

Deep Reefs

Russ Babcock, Joe Turner, Karl Forcey, Nick Mortimer, Rob Gregor, Stuart Edwards

Ningaloo Outlook – A partnership between BHP and CSIRO

WESTERN COASTAL/OCEAN & ATMOSPHERE www.csiro.au



Ningaloo Outlook is a BHP-CSIRO Industry-Science Marine Research Partnership investing A\$5.4 million 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

Deep reef research for management



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

Importance of Deep reefs

What are they like?

 Reef zonation: Coral reef growth limited by light availability at depth, but deep areas can be extensive, and different from shallow reefs

Why are they important?

- Undiscovered biodiversity
- Refugia for shallow water populations in times of stress (resilience)
- Habitat for many species important to us (e.g. fisheries)

Generally these areas are poorly known e.g. composition & location but especially their dynamics.

Characterising and mapping deep reefs

Substrate mapping



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

community composition



species distribution modelling



Turner et al. Ecography (in review)

efficient analysis and high confidence predictions



Turner et al. Journal of Biogeography. (In press).

Unique features of Ningaloo deep reefs

11 | Deep Reefs | russ.babcock@csiro.au

Distribution of Ningaloo mesophotic coral habitats Coral Distribution

Results

- Depth extent shallower
- Composition
- Peak in cover @ 20m







Novel assemblage - Cycloseris distorta

- 2.7km long bed, average 90m wide in depths 38-42m
- Density 51 m⁻² but >100 m⁻² 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





Temporal trends in deep reef assemblages

2016 and 2017 deep reef surveys

coral cover at 20-26m 2016: 13.6 ±1.5 SE 2017: 12.7 ±1.2 SE

Do deep reefs really provide a refuge?

Can we reduce variance and ability to detect change?



New Technologies

20 | Deep Reefs | russ.babcock@csiro.au

Starbug-X AUV

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



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

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



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
- t 08 9333 6537

Acknowledgements

- BHP-CSIRO Ningaloo Outlook Marine Research Partnership
- DBCA staff in Perth and Exmouth
- Margaret Miller for data wrangling
- Ryan Crossing and the crew of RV Linnaeus
- CSIRO O&A EMT team
- IMOS AUV Facility
- Jo Myers, and the extended team



Conclusions

- Patterns of recruitment suggest that deep reefs are not likely to provide a major source of recruits for recovery of impacted shallow reefs
- Coral cover on deep reefs may be more stable than on shallow reefs, but too early to really say.....
- There is plenty left to discover!