

# Investigations of a chronic and acute stressor at Ningaloo Reef

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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

### ACUTE stressor

CHRONIC

Response : Fish

: Fishing

: Cyclones

**Response : Coral** 

Damian Thomson, Michael Renton

### Aim

Build a 3D simulation model to investigate impact and recovery from hydrodynamic disturbances in a coral community





### **Four colony structures**



### A community of corals



Time step 70



### Light absorption in a community



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### **Through time: reproduction and disturbance**





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### Scenario: Disturbance at 150 and 300 ts



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### ACUTE stressor

### : Cyclones



### **Response : Coral**

## Resp

### CHRONIC stressor

### : Fishing

### **Response : Fish**

# ACUTE **Response : Coral**

### **Response : Fish**

**CHRONIC** 

stressor

In collaboration with: Thomas Holmes, Timothy Langlois, Shaun Wilson, Joachim Claudet, Damian Thomson, Rick Stuart-Smith, Martial Depczynski, Chris Fulton, Paul Tinkler, Al Cheal, Di McLean, Russ Babcock, Mat Vanderklift, Mick Haywood, Michael Renton, Ben Fitzpatrick, Mark Westera, Rebecca Fisher, Tony Ayling

: Fishing



### 30 years of fish surveys

5115 surveys (BRUV drops, transects) !

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### Interesting findings so far...

- A significant difference inside to outside sanctuary for Lethrinids
- Pattern driven by large sublegals
- Analyses underway to determine variables that may influence the effectiveness of the sanctuaries, so far:
  - Reef Zone and Sanctuary Area important
  - Survey method not important BRUV, DOV and UVC comparable!



### **Summary**

# Chronic and acute stressors The dynamics of change in coral reef ecosystems





### Thank you.

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### What variables increase/decrease effectiveness?



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### **Community zoning**



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### The model



### The model: Light and shading







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### The model: levels

Real communities



Simulated community



Colony level

Polyp level

Resource sharing Hydrodynamics Directional growth

Light uptake Resource limited death Maintenance

### Hydrodynamic vulnerability, V



Calculation modified from Madin et al. 2006, Nature

### **Morpho-functional parameters**

Morpho-functional parameter		Meaning
RESOURCES/ RESOURCE ALLOCATION	Required resources	Resources required to grow
	Density	Resource to volume conversion. A greater amount of resources used equates to a higher density cell being created
DIRECTIONAL GROWTH	Ontogenetic growth change	Describes whether older colonies have greater tendency to grow upwards
	Ontogenetic growth directions	Sides, Up, Both
SHARING	Resource sharing	Proportion or resources shared with adjacent living cells
	Directional resource sharing (light)	Tendency to move resources towards adjacent living cells with higher light absorption

### Scenario: No disturbance

