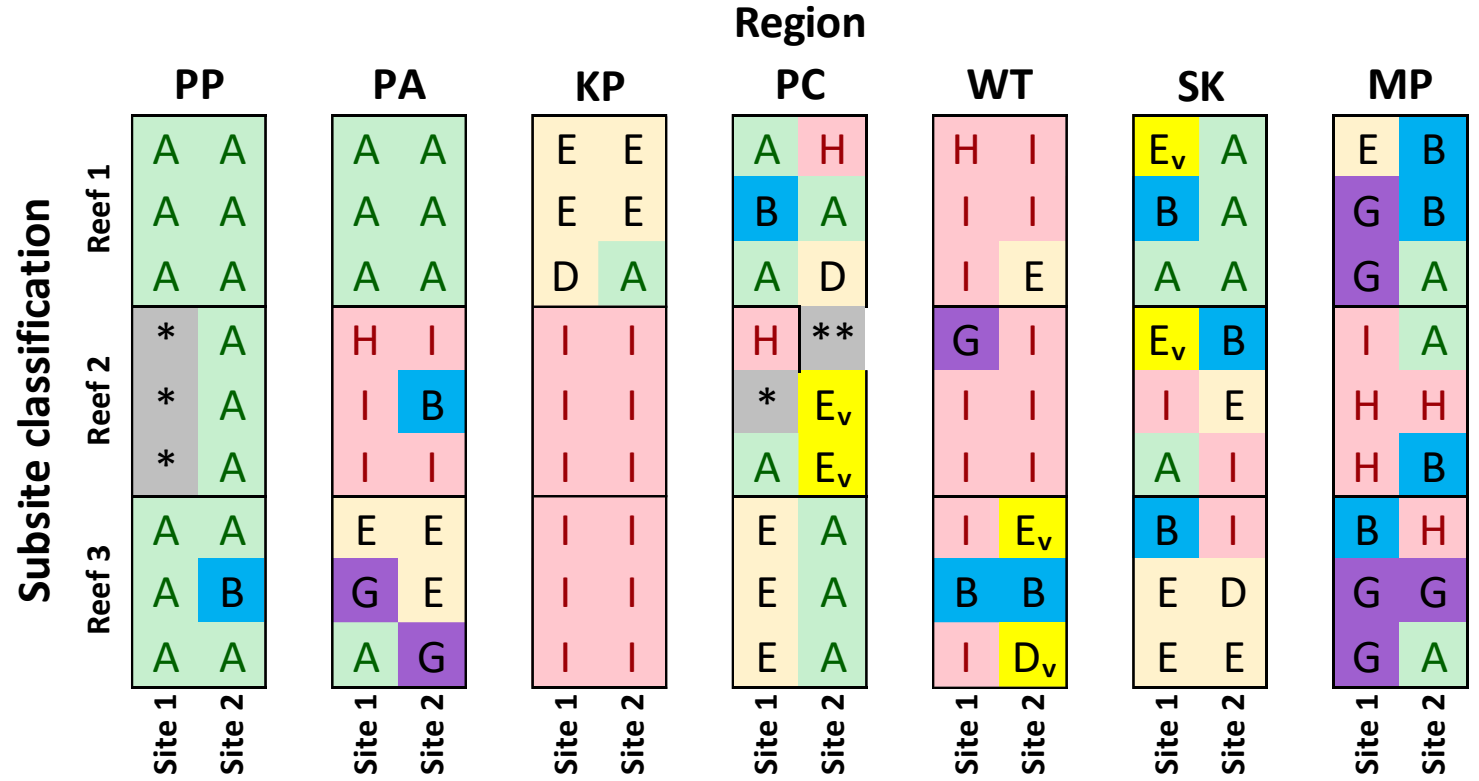
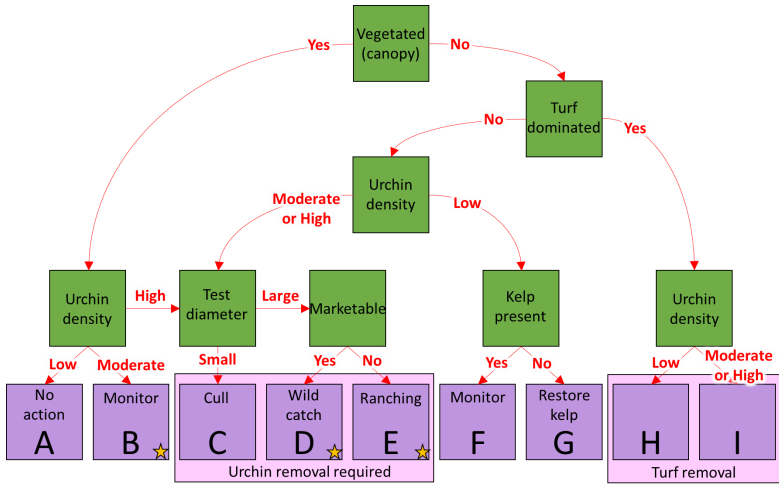


# Categorization Tree



*Categorization tree for reef management actions. Green boxes contain questions, red text the responses, and purple boxes the resulting actions. Stars indicate priority actions with greatest return for effort.*

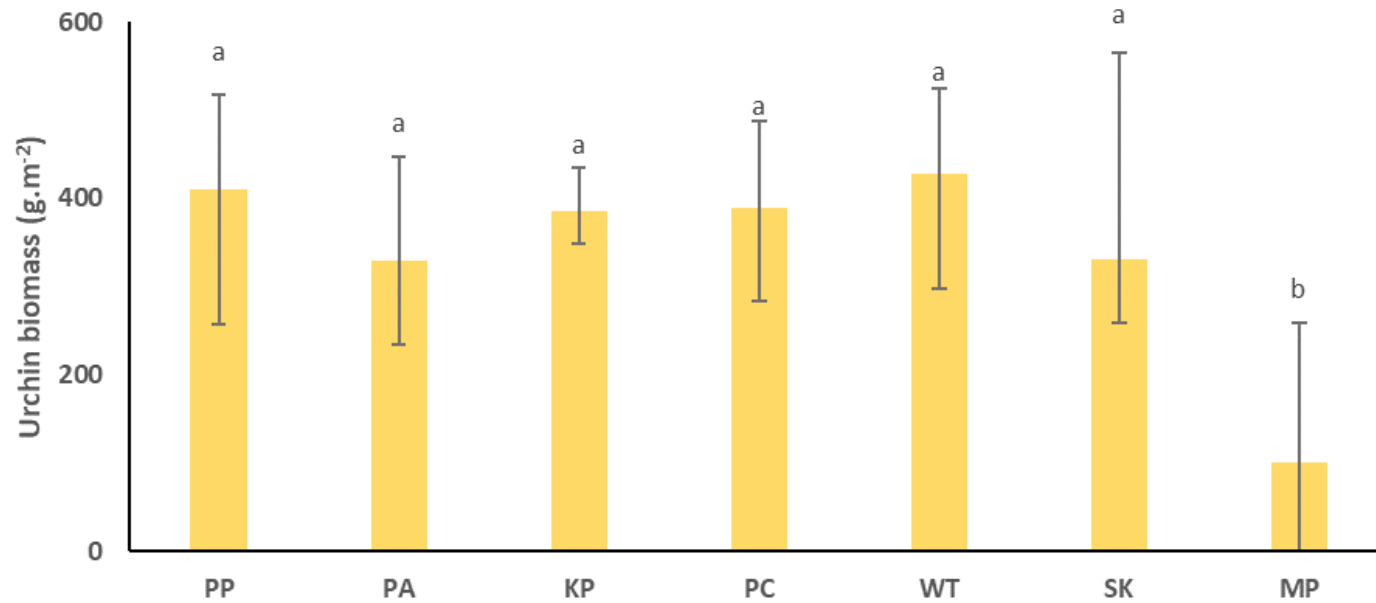
# Actions for Subsites



Subsite management category based on categorization tree. A = no action required, B = monitor, C = cull, D = wild catch, E = ranching, F = monitor, G = restore kelp, H = turf removal, I = turf removal. The subscript <sub>v</sub> indicates vegetated reefs. \* = A, F, G, or H; \*\* = A, B, or E.



# Let's extrapolate



$$\frac{e^{(a+c_1x_1+c_2x_2+\dots)}}{1 + e^{(a+c_1x_1+c_2x_2+\dots)}} = 0.5$$

$$x_1 = \frac{(a + c_2x_2 + \dots)}{-c_1}$$

# Summary

- Considering multiple factors allows more targeted restoration
- Similar thresholds for urchin density may be present for canopy algae more broadly
- We need subsite scale urchin density data.
- We need to collaborate
- Context matters



# Thankyou



## **Supervisors:**

Becki Morris, Beth Strain, Steve Swearer

## **Other co-authors:**

Paul Carnell, Fletcher Warren-Myers

Field and lab help from both UniMelb and Deakin

## **Funding:**

RTP scholarship, DELWP's PPB fund, NESP (NCCC) Earth Systems and Climate Change Hub

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