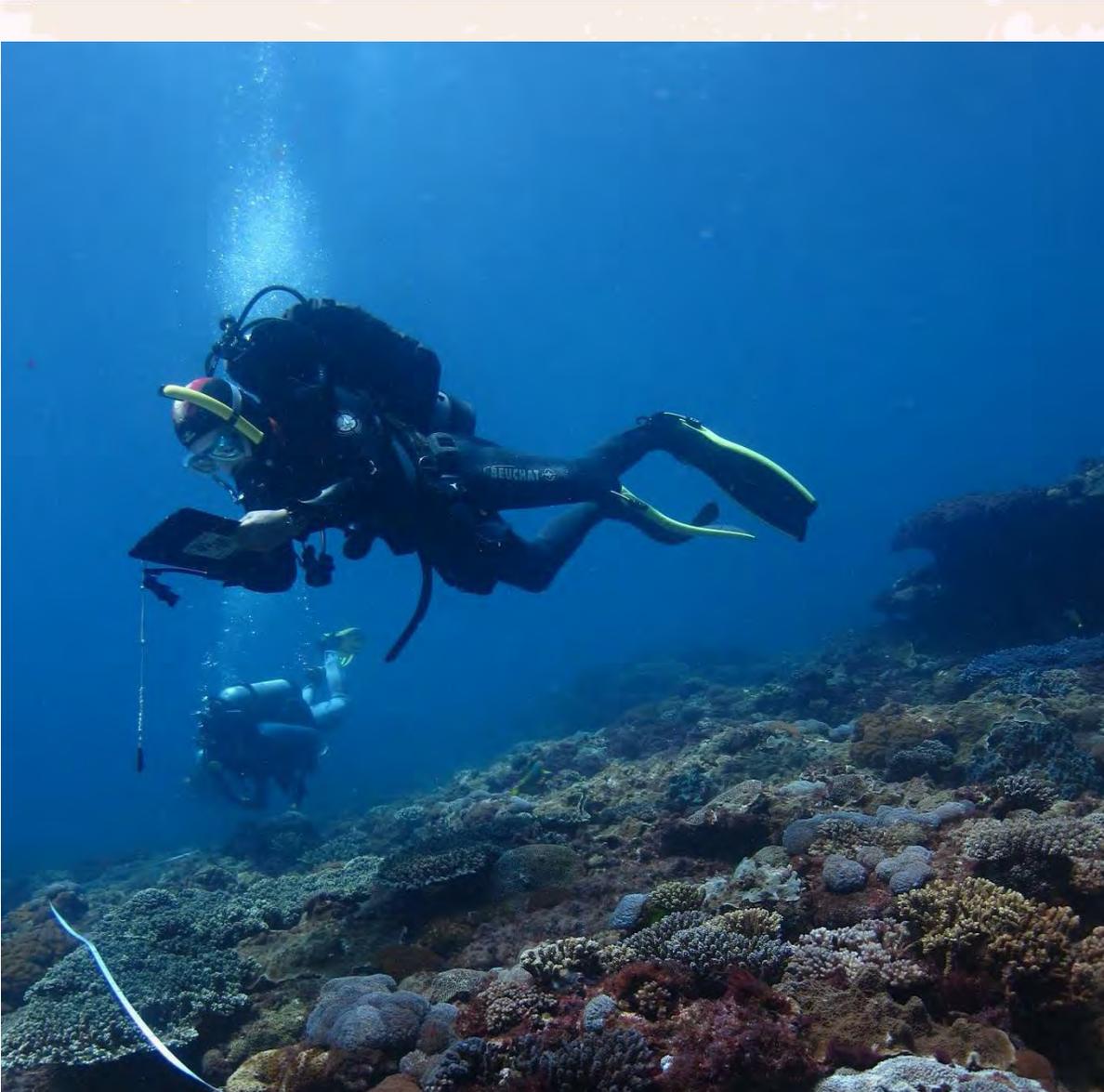


# Reef Check Australia

## South East Queensland

### Season Summary Report 2014



Reef Check Foundation Ltd  
A. Lea, J. Loder and J. Salmond  
[www.reefcheckaustralia.org](http://www.reefcheckaustralia.org)

2014

This project was made possible by a network of dedicated volunteers, dive operators, science advisors, collaborators and funding agencies.

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Industry Champions provide in-kind support to support survey activities, volunteer training and clean-up events.

We are grateful for the support for the 2014 survey season through:  
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A note of welcome and thanks to the PLEA UniDive Marine Conservation team, who participated in RCA training and surveys in 2014, as well as building additional records of fish abundance and spatial maps for Point Lookout dive sites. Their efforts help to expand on available citizen science information for the reefs of Moreton Bay.





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# 1.0 Introduction

## 1.1 Reef Check Australia & the 2014 SEQ survey season

Reef Check Australia (RCA) has been supporting volunteer reef monitoring, education and conservation projects since 2001. Surveys conducted by hundreds of trained volunteers have helped to collect long-term data relating to reef health at a local, national and global scale.

RCA surveys collect quantitative data documenting abundance of key invertebrate species and target fish species as well as benthic cover. Additionally, natural and anthropogenic impacts affecting reef habitats are also monitored.

In 2007, Reef Check Australia expanded its monitoring network to survey subtropical rocky reefs in South East Queensland (SEQ). By 2009, RCA established a regional base and since then, teams have expanded to more than 20 priority reef monitoring sites in the region. From 2007 to 2014 RCA carried out 142 reef health surveys on 26 monitoring sites in SEQ.

This report presents a summary of the findings for surveys conducted on subtropical reefs in South East Queensland (SEQ) during the 2014 season. Teams of trained volunteers monitored a total of 18 sites on 9 different reefs. In total, an area of 7,200m<sup>2</sup> of reef habitat was surveyed.

The 2014 survey season focused on returning to established sites to continue to build on and strengthen the RCA data set. One new dive site was implemented at Inner Gneerings (Sunshine Coast) to provide enhanced representation of reef habitats and human use areas. Several existing Reef Check Australia monitoring locations were not visited during the 2014 survey season due to weather conditions or funding resources.



# 1.0 Introduction

## 1.2 Subtropical reefs in SEQ

The subtropical reefs in SEQ are unique. This marine habitat is a transitional area where temperate, tropical and sub-tropical species exist (Perry & Larcombe 2003). The reefs here are generally restricted from building reef structure due to environmental factors such as poor light, temperature, and turbidity (Fellegara & Harrison 2008). Yet the region also hosts notable coral communities (Harrison, Harriot, Banks & Holmes 1998, Wallace, Fellegara, Muir, & Harrison 2009).

The RCA dataset can contribute to a better understanding of the ecology and biology of these subtropical reefs, as well as documenting how these habitats may be changing over time. This is particularly important given the uncertainty around how transitional marine habitats like those of SEQ will be impacted by changing climate regimes (Munday *et al.* 2009, Figueira and Booth 2010, Graham *et al.* 2010, Lybolt *et al.* 2011). Already there are documented impacts on SEQ reefs from more localised chronic issues such as water quality and fishing pressure, as well as acute events such as floods (Smith *et al.* 2008, EHMP 2010, Gibbes *et al.* 2013).

### **Additional recent relevant reports on SEQ reefs include:**

Citizens & Reef Science: A Celebration of Reef Check Australia's volunteer reef monitoring, education and conservation programs (Loder *et al.* 2015), with subregional, state-wide and global comparisons of RCA survey data.

The Ecological Assessment of the Flora and Fauna of Point Lookout Dive Sites, North Stradbroke Island, Queensland by the University of Queensland Underwater Club (Roelfsema *et al.* 2014), with more detailed seasonal and spatial mapping reports on Flat Rock, Shag Rock and Manta Bommie, methods based on Reef Check and Coral Watch protocols. All data, maps and reports are publically accessible (Kovacs *et al.* 2014 and Pheasant *et al.* 2014).



# 1.0 Introduction

## 1.3 Key Findings

The 2014 survey season included the monitoring of 18 survey sites, including 17 existing survey sites and one new site.

### **Substrate**

- Of the 17 existing sites surveyed, 7 sites experienced a decrease in hard coral cover compared to previous surveys, while an increase in cover was seen at 11 sites.
- Hard coral cover ranged from 6% at Shag Rock North, Site 1 to 63% at Flinders Reef, The Nursery, Site 2. Through all the sites, there was an average hard coral cover of 28% and a median of 27%.
- The most significant substrate type recorded across all 18 surveys was rock, with an average coverage of 45% per survey.



### **Invertebrate Abundance**

- Apart from *Drupella* snails, Long spined (*Diadema*) urchins were the most abundant invertebrate recorded, with a total of 121 counts. The highest count, 55, was recorded at Myora Reef.
- 11 giant clams were recorded over the season with 3 being recorded at Flinders, Aladdin's Cave.
- Over the 18 surveys only 2 banded coral shrimp were seen.
- Anemones were recorded on 9 out of 18 sites, with the highest abundance at Flat Rock, The Nursery (106).



### **Fish Abundance**

- Fish surveys were carried out on 14 of the 18 survey dives.
- Of the target species, butterflyfish were the most abundant with a total of 99 counts over the 14 surveys. 33 of the 99 were recorded at Flinders Reef, Aldens Cave.
- A total of 26 sweetlips, 30 snapper and 7 other parrotfish were recorded over the 10 fish surveys.
- There was a total of 4 moray eels recorded.

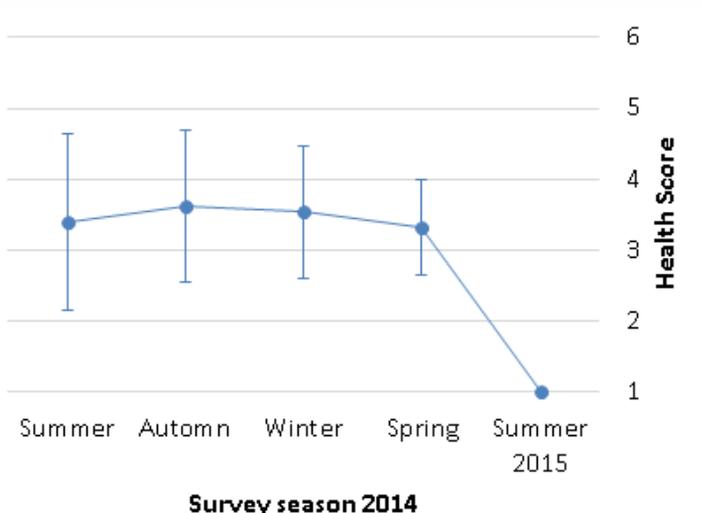
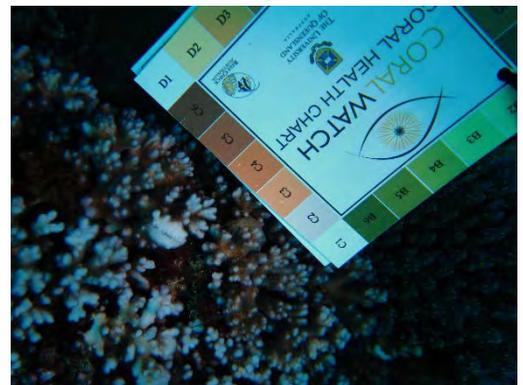


# 1.0 Introduction

## 1.3 Key Findings

### Coral bleaching

- Bleaching was recorded on all of the sites surveyed, with an average of 7% of the coral population impacted. This was higher than previous annual average population level impacts (compared to 4% in 2013 and 3% in 2012).
- There was an average of 25% each colony impacted, compared to 10% in 2013 and 20% in 2012.
- Inner Moreton Bay sites had the highest regional bleaching average, with just over 12% population level impacts across all sites.
- A review of long-term data reveals that sites at Shag Rock had bleaching levels in 2014 (4% at both Shag Rock East and Shag Rock West), with the only other year of notable bleaching in 2012 (9% Shag Rock East and 36% Shag Rock West).
- The UniDive PLEA (Point Lookout Ecological Assessment) surveyed 2014 seasonal coral bleaching levels at Flat Rock, Shag Rock and Manta Bommie using the CoralWatch coral health chart (see graph for one survey site, Shag Rock East below). The health score reflects an approximate assessment of coral health including bleaching. Results indicated relatively stable coral health for 2014. Follow up surveys carried out by RCA and PLEA divers documented a decline in coral health (increased bleaching) during summer 2015 surveys.



CoralWatch health scores based on the Coral Health Chart for Summer 2014 to Summer 2015 at Shag Rock, East. Higher scores indicate healthier coral with higher concentrations of symbiotic zooxanthellae algae.

# 1.0 Introduction

## 1.3 Key Findings (Continued)

### **Coral scarring**

- Of the 186 counts of coral scarring recorded, 178 were unknown scars with a maximum of 40 being recorded at Myora Reef.

### ***Drupella* sp. snails**

- *Drupella* snails were recorded on 12 out of 18 surveys. A total of 118 *Drupella* snails were recorded, with a maximum of 66 recorded on a single survey (Mudjimba Island, site 1).
- *Drupella* scars were observed at 4 of the 18 sites with the highest abundance (4) at Flinders Reef, Aldens Cave.

### **Coral damage**

- A total of 110 counts of coral damage were recorded over 15 of the 18 surveys. This equates to an average of 11 counts per survey.
- 5 counts of anchor damage were recorded in total, with 4 instances at Flinders Reef, Aldens Cave.

### **Coral disease**

- A total of 59 instances of coral disease were recorded over 9 surveys. The highest abundance of disease occurred at Inner Gneerings, both The Caves, Site 1 (24) and Site 2 (13). Coral disease type appeared to be white syndrome.

### **Marine debris**

- 4 counts of marine debris (non fishing gear) were recorded on surveys.
- Fishing gear was found on 6 of the 18 surveys, with a total of 18 counts recorded. The highest abundances of fishing gear were at Goat Island (6) and Inner Gneerings Site 2 (6).

### **Rare animals**

- Rare animals sighted during the surveys included Grey Nurse sharks (n=1), Hawksbill turtle (n=1), wobbegongs (n=6).



# 1.0 Introduction

Basic site summary							Presence of Impacts									
	% Hard Coral	% Soft Coral	Hard coral increased or decreased from previous year?	Macroalgae (MA) in 100m <sup>2</sup>	% Nutrient Indicator Algae (NIA)	Silt Loading	Drupella Scar	Unknown Scar	Anchor Damage	Coral Damage (unknown causes)	Fishing Line	Fishing Net	General Trash	Coral Disease	Coral Bleaching present	
Currumundi S1	43	4	↑	10	0	Low		4								x
Currumundi S2	34	6	↓	10	0	Low	1	6						1		x
Inner Gneerings S1	28	3	↓	0	8	Low		30		4				30		x
Inner Gneerings S2	35	9	↓	0	0	Low		2		3	6					x
Inner Gneerings S3	33	14	N/A	0	6	Low		21		11				13		x
Kings Beach	7	2	↑	0	0	Low				1	1		2			x
Mudjimba Island The Ledge S1	36	7	↑	0	0	Low		11		3	1			4		x
Mudjimba Island The Ledge S2	19	9	↑	0	1	Low		16		4						x
Mudjimba Island Northwest Reef	26	8	↓	0	0	Low		4			2		1			x
Goat Island	30	19	↑	0	0	Medium		1		7	6		1			x
Myora Reef	39	0	↑	0	5	None	1	40		40						x
Flat Rock, Shark Gulley	27	3	↑	0	1	Low		7		3						x
Flat Rock, The Nursery	25	1	↑	0	0	Low		2		2						x
Flinders Reef, The Nursery S1	23	25	↑	7	0	Low		21		12						x
Flinders Reef, The Nursery S2	63	1	↓	0	1	None		5		20				3		x
Flinders Reef, Aladdin's Cave	30	19	↓	5	0	None			4	2				2		x
Shag Rock North	6	0	↑	0	15	Low	2	6		8						x
Shag Rock South	18	6	↑	0	24	Low		13		1	2			4		x

Summary of key findings for RCA SEQ monitoring sites visited in 2014 showing: hard coral cover, soft coral cover, increase or decrease in hard coral cover from previous survey, macroalgae abundance (per survey, 400m<sup>2</sup>), percent cover nutrient indicator algae, silt loading level, abundance of reef health impact categories (per survey, 400m<sup>2</sup>).

# 1.0 Introduction

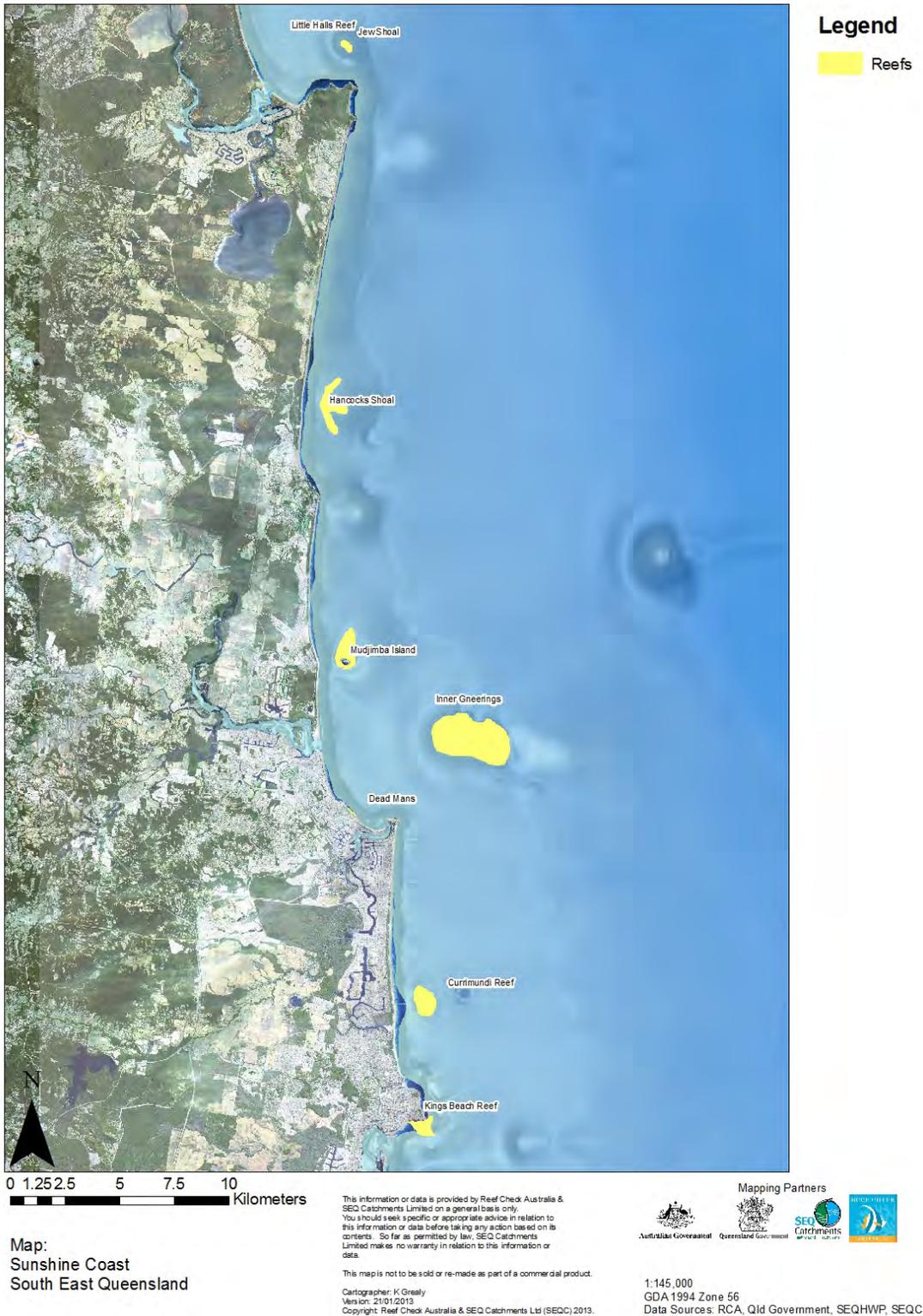
## 1.4 Monitoring sites

RCA monitoring sites ranged from the Sunshine Coast to the Gold Coast (See maps in each section for spatial locations). In 2014, surveys (n=18) were conducted within Moreton Bay Marine Park or on Sunshine Coast sites (nine surveys completed in each area). Sites surveyed by RCA include varied reef habitats (such as inshore and offshore areas as well as reef flats and reef slopes). For contrast and comparison, protected (marine national park, no-take areas) and non-protected areas were surveyed. Six surveys were conducted in protected areas in 2014. During the 2014 SEQ season, RCA established 1 new sites for a total of 35 sites surveyed since 2007 (21 priority monitoring sites with regular monitoring records). Other monitoring locations were not visited this season due to ongoing weather issues, team availability and/or funding restrictions.

Location	Site #	Site	Depth (m)	1 <sup>st</sup> Survey	Site Zoning
Sunshine Coast	1	Currimundi Reef	9	2009	n/a
Sunshine Coast	2	Currimundi Reef	9	2009	n/a
Sunshine Coast	1	Inner Gneerings, The Caves	10	2009	n/a
Sunshine Coast	2	Inner Gneerings, The Caves	9	2013	n/a
Sunshine Coast	3	Inner Gneerings, The Caves	10	2014	n/a
Sunshine Coast	1	Kings Beach	3	2009	HP
Sunshine Coast	1	Mudjimba Island, The Ledge	6	2007	n/a
Sunshine Coast	2	Mudjimba Island, The Ledge	10	2013	n/a
Sunshine Coast	3	Mudjimba Island, The Ledge	6	2013	n/a
Sunshine Coast	1	Mudjimba Island, NW Reef	9	2013	n/a
Inner Moreton Bay	1	Goat Island	1	2009	CP, Ramsar
Inner Moreton Bay	1	Myora Reef	3	2009	MNP, Ramsar
Outer Moreton Bay	1	Flat Rock, Shark Gulley	9	2009	MNP
Outer Moreton Bay	1	Flat Rock, The Nursery	6	2008	MNP
Outer Moreton Bay	1	Flinders Reef, The Nursery	6	2007	MNP
Outer Moreton Bay	2	Flinders Reef, The Nursery	9	2009	MNP
Outer Moreton Bay	1	Flinders Reef, Aladdin's Cave	10	2008	MNP
Outer Moreton Bay	1	Shag Rock, North	6	2009	HP
Outer Moreton Bay	1	Shag Rock, South	6	2008	HP

18 RCA SEQ monitoring locations visited in the 2014 SEQ season, including site number, location, depth, year of initial survey and site designation including four zones within the Moreton Bay Marine Park: Marine National Park (MNP), Conservation Park (CP), Habitat Protection (HP) or Ramsar Wetland site status (Ramsar).

# 2.0 Sunshine Coast



Map shows spatial extent of reef areas on the Sunshine Coast monitored by Reef Check Australia.

# REEF CHECK

## AUSTRALIA



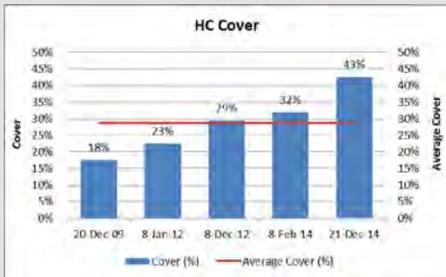
Hard Coral, Currimundi Reef, Site 1



Anemone, Currimundi Reef, Site 1



Drupella Snails, Currimundi Reef, Site 1



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

### 2.1 Currimundi Reef, Site 1

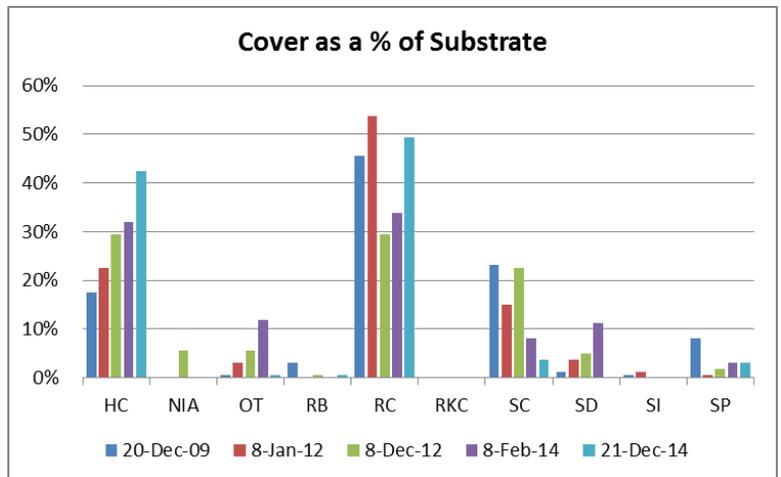
This site is comprised of an exposed rocky outcrop that is not frequented by divers, fishers or boaters.

With a hard coral cover of 43%, Currimundi Reef, Site 1 has continued to increase on every survey since 2009 when just 18% cover was recorded. Of the hard coral category, nearly 87% was recorded as encrusting hard coral. Rock (including rock with turf algae and rock with coralline algae) accounted for 49% of the area surveyed. Surveys from both 2014 and 2013 showed no nutrient indicator algae (NIA) present in comparison to the 2012 survey where nutrient indicator algae was recorded (6%).

Eleven anemones and two *Drupella* snails were recorded on the invertebrate survey.

Coral bleaching was recorded at Currimundi Reef, Site 1 in 2014 (no bleaching was recorded in 2013). A total of 1% of the population was bleached with an average of 25% of colonies affected. Four unknown scars were the only other impact recorded.

A fish survey was completed. Six butterflyfish, two snapper, and two sweetlips.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



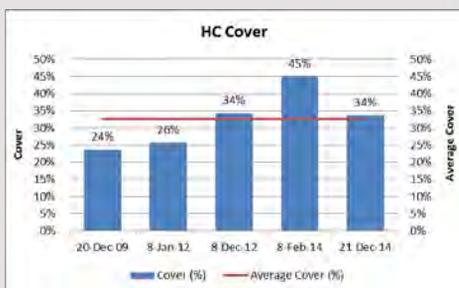
Moray Eel, Currimundi Reef, Site 2



Cowrie on soft coral, Currimundi Reef, Site 2



Site photo, Currimundi Reef, Site 2



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

### 2.2 Currimundi Reef, West: Site 2

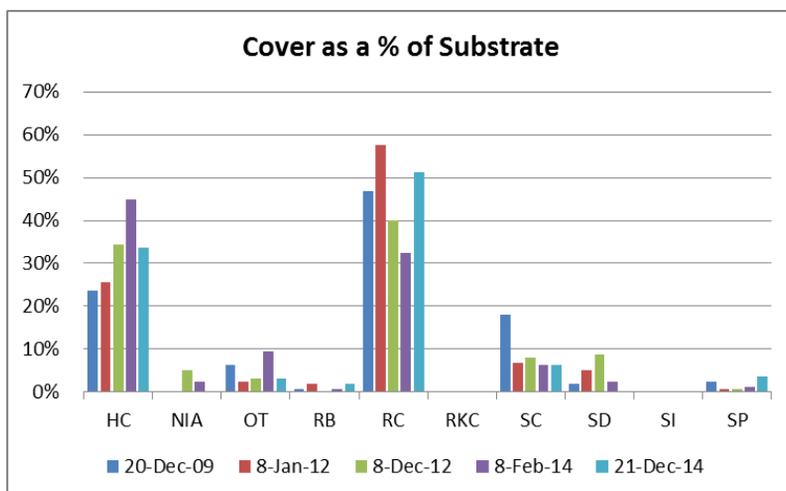
This site is comprised of an exposed rocky outcrop that is not frequented by divers, fishers or boaters.

Recorded hard coral cover at Currimundi Reef, Site 2 decreased from 45% in 2013 to 34% in 2014. Hard coral cover composition was made up of 91% encrusting growth forms, with the remaining 9% being foliose and branching hard coral. Soft coral accounted for 6% of substrate cover. 51% of the substrate was recorded as rock; an increase to 31% from the previous season's survey.

The invertebrate survey recorded 3 anemones and 7 *Drupella* snails.

Coral bleaching was observed on just 1% of the total coral population, and each colony bleached had an average bleaching of 31%. There was one incidence of disease, six unknown scars, and one *Drupella* scar.

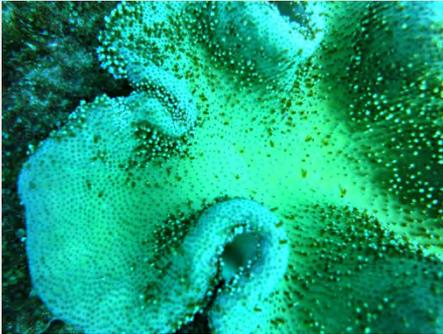
A fish survey was completed; five butterflyfish and one moray eel were recorded.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



Soft Coral, The Caves, Site 1



Asparagopsis, The Caves, Site 1



Giant Clam, The Caves, Site 1



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

### 2.3 Inner Gneerings, The Caves, Site 1

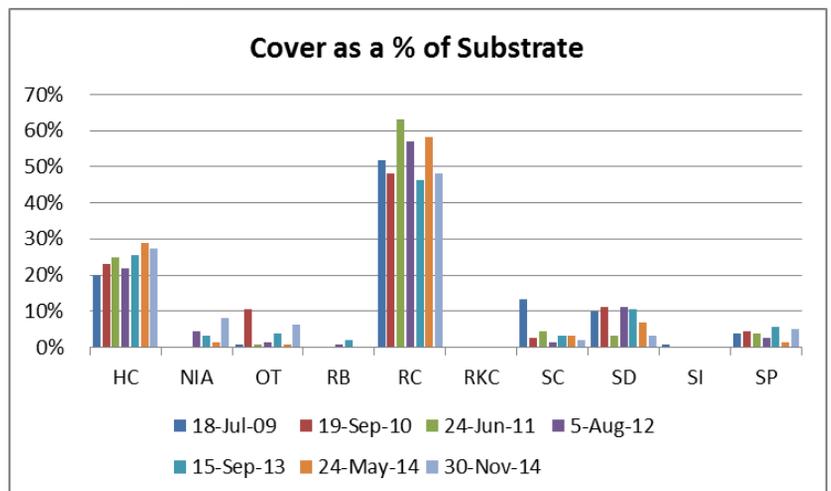
This reef is situated approximately 3km offshore from Mooloolaba and covers a wide range of depths from 10 to 25m. This site is popular for recreational fishing and diving with some boating usage. Two surveys were completed at this site in 2014, one in May and one in November.

The substrate composition at Inner Gneerings, Site 1 has remained relatively consistent since 2009 (average 25% hard coral), with rock (46%) and hard coral (28% in 2014) making up the majority of the site. Encrusting hard coral continued to be the main hard coral growth form recorded making up 75% in 2014, while foliose hard coral contributes approximately 11%. *Asparagopsis* was the most dominant algae type recorded.

One giant clam and one collector urchin were observed on the May invertebrate survey. Two anemones were the only invertebrates recorded in November.

Recorded impacts at this site included 30 counts of unknown scars, 4 counts of other damage and 24 incidents of coral disease. Bleaching was recorded on 13% of the total coral population and 12% of each colony.

A fish survey was completed with 8 butterflyfish and 15 sweetlips recorded.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



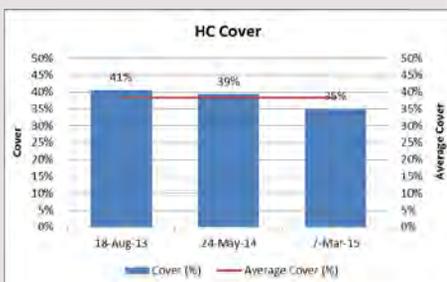
Site Photo, The Caves, Site 2



Bleached Coral, The Caves, Site 2



Encrusting Hard Coral, The Caves, Site 2



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

### 2.4 Inner Gneerings, The Caves, Site 2

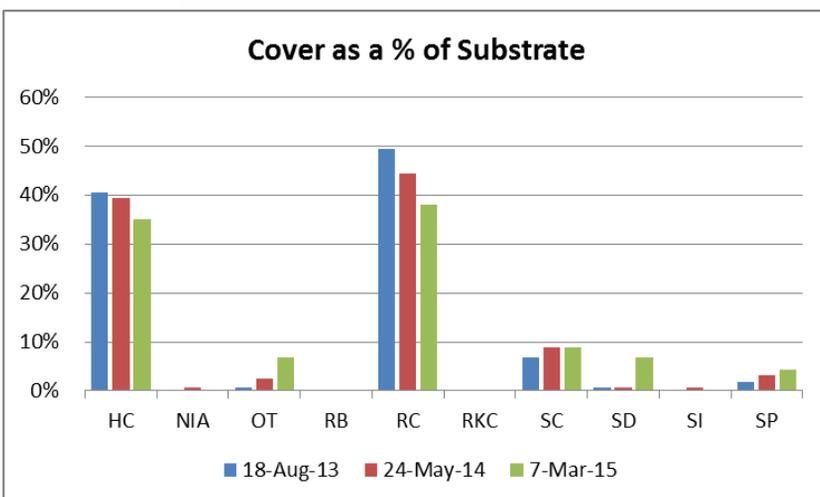
This reef is situated off shore from Mooloolaba and covers a wide area of depths from 10 to 25m. This site is popular for recreational fishing and diving with some boating usage. This site has been surveyed three times, once in 2013 and twice in 2014.

Rock (38%), hard coral (35%) and soft coral (9%) make up the majority of the site. Hard coral cover showed a decrease from 41% in 2013 to 35% in November this year. Encrusting hard coral is the main hard coral growth form (50%), followed by the general hard coral category (19%) and foliose and plate corals (9% each). The "Other" substrate category accounted for 7% of substrate cover, most of which was ascidians.

Four *Drupella* snails were the only target invertebrates found.

Three incidents of unknown coral damage, two unknown scars and six pieces of fishing debris were recorded in November. Of the bleached colonies, an average of 42% of each coral colony was recorded as bleached with 2% of the total coral population observed as having bleaching.

A fish survey was completed in May, however no target species were seen. No fish survey was completed in November.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



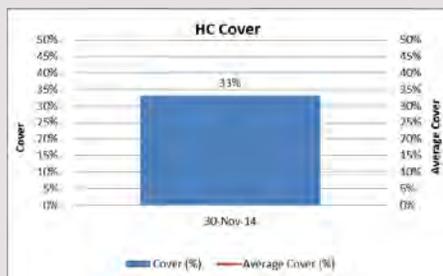
Non target fish species, The Caves, Site 3



Ascidians, The Caves, Site 3



Surveyors on survey ,The Caves, Site 3



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

### 2.5 Inner Gneerings, The Caves, Site 3

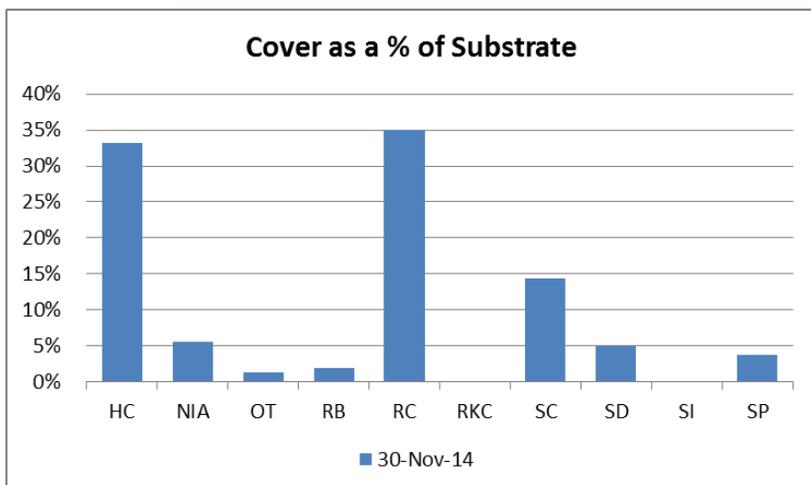
Site 3 at Inner Gneerings is a new site for 2014. The reef is situated approximately 3km offshore from Mooloolaba and is a popular recreational fishing and diving spot. Site 3 is located close to the RCA Caves Site 1 and runs at a similar depth almost parallel to it. Altogether, Sites 1, 2 and 3 cover a significant proportion of the shallow areas of this popular reef structure. The site expansion will help to offer additional information about this ecologically important and heavily utilized reef area.

Rock made up 35% of the substrate cover whilst hard and soft coral made up 33% and 14% respectively. Almost 80% of the hard coral recorded consisted of encrusting hard coral.

No invertebrates were recorded at this site during the survey.

Six percent of the coral population on the transect were bleached. Of these, approximately 10% of the colony surface was bleached. Eleven incidents of coral damage, 21 unknown scars and 13 incidents of disease were also recorded at this survey site.

Ten butterflyfish and one parrotfish were observed at this site during the fish abundance survey.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



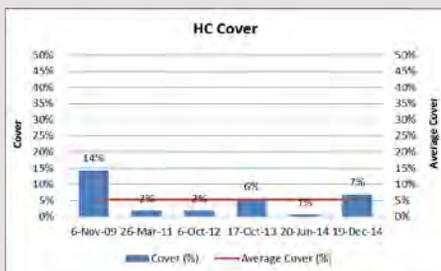
Site Photo, Kings Beach, Site 1



Hard Coral, Kings Beach, Site 1



Collector Urchin, Kings Beach, Site 1



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

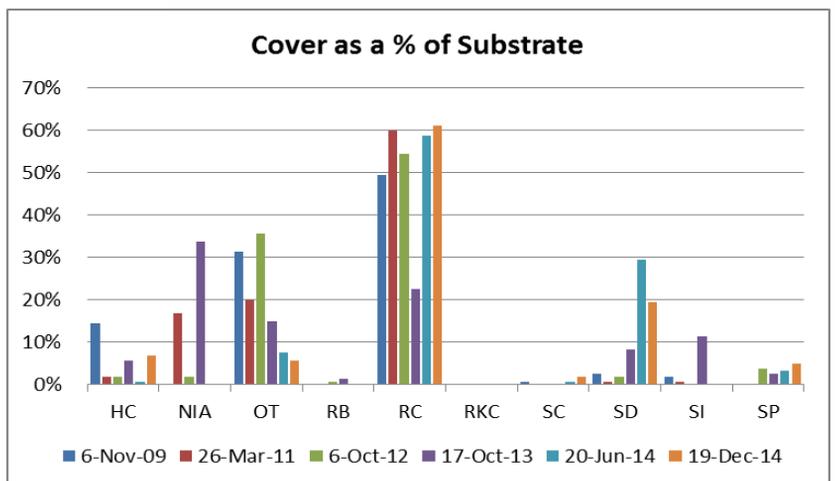
### 2.6 Kings Beach, Site 1

The site is located just 50m offshore, adjacent to a popular boat ramp and near to Caloundra's beachfront area. In 2011, this location was exposed to the resulting flood plume from the major SEQ flooding event. A survey in March 2011 showed a dramatically reduced hard coral population (14% to 2%). Two surveys were carried out in 2014, one in June and one in December. Hard coral in June remained low with just 1% cover; however, in December 2014, 7% hard coral was recorded. Encrusting hard coral combined with the general hard coral category comprised 100% of the hard coral recorded. The "Other" category accounted for 6% of the recorded substrate and consisted primarily of ascidians and *Halimeda*. Rock (61%) made up the majority of the site in the December survey. Both silt and nutrient indicator algae (NIA) were absent in the surveys in 2014.

*Drupella* snails (8), collector urchins (3) and sea cucumbers (5) were found during the December survey. No indicator invertebrates were recorded in June 2014.

Impacts recorded at this site in June 2014 consisted of four counts of trash. During the December survey, one count of other coral damage, one count of fishing line and two counts of general trash were recorded. In June 2014, 25% of the total coral population was bleached, with an average of 20% of coral colonies bleached. In December, less than 1% of the total coral population was bleached, with an average of 28% of coral colonies bleached.

One sweetlip and two snapper were recorded in June 2014. One butterflyfish and one sweetlip was recorded in December 2014.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



Surveyor on site, The Ledge, Site 1



Anemone with fish, The Ledge, Site 1



Site Photo, The Ledge, Site 1



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

### 2.7 Mudjimba Island, The Ledge, Site 1

Mudjimba Island is close to the mainland and the Maroochydoore and Mooloolah River mouths. This location is a popular location for a variety of water activities.

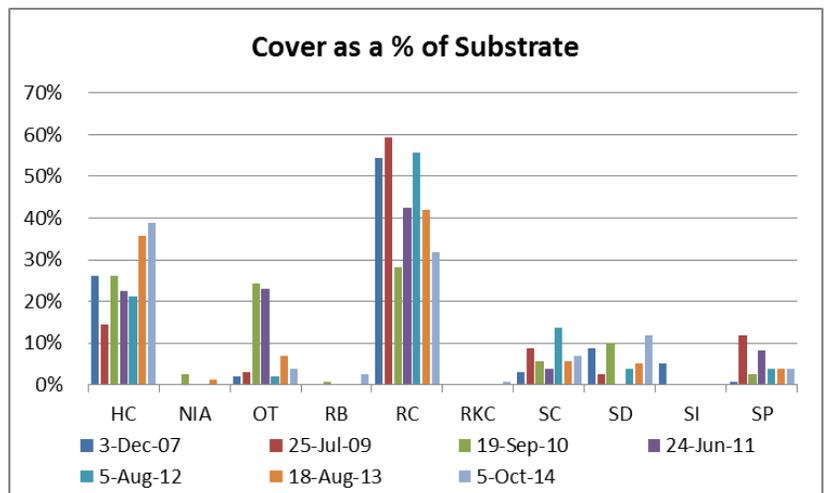
Hard coral cover (consisting of mostly encrusting growth forms) increased slightly from 36% in 2013 to 39% in 2014. Soft coral cover remained consistent (6% in 2013; 7% in 2014).

In 2014, the 'other' category accounted for 4% of the reef benthos, a slight decrease from 7% in 2013. Rock accounted for the other notable substrate category (32%). No macro algae was recorded at this site in 2014, and siltation was low. The dominant algae recorded were *Dictyota* and *Halimeda* turf algae.

No consistent trend has been recorded for invertebrates at Mudjimba Island, however key species have been recorded at this site over time. During the 2014 surveys, two anemones and 66 *Drupella* snails were recorded.

The site had an increase in bleaching recorded in 2014, from 1% of the total population in 2013 to 9% of the population in 2014. The average percentage of bleaching of a colony in 2014 was 21%. Three counts of unknown coral damage, 4 counts of coral disease and 11 unknown scars were also recorded. One instance of fishing debris was recorded on the transect.

The fish survey counted two moray eels.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



Site photo, The Ledge, Site 2



Coral Bleaching, The Ledge, Site 2



Cuttlefish, The Ledge, Site 2



Hard Coral cover as a % of total substrate

## 2.0 SUNSHINE COAST SITES

### 2.8 Mudjimba Island, The Ledge, Site 2

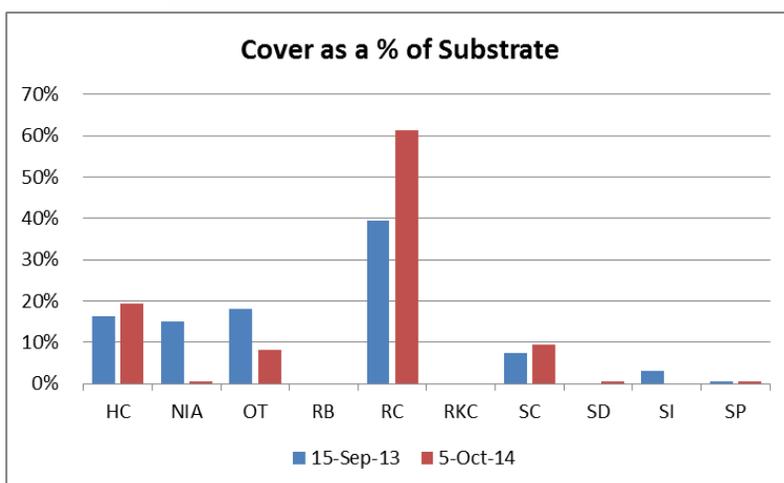
This site was established in 2013. It is the second site at The Ledge, Mudjimba Island and is located on the deeper slope of the dive site. This deeper location represents a different reef section than the long-established research Site 1.

Substrate composition at The Ledge, Site 2 is primarily composed of rock (61%). Additional substrate components include hard coral (19%), 'other' (8%: predominantly ascidians and crustose algae) and soft coral (9%). A small increase in hard coral cover from 16% in 2013 to 19% in 2014 was observed. Encrusting hard coral remains the dominant hard coral recorded. Nutrient indicator algae was found in a lower abundance in 2014, consisting mostly of *Dictyota*. The dominant algae recorded was turf algae. Low silt loading was recorded on the site.

Four *Drupella* snails were the only invertebrates recorded.

Coral bleaching was observed to have impacted 6% of the coral population with an average of 11% of each colony affected. Impacts recorded at this site included four counts of coral damage, eight counts of coral disease and 16 counts of unknown scars.

The fish survey was completed with two butterflyfish recorded. Two cuttlefish and a wobbegong shark were seen on the dive as well as several nudibranchs.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA

## 2.0 SUNSHINE COAST SITES

### 2.9 Mudjimba Island, North West Reef, Site 1



Ascidians, North West Reef, Site 1



Halimeda, North West Reef, Site 1



Anemone, North West Reef, Site 1

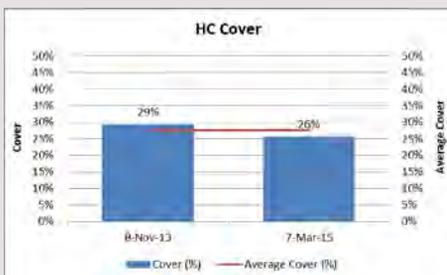
In 2013, the North West Reef off Mudjimba Island was included as part of new SEQ surveyed sites. Mudjimba Island is close to the mainland, and this particular site faces the northwest side of the island. This site varies substantially from the southern area already surveyed, offering new insights to this culturally and ecologically important location.

Hard coral cover made up 26% of the reef benthos in 2014, similar to that recorded in 2013 (29%). Soft coral cover increased from 3% in 2013 to 8% in 2014. Sponge cover also increased (2% in 2013, 8% in 2014). Rock accounted for 28% of the recorded substrate in 2014 (29% in 2013) and the 'other' category showed little change (from 6% in 2013 to 5% in 2014). No nutrient indicator algae was recorded in 2014, a decrease from 19% in 2013. There was no macro algae recorded in 2014 and only one count in 2013.

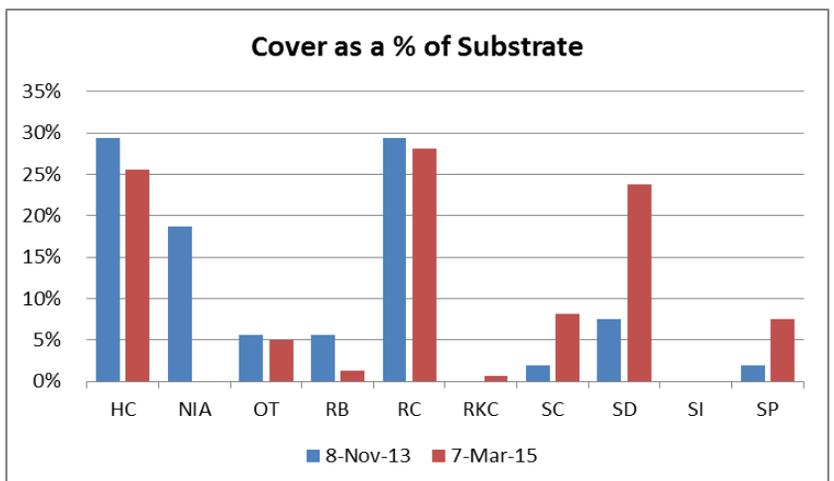
Three *Drupella* snails, one anemone and one collector urchin were recorded on the invertebrate survey.

The site showed 14% bleaching of the total coral population with an average of 42% of the colony bleached in 2014. Only a single count of coral bleaching was recorded in 2013 (<1%). Other impacts recorded include 1 count of trash, 4 unknown scars and 2 counts of fishing debris.

No fish survey was carried out.

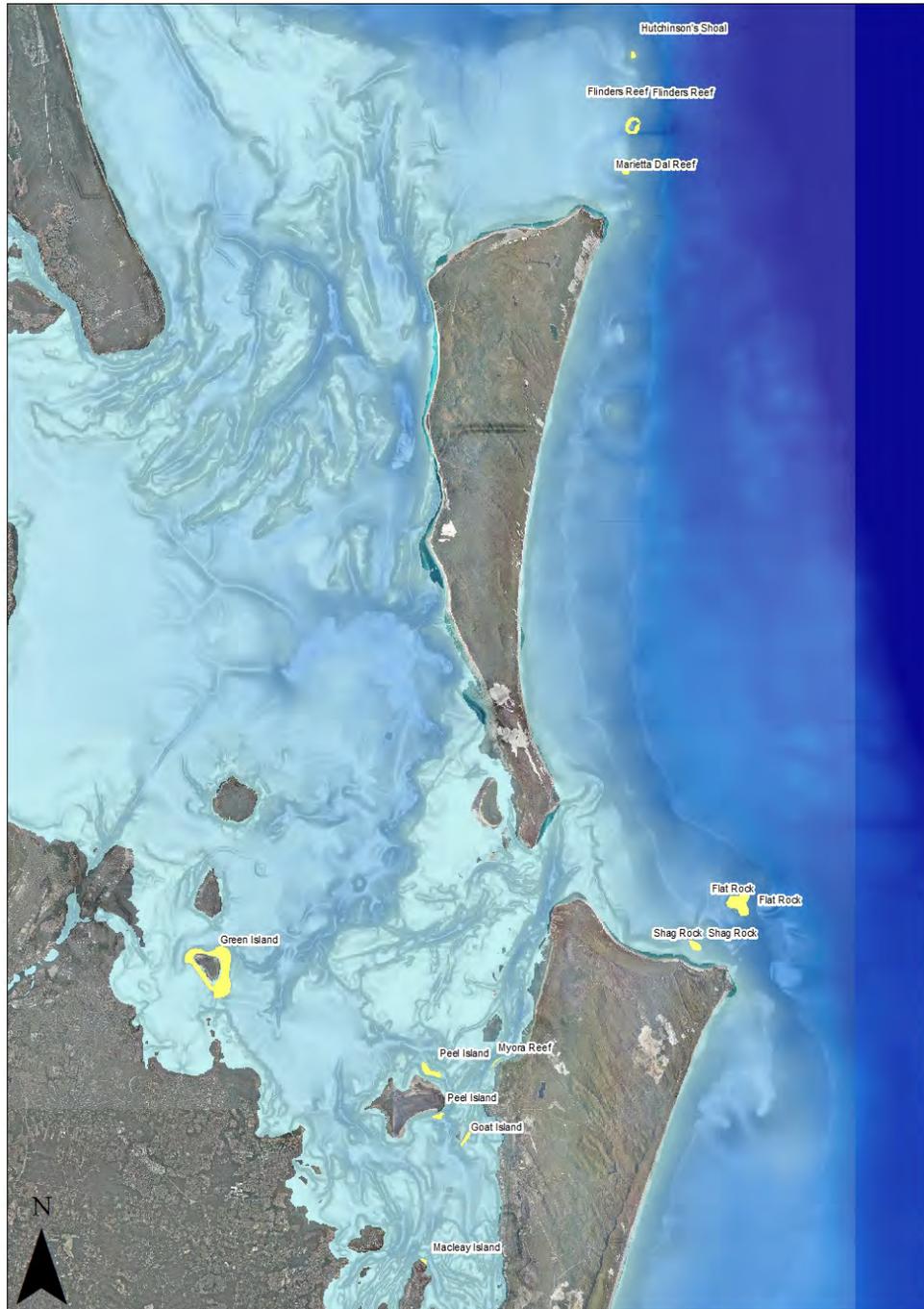


Hard Coral cover as a % of total substrate

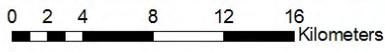


Cover as a % of substrate, by year, for Reef Check categories

# 3.0 Moreton Bay



**Legend**  
 Reefs



Map:  
 Moreton Bay,  
 South East Queensland

This information or data is provided by Reef Check Australia & SEQ Catchments Limited on a general basis only. You should seek specific or appropriate advice in relation to this information or data before taking any action based on its contents. So far as permitted by law, SEQ Catchments Limited makes no warranty in relation to this information or data.

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Cartographer: K Grealley  
 Version: 21/01/2013  
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Mapping Partners

1:210,000  
 GDA1994 Zone 56  
 Data Sources: RCA, Qld Government, SEQHWP, SEQC

Map shows spatial extent of reef areas in Moreton Bay monitored by Reef Check Australia.

# REEF CHECK

## AUSTRALIA



Hard coral bleaching, Goat Island, Site 1



Rope debris, Goat Island, Site 1



Site photo, Goat Island, Site 1



Hard Coral cover as a % of total substrate

## 3.0 INSHORE MORETON BAY SITES

### 3.1 Goat Island, Site 1

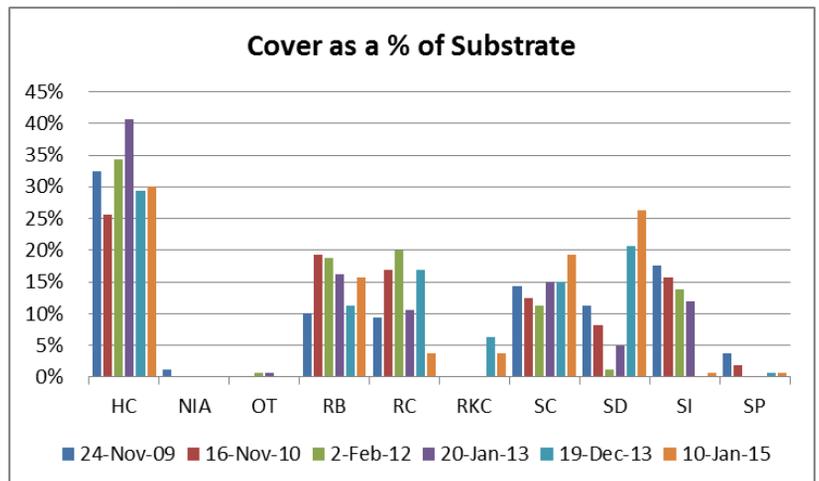
A shallow sandy reef fringes Goat Island. This site is exposed to regular boat traffic, including surge from the nearby boat channel where the North Stradbroke Island ferries travel.

Hard coral abundance was similar to last year (30% compared to 29% in 2013) but down from 41% in 2012. Soft coral makes up a large portion of substrate cover at this site (19%) and has been relatively consistent over time. Recently killed coral was recorded this year (4% of the substrate), which is less than 2013, but was not seen in previous surveys.

One *Drupella* snail was found on this survey, which is the only invertebrate sighted over the last three surveys.

The impact survey showed seven incidences of other coral damage, and one unknown scar. There were six counts of fishing line and one general trash. Coral bleaching was high at this site with the average percent of coral surface being 79% bleached (higher than 54% in 2013). The entire coral population was estimated to be 56% bleached (similar to 53% in 2013).

A fish survey was not carried out.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



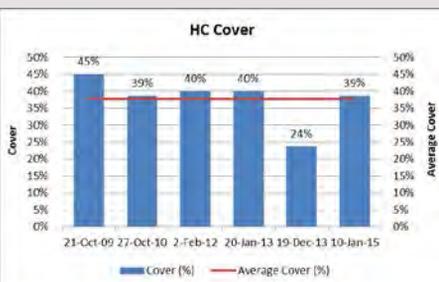
Site photo, Myora Reef, Site 1



Coral scar, Myora Reef, Site 1



Diadema urchin, Myora Reef, Site 1



Hard Coral cover as a % of total substrate

## 3.0 INSHORE MORETON BAY SITES

### 3.2 Myora Reef, Site 1

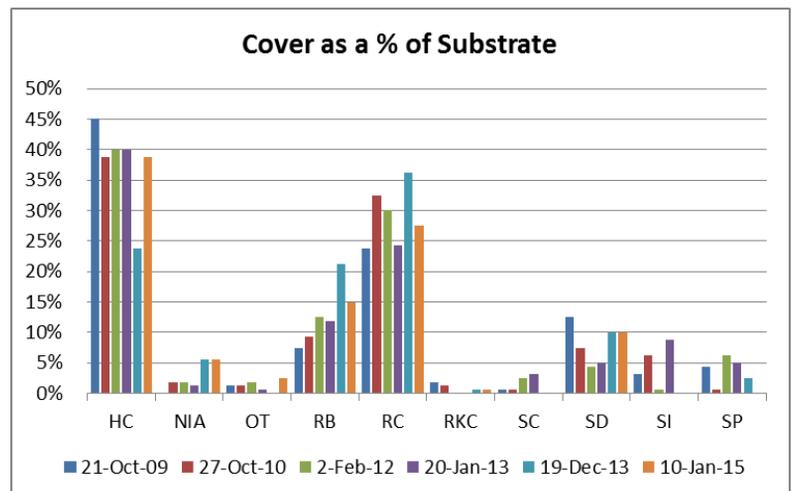
Myora Reef hosts a unique and substantial community of Acropora coral for inshore Moreton Bay. This area was declared a Marine National Park (MNP) zone in 2009.

Hard coral cover recorded in 2014 (39%) was back up to the relatively consistent levels in previous years (ranging from 45% in 2009 to 40% in 2012). There had been a lower level recorded in 2013 (24%). Of the hard coral, 98% was recorded as general hard coral (exclusively *Acropora sp.*) and 2% as branching hard coral. Rock made up 36% of the substrate type, followed by rubble (15%). No soft coral was found for the second survey year.

There were two *Drupella* snails found on the survey and 55 *Diadema* urchins. This abundance of urchins is similar to the numbers found in 2013 (59).

The impact survey showed forty incidents of coral damage and forty incidents of unknown scars. One *Drupella* scar was also observed. The average bleaching of a coral surface was 21%, which was similar to 2013 (25%) and the entire coral population was 6% bleached, less than the total bleaching observed in 2013 (19%).

A fish survey was not carried out.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



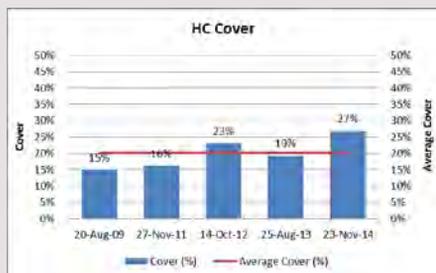
Site photo, Shark Alley, Site 1



Asparagopsis algae, Shark Alley, Site 1



Pencil urchin, Shark Alley, Site 1



Hard Coral cover as a % of total substrate

## 3.0 OUTER MORETON BAY SITES

### 3.3 Flat Rock, Shark Alley, Site 1

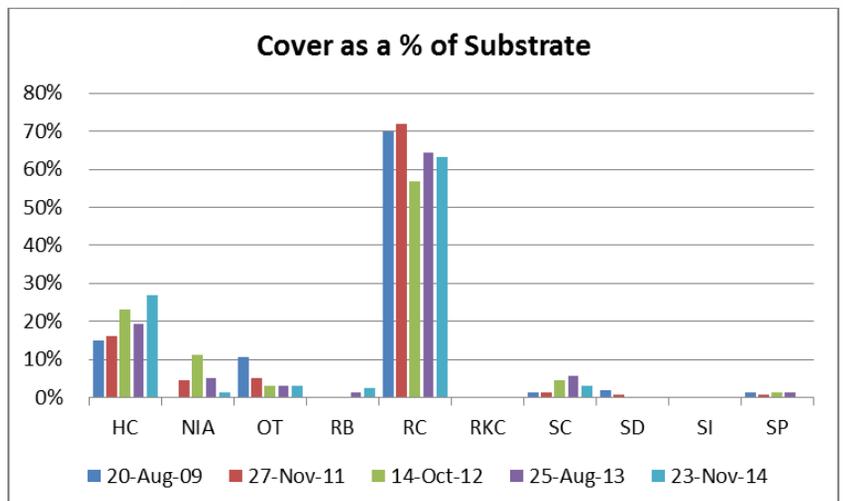
Shark Alley was declared a Marine National Park (MNP) zone in 2009. The alley is located on the eastern edge of the Flat Rock Reef and is a popular recreational diving and boating area due to its Grey Nurse Shark population. The dive site contains two large sand bottom channels that run parallel to each other, separated by rocky reef.

Hard coral cover made up 27% of the reef benthos, up slightly when compared to the previous year (19%). Corals were mostly encrusting growth forms (12%). Soft coral cover was lower and made up 3% of the reef area. Nutrient indicator algae decreased to just 1% in 2014 (5% in 2013). The dominant algae at this site were *Laurencia*, *Asparagopsis*, and crustose coralline algae.

Invertebrates recorded included 2 banded coral shrimp, 8 *Diadema*, 2 pencil urchins, 2 anemone with fish, 22 anemones without fish, 1 giant clam, and 6 *Drupella* snails.

Three counts of 'other' coral damage were observed, as well as 7 counts of unknown scars. Coral bleaching was recorded as affecting approximately 4% of the population and on average 16% of colonies. No bleaching was recorded in 2013.

The fish surveyed showed 22 butterfly fish, 22 snapper, 2 parrotfish and 3 sweetlips. A Hawksbill turtle and wobbegong shark were also observed.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA

### 3.0 OUTER MORETON BAY SITES

#### 3.4 Flat Rock, The Nursery, Site 1



Lobster, The Nursery, Site 1



Unknown coral scar, The Nursery, Site 1



Anemone without fish, The Nursery, Site 1

This site is in a sheltered, shallow reef area within a fully protected marine park. It is also a Grey Nurse Shark Protection area.

Hard coral cover increased to 25%, the same levels recorded between 2008 and 2010. All recorded hard coral were encrusting growth forms. Soft coral cover accounted for 1% cover, which is relatively consistent with previous surveys. Sponge covered 4% of the reef benthos, consistent with recent previous surveys. The 'other' category (described as mostly calcareous algae) decreased from 19% in 2012 to just 1% in 2013 and 2014.

Macro algae decreased from last year (from 26 to 16 counts), with the main dominant macro algae being *Asparagopsis*.

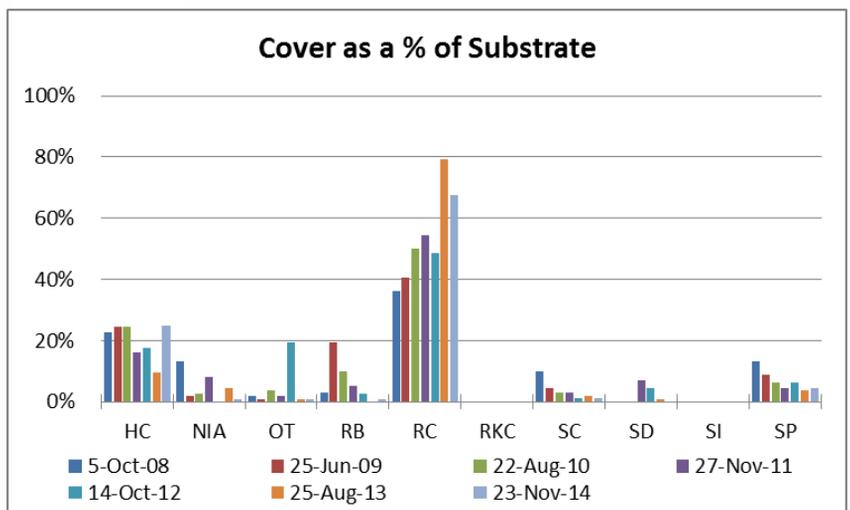
Five *Diadema*, 2 lobsters, 2 giant clams and 106 anemones without fish were recorded on the transect.

Impacts included 2 unknown scars, 3 counts of disease and 2 of other damage. Bleaching was estimated to impact less than 1% of the coral.

Fish surveys recorded 20 butterflyfish, 2 parrotfish, 2 snapper and 2 sweetlips. Rare animals sighted included one wobbegong.



Hard Coral cover as a % of total substrate



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA

# 3.0 OUTER MORETON BAY SITES

## 3.5 Flinders Reef, The Nursery, Site 1



Site photo, The Nursery, Site 1



Collector urchin, The Nursery, Site 1



Coral bleaching, The Nursery, Site 1

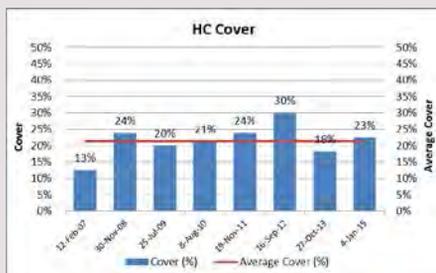
Flinders Reef is an established Marine National Park (Green) zone. It is a popular diving location. This site has been surveyed annually by Reef Check since 2007.

Hard coral cover accounted for 23% in 2014, which is consistent with the average coral cover observed since 2007 (21%). Coral cover was made up of mostly encrusting (61%) and branching hard coral (25%). Soft coral increased to levels seen in previous years, 25% in 2014 (23% in 2012 and 20% in 2011). Soft coral was mostly leathery growth forms. An increase in sponge cover was recorded at 8% in 2014 compared to 1% in 2013

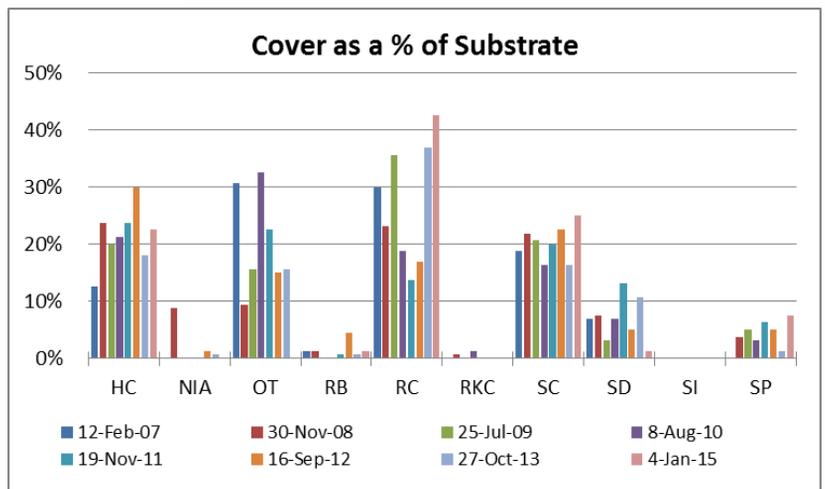
The invertebrate survey observed two pencil urchins, one collector urchin, and two giant clams.. Five *Drupella* snails were also observed.

The impact survey recorded 12 counts of other coral damage and 21 unknown scars. Bleaching was observed on 4% of the total coral population and affected an average of 19% of the colonies.

No fish survey was completed at this site.



Hard Coral cover as a % of total substrate



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA



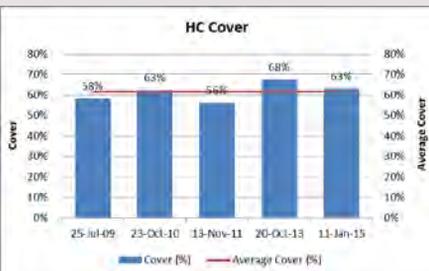
Site photo, The Nursery, Site 2



Acropora patch, The Nursery, Site 2



Nutrient indicator algae, The Nursery, Site 2



Hard Coral cover as a % of total substrate

## 3.0 OUTER MORETON BAY SITES

### 3.6 Flinders Reef, The Nursery, Site 2

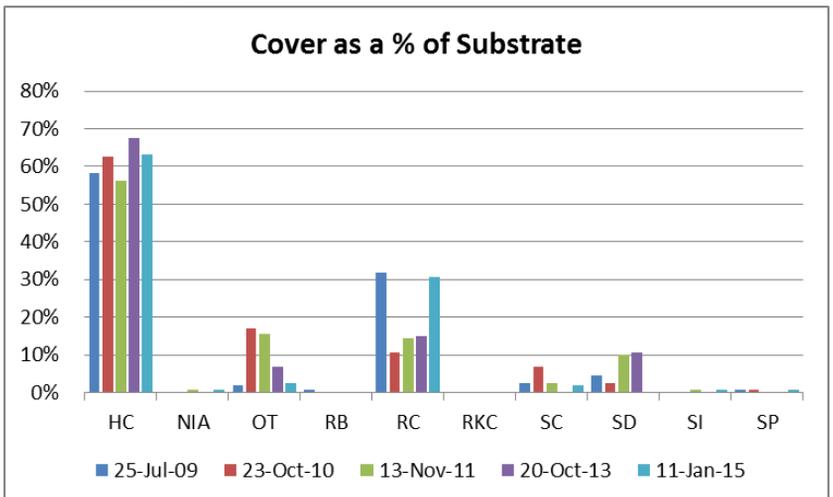
This site is located at a large patch of *Acropora* coral patch near the turtle cleaning station on Flinders Reef. Flinders Reef is Marine National Park at popular dive site, Flinders Reef.

This site has shown a high and relatively consistent hard coral cover with an average cover of 62% over the 5 years of monitoring. Hard coral accounted for 63% of the survey cover in 2014. Most of the 'other' category recorded at this site (3%) were corallimorphs.

Two *Diadema* long-spined urchins and one anemone (with a resident anemone fish) were the only invertebrates recorded.

Twenty incidences of coral damage, five unknown scars and three instance of disease were recorded. Five percent of the coral population was estimated to be impacted by bleaching, affecting an average of 11% of colonies.

A fish survey was not carried out.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA

### 3.0 OUTER MORETON BAY SITES

#### 3.7 Flinders Reef, Aldens Cave, Site 1



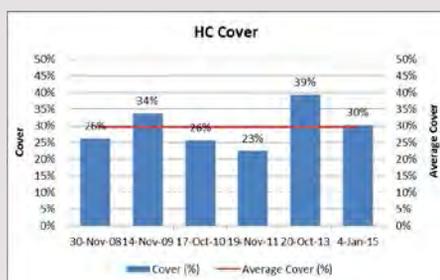
Giant clam, Aldens Cave, Site 1



Butterflyfish, Aldens Cave, Site 1



Site photo, Aldens Cave, Site 1



Hard Coral cover as a % of total substrate

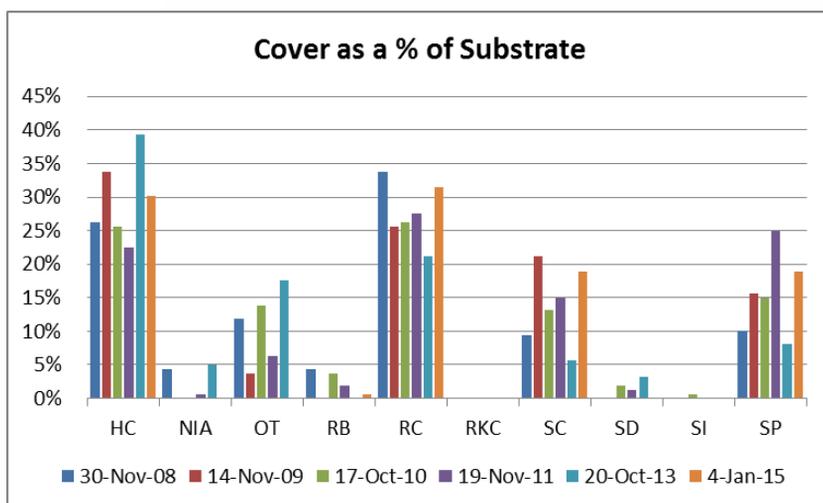
Flinders Reef is a Marine National Park zone. It is a frequented diving and boating location, and there are reports of fishers utilising the area. This southerly site tends to be more exposed to prevailing ocean swell than the protected Nursery area on the other side of the reef.

Hard coral accounted for 30% of benthic cover in 2014, although hard coral has fluctuated a bit across all surveys, this is consistent with the average hard coral cover. Encrusting hard coral makes up the majority of the hard coral type (73%). 'Other' substrate category accounted for 6% of benthic cover (made up mostly of corallimorphs). Soft coral cover accounted for 19% of the substrate in 2014, up from 6% in 2013. The percent cover of sponge increased to 19% in 2014, up from 8% in 2013.

At this site, three giant clams, one *Diadema* urchin and one lobster were recorded.

Approximately 1% of the coral population was estimated to be impacted by bleaching. There were 4 incidences of anchor damage, despite a mooring line close by. There were also two counts of unknown damage and two incidences of disease.

A fish survey observed 33 butterflyfish, 2 snapper and 3 parrotfish.



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA

### 3.0 OUTER MORETON BAY SITES

#### 3.8 Shag Rock West, Site 1



Collector urchin, Shag Rock West, Site 1



Site photo, Shag Rock West, Site 1



Coral damage, Shag Rock West, Site 1

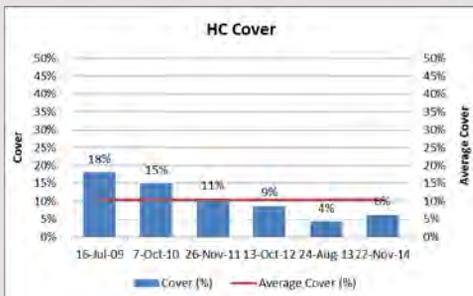
This site is located on the northern, more exposed side of Shag Rock. Fishing and boating are commonly observed at this site and divers visit regularly.

This site has shown a decline in hard coral cover over the past five years of monitoring from 18% in 2009 to 4% in 2013. A slight increase in cover to 6% was seen in 2014. The hard coral cover in 2014 consisted of plates and general hard coral growth forms (no branching, foliose or massive growth forms as found in previous surveys). Soft coral cover has fluctuated over time with an average cover of 5%, though no soft coral was found in 2014. Much of the site's benthos was made up of rock (66%) and nutrient indicator algae (15%), which was mostly *Lobophora*.

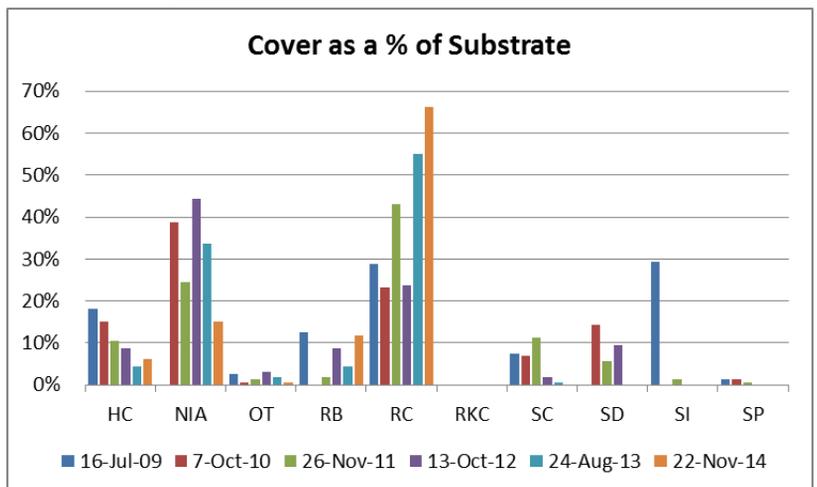
Six anemones, 78 collector urchins and 21 *Diadema* urchins were recorded.

The average estimated bleaching of the coral population throughout the site was 4%, with an average of 51% of each colony affected. There were 8 observations of coral damage. Two *Drupella* scars was recorded and 6 unknown scars were recorded on the transect.

A fish survey was conducted in 2014 with two sweetlips observed.



Hard Coral cover as a % of total substrate



Cover as a % of substrate, by year, for Reef Check categories

# REEF CHECK

## AUSTRALIA

### 3.0 OUTER MORETON BAY SITES

#### 3.9 Shag Rock East, Site 1



Giant clam, Shag Rock East, Site 1



Coral disease, Shag Rock East, Site 1



Moray eel, Shag Rock East, Site 1

This site is situated in a relatively sheltered cove on the more southern area of Shag Rock. Fishing and boating are commonly observed at this site, and divers visit regularly.

This site has shown minimal fluctuations in hard coral cover with an average cover of 15% in previous years and 18% cover recorded in 2014. Encrusting hard coral was recorded as the most common growth form, accounting for more than 40% of growth form composition. Soft coral cover has fluctuated with an average cover of 9% over the past six years of monitoring and 6% recorded in 2014. Nutrient indicator algae (mostly *Lobophora*) was abundant at this site (24%).

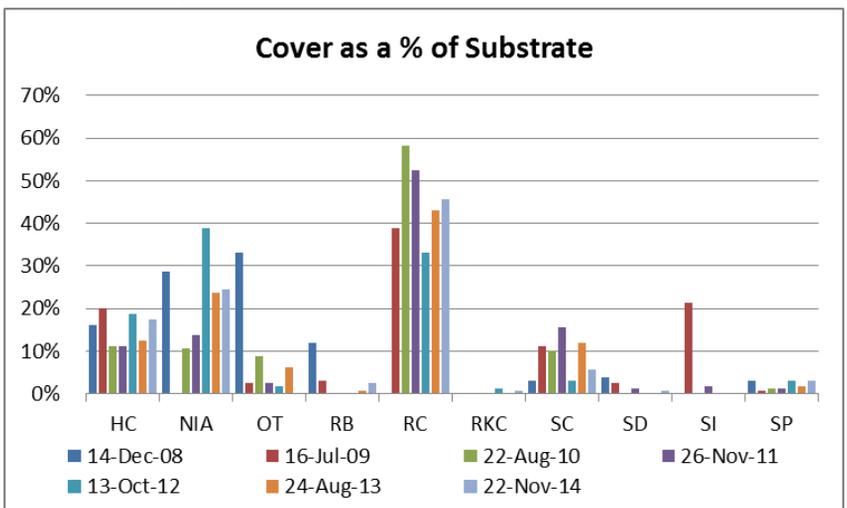
The invertebrate survey was completed in 2014, and a total of 31 long spined urchins, 10 collector urchins, 2 giant clams, and 14 anemones were found.

An average of 4% of the coral population was estimated to be impacted by bleaching, affecting 31% of each colony on average. There were records of coral damage (1), disease (4), unknown scars (13) and fishing line (2).

A fish survey was completed in 2014, and two butterflyfish and one moray eel were counted.



Hard Coral cover as a % of total substrate



Cover as a % of substrate, by year, for Reef Check categories

# 1.0 Literature Cited

- EHMP (2010) Ecosystem Health Monitoring Program 2008–09. Annual Technical Report Executive Summary. South East Queensland Healthy Waterways Partnership, Brisbane.
- Fellegara, I., & Harrison, P. L. (2008). Status of the subtropical scleratinian coral communities in the turbid environment of Moreton Bay, south east Queensland. *Memoirs of the Queensland Museum--Nature*, 54 (1), pp. 277-291.
- Figueira W.F. and Booth D.J. (2010). Increasing ocean temperatures allow tropical fishes to survive overwinter in temperate waters. *Global Change Biology*, 16: 506–516. doi: 10.1111/j.1365-2486.2009.01934.x.
- Gibbes B., Grinham A., Neil D., Olds A., Maxwell P., Connolly R., Weber T., Udy N., Udy J. (2014). Moreton Bay and its estuaries: a sub-tropical system under pressure from rapid population growth. In: E. Wolanski (ed) *Estuaries of Australia in 2050 and Beyond, Estuaries of the World*. Springer, Dordrecht.
- Graham N.A.J., Nash K.L., Kool J.T. (2010). Coral reef recovery dynamics in a changing world. *Coral Reefs* 30 (2), 283-294.
- Harrison, P., Harriot, V., Banks, S., & Holmes, N. (1998). The coral communities of Flinders Reef and Myora Reef in the Moreton Bay Marine Park, Queensland, Australia. In I. Tibbits, N. Hall, & W. Dennison, *Moreton Bay and Catchment* (pp. 525-536). St Lucia: School of Marine Science, University of Queensland.
- Kovacs, Eva M; Bray, Peran; Thurstan, Ruth; Flower, Jason; Beger, Maria; Gallo, Michelle; Loder, Jennifer; Gomez Cabrera, K-Le; Lea, Alex; Ortiz, Juan; Roelfsema, Chris M (2014): Ecological assessment data of the marine flora and fauna of Point Lookout in 2014. University of Queensland Underwater Club, Brisbane, Australia, Dataset doi:10.1594/PANGAEA.843122
- Lybolt, M.L.M., Neil D., Zhao J.X., Feng Y.X., Yu K.F., and Pandolfi J. (2011). Instability in a marginal coral reef: the shift from natural variability to a human-dominated seascape. *Frontiers in Ecology and the Environment*, 9, 154–160.
- Munday P.L., Cheal A.J., Graham N.A.J. et al. (2009). Tropical coastal fish. In: *A marine Climate Change Impacts and Adaptation Report Card for Australia 2009* (eds E. S. Poloczanska, A. J. Hobday and A. J. Richardson) 22 pp. NCCARF Publication 05/09, Brisbane.
- Perry, C., & Larcombe, L. (2003). Marginal and non-reef building coral environments. *Coral Reefs*, 22, pp. 427-432.
- Pheasant, Mike; Stetner, Douglas; Pollard, Lachlan; Barrenger, Trevor; Raby, Lee; Roelfsema, Chris M (2015): Habitat Maps derived from Point Lookout Ecological Surveys (PLEA) of the Shag Rock, Manta Ray Bommie and Flat Rock dive sites at Point Lookout, North Stradbroke Island, Australia, in 2014, in ArcGIS (shapefile) format. doi:10.1594/PANGAEA.845011
- Roelfsema C., R. Thurstan, J. Flower, M. Beger, M. Gallo, J. Loder, E. Kovacs, K. Gomez Cabrera, A. Lea, J. Ortiz, D. Brunner, and D. Kleine (2014). Ecological Assessment of the Flora and Fauna of Point Lookout Dive Sites, North Stradbroke Island, Queensland., UniDive, The University of Queensland Underwater Club, Brisbane, Australia.
- Smith S.D.A., Rule M.J., Harrison M. and Dalton S.J. (2008). Monitoring the sea change: preliminary assessment of the conservation value of nearshore reefs, and existing impacts, in a high-growth, coastal region of subtropical eastern Australia. *Marine Pollution Bulletin* 56, 525–534.
- Volunteers, Staff and Supporters of Reef Check Australia (2015). Authors J. Loder, T. Done, A. Lea, A. Bauer, J. Salmond, L. Galway, E. Kovacs, M. Walker, J. Roberts, S. Mooney, J. Hill, M.L. Schläppy, A. Pribyl Rinke. *Citizens & Reef Science: A Celebration of Reef Check Australia's volunteer reef monitoring, education and conservation programs 2001-2014*. Reef Check Foundation Ltd.
- Wallace, C. C., Fellegara, I., Muir, P. R., & Harrison, P. L. (2009). The scleratinian coral of Moreton Bay. eastern Australia: high latitude, marginal assemblages with increasing coral richness. In P. Davie, & J. Phillips, *Proceedings of the 13th International Marine Biological Workshop, The Marine Flora and Fauna of Moreton Bay, Queensland. Memoirs of the Queensland Museum--Nature* 54(2) (pp. 1-118).