



National Environmental
Research Program

27-year decline of coral cover on the GBR

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for
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Australian Government



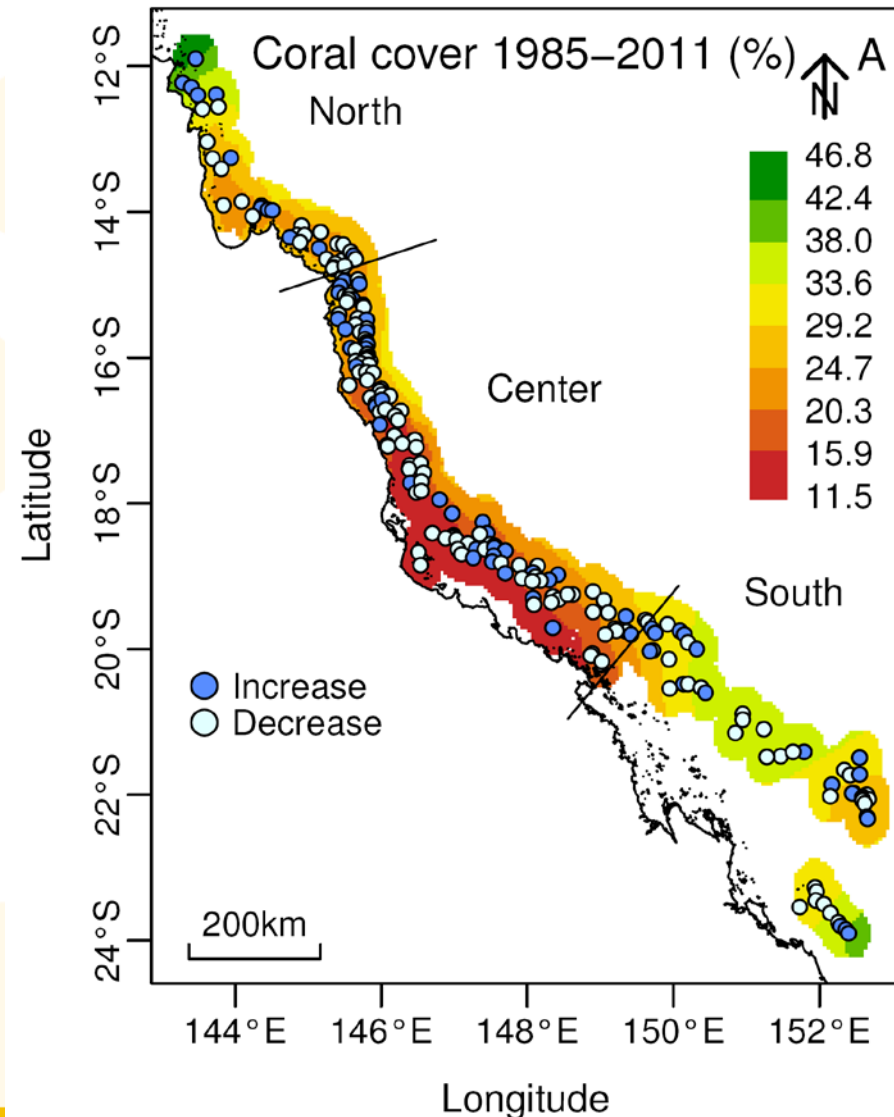
AUSTRALIAN INSTITUTE
OF MARINE SCIENCE

AIMS LONG-TERM MONITORING OF THE GREAT BARRIER REEF

- The program began in the early 1980s as a GBR-wide survey of *Acanthaster* numbers.
- Based on manta tows of entire perimeters of survey reefs.
- Coral cover for each survey estimated on a 5- and later 10-point scale from 1985 onwards.
- Present the original 2012 summary and an update

CHANGES IN CORAL COVER OVER THE LENGTH OF THE PROGRAM

- Used estimates of reef-wide coral cover from manta tows
- Only included values from reefs that have been surveyed at least 5 times in the 27 years (214 reefs)
- Predominantly midshelf and offshore reefs

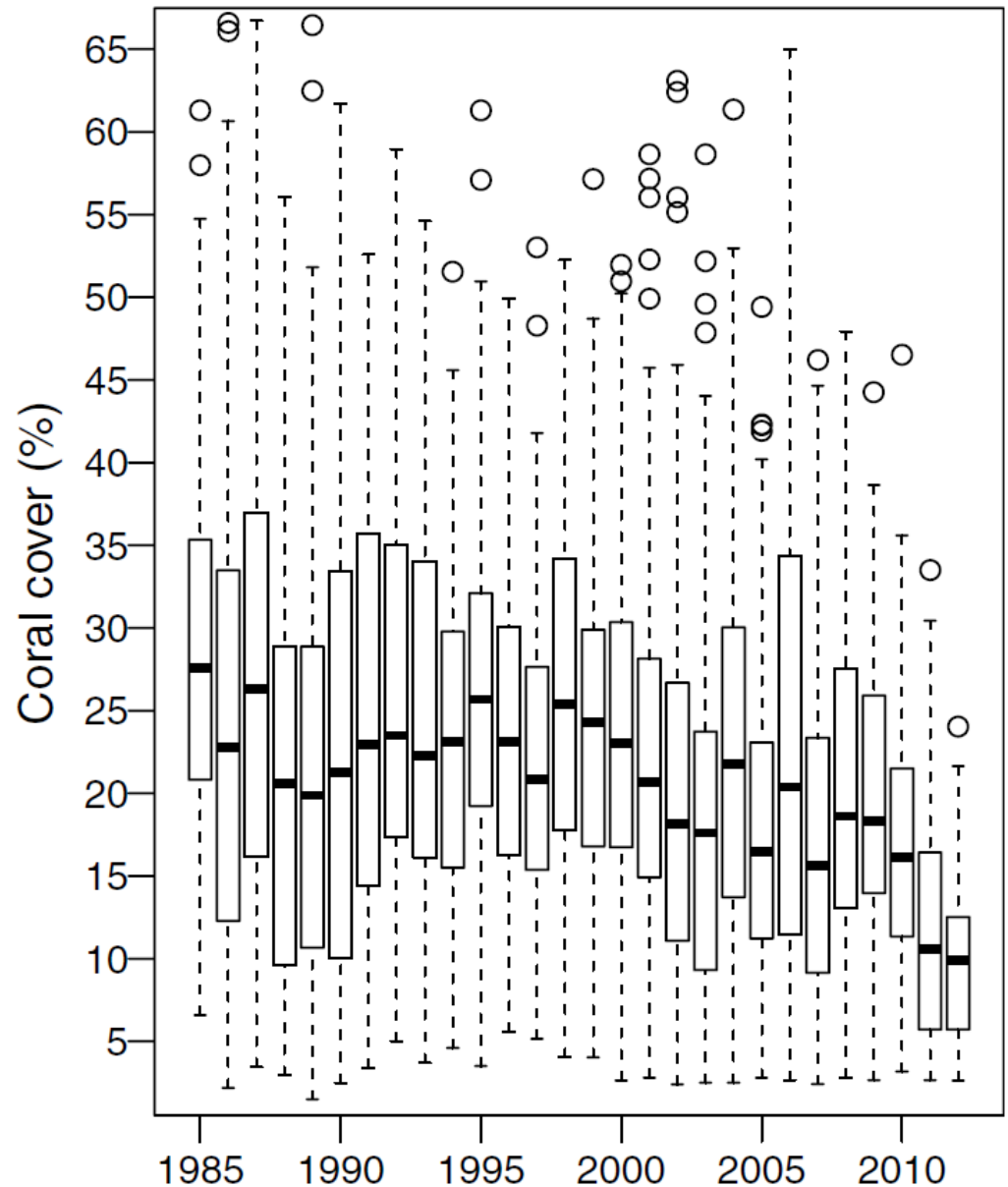




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CHANGES IN CORAL COVER 1985-2012

Boxplot of annual
coral cover records

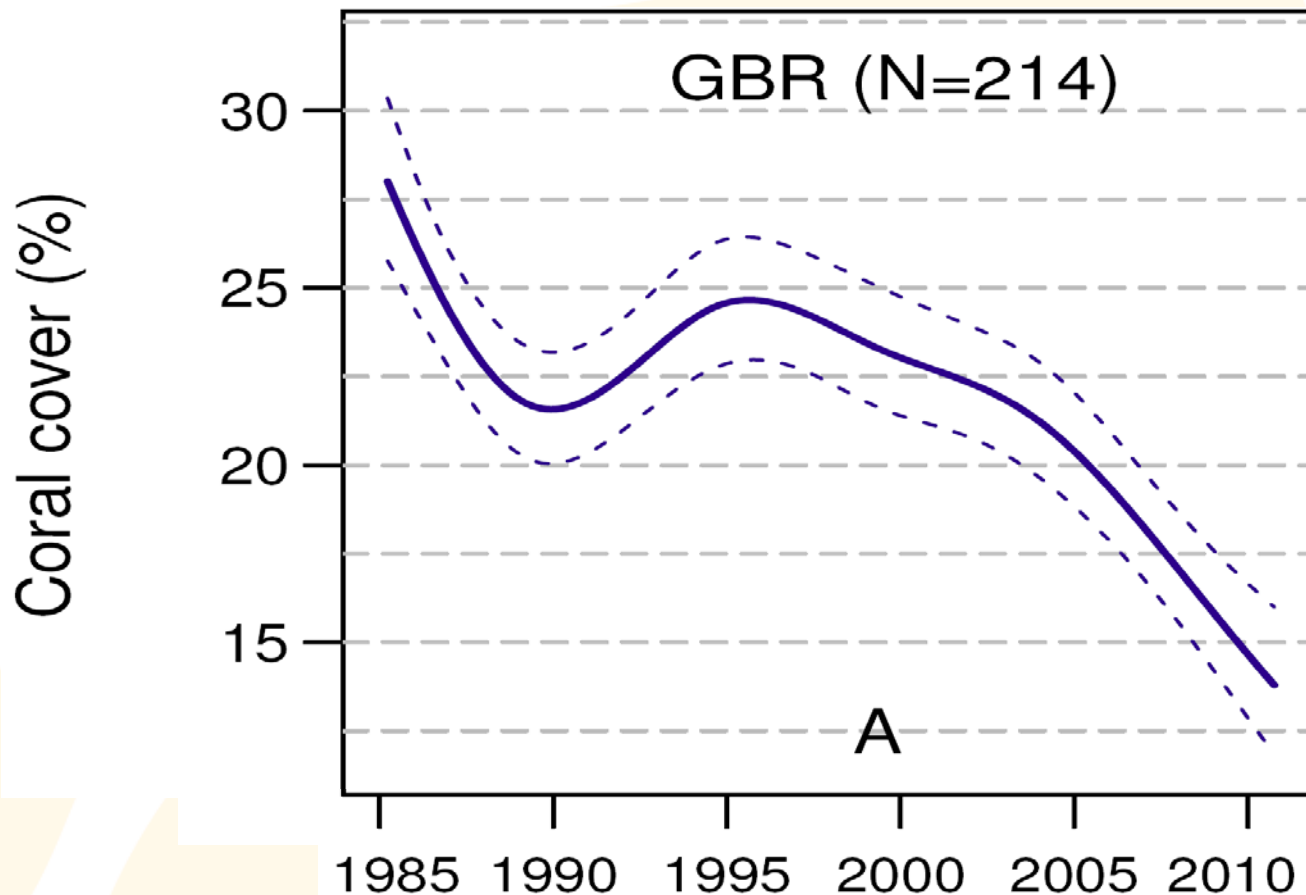




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CHANGES IN CORAL COVER OVER THE LENGTH OF THE PROGRAM

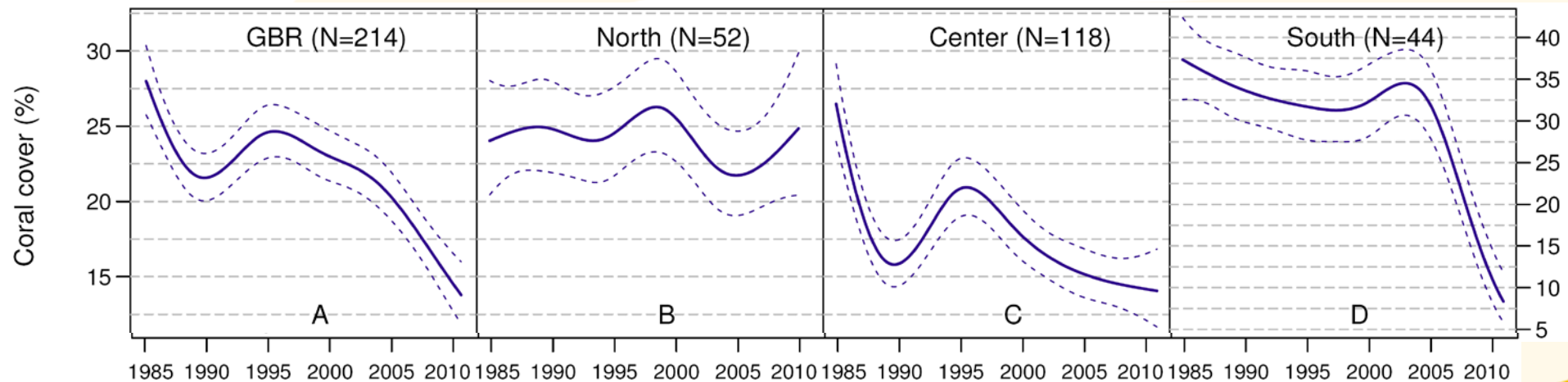
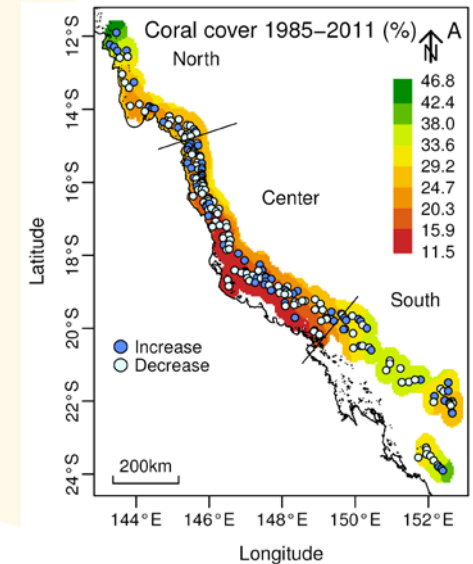
Modelled mean coral cover 1985 - 2012



CHANGES IN CORAL COVER OVER THE LENGTH OF THE PROGRAM

Regional differences in:

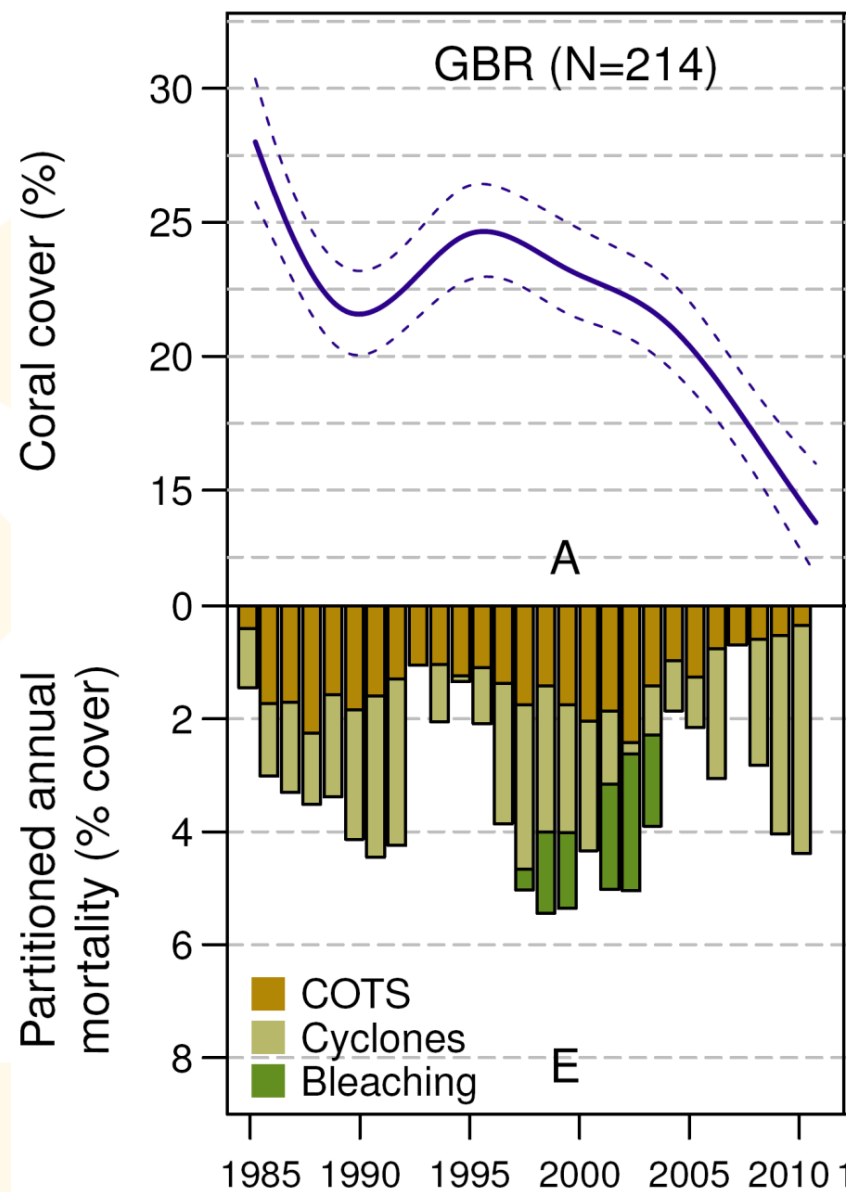
- extent of change
- timing of change



CHANGES IN OVERALL CORAL COVER ON THE GBR 1985-2012

Causes of coral loss vary over time:

- *Acanthaster* usually present along the GBR
- Cyclones occur in groups
- Bleaching around 1998 and 2002



CAUSES OF CHANGES IN CORAL COVER 1985-2012

The study looked at the contribution of three major types of acute disturbance: cyclones, *Acanthaster* and coral bleaching

Table 1: A: Estimated rates ($\% \text{ yr}^{-1}$) and standard errors (SE) of decline, growth and total mortality of coral cover. B: Total coral mortality partitioned between COTS, cyclones and bleaching. All rates are based on 20% coral cover, and are estimated for the whole GBR, and for the northern, central and southern sections.

		GBR	North	Center	South
A	Decline	0.53 (0.08)	0.11 (0.14)	0.44 (0.08)	1.04 (0.16)
	Growth	2.85 (0.26)	2.07 (0.44)	2.78 (0.26)	2.34 (0.52)
	Total mortality	3.38 (0.19)	2.18 (0.35)	3.22 (0.18)	3.38 (0.44)
B	COTS mortality	1.42 (0.17)	0.77 (0.25)	1.54 (0.24)	1.59 (0.27)
	Cyclone mortality	1.62 (0.22)	1.05 (0.23)	1.29 (0.14)	1.75 (0.32)
	Bleaching mortality	0.34 (0.08)	0.36 (0.13)	0.39 (0.09)	0.04 (0.11)

CAUSES OF CHANGES IN CORAL COVER 1985-2012

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Table 1: A: Estimated rates (% yr⁻¹) and standard errors (SE) of decline, growth and total mortality of coral cover. B: Total coral mortality partitioned between COTS, cyclones and bleaching. All rates are based on 20% coral cover, and are estimated for the whole GBR, and for the northern, central and southern sections.

		GBR	North	Center	South
Observed	A → Decline	0.53 (0.08)	0.11 (0.14)	0.44 (0.08)	1.04 (0.16)
	Growth ←	2.85 (0.26)	2.07 (0.44)	2.78 (0.26)	2.34 (0.52)
	→ Total mortality	3.38 (0.19)	2.18 (0.35)	3.22 (0.18)	3.38 (0.44)
Predicted from knowledge of impacts	B COTS mortality	1.42 (0.17)	0.77 (0.25)	1.54 (0.24)	1.59 (0.27)
	Cyclone mortality	1.62 (0.22)	1.05 (0.23)	1.29 (0.14)	1.75 (0.32)
	Bleaching mortality	0.34 (0.08)	0.36 (0.13)	0.39 (0.09)	0.04 (0.11)

Predicted - Observed



CAUSES OF CHANGES IN CORAL COVER 1985-2012

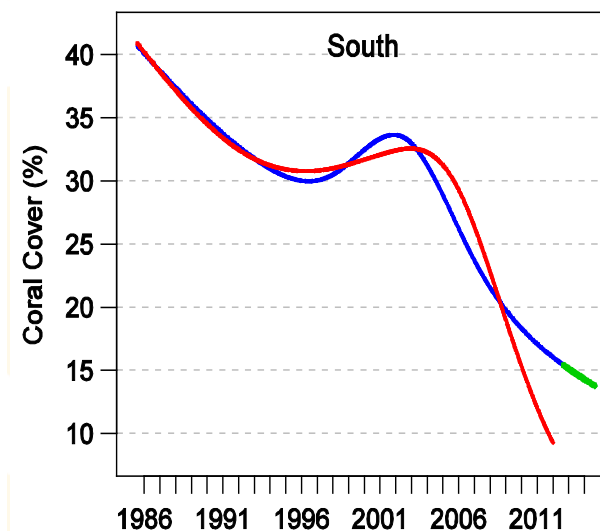
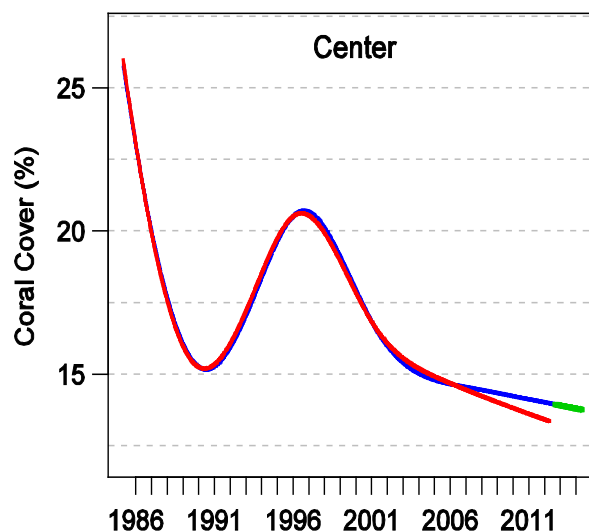
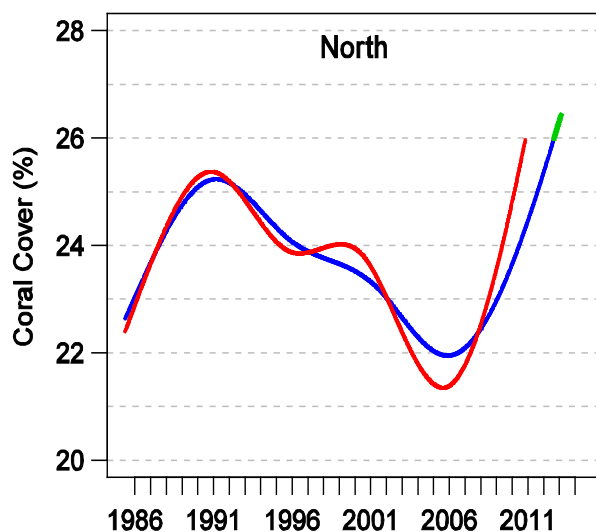
The study looked at the contribution of three major types of acute disturbance: cyclones, *Acanthaster* and coral bleaching.

This raises three points:

1. The study does **not** consider the effects of many other acute and chronic stresses on GBR reefs.
2. If additional stresses affect the study reefs, then **the rate of growth in coral cover** must be greater than the estimate given here.
3. This suggests that GBR reefs retain capacity to recover from disturbance, **if** the interval between disturbances is sufficiently long.

HOW HAS CORAL COVER ON THE GBR CHANGED SINCE 2012?

- No major disturbances on midshelf and offshore reefs
- 108 new surveys of reefs that were included in the original analysis





SUMMARY

- Evidence of substantial decline in overall coral cover over 30 years
- Extent of decline, causes, and timing vary among regions
- Rapid rate of decline has slowed in recent years
- Balance of rate of disturbance vs recovery is critical



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