

# REEF CHECK AUSTRALIA



## Great Barrier Reef Season Summary Report 2014



Reef Check Foundation Ltd  
Annie Bauer  
Edited by Jennifer Loder  
[www.reefcheckaustralia.org](http://www.reefcheckaustralia.org)

# REEF CHECK AUSTRALIA

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# REEF CHECK AUSTRALIA

## Table of Contents

### Introduction

What does Reef Check monitor? .....	5
Monitoring sites .....	7
Overall trends and patterns .....	8-10

### Whitsundays Region

#### Hayman Island

Blue Pearl Bay, Site 1 and 2 .....	11-15
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#### Daydream Island

Lovers Cove, Site 1 .....	16-17
Mermaids Cove, Site 1 .....	18-19

### Magnetic Island

Alma Bay, Site 1 and 2 .....	20-24
Florence Bay, Site 1 .....	25-27
Geoffrey Bay, Site 1 .....	28-30
Middle Reef, Site 1 and 2 .....	31-34
Nelly Bay, Site 1 and 2 .....	35-38

### Cairns Region

Hastings Reef (The Point), Site 1 .....	39-40
Norman Reef (Middle Mooring), Site 1 .....	41-42
Moore Reef, Site 1 .....	43-45

# REEF CHECK AUSTRALIA

Reef Check Australia (RCA) is an environmental charity dedicated to protecting Australia's reefs and oceans by engaging the community in hands-on citizen science and education initiatives. Our teams are part of a worldwide network of trained volunteers that regularly monitor and report on reef health in more than 90 countries using the standardised Reef Check scientific survey method.

Reef Check volunteers have been monitoring the Great Barrier Reef since 2001 and extended to monitor rocky reefs in South East Queensland in 2007. The data collected by our volunteer teams offers a powerful opportunity to produce locally relevant results with global applications

Our volunteer surveyors are trained to collect information about reef composition, indicator organisms (including invertebrates and fish) and reef health impacts. A study to look at observer effects from haphazardly deployed transects that were surveyed by a sample of trained RCA volunteers found that differences between observers and subsequent transect deployments is low (Done et al 2012 in draft), with only 6.14% of the random variation due to observer effects across all substrate categories. We have confidence that RCA protocols can identify temporal trends in cover, especially that of the important and unambiguous attribute 'Hard Coral'. Substrate cover changes in the 10% range are likely to represent real change when looking at data from one year to the next. These findings indicate that trained volunteers using the Reef Check protocols can provide estimates of the percentage cover of major indicators of reef status that are sufficiently precise for monitoring of temporal status and trends in selected sites.





# WHAT DOES RCA MONITOR?

This short description summarizes RCA survey protocols. Each survey is conducted over four 20m replicate areas. Substrate data is recorded using a point intercept approach, collecting data at every 0.5m to calculate percent cover for 25 substrate categories. Invertebrate, fish and reef impact data is recorded within four 20x5m areas (4x100m<sup>2</sup>).

## Substrate

Hard Coral

Hard coral: branching

Hard coral: massive

Hard coral: encrusting

Hard coral: foliose

Hard coral: plating

Soft coral

Soft coral: zoanthids

Soft coral: leathery

Nutrient indicator algae

Other (tunicates, etc.)

Rubble

Rock

Rock with coralline algae

Rock with turf algae

Recently killed coral

Recently killed coral with nutrient indicator algae

Sand Silt

Sponge

Encrusting sponge

Macro algae



## Invertebrates

Banded coral shrimp

Long-spine urchin (*Diadema*)

Pencil Urchin

Sea Cucumber (3 species)

Crown of Thorns Starfish

Giant clam

Triton shell

Trochus shell

*Drupella* snails

Lobster

Anemone

## Impacts

Coral damage

Fishing line

Fishing net

General trash

Coral bleaching

Coral disease

Unknown scars

*Drupella* scars

Crown of Thorns Starfish scars

## Fish (not conducted in 2014)

Butterflyfish

Sweetlips

Snapper

Barramundi cod

Grouper (>20cm)

Queensland grouper

Humphead wrasse

Bumphead parrotfish

Parrotfish

Moray eel

Coral trout (>20cm)

## Survey placement

In line with Reef Check global protocols, RCA monitoring locations are selected for exceptional recreational diving qualities, and hence may not be representative of the larger regions in which they occur. RCA survey sites are visited annually to measure changes in: substrate composition, abundance of key invertebrates and fish, and levels of reef health impacts. Sites are not marked by permanent transects, but a system of GPS coordinates, maps, and mean tide times are used to ensure that survey areas are as close as possible to the same location each year.

# RCA MONITORING SITES

Reef Check Australia monitoring sites in the Great Barrier Reef range from Lady Elliot Island to Port Douglas (figure 1). RCA collects data in varied reef habitats, both within protected and non-protected marine park areas for contrast and comparison. During the 2014 GBR survey season, 25 of the existing 73 reef sites were surveyed, and 5 new sites were implemented; giving a total of 30 sites surveyed. This number includes 3 new sites in Heron Island (with total of 15 sites surveyed on the island in 2014) (Table 1). For summary information on Heron Island, please see the Reef Check Australia 2014 Heron Island Reef Report.

14 of the 29 sites surveyed occurred within the protected national marine park one. Site protection levels are listed in table 1. For more information about GBRMPA zoning, visit <http://www.gbrmpa.gov.au/zoning-permits-and-plans/zoning>.

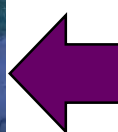
**Table 1:** Sites visited in 2014. Site designation is according to the Great Barrier Reef Marine Park Authority protection levels (2004): Green: Marine national park zone, protected area, no recreational or commercial fishing permitted, tourism and research allowed with permit. Yellow: Conservation park zone, limited recreational and commercial fishing allowed, including limited impact research. Dark blue: Habitat protection zone, recreational and commercial fishing permitted. Blue: General use zone, recreational and commercial fishing permitted. Shipping permitted without permit. Orange: Scientific zone, designated for research. For those not participating in research, zone acts as a Green Zone.

Site	#	Depth	Location	1st Survey	Site Designation
Lover's Cove	1	Shallow	Whitsundays	2013	Yellow
Mermaids Cove	1	Shallow	Whitsundays	2013	Yellow
Blue Pearl Bay	1	Shallow	Whitsundays	2002	Green
Blue Pearl Bay	2	Shallow	Whitsundays	2005	Green
Norman Reef, Middle Mooring	1	Shallow	Cairns	2014	Green
North Hastings, The Point	1	Shallow	Cairns	2003	Green
Moore Reef	1	Shallow	Cairns	2005	Green
Nelly Bay	1	Shallow	Magnetic Island	2003	Blue
Nelly Bay	2	Shallow	Magnetic Island	2003	Blue
Alma Bay	1	Shallow	Magnetic Island	2004	Green
Alma Bay	2	Shallow	Magnetic Island	2005	Green
Florence Bay	2	Shallow	Magnetic Island	2006	Green
Geoffrey Bay	1	Shallow	Magnetic Island	2003	Green
Blue Pools	1	Shallow	Heron Island	2014	Yellow
Canyons	1	Medium	Heron Island	2013	Orange
Cappuccino Express	1	Shallow	Heron Island	2013	Green
Coral Cascade	1	Medium	Heron Island	2013	Yellow
Coral Garden	1	Shallow	Heron Island	2011	Green
Coral Grotto	1	Shallow	Heron Island	2011	Yellow
Half Way (Doug's Place)	1	Shallow	Heron Island	2014	Orange
Harry's Bommie	1	Shallow	Heron Island	2011	Orange
Heron Bommie	1	Shallow	Heron Island	2011	Green
Jetty Flat	1	Shallow	Heron Island	2011	Green
Last Resort	1	Shallow	Heron Island	2013	Yellow
Libby's Lair	1	Medium	Heron Island	2011	Yellow
Research Zone	1	Shallow	Heron Island	2011	Orange
Shark Bay	1	Shallow	Heron Island	2011	Yellow
White Wedding	1	Shallow	Heron Island	2014	Green

# MAP OF RCA MONITORING SITES



Figure 1a: Map of sites surveyed in 2014

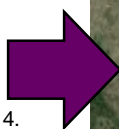


## Northern Sites

Sites summarized in this report

## Southern Sites

For summaries, please see Heron Island Report 2014.





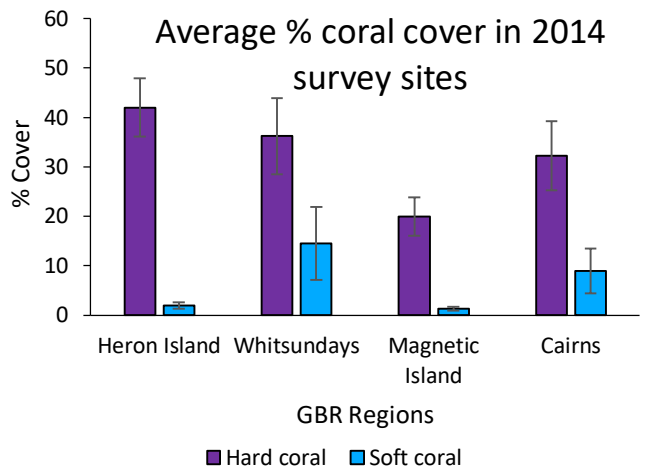
# 2014 Trends & Patterns

## Coral Cover

- On average, hard coral covered 32%, and soft coral covered 4% of the benthos.
- Hard coral cover on average was the highest in the Heron Island reefs (42%), however sites within the Whitsundays region had the highest average soft coral cover (15%).
- Of the 30 sites monitored in 2014 (including Heron Island) 12 increased in hard coral cover since the last survey, and 13 decreased.
- The hard coral cover at Magnetic Island had the lowest average, covering approximately 20% of the substrate. Of the 8 sites surveyed, five decreased in hard coral cover since the last survey.
- Branching corals was the most common growth form, and covered on average 15% of the substrate throughout the monitored sites.
- Leathery soft coral was the most common growth form of soft coral, but only found to cover approximately 3% of the substrate throughout monitored sites.

## Substrate patterns

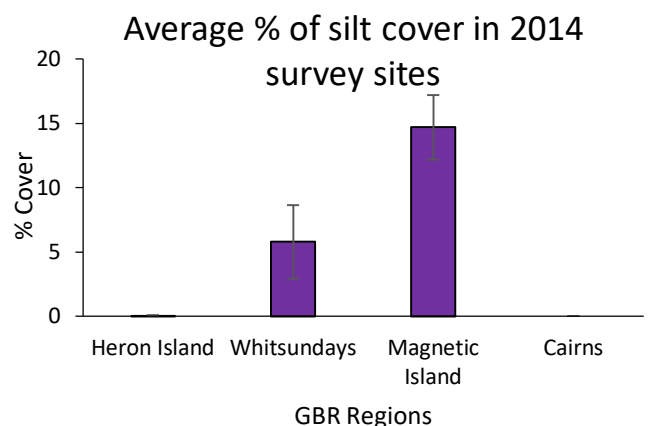
- The presence of rock with turf algae was found to be the most dominant benthic substrate, apart from corals, covering on average 26% of the benthos.
- The abundance of silt was relatively low throughout GBR sites, covering an overall average of 5% of the substrate. However, silt was highest within inshore sites, covering 5% of the substrate in the Whitsundays, and 15% of the substrate in Magnetic Island sites.
- Nutrient indicator algae was found to cover on average 8% of the substrate.



**Figure 2:** The average percent hard coral cover (+/-SE) among the four regions monitored in North Queensland in the 2014 survey season: (south to north) Heron Island, the Whitsunday Islands, Magnetic Island, and Cairns



Long time RCA volunteer Erin Connolly at Festival of the Sea in Townsville



**Figure 3:** The average percent silt cover (+/-SE) among the four regions monitored in North Queensland in the 2014 survey season: Heron Island, the Whitsunday Islands, Magnetic Island, and Cairns.



# 2014 Trends & Patterns

## Impacts

- 29 impact surveys were conducted in the 2014 survey season.
- Bleaching occurred at all sites, and on average affected 4.48% of the coral population.
- Approximately 43% of the impacts of corals were due to bleaching.
- Coral damage, disease, and coral scars impacted corals almost equally, with each affecting 7 to 9% of the impacted coral population.
- Crown of Thorns Starfish scars impacted the corals the least, as only one was found across all monitored sites in 2014.
- A total of 9 incidents of fishing line, 1 fishing net, and 4 incidents of general rubbish was found on transect in 2014.

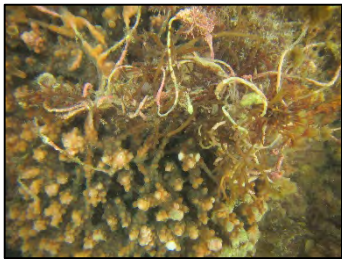
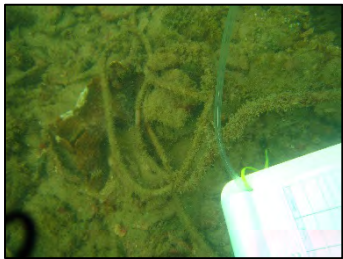


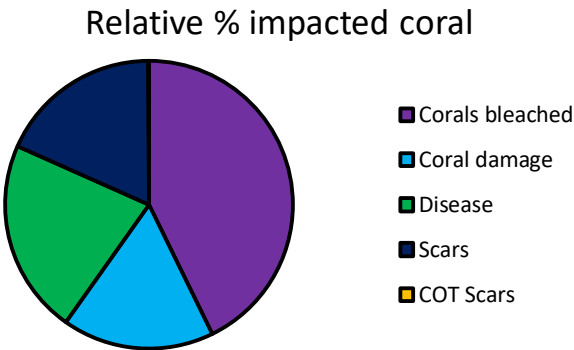
Photo 1 and 2: Fishing net and line found on Magnetic Island sites

## Inverts

- 29 invert surveys were conducted in the 2014 survey season
- Giant clams were the most abundant indicator invertebrate observed, with a total of 254 individuals recorded in 2014!
- A total of 129 RCA indicator sea cucumbers were recorded, however were only observed in Heron Island reefs.
- A total of 33 *Drupella* snails were recorded.
- One crown of thorn starfish was observed in 2014 surveys, and was found in North Hastings Reef.

**Table 2:** The percent of RCA survey sites with recorded impacts (of a total of 29 sites), and the average abundance of impacts recorded in 2014

Impacts	% of sites with impact	Average abundance (impacts/400m <sup>2</sup> )
Coral Bleaching	100	4.48%
Coral Damage	83	7.34
Coral Disease	52	9.41
<i>Drupella</i> Scars	14	0.21
Fishing line	17	0.31
Marine Debris	7	0.14
Unknown scars	83	10.07



**Figure 4:** The cumulative percent of impact type in 2014. To calculate, the total number of incidents was divided by the total number of recorded impacts across all surveys.



Photo 3 and 4: Crown of thorn starfish (top) and *Drupella* snail (bottom) found in 2014 surveys

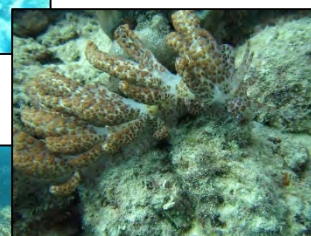
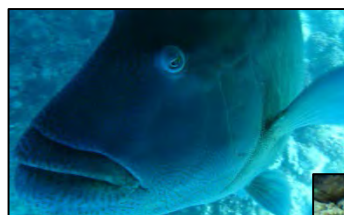
# 2014 Trends & Patterns

**Table 3:** Overview of basic site characteristics: percent cover of hard coral, percent cover of soft coral, whether hard coral cover increased or decreased from 2010, average macro algae (MA), percent cover of nutrient indicator algae (NIA), and silt loading levels where low levels (L) are a light layer of silt visible on occasional surfaces, medium levels (M) are silt layer that cover most surfaces and high levels (H) cover all surfaces, presence of reef health impacts (including *Drupella* snail scars, unknown scars, coral damage, fishing line and net, marine debris (trash), coral disease, and coral bleaching). Boxes with “x” signify presence of impact. Boxes with “n/a” signify sites where impact surveys were not completed.

	Basic site summary								Presence of Impacts							
Region	Site	% Hard Coral	% Soft Coral	Hard coral increased or decreased from 2010	Average Macro algae (MA) per 100m²	% Nutrient Indicator Algae (NIA)	Silt	Drupella Scar	Unknown Scar	COT Scars	Anchor Damage	Coral Damage (Unknown cause)	Fishing Line/Net	General Trash	Coral Disease	Coral Bleaching
Whitsundays	Blue Pearl Bay S1	50	8	↑	0	0	H						X			X
	Blue Pearl Bay S2	43	1	↓	0	0	L		X				X			X
	Lovers Cove	38	35	↑	1	0	H		X			X	X			X
	Mermaids Cove	14	14	↓	0	0	H					X	X			X
Cairns	North Hastings, The Point	29	8	n/a	0	0	L		X	X		X			X	X
	Reef Magic Pontoon S1	46	18	↓	0	2	L	X	X			X				X
	Norman Reef, Middle Mooring	22	2	n/a	0	1	L		X			X			X	X
Magnetic Island	Nelly Bay S1	16	1	↑	2.25	21	M	X				X	X		X	X
	Nelly Bay S2	24	1	↓	>1	14	M									X
	Alma Bay S1	23	3	↑	16	11	H	X	X			X	X			X
	Alma Bay S2	14	1	↓	18	9	H		X						X	X
	Florence Bay S2	23	1	↓	12	1	L	X	X			X			X	X
	Geoffrey Bay S1	13	1	↓	5	11	H	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Middle Reef S1	5	1	↓	2	55	M					X				X
	Middle Reef S2	42	3	↑	2	41	M		X			X		X		X

## COOL ANIMALS OBSERVED ON SURVEY IN 2014!

- Humphead (Maori) wrasse (Moore Reef, top photo)
- Solar-powered sea hare (North Hastings, The Point, middle photo)
- Starry toadfish (Moore Reef, bottom photo)
- Sea Snake (Magnetic Island, Geoffrey Bay)



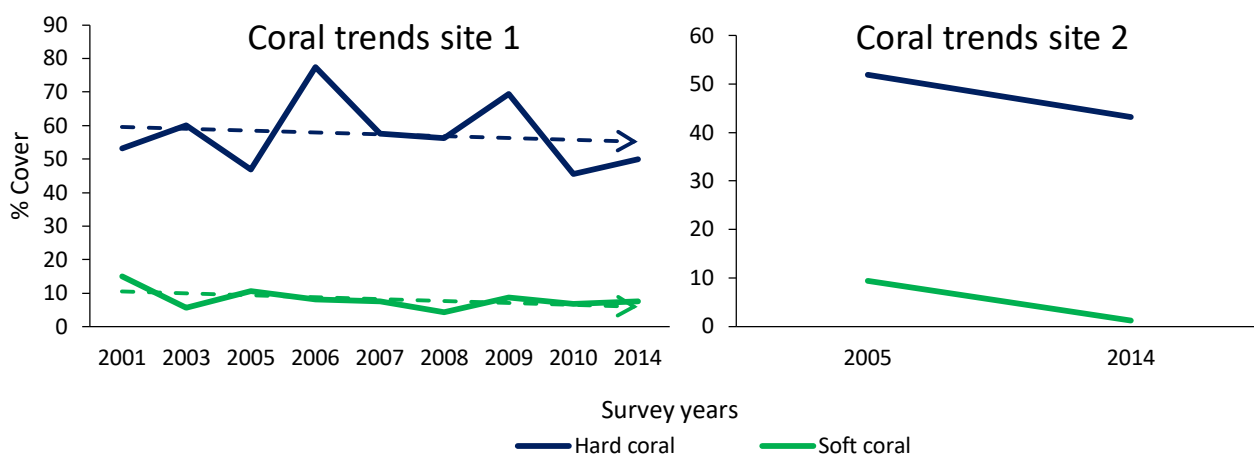
# WHITSundays region

## Blue Pearl Bay, Hayman Island

Blue Pearl Bay is located Hayman Island (Whitsundays) is one of Reef Check Australia's earliest monitoring locations, with surveys beginning in 2001. This reef has been regularly monitored since, however, due to impacts from Cyclone Anthony in January 2011 and Cyclone Yasi in February 2011, RCA teams were unable to return to the site since 2010 due to limited options for site access. Surveyors returned for the first time since this period in the 2014 survey season. Due to logistical reasons, site 2 has not been revisited since it was first implemented in 2005. However, the survey team was able to return in the 2014 season.

### Coral trends

Hard coral cover has remained relatively stable in site 1 over the last 13 years of monitoring, showing only a slight declining trend of 0.5% per year. When Reef Check Australia began surveys in 2001, hard coral covered 53% of the seafloor. Highest hard coral cover at the site was 77% recorded in 2006, but has decreased again to 50% in 2014. Fluctuations in coral, such as these, are common due to natural impacts such as cyclones. This stability in coral cover is a good sign to reef health and resilience. However, soft coral cover showed a stronger declining trend, where coral cover started at 16% in 2001, and declined to 8% in 2014. Site 2 was visited for the first time since the site was implemented in 2005. Both hard coral and soft coral was found to have a slight decreasing trend, with hard coral declining from a 52% cover in 2005 to a 43% cover in 2014. Soft coral declined from 9% in 2013 to 1% in 2014.



Site photos (left to right), 2005, 2008, 2009, 2014

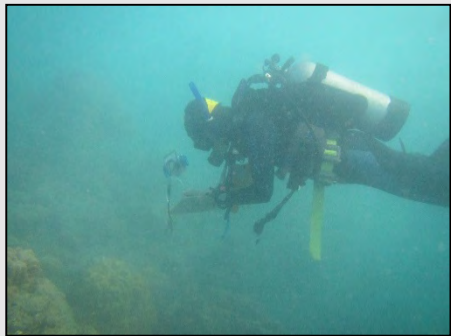


# REEF CHECK

## AUSTRALIA



Blue Pearl Bay, Flat worm, 2014



Surveyor at Blue Pearl Bay, 2014



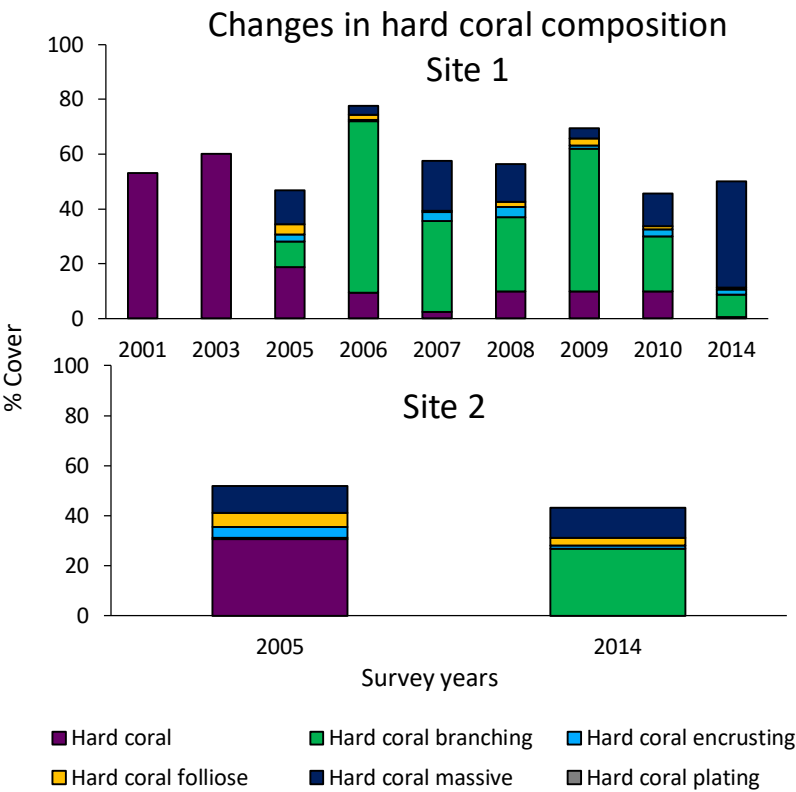
Surveyors at Blue Pearl Bay, Photo cred: Matt Newton, 2014



Surveyors at Blue Pearl Bay, Photo cred: Matt Newton, 2014

Much of the coral composition in both sites is made up of branching and massive corals. The fluctuation of hard coral cover is largely explained by the fluctuation in abundance of branching corals, which are more susceptible to impacts such as storm damage, bleaching and predation from coral eating organisms. In site 1, branching corals were found to be at their highest in site 1 in 2006 and 2009, where they made up 63% and 52% respectively of the entire 100m transect. This has declined considerably, and now only 8% of the survey consisted of branching corals. Massive corals are slow growing and tend to be most resilient to natural impacts. RCA surveys have recorded an increasing trend (3% average increase over 13 years) in the massive coral growth form, increasing to cover 39% of the substrate in 2014. Little to no plating, foliose, and encrusting corals has been observed in site 1 over the course of monitoring.

Site 2 had very little changes in hard coral composition. The use of hard coral categories changed after 2003, where most coral was classified under the general hard coral category. It is likely that much of the coral community recorded within the general category was branching corals due to this change.



Leathery soft corals have shown an increasing trend in site 1 since 2003, and now make up much of the soft coral composition. In site 2, soft corals are equally composed of leathery corals, and general soft coral (>1%). A small abundance of zoanthids, covering 3% of the substrate was recorded in 2005, however, were not observed in the 2014 survey.



# REEF CHECK

## AUSTRALIA



Blue Pearl Bay, Photo cred: Matt Newton, 2014



Blue Pearl Bay, nudibranch, 2014



Blue Pearl Bay site 1, branching hard coral, 2007

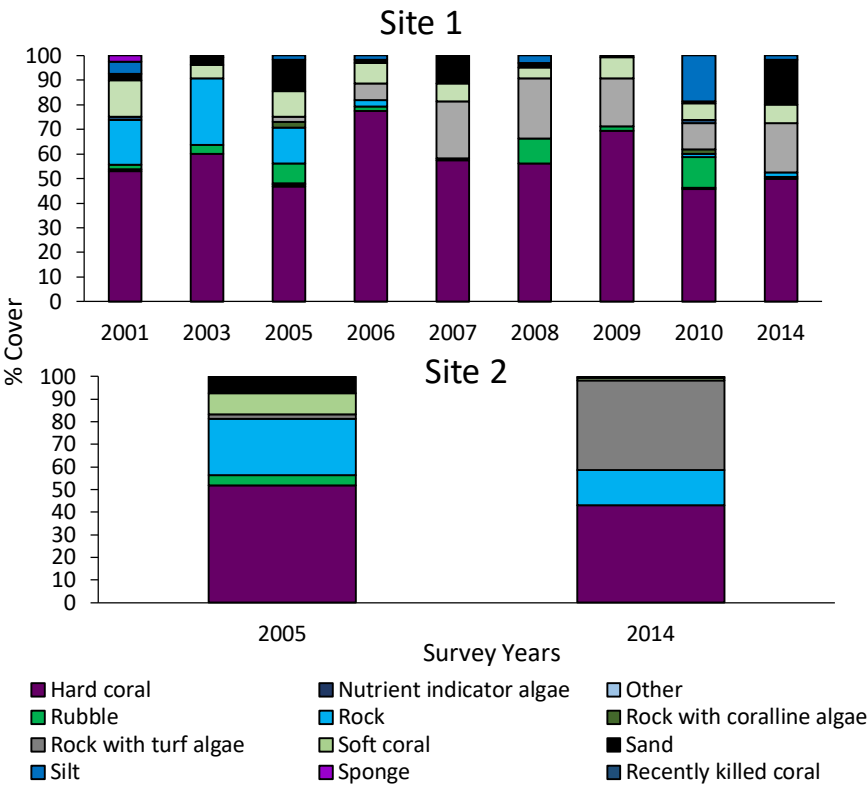


Blue Pearl Bay site 1, photo, 2007

## Substrate composition

The presence of rock with turf algae in site 1 has fluctuated in abundance during the monitoring, most recently increasing from a 10% cover in 2010 to 20% in the 2014 survey. No rock with turf algae was recorded between 2001 and 2005, however rock was recorded instead. This is likely due to changes in RCA categories where surveyors were encouraged to start using rock with turf algae in later years. A similar pattern occurred in site 2, where no rock with turf algae was recorded in 2005, but was recorded in high abundance (making up 39% of the substrate) in 2014. The presence of rubble was found to peak in 2010, just after cyclone Yasi, and made up 13% of the substrate. This has since declined, and now makes up less than 1% of the substrate. The rest of the substrate in site 1 was is composed of sand, which was found to make up 18% of the benthos.

### Substrate composition



Silt generally has covered about 0-5% of the substrate in site 1 from 2001 to 2009, but peaked to 20% in 2010. However, this sudden peak in abundance may be due to a single, isolated event. The substrate data suggests that silt was not the predominant feature under the transect tape. In addition to recording silt levels in substrate survey, surveyors also provide a qualitative description of silt levels (none, low, medium, and high) after each survey beginning in 2008. Surveyors would consider silt levels still to be quite high, compared to other survey sites within the Great Barrier Reef. No silt was recorded on site 2 in either the 2005 or 2014 survey.

# REEF CHECK

## AUSTRALIA



Blue Pearl Bay site 1, giant clam in branching coral, 2010



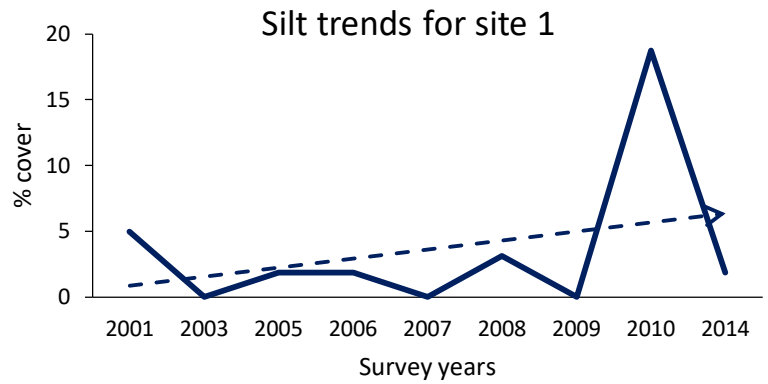
Blue Pearl Bay site 1, Damaged coral likely due to storm damage, 2010



Blue Pearl Bay site 1, Fishing line 2014

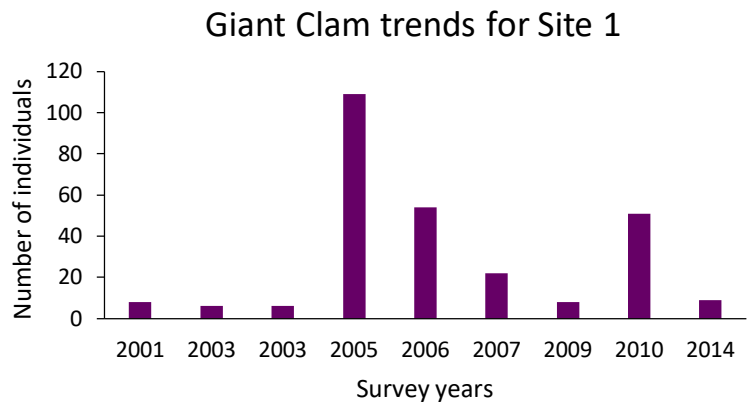


Blue Pearl Bay site 1, coral bleaching, 2014



## Invertebrates

Very few RCA indicator invertebrates have been found within Blue Pearl Bay over the last 13 years, except for high populations of giant clams, which are long lived, but sensitive to water quality. In site 1, giant clams were in high abundance in 2005, with a total of 109 individuals observed on transect. The majority of these individuals were juveniles between 0-20cm in length. However, declined by half the following year (this may be evidence of juveniles mortality or a slight change in transect tape placement). Another wave of juveniles came in 2010, but were not observed in the same numbers in RCA's most recent 2014 survey. Similar patterns occurred in site 2, where a total of 189 individuals were recorded in 2005. This number has decreased, with only 6 individuals recorded in the 2014 survey. One anemone was also recorded in site 2 in 2014.

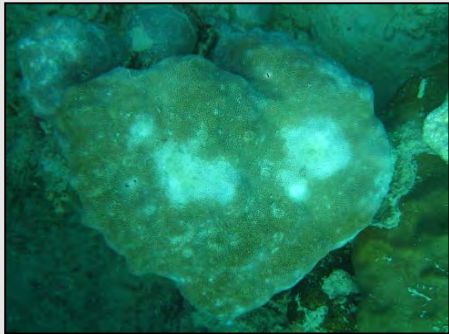


Surveyors with Explore Whitsundays. Photo cred: Matt Newton



# REEF CHECK

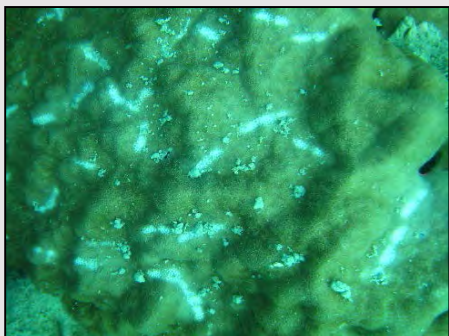
## AUSTRALIA



Blue Pearl Bay site 1, coral bleaching, 2014



Blue Pearl Bay site 2, unknown scar, 2014



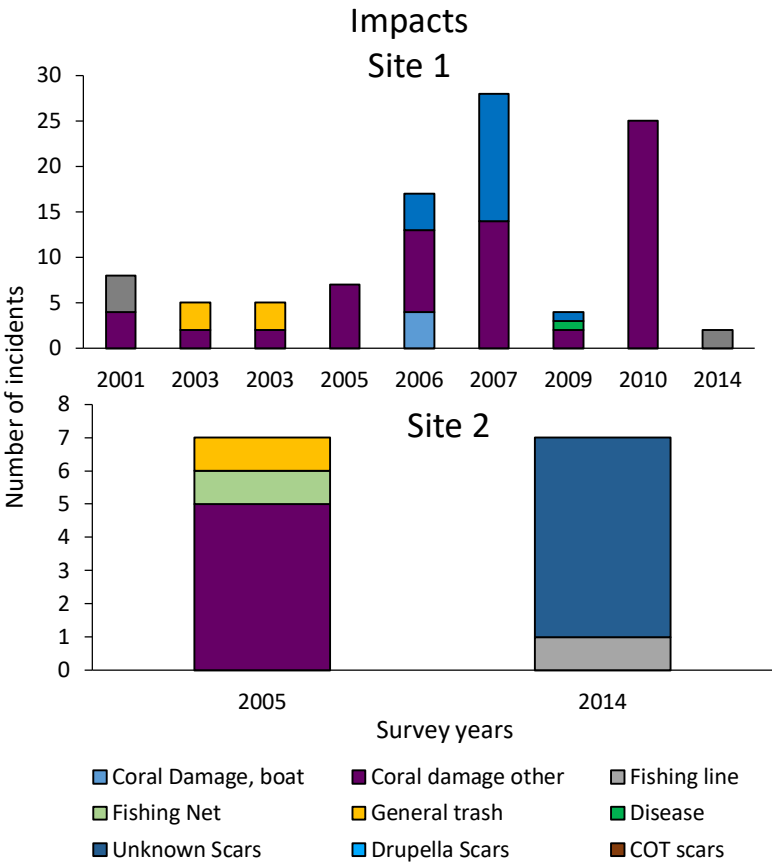
Blue Pearl Bay site 2, unknown scar, 2014



Blue Pearl Bay site 2, fishing line, 2014

## Impacts

Low levels of reef health impacts have been documented in Blue Pearl Bay over the course of monitoring. In site 1, only one instance of coral disease (2009) was ever recorded over the last 13 years. Similarly, no coral disease in site 2 was recorded in either the 2005 or 2014 survey. Additionally, very low amounts of coral bleaching have been observed over the years. In site 1, coral bleaching was recorded to be at its highest in 2010, only affecting 2.5% of the coral population. Coral bleaching was found to affect less than 1% of the coral population in both sites in the 2014 surveys. In the past, coral damage and scars was found to have the largest impact on the coral population for both survey sites, however neither impact was observed in site 1. Six instances of unknown scars were observed in site 2. Fishing line was found at both sites, with two instances in site 1, and 1 in site 2. Fishing debris has not been recorded on survey since 2001 in site 1, and 2005 in site 2.



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## AUSTRALIA



Survey team with Daydream Resort  
Photo credit: John Ashtley, 2014



Lovers Cove, site photo. Photo credit:  
John Ashtley, 2014



Lovers Cove, site photo. Photo credit:  
John Ashtley, 2014



Surveyor at Lovers Cove. Photo credit:  
John Ashtley, 2014

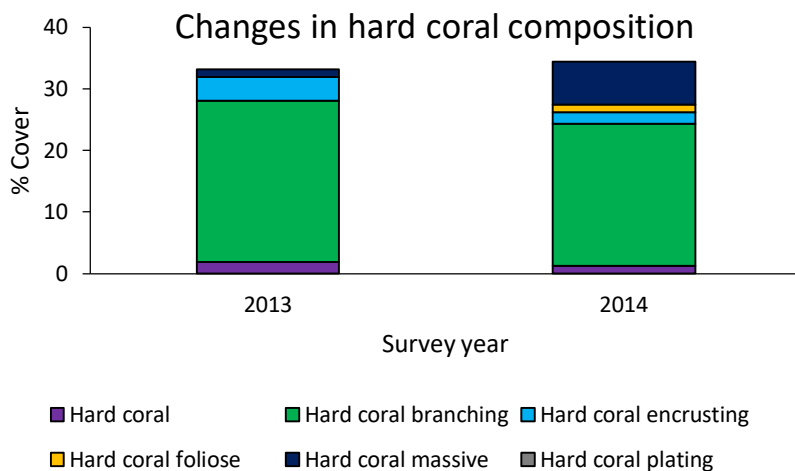
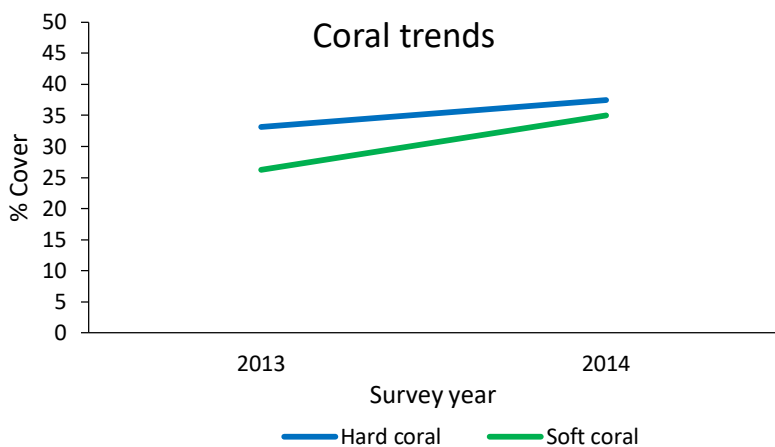
## DAYDREAM ISLAND, LOVERS COVE

This site was first implemented in 2013, and is located among the fringing reef of the leeward side of Daydream Island. This site is shallow, allowing snorkelers to survey the site. It is one of the more popular sites for resort guests to snorkel and swim.

### Coral trends

Hard coral cover has changed little within the past year, only increasing in by 5% since the 2013 survey, and now represents 38% of the substrate. Much of the hard coral composition consists of coral species with branching morphology (23%), in addition to small abundances of encrusting (2%), foliose (1%) and massive corals (7%).

Soft coral was found to be the dominant coral growth within Lovers Cove, and covered 35% survey. This has been found to remain relatively stable over the year, only increasing in abundance by 9%. Leathery corals have remained the Dominant growth form, however, this year's survey detected a higher abundance of zoanthids (3%), and general soft coral (4%) from the 2013 survey.





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## AUSTRALIA



Lovers Cove, scarring on soft coral, 2014



Lovers Cove, high abundance of burrowing clams observed on invertebrate survey, 2014



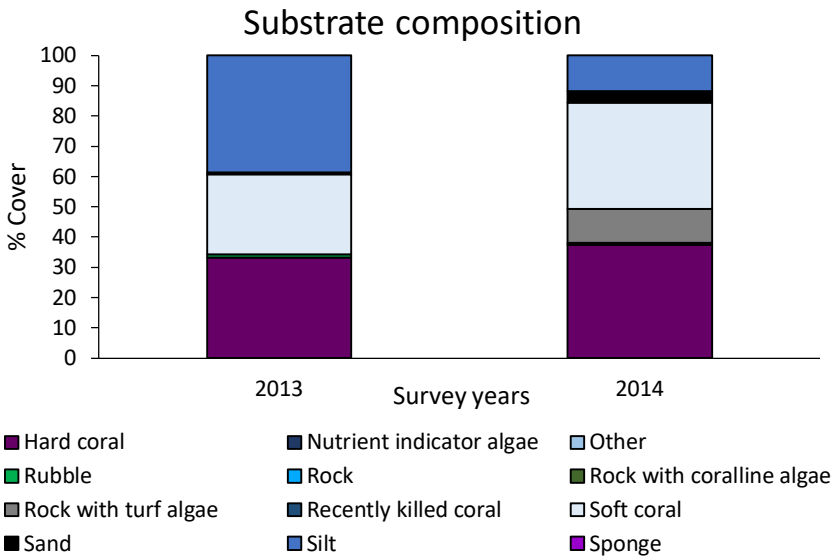
Lovers Cove, one *Diadema* sp. was observed on invertebrate survey, 2014



Lovers cove, Dominant algae: *Turbinaria* sp. 2014

### Substrate Composition

The presence of rock with turf algae increased over the past year from covering 0% of the substrate in 2013, to 11% in 2014. The abundance of silt decreased from covering 28% of the substrate in the 2013 survey to only 12%. The abundance of macro algae increased from 1 count to 4 in the most recent surveys, with *Turbinaria* the most commonly observed. No other algae was recorded.

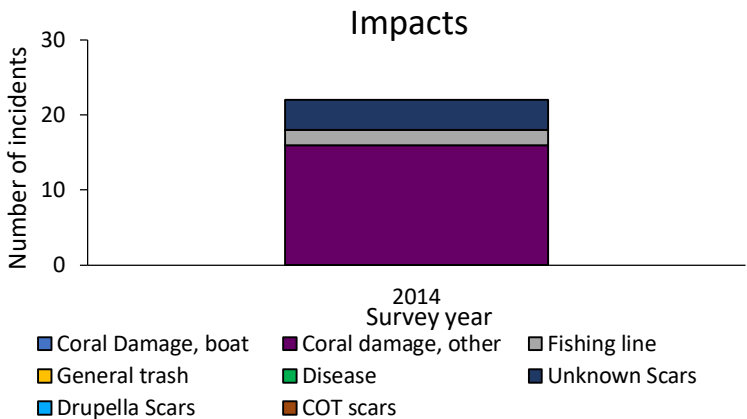


### Invertebrates

An invertebrate survey was performed for the first time in the 2014 survey. Giant clams (all burrowing) were the most abundant indicator invertebrate, with a total of 39 individuals observed on transect. All individuals observed were between 0-20cm long. Almost no other indicator invertebrates were observed, apart from one *Diadema* urchin.

### Impacts

Coral damage due to unknown causes had the highest impact on coral cover, with a total of 16 instances recorded on survey. Four instances of coral scars were observed, but all from unknown causes. Three of which were found on soft corals. No coral disease was recorded, and coral bleaching only affected 7% of the coral population. Two instances of fishing line wrapped around coral was recorded, but no other anthropogenic impacts were observed.

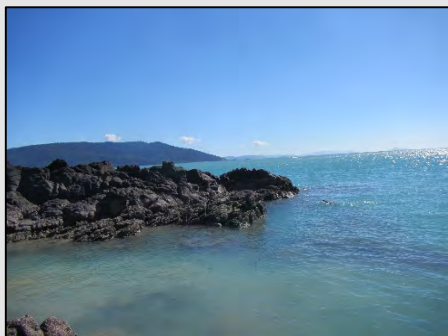


# REEF CHECK

## AUSTRALIA



Surveyors at Mermaids Cove, 2014



Mermaids Cove, 2013



Mermaids Cove, site photo, 2014



Mermaids Cove, site photo 2014

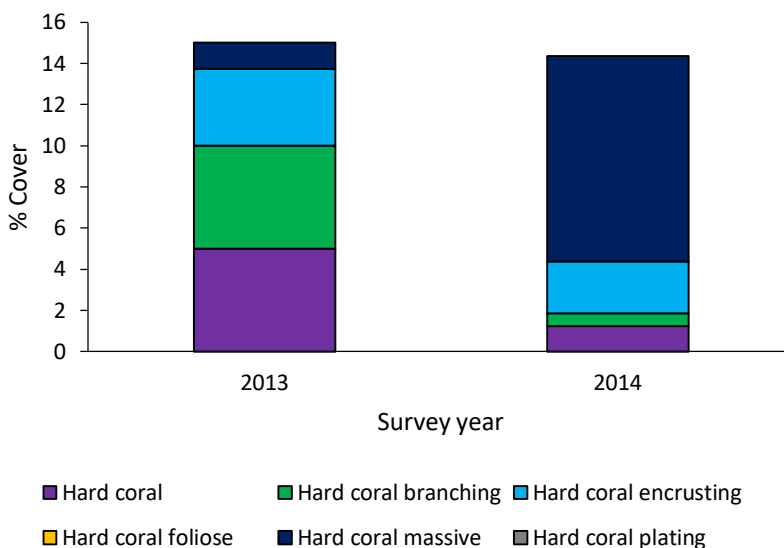
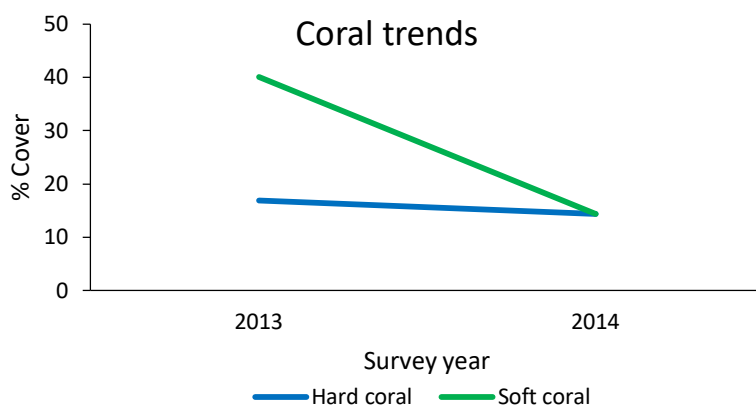
## Daydream Island, Mermaids Cove

This site is located on the northern-most, leeward side of Daydream Island, and was first implemented in 2013. A shallow, intertidal reef occurs along the rocks, where snorkelers are able to easily survey. On extremely low tides, corals are exposed. This site is not a popular tourists location, and instead most frequently visited by resort staff.

### Coral trends

Similar to coral trends in Lover's cove, hard coral cover has remained stable over the last year. Hard coral was found to decrease by 3% since the previous year, and now covers 14% of the substrate. However, soft coral abundance has declined, transitioning from 40% of the substrate in 2013, to 14% in the recent 2014 survey. This may demonstrate the patchiness of the habitat, as the bay is small, and variation of transect placement is limited.

Hard coral mostly consist of massive corals, which were found to cover 10% of the substrate. Some encrusting corals (3%), branching (1%), and corals in the general hard coral category (e.g. digitate, and sub-massives) (1%) were also recorded on survey. Only leathery soft corals were recorded in the 2014 survey, with no zoanthids observed.





# REEF CHECK

## AUSTRALIA



Mermaids Cove, dominant algae: *Turbinaria* sp. 2014



Mermaids Cove, High abundances of giant clams were observed in the 2014 invertebrate survey



Mermaids Cove, Coral damage, 2014



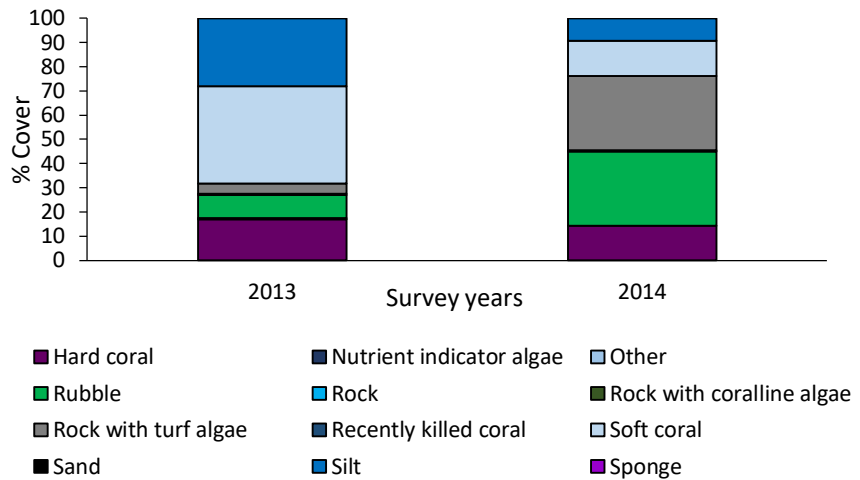
Mermaids Cove Fishing line, 2014

## Substrate composition

The presence of rock with turf algae increased significantly, making up 4% of the benthic cover in the 2013 survey to 31% in 2014. Similarly, rubble was also found to increase, with only a recorded abundance of 9% in 2013 to 31% in 2014.

However, the amount of silt was found to decrease, covering 28% of the substrate in 2013 to 9% in the recent survey. No macro algae was recorded on the substrate survey, however, *Turbinaria* sp. was commonly observed.

### Substrate composition

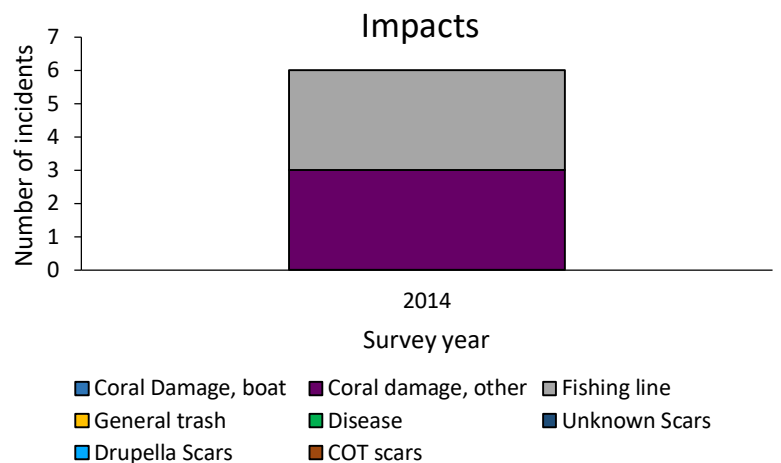


## Invertebrates

An invertebrate survey was performed for the first time in 2014. Giant clams (all burrowing) were the only indicator invertebrate recorded, with a total of 82 individuals observed on transect. All individuals observed were between 0-20cm in size.

## Impacts

Very few impacts on corals were observed on survey, likely due to the low abundance of hard corals. Only 3 incidents of coral damage were recorded on transect. No disease or coral scarring was observed, and less than 1% of the coral population was bleached. However, 3 instances of fishing line was observed.



# Magnetic Island

## Alma Bay

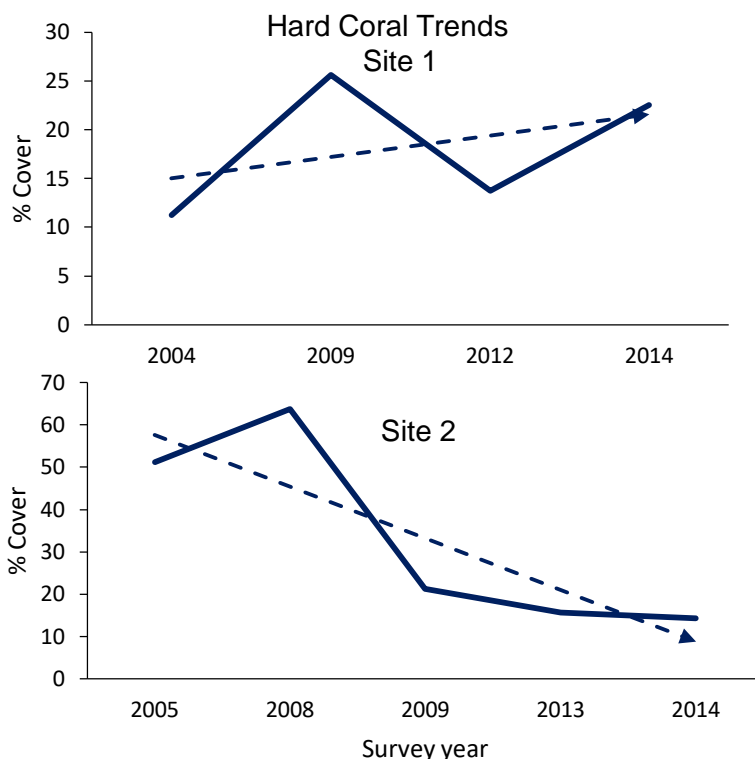
Alma Bay is a small bay that is protected from fishing activities, and is located on the exposed, Eastern side of Magnetic Island. It is commonly used recreationally by beach goers and locals. There are two monitoring sites within this Bay that were established in 2004 and 2005.

### Coral trends

Alma Bay is a small bay that is protected from fishing activities, and is located on the exposed, Eastern side of Magnetic Island. It is commonly used recreationally by beach goers and locals. There are two monitoring sites within this Bay that began in 2004 and 2005.

Hard coral cover shows varying trends depending on the site within the bay. Site 1 has remain relatively stable in hard coral cover, averaging between 15-20% of the substrate. However, the opposite end of the bay, (site 2), was originally observed to have high hard coral abundance, covering over 50% of the substrate in 2005. This declined considerably after 2008, with hard coral covering 13% of the substrate in 2014. Alternatively, soft coral cover has remained in low abundance on both sides of the bay, never exceeding 3% of the benthic substrate.

Much of this hard coral loss may be contributed to a bleaching event in 2008, with additional impacts due to Cyclone Yasi in February 2011, which resulted in reports of high damage on Magnetic Island.



Alma Bay, 2014



Alma Bay, site photo 2014



# REEF CHECK

## AUSTRALIA



Alma Bay site 2, 2008



Alma Bay site 2, 2013



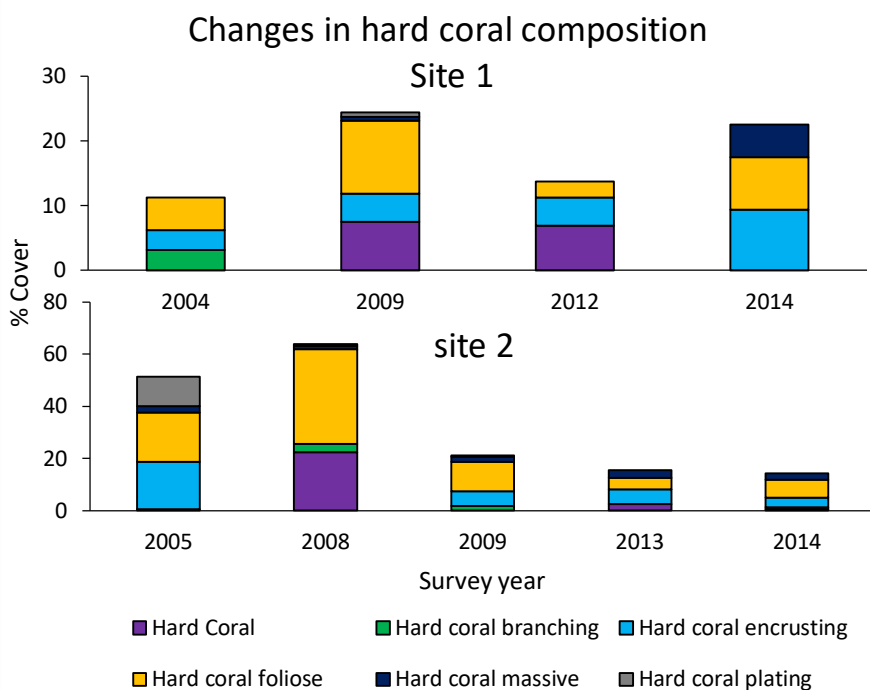
Alma Bay site 2, surveyor, 2013



Alma Bay, site 1, bleached branching coral 2009

Changes in hard coral composition (as viewed below) are important to monitor, as some corals are more resilient to impacts than others. The figure below looks at the changes between hard coral (general category), branching, plating, foliose, massive, and encrusting corals.

Much of the coral composition for both sites in Alma Bay are made up of foliose, massive, and encrusting corals. Branching corals were observed at site 1 in 2004, and site 2 until 2009, however, they have not since been observed in substrate surveys. Branching corals are more susceptible to impacts such as storm damage, bleaching, coral disease, and predation from coral eating organisms. While foliose, massive, and encrusting corals appear to be much more resilient.



## Substrate composition

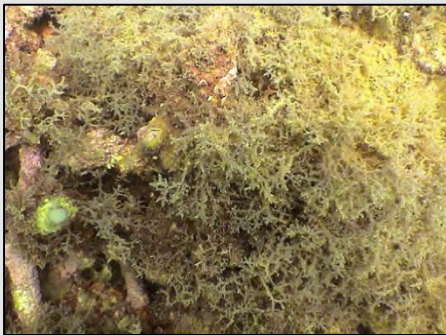
General substrate has changed considerably for both survey sites within the last 10 years (as seen below). For site 1, rock with turf algae increased in abundance, covering 13% of the substrate in 2009. This further increased to 33% in 2012, but decreased again in 2014 to covering only 6% of the substrate. Nutrient indicator algae, such as *Lobophora sp.* and *Dictyota sp.* also contributed to much of the fluctuation throughout the years, however, seasonal changes can contribute to these fluctuations. Alternatively, the massive decline in hard coral abundance in site 2 was replaced by a significant increase of rock with turf algae, covering 45% of the substrate in 2009. This subsequently decreased to 13% in the 2014 survey.

# REEF CHECK

## AUSTRALIA



Alma Bay site 1, sponge, 2004



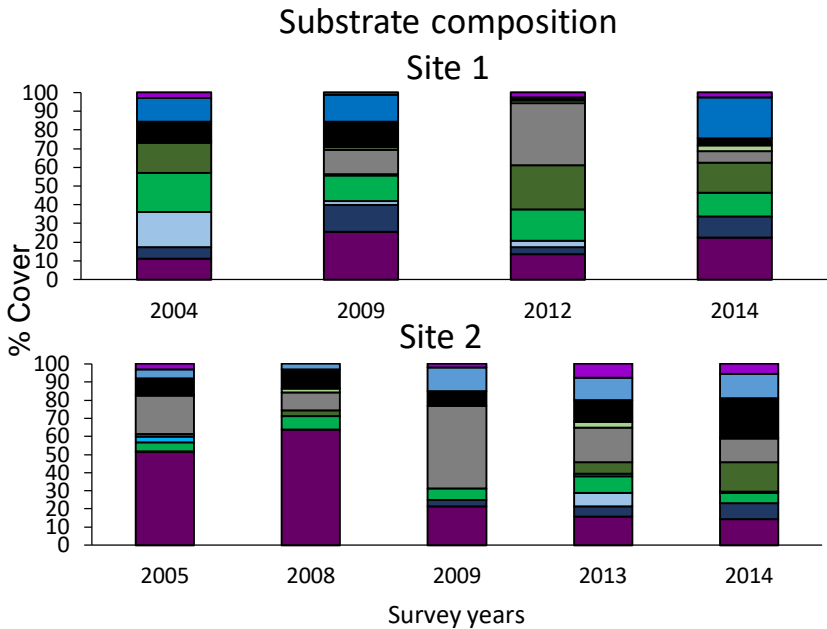
Alma Bay site 1, dominant algae, 2004



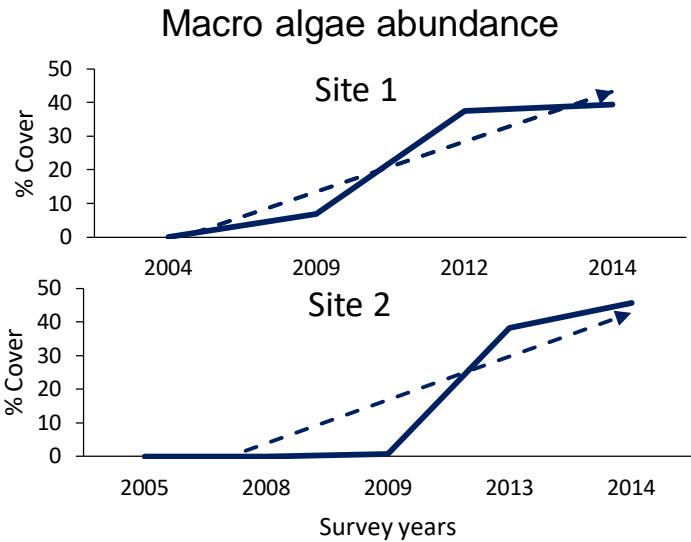
Alma Bay site 1, dominant algae, 2009



Alma Bay site 1, dominant algae, 2014



Macro algae has increased considerably for both sites since surveys began in 2004, with an average increase of 15% for site 1, and 13% for site 2. This has mostly consisted of *Sargassum spp.*, and *Padina spp.* While it is important to note that the fluctuation of macro algae is often due to seasonal patterns, the steady increase of algae is a concern for reef health.

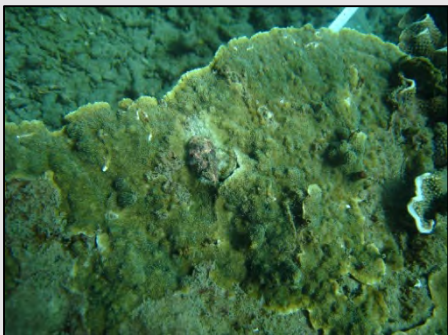


Silt cover has also increased since surveys began. In site 1, silt has increased on average of 1% over the last 10 years, starting at 13% in 2004. Silt was not recorded in 2012, however in 2014, silt covered 22% of the transect. For site 2, silt covered 5% in 2005, but increased to 13% in 2009 where it has remained stable. Silt cover is considered very high in Alma Bay compared to other GBR sites.



# REEF CHECK

## AUSTRALIA



Alma Bay *Drupella* snail and scar, 2009



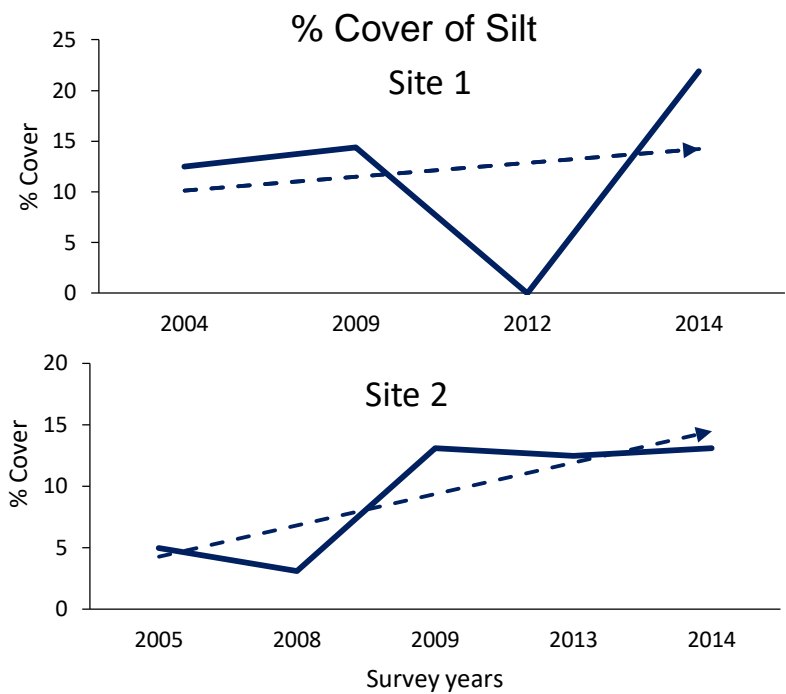
Alma Bay, nudibranchs, 2014



Alma Bay, blue spotted stingray, 2014

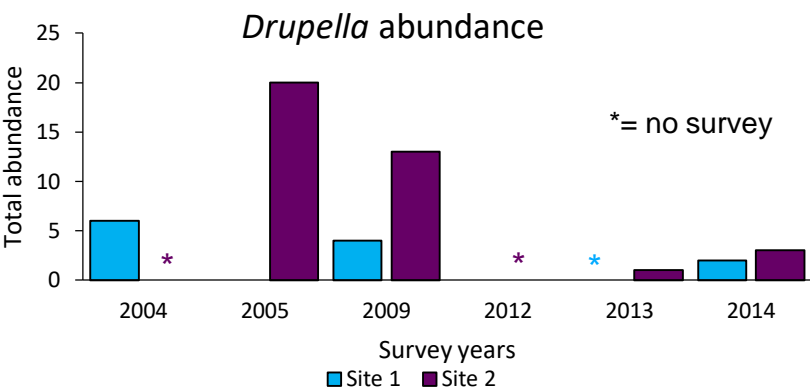


Alma Bay, nudibranchs, 2005



## Invertebrates

Very few RCA indicator invertebrates have been recorded within Alma Bay over the last 10 years, except high abundances of *Drupella* snails. Populations of these corallivores need to be monitored as outbreaks can be detrimental to live coral cover. *Drupella* abundance peaked in 2005 where a total of 20 snails were observed on a 100m transect in site 2. However, no snails were observed in site 1 the same year. The abundance of *Drupella* snails were still high in 2009, with a total of 13 individuals observed in site 2, and 4 in site 1. These abundances have since decreased, however, the number of *Drupella* snails are still considered in high abundance compared to other GBR sites. Other key invertebrates have been observed, such as one giant clam in 2013 in site 2, and one *Trochus* shell in 2004 in site 1. Five lobsters were observed in site 1 in 2009, but have not been observed on transect since.



# REEF CHECK

## AUSTRALIA



Alma Bay, coral bleaching, 2014



Alma Bay, coral disease, 2014



Alma Bay, blenny scar, 2014



Alma Bay. fishing line, 2014

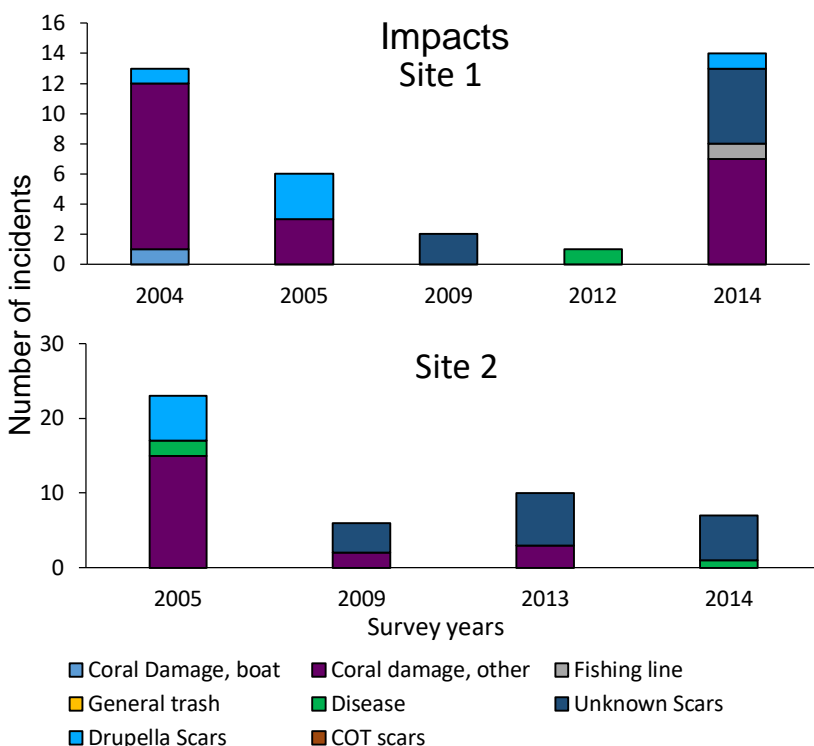
## Impacts

Few impacts on hard coral have been observed in Alma bay over the last 10 years. Coral damage seems to have the largest effect on coral colonies, with the number of incidents peaking for site 1 in 2004 with 11 counts, and in 2005 for site 2 with 15 counts. This number decreased over the years, but has increased again in the latest survey to 7 incidents in site 1.

Despite the large quantities of *Drupella* snails over the years, few *Drupella* scars have been observed. Only 4 incidents were observed over all 5 surveys performed over the last 10 years in site 1. In site 2, six incidents were observed in 2005, but none have been observed since. Conversely, the number of unknown scars have increased over the years, with 5 incidents observed in site 1, and 6 in site 2 in 2014. In addition, surveyors have noticed a large numbers of blenny scars on massive corals in 2014. These scars are not included in impact surveys, but noted separately by surveyors.

Coral disease has rarely been observed, with the first observation of disease in 2013 in site 1. Two incidents were observed in site 2 in 2005, but not again until 2014, where one incident was observed.

No other impacts, apart from small levels of coral bleaching were observed in the latest survey (1% population bleaching for both sites), however one incident of fishing line was observed in site 1.





# REEF CHECK

AUSTRALIA

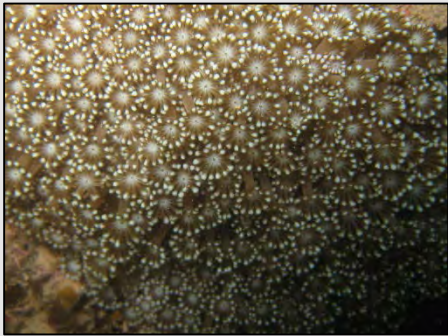
## Florence Bay

This site is located on the north eastern point of Magnetic Island and is a designated green zone, where fishing is prohibited. It has been surveyed three times by the Reef Check Australia team since the site was implemented in 2006.

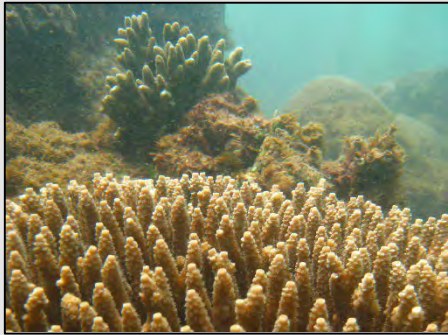
### Coral trends

Hard coral cover has shown a decreasing trend, averaging an 11% decline per year. Hard coral covered approximately 45% of the substrate in 2006, but has since declined by half, covering 23% in the 2014 survey. When surveys began, much of the coral cover consisted of encrusting, plating, massive and branching corals. However, in the 2014 survey, no plating corals were observed, and encrusting and branching corals only represented 5% and 1% of the substrate, respectively. Alternatively, massive coral abundance increased from 6% in 2006 to 11% in 2014. The increase of the general hard coral cover to 26% in 2012 is likely due to misidentification of hard coral categories.

Alternatively, soft coral has remained in low abundance, covering only 1% of the substrate in all three surveys.



Florence Bay, hard coral, 2014



Florence Bay, site photo, 2012

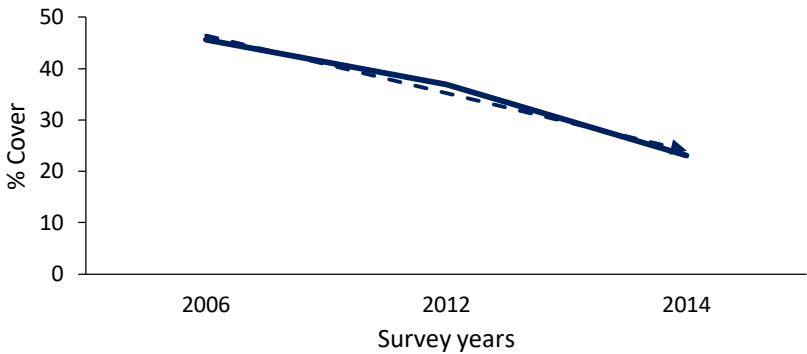


Florence Bay, algae growing over coral, 2012

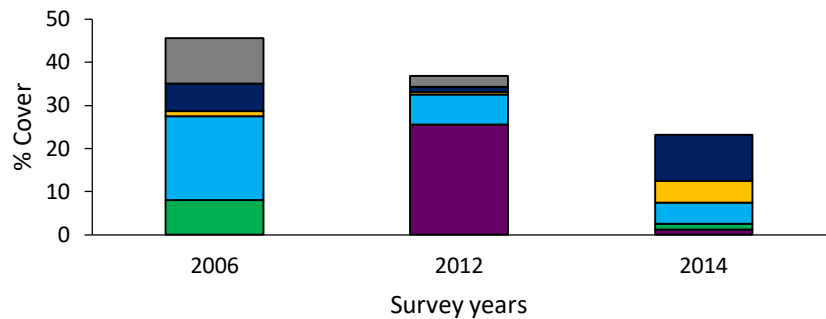


Florence Bay, nudibranchs, 2006

Hard coral trends



Hard coral composition



■ Hard coral ■ Hard coral branching ■ Hard coral encrusting  
■ Hard coral foliose ■ Hard coral massive ■ Hard coral plating

# REEF CHECK

## AUSTRALIA



Florence Bay, crustose algae and macroalgae was also highly abundant, 2014



Florence Bay, dominant algae, 2006



Florence Bay, dominant algae, 2014

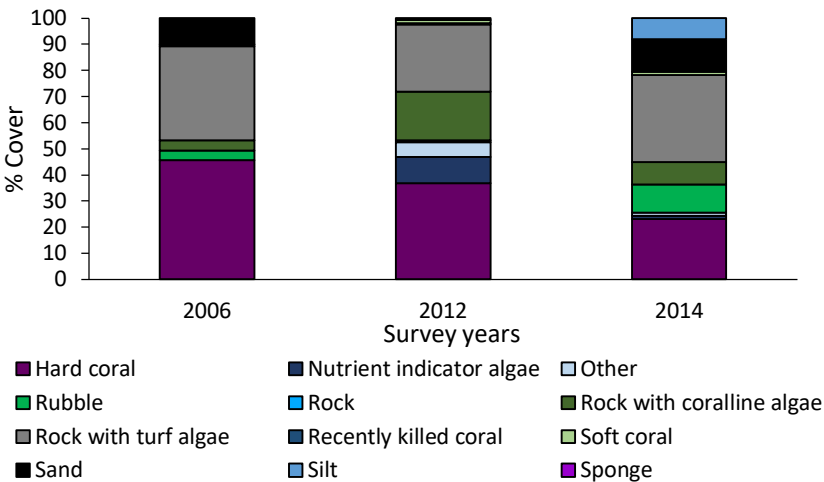


Florence Bay, giant clam, 2012

## Substrate composition

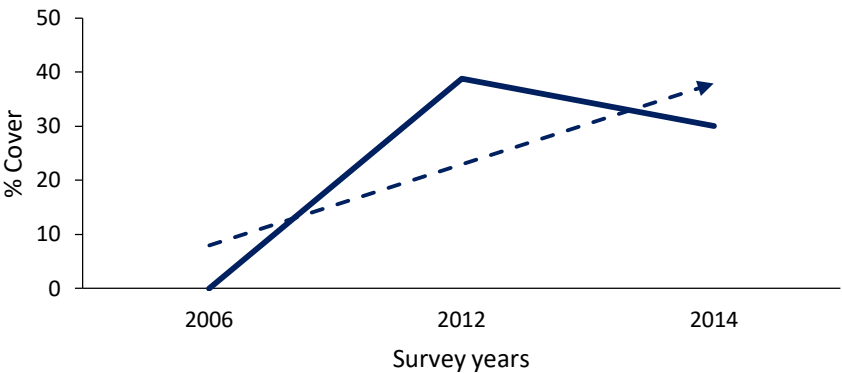
Apart from hard coral, the substrate at Florence Bay is greatly composed of rock with turf algae, representing 33% of the substrate in the latest 2014 survey. In addition, there was a recent appearance of silt, which was found to cover 8% of the substrate. While silt has been in high concentrations in the Magnetic Island sites, this was the first time it was recorded within the substrate survey in Florence Bay. The amount of rubble found on site was also found to increase, representing 10% of the substrate. This is likely to be correlated to the recent decline of hard coral within this site. The abundance of nutrient indicating algae in 2012 was found to be relatively high in abundance compared to other GBR sites, covering 10% of the substrate in 2012. However, this declined considerably in 2014, only representing 1% of the substrate. The slight fluctuations of sand are likely due to slight variations of transect placement.

### Substrate composition



Similar to adjacent sites, the abundance of macro algae has increased significantly over the years, now covering approximately 30% of the substrate. This has declined from the previous survey, however this may be due to seasonal fluctuations.

### Macro algae abundance





# REEF CHECK

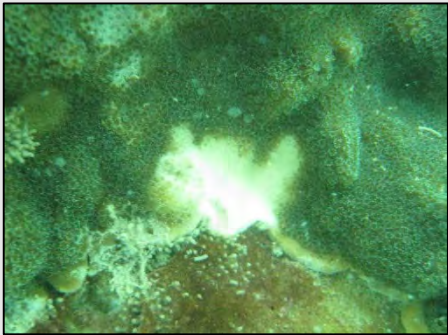
## AUSTRALIA



Survey crew after a day of diving with Dave Stewart and Dive Patrol, 2014



Florence Bay, sea urchin, 2012



Florence Bay, coral scar, 2014



Florence Bay, coral Damage, 2014

### Invertebrates

Very few key invertebrates have been observed at Florence Bay. Only 3 *Drupella* snails (one of which is pictured below) were observed in the 2014 survey. However, the abundance of *Drupella* snails has declined from 6 individuals observed in 2006. Previous surveys have observed one giant clam and one anemone, but they were not recorded in the latest survey.

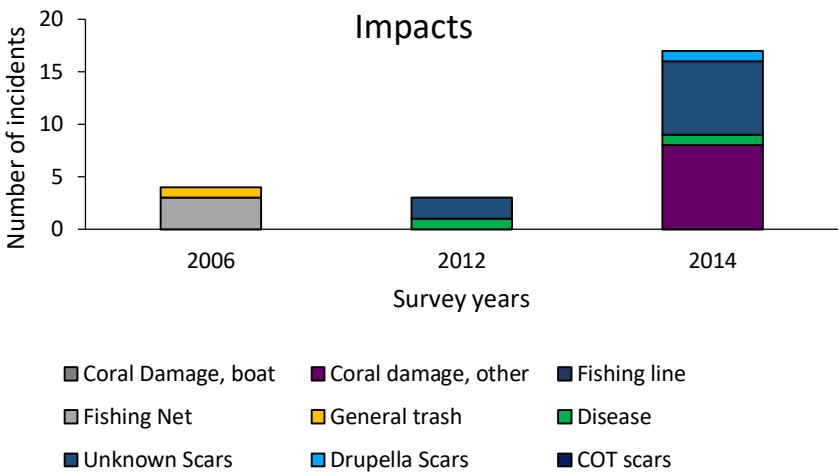


*Drupella* and scar, 2014

### Impacts

Coral damage and unknown scars were found to have the largest impacts of coral at this site, with a total of 8 and 7 incidents recorded respectively. One incident of *Drupella* scar and one incident of coral disease were also reported in the 2014 survey.

Fishing nets and debris were recorded in the first survey of 2006, but have not been observed since. Coral bleaching has been found to have a small effect on corals at this site, only affecting 2% of the population each survey year.





# REEF CHECK

## AUSTRALIA



Geoffrey Bay, site photo 2005



Geoffrey Bay, site photo, 2007



Geoffrey Bay, site photo, 2007



Geoffrey Bay, site photo, 2009

# Geoffrey Bay

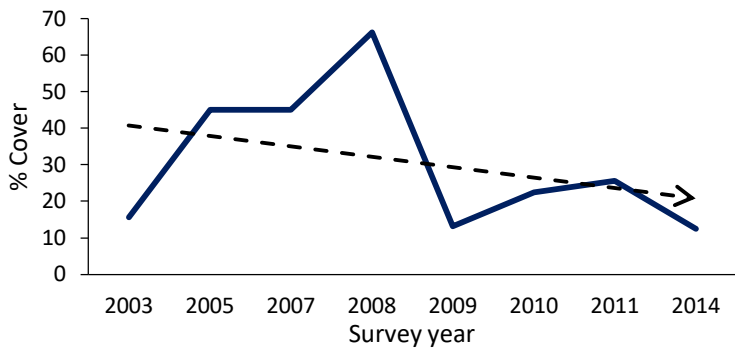
Geoffrey Bay is located on the Eastern side of Magnetic Island, between Nelly and Alma Bay, and is a designated green zone, where fishing is prohibited. Sites were first implemented in 2003, and have been regularly monitored since. A large fringing reef extends the length of the bay, and is frequently visited by tourists that snorkel and dive.

## Coral trends

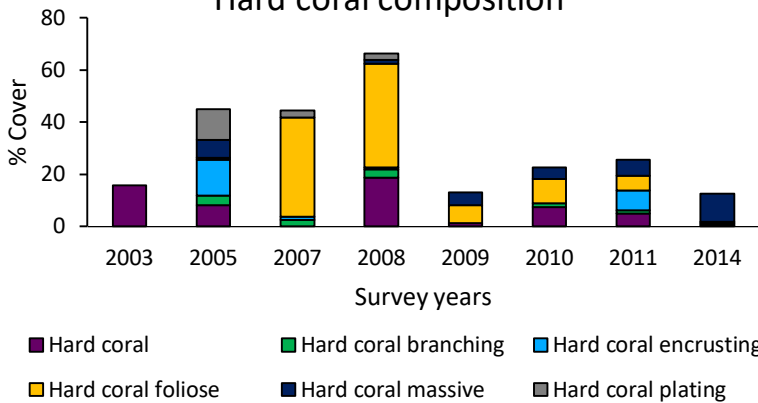
Hard coral trends have fluctuated considerably over the 11 years of monitoring. Hard coral covered 16% of the substrate in 2003, but increased to 66% just five years later in 2008. The abundance of coral declined again in 2009 to covering only 13% of the substrate. Since this decline, hard coral abundance has yet to recover, with hard coral covering 13% of the substrate in the 2014 survey.

Much of the loss was attributed to the loss of corals within the foliose morphology. This coral growth form covered 40% of the substrate in 2008, and has seen a steady decline since, now covering less than 1% of the substrate. Instead, massive corals Dominant the hard coral population, representing 10% of the substrate cover. Encrusting coral and plating coral were found to be in higher abundance in 2005 (14 and 12% respectively), but have declined to representing less than 1% of the substrate in 2014.

Hard coral trends



Hard coral composition



# REEF CHECK

## AUSTRALIA



Geoffrey Bay, Dominant algae, 2011



Surveyors at Geoffrey Bay, 2011



Geoffrey Bay, *Padina*, 2011



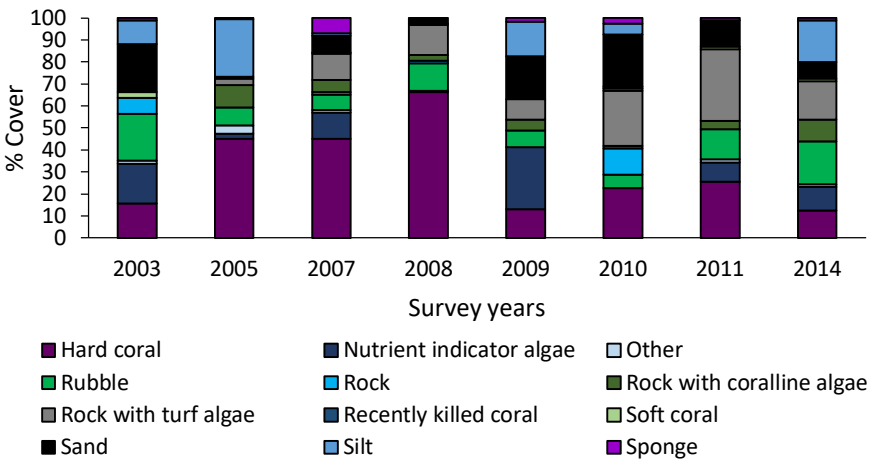
Geoffrey Bay, Dominant algae, 2011

### Substrate composition

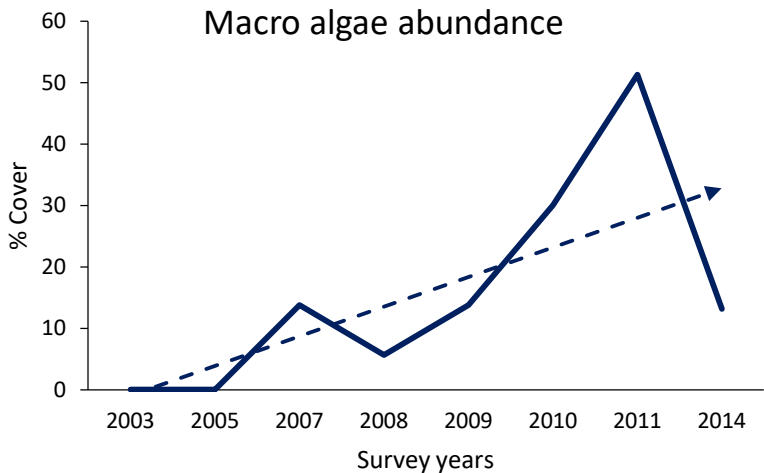
Other than hard coral, in the 2014 survey, the substrate at Geoffrey Bay mostly consists of nutrient indicator algae (11%), rubble (19%), rock with turf algae (18%), silt (19%), and sand (8%). These categories have been consistently present across all survey years, except for silt, which increased in prevalence starting in 2007.

Very little soft coral and sponge have ever been observed at this site, and have both covered approximately 1% of the substrate since 2005. After the decline in hard coral abundance in 2009, there was an increase of nutrient indicator algae and silt. However the abundance of silt has fluctuated greatly, and dropped down to 0% in 2011, only to increase again to 19% in 2014. In addition, macro algae abundance increased significantly, from covering 5% of the substrate in 2005, to 51% in the 2011 survey. This has since decreased, representing 13% of the substrate, however, macro algae has increased at a 5% rate since surveys began.

### Substrate composition

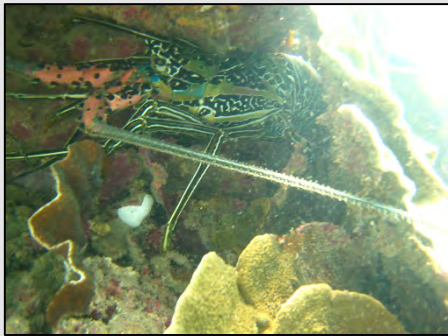


### Macro algae abundance



# REEF CHECK

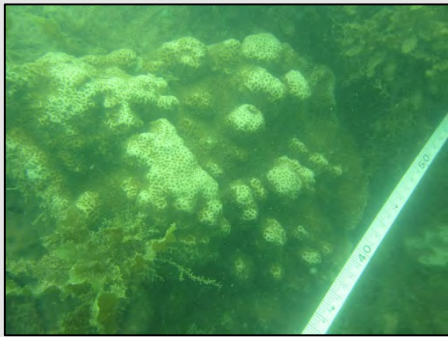
## AUSTRALIA



Geoffrey Bay, lobster, 2007



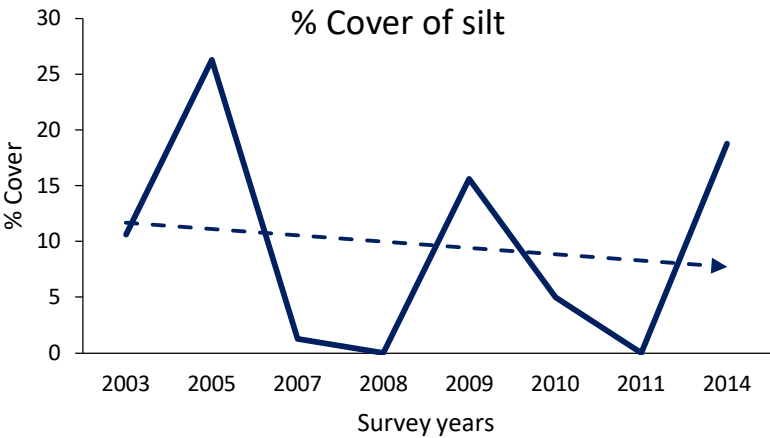
Geoffrey Bay, moray eel, 2010



Geoffrey Bay, coral bleaching, 2011



Geoffrey Bay, coral damage, 2011

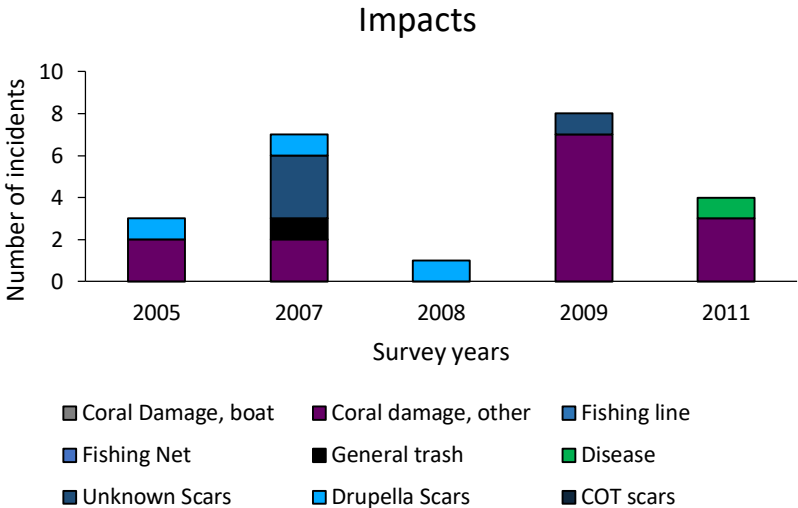


### Invertebrates

An invertebrate survey was not conducted in the 2014 survey. No key invertebrates were recorded in the previous 2011 survey, however, in earlier surveys, high numbers of *Drupella* snails were observed in 2005 (7 individuals). This later declined 3 individuals in 2009. Trochus shells have also been observed, however, only two were recorded on survey within the last 11 years. One lobster was recorded in 2007, but have not been observed on transect since.

### Impacts

An impact survey was also not conducted in the 2014 survey. However, previous surveys have found that like other Magnetic Island sites, coral impacts are largely due to unknown coral damage. The amount of coral damage peaked in 2009, with a total of 7 incidents. This decreased to 3 incidents in the subsequent 2011 survey. *Drupella* and unknown scars have also have been observed at this site in relatively high abundance in earlier surveys, but were absent in the latest 2011 survey. Coral disease was observed for the first time in the 2011 survey at this site. Very little coral bleaching have been observed over the years, apart from 2009, where 23% of the population was bleached.





# REEF CHECK

## AUSTRALIA



Middle Reef, hard coral branching, 2005



Middle Reef, site photo, 2007



Middle Reef, turf algae, 2009



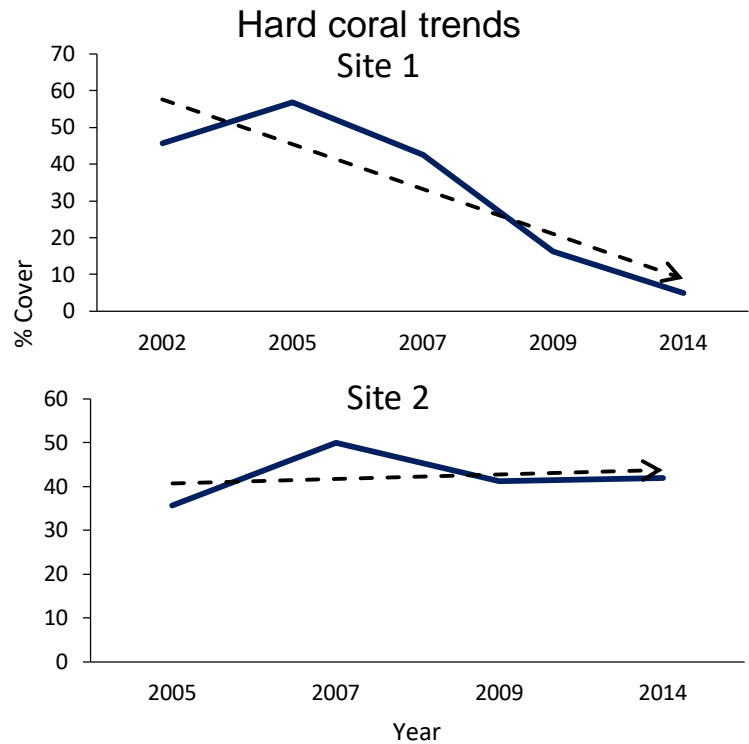
Middle Reef, site photo, 2014

# Middle Reef

Middle reef is a shallow site, and is located in Cleveland Bay, 2km off the coast of Pallarenda. This site is a blue zone in the Great Barrier Reef Marine Park, where fishing is permitted. Two sites were established in 2002 and 2005. However, due to funding restrictions, Middle Reef sites have been difficult to visit within the last five years. This year, a RCA team was able to return to the site for the first time since the last survey 2009.

## Coral trends

Hard coral cover trends have shown different patterns for each site. On average, site 1 has shown a 12% decline of coral cover since surveys began in 2002. Through 2001 and 2005, hard coral abundance was found to represent approximately half of the benthic substrate (46% and 57% respectively). However, in 2009 hard coral cover declined to 16%, and again to 5% in 2014. Despite these strong patterns in site 1, the adjacent site has shown slightly different trends, with hard coral abundance remaining relatively stable, with an average cover of 40% since surveys began in 2005.



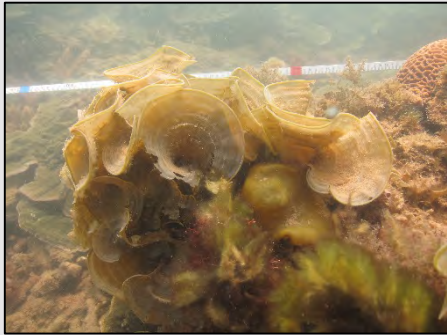
Corals within the foliose category were most abundant throughout the years of surveys in both sites (see next page figure). Branching corals were also found in high abundance, however recent surveys show that they only cover less than 1 and 2% of the substrate for site 1 and 2. In 2007, much of the coral population were recorded within the general hard coral category, however, this is likely to be a discrepancy in growth form categorization.

# REEF CHECK

## AUSTRALIA



Middle Reef, dominant algae, 2014



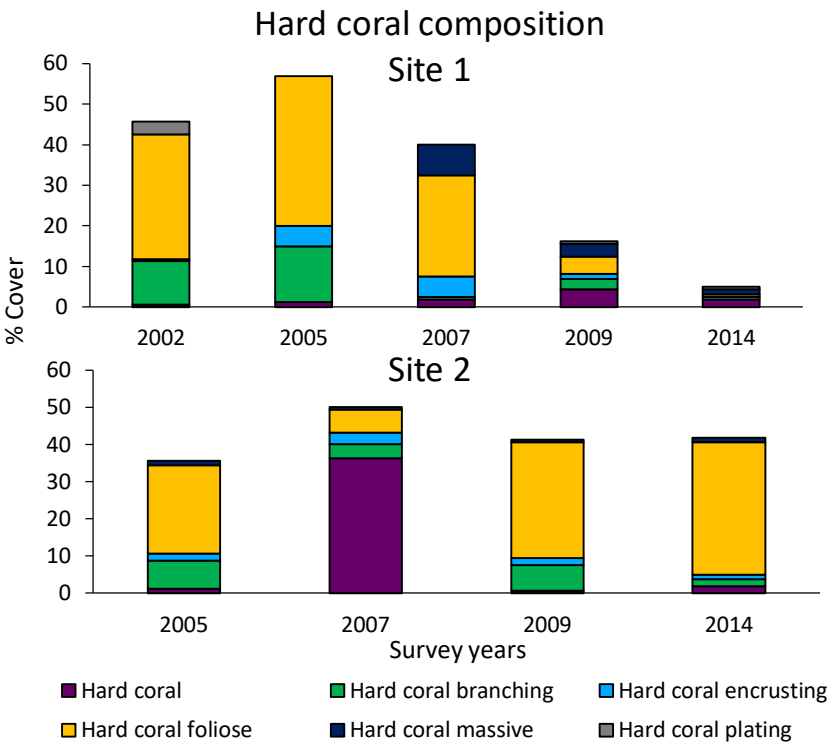
Middle Reef, macro algae, 2014



Middle Reef, turf algae, 2005



Middle Reef, hard coral, 2009

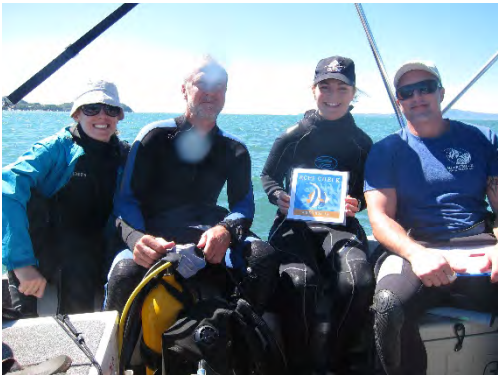


### Substrate composition

As other Magnetic Island sites, soft coral abundance have remained stable, covering approximately 1% of the survey in site 1 and 3% in site 2.

When surveys began in site 1 in 2002, half of the substrate (50%) consisted of rock with turf algae. However, a recent increase of nutrient indicating algae and silt has replaced rock with turf algae, now covering 55% and 23% of the substrate respectively. Similar reports have been found in site 2, where rock with turf algae made up 35% of the benthos in 2005, but covers less than 1% in 2014. Instead, nutrient indicator algae covers 41% and silt covers 9% of the substrate.

Unlike other Magnetic Island sites, macro algae was found to represent only 5% of the substrate for both sites in the 2014 survey, and very little has been observed over the years.



Surveyors at Middle Reef, 2014



# REEF CHECK

## AUSTRALIA



Middle Reef site 1, anemone, 2014



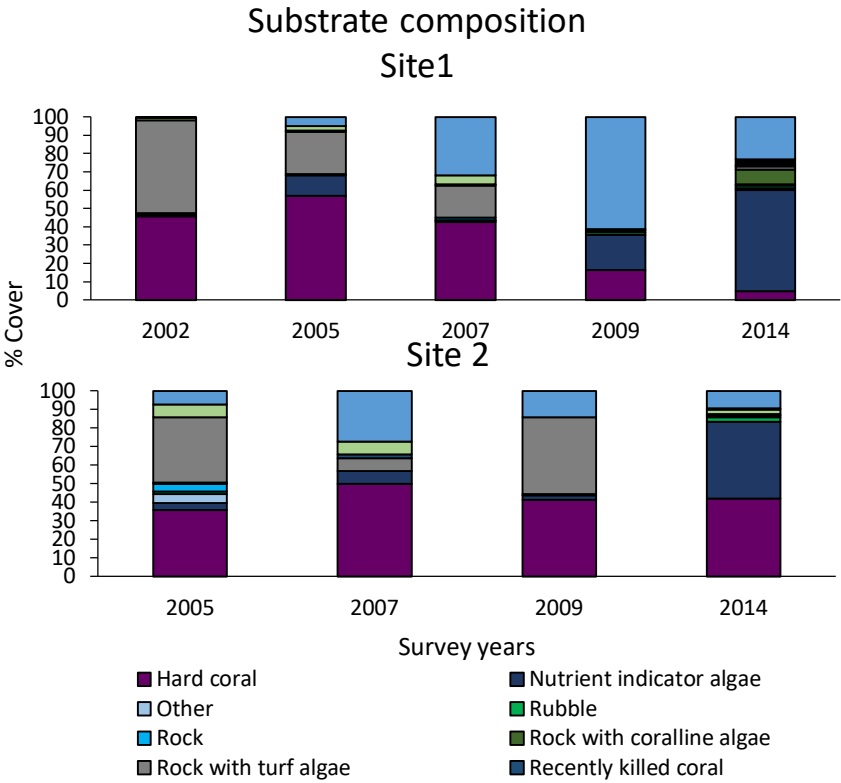
Middle Reef site 1, mushroom coral, 2014



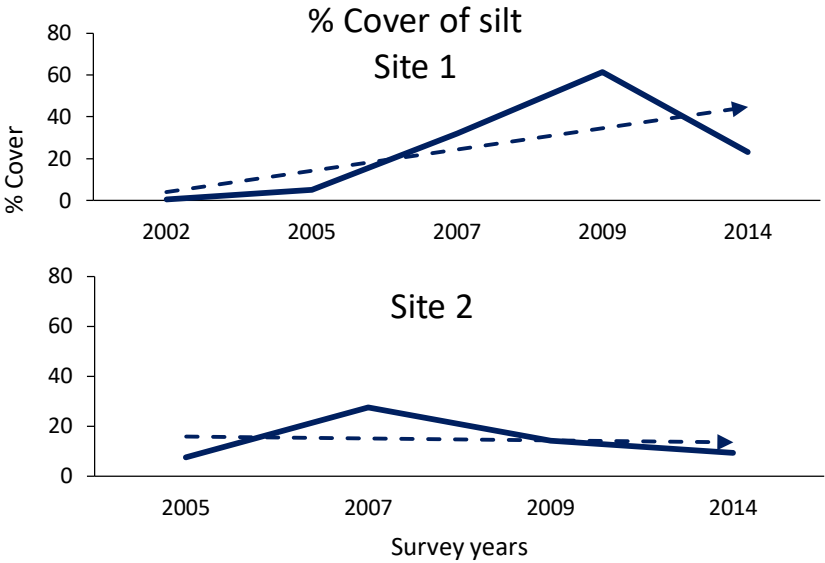
Middle Reef, silt covering coral, 2014



Middle Reef site 2, coral damage and silt, 2014



There has been a 10% increase in silt concentration at site 1 over the last 12 years. The increase began in 2007, where silt covered 32% of the substrate. This increased further in 2009 to 61%, but decreased again to covering 23% of the substrate in the latest 2014 survey. Silt concentrations at site 2 have remained relatively high, there has been almost no change in abundance since surveys began in 2005. Due to the location, Middle Reef is highly subject to coastal influences (such as sediment from the catchments) and marine activities in Cleveland Bay.





# REEF CHECK

## AUSTRALIA



Middle Reef, *Diadema*, 2007



Middle Reef site 2, nudibranchs, 2014



Middle Reef site 1, coral damage, 2014



Middle Reef site 1, unknown scar, 2014

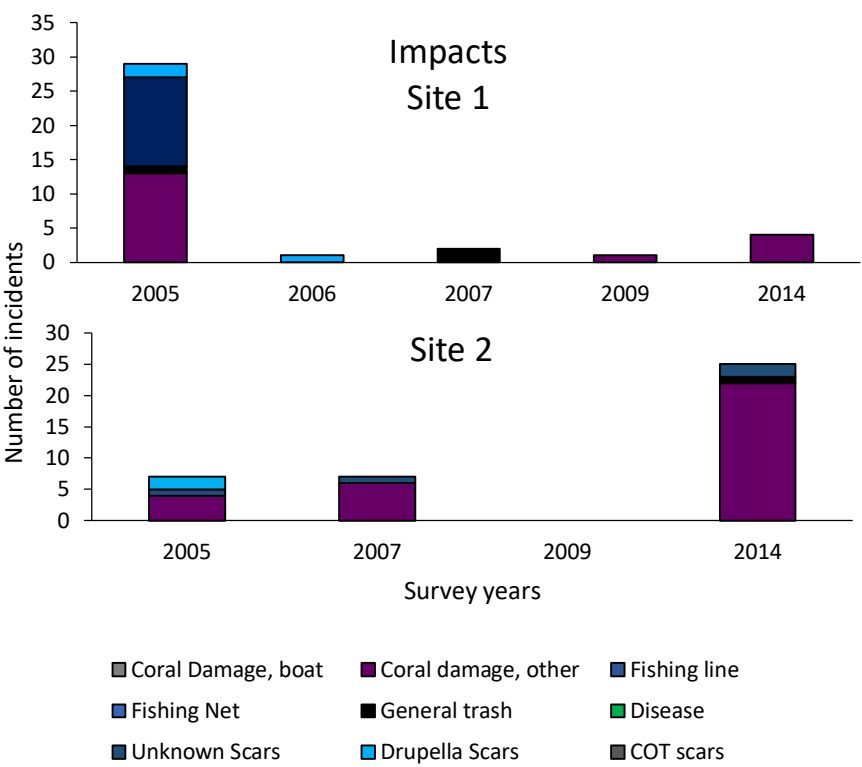
## Invertebrates

*Drupella* snails have been the most abundant invertebrate observed in Middle Reef. Populations peaked in 2006 where 6 snails were recorded within the 100m transect. *Drupella* snails have been recorded at this site every year except in 2009, where instead, 9 *Diadema* urchins were observed. Very few other key invertebrates have been recorded on surveys. For example, one trochus shell was observed in 2007, but has not been recorded since. In addition, anemone was observed for the first time in the 2014 survey in site 1. No key invertebrates have ever been recorded in site 2, except for one *Drupella* snail recorded in 2007.

## Impacts

Coral damage by unknown causes, and unknown scars have had the largest impact on coral populations at both sites in Middle Reef. Much of the coral impacts in site 1 occurred in 2005, but very little has been observed since. However, site 2 has shown the opposite trend, where the highest amount of coral damage was found in the latest 2014 survey, where a total of 22 incidents of coral damage were recorded on transect. *Drupella* scars have also been observed at both sites, but only in 2005 and 2006, and have not been recorded since.

Although this site is open to fishing, no fishing debris has been recorded on transect. However, general rubbish has been observed in both sites, with one incident in 2005, and 2 in 2007 in site 1. One incident was recorded in the latest 2014 survey in site 2.



# REEF CHECK

## AUSTRALIA



Volunteers with Magnetic Dive, 2014



Nelly Bay site photo, 2005



Nelly Bay, hard coral, 2006



Nelly Bay, site photo, 2009

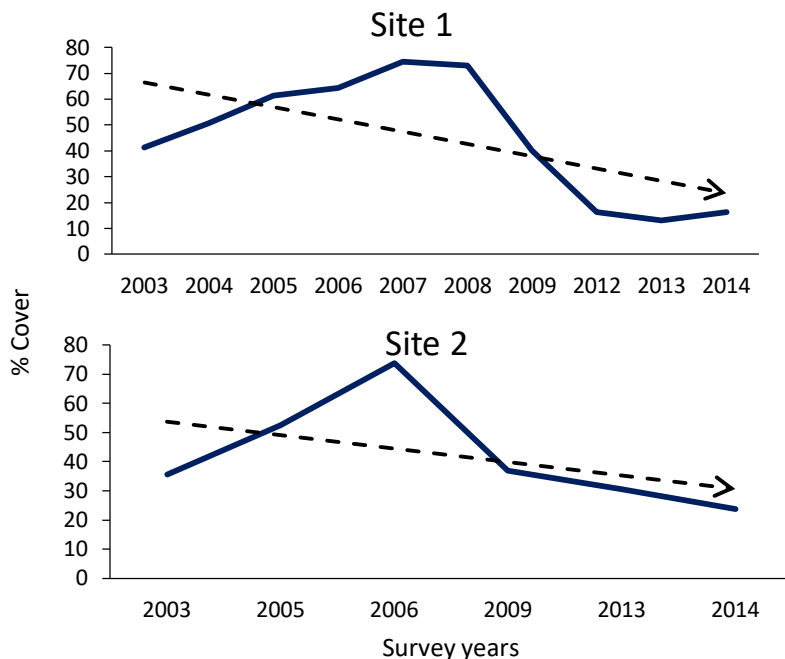
## Nelly Bay

Nelly Bay is located on the South Eastern end of the Island, and is located in the blue zone where fishing practices are allowed. Both Sites 1 and 2 are easily accessible from shore, and run parallel to the beach in approximately 3 meters of water. Surveys began in 2003 for both sites, and have been regularly monitored since.

### Hard coral trends

Similar to other Magnetic Island sites, Nelly Bay experienced a decline in coral cover after the 2008 bleaching event. On average, both sites have shown a 5% decline of hard coral cover, since surveys began in 2003. The 2013 and 2014 surveys reported the lowest coral abundance yet, with the hard coral cover representing 16% of the substrate in site 1 and 24% of the substrate in site 2.

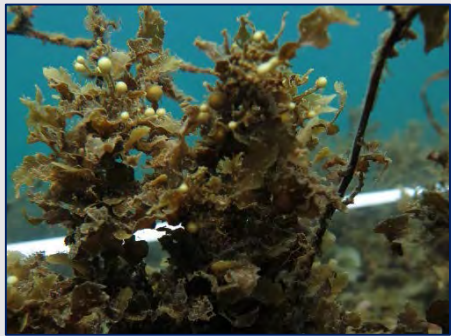
Both sites were largely composed of foliose corals, where in their highest abundance, they covered 48% of the substrate in site 1 and 33% in site 2 (2008 and 2006, respectively). Branching, encrusting, and plating corals were also prevalent at these sites, but now occur in low abundances. Corals in the general hard coral category were recorded in 2003, but have not since. This is likely due to changes in hard coral categorization in later years.





# REEF CHECK

## AUSTRALIA



Nelly Bay, macro algae, 2013



Nelly Bay, macro algae, 2013

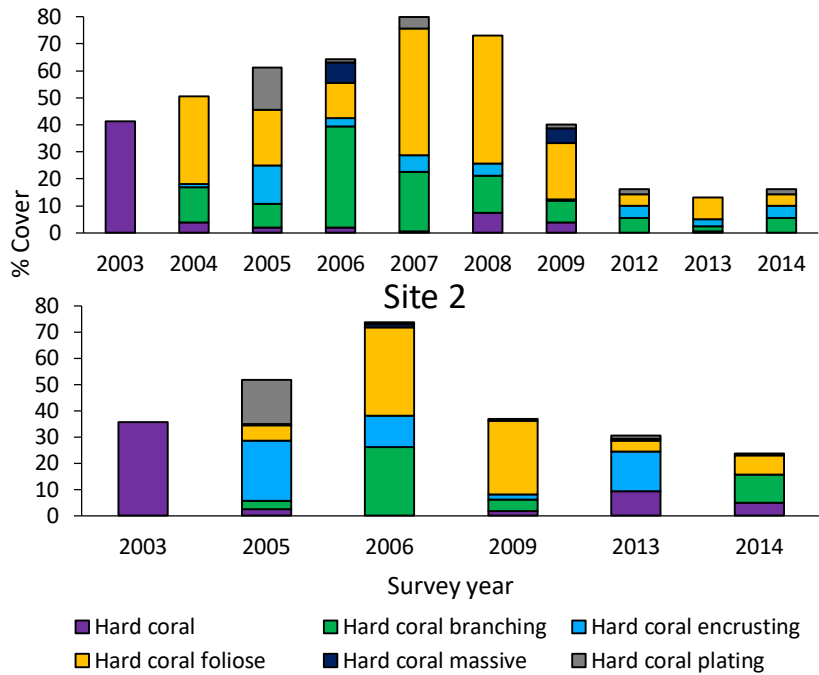


Nelly Bay, macro algae, 2013



Nelly Bay, epaulette shark, 2008

### Hard coral composition



### Substrate composition

After the decline of hard coral abundance in 2008, nutrient indicator algae and silt became more prevalent in both sites. In site 1, nutrient indicator algae increased from 2% in 2008 to 21% in 2009, while silt increased from a 1% to a 14%. The same pattern occurred in site 2, where there was nearly a 20% increase of both algae and silt between 2008 and 2009. The abundance of rock with turf algae also increased, and covered 50% of the substrate in 2012 in site 1. The amount of rubble found on both surveys increased in 2013, likely due to storm damage in previous years. However, this has declined in the latest 2014 survey, and the substrate is now equally composed of hard coral, nutrient indicator algae, rock with turf algae, sand, and silt.

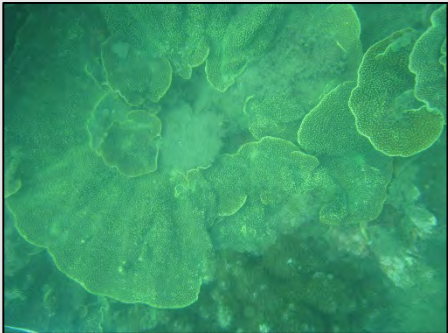


Nelly Bay site 2, 2014



# REEF CHECK

## AUSTRALIA



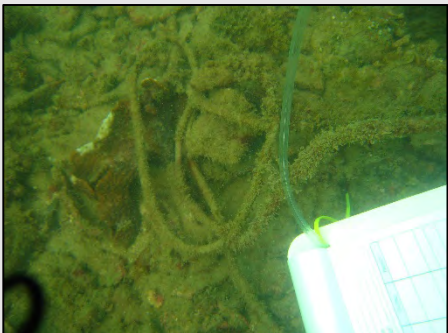
Nelly Bay site 1, hard coral foliose, 2014



Nelly Bay site 1, hard coral, 2014

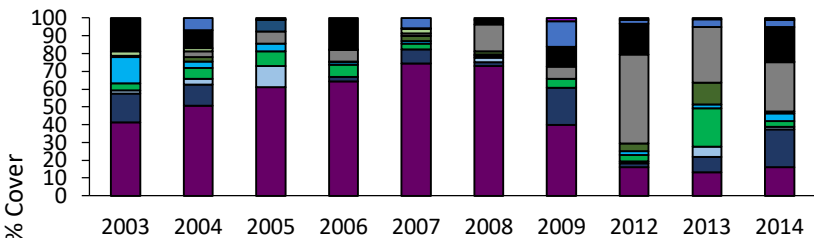


Nelly Bay site 1, crustose algae, 2014

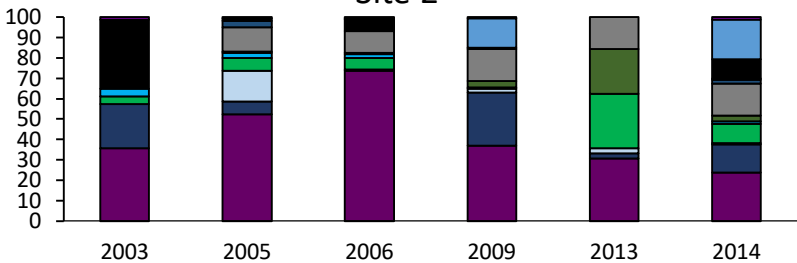


Nelly Bay site 1, fishing net, 2014

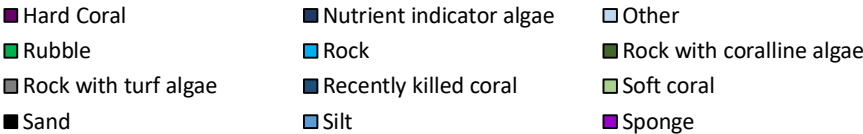
### Substrate composition Site 1



### Site 2



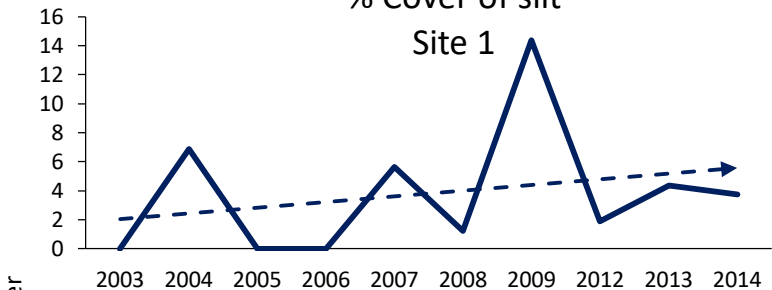
### Survey years



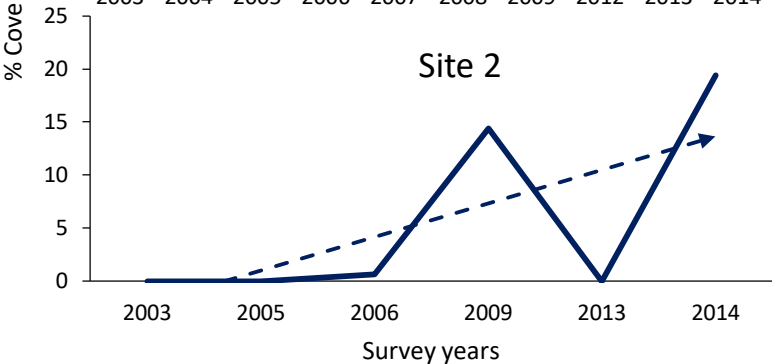
Macro algae abundance increased to nearly 50% of the substrate in 2013, however this decreased to less than 5% cover in 2014 in both sites. This is likely due to seasonal fluctuations, however, macro algae is considered to be in high abundance in Nelly Bay compared to other GBR sites.

### % Cover of silt

#### Site 1



#### Site 2



The abundance of silt has also fluctuated over the years, which may be due to seasonal trends. However, there has been a slight upward trend since surveys began in 2003. In the 2014 survey, silt covered 4% in site 1 and 19% of the substrate in site 2.

# REEF CHECK

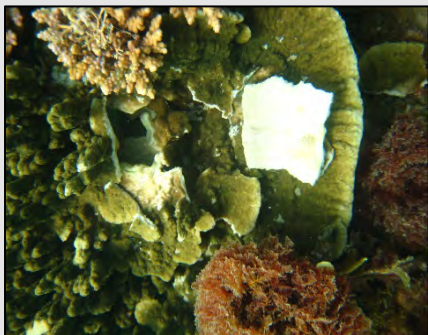
## AUSTRALIA



Nelly Bay, *Drupella* snails, 2013



Nelly Bay, trochus shell, 2013



Nelly Bay, coral damage, 2008



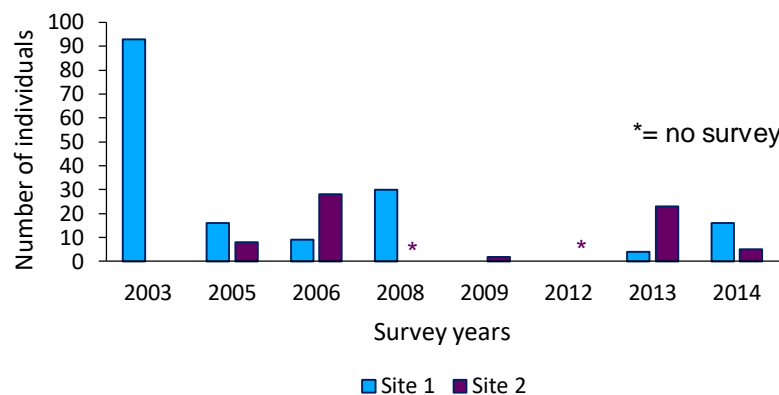
Nelly Bay, coral bleaching, 2009

### Invertebrates

*Drupella* snails are the most abundant RCA indicator invertebrate observed in Nelly Bay. In 2003, 93 individuals were observed in site 1. The abundance of snails have fluctuated since, but are still considered to be at high abundance with a total of 21 individuals recorded in the last 2014 surveys. However, overall *Drupella* snail abundance has declined in abundance over time at these two sites.

One trochus shell snails was recently been observed at both Nelly Bay sites, with one observed in site 1, and two in site 2 in 2014. In addition, one giant clam was observed for the first time in site 2, but have not been observed since 2008 in site 1.

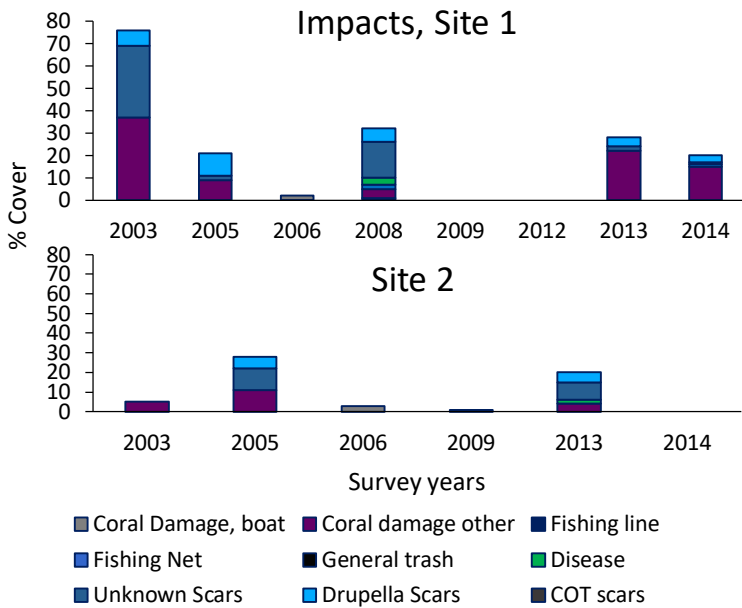
#### *Drupella* abundance



### Impacts

Over the years, coral damage and unknown scars have been the most prevalent impact on corals at Nelly Bay sites. There was high abundances of coral damage (37 incidents), unknown scars (32 incidents), and *Drupella* scars (7 incidents) in site 1 in 2003, while hardly any impacts were observed the same year in site 2. While the prevalence of these three impacts fluctuated throughout time at site 1, impacts remained in low abundance in site 2. Much of the impacts in the 2014 survey consisted of coral damage in site 1. One fishing net, and 3 *Drupella* scars were also observed. No impacts were observed in site 2.

#### Impacts, Site 1



# CAIRNS REGION

## North Hastings, The Point

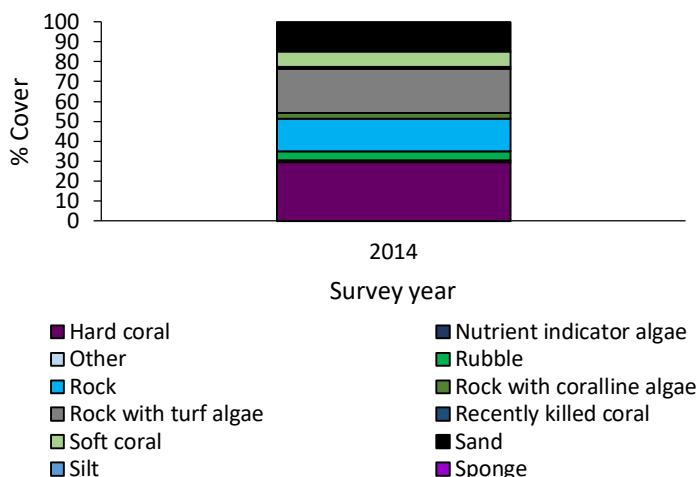
Hastings Reef is located 30 nautical miles off of Cairns has been regularly monitored since 2003. However, operators access the reef by utilizing different moorings throughout the years, making it difficult for RCA to monitor the same the same site each year. Do to this reason, a new site located on the northern tip of the reef was implemented this year.

### Substrate composition

Hard coral was found to cover 29% of the substrate, and mostly consisted of branching corals (11%), massive corals (16%), and some plating corals (1%), and general hard corals (>1%). Soft corals covered 8% of the substrate and was composed of a good mixture of leathery (3%), zoanthids (1%), and general soft corals (4%).

A high prevalence of rock, and rock with turf algae were recorded within the substrate survey, making up 16%, and 22% of the benthos, respectively. Some rock with coralline algae was also present, covering 3% if the survey. Nutrient indicator algae was only recorded on recently killed coral, and covered 1% of the substrate. The rest of the benthos was made up of sand, rubble, and "other" (mostly consisting of ascidians) making up 15%, 4%, and 1% of the survey. No macro algae was recorded.

Substrate composition

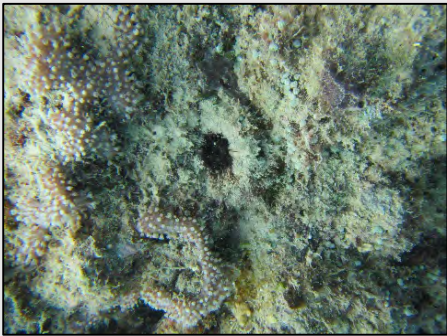


Surveyors at N. Hastings, The Point, 2014



# REEF CHECK

## AUSTRALIA



North Hastings, burrowing urchin, 2014



North Hastings, 100% bleached coral, 2014



North Hastings, coral damage, 2014



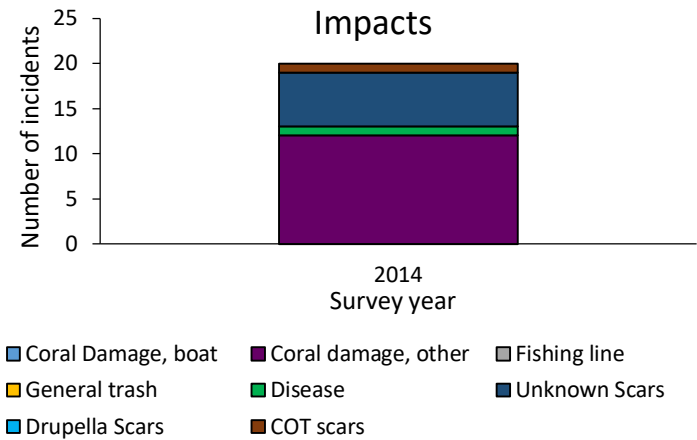
North Hastings, Solar-powered sea hare, 2014

### Invertebrates

Very few indicator invertebrates were observed, with one crown of thorn starfish, and one giant clam observed on transect. A high abundance juvenile burrowing urchins were also noted, however are not a RCA indicator invertebrate.

### Impacts

Coral damage had the largest impact on the coral population, with a total of 12 instances recorded on transect. Coral scars were also observed, with 6 from unknown sources, and 1 from the crown of thorn starfish. Only one instance of disease was recorded, and coral bleaching only affected 1% of the coral population. No other impacts were found.



Crown of Thorn Sea Star and Scar, 2014

# REEF CHECK

AUSTRALIA



Norman Reef, site photo, 2014



Norman Reef, dominant algae: NIA, 2014



Norman Reef, dominant algae: Turtle weed (NIA), 2014



Norman Reef, falcon hawkfish (*Cirrhitichthys falco*) observed at Norman Reef, 2014

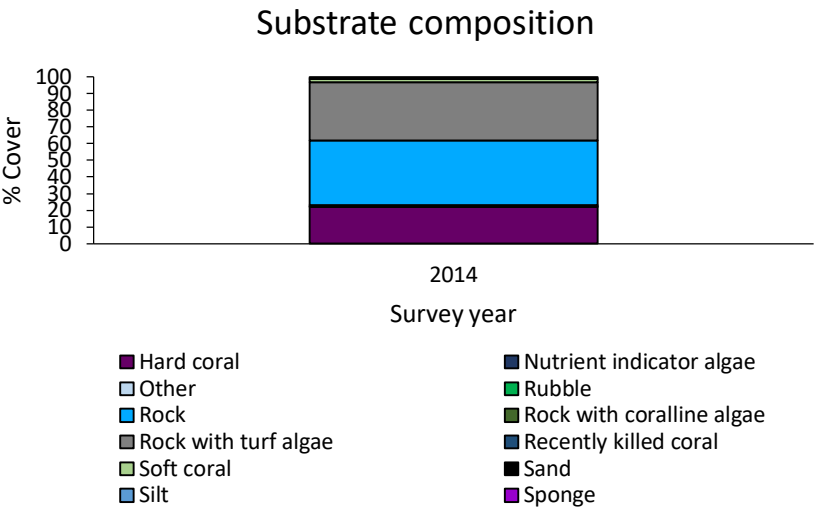
## Norman Reef (Middle Mooring)

This newly implemented site is located just north of Hastings Reef, and approximately 70km from shore. It is visited frequently by tourist operators, however, like Hastings Reef, it has multiple moorings.

### Substrate composition

Hard coral was found to cover 22% of the substrate, and was composed of branching corals (9%), massive corals (12%), and some encrusting corals (>1%). A small abundance of soft corals were observed, only covering 2% of the substrate. Only corals within the general soft coral category and leathery corals were recorded.

Rock and rock with turf algae was most prevalent on the survey, making up 39% and 35% of the benthos, respectively. Nutrient indicator algae, sand organisms in the “other” category, all covered approximately 1% of the substrate. While nutrient indicator algae was not prevalent in the line survey, it was noted a dominant algae within the site.



Surveyor at Norman Reef, 2014

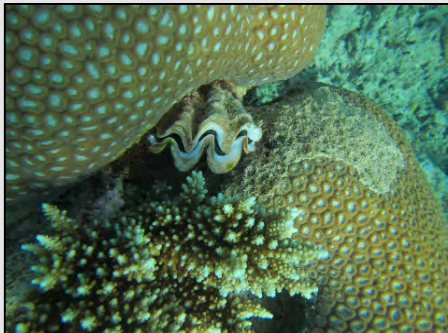


# REEF CHECK

## AUSTRALIA



Norman Reef, burrowing urchin, 2012



Norman Reef, giant clam, 2014



Norman Reef, coral damage, 2014



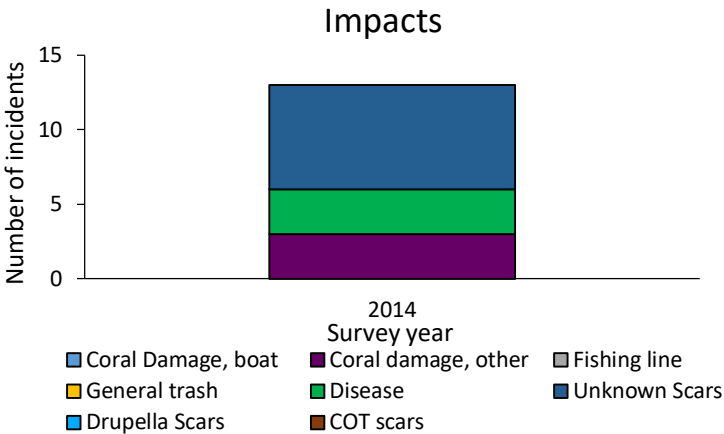
Norman Reef, unknown scars, 2014

### Invertebrates

Giant clams were the only RCA indicator invertebrate observed on transect, with a total of 8 individuals recorded between the sizes of 0-20cms in length. However, like N. Hastings Reef, a high abundance of burrowing urchins were also noted.

### Impacts

Very few coral impacts were observed, at this site. Unknown scars had the largest impacts, with 7 incidents recorded on transect. Three incidents of coral damage, and three incidents of disease were also observed. However, some unique and unusual scarring was observed in *Porites* (see photos below). Coral bleaching only affected 1% of the coral population.



Unusual scarring observed on Massive *Porites*. This seems like a COT scar, but they are rare on *Porites*.

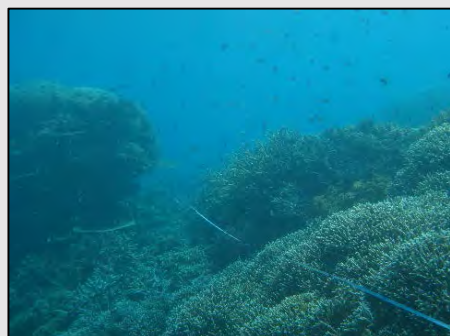


Close up to scarring picture above.

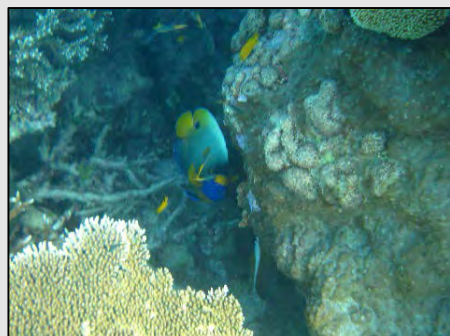


# REEF CHECK

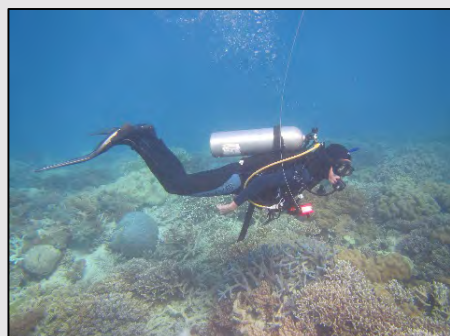
## AUSTRALIA



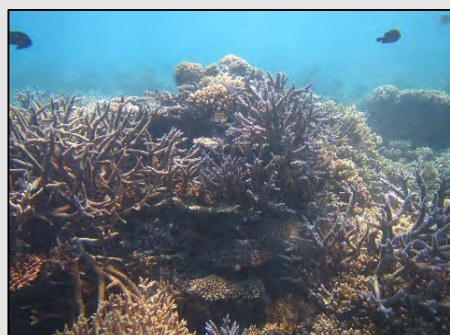
Moore Reef, site photo, 2014



Moore Reef, fish cleaning station, 2014



Moore Reef, surveyor, 2014



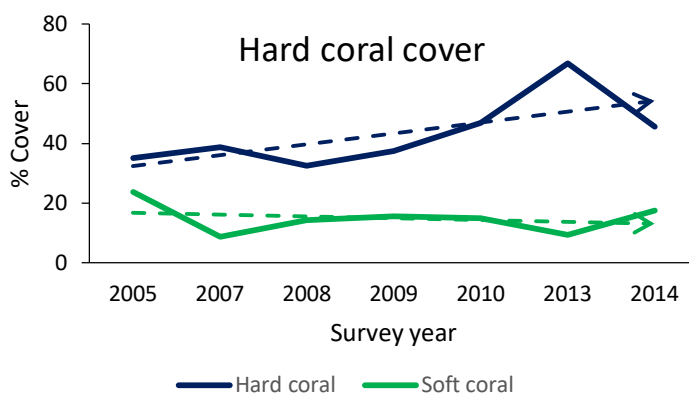
Moore Reef, branching corals, 2014

## Moore Reef Site 1, shallow

A permanent pontoon allows this protected marine park zone to be frequently visited by snorkelers and divers. The site is located on a back reef slope at approximately three meters of depth, and has been regularly monitored since 2005.

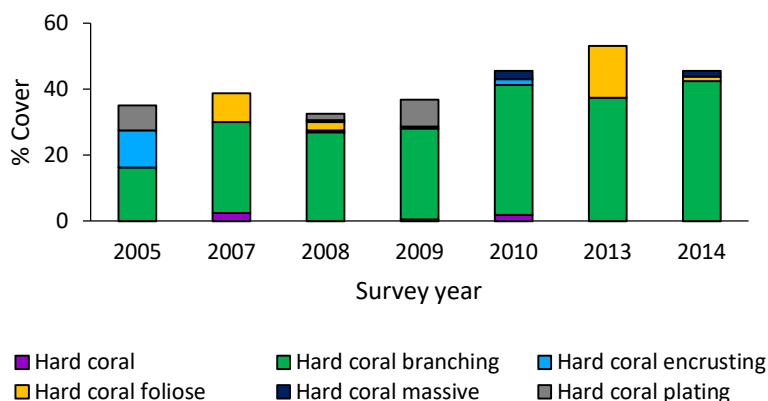
### Coral trends

Hard coral cover has shown a slight increasing trend over the course of monitoring, with an average yearly increase of 3.7% cover over the study period. When surveys began in 2005, hard corals covered 35% of the substrate. This increased to 67% in 2013, however, has recently declined to a 46% cover in the 2014 survey. This recent decline may be due to slight changes in transect placement. Conversely, soft coral abundance has remained stable over the study period, with a only a slight negative trend of -0.6% a year.



Hard coral has continued to be mostly composed of corals with the branching morphology, which was found to cover 43% of the benthic substrate. Few foliose corals (1%) and massive corals (2%) were recorded on transect. Soft corals consisted of leathery soft coral, and a small abundance (>1%) of zoanthids.

### Hard coral composition



# REEF CHECK

## AUSTRALIA



Moore Reef, tunicate on massive coral, 2014



Moore Reef, giant clam, 2014



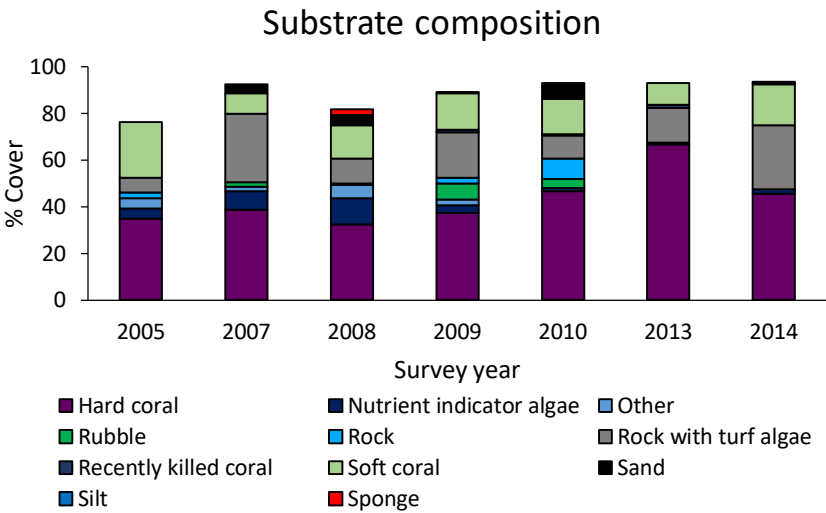
Moore Reef, sea star, 2014



Moore Reef, anemone and anemone fish, 2014

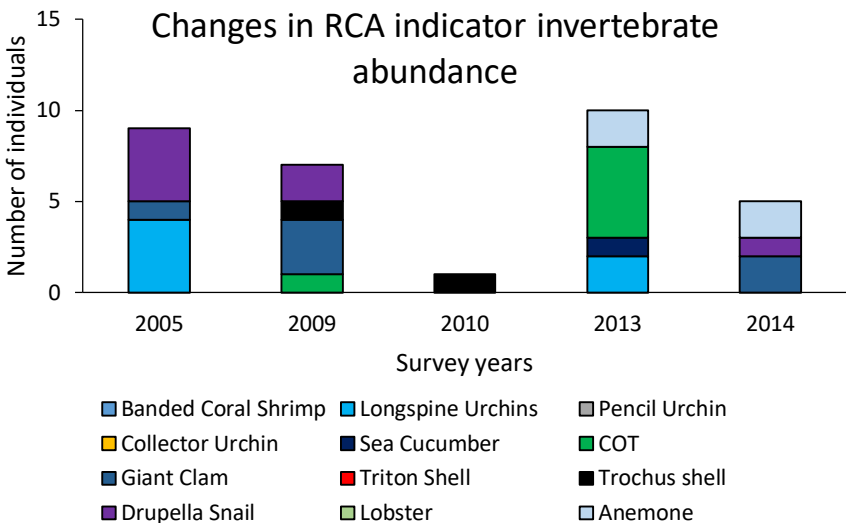
## Substrate composition

Rock with turf algae was found to make up 28% of the benthos in 2014, increasing from a 15% cover in 2013. The presence of rock with turf algae had not been as high since 2007, where rock with turf algae made up 29% of the benthos. As usual, rock with coralline algae was also recorded on transect, and covered 6% of the substrate. The abundance of coralline algae has remained stable over the last four surveys. Almost no other algae was recorded, apart from nutrient indicator algae, which only covered 2% of the substrate. No macro algae was recorded, however *Halimeda*, and other crustose algae was recorded as a Dominant algae within the belt survey.



## Invertebrates

Only 2 giant clams, 1 anemone, and 2 *Drupella* snails were recorded in the 2014 survey. No crown of thorn starfish were recorded this year (5 individuals were observed in 2013). Unlike the 2013 survey, no *Diadema* urchins were observed.





# REEF CHECK

## AUSTRALIA



Moore Reef, coral damage and bleaching, 2014



Moore Reef, dominant algae: *Halimeda*, 2014



Moore Reef, dominant algae, 2014



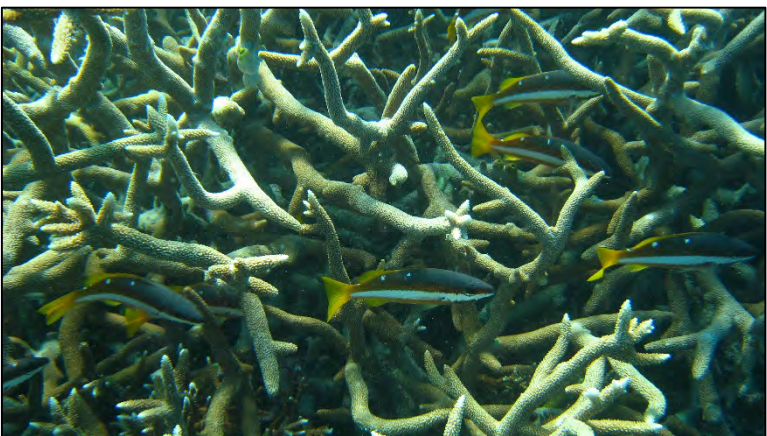
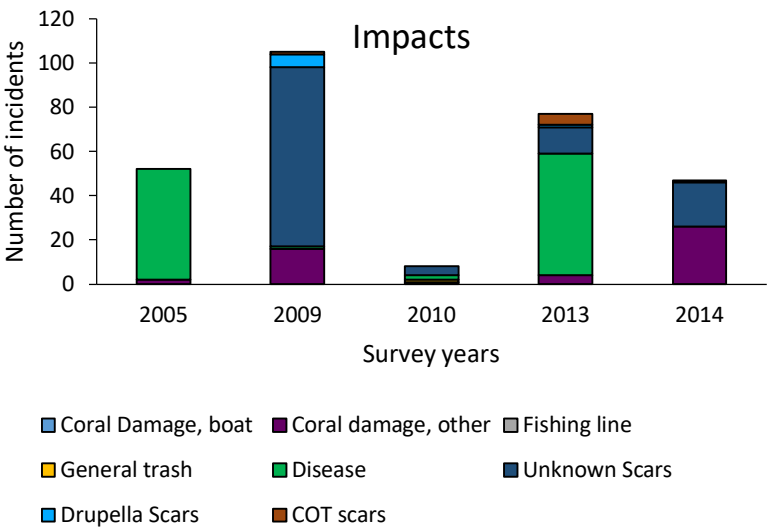
Moore Reef, coral bleaching, 2014

## Impacts

Coral damage due to unknown causes had the largest impact on hard corals in the 2014 survey, with a total of 26 incidents recorded. This increased from only 4 incidents were recorded in 2013.

Similarly, 20 incidents of unknown scars were also recorded in 2014, increasing from the 12 that were observed last year. However, no disease was recorded this year, whereas last year, a total of 55 incidents were observed. This may be due to seasonal differences, as surveys were performed in July of this year, instead of April/May surveys in previous surveys.

Coral bleaching was found to affect less than 1% of the coral population, and 1 *Drupella* scar was recorded.



Moore Reef, school of fish in branching coral, 2014