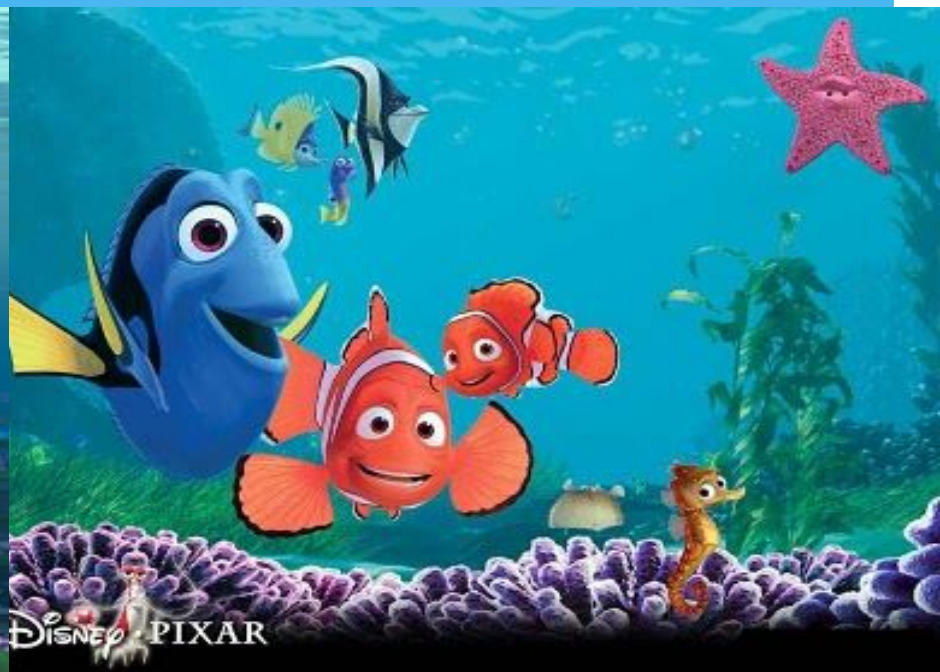
Doom and Boom on a Resilient Reef: Climate Change, Algal Overgrowth and Coral Recovery



Introduction to Coral Reefs

What is a Coral Reef?

* Among the most biologically diverse and economically important ecosystems
* Foundation for many marine species
* Grow in shallow clear water

What are Coral Reefs Made of?

* Coral reefs are **colonies** of various types of reef-building stony hard corals
* Each coral colony is composed of tiny animals called **polyps**
* Each polyp secretes **hard calcium carbonate skeleton**
* **Calcium carbonate** is continuously secreted at the base of the polyps.

Why are Coral Reefs Important?

* Provide source of food & shelter
* Protect coastlines from floods & ocean storms
* Environmental indicators of water quality
* Important sources of new medicines

The Research Paper

Purpose

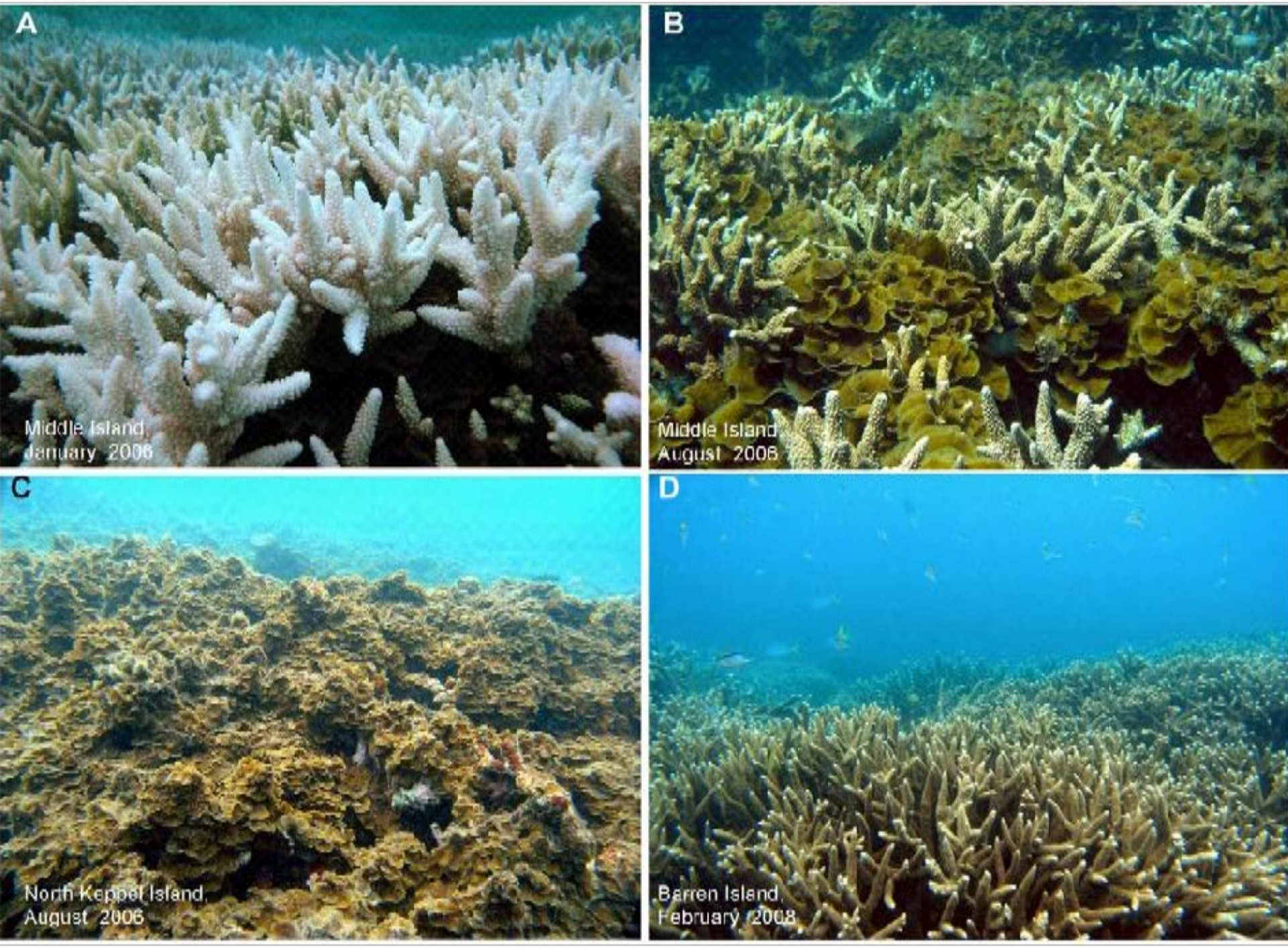
* Document some novel mechanisms for coral reef resilience based on changes in coral & seaweed abundance
* Coral reefs are experiencing large-scale degradation largely due to **climate change**
* Climate change causes more frequent and severe **coral bleaching.**

Materials & Methods

* Monitored the dynamics of corals & benthic algae on the reef slopes
* Studied after the January 2006 mass coral bleaching event that affected reefs of the Keppel Islands:
    - Middle Island
    - Halfway Island
    - Barren Island
    - North Keppel Island
* Cover of bleached coral was estimated visually through **aerial photographs**
* Coral regrowth data was examined using thin sections of ***Acropora* branches**
* Density of herbivorous fish were measured using **underwater visual census** by scuba

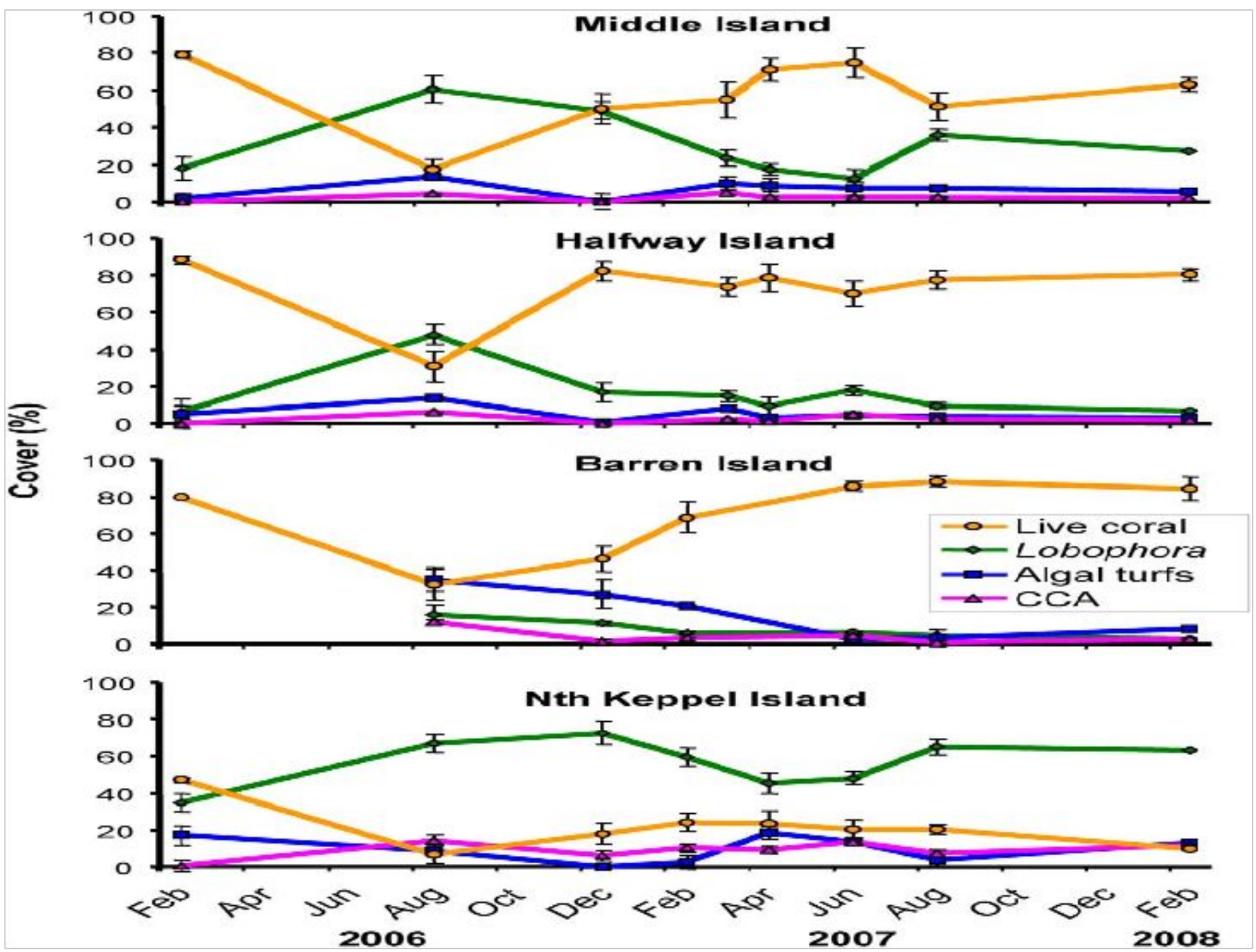
Coral Bleaching

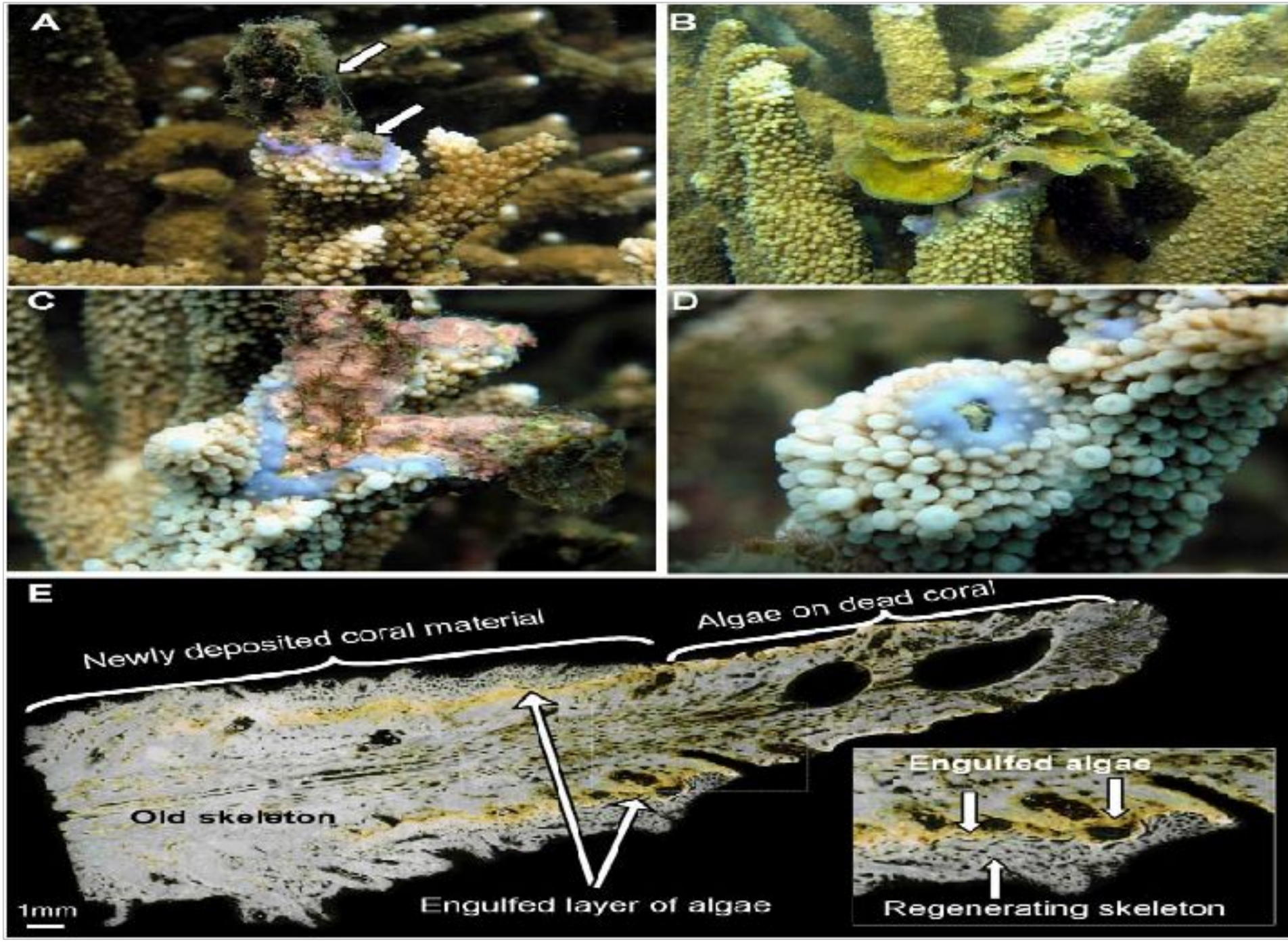
* Extraordinary bloom of the brown seaweed ***Lobophora Variegata***
  * Commonly grows between the branches of most ***Acropora*** colonies
* Seaweed & algal turfs were completely annihilated, but dramatically increased later on.


A
Middle Island,
January 2006
B
Middle Island,
August 2006
C
North Keppel Island,
August 2006
D
Barren Island,
February 2008

Coral Recovery

* Most sites showed rapid recovery after the seaweed bloom, reaching pre-bleaching levels by December 2006
* Did NOT involve recruitment of new coral larvae
* Involved rapid regeneration & regrowth of remnant coral tissue
* Coral cover also has strong growth and competitive rates
* ***Lobophora Variegata*** disappeared because of inherent seasonal dieback.
* Seldom involved herbivorous fishes


Middle Island
Halfway Island
Barren Island
Nth Keppel Island
Cover (%)
100
80
60
40
20
0
Live coral
Lobophora
Algal turfs
CCA
Feb
Apr
Jun
Aug
Oct
Dec
Feb
Apr
Jun
Aug
Oct
Dec
Feb
2006
2007
2008


A
B
C
D
E
Newly deposited coral material
Algae on dead coral
Old skeleton
Engulfed layer of algae
1mm
Engulfed algae
Regenerating skeleton

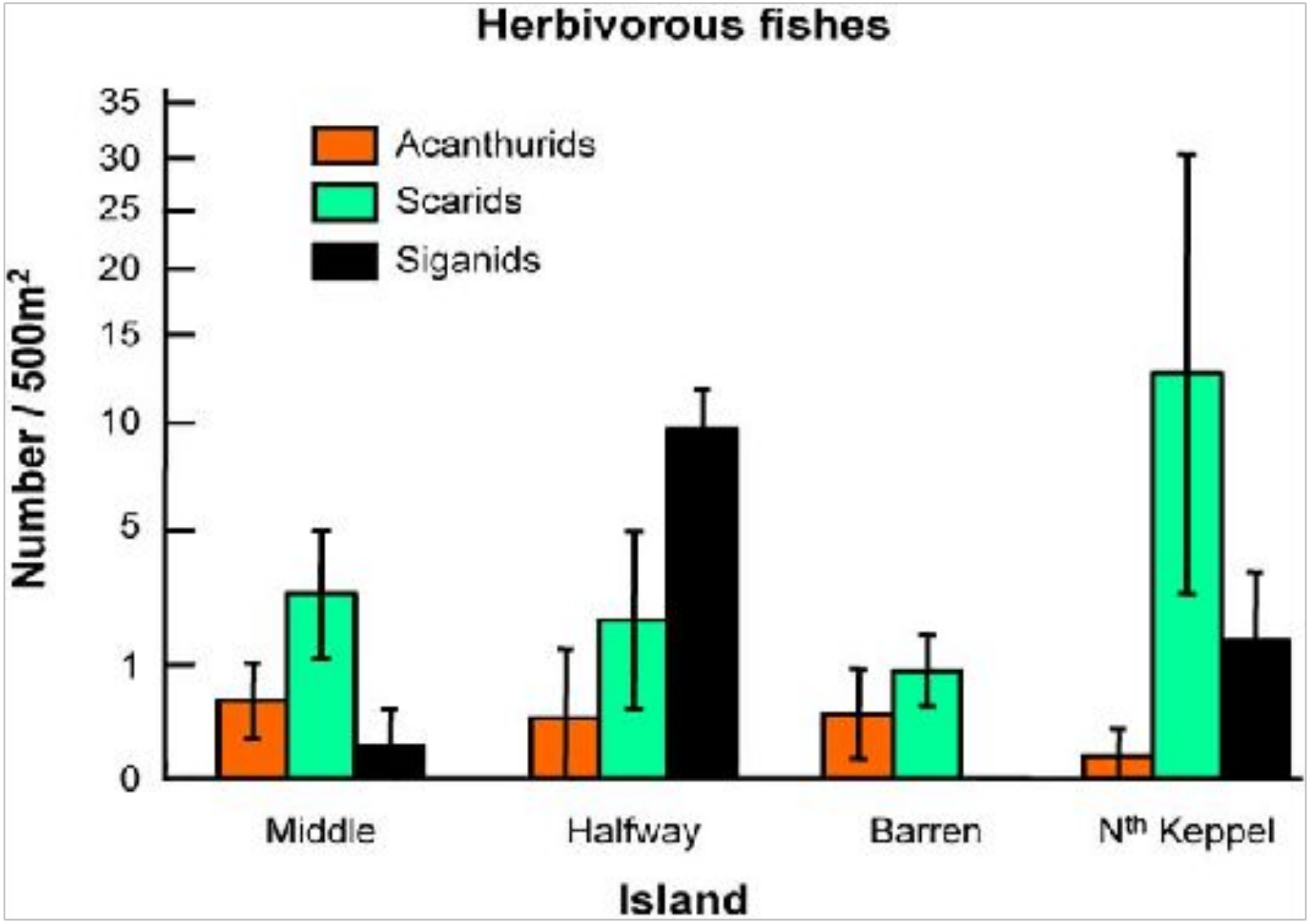


Figure 6. Herbivore abundances. Herbivore density data from the study sites are square root

Conclusions

* The coral tissue have exceptionally speedy regeneration rates.
* Rapidly growing & branching *Acropora* are better suited to compete with algal growth.
* *Lobophora Variegata* are quite vulnerable to changing seasons.
* The Keppel Islands have an effective marine protected area system.

Sources Cited

* "Coral Reef Protection: What are Coral Reefs?" *Water: Habitat Protection.* United States Environmental Protection Agency, 14 May 2012. Web. 19 Sept. 2012.

http://water.epa.gov/type/oceb/habitat/coral_index.cfm