Project 9.1

Decision support for a vulnerable GBR under environmental change

Ken Anthony, Nick Wolff, Pete Mumby, Karlo Hock, Michelle Devlin, Roger Beeden
A Vulnerable or Resilient Great Barrier Reef?

- Coral cover (%)
- Partitioned annual mortality (% cover)

GBR (N=214)

De’ath et al. 2012

- COTS
- Cyclones
- Bleaching
Surely this little pressure must be insignificant.

Cumulative impacts – what’s the last straw?
Objective 1 of 2

• Develop spatial understanding of vulnerability and resilience of GBR corals as we move towards year 2050
Objective 2 of 2

• Guide effective management decisions to protect GBR corals – what reefs can we / should we protect and how?
Potential outcomes

Mean coral cover (%)

Year

2015 2020 2025 2030 2035 2040 2045

Limited CoTS management

Total CoTS management

Only cyclones

Mean coral cover (%)

Limited CoTS control

All stressors

Potential outcomes

Just cyclones

Just cyclones and climate change (no CoTS)

Modified from Mumby and Anthony (in review)
Can help (1) identify reefs that will give best return on management investment (2) guide the design of targeted monitoring programs

All stressors combined

Wolff et al. (ms)
Wolff et al. ms (see poster!)
SCENARIO MODELLING

LOCAL / REGIONAL
- Land-use practices
- Coastal development

GLOBAL / REGIONAL
- Cyclones
- Ocean warming
- OA

DECISION ANALYSES
- Management options / alternatives

Review of results against objectives: min vulnerability & max resilience

Framework

ECOSYSTEM MODEL

Coral vulnerability or resilience

Run-off and nutrient export

Coral bleaching and disease

DECISION ANALYSES

ECOSYSTEM MODEL
Scenario: Status Quo

Vulnerability attribution
- Cyclones
- COTS
- Water Quality
- Bleaching

Normalized vulnerability within the Cape York development scenario, showing a 75% increase in DIN and a 10% increase in TSS.
SCENARIO MODELLING

GLOBAL / REGIONAL
Ocean warming
OA

LOCAL / REGIONAL
Land-use practices
Coastal development

Coral vulnerability or resilience

Run-off and nutrient export

Coral bleaching and disease

Coastal development
Ocean warming

DECISION ANALYSES
Management options / alternatives

Review of results against objectives: min vulnerability & max resilience

Coral vulnerability or resilience

ECOSYSTEM MODEL

Cyclones

Framework
Connectivity networks reveal the risks of crown-of-thorns starfish outbreaks on the Great Barrier Reef

Karlo Hock¹,²*, Nicholas H. Wolff¹, Scott A. Condie³, Kenneth R. N. Anthony² and Peter J. Mumby¹
Connectivity pattern and threat assessment for valuable tourism reefs

Hock K, Wolff NH, Hoey J, Beeden R, Condie SA, Anthony KRN, Possingham HP, Mumby PJ.
Adaptive control in connectivity networks: a coral reef pest example. MS
Management alternatives, risks & consequences

Objectives

- Env risk GBR wide
- Env risk priority reefs
- Cost to tourism industry
- Cost to farmers
- Mitig costs to Governm

Alternatives

A: Unregulated development
B: Targeted land management
C: More effective COTS control
D: Smart options for dredging
B+C+D

Risk or cost:
- Low
- L/M
- Mod
- M/H
- High

Invitation!
Next steps in partnership with GBRMPA, AMPTO, DotE and Qld Gov
SCENARIO MODELLING

LOCAL / REGIONAL

Land-use practices
Coastal development

GLOBAL / REGIONAL

Cyclones
Ocean warming
OA

Run-off and nutrient export
Coral bleaching and disease

Management options / alternatives

Review of results against objectives: min vulnerability & max resilience

Coral vulnerability or resilience

DECISION ANALYSES

Framework

ECOSYSTEM MODEL
Global disparity in the ecological benefits of reducing carbon emissions for coral reefs

Juan Carlos Ortiz¹,²*, Yves-Marie Bozec¹,², Nicholas H. Wolff¹,², Christopher Doropoulos¹,² and Peter J. Mumby¹,²

RCP 8.5

RCP 2.6
Coral vulnerability attributions under environmental change

Now

Later

- Acidification
- Water Quality
- Bleaching
- COTS
- Cyclones
Operationalizing resilience for adaptive reef management
(Anthony, Marshall, Beeden, Mumby and 24 co-authors, 2014)
Thank you!

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