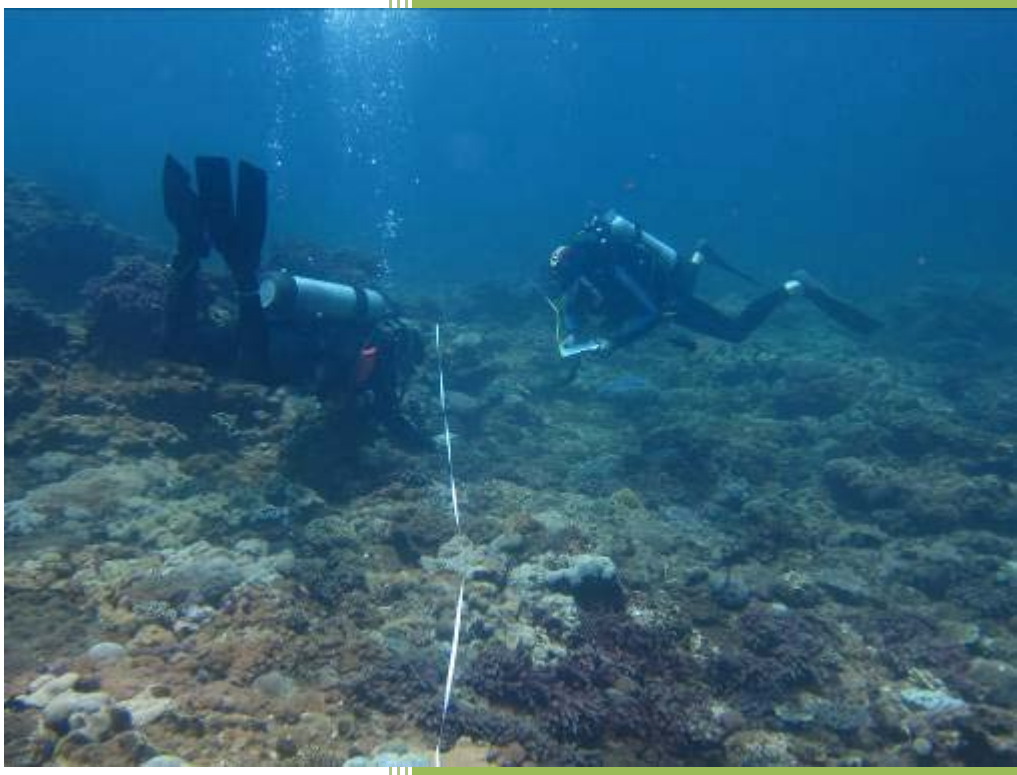
2011-2012

Reef Check Australia South East Queensland Survey Season Summary



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Reef Check Australia greatly appreciates all of the people
and organizations who have helped to make this project a success.
A big thank you to our dedicated volunteers, generous dive operators,
innovative collaborators and supportive funding agencies.

Huge thank you to the dedicated volunteers who have joined us on a survey this year:

Corinna Byrne, Sophie Clay, Angela Dean, Terry Farr, David Glover, Diana Kleine, Jody Kreuger, Emma Ladouceur, Alexandra Lea, Jenn Loder, Beatrice Loh, Deanne Passenger, Josh Passenger, Sonya Perks, Juan Rey, Jodi Salmond, Julie Schubert.

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Executive Summary

Reef Check Australia surveyed 22 existing monitoring sites and also added one new site in 2011. Ten sites showed a slight increase in coral cover, eight sites had decreased coral cover. One site had fluctuating hard coral cover over the course of monitoring. Artificial structures form the basis of the other two existing sites, where hard coral growth has never been recorded. Excluding these two artificial sites, hard coral cover ranged from two to 56 percent across all monitoring sites, with most sites averaging between 15 and 25 percent cover.

Throughout the season, coral bleaching was observed at fourteen sites, an increase from the nine sites where bleaching was found in the 2010 season. The maximum recorded bleaching level was ten percent of the hard coral community at Currumundi Reef on the Sunshine Coast, however most sites had less than one percent impact across the hard coral community. Coral disease was also recorded at fourteen sites, with the highest reported incidence of less than 4 counts per $100m^2$.

Drupella sp. (coral-eating snails) were recorded at seven sites, but generally in fairly low abundance (<2/$100m^2$ on all transects). *Drupella* scarring was recorded at seven sites (with maximum reported scars <1/$100m^2$ for any survey).

Most surveys reported hard coral damage (n=15); some sites with as little as one incident and some sites averaging more than 3/$100m^2$. Coral scarring from unknown causes was also relatively common and was recorded at 17 sites, ranging from just one scar to as many as 4/$100m^2$ at Flat Rock (Shark Gulley).

Discarded fishing line was observed at fourteen different sites, with maximum counts reaching 15/$100m^2$ on one survey at the Gold Coast Seaway. Other assorted rubbish was discovered at eight survey sites, including items such as bottles, fish cages and car tyres.

Several sites, including Flat Rock (Shark Gulley), Shag Rock South and Currumundi Reef (Site 2) reported simultaneous disease, Drupella snails, fishing line, unknown damage and scarring.

Other features to note included high counts of *Diadema* sp. urchins (≥9/$100m^2$) at Palm Beach Reef sites and Shag Rock sites. High abundances of pencil urchins (≥16/$100m^2$) and anemones (≥25/$100m^2$) were also found at Palm Beach Reef, which were much higher than any other SEQ site. Banded coral shrimp were reported at Myora and Mudjimba Island.

Invertebrate surveys were conducted at 21 out of the 22 surveys completed and found that anemones and long-spined sea urchins were the most common target invertebrate sighted on surveys.

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1.0 Introduction

Reef Check Australia's (RCA) monitoring program helps to provide an early warning system for changes in the health of surveyed coral habitats. Annual surveys provide long-term data sets that can reveal important patterns over time. Quantitative data is collected in relation to substrate cover, as well as abundance of key invertebrate species and target fish species. RCA also monitors natural and anthropogenic impacts that affect coral habitats.

A summary of the findings for surveys conducted in South East Queensland (SEQ) during the 2011 season are presented in this report. Teams of trained volunteers monitored a total of 22 sites across 19 different reef sites. These sites included existing survey sites ranging from Noosa down to Palm Beach, as well as one new site, Little Halls Reef on the Sunshine Coast.

SEQ represents the marginal edge of coral growth (Perry & Larcombe, 2003) and a transitional area where tropical, sub-tropical and temperate species all exist within the same habitat area. Some coral communities in this area may receive larval recruitment from the southern Great Barrier Reef, but are generally limited from accreting reef structures by environmental factors such as light, temperature, aragonite availability and/or turbidity (Fellegara & Harrison, 2008 and Kleypas, McManus & Menez 1999). However, within SEQ there are numerous individual coral communities which include a diverse and extensive range of coral growth forms, including offshore sites like Flinders Reef. Here, 119 different coral species have been recorded (Harrison, Harriot, Banks, & Holmes, 1998). While coral communities within inshore Moreton Bay may not contain such diversity (with 64 species recently documented), there are many locations with considerable historical and existing coral cover (Wallace, Fellegara, Muir, & Harrison, 2009)

The SEQ area includes about seven percent of the State's coastline and 65 percent of its human population (The State of Queensland, Environmental Protection Agency, August 2006). Immense population growth and development within the region are increasing pressures on the marine ecosystem, both directly and indirectly. Stresses such as sediment and nutrient runoff, habitat loss, boating and anchoring impacts, waste disposal, overfishing, aquarium trade collection and climate change all have the potential to negatively impact coral habitats.

Despite the unique assemblage of marine species and recognized threats to the health of coral habitats in SEQ, limited long-term monitoring of these habitats are currently being conducted. As habitat and species shifts may be likely as a result of climate change, as well as pressures from anthropogenic threats, this transitional area is gaining recognition as an important area to study and protect (Wallace, Fellegara, Muir, & Harrison, 2009). The data that is being collected as part of RCA's monitoring program provides important baseline data which describes the current health condition of coral habitats within SEQ.

1.1 Monitoring Sites

RCA monitoring sites ranged from Noosa to Palm Beach Reef. Most surveys were conducted within Moreton Bay Marine Park, covering an area of 3400 km^2 from Caloundra to the Gold Coast. RCA collects data in varied coral habitats, both within protected and non-protected marine park areas for contrast and comparison. During the 2011 SEQ season, 23 out of the existing 28 sites were monitored (Table 1). Eight of these occurred within MNP zones. RCA monitors coral habitats within six Ramsar wetland sites.

Figure 1. Map of South East Queensland survey sites from Google Earth

Table 1. Table of 23 RCA SEQ monitoring locations visited in 2011 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 General Use (GU) zones as well as Ramsar Wetland site status (Ramsar)

Site	#	Location	Depth (m)	1st Survey	Site Designation
Currimundi Reef	1	Sunshine Coast	9	2009	n/a
Currimundi Reef	2	Sunshine Coast	9	2009	n/a
Flat Rock, Shark Gulley	1	Outer Moreton Bay	9	2009	MNP
Flat Rock, The Nursery	1	Outer Moreton Bay	7	2008	MNP
Flinders Reef, Aladdin's Cave	1	Outer Moreton Bay	10	2008	MNP
Flinders Reef, The Nursery	1	Outer Moreton Bay	6	2007	MNP
Flinders Reef, The Nursery	3	Outer Moreton Bay	6	2009	MNP
Goat Island	1	Inner Moreton Bay	2	2009	CP, Ramsar
Gold Coast, South West Wall	1	Gold Coast	6	2007	n/a
Inner Gneerings, The Caves	1	Sunshine Coast	11	2009	n/a
Jew Shoal, The Pin	1	Sunshine Coast	10	2009	n/a
Little Halls Reef	1	Sunshine Coast	14	2011	n/a
Kings Beach	1	Sunshine Coast	3	2009	HP
Macleay Island	1	Inner Moreton Bay	2	2009	HP, Ramsar
Mudjimba Island	1	Sunshine Coast	5	2007	n/a
Myora Reef	1	Inner Moreton Bay	2	2009	MNP, Ramsar
Narrow Neck Artificial Reef	1	Gold Coast	5	2007	n/a
Palm Beach Reef	1	Gold Coast	10	2007	n/a
Palm Beach Reef	2	Gold Coast	10	2009	n/a
Peel Island, North	1	Inner Moreton Bay	2	2009	MNP , Ramsar
Peel Island, South	1	Inner Moreton Bay	3	2009	CP, Ramsar
Shag Rock, North	1	Outer Moreton Bay	6	2009	HP
Shag Rock, South	1	Outer Moreton Bay	6	2008	HP

Table 2. **Overview of all recorded impacts, hard coral cover, algae and silt levels for all 2011 RCA research sites**

	Drupella Scar	Unknown Scar	Anchor Damage	Other Coral Damage	Fishing Line	Fishing Net	General Trash	Coral Disease	Bleaching	% Hard Coral	Increase/decrease % coral from 2010?	Average MA Per 100m^2	NIA	Silt
Currumundi S1		X		X				X	X	26%	↑	<1	0%	Low
Currumundi S2	X	X		X	X		X	X	X	23%	↑	<1	0%	None
Inner Gneerings		X			X			X	X	25%	↑	0	0%	Low
Jew Shoal		X	X	X	X				X	16%	↓	1	3%	Low
Kings Beach										2%	↓	0	17%	Med
Little Halls Reef					X		X			4%	n/a	<4	13%	Med
Mudjimba Island		X		X	X		X		X	23%	↓	0	0%	Low
Goat Island		X		X	X		X	X	X	34%	↑	0	0%	Med
Macleay Island										11%	↑	<1	13%	Low
Myora Reef		X		X	X		X	X	X	40%	↑	0	2%	Low
North Peel Island		X		X		X		X	X	18%	↑	0	15%	Med
South Peel Island		X			X	X	X		X	9%	↓	0	33%	Med
Flat Rock, Shark Gulley	X		X	X	X			X		16%	↑	>7	4%	Low
Flat Rock, The Nursery	X	X		X			X	X	X	16%	↓	5	8%	Low
Flinder Reef, Aladdins Cave	X	X		X	X			X	X	23%	↓	<1	1%	Low
Flinders Reef, The Nursery S1		X		X					X	24%	↑	1	0%	None
Flinders Reef, The Nursery S3		X		X	X			X		56%	↑	>1	1%	Low
Shag Rock North	X		X	X	X			X		11%	↓	<1	24%	Low
Shag Rock South	X	X	X	X	X		X	X	X	11%	-	>1	14%	Low
Palm Beach Reef	X	X			X			X	X	13%	↓	0	3%	None
Gold Coast SW wall					X		X			0%	n/a	>5	4%	High
Narrowneck Artificial Reef										0%	n/a	7	43%	Low

1.2 January 2011 Flood Event

Between January 12-14th 2011 a large proportion of South East Queensland including Brisbane was flooded. As a result of sustained heavy rain within the region, the Brisbane River broke its bank and carried ten million tonnes of sediment into Moreton Bay (Olds *et al.* 2012). This increased amount of sediment in the water column and increased turbidity levels within the Bay to the highest levels recorded in ten years of monitoring (Olds *et al.* 2012). This suspended mud can then settle out over corals habits within the bay, which can negatively impact on health condition and can result in coral bleaching or mortality. Surveys of the bay by Griffith University after the flood event indicated the extent of mud coverage had increased from 30% to 70% (Olds *et al.* 2012).

Initial studies by Griffith University have found that across the Bay, 2-10% of corals were affected by bleaching post flood. It should be considered however that not all areas of the Bay were equally affected by the flood event. The study conducted by Griffith also found that the flood effects on coral health within the Bay were spatially and temporally variable with no correlation to the flood plume.

Surveys in the 2011 season with Reef Check found the percentage of sites with bleaching to be 64%, an increase from the 56% of sites with bleaching in 2010. However the severity of bleaching at sites was a mixture of increases and decreases in the percentage of the population affected.

1.3 Trends and Patterns 2011

Coral Cover

Of the 22 existing sites that were surveyed in 2011, ten sites showed a slight increase in coral cover, eight sites had decreased coral cover and one site had fluctuating hard coral cover over the course of monitoring. Artificial structures form the basis of the other two existing sites, where hard coral growth has never been recorded. Excluding these two artificial sites, hard coral cover ranged from two to 56 percent across all monitoring sites, with most sites averaging between 15 and 25 percent cover (Figure 2).

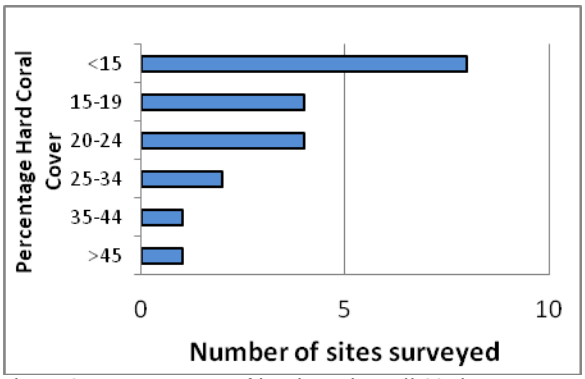


Figure 2. Percent cover of hard coral on all 22 sites monitored during 2011 survey season

Table 3: Percentage of RCA survey sites with recorded impacts in 2011 and the highest and lowest abundance recorded of these impacts.

Impacts	% of sites with impact	Highest Abundance (per 100m^2)	Lowest Abundance (per 100m^2)
Bleaching (% population)	64	10	0.25
Coral Damage (unknown cause)	64	3.25	0.25
Coral Damage (anchor)	18	2	0.25
Coral Disease	59	3.5	0.25
Drupella Scars	32	0.5	0.25
Fishing line	68	14.75	0.25
Marine Debris	41	6.25	0.25
Unknown scars	68	4	0.25

Reef Health Impacts

Throughout the season, coral bleaching was observed at fourteen sites, this is an increase from the nine sites where bleaching was found in the 2010 season. The January 2011 flooding event may have increased coral stress at some locations. Cold water stress may be an attributing factor as well, as most surveys completed during the winter months (with reported water temperatures between 15 to 18°C).The maximum recorded bleaching level was ten percent of the hard coral community at Currumundi Reef, however most sites had less than one percent impact across the hard coral community.

Coral disease was also recorded at fourteen sites, with the highest reported incidence of less than 4 counts per $100m^2$. Many sightings appeared to be white syndrome.

Drupella sp. (coral-eating snails) were recorded at seven sites, but generally in fairly low abundance (<$2/100m^2$ on all transects). *Drupella* scarring was recorded at seven sites (with maximum reported scars <$1/100m^2$ for any survey).

Most surveys reported hard coral damage (n=15); some sites with as little as one incident and some sites averaging more than $3/100m^2$. Coral scarring from unknown causes was also relatively common and was recorded at 17 sites, ranging from just one scar to as many as $4/100m^2$.

Discarded fishing line was observed at fourteen different sites, with maximum counts reaching $15/100m^2$ on one survey at the Gold Coast Seaway. Other assorted rubbish was discovered at eight survey sites, including items such as bottles, fish cages and car tyres.

Several sites, including Flat Rock (Shark Gulley), Shag Rock South and Currumundi (Site 2) reported simultaneous disease, Drupella snails, fishing line, unknown damage and scarring.

Invertebrate Abundance

Invertebrate surveys were conducted at 21 out of the 22 surveys completed. An invertebrate survey was not carried out at Macleay in 2011 due to poor visibility.

Table 4 illustrates that anemones and sea urchins were the most common target invertebrate sighted on surveys, with high counts of *Diadema* sp. urchins (≥$9/100m^2$) at Palm Beach Reef sites and Shag Rock sites. High abundances of pencil urchins (≥$16/100m^2$) and anemones (≥$25/100m^2$) were also found at Palm Beach Reef, which were much higher than any other SEQ site. Banded coral shrimp were reported at Myora and Mudjimba Island.

Fish Abundance

Fish abundance surveys were conducted on six out of the 23 surveys completed in the 2011 season.

Butterfly fish and snapper were the most commonly recorded fish groups in SEQ, as well as parrotfish and sweetlips (Table 5). Additional indicator fish species are currently being reviewed for inclusion in RCA SEQ surveys.

Table 4. *Comparison of total target invertebrate abundances for all 2010 RCA research sites (*empty cell is zero count, for ease of viewing)

	Anemone (All spp.)	Banded Coral Shrimp (*S. hispida*)	Collector Urchin (*Tripneustes* spp.)	COTS (*A. planci*)	*Drupella* spp. snails	Giant Clams (*Tridacna* spp.)	Lobster, Spiny & Slipper (*Scyllarides, Ponulris* Spp.)	Long-spined black sea urchins (*Diadema* spp.)	Pencil Urchin (All spp.)	Triton (*Charania* spp.)	Trochus (*T. niloticus*)	Sea Cucumber: Pinkfish (*H. edulis*)	Sea Cucumber: Prickly Greenfish (*S. chloronatus*)	Sea Cucumber: Prickly Redfish (*T. ananas*)
Currumundi Reef Site 1	20													
Currumundi Reef Site 2	12													
Inner Gneerings						1								
Jew Shoal														
Kings Beach														
Little Halls Reef		1							2					
Mudjimba Island		1				3								
Goat Island														
Myora Reef		2			7			5						
Peel Island (North)														
Peel Island (South)														
Flat Rock, Shark Gulley	9				1	4		18	1					
Flat Rock, The Nursery	9				3	1		3						
Flinders Reef, Aladdins Cave					2	3								
Flinders Reef, The Nursery (Site 1)						5								
Flinders Reef, The Nursery (Site 3)	1							2						
Shag Rock (North)	2				5	1	5	38						
Shag Rock (South)	9				7	2		24						
Palm Beach Reef	101							38	65					
Gold Coast South West Wall	1		5					1						
Narrow Neck Artificial Reef														

Table 5. *Comparison of total target fish abundance for all 2010 RCA research sites (*empty cell is zero count, for ease of viewing)

	Barramundi cod (*Cromileptes altivelis*)	Bumphead parrot (*Bolbometopon muricatum*)	Butterfly fish (*Chaetodontidae*)	Coral trout >30cm (*Plectropomus spp., Variola spp.)*	Grouper >30 cm (*Serranidae*)	Humphead wrasse (*Cheilinus undulates*)	Moray eel (*Muraenidae*)	Parrotfish >20cm (*Scaridae*)	Queensland Grouper (*Seranidae*)	Snapper (*Lutjanidae*)	Sweetlips (*Haemulidae*)
Currumundi Reef S1							4			4	1
Currumundi Reef S2			3				3			3	
Flat Rock, Shark Gulley			36					6			
Flat Rock, The Nursery			19					4		67	3
Shag Rock North			7					4		26	1
Shag Rock South			13							3	3

2.0 Sunshine Coast Sites

Sunshine Coast Sites

The seven Sunshine Coast sites averaged 17 percent hard coral cover, with actual cover ranging from 2 to 26 percent. There were equal numbers of sites with increases and decreases in hard coral coverage, however Kings Beach showed a marked decrease in hard coral coverage, decreasing by 12.5%.We also surveyed a new site called Little Halls Reef for the first time in 2011.

2.1 Currimundi Reef, Site 1

This site comprises an exposed rocky outcrop that is not frequented by divers, fishers or boaters. Hard coral cover has increased at this site since 2009 by 5%, to almost 23 percent cover. The predominant growth form at this site is still encrusting. Soft coral coverage has decreased by 8%, to 15% coverage, with the leathery growth forms remaining the dominant form. The only growth form of sponge that exists at the site, encrusting, has decreased from 8% to less than 1% cover. The percentage of rock with turf algae has increased from 37% to 44%. Siltation levels were low.

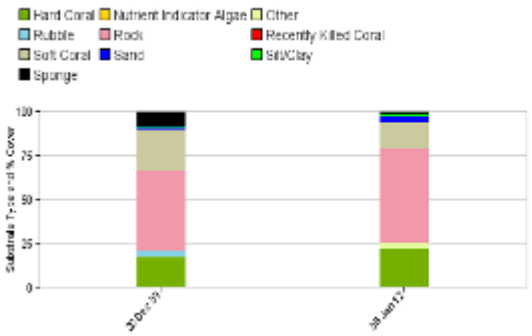


Figure 3: Substrate type and percent cover at Currimundi Reef medium: Site 1: Rocky outcrop

The only recorded invertebrates at the site were anemones, with 20 individuals recorded. This is a sharp increase from the one sole anemone observed in 2009.

There were no *Drupella* snails observed this year, compared with three found in 2009. Three coral scars were recorded over the entire transect and one instance of coral damage was observed. In 2009 only one scar was recorded as well as three *Drupella* scars, but no coral damage was observed. This year found an average of 10% bleaching of the hard coral communities per 100m^2 with an average of more than 30% of the surface of the hard corals affected per 100m^2 in contrast to no bleaching in 2009.

The fish survey conducted at this site in 2011 recorded a total of one sweetlips, four snapper and 4 moray eels over the entire transect.

Photo 1. Currimundi Reef, Site 1

2.2 Currimundi Reef, Site 2

The second survey site at Currimundi Reef showed an increase in hard coral cover of 2%, to a total of 25% cover. Growth forms were found to be generally encrusting (>75%). Soft coral cover decreased dramatically by 11% from almost 20 percent cover to just 7%, with the percentage of leathery soft coral growth forms remaining constant. A decrease in other soft coral growth forms and zooanthids was noted.

Most of the rock that was observed was covered with turf algae (41%), although the percentage cover of rock covered with calcareous algae increased to 12%.

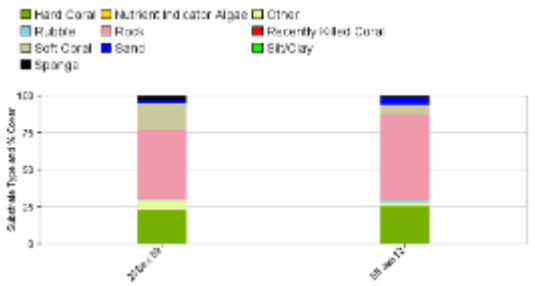


Figure 4: Substrate type and percent cover at Currimundi Reef: Currimundi Reef: deep: Site 2: Rocky outcrop

Three anemones were recorded along the 100m^2 transect but no *Drupella* were observed at this site. In comparison, one was observed in 2009. A total of three scars from unknown causes were also recorded on the survey, compared to two in 2009. One count of coral damage was also recorded as well as one count of fishing line and one of trash.

In 2009 no instances of coral bleaching or disease were recorded at this site, but in 2011 there was an average of 6.25% hard coral bleaching per 100m^2 with an average of 48% of the colony affected per 100m^2. There was an average disease count of 1 per 100m^2 of recorded in 2011.

The fish survey conducted in 2011 counted three snapper, three sweetlips and three moray eels over the entire transect.

Photo 2. Currimundi Reef, Site 2

2.3 Inner Gneerings, The Caves, Site 1

This reef is located just off shore from Mooloolaba and covers an extensive area ranging in depths from 10 to 25m. The area is heavily used for boating and some recreational fishing and diving.

Hard coral cover increased slightly from 23 percent to 25 percent. Soft coral coverage showed slight increase from 3 percent to 4 percent, but is still below the amount recorded in 2009 of 13 percent. No macro algae was recorded in 2011 similar to 2009. Abundance in turf algae continue to occur, but increased by almost 20 percent.

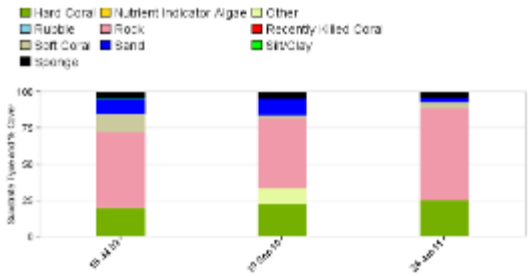


Figure 5: Substrate type and percent cover at Inner Gneerings: The Caves: medium: Site 1: Rocky outcrop

Only one giant clam was sighted in 2011 and no *Drupella* snails were found. A total of 2 instances of coral disease were found as well as four discarded fishing lines. Bleaching was also recoded at the site with less than 1% affecting the community and but the colonies affected had a surface bleaching of less than 10%.

Photo 3. Inner Gneerings, The Caves, Site 1

2.4 Jew Shoal, Pinnacles, Site 1

We returned to this site on the Sunshine Coast in 2011. Close to the Noosa River, the site consists of a large pinnacle with a wall along one edge. This is a major fishing site and a relatively popular boating location.

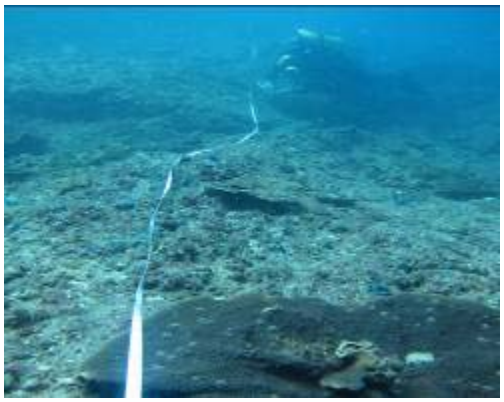


Photo 4. RCA surveyor at Jew Shoal, Site 1

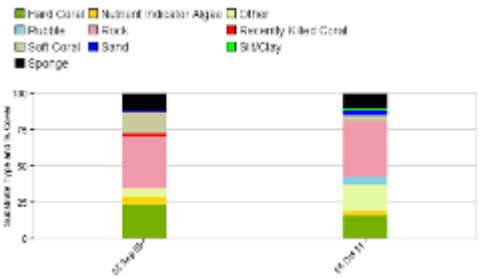


Figure 6: Substrate type and percent cover at Jew Shoal: The Pinnacles (The Pin): medium: Site 1: Rocky outcrop

The site had an 8% decrease in hard coral cover from 24 percent to 16 percent. The hard coral was made up of 75 percent encrusting coral and 10 percent branching, foliose coral forms were not found in 2011 compared to 15% in 2009. There was a ten percent decrease in soft coral cover (65 percent leathery) and consistent coverage of ten percent sponge. Almost all of the 35 percent rock substrate was covered with turf algae.

No indicator invertebrates were recorded.

The site had an average of less than one incidents of scarring per 100m^2 the same as in 2010(Photo 15). There were two counts of coral damage over the whole survey. Coral bleaching was seen on less than one percent of colonies, impacting around seven percent of each colony surface. Numerous discarded fishing lines were sighted but less than in previous years(>1/100m^2, Photo 16).

Photo 5. Unknown coral scars

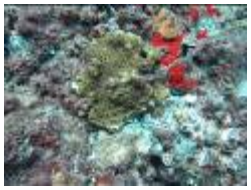
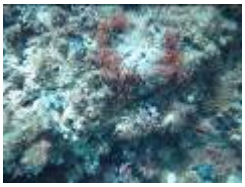


Photo 6. Fishing line



2.5 Kings Beach, Site 1

This site was heavily impacted by the 2011 floods due to its proximity to the coast. The site is located just a few hundred meters offshore, adjacent to a boat ramp.

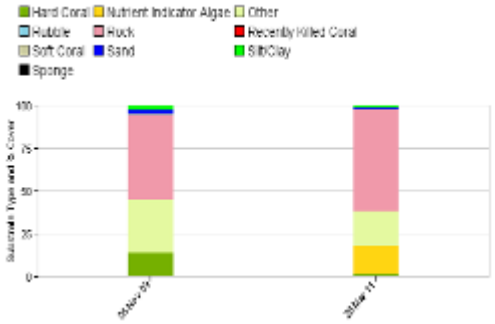


Figure 7: Substrate type and percent cover at Kings Beach: Kings Beach Reef: shallow: Site 1: Fringing reef seaward

Hard coral decreased to less than 2 percent of the transect from 15 percent. More than 50 percent of this was bleached coral and the rest was in the general hard coral (HC) category (Photo 17). More than 20 percent of the transect was made up of the RCA “other” substrate category (the vast majority of this being colonial ascidians, Photo 17). Almost fifty percent of the transect recorded rock, more than 95 percent covered with turf algae.

Photo 7. Site photo Kings Beach

Invertebrates included an average of two *Drupella* snails, less than one *Diadema* urchins over each 100m^2, two lobsters were also found on the survey in 2011. One incident of coral damage was seen in total.

2.6 Little Halls Reef, Site 1

Little Halls Reef is a new site for 2011. It was established because it is close to the mouth of the Noosa River and to expand our coverage of the Sunshine coast.

This site has 4% hard coral coverage. With the site more dominated by sand and rock with turf algae (19% each). There was 14% nutrient indicator algae and no soft corals at this site.

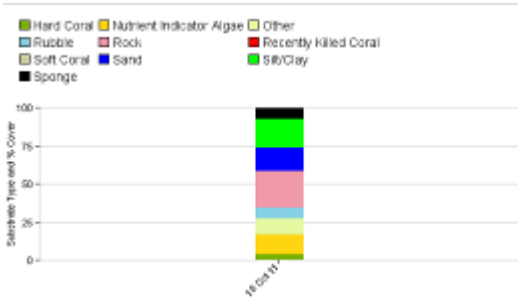


Figure 8: Substrate type and percent cover at Little Halls Reef: medium: Site 1

One banded coral shrimp and two pencil urchins were found across the whole transect.

Surveyors found less than three counts of fishing line per 100m^2 and less than one count of trash per 100m^2. There were no sightings of bleaching or disease.

Photo 8. Little Halls Reef, Site 1

2.7 Mudjimba Island, Site 1

The fringing reef around the island is close to the mainland and near the Mooloolah River mouth. The island has been deemed as a conservation zone for cultural reasons, although marine-based activities are not restricted.

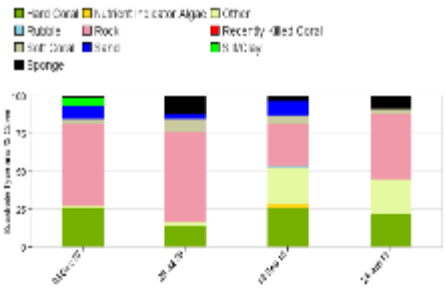


Figure 9: :Substrate type and percent cover at Mudjimba Island: Mudjimba Island: medium: Site 1: Fringing reef leeward

After a slight increase in coral cover in 2010 coral cover has decreased in 2011 (from 26% down to 23%). The percentage of encrusting coral increased and makes up the majority of the coral seen (90%), foliose and plate corals make up the remaining 10%.

Photo 9. Mudjimba Island, Site 1

Increases were seen in the cover of sponge (up from 3% to 8%) but a slight decrease in the cover of soft coral (up from 5% to 4%). All rock surfaces were covered with turf algae.

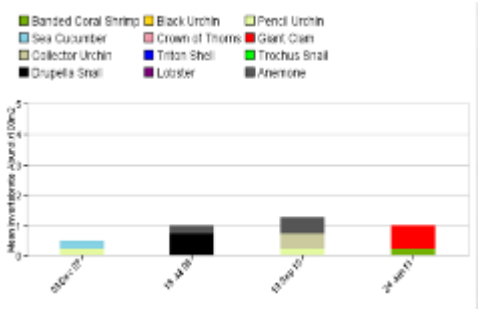


Figure 10: Mean abundance of invertebrates at Mudjimba Island: Mudjimba Island: medium: Site 1: Fringing reef

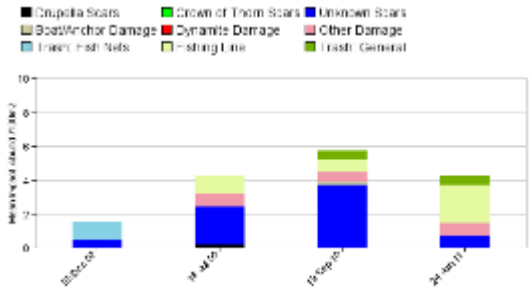


Figure 11: Mean abundance of impacts at Mudjimba Island: Mudjimba Island: medium: Site 1: Fringing reef leeward

Incidents of discarded fishing line increased to more than 2/100m^2 from less than 1/100m^2 in 2007. Coral scars increased from >3/100m^2 in 2010 to <1/100m^2. Coral damage remained constant from 2010 (n=3). There was a small amount of coral bleaching seen, affecting less than one percent of all hard corals, averaging 7 percent of the surface of impacted colonies.

Photo 10. Fishing line

Photo 11. Cleaner Shrimp

The composition of RCA indicator invertebrates has changed over the four years of surveying at this site. In 2011 the only invertebrates seen were one banded coral shrimp and three giant clams.

*3.0 M*oreton Bay Sites

RCA survey teams monitored five inshore sites within Moreton Bay. These sites may be exposed to coastal impacts and often showed heavier siltation levels than off-shore sites, although many inshore sites also have extensive coral cover. The inshore sites ranged from nine to 40 percent hard coral cover, with an average of 23 percent across all sites. The seven sites located offshore from Moreton Bay had an average of 22 percent hard coral cover, with some sites having cover as low as 11 percent, and other sites with extensive hard coral cover (56%).

Inshore Sites

3.1 Goat Island, Site One

Goat Island was established in 2009 as a site due to the recognition as an important inshore site, with historical communities of diverse hard coral species (Fellegara, 2008). There is high boat traffic in the area and the ferries to North Stradbroke Island travel in close proximity to the island. Recreational fishing levels are considered mid-range. The transect area at Goat Island is a shallow, sheltered coral habitat fringing the island.

Photo 12. Goat Island, Site 1

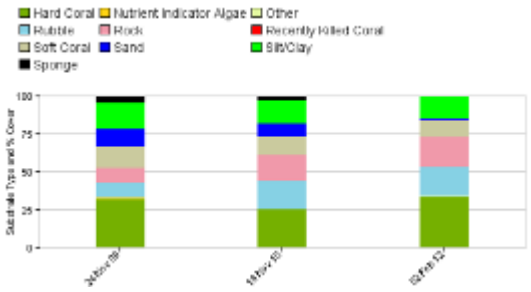


Figure 12: Substrate type and percent cover at Goat Island: Goat Island: shallow: Site 1: Fringing reef

After a decrease in 2010 of hard coral cover in 2011 it had increased to more than was found in 2009 at 34 percent of the transect area and soft coral decreased slightly to 11 percent. All of the recorded soft coral was leathery. There is heavy siltation at this site, accounting for 13 percent of the substrate surveyed and evidenced on top of many corals.

The incidents of coral damage remained constant from 2012 at 2 per 100m^2. Coral scars from unknown causes were recorded in higher abundances than 2012 at almost 3 per 100m^2 during the survey. Some bleaching was recorded, representing slightly more than four percent of the population, impacting about 45 percent of the surface of each affected colony.

Photo 13. Bleached hard coral

No RCA indicator invertebrates were recorded during the survey.

3.2 Macleay Island, Site 1

This is a shallow fringing site inshore Moreton Bay. The site is close to a pier utilized for fishing but does not experience extensive boat traffic. More than fifteen percent of the substrate cover was soft coral, mostly ornate (80%). Hard coral accounted for 11 percent of substrate cover increasing by 1% from 2012; 50 percent of this consisted of massive coral growth forms. The average macro algae count was <1/100m^2 (mostly *Padina* and *Asparagopsis*). All of the rock substrate was covered with turf algae. There was heavy suspended siltation at this site.

Only a substrate survey was completed at this site due to low visibility.

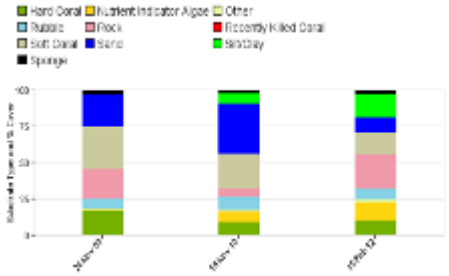


Figure 13: Substrate type and percent cover at Macleay Island: Macleay Island: shallow: Site 1: Fringing reef

Photo 14. Macleay Island, Site 1

3.3 Myora Reef, Site 1

This is a shallow reef in Moreton Bay, close to North Stradbroke Island. There is 40 percent hard coral cover an increase of more than 1% from 2010, mostly general hard coral growth forms (*Acropora*). Eighty percent of rock surfaces were covered with turf algae. In March 2009, the area was established as a MNP (green) zone.

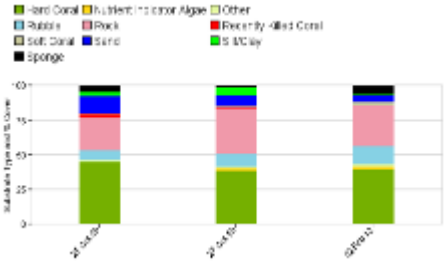


Figure 14: Substrate type and percent cover at Myora Reef: Myora Reef: shallow: Site 1: Fringing reef

No indicator invertebrates were found in 2011.

Coral scars were recorded at two scars per 100m^2. Two accounts of coral damage were recorded, along with one discarded fishing line which is a large decrease from 2010 but similar to 2009.

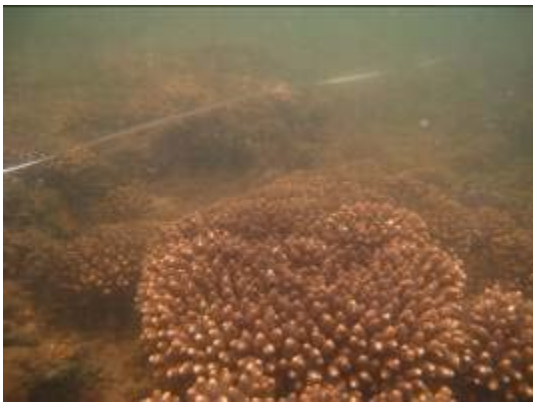


Photo 15. Myora Reef, Site 1

There were no RCA indicator invertebrates found at this site in 2011.

Low levels of bleaching were seen, impacting 40 percent of each colony surface on average, but representing less than two percent of the overall population (Photo 25). Discarded fishing line was found less than once per 100m^2 (Photo 26) and other rubbish was found in approximately the same abundance, discarded fishing nets were found in an abundance of once per 100m^2.

Photo 16. Hard coral bleaching

Photo 17. Cowrie

3.4 Peel Island North, Site 1

This is a new shallow site inshore Moreton Bay. The northern area of Peel Island is an established MNP (green) zone but it is an area with heavy boat traffic.

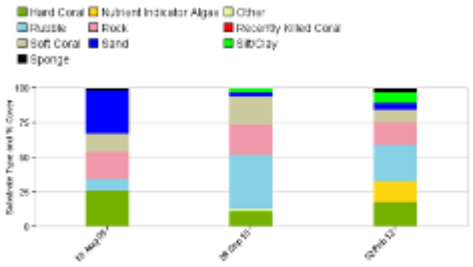


Figure 15: Substrate type and percent cover at Peel Island: North Peel: shallow: Site 1: Fringing reef

The site had 18 percent hard coral cover recorded, which is an increase by more than 5% from 2010 but ten percent less than in 2009.There was coverage of about ten percent soft coral which is a ten percent decrease from 2010 but similar to that found in 2009. Hard coral fell mostly into the categories of massive, encrusting or general HC. Rock covered with turf algae made up around 15 percent of the transect. Siltation levels were mid-range and could be seen accumulating on macro algae surfaces.

No RCA indicator species were found in 2011 survey. There was one count of coral damage and an average of more than 2 per 100m$^{2.}$ There was one fishing net found on the survey. There was less than 1 disease counted per 100m^2. There was bleaching found on less than 3% per 100m^2 of all the colonies and those colonies were affected by an average of 33 per 100m^2.

Photo 18. North Peel Island, Site 1

3.5 Peel Island South, Site 1

This is a shallow site inshore Moreton Bay on the south eastern side of Peel Island. This area is a Conservation Park (yellow) zone and sees high boat traffic and fishing use.

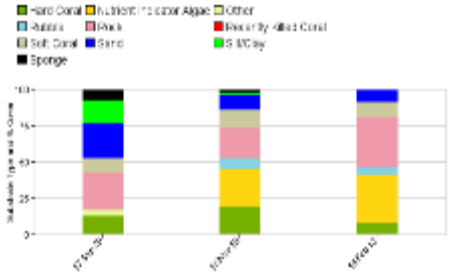


Figure 16: Substrate type and percent cover at Peel Island: South Peel: shallow: Site 1: Fringing reef

Hard coral cover on this side of Peel Island remains less abundant compared to the northern side, with 8 percent cover recorded, this is a decrease from the 20% recorded in 2010. Coral growth forms were mostly encrusting and massive. There was no sponge recorded and only 10 percent soft coral growth, with three quarters of soft coral being leathery growth forms. This is a 2% decrese from 2010 but more than was found in 2009. Rock covered with turf algae accounted for a third of the substrate cover but is less than found in previous years.

Photo 19. South Peel Island, Site 1

Moreton Bay Offshore Sites

3.6 Flat Rock, Shark Gulley, Site 1

We returned to this popular recreational diving and boating site on the southern side of Flat Rock in 2011. This site was declared a Marine National Park (MNP) zone in 2009 and is also a Grey Nurse Shark Protection Area.

Compared to the previous year's survey, hard coral cover increased by 1% to 16 percent with very little soft coral or sponge observed. More than half of the hard coral that was observed was encrusting growth form. The majority of other corals were branching and the sponges that were recorded was all encrusting. A fair amount of macro algae, mostly *Lobophora* and *Asparagopsis* was also recorded (7/100m^2). Almost all rock surfaces were covered with turf algae in similar percentages to that recorded in 2009.

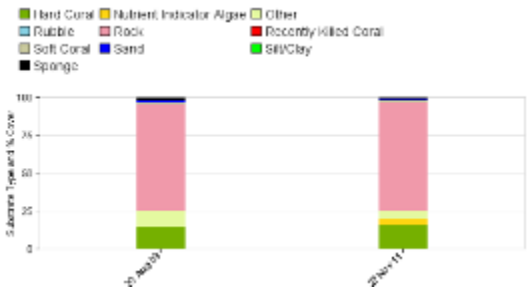


Figure 17: Substrate type and percent cover at Flat Rock Island: Shark Gulley: medium: Site 1: Fringing reef seaward

There was an increase in the number of all the RCA indicator invertebrates recorded during the survey in 2011 compared to 2009. This included *Diadema* urchins (from 3/100m^2 to <4/100m^2), anemones from <1/100m^2 to >2/100m^2 and an increase from one giant clam to four. One pencil urchin was also recorded on the survey. The incident of coral damage increased from 1 to 3 per 100m^2. The counts of coral scars increased from <1 to 4 per 100m^2, with 1 *Drupella* scar

from one recorded snail counted over the entire survey. Counts of disease were >1 per 100m^2 compared to no disease sighted in 2009.

There were nine butterfly fish and more than 1 parrotfish per 100m^2 on average across the transect.

Photo 20. Flat Rock, Shark Gulley, Site 1

3.7 Flat Rock, The Nursery, Site 1

This site is surrounded by fringing coral and is a regular dive site for commercial operators. The area was rezoned in March 2009 and is now a MNP (green) zone. It is also a Grey Nurse Shark Protection area.

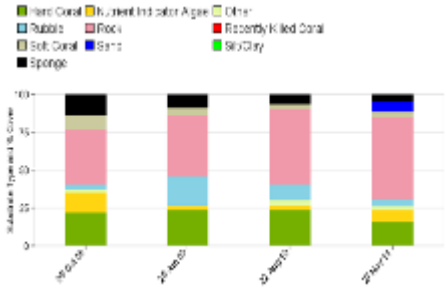


Figure 18: Substrate type and percent cover at Flat Rock: Nursery: medium: Site 1: Fringing reef

Hard coral cover at this site decreased by 10% this year from the consistent levels seen since 2008, with coverage decreasing to 16 percent. Rubble decreased to just 5% almost as low as those found in 2008. Nutrient indictor algae increased by 6% to 8%. Soft coral cover remained at a low 3%. Macro algae abundance increased from 2010 but is lower than in 2008 at 5 counts per 100m^2. As recorded in previous surveys, most hard coral was encrusting (13%), but other hard coral growth forms was found in small amounts (<2%). Turf algae growing on rock surfaces accounted for 41% of the cover but corraline algae on rock surfaces has increased by 10% since 2010.

Photo 21. Flat Rock, The Nursery, Site 1

Figure 19: Mean abundance of invertebrates at Flat Rock: Nursery: medium: Site 1: Fringing reef

After an increase in the number of recorded invertebrates found in 2010 it decreased in the 2011 survey. *Diadema* (previously <5/100m^2) and pencil urchin (previously <1/100m^2) decreased to one each in 2009. Three *Drupella* snail were sighted as well as one giant clam. More than two anemones were seen per 100m^2 (Photo 30).

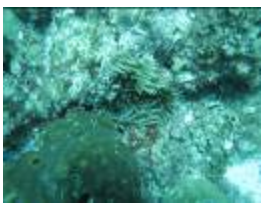


Photo 22. Anemone

Photo 23. Hard coral bleaching

Impacts on this site included coral damage (>3/100m^2, Photo 31), coral scars (>1/100m^2) and disease (<1/100m^2). Coral

bleaching was recorded; impacting 17 percent of each colony surface but less than one percent of the overall hard coral population. One piece of marine debris was recorded.

Recorded fish abundances showed a increase in butterfly fish (from 2/100m^2 to more than 4/100m^2), but an decrease in sweetlips (from more than 2/100m^2 to less than 1/100m^2).Large numbers of snapper were seen on the survey (16/100m^2) compared to none sighted in 2010. One parrotfish per 100m^2 was also sighted in this year's survey.

3.8 Flinders Reef, Aladdin's Cave, Site 1

Flinders Reef is a MNP zone, but is a frequented diving and boating location and there are reports of fishers utilising the area. Anchor damage is a concern at this site, as there are no mornings.

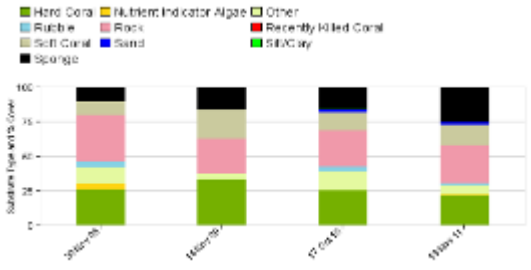


Figure 20: Substrate type and percent cover at Flinders Reef: Aladdin's Cave: medium: Site 1: Fringing reef seaward

The percent cover of hard coral cover decreased a further 3% since the last survey (to 22%). On the same transect, nutrient indicator algae and bare rock increased slightly while soft coral increased (from 13% to 15%). Almost half of the soft coral category cover consisted of ornate forms. Sponge cover also increased (from 15% to 25%) and almost all was encrusting. Rock substrate previously covered with turf algae increased to 80 percent. Macro algae averaged less than 1/100m^2 (mostly *Asparagopsis*).

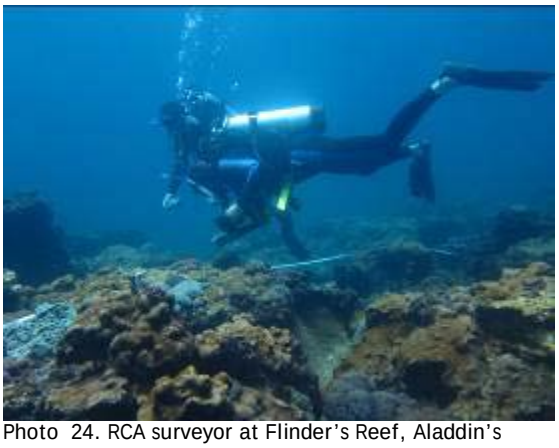


Photo 24. RCA surveyor at Flinder's Reef, Aladdin's Cave, Site 1

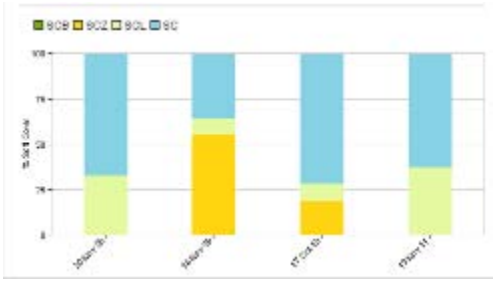


Figure 33: Soft coral type and percent cover at Flinders Reef: Aladdin's Cave: medium: Site 1: Fringing reef seaward

Three giant clams were recorded on the transect. There was a decrease in reporting of coral damage (from >3/100m^2 to 1/100 m^2) and unknown scars (from >3/100m^2 to 1/100 m^2) compared with 2010. Two *Drupella* snails were sighted along with one count of *Drupella* scars. Five accounts of coral disease were recorded along with 1% bleaching average of the community and more than 6% bleaching to the surface of those colonies.

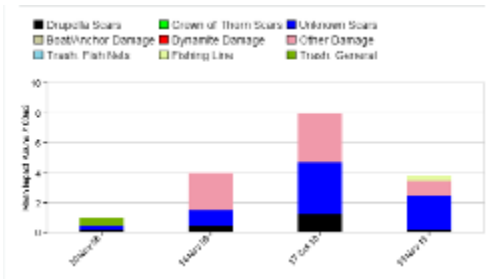


Figure 21: Mean abundance of impacts at Flinders Reef: Aladdin's Cave: medium: Site 1: Fringing reef seaward

Butterfly fish abundance remained the same from 2010 at eight individuals per 100m^2. Snappers were not seen this year, but sweetlips were spotted in the same abundance as 2010(<1/100m^2).

Photo 25. Flinder's Reef, Aladdin's Cave, Site 1

3.9 Flinders Reef, The Nursery, Site 1

This site has been surveyed annually since 2007. Over this time hard coral cover has fluctuated, this year showing similar levels to that found in 2008, around 23 percent, but overall showing an increase in coral cover since 2007 (12%). Branching coral forms have shown a decrease since 2007, although encrusting and plate growth formations have increased. Sponge cover has increased from two to six percent. Nutrient indicator algae that were recorded in 2008 were not seen this year (possibly a seasonal variation). Most organisms in the RCA "other" category were colonial ascidians (Photo 43). Macro algae levels have fluctuated over time, with this year more than the zero found last year (1/100m^2 but lower than 9/100m^2 in 2008)—again potentially due to seasonal variation. Rock substrate is generally covered with turf algae (13%).

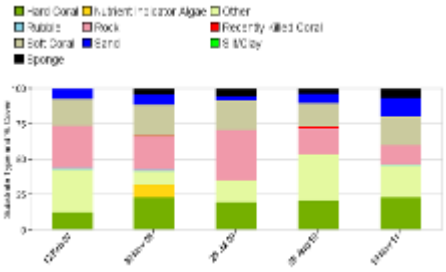


Figure 22: Substrate type and percent cover at Flinders Reef: Nursery: medium: Site 1: Fringing reef leeward

Photo 26. Drupella

Photo 27. Giant clam

Invertebrate abundances have been generally low at the site over the three year monitoring period; only giant clams (n=5) were recorded this year (Photo 44). There were recorded accounts of coral damage (2/100m^2) and coral scars (<1/100m^2). Bleaching remains at consistent low levels of <1% over the entire population per 100m^2 and each colony being affected by 40%.

A fish survey was not conducted in 2011.

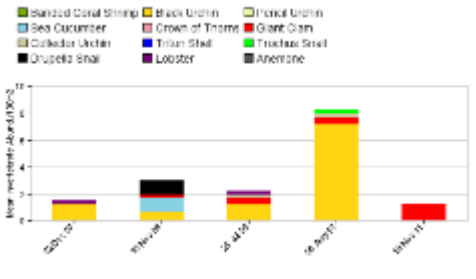


Figure 23: Mean abundance of invertebrates at Flinders Reef: Nursery: medium: Site 1: Fringing reef leeward

Photo 28. Bleaching at Flinder's Reef, Site 1

3.10 Flinders Reef, Nursery, Site 3

This site had an increase from 36 percent to 56 percent hard coral cover and a small amount of soft coral (3%). Nearly all the hard coral recorded was branching (99%). Half of the rocky substrate was covered with turf algae and large portion was covered with coralline algae (40%), this is an increase in coralline algae from 2009 and a decrease in the percentage of turf algae.

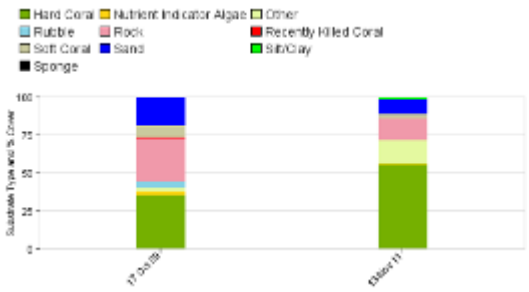


Figure 24: Substrate type and percent cover at Flinders Reef: Nursery: medium: Site 3: Fringing reef leeward

Anemones were found at abundances of less than one per 100m^2. Other invertebrates included two *Diadema* urchins but the giant clam recorded last time was not recorded in 2011.

One scar per 100m^2 were recorded, as well as more than one incidents of coral damage per 100m^2. One discarded fishing line was found. More than three counts of disease were recorded per 100m^2.

A fish survey was not conducted on this survey due to team constraints.

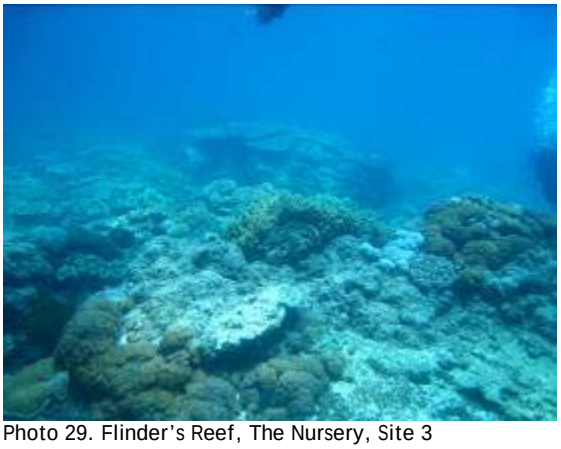


Photo 29. Flinder's Reef, The Nursery, Site 3

3.11 Shag Rock North, Site 1

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

Hard coral cover (10%) decreased by 4% from the data gathered from last season, and included mostly branching coral. Siltation levels decreased dramatically from an average of 30 counts per 100m² in 2009 to zero counts last year and has increased slightly to more than one count per 100m^2 recorded this season. In addition, Macro algae counts decreased from an average of 3/100m^2 (*Lobophora* and *Ulva*) to zero counts but has increased to less than 1/100m^2 this year. Nutrient indicating algae was found to cover 24% of the substrate which is down from more than 35% in 2010.

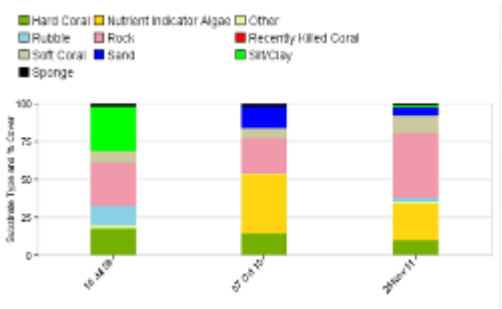


Figure 25: Substrate type and percent cover at Shag Rock Island: Shag Rock North: medium: Site 2: Fringing reef

Diadema urchins has remained abundant (10/100m^2) but 2011 saw one giant clam and five lobsters over the survey, as well as an anemone (<1/100m^2) and *Drupella* snails (< 2/100m^2).

Boat damage (<1/100m^2) and other unknown causes of coral damage (>1/100m^2) were found on the transect along with discarded fishing line (<1/100m^2) and trash (<1/100m^2). Numbers of *Drupella* scars have increased less than one found per 100m² along with other coral scars (<1/100m^2).More than two counts of disease were found per 100m^2 which is an increase from previous years.

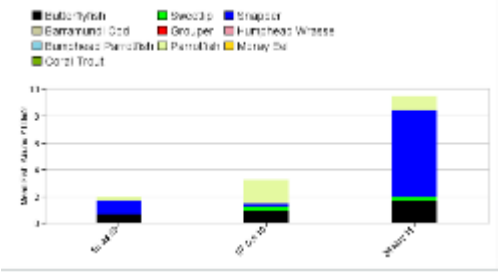


Figure 26: Mean abundance of fish at Shag Rock North: Site 1 Fringing reef leeward

A fish survey was conducted finding Snapper (<6/100m^2), butterfly fish (1/100m^2) and parrotfish (<2/100m²) were also recorded on transect, this is an increase in snapper from previous years (Figure 26).

Photo 30. Shag Rock North, Site 1

3.12 Shag Rock South, Site 1

This site shows a consistent cover in hard coral cover at more than 11% but an increase in soft coral from 10 to 15 percent (mostly ornate) since 2010 (Figure 27). Hard coral includes mostly branching coral, foliose with some encrusting coral and massive hard coral categories. Nutrient indicator algae increased slightly (from 10% to more than 13%) with 50% bare rock (85 percent covered with turf algae). Macro algae counts averaged more than 1/100m^2 for the transect (mostly *Lobophora*).

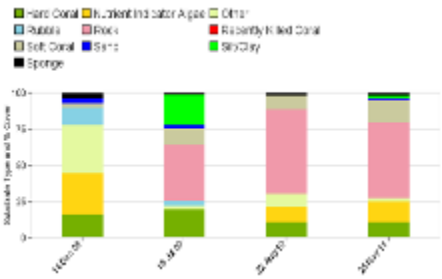


Figure 27: Substrate type and percent cover at Shag Rock Island: Shag Rock South: medium: Site 1: Fringing reef

Diadema abundance decreased from more than 34 per 100m^2 to just 6 per 100m^2. Abundances of both pencil urchins (seen in 2008) remain at zero and *Drupella* snails seen have increased to >1/100m^2 in 2011 (Figure 28). Two giant clams were recorded (Photo 31).

Photo 31. Giant clam

Photo 32. Coral bleaching

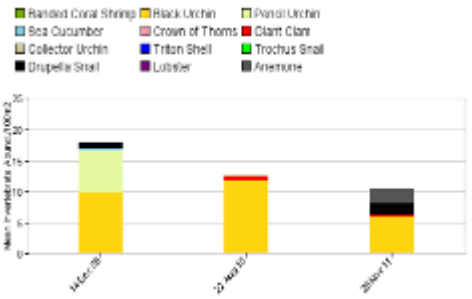


Figure 28: Mean abundance of invertebrates at Shag Rock Island: Shag Rock South: medium: Site 1: Fringing reef

Unknown coral damage increased since the 2010 survey n=0 to one accounts per 100m^2. More than 2/100m^2 accounts of coral disease were recorded. There was less than one coral scar per 100m^2 and less than one *Drupella* scar per 100m^2. There were three counts of discarded fishing line and two counts of trash.

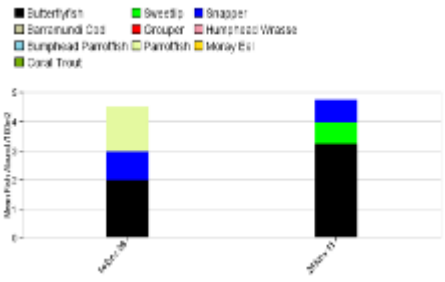


Figure 29: Mean abundance of fish at Shag Rock Island: Shag Rock South: medium: Site 1: Fringing reef

Record numbers of butterflyfish were seen in 2011 (up to more than 3/100m^2 from the previous record 2/100m^2 in 2008). Less that one sweetlips and snapper were seen per 100m^2 (Figure 29).

Photo 33. Shag Rock South Site 1 Site photo

4.0 Gold Coast Sites

Gold Coast Sites

As many reefs within the Gold Coast region surpass RCA depth limits of 12m; only one reef is monitored by RCA in this area. This site has an average of 13 percent hard coral cover.

RCA also monitored two artificial reef structures on the Gold Coast. These were chosen due to heavy human impacts and high community interest. No hard coral cover has been reported on these sites, but there is varied marine life found in these areas.

4.1 Palm Beach Reef, Site 1

This is a fringing reef made up of numerous ridges and gullies, close to the beach (800 to 1000m offshore). This site was first surveyed in 2007 and has shown fluctuations in hard coral cover over the three years of monitoring.

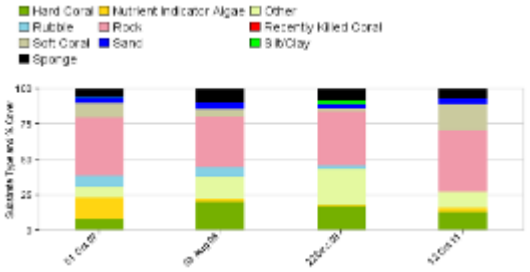


Figure 30: Substrate type and percent cover at Palm Beach Reef: Palm Beach Reef: medium: Site 1: Fringing reef seaward

Hard coral cover decreased slightly from 2010 levels (down from 17% to 13%). Recorded coral was encrusting, plate or general hard coral (HC). Most rock surfaces were covered with turf algae. Nutrient algae was up from 1% to 3% and rubble down from 2% to zero. Rubble has consistently decreased since 2007. Of note, hardly any of these anemones have resident anemone fish.

Photo 34. Anemone

Photo 35. Nudibranch

Anemones have almost halved in number from 2010 (from 50/100m^2 to 25/100m^2, Photo 46), as have pencil urchins (down from 22/100m^2 to 16/100m^2, Photo 47) since 2007. *Diadema* (up from 2/100m^2 to 9/100m^2) have increased since 2010 but *Drupella* have not been seen since 2007.

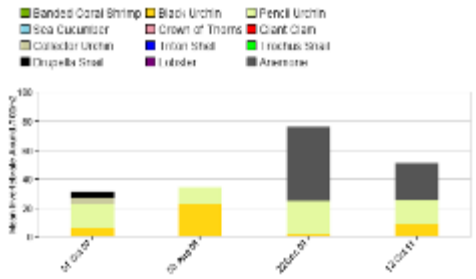


Figure 31: Mean abundance of invertebrates at Palm Beach Reef: Palm Beach Reef: medium: Site 1: Fringing reef seaward

The occurrence of coral scars has increased from zero to >2/100m^2 since 2010 when they dropped from 7/100m^2. There was one occurrence of fishing line and one sighting of disease. There was also some recorded bleaching affecting less than 1% of the community but each colony on average of less than ten percent.

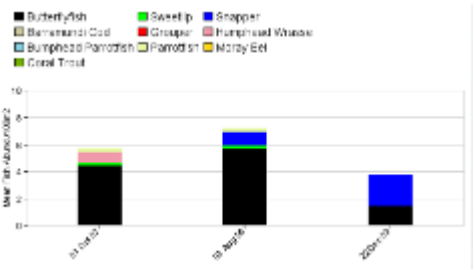


Figure 32: Mean abundance of fish at Palm Beach Reef: Palm Beach Reef: medium: Site 1: Fringing reef seaward

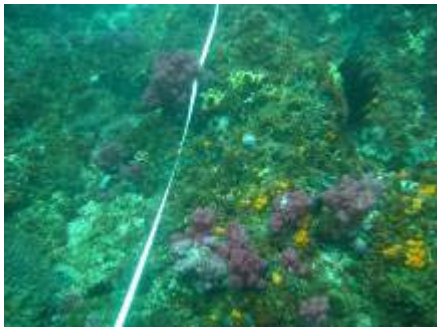


Photo 36. Palm Beach Reef transect, Site 1

4.2 Gold Coast Seaway Southwest Wall, Site 1

This is a shallow, sheltered site in the Gold Coast Seaway (built in 1971). Rocks on the constructed sea wall have created bare substrate for settlement. There is substantial silt loading, but numerous unique marine species are reported by divers and it is a popular dive location. There are high levels of boat traffic and urban influences.

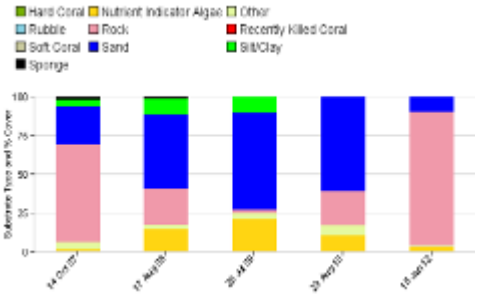


Figure 33: Substrate type and percent cover at Gold Coast Seaway Reefs: South-West Wall: medium: Site 1: artificial reef

No hard coral growth has ever been reported at this site. This site showed an move from sand dominated habitat (61% to 10%), to one dominated by rock covered by turf algae (21% to 78%).Nutrient indicator algae has shown fluctuations over the five years of monitoring since 2007 and is currently at a low level (11% to 3%). Macro algae increased to 5 counts per 100m^2 which is the third year of increase since a low in 2009(less than 1 count per 100m^2).

Photo 37. Southwest Wall, Site 1, site photo

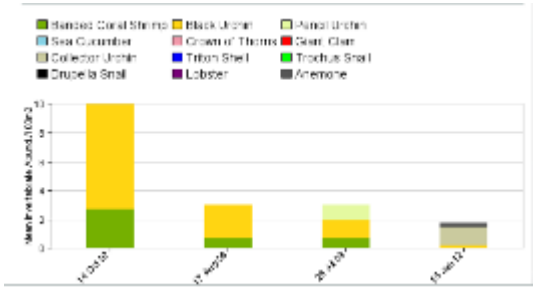


Figure 34: Mean abundance of invertebrates at Gold Coast Seaway Reefs: South-West Wall: medium: Site 1: Artificial reef

The mean abundance of *Diadema* (>1/ 100m^2) and banded coral shrimp (zero/100m^2) has decreased over the course of the five years and remained low. Collector urchins were found at an abundance of more than one per 100m^2 (Photo 50). One anemone was found on the transect which is the first record of one at this site in the five years of surveying. More than fourteen counts of discarded fishing line were recorded for each 100m^2 and more than 6 counts of trash per 100m^2.

Photo 38. Collector urchin

Photo 39. Surveyor photo

4.3 Narrowneck Artificial Reef, Site 1

This is an artificial reef only 300m offshore created from geotextile sand containers as a beach stabilization tool and surf break. The artificial reef averages about 5m in depth. Since its installation in the structure has reportedly grown numerous species of brown algae as well as hydroids, ascidians and crinoids (Edwards, 2003).

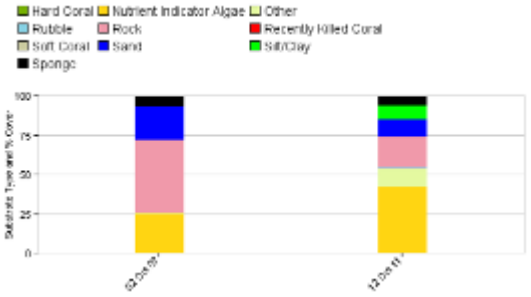


Figure 35: Substrate type and percent cover at Narrowneck Artificail reef: medium: Site 1

No hard coral has been recorded at this site in the several years of monitioring. The level of nutrient indicator algae has increased from 26% to 43% and there was one less count of macro algae per 100m^2 (down to 7 from 8 in 2007) but the macro algae was well established (including *Padina* and *Sargassum*). In 2011 we found our first record of kelp on a survey in SEQ. A small young example of *Ecklonia* was found (Photo 60. *Ecklonia*)

Photo 40. *Ecklonia*

Also of note is that the material on the geotextile bags is becoming unattached in

numerous locations (Photo 53). The loose substrate had very little biological growth, but added additional structural complexity; many fish seemed to seek shelter in these areas. No RCA indicator invertebrates or impacts were recorded during the survey.

Photo 41. Detached textile material

Four wobbegongs were sighted hiding in the folds of the material.

Photo 42. Wobbegong

Photo 43. Narrowneck Artificial Reef, Site 1

5.0 Literature Cited

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