



ningaloo  
outlook

**BHP**



# Deep Reefs of Ningaloo: what we have learned and what we still need to know

Russ Babcock, Joe Turner, Karl Forcey, Nick Mortimer, Rob Gregor, Stuart Edwards, Melanie Trapon, Chris Doropoulos

**Ningaloo Outlook – A partnership between BHP and CSIRO**

WESTERN COASTAL/OCEAN & ATMOSPHERE  
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*Ningaloo Outlook is a BHP-CSIRO Industry-Science Marine Research Partnership investing over five years to gather new knowledge on the Ningaloo reef and its important ecological values*



# Outline

- Deep reefs objectives
- Importance of Deep reefs
- What we have done throughout the project;
  - Distribution of key deep-reef habitats
  - Unique features of Ningaloo deep reefs
  - Insights into deep reef processes
  - Temporal trends in deep reef assemblages
  - New technologies
  - Outreach and education
- Future research directions

# Deep reefs - Objectives

## Discover and describe

- assess distribution and abundance of deeper-water habitats i.e. coral, filter feeding assemblages (baselines)
- assess structuring processes among deep-water habitats

*“Undertake research to characterise the coral species and distribution within the reserves with a particular emphasis on the seaward deeper water community abundance and key functional groups of coral populations (CALM) (H)” Ningaloo Management Plan 2005*

## Process understanding

- identifying timescales for turnover rates for benthic assemblages.
- variability of deeper-water habitats i.e. coral, filter feeding assemblages.

*“Performance measures: diversity and biomass constant or positive” Ningaloo Management Plan 2005*

# Importance of Deep reefs

## What are they like? Characterising and Mapping

- Reef zonation: Coral reef growth limited by light availability at depth, but deep areas can be extensive, and different from shallow reefs
- Habitat for many species important to us (e.g. fisheries)

## Why are they important? Unique Features

- Undiscovered biodiversity

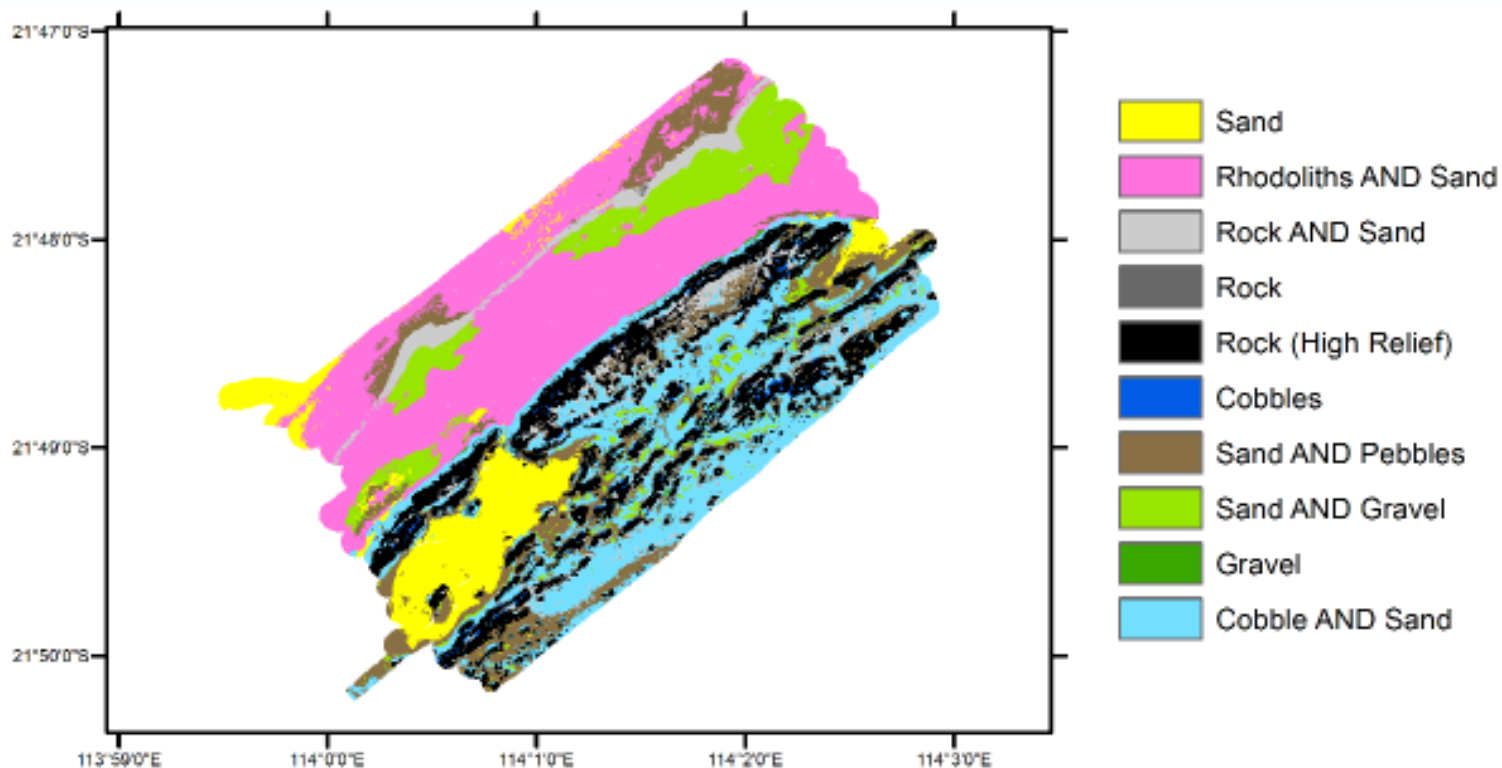
## How do they work? Processes and Trends

- Generally these areas are poorly known e.g. composition & location but especially their dynamics.
- Refugia for shallow water populations in times of stress (resilience)

# Characterising and mapping deep reefs

# Distribution of Ningaloo deep-reef habitats

## Substrate mapping

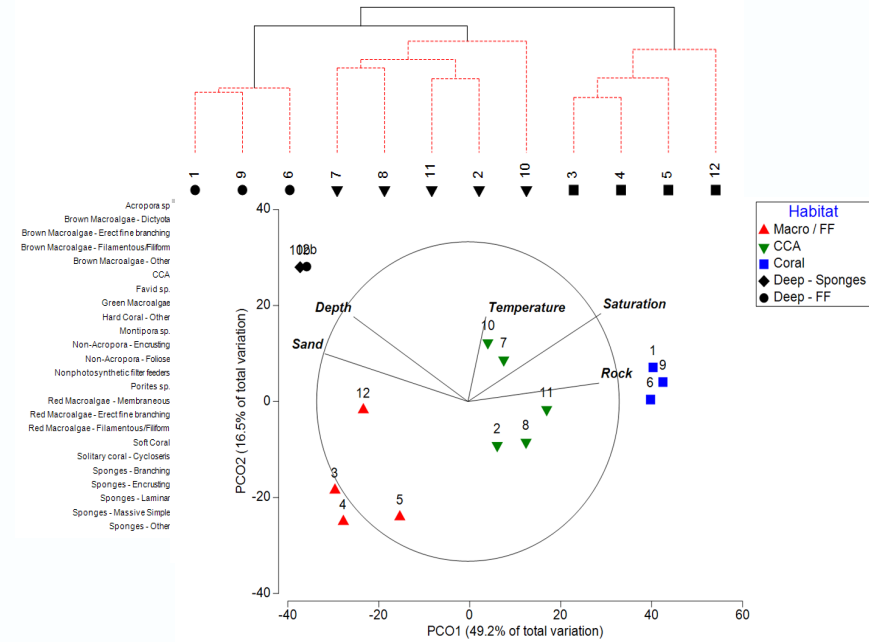
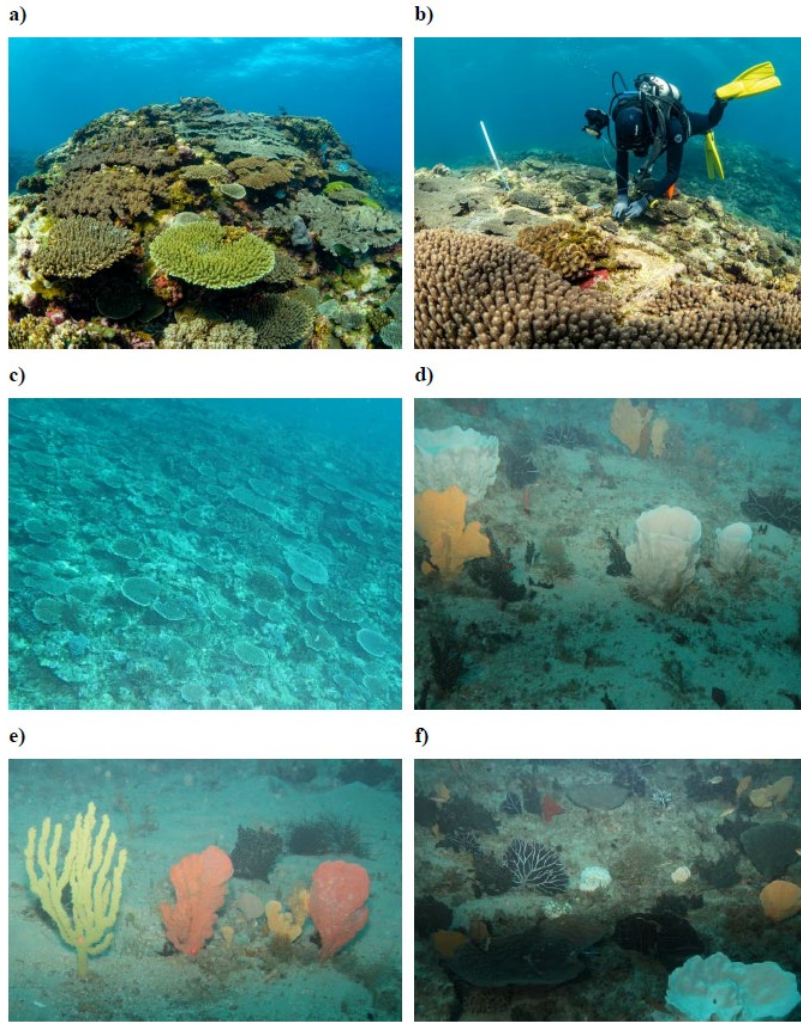


Turner et al. 2018. Estuarine, Coastal and Shelf Science, 204: 149–163



# Distribution of Ningaloo deep-reef habitats

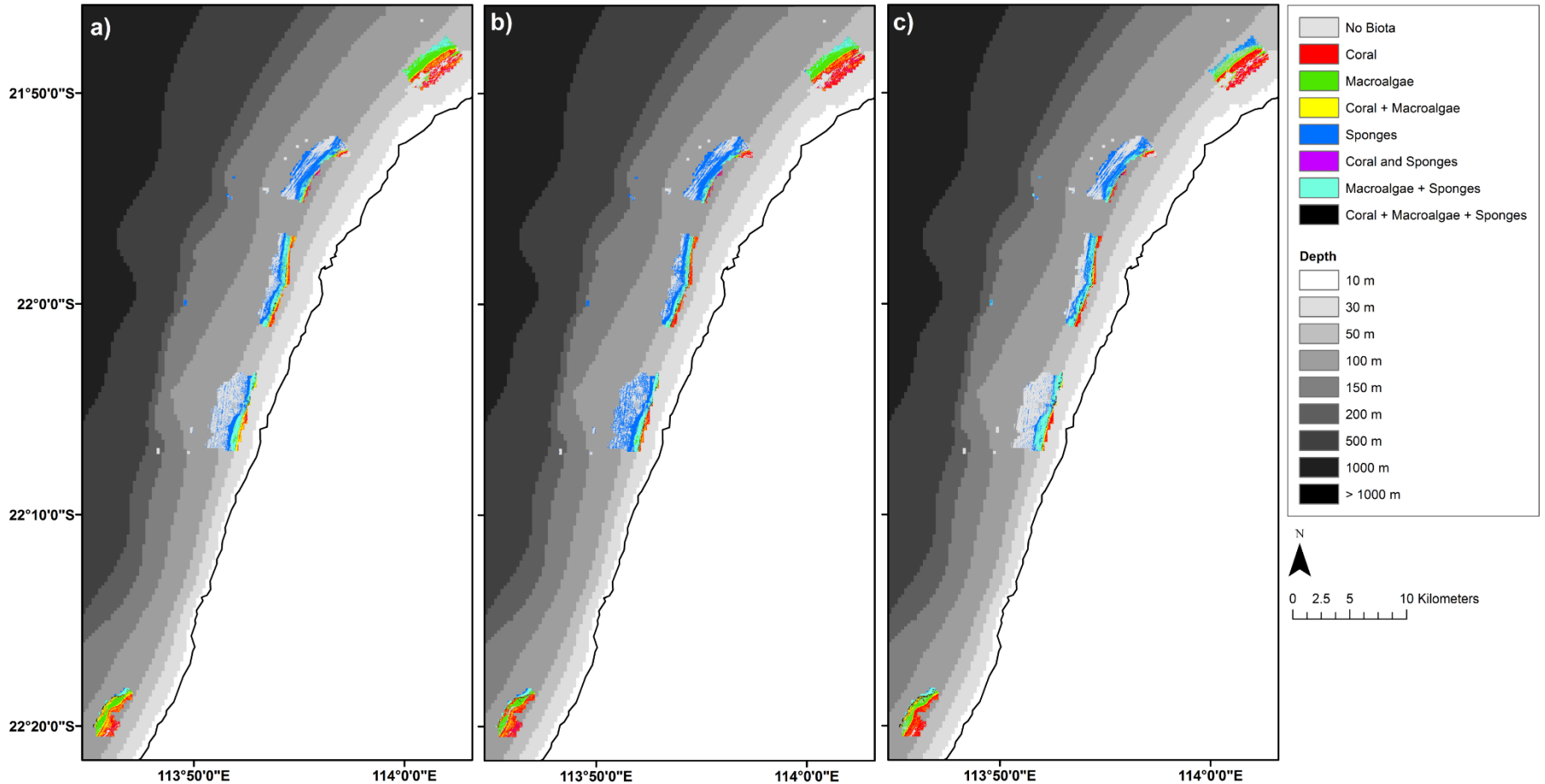
## community composition



Turner et al. 2018. Coral Reefs 37:763-778

# Distribution of Ningaloo deep-reef habitats

## species distribution modelling

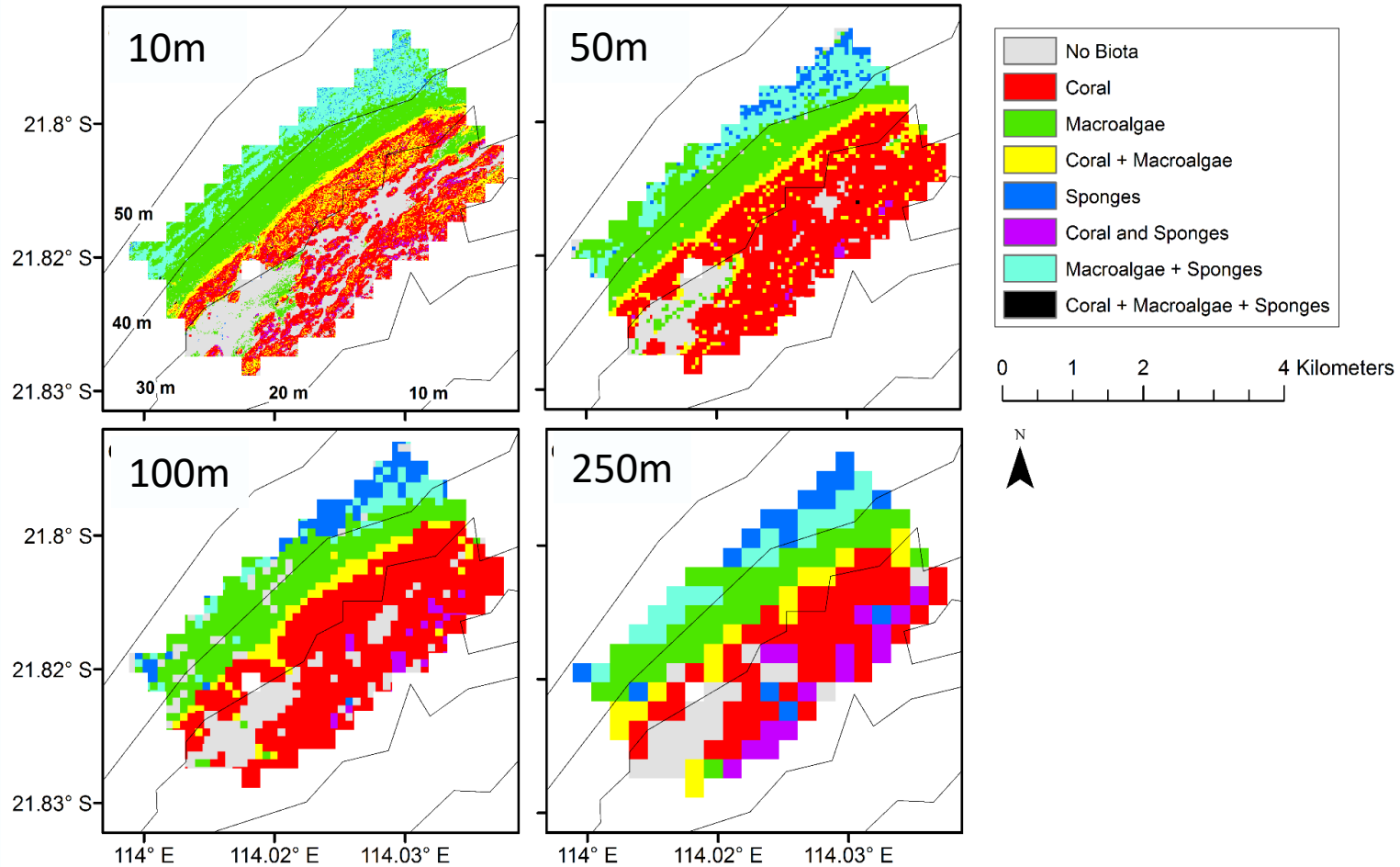


Turner et al. *Journal of Biogeography*. 46(6), pp.1249-1259



# Distribution of Ningaloo deep-reef habitats

## efficient analysis and high confidence predictions



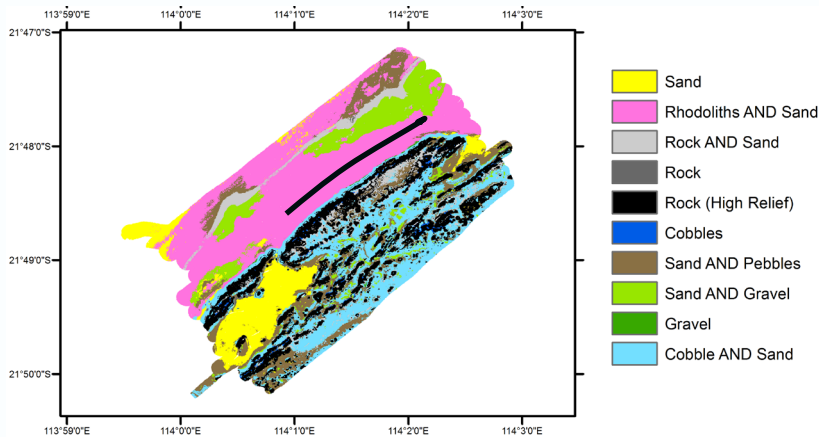
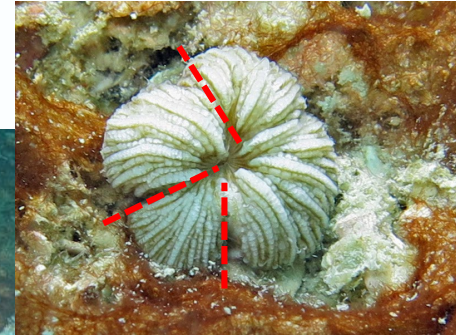
Turner et al. *Journal of Biogeography*. 46(6), pp.1249-1259

# Unique features of Ningaloo deep reefs

# Novel assemblage - *Cycloseris distorta*

- 2.7km long bed, average 90m wide in depths 38-42m
- Density 51 m<sup>-2</sup> but >100 m<sup>-2</sup> in places
- Up to 12 million individuals
- Goldilocks Zone?

fragmentation



# Magic Mushrooms

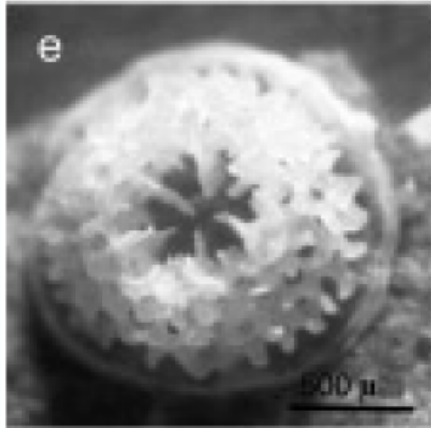
## A Coral Reef good news story....

- Total media coverage: 1.4M (13 separate TV clips, running nationally over two days)
- Total social media: 28,637 (Facebook 7,053, LI 11,072 Twitter 10,512); likely higher as ABC shared story on Facebook and Twitter
- feature news story of the day in Qantas lounges across Australia.

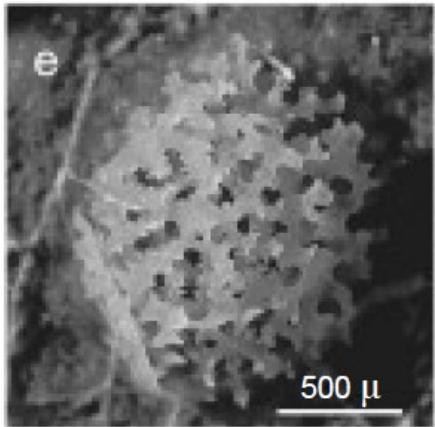


# Insights into deep reef processes

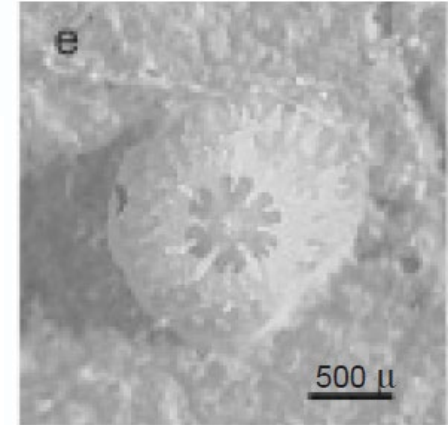
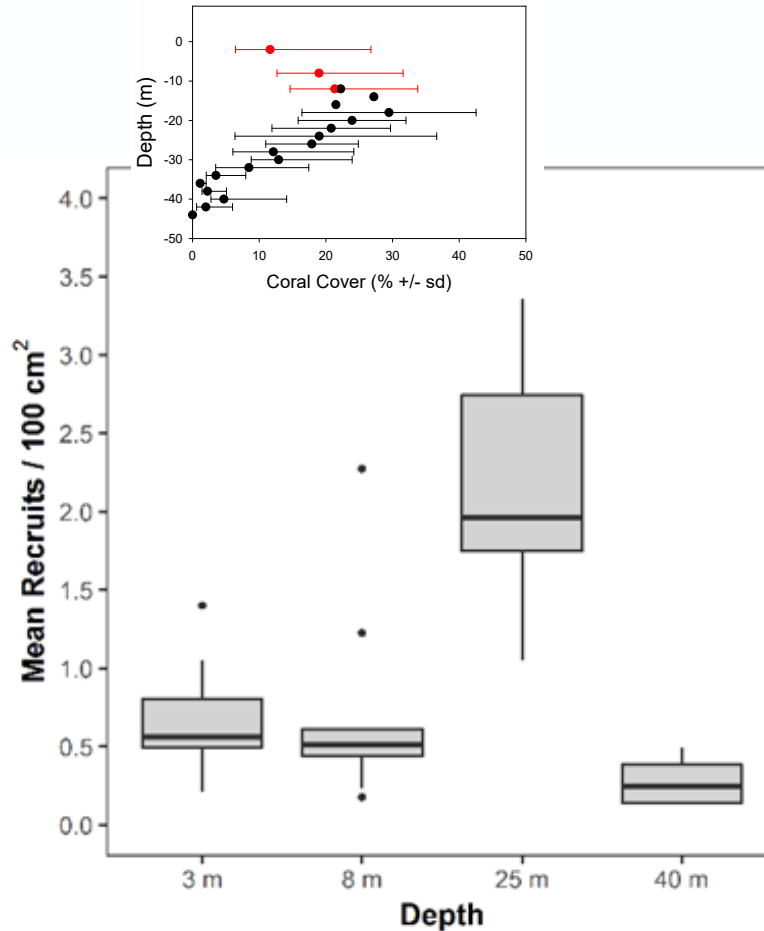
# Variation in recruitment with depth



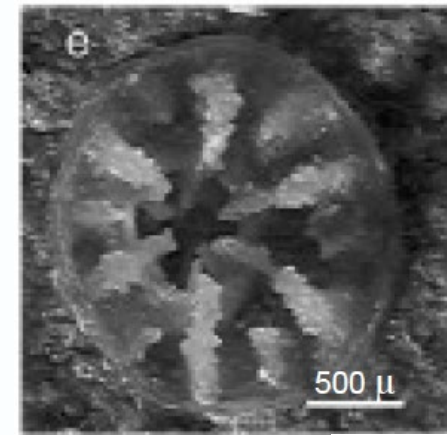
Acroporidae



Poritidae



Pocilloporidae



"others"

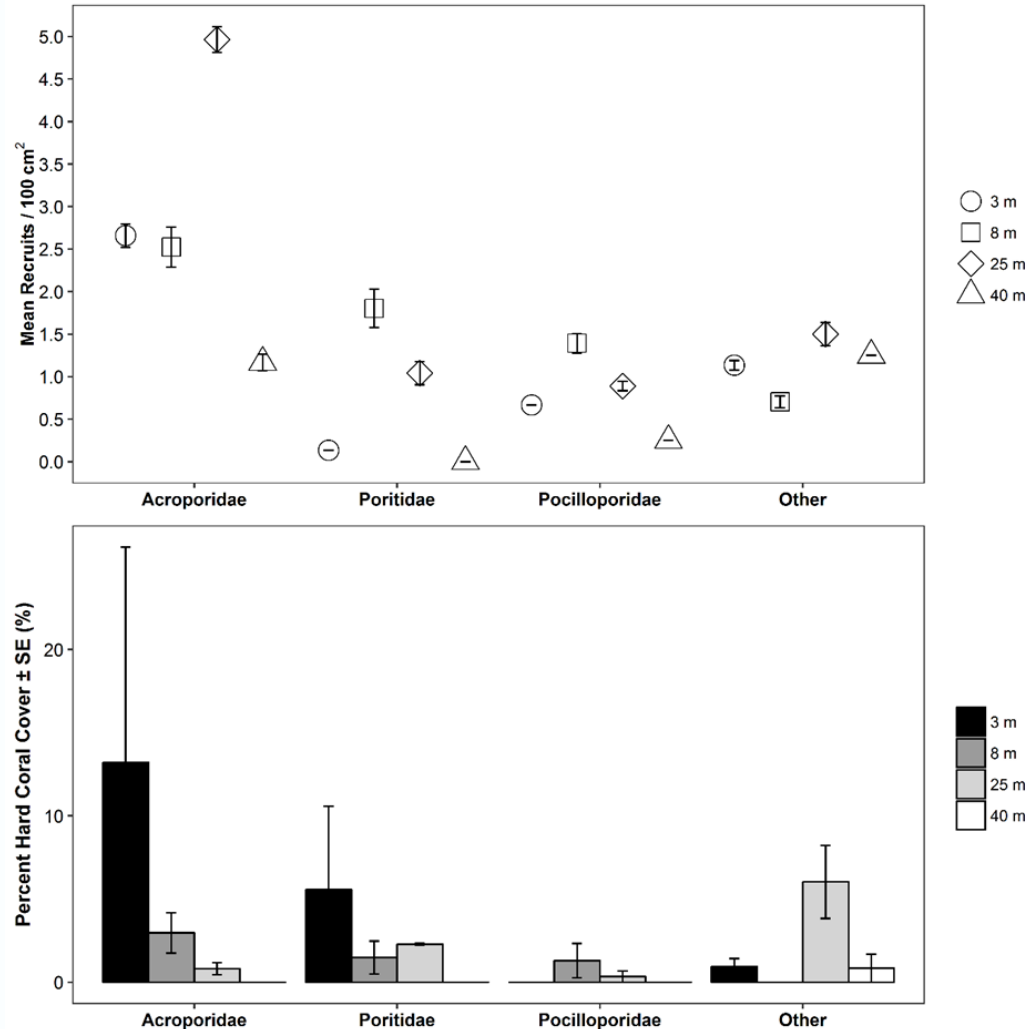


# Recruit composition

- Varied with depth
- A moderate, but significant correlation between recruit assemblage and cover of coral genera was observed

(RELATE,  $\rho = 0.378$ ,  $p = 0.001$ .  
DistLM  $R^2 = 0.444$ )

- Recruitment not consistent with deep water refugia hypothesis



Turner et al. 2019. Coral Reefs 37:711-722

# Temporal trends in deep reef assemblages

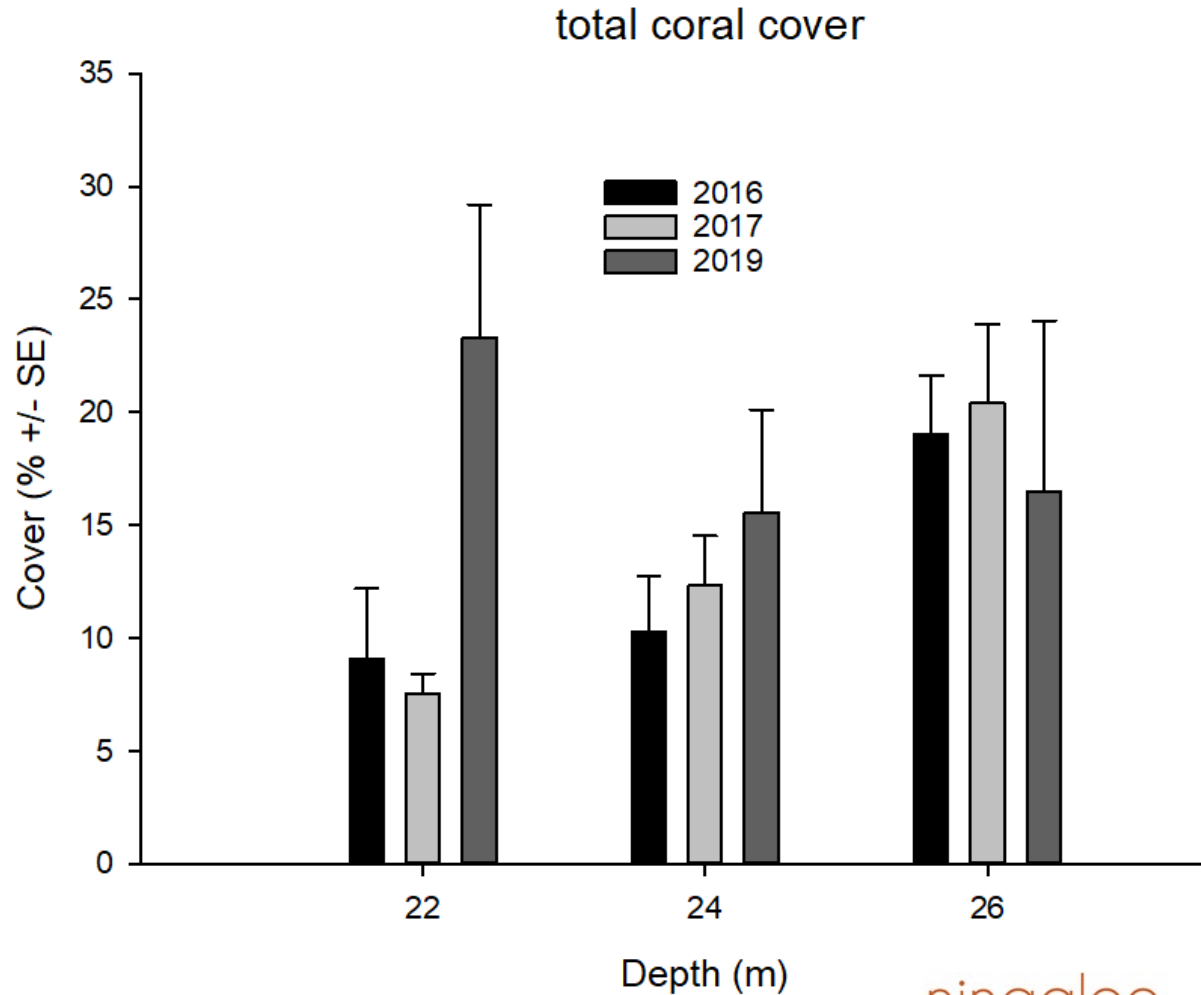
# 2016 and 2017 deep reef surveys

Mean(SE) coral cover  
(20-26)m

2016: 13.6 ±1.5

2017: 12.7 ±1.2

2019: 17.9 ±3.6



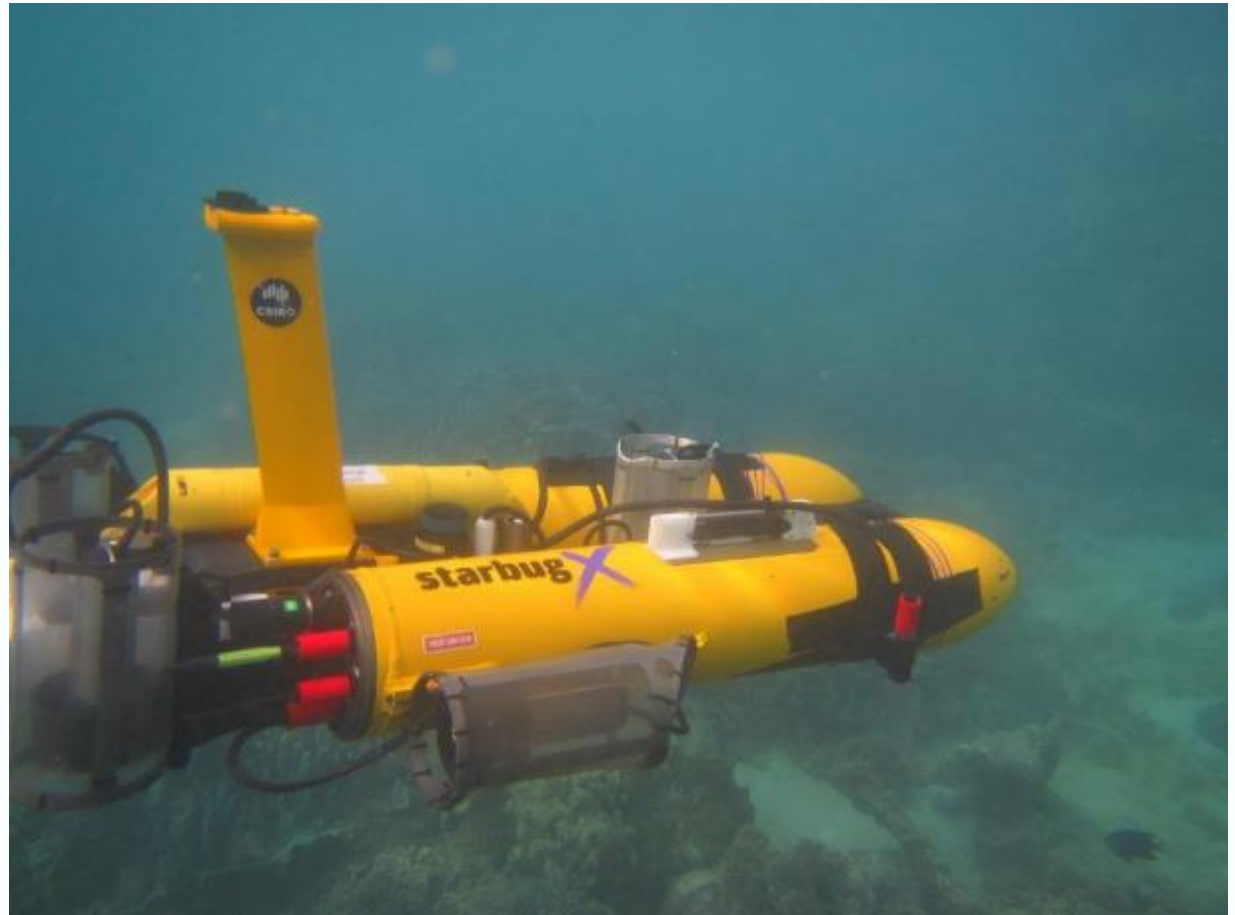
# Deep Reefs “report card”

Benthic condition indicators	2015/2016		2016/2017		2017/2018		2018/2019	
	Trend	Confidence	Trend	Confidence	Trend	Confidence	Trend	Confidence
Coral cover deep reef slope	Stable	Low	Stable	Moderate to High	Stable	Moderate to High	Stable	Moderate to High

# New Technologies

# Starbug-X AUV

- Extensive photo transects at depth
- Logging multiple streams of environmental data
- repeatability and sampling precision
- Routinely operable from small vessels

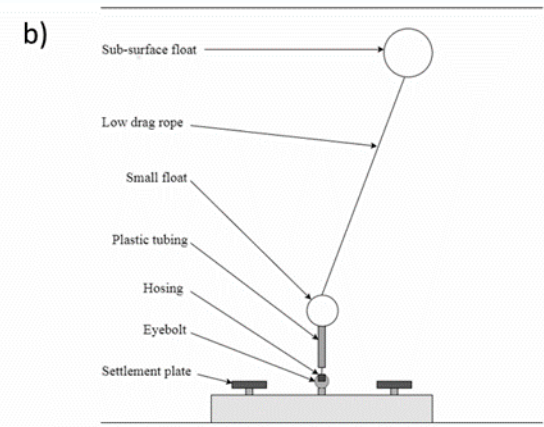
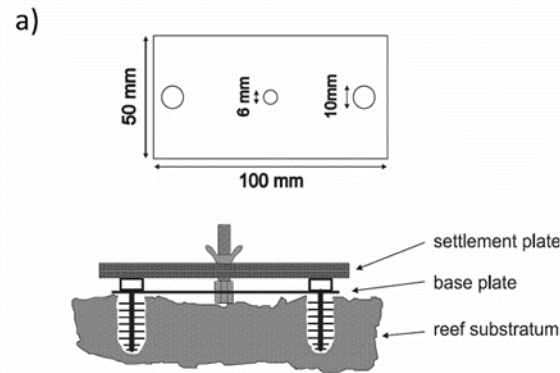


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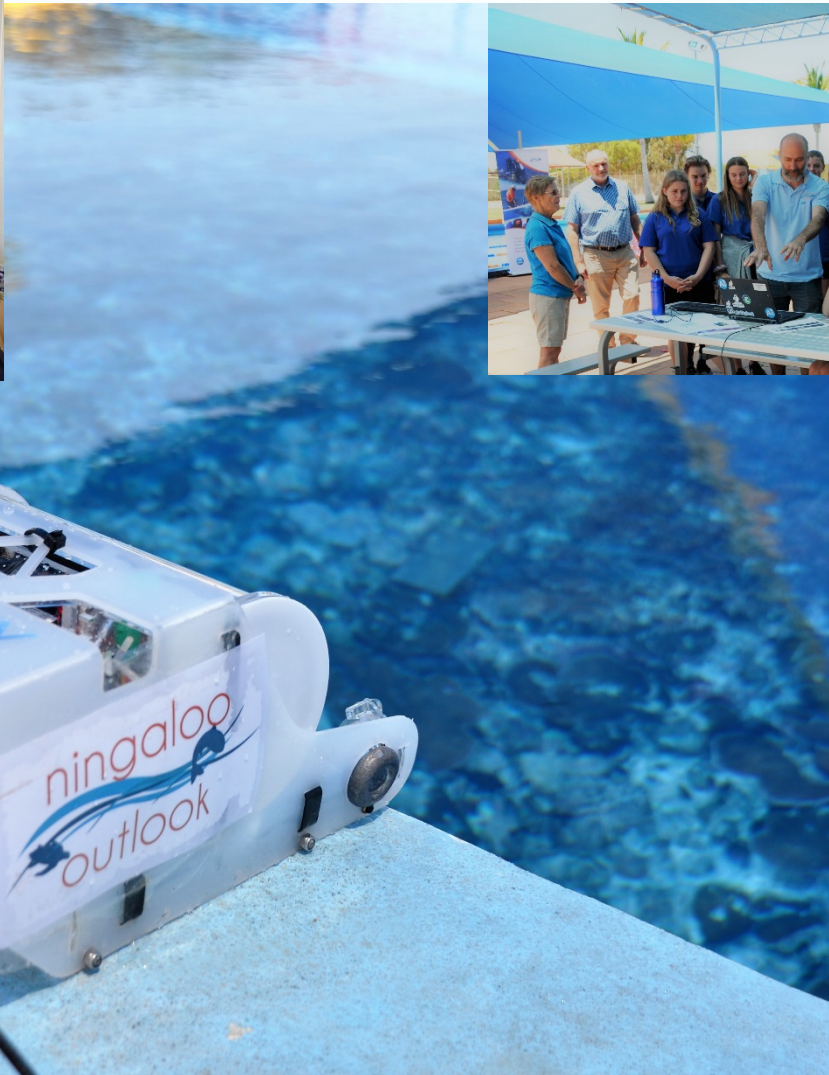
# Novel deployment method for deepwater recruitment studies

- Number and composition of recruit assemblages do not differ from those on conventionally deployed tiles



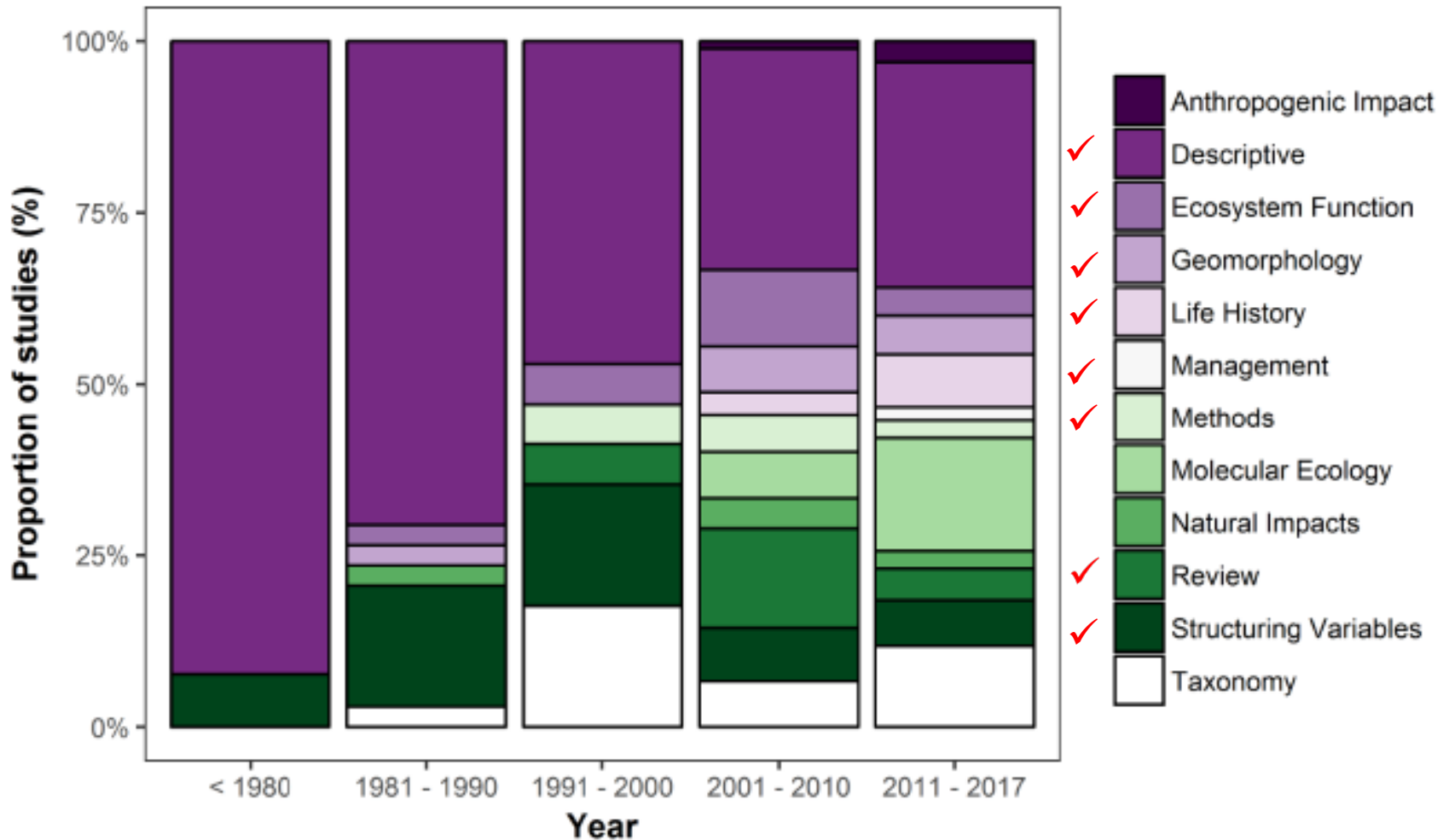
Turner et al. 2019. Coral Reefs 37:711-722

# Outreach and Education





# Deep reef research for management



Turner et al. 2017. ICES Journal of Marine Science 74(9):2309-2320

# Future research directions

- Better information for management: Continuous habitat map for Ningaloo deep reefs
- Response to natural and anthropogenic impacts: Continued monitoring and deeper integration with shallow reef monitoring
- Effect of management practices: Inclusion of deep reef fish assemblage monitoring

# Thank you!



**CSIRO Oceans and Atmosphere**

e [russ.babcock@csiro.au](mailto:russ.babcock@csiro.au)

t 08 9333 6537

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