Reef Check Australia

South East Queensland
Season Summary Report 2017-18

Reef Check Foundation Ltd. (Australia)
www.reefcheckaustralia.org

This report should be cited as: R. Mulloy, J. Salmond, J. Passenger and J. Loder (2018). South East Queensland Season Summary Report 2017-18. Reef Check Foundation Ltd.

REEF CHECK
AUSTRALIA

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

Thank you to the dedicated citizen scientists who have contributed to survey activities: Jeremiah Abberdan, Isaac Burns, Shary Braithwaite, Nathan Caromel, Jenni Calcraft, Lucas Close, Patrick Coolwell, Paul Colquist, Amanda Delaforce, Isabelle Derouet, Philip Dunbavan, Shaun Fisher, Jean Ettwiller, Terry Farr, Josh Hanson, Michael Hartcher, Emma Kennedy, Jody Kreuger, Jacob Martin, Lauren Morgan, Michael Nothling, Moses Robinson, Julie Schubert, Doug Stetner, Hannaleena Vaisanen, Meg Vassie, Breanne Vincent, Scott Wallace.

A special note of acknowledgement to our trainers, professional volunteers and staff: Jody Kreuger, Jennifer Loder, Jodi Salmond, Chris Roelfsema and Rebekka Pentti.

Project activities were conducted on the traditional lands of the Quandamooka People. We acknowledge the Traditional Custodians of the land, of Elders past and present. They are the Nughi of Moorgumpin (Moreton Island), and the Nunukul and Gorenpul of Minjerribah.

Snorkel transects were monitored in partnership with Quandamooka Yoolooburrabee Aboriginal Corporation and Quandamooka Land and Sea Management Agency.

This project is supported by Reef Check Australia, through funding from The Queensland Government Community Sustainability Action Grant Program, Port of Brisbane, and Sunshine Coast Council.

Thank you to industry supporters who provided in-kind support during this survey season for surveys, and volunteer training events including: Dive Repairs, Manta Lodge & Scuba Centre, Nautilus Scuba Centre, Point Lookout Scuba Dive Charters, Scuba World, and Subsurface SCUBA.

A note of thanks to our amazing citizen science partners in the region for their ongoing collaboration.

The UniDive Flinders Reef Ecological Assessment team undertook three surveys at long-term monitoring sites in the Nursery area of Flinders Reef that are summarized in this report. For more detail on their findings, please see the *Ecological Assessment of the Flora and Fauna of Flinders Reef, Moreton Bay Marine Park, Queensland* (Roelfsema et al 2018).

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1.0 Introduction

1.1 Ten years of subtropical reef monitoring

The subtropical reefs of SEQ are located adjacent to some of Australia's fastest growing cities. Both local pressures and climate change will continue to pose notable implications for the health, resilience and persistence of these unique subtropical reef communities, and the ecosystem services they provide. As such, both long-term monitoring of these habitats and community engagement in reef health issues is critical.

There is relatively limited long-term monitoring of reef health across the SEQ region's subtropical reefs. RCA's trained volunteers have been collecting data in the region since 2007, providing a unique citizen science dataset and sharing results with the community.

In that time, teams have expanded to annually survey more than 25 priority reef monitoring sites with regular reports to stakeholders, contributed to the revision of SEQ Natural Resource Management Plan targets for coral, worked collaboratively to help revise reef habitat maps for the inshore Moreton Bay for the first time in a decade, and worked with UniDive to bring Moreton Bay to the international stage with the declaration of Moreton Bay as a Hope Spot. The long-term data set collected by trained volunteers reports on reef health at a local, national and global scales.

In recent years, we have actively sought new innovative ways to share findings and empower more positive local action for reefs through our Reef Ambassador programs. We now have trained community outreach volunteers catalyzing change on the Sunshine Coast and in Brisbane and we're inspired to watch this program grow.

Huge congratulations to those volunteers, partners, and supporters who have helped to build this decade-long legacy of citizen science and community engagement to help more people look after these amazing subtropical reefs.

Jennifer Loder
Director of Programs & Partnerships, 2018

Images from top down: Surveyors at Myora Reef Moreton Bay (Photo Gary Cranitch), Surveyors in training at Shag Rock Point Lookout, Reef Ambassadors at The Planting, Woodfordia.

1.0 Introduction

1.2 SEQ's subtropical reefs

SEQ represents a transitional area where temperate, tropical and sub-tropical species exist within the same habitat (Perry & Larcombe 2003). The SEQ region is significant as a unique transitional marine habitat that is located close to major metropolitan areas. The marine ecosystem along SEQ is likely to face increasing anthropogenic pressures as the population grows exponentially, with numbers expected to reach 4 million in 2026. Environmental factors such as poor light, temperature and turbidity (Fellegara & Harrison 2008) can smother living corals and hinder, or even completely block, larval recruitment of reef-building corals. Stressors such as habitat loss, poor water quality, boating, anchoring, overfishing, marine debris and climate change will undoubtedly have further consequences on the reefs in the SEQ region.

SEQ includes various coral communities with diverse and extensive coral growth forms. The offshore site Flinders Reef, for instance, is home to 119 distinct coral species (Harrison et al. 1998). A number of other locations with historical and extensive coral cover are also found in SEQ (Wallace et al. 2009); however, long-term monitoring of these habitats is limited.

SEQ, like many other reef locales, is no outlier when is comes to habitat and species shifts resulting from climate change and other anthropogenic impacts. Its unique assemblages of marine species has warranted recognition of the region as an important area to study and protect (Wallace et al. 2009). RCA's monitoring program provides crucial long-term data that assesses changing health conditions of reefs within SEQ and supports appropriate management responses to ensure long-term survival of the marine habitats.

RCA's survey methods collect quantitative data in relation substrate cover, key invertebrate species, target fish species, as well as anthropogenic and natural impacts on reef habitats.

Images from top down: Northern end of Peel Island Moreton Bay (Photo Gary Cranitch), Brisbane city skyline from Moreton Bay, Mudjimba Island corals (Photo by Jodi Salmond)

1.0 Introduction

1.3 Reef Check Australia monitoring sites

This report presents a summary of the findings for surveys conducted in SEQ during the 2017-18 season. Teams of trained volunteers monitored a total of 35 sites on 17 different reefs, which included survey sites ranging from Mudjimba (Old Woman) Island on the Sunshine Coast to the artificial Seaway reefs on the Gold Coast. 13,200m^2 of reef habitat was surveyed in total during the 2017-2018 season (where one survey covers 400m^2). The UniDive Flinders Reef Ecological Assessment team (FREA) surveyed three existing long-term sites at Flinders Reef, The Nursery, that are included in this report.

The SEQ region is broken down into the four sub-regions: Sunshine Coast, Inshore Moreton Bay, Outer Moreton Bay and Gold Coast. Some existing Reef Check Australia monitoring locations were not visited during the 2017-18 survey season due to funding availability. Several new sites were surveyed for the first time.

In the 2017-18 season, RCA monitoring sites ranged from Mudjimba Island on the Sunshine Coast to the Gold Coast Seaway (See Figure 1 for map locations). Reef habitats at the survey sites varied from inshore to offshore areas, and included reef flats, crests and slopes. Sites also spanned protected (marine national park, no-take zones) and non-protected areas. Of the 36 surveys, 25 were conducted within the Moreton Bay Marine Park (11 of which are located within Green Zones), 9 were conducted north of the Marine Park, on the Sunshine Coast, and 2 were conducted south of the Marine Park, on the Gold Coast. Other RCA monitoring locations were not re-visited due to weather related issues and funding restrictions.

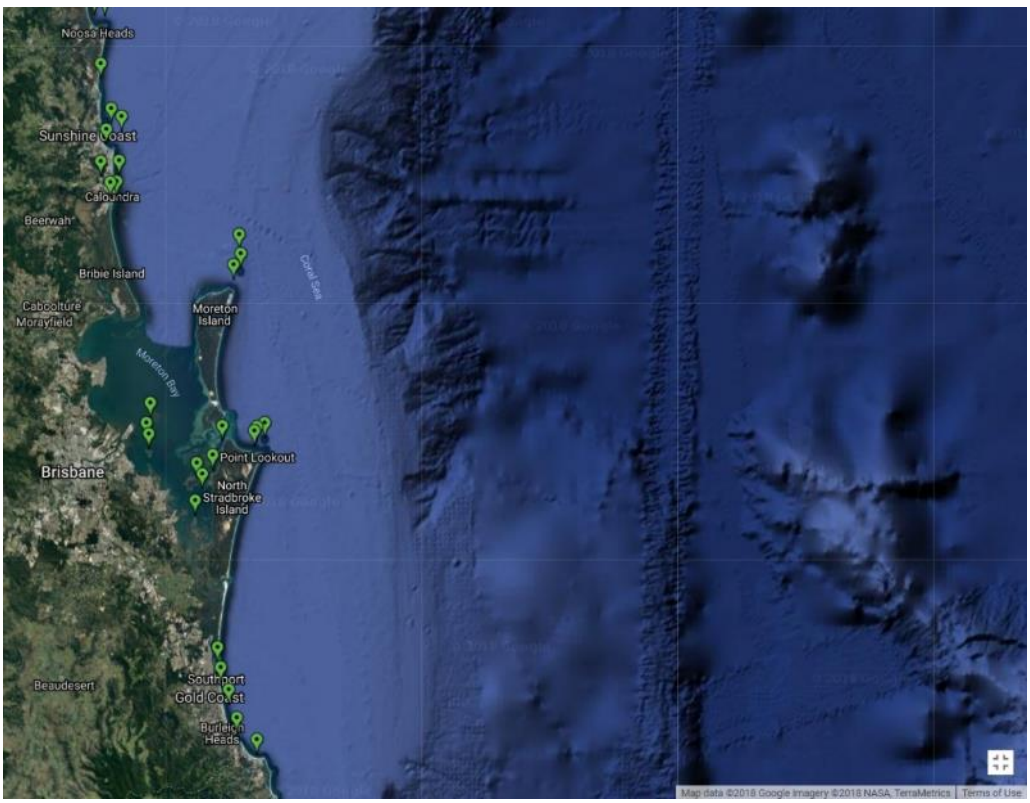

Figure 1. Map of South East Queensland survey sites from Google Earth.

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Table 2. Table of RCA monitoring locations in the Sunshine Coast and Inshore Moreton Bay visited in the 2017-18 SEQ season, including site number, location, depth, year of initial survey and site designation. Site designation includes four zones within the Moreton Bay Marine Park: Marine National Park (MNP), Conservation Park (CP), Habitat Protection (HP) or Ramsar Wetland site status (Ramsar).

Location	Site #	Site	Depth (m)	1st Survey	Site Zoning
Sunshine Coast	1	Bulcock Beach, Boardwalk	4	2018	N/A
Sunshine Coast	1	Currimundi Reef	9	2009	N/A
Sunshine Coast	2	Currimundi Reef	9	2009	N/A
Sunshine Coast	2	Inner Gneerings, Scuba World Caves	10	2009	N/A
Sunshine Coast	1	Inner Gneerings, The Caves	10	2013	N/A
Sunshine Coast	1	Kings Beach	3	2009	HP
Sunshine Coast	1	Mudjimba Island, NW Reef	8	2013	N/A
Sunshine Coast	1	Mudjimba Island, The Ledge	5	2007	N/A
Sunshine Coast	2	Mudjimba Island, The Ledge	9	2013	N/A
Sunshine Coast	3	Mudjimba Island, The Ledge	6	2013	N/A
Inshore Moreton Bay	2	Amity Point	4	2016	MNP
Inshore Moreton Bay	1	Goat Island	3	2009	CP, Ramsar
Inshore Moreton Bay	1	Goat Island West	1	2014	MNP
Inshore Moreton Bay	1	Green Island North	3	2015	HP
Inshore Moreton Bay	1	Green Island West	3	2017	HP
Inshore Moreton Bay	1	Macleay Island	2	2009	MNP
Inshore Moreton Bay	1	Mud Island, Coral Galore	2	2017	HP
Inshore Moreton Bay	1	Mud Island, Rubble Patch	2	2017	HP
Inshore Moreton Bay	1	Myora Reef	2	2009	MNP, Ramsar
Inshore Moreton Bay	2	Myora Reef	2	2014	MNP, Ramsar

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Table 3. Table of RCA monitoring locations in Outer Moreton Bay and Gold Coast visited in the 2017-18 SEQ season, including site number, location, depth, year of initial survey and site designation. Site designation includes four zones within the Moreton Bay Marine Park: Marine National Park (MNP), Conservation Park (CP), Habitat Protection (HP) or Ramsar Wetland site status (Ramsar). *Sites surveyed by UniDive Flinders Reef Ecological Assessment team in 2017.

Location	Site #	Site	Depth (m)	1st Survey	Site Zoning
Inshore Moreton Bay	1	Peel Island, East	2	2009	MNP, Ramsar
Inshore Moreton Bay	1	Peel Island, North	2	2009	MNP, Ramsar
Inshore Moreton Bay	1	Peel Island, North East	2	2014	MNP
Inshore Moreton Bay	1	St Helena, Palindrome	2	2014	MNP
Inshore Moreton Bay	1	St Helena, Ray of Sunshine	2	2014	MNP
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, Alden's Cave	12	2008	MNP
Outer Moreton Bay	1	Flinders Reef, Nursery*	6	2007	MNP
Outer Moreton Bay	2	Flinders Reef, Nursery*	6	2009	MNP
Outer Moreton Bay	3	Flinders Reef, Nursery*	6	2009	MNP
Outer Moreton Bay	1	Shag Rock, East	5	2008	HP
Outer Moreton Bay	2	Shag Rock, West	6	2009	HP
Gold Coast	1	Gold Coast Seaway South West Wall	2	2007	N/A
Gold Coast	1	Gold Coast Seaway The Pipe	9	2015	N/A

1.0 Introduction

1.4 Key Findings

The 2017-18 season included surveys at 35 monitoring sites. Six new sites were surveyed (Bulcock Beach, Green Island West, Palindrome and Ray of Sunshine at Saint Helena, and Coral Galore and Rubble Patch at Mud Island).

Substrate

• Of the 25 sites surveyed in both the 2017-18 and seasons, most sites remained relatively stable in hard coral cover. Fourteen sites had decreases of less than 10%, seven sites had increases of less than 10%. Three sites had notable decreases in coral cover (-14 to -17%, including Flinders Reef Alden's Cave, Currimundi Reef S2, Mudjimba Island NW). One site had an increase of more than 15% (Myora Reef S2). Soft coral cover remained relatively stable, with no change at 6 sites, decreasing by less than 10% at seven sites, and increasing by less than 10% at 11 sites. Soft coral increased notably (12-16%) at three sites (Currimundi Reef S1, Goat Island West, Peel Island North) and decreased notably (-15%) at one site, Flinders Reef Alden's Cave.

• Hard coral cover ranged from 0%, at Rubble Patch S1, Mud Island, in Inshore Moreton Bay to 79% at Flinders Reef The Nursery Site 2. The average hard coral cover across all surveyed sites was 19%. This overall regional average is lower than previous years (26% in 2016-17 season), partly due to additional Inshore Moreton Bay sites being included for the first time, which have lower hard coral cover.

• The Gold Coast Seaway sites are artificial structures where hard coral growth has never been recorded by RCA on the line intercept transect. The two sites within the Gold Coast Seaway are therefore excluded from hard coral cover and coral impacts analysis in this report.

• The most predominant substrate type recorded across all 33 surveys was rock, attributing to 35% of the benthos surveyed (this includes all RCA rock categories; rock (RC), rock covered with coralline algae (RCCA) and rock covered with turf algae (RCTA). Hard coral accounted for the second most abundant substrate, with 19%.

Images from top down: Acropora hard coral at Myora Reef (Photo by Gary Cranitch), Green turtle at Flinders Reef (Photo by Jenn Loder), Sponges at Bulcock Beach Boardwalk (Photo by Jodi Salmond)

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Table 5. Summary table of RCA monitoring findings for surveys conducted in the Sunshine Coast and Inshore Moreton Bay in the 2017-2018 season. Information includes a basic site summary of average hard and soft coral cover (%), total macroalgae (MA) abundance, nutrient indicator algae (NIA) cover (%), and silt levels (N=none, L=low, M=medium, H=high), as well as a summary of the impacts at each site: average coral bleaching of the population (%) and abundance of reef impacts (coral disease, marine debris, coral damage, and scars, coral damage). All figures showing a count, rather than a percentage, are a total across all 4 transects at the site (i.e. at total across 80m).

	Basic site summary					Presence of Impacts							
	Hard Coral Coverage (%)	Soft Coral Coverage (%)	Macroalgae (#) per 80m transect	Nutrient Indicator Algae (%)	Silt Loading	Coral Population Bleaching (%)	Coral Disease (#)	Fishing Line (#)	Marine Debris (General) (#)	Anchor Damage (#)	Coral Damage (#) (unknown causes)	Drupella Scar (#)	Unknown Scar (#)
Bulcock Beach S1	0.6	0	0	11	M	0	0	65	22	0	0	0	0
Currimundi Reef S1	28	21	22	3	L	7	0	0	0	0	0	0	12
Currimundi Reef S2	23	4	39	1	L	5	0	0	0	0	0	0	3
Inner Gneerings Scuba World Caves S2	39	2.5	30	0	L	0.5	1	0	0	0	2	0	1
Inner Gneerings The Caves S1	37	4	4	4	N	0.25	0	2	0	0	0	0	6
Kings Beach Reef S1	5	0	16	16	M	4	0	3	6	0	3	2	11
Mudjimba Island North West Reef S1	20	7	15	1	N	6.5	0	3	1	0	6	0	7
Mudjimba Island The Ledge S1	37	9	0	0	L	1	4	4	0	2	12	3	30
Mudjimba Island The Ledge S2	19	16	6	0	L	0	0	10	0	0	1	0	0
Mudjimba Island The Ledge S3 (2017)	36	18	0	0	N	1	0	6	0	0	3	2	0
Mudjimba Island The Ledge S3 (2018)	42	18	1	2.5	N	0.25	3	13	1	0	11	0	0
Amity Point S2	6	2.5	0	0	M	12.5	0	28	6	0	11	0	0
Goat Island S1	21	31	0	0	M	3	0	10	0	0	10	0	3
Goat Island West S1	12.5	31	0	0	M	11	0	2	1	0	2	0	1
Green Island North S1	8	11	20	0	M	37.5	0	0	0	0	0	0	12
Green Island West S1	6	16	21	0	M	8	0	0	0	0	0	0	18

1.0 Introduction

Table 4. Summary table of RCA monitoring findings for surveys conducted in both Inner and Outer Moreton Bay, and the Gold Coast in the 2017-2018 season. Information includes a basic site summary of average hard and soft coral cover (%), total macroalgae (MA) abundance, nutrient indicator algae (NIA) cover (%), and silt levels (N=none, L=low, M=medium, H=high), as well as a summary of the impacts at each site: average coral bleaching of the population (%) and abundance of reef impacts (coral disease, marine debris, coral damage, and scars, coral damage). All figures showing a count, rather than a percentage, are a total across all 4 transects at the site (i.e. at total across 80m).

	Basic site summary					Presence of Impacts							
	Hard Coral Coverage (%)	Soft Coral Coverage (%)	Macroalgae (#) per 80m transect	Nutrient Indicator Algae (%)	Silt Loading	Coral Population Bleaching (%)	Coral Disease (#)	Fishing Line (#)	Marine Debris (General) (#)	Anchor Damage (#)	Coral Damage (#) (unknown causes)	*Drupella* Scar (#)	Unknown Scar (#)
Macleay Island S1	8	11	12	14	M	2	0	0	0	0	4	0	0
Mud Island Coral Galore S1	2	44	39	0.6	M	5	0	1	0	0	0	3	0
Mud Island Rubble Patch S1	0	4	32	4	L	0.5	0	0	0	0	0	0	0
Myora Reef S1	36	0	5	4	L	1	28	3	1	0	14	6	38
Myora Reef S2	32.5	0	0	4	M	1	0	4	5	0	14	10	8
Peel Island East S1	7	5	0	26	M	3.5	0	12	0	0	2	0	6
Peel Island North S1	12.5	29	26	2.5	M	20	0	0	1	0	1	2	0
Peel Island North East S1	11	5	0	10	M	3	1	1	0	0	2	0	0
St Helena Palindrome S1	4	7	26	27.5	H	2	0	0	0	0	0	0	2
St Helena Ray of Sunshine S1	12	16	14	12.5	H	55	0	0	0	0	2	0	1
Flat Rock Shark Gulley S1	26	2.5	10	8	L	0.5	0	1	0	0	3	0	12
Flat Rock The Nursery S1	19	2	0	7	N	1	0	0	0	0	9	0	4
Flinders Reef Alden's Cave S1	24	18	27	0	L	10	7	0	0	0	0	0	0
Flinders Reef The Nursery S1	17.5	5	17	0.6	N	0	6	0	0	0	24	0	8
Flinders Reef The Nursery S2	79	0.6	17	2.5	N	0	56	0	0	0	7	0	0
Flinders Reef The Nursery S3	16	20	22	0.6	N	0	4	0	0	0	29	0	2
Shag Rock East S1	24	9	5	13	N	2	5	4	0	0	14	2	16
Shag Rock West S2	7	1	37	27	L	0	0	0	0	0	14	0	5
Gold Coast Seaway South West Wall S1	0	0	0	12.5	M	0	0	8	4	0	0	0	0
Gold Coast Seaway The Pipe S1	0	0.6	0	0.6	M	0	0	91	0	0	0	0	0

1.0 Introduction

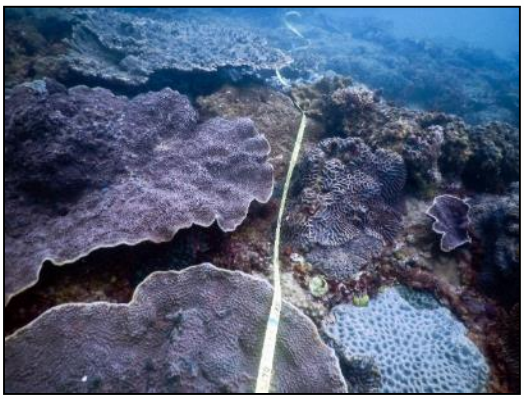
1.4 Key Findings

Impacts: Coral bleaching

• Coral bleaching was recorded at 27 of the 35 sites (77% of the sites, compared to 86% in 2017 and 77% in 2015). On average, 6% of the coral population was affected, with individual colonies suffering an average of 23% surface bleaching. These levels are on par with those recorded in 2017 (6% of the population and 24% for individual colonies), and 2015 (6% of the population and 24% for individual colonies).

• Of the regions, Inshore Moreton Bay sites had the highest population bleaching, with an average of 11%. This corresponds with the results in 2017 (11%) and 2015 (13%).

•The following 4 pages depict changes in coral cover, and coral bleaching, over time at each site, and are categorised by sub-regions (Gold Coast sub-region sites have not been included in this analysis, as no hard coral or soft coral was recorded on the line intercept transects at these sites).



Images from top down: Close up of plate hard coral; Site photo at Mudjimba Reef; Bleached hard coral at Goat Island West (Jodi Salmond).

1.0 Introduction

Sunshine Coast Regional Summary of Coral Trends and Bleaching

Hard coral coverage has remained relatively constant over the years in the Sunshine Coast. However, there were noticeable decreases recorded on three sites in the region; at Currimundi Reef, S1 and S2, and Mudjimba Island, North West reef S1. All other sites surveyed at Mudjimba Island in 2017-18 recorded an increase in hard coral coverage. Currimundi Reef S1 exhibited the highest percentage of coral bleaching, with nearly 7% of the population affected. The Caves S1 at Inner Gneerings recorded almost no bleaching.

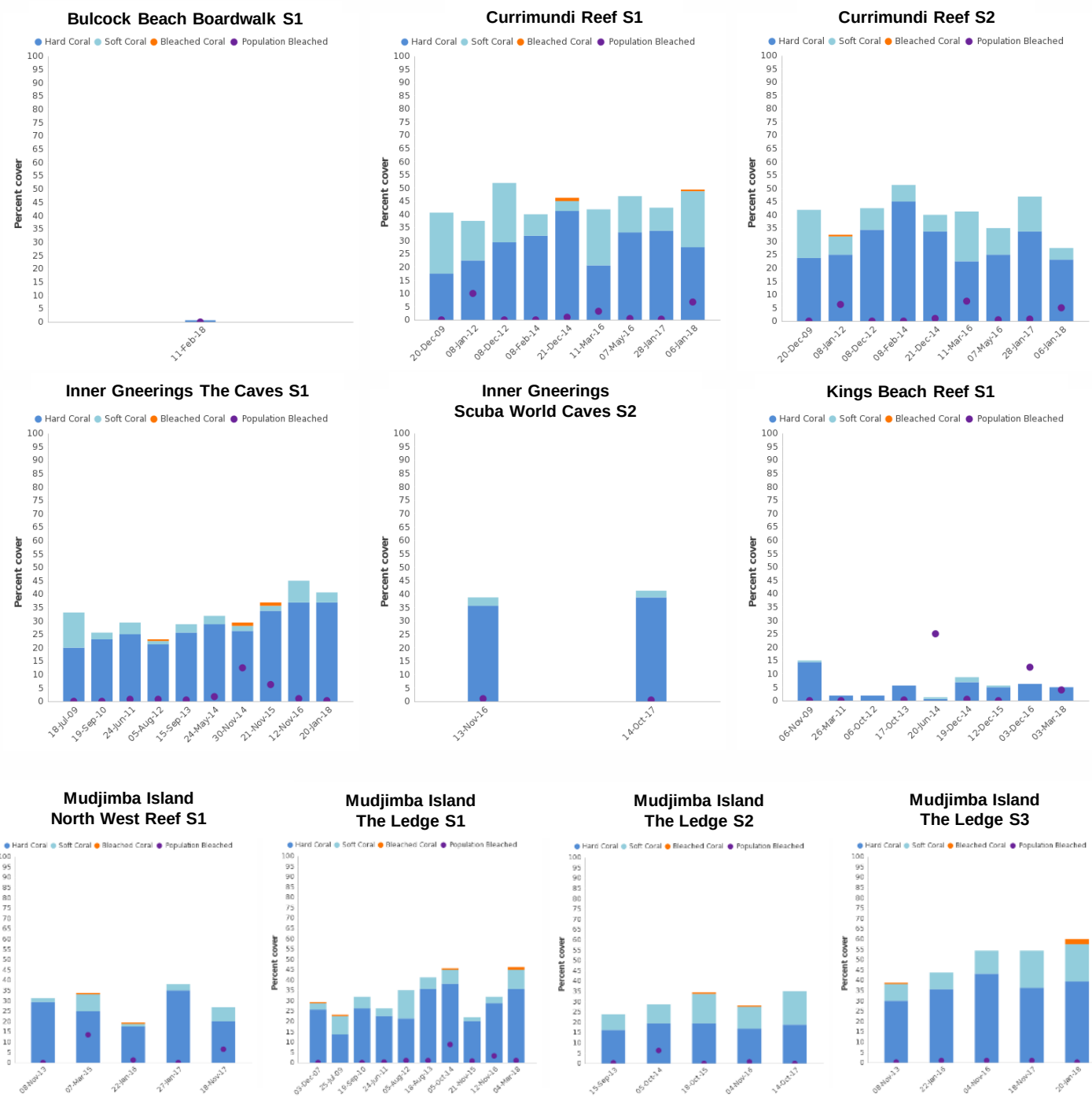


Figure 2. Percent cover of hard coral (blue), soft coral (light blue), and bleached coral (orange) by survey year at Sunshine Coast Reef Check Australia reef health monitoring sites, as per point-intercept substrate surveys for benthic composition. Percentage of the coral population exhibiting bleaching (purple dot), as documented on belt transect survey for reef health impacts, is included where available.

1.0 Introduction

Inshore Moreton Bay Regional Summary of Coral Trends and Bleaching

Hard coral coverage decreased at several of the Inshore Moreton Bay sites in 2017-18. Myora Reef S1 and S2 saw noticeable increases in hard coral coverage (4% at S1 and 17.5% at S2). Myora Reef sites also exhibited the lowest average coral population bleaching of existing sites (0.75% at S1 and 1.25% at S2). Several new sites in the area were surveyed for the first time.

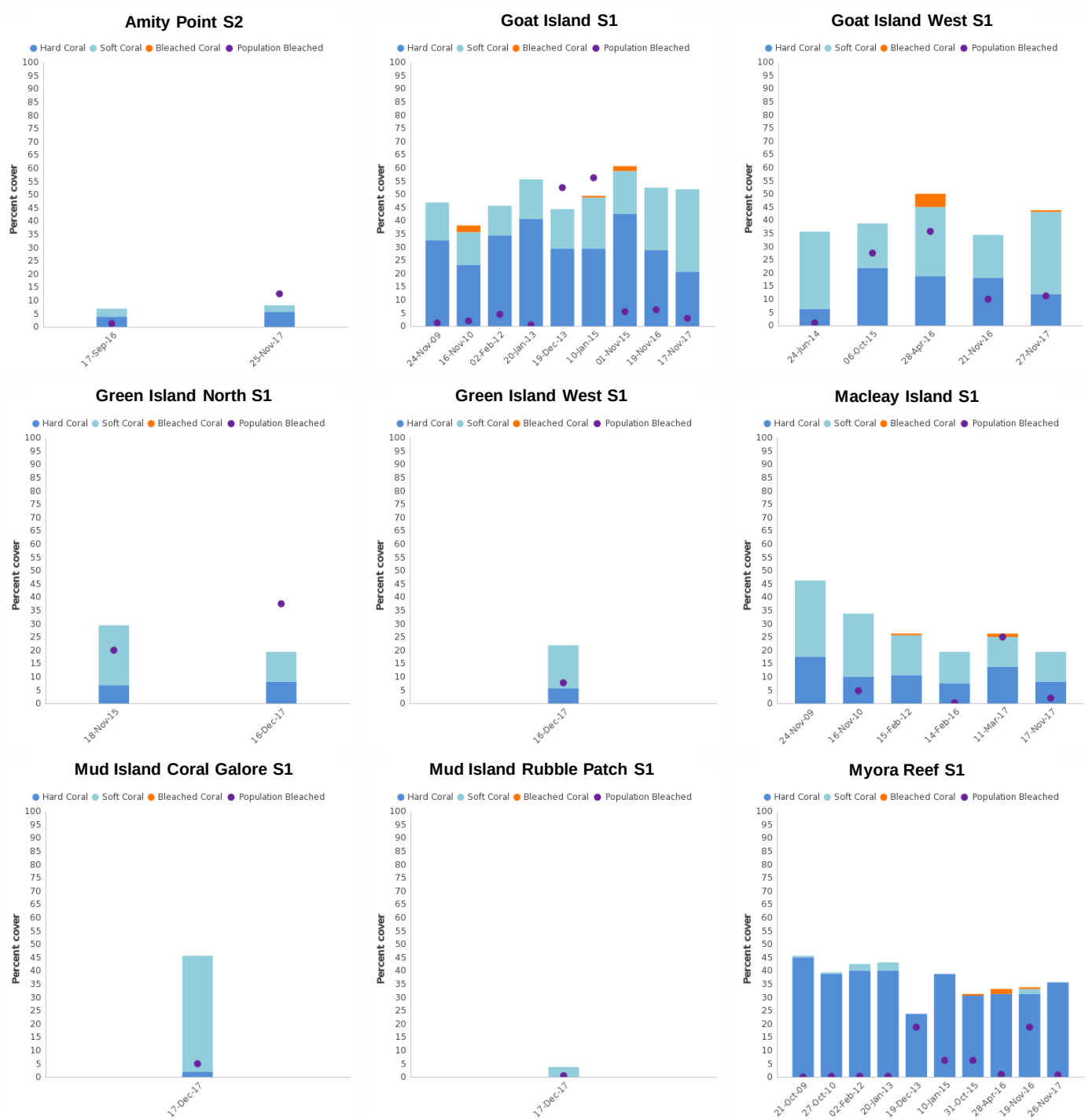


Figure 3. Percent cover of hard coral (blue), soft coral (light blue), and bleached coral (orange) by survey year at Inshore Moreton Bay Reef Check Australia reef health monitoring sites, as per point-intercept substrate surveys for benthic composition. Percentage of the coral population exhibiting bleaching (purple dot), as documented on belt transect survey for reef health impacts, is included where available.

1.0 Introduction

Inshore Moreton Bay Regional Summary of Coral Trends and Bleaching (cont')

Ray of Sunshine S1, at St Helena, recorded the highest average coral bleaching, with 55% of the population affected. Green Island North S1(37.5%), and Peel Island North S1 (20%), also recorded high average population bleaching.

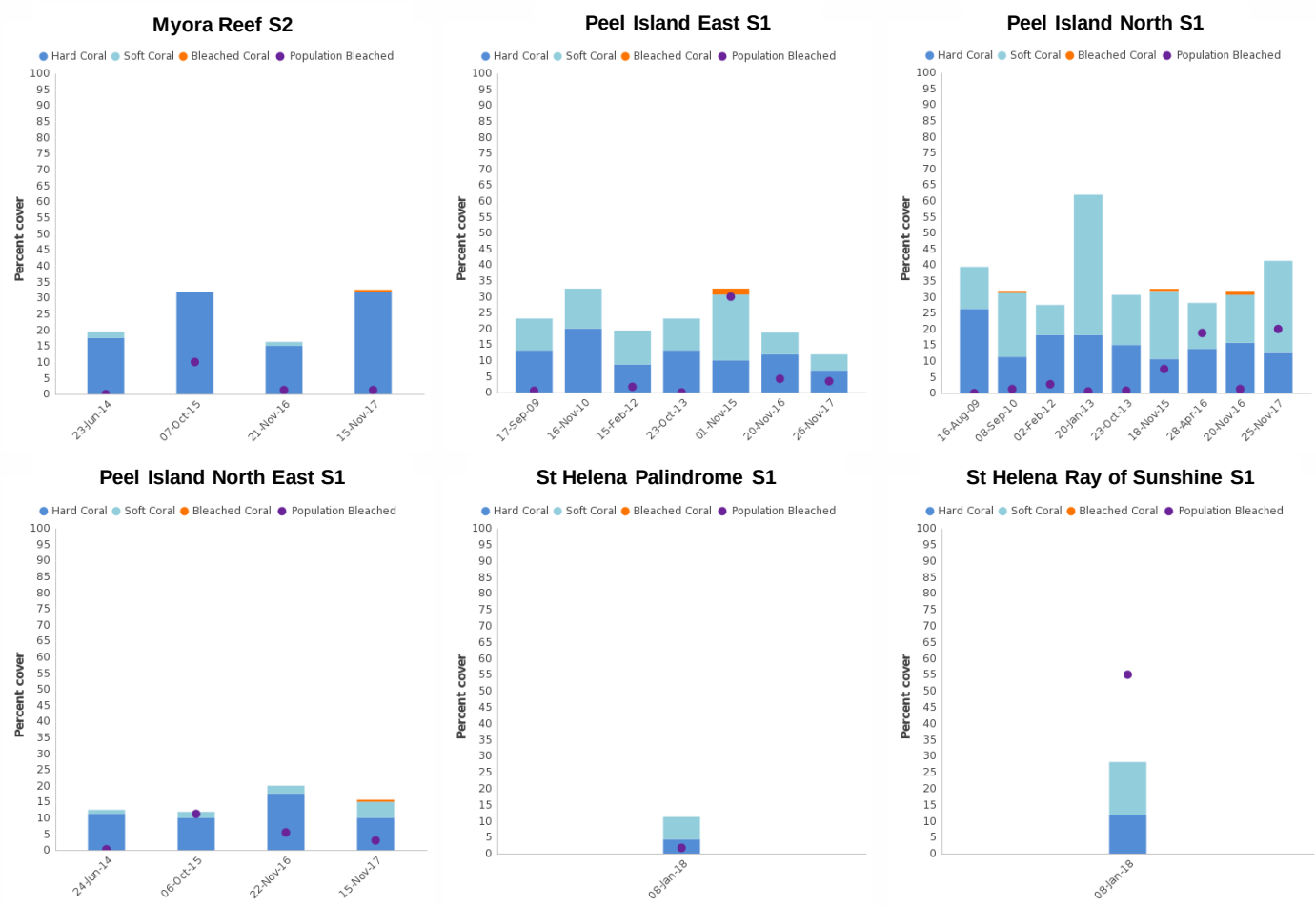


Figure 4. Percent cover of hard coral (blue), soft coral (light blue), and bleached coral (orange) by survey year at Inshore Moreton Bay Reef Check Australia reef health monitoring sites (continued), as per point-intercept substrate surveys for benthic composition. Percentage of the coral population exhibiting bleaching (purple dot), as documented on belt transect survey for reef health impacts, is included where available.

1.0 Introduction

Outer Moreton Bay Regional Summary of Coral Trends and Bleaching

Hard coral coverage increased at Shag Rock East S1, but decreased at all other Outer Moreton Bay sites in 2017-18. Alden's Cave S1 at Flinders Reef recorded the highest average coral population bleaching, at 10%. No other site recorded more than 2% coral population bleaching, and no bleaching was recorded at Shag Rock West S1, or Flinders Reef The Nursery S1, S2, or S3.

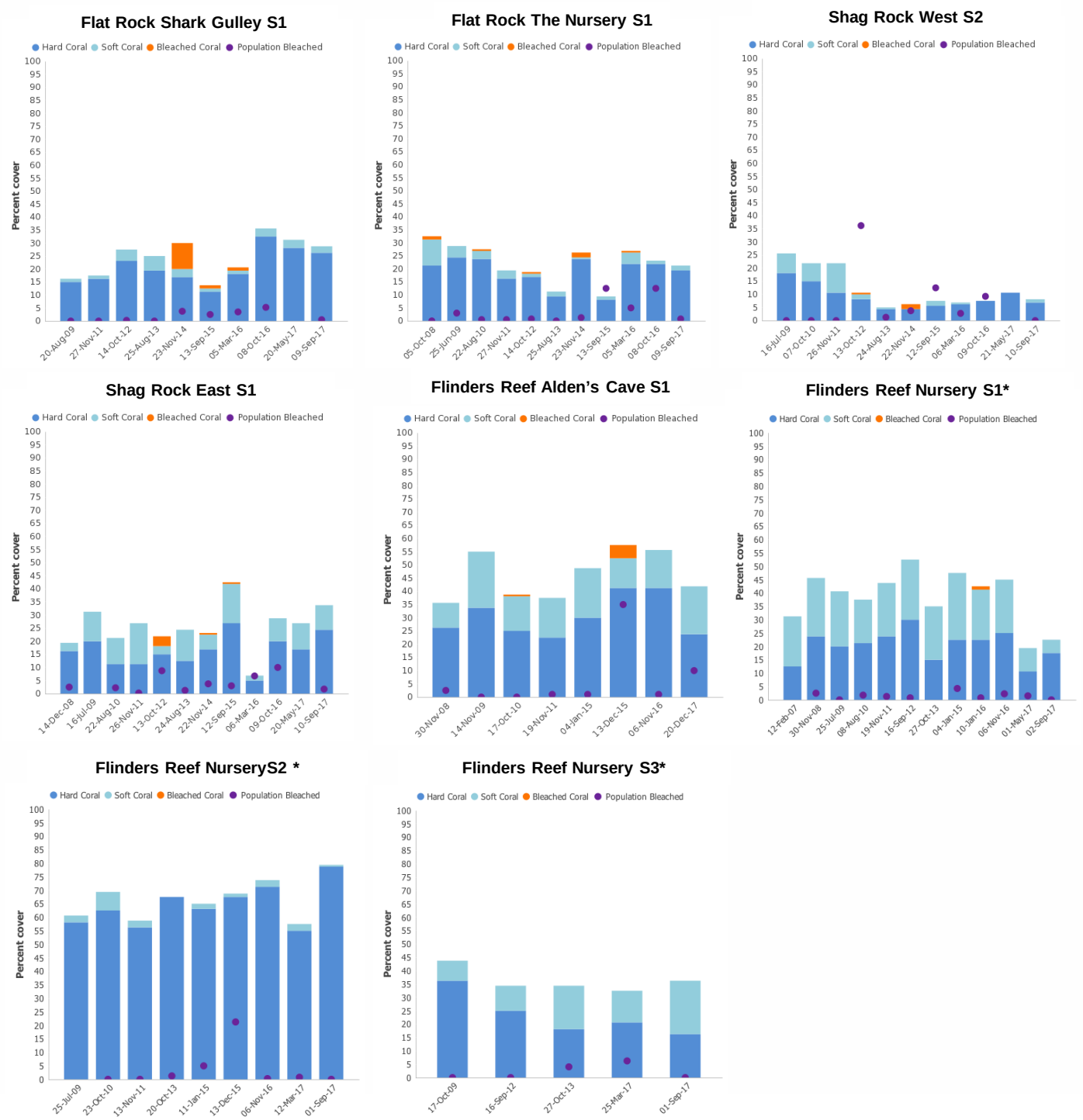


Figure 5. Percent cover of hard coral (blue), soft coral (light blue), and bleached coral (orange) by survey year at Outer Moreton Bay Reef Check Australia reef health monitoring sites, as per point-intercept substrate surveys for benthic composition. Percentage of the coral population exhibiting bleaching (purple dot), as documented on belt transect survey for reef health impacts, is included where available. *Sites surveyed by UniDive Flinders Reef Ecological Assessment team in 2017.

1.0 Introduction

1.4 Key Findings (Continued)

Coral damage

- Coral damage (due to unknown causes) was recorded on 24 of the 35 sites. The highest recordings for coral damage were at Flinders Reef the Nursery S3 (29) and S1 (24). Shag Rock East S1, Shag Rock West S2, and Myora Reef S1 and S2, all recorded 14 incidences of coral damage. A total of 200 incidences of coral damage were recorded in the 2017-18 season, more than the count from last season (162).

- As with last year, only 2 incidences of boat anchor damage were recorded, both at Mudjimba, The Ledge, S1.

Coral disease

- Coral diseases was recorded 115 times during the 2017-18 season, more than the total from last season's surveys (109). Of these, 56 recordings of coral disease were taken at Flinders Reef The Nursery S2, and 28 were taken at Myora Reef S1. No coral disease was found at 26 sites.

Marine debris

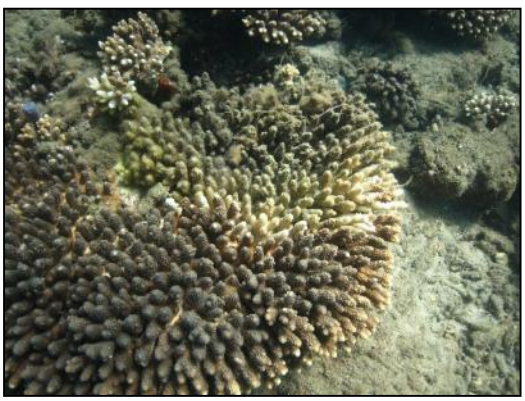
- There were 48 incidences of non-fishing related marine debris recorded during the 2017-18 survey season. This is less than half the total recordings for marine debris last season (137). There were 22 recordings of marine debris at new site Bulcock Beach, Boardwalk S1. Marine debris was only recorded on 10 of the 33 surveys conducted.

- Fishing line was recorded a total of 271 times during the season, with 90 of these occurring at The Pipe S1, Gold Coast. This is more than double the number of times fishing line was recorded last season (113). At Bulcock Beach, Boardwalk S1 fishing line was recorded 65 times.

Coral scarring

- Of the 236 total coral scars recorded, *Drupella* accounted for 30 of them. *Drupella* scars were recorded at 10 of the 33 sites surveyed, with Myora Reef S2 recording the most (10).

- There were 206 incidences of unknown scarring across all surveys. Myora Reef S1 recorded the highest number of unknown scars (38). Out of the 35 sites surveyed, 11 recorded no scarring of any form.



Images from top down: Damaged coral at Goat Island, Coral disease at Myora Reef, Marine debris at the Gold Coast

Tables 4 and 5 on the subsequent pages display these key findings by survey name and sub-region.

1.0 Introduction

1.4 Key Findings (Continued)

Invertebrate Abundance

• Invertebrate surveys were carried out at all sites visited, except for Alden's Cave at Flinders Reef.

• The most abundant indicator invertebrate was the *Diadema* long spined urchin, with 356 individuals recorded in the 2017-18 season. The vast majority of these were recorded at 3 sites; Amity Point S2 (106), Shag Rock East S1 (100), and Myora Reef S1 (93).

• 131 collector urchins were recorded across all survey sites (123 of which were recorded at Shag Rock S1 and S2), as well as 62 anemones.

• Across the 36 surveys, 82 anemones, 14 banded coral shrimp (12 of which were recorded on Gold Coast sites), 10 lobster, 7 giant clams, 5 pencil urchins, 5 sea cucumber, and 3 *Trochus* snails were also recorded. No tritons were recorded during the 2017-18 survey season.

• Only 1 Crown of Thorns Starfish (COTS) was recorded during the 2017-18 survey season, at Shag Rock East S1, and 133 *Drupella* snails were recorded. Kings Beach Reef S1 recorded the highest number of *Drupella* (29).

Fish Abundance

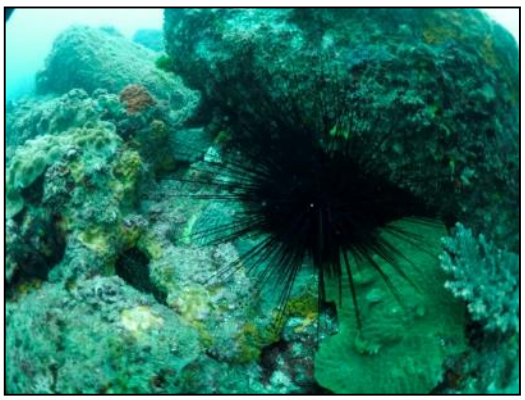
• Fish surveys were carried out on 29 of the 36 surveys.

• Again, butterflyfish were the most abundant target fish species with a total of 259 sightings across all surveys. 57 of these were encountered at Myora Reef, Site 1, which has had the highest butterflyfish count in for the last 3 survey seasons.

• Also recorded over the 29 surveys were a total of 53 parrotfish, 34 snapper (22 of which were recorded at The Nursery S1, Flat Rock), 24 sweetlips, 14 moray eels, 2 coral trout, and 1 other grouper.

Rare animals

• Rare animals sighted during the surveys included wobbegong sharks (11), stingrays (4), tawny nurse sharks (3), turtles (2), an octopus, a flamboyant cuttlefish, and dolphins.



Images from top down: Anemone with fish at Currimundi Reef, Diadema urchin at Mudjimba Island (Photo by Jodi Salmond), Catshark and banded coral shrimp at Myora Reef

1.0 Introduction

1.5 Regional Summary

The Outer Moreton Bay and Sunshine Coast sub-regions had the highest average hard coral cover, with 27% and 26% on average respectively (Figure 6). Inshore Moreton Bay recorded an average of 12% hard coral coverage. Note that the Gold Coast Seaway sites had no hard coral recorded during the 2017-18 (or the previous year). The average hard coral cover for the entire SEQ region was 16%, (21% when the Gold Coast sub-region, which has historically recorded 0% hard coral cover, is excluded). No hard coral was recorded in the Gold Coast sub-region, although soft coral was (<1% of substrate surveyed). The average soft coral coverage across the SEQ region was 8%, a similar level to last season's 7%.

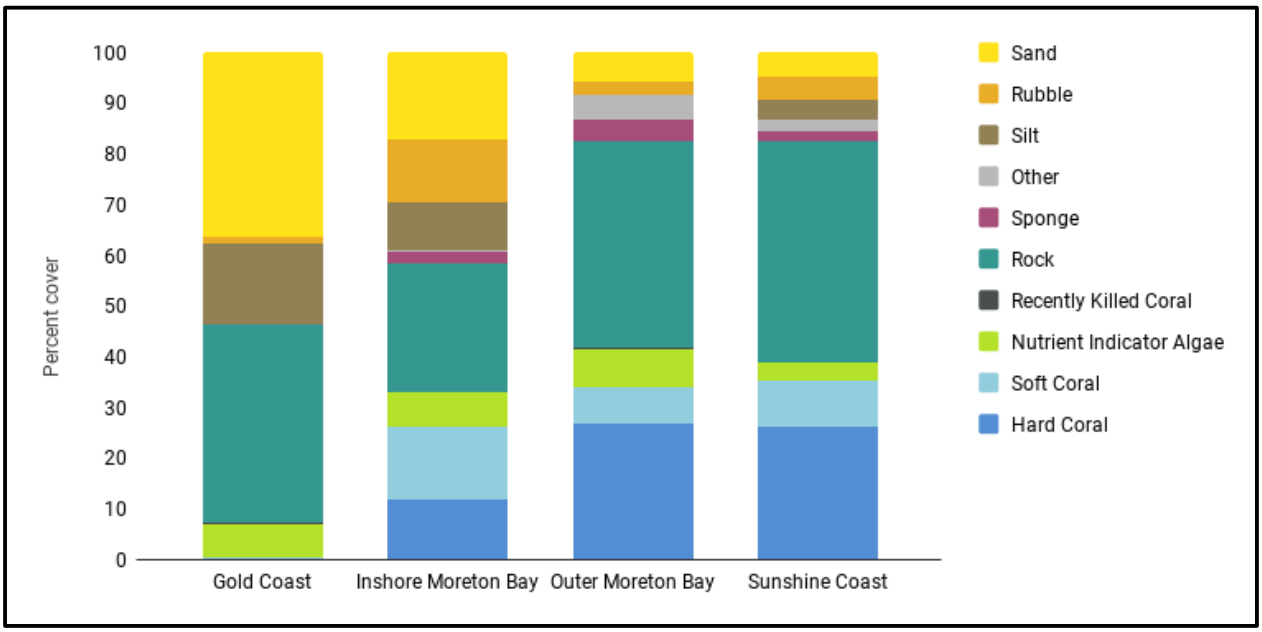


Figure 6. Percent cover of substrate for SEQ sub-regions in 2017-18 survey season.

Coral populations at Inshore Moreton Bay sites exhibited the highest average bleaching (11%). On average, 3% of Outer Moreton Bay populations were affected by bleaching, 2% of Sunshine Coast populations were affected. Inshore Moreton Bay sites also recorded the highest bleaching percentage for individual colonies (31%), while Outer Moreton Bay. There was no bleaching found in the Gold Coast sub-region (Figure 7).

1.5 Regional Summary (Continued)

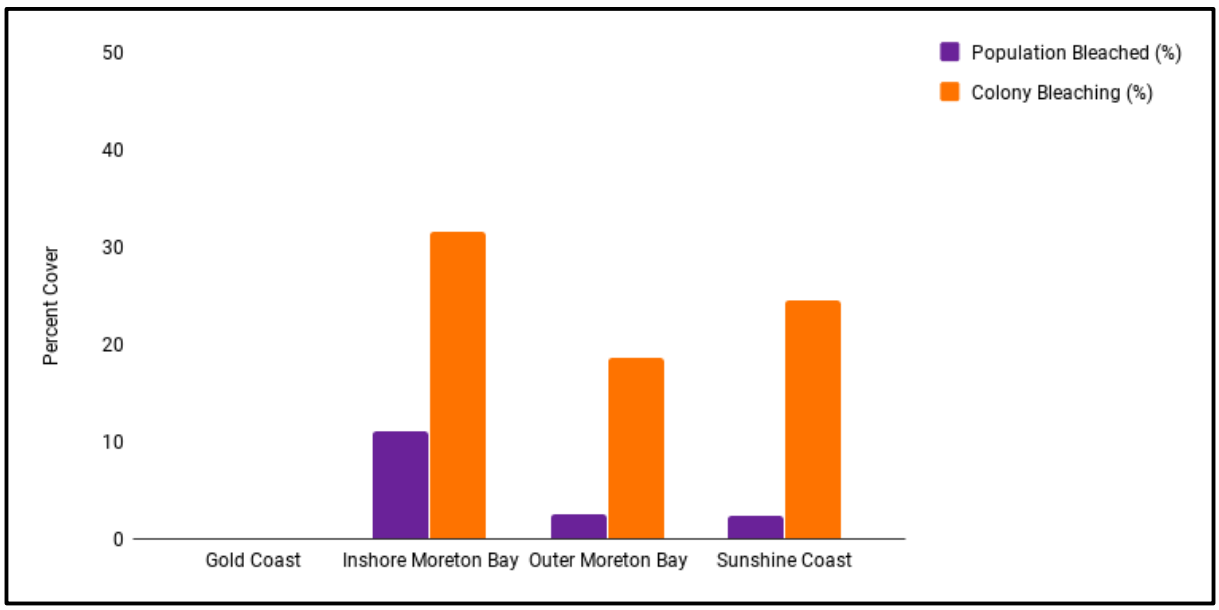


Figure 7. Average bleaching percentage per survey within the SEQ sub-regions.

The Gold Coast reported the highest average number of impacts out of all 4 sub-regions (this is heavily influenced by 91 pieces of fishing line recorded at one site). Outer Moreton Bay recorded an average of 29 impacts per 400m² survey, and the Sunshine coast recorded an average of 24 (65 pieces of fishing line were recorded at new Sunshine Coast, Bulcock Reef S1). The Sunshine Coast was the only sub-region to record evidence of anchor damage (Figure 8). Outer Moreton Bay recorded the highest amount of coral disease (56 instances were recorded at Flinders Reef The Nursery, Site 2). Coral disease, *Drupella* scarring, and other scarring, were recorded in all sub-regions where the is significant coral coverage (these impacts were not found on the Gold Coast sites).

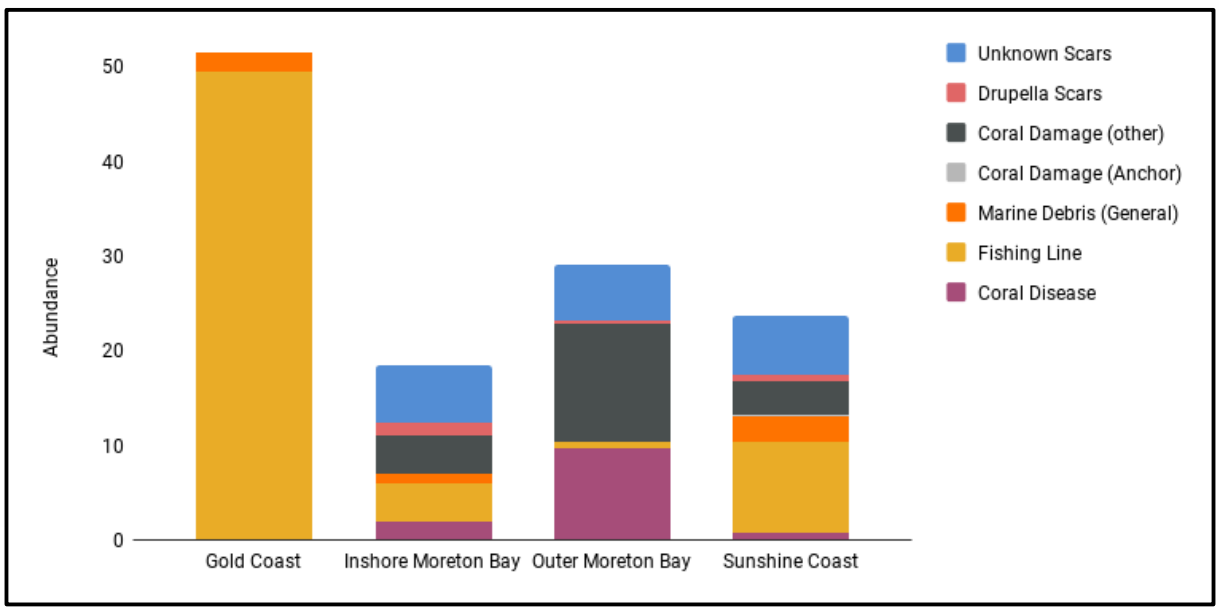
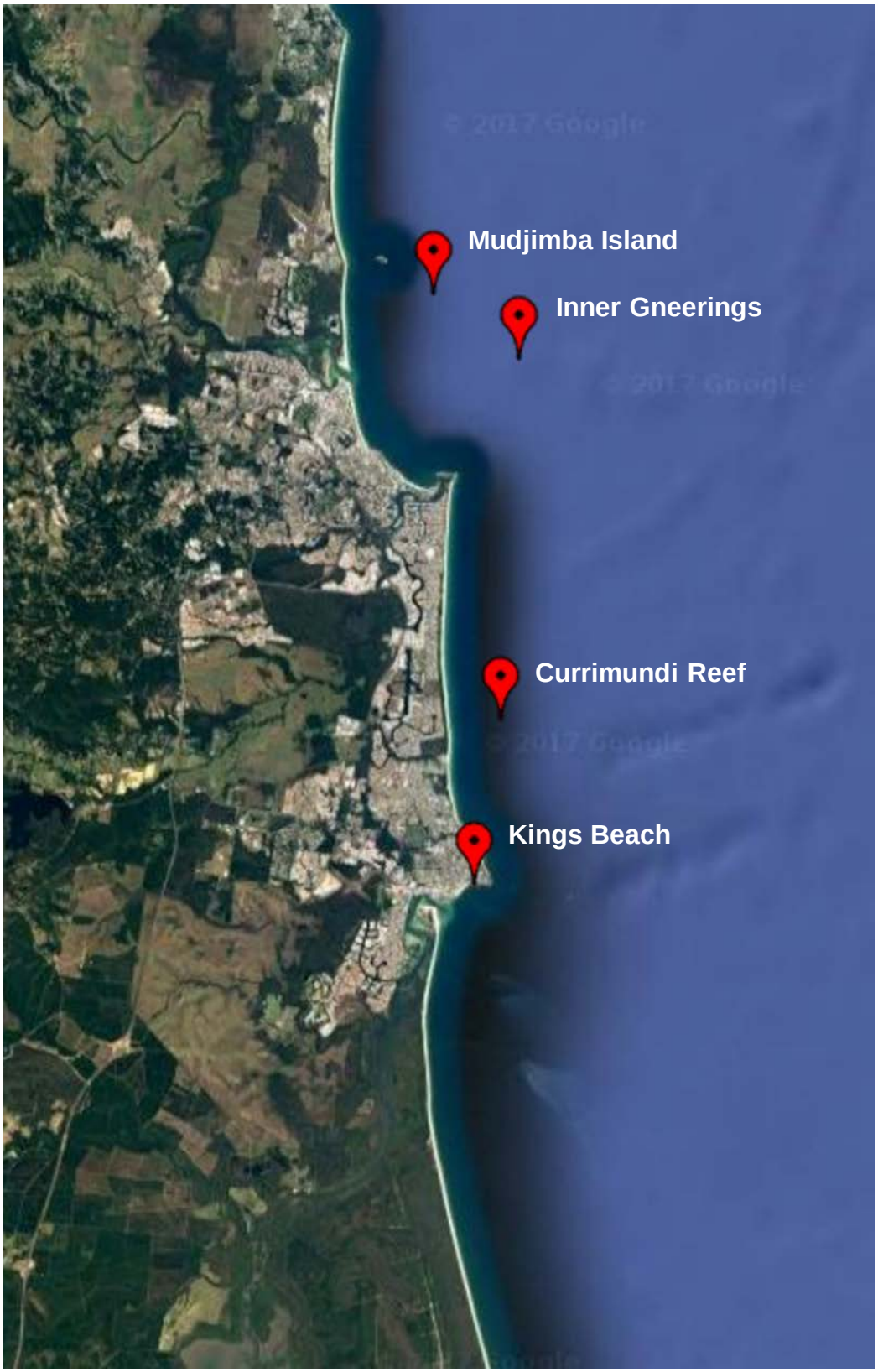


Figure 8. Average abundance of impacts per survey within the SEQ sub-regions.

2.0 Sunshine Coast



Map: Sunshine Coast, South East Queensland
Image courtesy of Google Earth

REEF CHECK

AUSTRALIA

2.0 Sunshine Coast Sites

2.1 Bulcock Beach, Boardwalk Site 1

Bulcock Beach, Boardwalk, Site 1, was surveyed for the first time in this 2017-18 season. Bulcock Beach is a popular coastal recreation area located south of Caloundra. Some areas of the boardwalk are open to fishing.

The predominant substrate recorded was silt (43%), followed by rubble (22%). A small amount of hard coral (<1%) was recorded, while no soft coral was found. Nutrient indicator algae (11%), sand (9%), sponge (7%), 'other' (5%), and rock (2%), made up the rest of the substrate. No macroalgae was found at the site.

Bulcock Beach recorded one of the highest number of impacts out of any site surveyed in the SEQ region, with 87 impacts recorded. Of these, 65 were fishing line and 22 were other marine debris.

On the fish survey 6 butterfly fish were recorded, 2 sweetlips, and 2 moray eels. The invertebrate survey recorded one lobster, and one collector urchin.

Sponges at site, Bulcokc Beach, Site 1

Discarded tyre, Bulcock Beach, Site 1

Stonefish, Bulcock Beach, Site 1

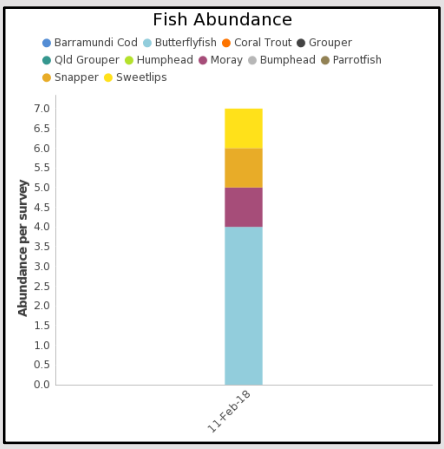


Figure 10. Fish abundance at Bulcock Beach, Boardwalk, Site 1; 2018.

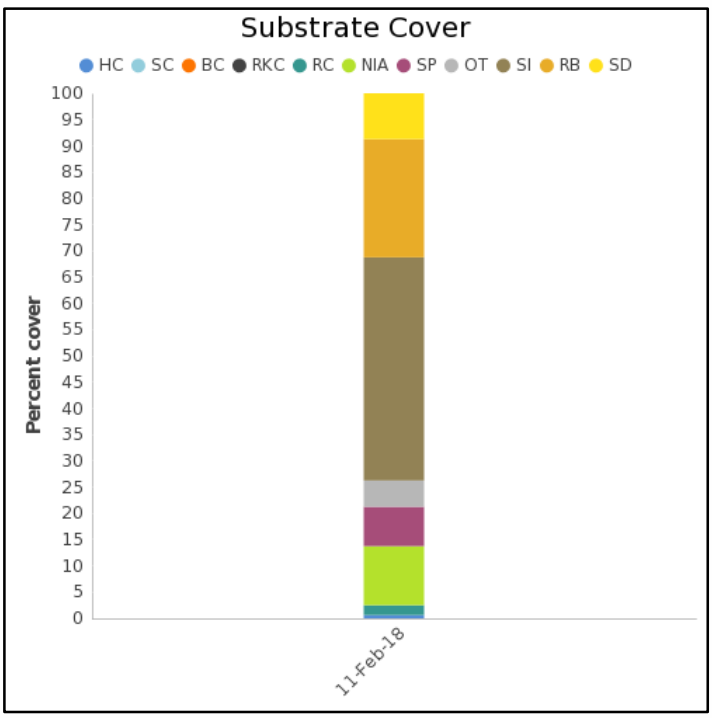


Figure 9. Benthic type and percent cover at Bulcock Beach, Boardwalk, Site 1; 2018.

2.0 Sunshine Coast Sites

2.2 Currimundi Reef, Site 1

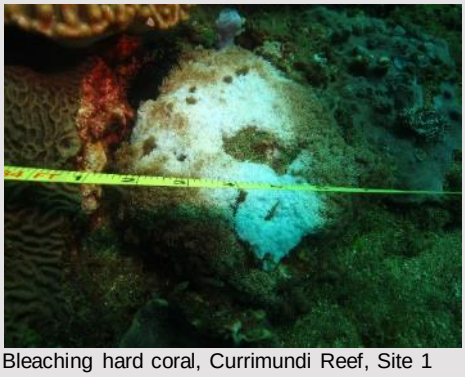
Currimundi Reef is situated on the reef flat at 9 meters on an exposed rocky outcrop off the Currimundi Coast. The site was first surveyed in 2009. This reef is not frequented by divers, fishers or boaters.

Hard coral accounted for 28% of the substrate, and soft coral accounted for 21%. This is similarly high coverage of hard coral to previous years (34% in 2016, 33% in 2015), and an increase of soft coral coverage (9% in 2016). The remaining substrate was mostly rock (45%), with nutrient indicator algae (3%), other (2%), and sand (<1%) also recorded.

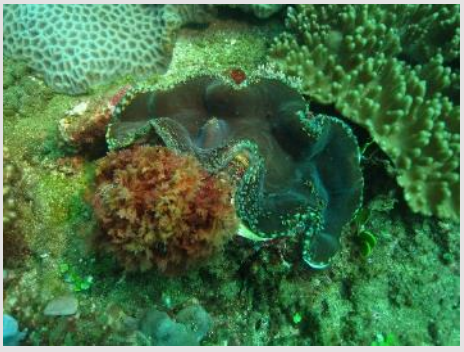
An average of 7% of the overall coral population showed signs of bleaching, while individual colonies exhibited an average of 60% surface bleaching (the second highest recorded at any SEQ site this season, after St Helena, Palindrome. Unknown scars (12) were the only other impact recorded.

The invertebrate survey recorded 1 giant clam, 1 trochus, and 1 anemone. A fish survey was also conducted this season, recording 10 parrotfish, 4 butterflyfish, 3 sweetlips, and 1 moray eel.

Fish at Currimundi Reef, Site 1



Bleaching hard coral, Currimundi Reef, Site 1



Giant clam, Currimundi Reef, Site 1

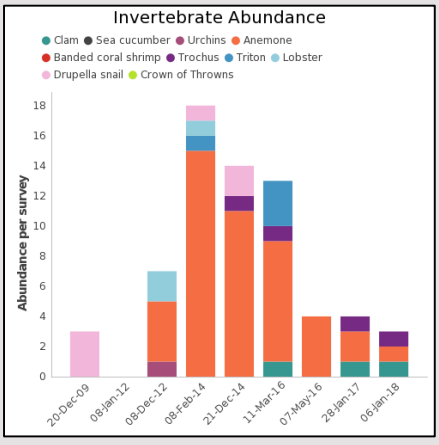


Figure 12. Invert abundance over time at Currimundi Reef, Site 1; 2009-2018.

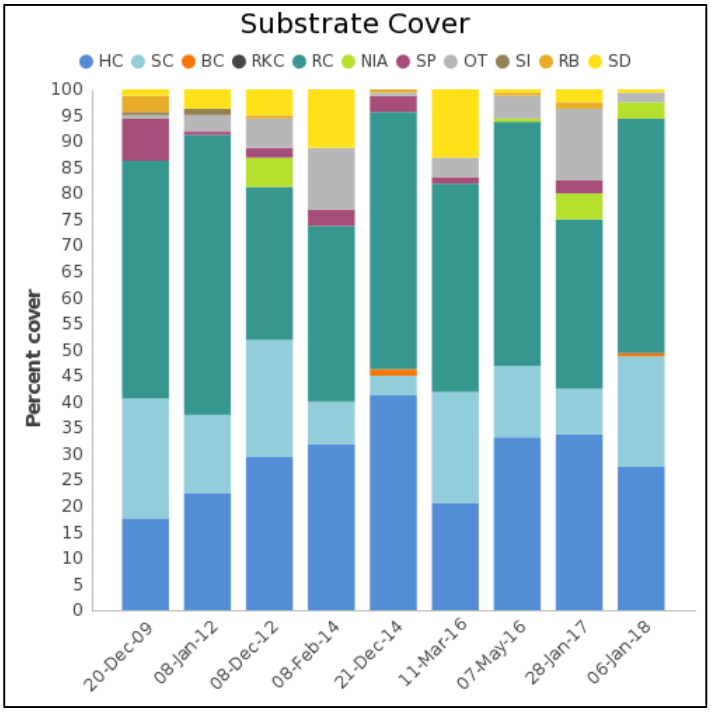


Figure 11. Benthic type and percent cover over time: Currimundi Reef, Site 1; 2009- 2018.

2.0 Sunshine Coast Sites

2.3 Currimundi Reef, Site 2

Currimundi Reef, Site 2 is not frequented by divers, fishers or boaters, similar to Currimundi Site 1. Site 2 is located on the reef flat on the western side of Currimundi Reef, Site 1, and was also established in 2009.

The substrate survey recorded 23% hard coral coverage, and 4% soft coral coverage. This is the lowest recording of soft coral at this site since RCA began surveys here, and one of the lowest for hard coral coverage. Rock accounted for the majority of the benthic cover (57%), with rubble (7%), sand (6%), nutrient indicator algae (1%), other (1%), and sponge (<1%) also recorded.

An average of 5% of the total coral population showed signs of bleaching, with individual colonies recording an average of 48% surface bleaching. Unknown scars (3) were the only other impact recorded.

Target invertebrates included anemones (12) and trochus (1). A fish survey was conducted this season, recording 1 butterflyfish, 1 snapper, 1 sweetlip, and 1 moray eel.

Siurveyor at site, Currimundi Reef, Site 2

Nudibranchs, Currimundi Reef, Site 2

Anemone with fish, Currimundi Reef, Site 2

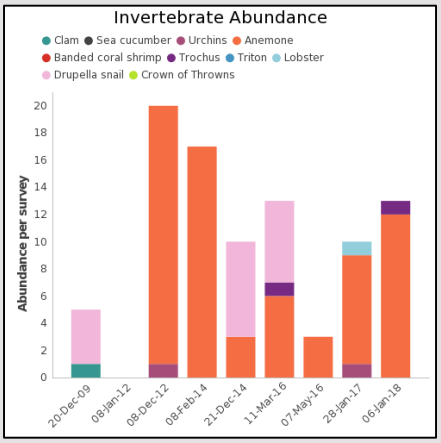


Figure 14. Invert abundance over time at Currimundi Reef, Site 2; 2009-2018.

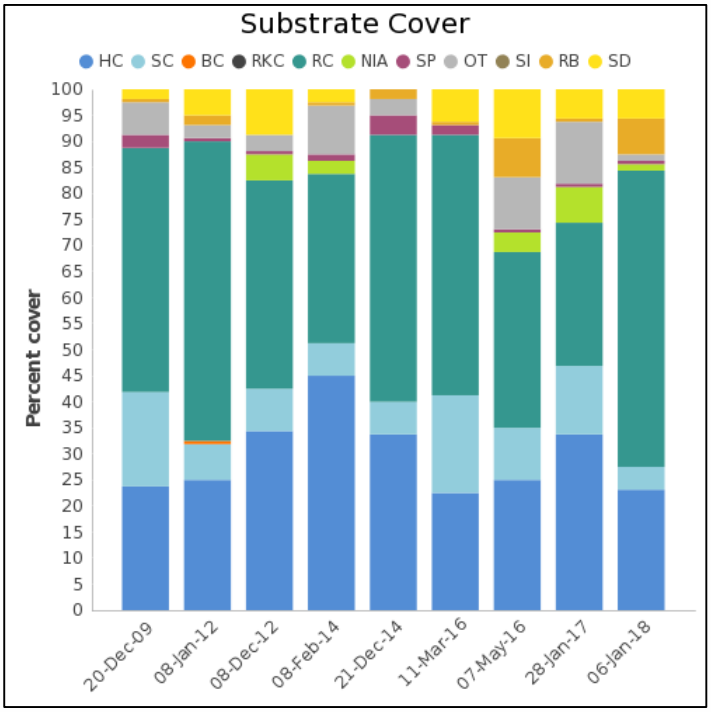


Figure 13. Benthic type and percent cover over time: Currimundi Reef, Site 2; 2009- 2018.

2.0 Sunshine Coast Sites

2.4 Inner Gneerings, The Caves Site 1

The Caves, Site 1, at Inner Gneerings, is located directly offshore from Mooloolaba. The reef extends from 10 to 25 metres deep, and is a popular site for recreational fishing and diving. Site 1 is located at 10 metres depth on the reef floor and is characterised by scattered rocky outcrops surrounded by coral, sponge and a collapsed cave structure. RCA has surveyed this site annually since 2009.

This site had hard coral coverage reported (37%), which aligns with results for the previous season. This is the highest cover for this site since RCA began surveys here in 2009. Soft coral coverage was recorded at 4%. Rock (42%), rubble (7%), nutrient indicator algae (4%), sand (4%), other (1%), and sponge (<1%) were also recorded on the substrate survey. Other was noted as hydroids and ascidians.

Less than 1% of the coral population showed evidence of bleaching, and an average of just 1% of individual colony surfaces were affected. There were 6 instances of unknown scarring recorded, and 2 items of fishing line.

Target invertebrates included just 1 giant clam, and l *Diadema.* A fish survey was conducted this season recording 7 butterflyfish, and 3 moray eels.

Site photo, The Caves Site 1

Lionfish, The Caves Site 1

Coral disease, The Caves Site 1

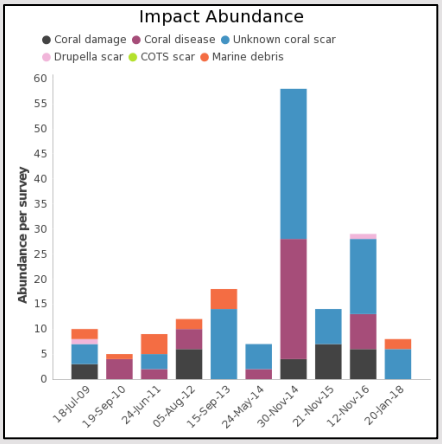


Figure 16. Invert abundance at Inner Gneerings, The Caves, Site 1; 2009-2018.

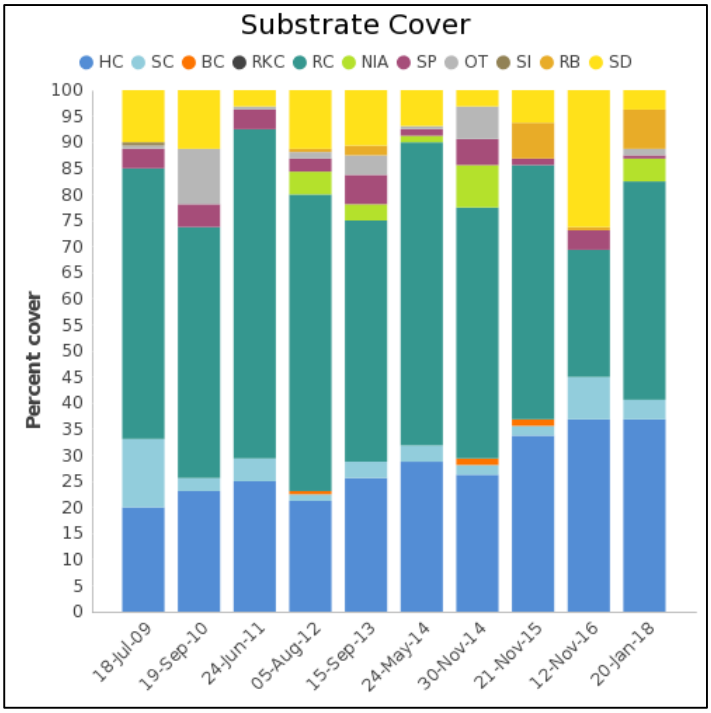


Figure 15. Benthic type and percent cover over time: Inner Gneerings, The Caves Site 2009- 2018.

2.0 Sunshine Coast Sites

2.5 Inner Gneerings, Scuba World Caves Site 2

Inner Gneerings, Scuba World Caves, Site 2, recorded 39% hard coral coverage, the second highest at any SEQ site this season (after Mudjimba The Ledge, Site 3). Soft coral accounted for 2.5% of the benthos. Rock (35%) and sand (19%) made up most of the remaining benthos, with other (3%) and sponge (1%) also being recorded. Other was noted as ascidians, and A*sparagopsis* was recorded as the dominant macroalgae, with 30 counts along the transect.

Bleaching affected 0.5% of the coral population, and an average of 12.5% of individual colony surfaces. Other impacts included unknown coral damage (2), coral disease, and unknown scarring (1). This is much fewer impacts compared to 2016, when over 20 were recorded.

Only 1 lobster was recorded on the invertebrate survey, while a fish survey recorded 15 butterflyfish. A wobbegong was also recorded.

Surveyor at site, Caves Site 2

Asparagopsis, Caves Site 2

Fishing line in coral, Caves Site 2

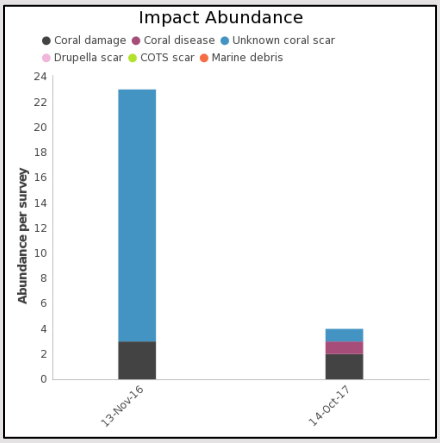


Figure 18. Invert abundance at Scuba World Caves, Site 2; 2009-2018.

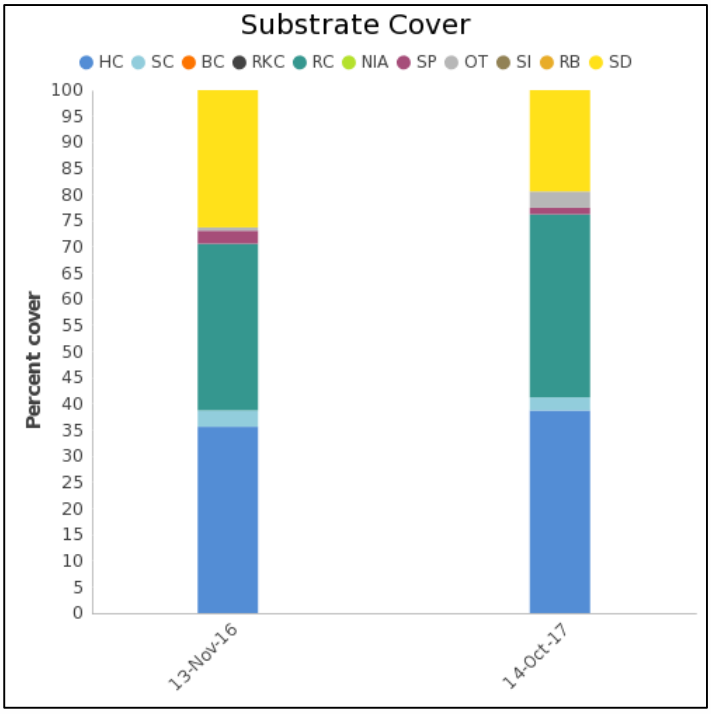


Figure 17. Benthic type and percent cover over time: Inner Gneerings, Scuba World Caves, Site 2; 2016- 2018.

2.0 Sunshine Coast Sites

2.6 Kings Beach Reef Site 1

Kings Beach Reef is located approximately 100m offshore, close to a boat ramp and regular boat traffic, and near to Caloundra's popular beach front area. Site 1 is situated at a depth of 3 meters, and was surveyed for the first time by RCA in 2009. In 2011, after a major flooding event in SEQ, this site was exposed to a flood plume. Data collected shortly after this event showed a dramatically reduced hard coral population (from 14% to 2%). Annual monitoring efforts have shown signs of recovery over time; and continued monitoring is required to document potential changes in the future.

At this site 5% of the substrate was hard coral, while no soft coral was recorded. The majority of the benthic cover here was rock (61%), which is in keeping with previous survey results. Nutrient indicator algae (16%), rubble (10%), other (6%), sponge (2%), and silt (0.6%) accounted for the remaining substrate. The dominant macroalgae were *Asparagopsis* and *Padina.*

Bleaching affected 4% of the coral population, with individual colonies suffering an average of 25.5% surface bleaching. Unknown scarring (11), marine debris (6), fishing line (3), unknown coral damage (3), and *Drupella* scarring (2) were other impacts recorded.

Kings Beach Reef, Site 1, recorded 29 *Drupella,* the most at any SEQ site this season. Other target invertebrates recorded included *Diadema* (9), collector urchin (4), and 1 trochus. A fish survey was conducted recording 2 butterflyfish, 2 sweetlips, and 1 wobbegong.

Crustose algae, Kings Beach

Bleached hard coral, Kings Beach

Nudibranch, Kings Beach

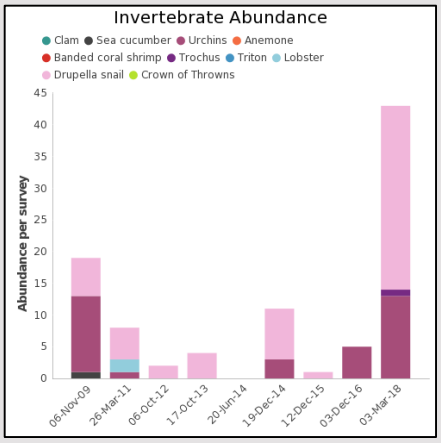


Figure 20. Invert abundance over time at Currimundi Reef, Site 1; 2009-2018.

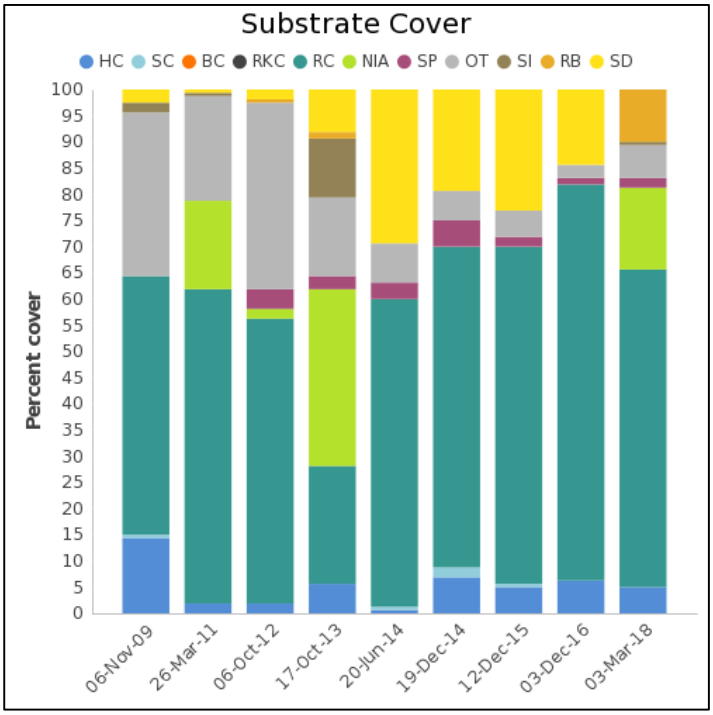


Figure 19. Benthic type and percent cover over time: Kings Beach Reef, Site 1; 2009-2018.

2.0 Sunshine Coast Sites

2.7 Mudjimba Island, North West Reef Site 1

Mudjimba Island is located just off the mainland, close to Maroochydore and the Mooloolah River Mouth. It is an area subject to high boat traffic as it is popular for various in-water activities. RCA began surveying this site in 2013 to collect data on this regularly-frequented reef. Site 1 faces the North West side of the island, and is situated at a depth of 8 meters. It varies substantially from the southern sites, offering new insights to this culturally and ecologically important location.

Hard coral accounted for 20% of the substrate, and soft coral for 7%. Rock made up most of the benthos (58%), and sand (11%), nutrient indicator algae (1%), sponge (1%), and other (1%) were also recorded. The dominant macroalgae was *Padina.*

Coral bleaching affected 6.5% of the total population, and individual colonies showed an average of 22% surface bleaching. Other impacts included unknown scarring (7), unknown coral damage (6), fishing line (3), and marine debris (1).

Target invertebrate species included 14 anemones, 4 *Drupella*, 3 collector urchins, 1 *Diadema*, 1 giant clam, and 1 sea cucumber. A fish survey recorded 6 parrotfish and 2 snapper. Surveyors also recorded 2 wobbegongs.

Foliose coral at site, Mudjimba Island NW Site 1

Branching coral, Mudjimba Island NW Site 1

Lions mane jelly, Mujimba Island NW Site 1

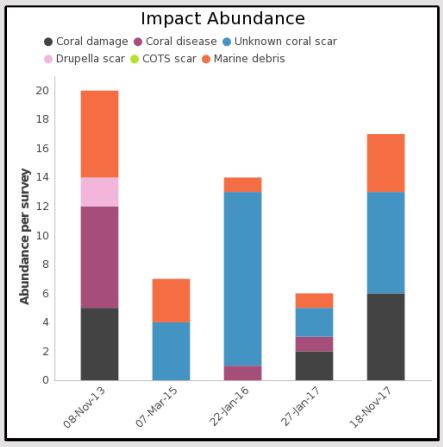


Figure 22. Impact abundance over time at Mudjimba Island, North West Reef, Site 1; 2009-2018.

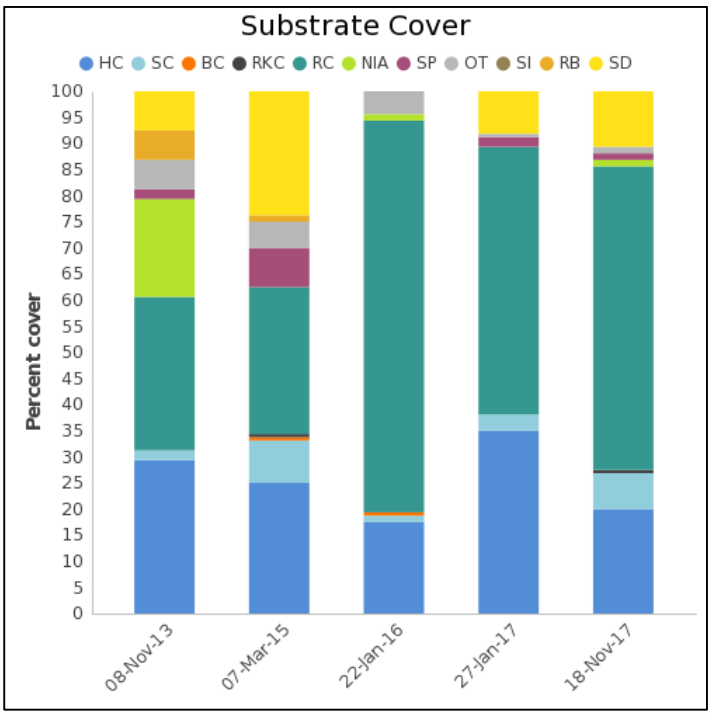


Figure 21. Benthic type and percent cover over time: Mudjimba Island, North West Reef, Site 1; 2009- 2018.

2.0 Sunshine Coast Sites

2.8 Mudjimba Island, The Ledge Site 1

The Ledge, Site 1, at Mudjimba Island is another high-traffic area, popular for various in-water activities including fishing, diving, and surfing. This site is located on the southern side of Mudjimba Island, at a depth of 5 metres on the reef flat.

The substrate comprised of 37% hard coral, and 9% soft coral coverage. These both represent an increase from the previous season (29% and 3% coverage respectively). The substrate survey also recorded rock (44%), sand (4%), sponge (3%), rubble (2%), and other (1%), which was noted as anemone.

Only 1% of the overall coral population showed signs of bleaching, but bleaching affected an average of 56% of individual colonies.

Site photo, Mudjimba Island The Ledge Site 1

Coral disease, The Ledge Site 1

Juvenile boxfish, The Ledge Site 1

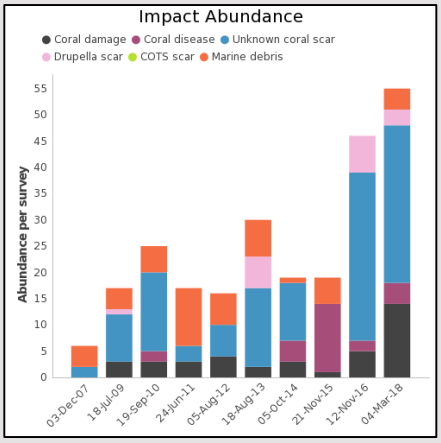


Figure 24. Impact abundance at Mudjimba Island, North West Reef, Site 1; 2009- 2018.

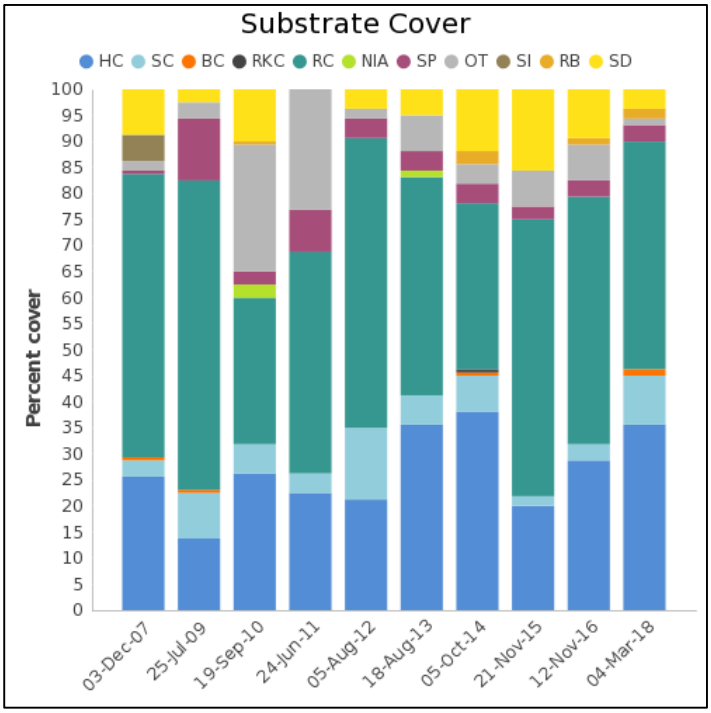


Figure 23. Benthic type and percent cover over time: Mudjimba Island, North West Reef, Site 1; 2009- 2018.

2.0 Sunshine Coast Sites

2.9 Mudjimba Island, The Ledge Site 2

The Ledge, Site 2, was first included in RCA's reef health monitoring site list in 2013. This is another site popular for various water activities. Site 2 is parallel to Site 1 on the southern side of Mudjimba Island, and is located at 9m on the reef slope.

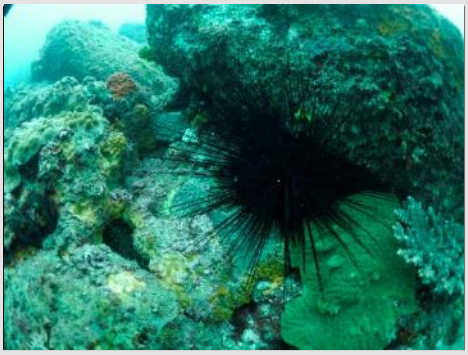
Hard coral cover has remained consistent at this location throughout monitoring (19%) in 2017. Soft coral may be suggesting a slightly increasing trend (16% in 2017). Rock makes up the majority of the benthos (59%).

Discarded fishing line (10 counts) and one count of coral damage were recorded on the impact survey.

The only invertebrates recorded were 1 anemone and 1 *Diadema* urchin.

In 2017, 15 butterflyfish, 5 sweetlips, and 1 grouper were recorded on the fish survey.

Site, Mudjimba Island The Ledge Site 2



Diadema, Mudjimba Island The Ledge Site 2

Angelfish, Mudjimba Island The Ledge Site 2

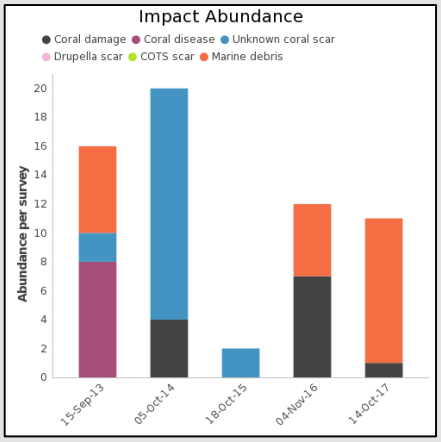


Figure 26. Impact abundance over time at Mudjimba Island, The Ledge, Site 1; 2013-2018.

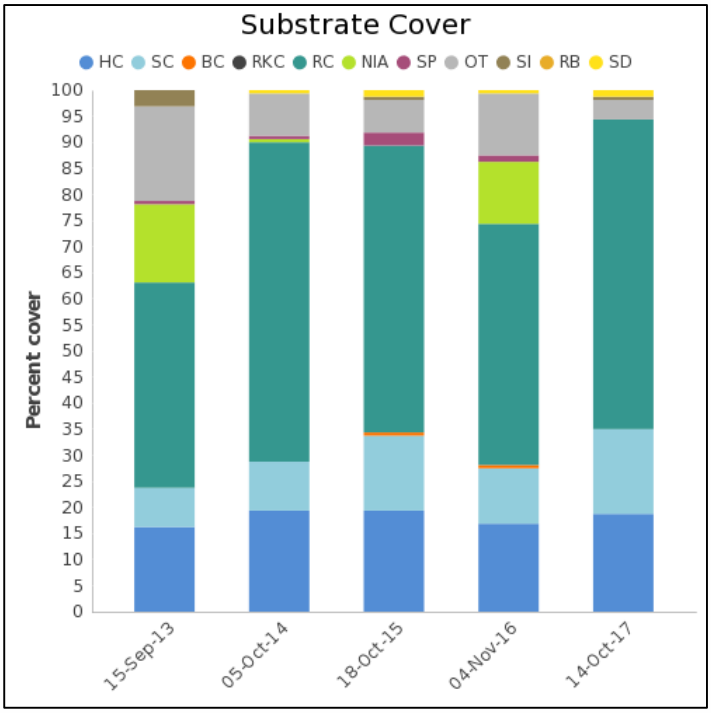


Figure 25. Benthic type and percent cover over time: Mudjimba Island, The Ledge, Site 1; 2013- 2018.

2.0 Sunshine Coast Sites

2.10 Mudjimba Island, The Ledge Site 3

The Ledge, Site 3, was established along with Site 2 in 2013. This third site was included to expand the area monitored by RCA, and thus their understanding of the impacts on the area by the high amount of boat traffic and in-water activities. Site 3 is on the southern side of the island, at 7 metres of depth on the reef slope (located between the shallow Site 1, and the deeper Site 2). Despite their proximity to each other, all sites represent a distinct habitat type, which is another reason Sites 3 and 2 were added.

Hard coral cover at this site has been relatively consistent over time (36% in 2018), with perhaps a slight increasing trend. Soft coral cover also suggests an increasing trend over time (18% in 2018).

Higher abundances of impacts were recorded this year than previously. This included coral damage (11), coral disease (3), and marine debris (13 counts of fishing line and 1 count of general debris).

Seventeen *Drupella* snails were the only invertebrate recorded on the survey.

On the fish survey, 1 coral trout, 1 moray eel, 2 parrotfish and 5 butterflyfish were recorded.

Site photo, Mudjimba Island Site 3

Anchor damage on coral, Mudjimba Island Site 3

Eel, Mudjimba Island Site 3

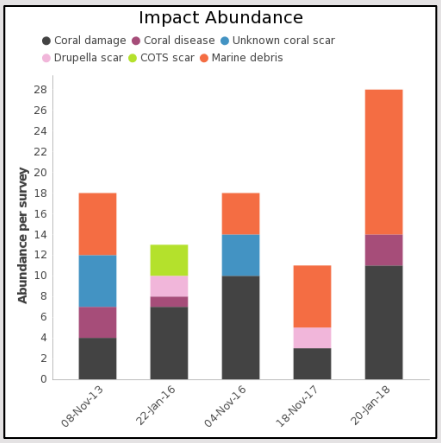


Figure 28. Impact abundance over time at Mudjimba Island, The Ledge, Site 3; 2009-2018.

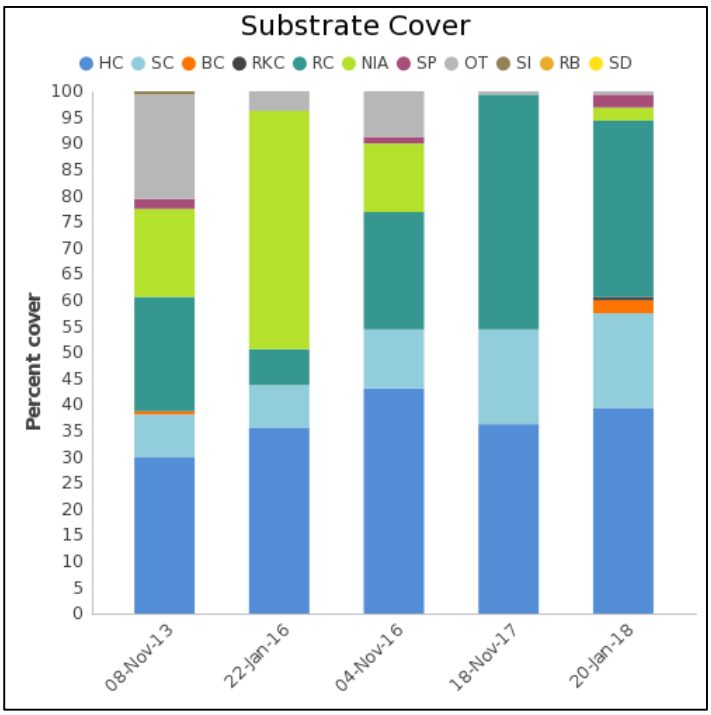
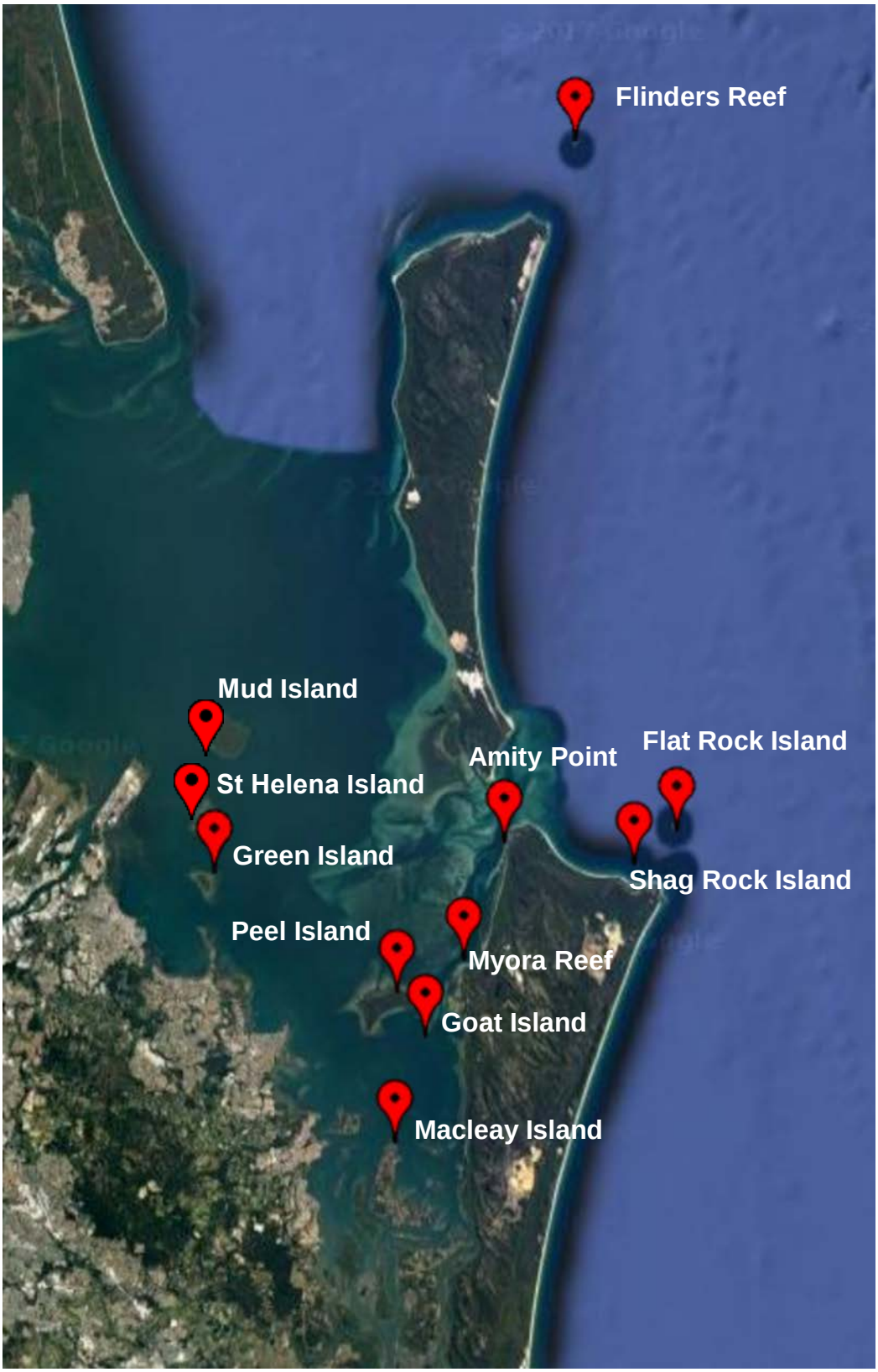


Figure 27. Benthic type and percent cover over time: Mudjimba Island, The Ledge, Site 3; 2009- 2018.

3.0 Moreton Bay



Map: Moreton Bay, South East Queensland
Image courtesy of Google Earth

3.0 Inshore Moreton Bay Sites

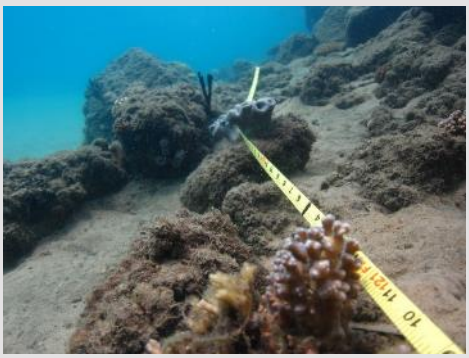
3.1 Amity Point Site 2

Amity Point, Site 2, was established and surveyed for the first time in 2016. It is located on the south west end of North Stradbroke Island, and is frequented by vast numbers of fishers, boaters and divers all year round. The site begins at the public boat ramp and continues along the artificial rock wall near a popular camping and fishing ground. Site 2 is on the back reef wall at a depth of 2 metres, above the deeper site 1.This site was added to RCA's reef health monitoring site list to better understand and record impacts on this heavily utilized site.

The substrate was largely comprised of rock (49%) and sand (36%). There was a some hard coral coverage (6%) and some soft coral (2.5%) coverage. The rest of the substrate was made up of sponge (4%) and rubble (2.5%). On the Invertebrate survey 109 *Diadema* long spined urchins were recorded. No macro algae was recorded for this site.

Bleaching affected roughly 12.5% of the total coral population, and the average bleaching on individual colonies was 50%. No coral disease was recorded during the survey, although there were 11 recorded instances of coral damage (unknown). There were 34 items of marine debris recorded, including 28 pieces of fishing line.

A fish survey was not conducted at this site, although some rare species were sighted, including 2 sweetlips, a grouper, a wobbegong, and a flamboyant cuttlefish.



Survey site, Amity Point Site 2

Flamboyant cuttlefish, Amity Point Site 2

Fishingline, Amity Point Site 2

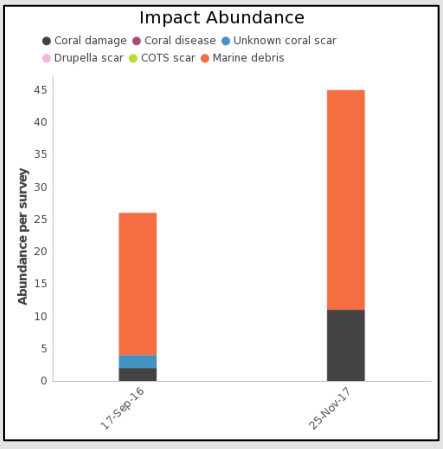


Figure 30. Invert abundance over time at Amity Point, Site 1; 2016-2018.

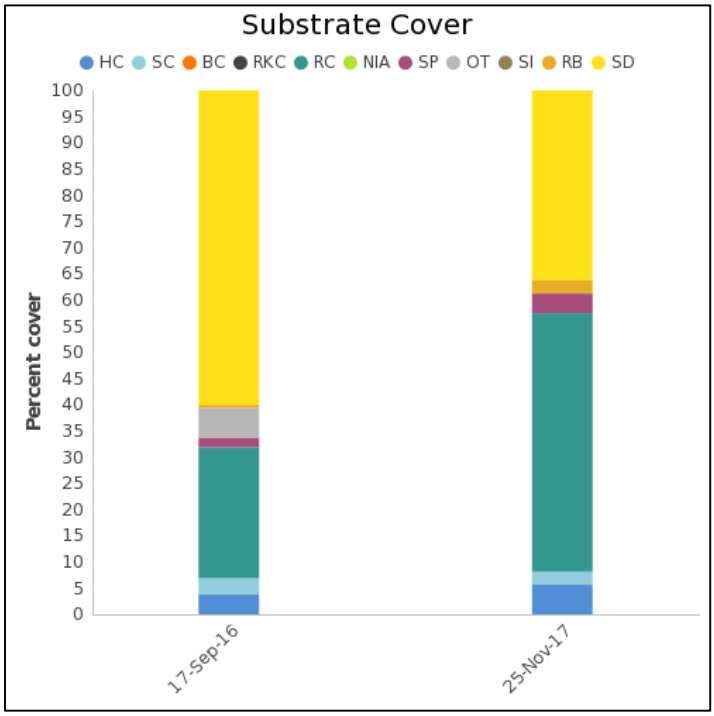


Figure 29. Benthic type and percent cover over time: Amity Point, Site 1; 2016-2018.

3.0 Inshore Moreton Bay Sites

3.2 Goat Island East Site 1

Goat Island is located between North Stradbroke Island and Peel Island in Moreton Bay. A shallow sand reef fringes the island. Site 1 is located on the eastern side of the island, adjacent to a boat channel used by North Stradbroke Island ferries. This proximity to the channel, and its shallow depth (approximately 1 meter) means that it is exposed to regular traffic and induced surge. Site 1 was established in 2009 to monitor this highly trafficked area.

The substrate survey recorded 21% hard coral coverage, and 31% soft coral coverage. The remaining substrate was made up of rubble (19%), rock (14%), sand (9%), and silt (7%). The site recorded a 'medium' silt loading, and no macro algae was recorded for this site.

No invertebrates were recorded during this year's survey, which is not atypical for some inshore sites. A fish survey was conducted but only 6 butterfly fish were recorded.

Roughly 3% of the total coral population was affected by bleaching, while the average bleaching of individual colonies was 44%. Impacts also included 10 instances of unknown coral damage, 11 items of marine debris (including 10 pieces of fishing line), and 3 unknown coral scars.

Survey site, Goat Island East S1

Coral damage, Goat Island East S1

Siltation and tissue loss, Goat Island East S1

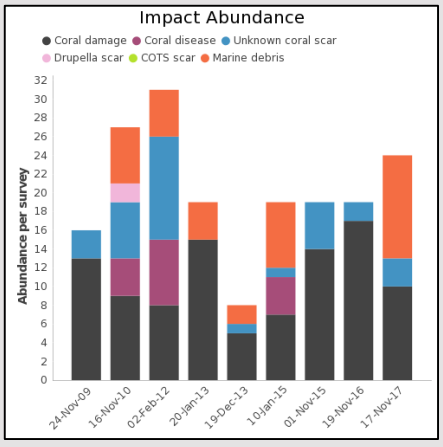


Figure 32. Impact abundance over time at Goat Island, Site 1; 2009-2018.

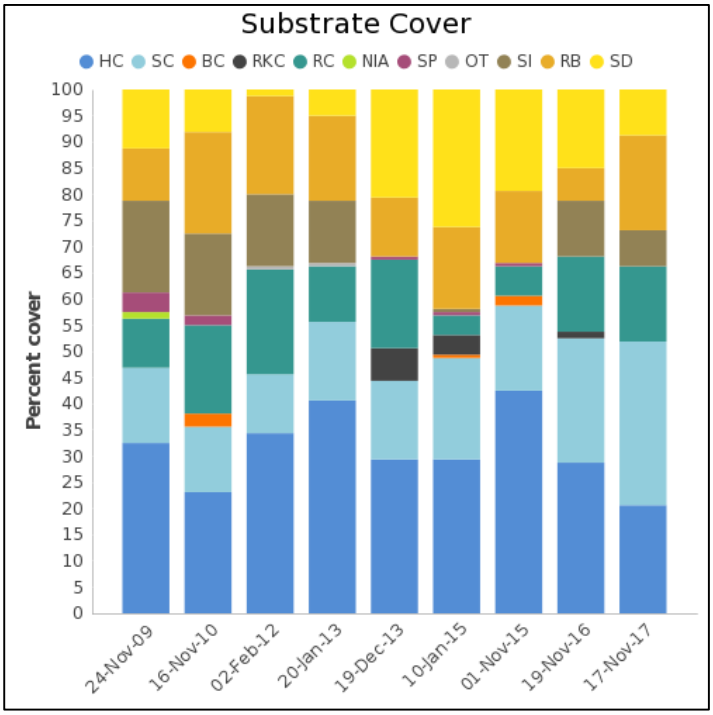


Figure 31. Benthic type and percent cover over time: Goat Island, Site 1; 2009-2018.

3.0 Inshore Moreton Bay Sites

3.3 Goat Island West Site 1

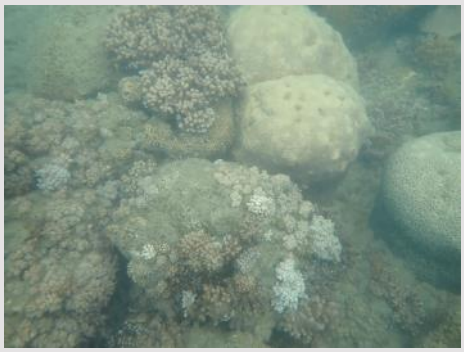
Goat Island West, Site 1, was first surveyed in 2014, in order to increase understanding of various habitat types around Goat Island. Goat Island West, Site 1, is located at a shallow depth of approximately one meter, similar to Goat Island, Site 1. This site, like Goat Island, is exposed to regular boating traffic and surge from the nearby boat channel. This site is monitored in\ partnership with Quandamooka Rangers.

The substrate survey recorded 12.5% hard coral coverage and 31% soft coral coverage. The rest of the substrate comprised of rock (26%), rubble (17.5%), silt (10%), sand (2.5%), and recently killed coral (0.6%). No macro algae was recorded for this site.

Of the total coral population, approximately 11% was bleached. Individual colonies exhibited an average of 19.5% bleaching. Other impacts recorded included 3 items of marine debris (2 of which were fishing line), 2 instances of unknown coral damage, and 1 unknown scar.

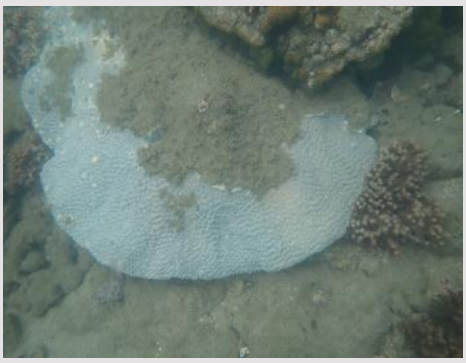
No fish survey was conducted this season, although dolphins were spotted near the survey site.

Our monitoring of this site is done in partnership with Quandamooka Yoolooburrabee Aboriginal Corporation and Quandamooka Land and Sea Management Agency.



Survey site, Goat Island West S1

Coral bleaching, Goat Island West S1



Sedimentation on coral, Goat Island West S1

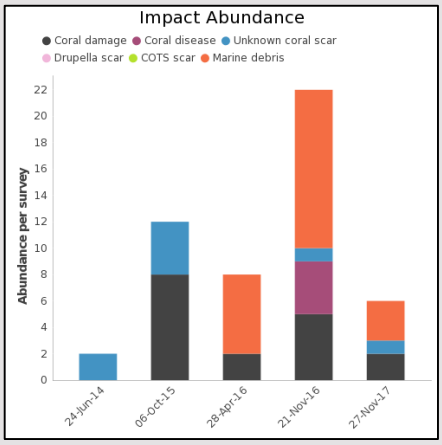


Figure 34. Impact abundance over time at Goat Island West, Site 1; 2014-2018.

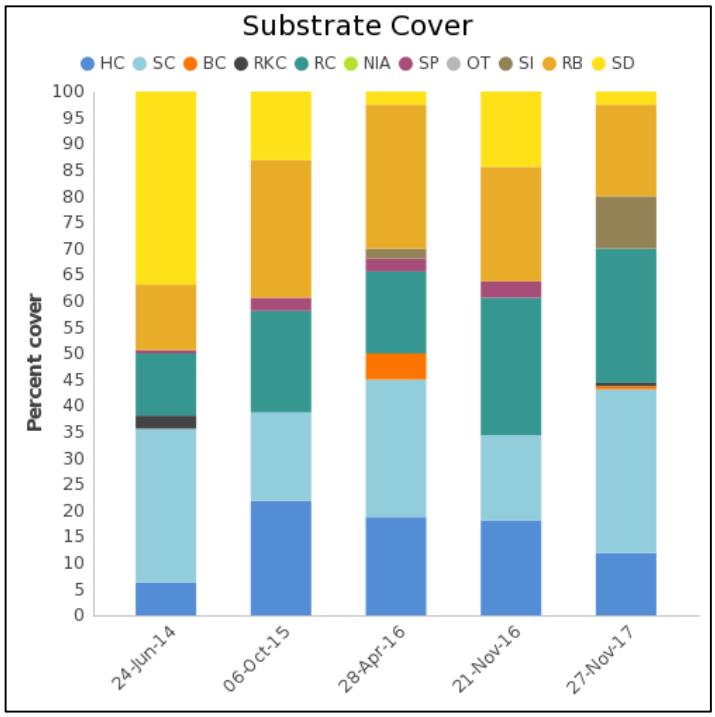


Figure 33. Benthic type and percent cover: Goat Island West, Site 1; 2014-2018.

3.0 Inshore Moreton Bay Sites

3.4 Green Island North Site 1

Green Island North, Site 1, was first surveyed in 2015. It is a site that hosts patchy coral cover on a sandy benthos.

The substrate survey recorded 8% hard coral coverage, and 11% soft. The other substrate was comprised of sand (48%), rock (16%), rubble (12%), sponge (3%), and other (<1%, crustose algae).

Green Island North had one of the highest overall coral population bleaching recordings, with approximately 37% of the population bleached. Individual colonies exhibited an average of 46% bleaching. No other impacts were recorded, apart from 12 unknown scars. There were 3 *Drupella* recorded, and 1 lobster, during the invertebrate survey, compared to no invertebrates when this site was first surveyed in 2015.

A fish survey was conducted this season, although no target species were recorded.

Survey site, Green Island North Site 1

Soft coral, sponge, Green Island North Site 1

Lobster, Green Island North Site 1

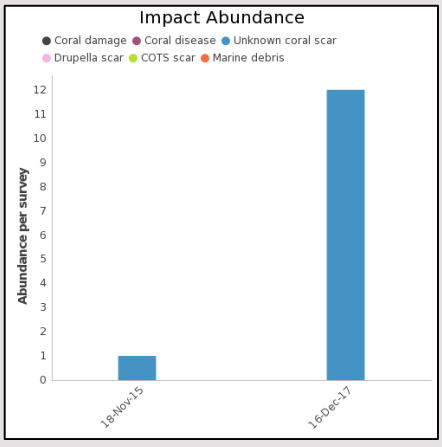


Figure 36. Impact abundance at Green Island North, Site 1; 2016-2018.

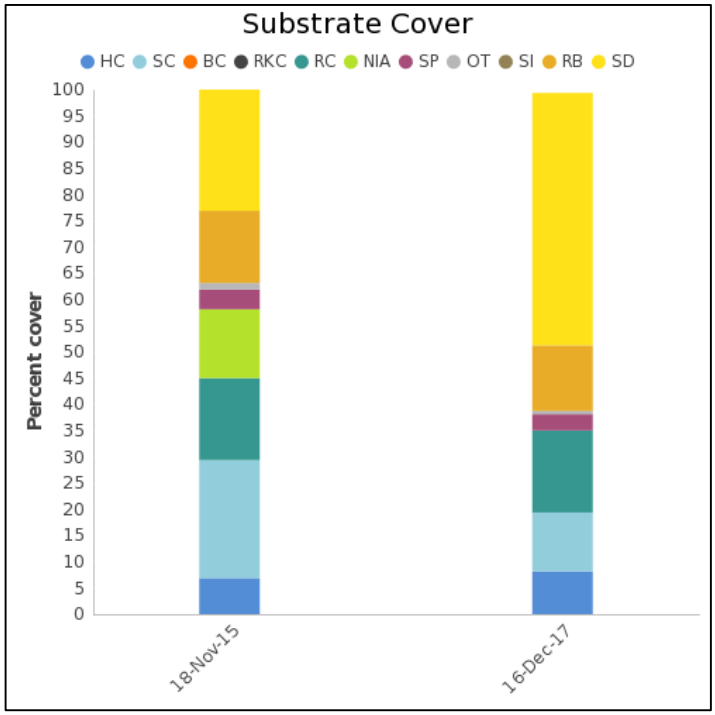


Figure 35. Benthic type and percent cover: Green Island North Site 1; 2016-2018.

3.0 Inshore Moreton Bay Sites

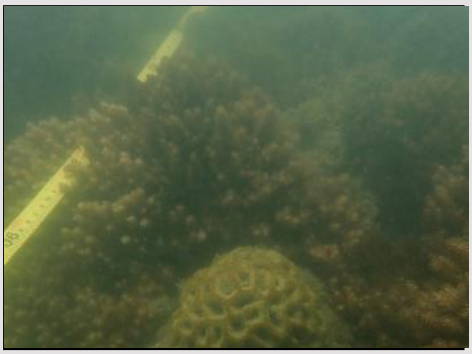
3.5 Green Island West Site 1

Green Island West, Site 1, was surveyed for the first time this season. The site hosts patchy coral on a soft sediment benthos.

The majority of the substrate was sand (53%), followed by rock (20%). The survey did record 6% hard coral coverage and 16% soft coral coverage. The remaining substrate was made up of sponge (3%), silt (1%), and rubble (0.6%). Although silt only accounted for 1%, much of the sand had siltation.

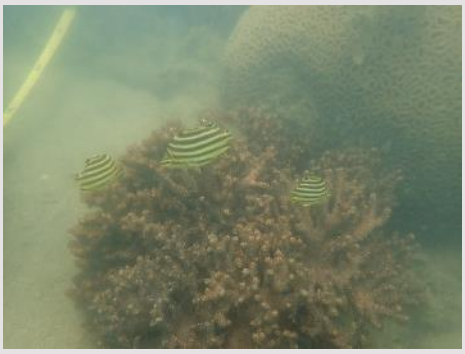
Approximately 8% of the total coral population showed signs of bleaching, with an average of 22% surface bleaching of individual colonies. The only other impacts recorded were 18 unknown scars.

A fish survey was also conducted, although no target species, and no target invertebrates, were recorded. This is not atypical of many inshore Moreton Bay sites.



Survey site, Green Island West

Ray in sand, Green Island West



Stripeys with soft coral, Green Island West

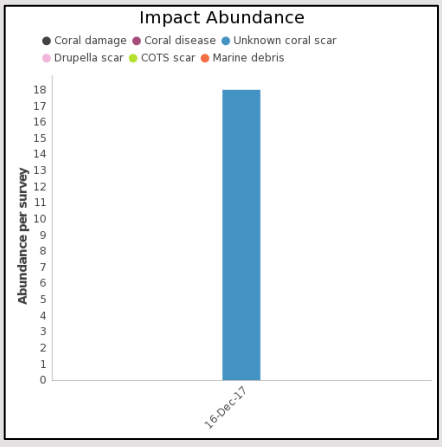


Figure 38. Invert abundance over time at Green Island West, Site 1; 2018.

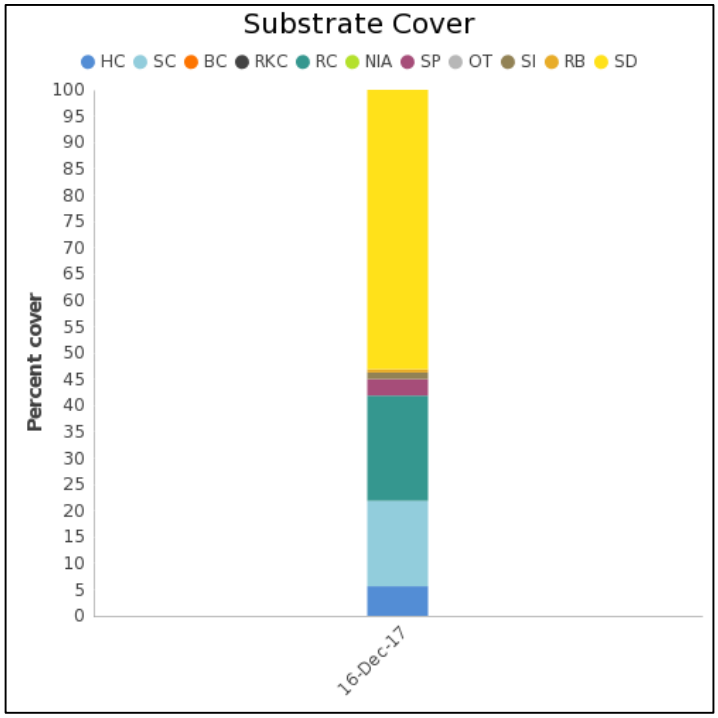


Figure 37. Benthic type and percent cover: Green Island West Site 1; 2018.

3.0 Inshore Moreton Bay Sites

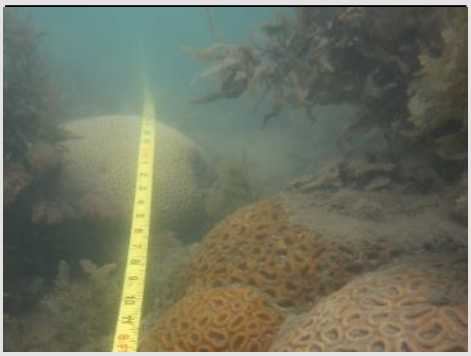
3.6 Macleay Island Site 1

This site was established in 2009 and is situated on the North-East side of Macleay Island in Moreton Bay. This site is located at a shallow depth of approximately one meter and is likely exposed to regular surge from boating traffic. This site also has relatively high siltation.

The substrate survey recorded 8% hard coral coverage, and 11% soft coral coverage. The remaining substrate comprised of rubble (24%), silt (22%), rock (16%), nutrient indicator algae (14%), and sand (4%).

Approximately 25% of the total coral population showed signs of bleaching, with individual colonies exhibiting an average of 42% surface bleaching. The impact survey recorded 4 instances of unknown coral damage, but no other impacts.

A fish survey was conducted this season, although neither this survey, nor the invertebrate survey, recorded any target species.



Survey site, Macleay Island Site 1

Bleached coral, Macleay Island Site 1

Nudibranch, Macleay Island Site 1

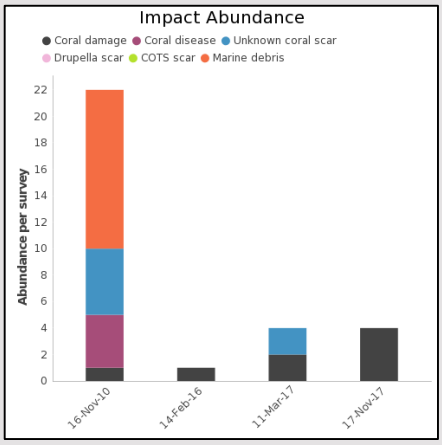


Figure 40. Impact abundance over time at Macleay Island, Site 1; 2009-2018.

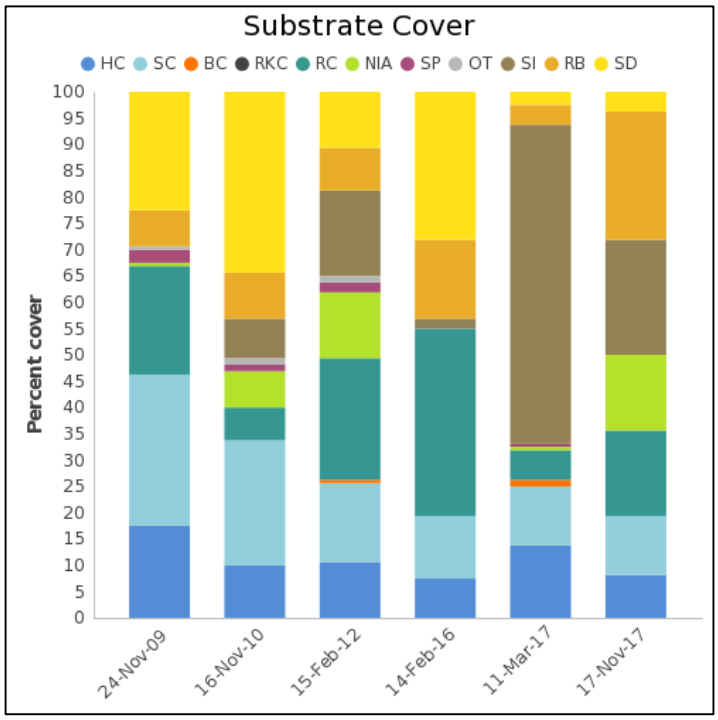


Figure 39. Benthic type and percent cover over time: Macleay Island, Site 1; 2009- 2018.

3.0 Inshore Moreton Bay Sites

3.7 Mud Island Coral Galore Site 1

This site was surveyed for the first time this season. The site was identified through reef habitat mapping (Roelfsema et al 2017) that indicated relatively higher areas of coral cover. The site sits on a gentle rocky slope.

The substrate survey recorded 2% hard coral coverage and 44% soft coral coverage, which was the highest soft coral coverage recorded across all SEQ sites this season. The remaining substrate comprised of rock (27%), rubble (20%), sand (6%), nutrient indicator algae (<1%), and other (<1%, tubeworm).

Approximately 5% of the overall coral population was bleached, and individual coral populations exhibited an average of 32.5% surface bleaching. Other impacts included 3 *Drupella* scars, and 1 fishing line.

Eight *Drupella* snails were the only recorded invertebrates, and no target fish species were recorded, although both surveys were conducted.

Survey site, Mud Island Coral Galore S1

Leathery soft coral, Mud Island Coral Galore S1

Drupella snails, Mud Island Coral Galore S1

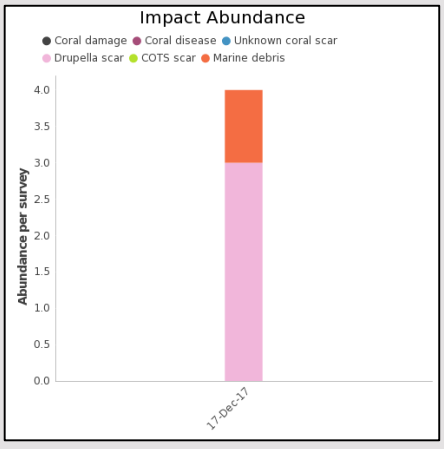


Figure 42. Impact abundance at Mud Island Coral Galore, Site 1; 2018.

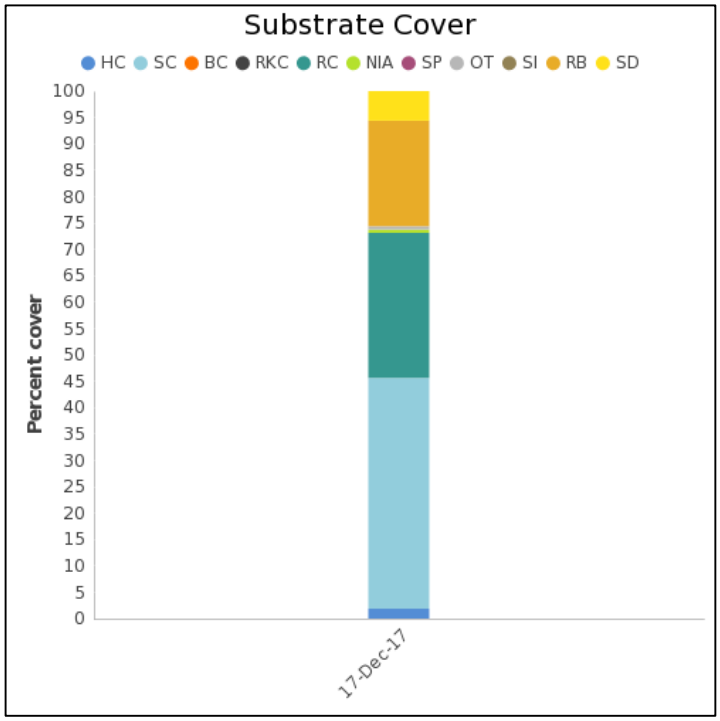


Figure 41. Benthic type and percent cover: Mud Island Coral Galore, Site 1; 2018

3.0 Inshore Moreton Bay Sites

3.8 Mud Island Rubble Patch Site 1

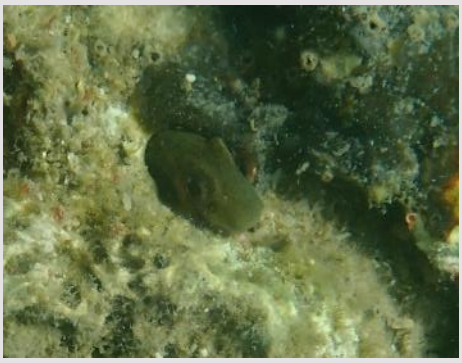
This site was surveyed for the first time in 2017. The site was identified through reef habitat mapping (Roelfsema et al 2017) that indicated relatively higher areas of coral cover. The site is made up almost exclusively of unconsolidated coral rubble.

As the name suggests, the majority of the substrate at Rubble Patch Site 1 was made up of rubble (56%), followed by rock (34%). No hard coral was recorded at this site, although some soft coral was recorded (4%). The surveyors also commented that there was a noticeable amount of soft coral that lay just off the transect, so further surveys may be required to attain a more accurate estimate of coral coverage. The remaining substrate was made up of nutrient indicator algae (4%) and sand (2%). *Sargassum* and *Padina* were the dominant macroalgae.

Less than one percent of the total coral population exhibited signs of bleaching, while the average surface bleaching for individual colonies was 2%. The only other recorded impact was 1 item of marine debris (a fish net).

The invertebrate survey recorded no target species, and no fish survey was conducted in this season.

Site photo with soft coral, Rubble Patch Site 1



Blenny, Rubble Patch Site 1

Coral rubble with stripeys, Rubble Patch Site 1

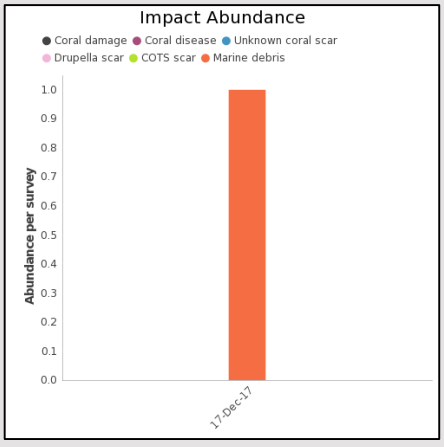


Figure 44. Impact abundance at Mud Island Rubble Patch, Site 1; 2018.

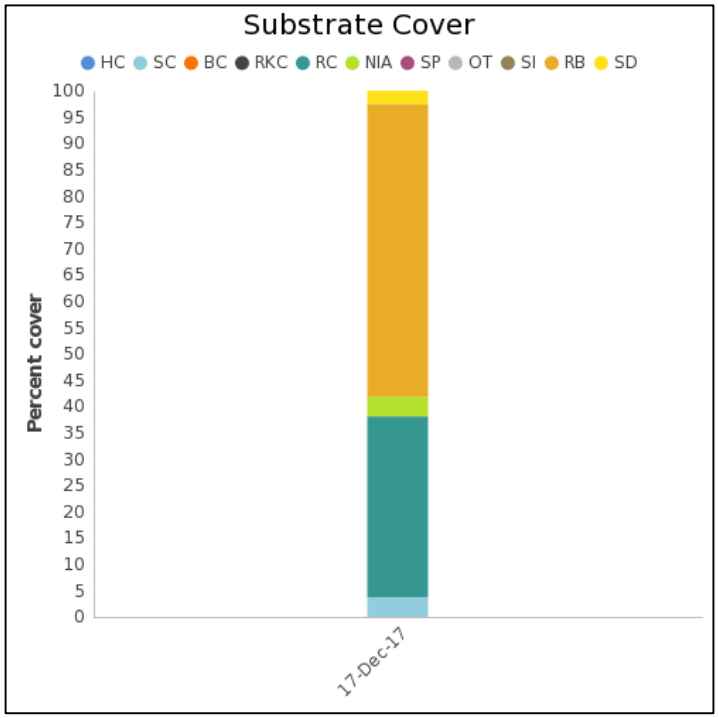


Figure 43. Benthic type and percent cover: Mud Island Rubble Patch, Site 1; 2018.

3.0 Inshore Moreton Bay Sites

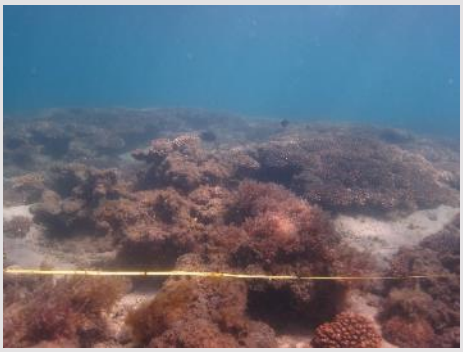
3.9 Myora Reef Site 1

Myora Reef is a unique reef habitat in Moreton Bay, as it is one of the only locations dominated by *Acropora* corals (Fellegara & Harrison 2008). This site is situated on a fringing reef on the west side of North Stradbroke Island, within the Green Zone. This site was established in 2009.

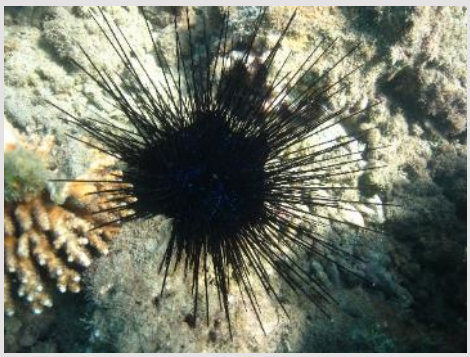
Myora Reef Site 1 recorded the highest amount of hard coral coverage out of any Inshore Moreton Bay site (36%). No soft coral was recorded, and the remaining substrate was made up of rock (39%), sand (13%), rubble (7%), nutrient indicator algae (3%), sponge (1%), and other (<1%), which was noted as ascidians.

Myora Reef Site 1 also recorded the highest number of impacts, with 38 unknown scars (the most recorded at any SEQ site) and 28 instances of coral disease (again, the highest at any SEQ site this season). Approximately 1% of the overall coral population showed signs of bleaching, and individual colonies exhibited an average surface bleaching of 32%. Other impacts include 14 recordings of unknown coral damage, 6 *Drupella* scars, 3 pieces of fishing line and one other item of marine debris.

The invertebrate survey recorded 93 *Diadema urchins*, the highest amount at any Inshore Moreton Bay site after Amity Point. 10 *Drupella,* 2 lobster, and 1 banded shrimp. A fish survey was conducted, recording 57 butterflyfish, 6 sweetlips, 5 parrotfish, as well as 2 wobbegongs and 2 tawny nurse sharks.



Survey site, Myora Reef, Site 1



Diadema urchin, Myora Reef, Site 1

Coral disease, Myora Reef, Site 1

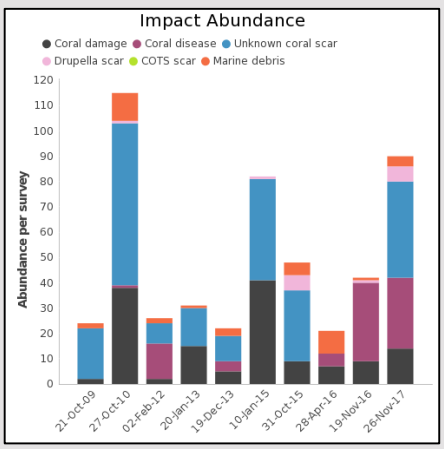


Figure 46. Impact abundance over time at Myora Reef, Site 1; 2009-2018.

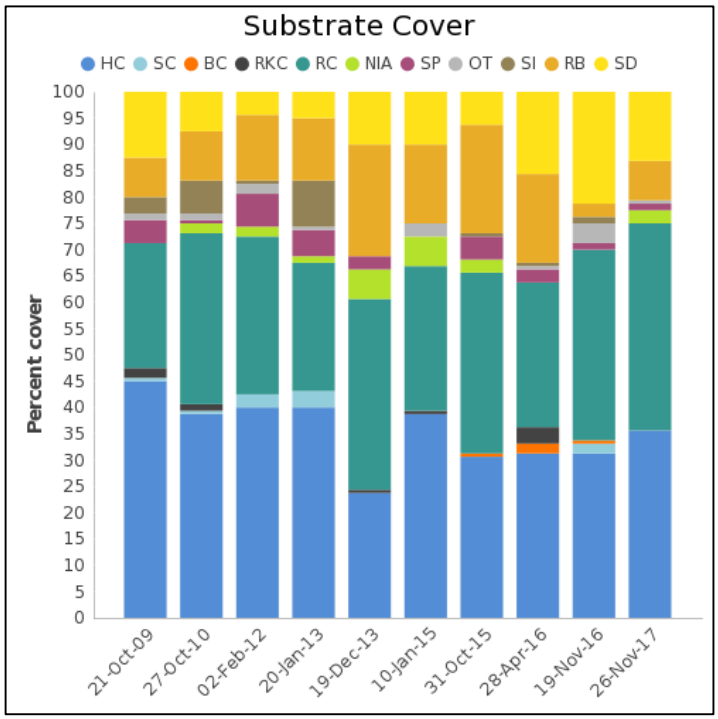


Figure 45. Benthic type and percent cover over time: Myora Reef, Site 1; 2009- 2018.

3.0 Inshore Moreton Bay Sites

3.10 Myora Reef Site 2

Myora Reef, Site 2, was established in 2014 on a fringing reef on the west side of North Stradbroke Island, also within the Green Zone. Site 2 is shallower than the long-established Myora Reef, Site 1, sitting at only one meter. The site is highly influenced by tidal fluctuations, and is also dominated by *Acropora* corals (Fellegara & Harrison 2008).

Myora Reef, Site 2, recorded 32.5% hard coral coverage, the second highest out of all Inshore Moreton Bay sites after Myora Reef, Site 1. The site recorded no soft coral, and the remaining substrate comprised of rock (36%), sand (12.5%), rubble (11%), sponge (4%), and nutrient indicator algae (4%).

The site recorded 1% total coral population bleaching, while individual colonies showed an average 1% surface bleaching, the lowest out of all Inshore Moreton Bay sites. Other impacts recorded were unknown coral damage (14), *Drupella* scarring (10), unknown scarring (8), marine debris (5), and fishing line (4).

A fish survey recorded 2 butterflyfish, and 2 moray eels, and no other target species. Target invertebrates recorded included 21 *Diadema*, and 10 *Drupella* snails.

Our monitoring of this site is done in partnership with Quandamooka Yoolooburrabee Aboriginal Corporation and Quandamooka Land and Sea Management Agency.

Survey site, Myora Reef S2

Fishing line in coral, Myora Reef S2

Diadema urchin, Myora Reef S2

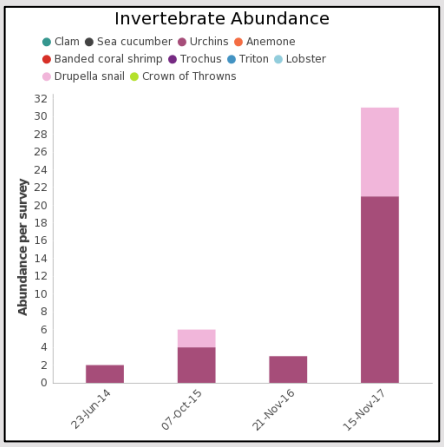


Figure 48. Invert abundance over time at Myora Reef, Site 2; 2014-2018.

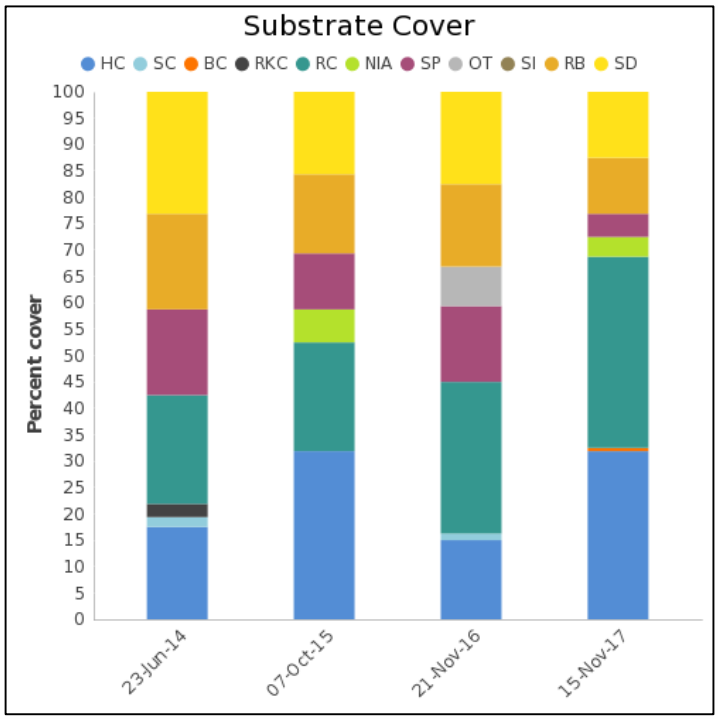


Figure 47. Benthic type and percent cover over time: Myora Reef, Site 2; 2014- 2018.

3.0 Inshore Moreton Bay Sites

3.11 Peel Island East Site 1

Peel Island East, Site 1, like Peel Island West, was established in 2009 and is situated on the reef flat at 2 meters depth. The site is easily accessible, and also experiences heavy boat traffic due to its proximity to a deep channel.

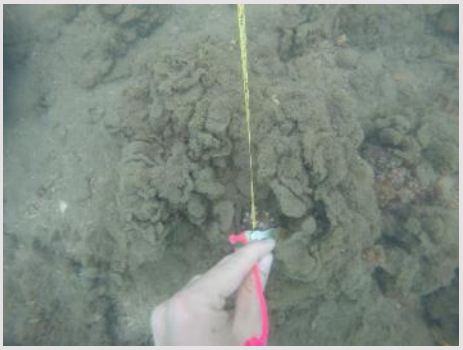
Peel Island East, Site 1, recorded 7% hard coral coverage, and 5% soft coral coverage. The remaining substrate comprised of sand (41%), nutrient indicator algae (26%), silt (12%), sponge (4%), other (4%), rubble (<1%), and rock (<1%).

Total coral population bleaching was recorded at 3%, and individual colonies recorded an average surface bleaching of 22%. Other impacts included 12 items of fishing line, 6 unknown scars, and 2 instances of unknown coral damage.

The invertebrate survey 1 banded shrimp and 1 *Drupella* snail. A fish survey recorded just 4 butterflyfish, although 3 stingrays were also seen.

Coral on survey, Peel East Site 1

Shovelnose ray, Peel East Site 1



Lobophora (NIA) on transect, Peel East Site 1

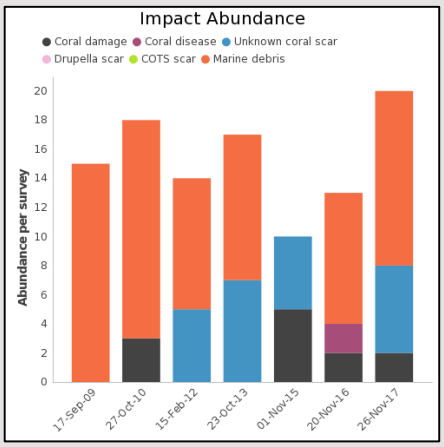


Figure 50. Impact abundance over time at Peel Island East, Site 1; 2009-2018.

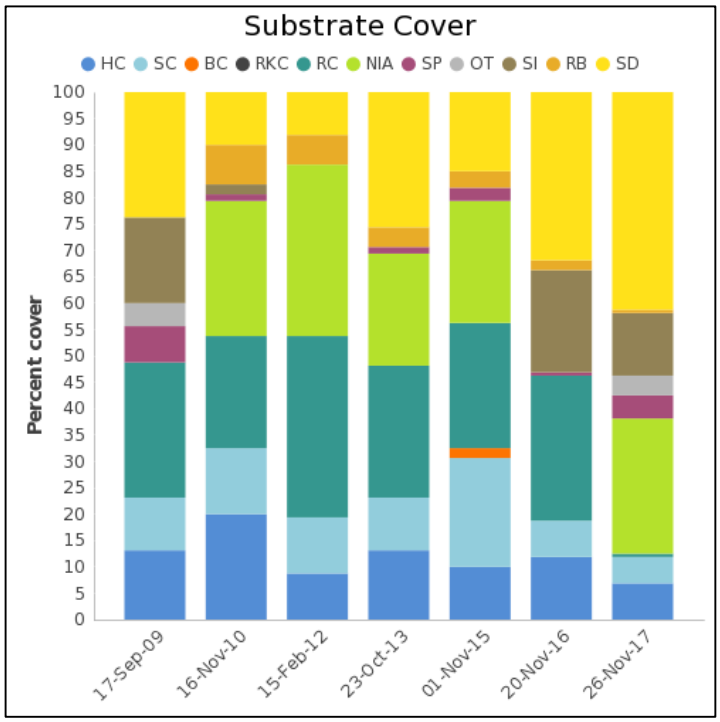


Figure 49. Benthic type and percent cover over time: Peel Island East, Site 1; 2009- 2018.

3.0 Inshore Moreton Bay Sites

3.12 Peel Island North Site 1

Peel Island North, Site 1, was established in 2009 and is located on the reef flat at a shallow depth of two meters. The site is easily accessible, and experiences heavy boat traffic due to its proximity to a deep channel. The northern area of Peel Island is an established MNP (green) zone.

Peel Island North, Site 1, recorded 12.5% hard coral coverage, and 29% soft coral coverage (higher than the last three survey seasons). The remaining substrate was mostly rock (44%), while rubble (5%), nutrient indicator algae (2.5%), sponge (2.5%), silt (2.5%), and sand (2%) were also recorded.

The impact survey recorded 20% of the overall coral population affected by bleaching, and an average surface bleaching of 30% for individual colonies. Other impacts included *Drupella* scarring (2), unknown coral damage (1), and marine debris (1). Of the target invertebrates, only *Drupella* (6) was recorded. No fish survey was conducted this season.

Survey site, Peel Island North Site 1

Coral bleaching, Peel Island North Site 1

Nudibranch, Peel Island North Site 1

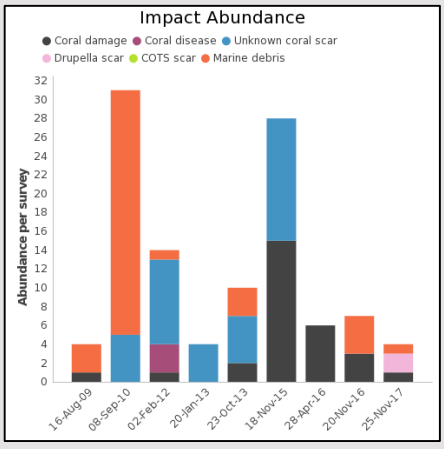


Figure 52. Impact abundance over time at Peel Island North, Site 1; 2009-2018.

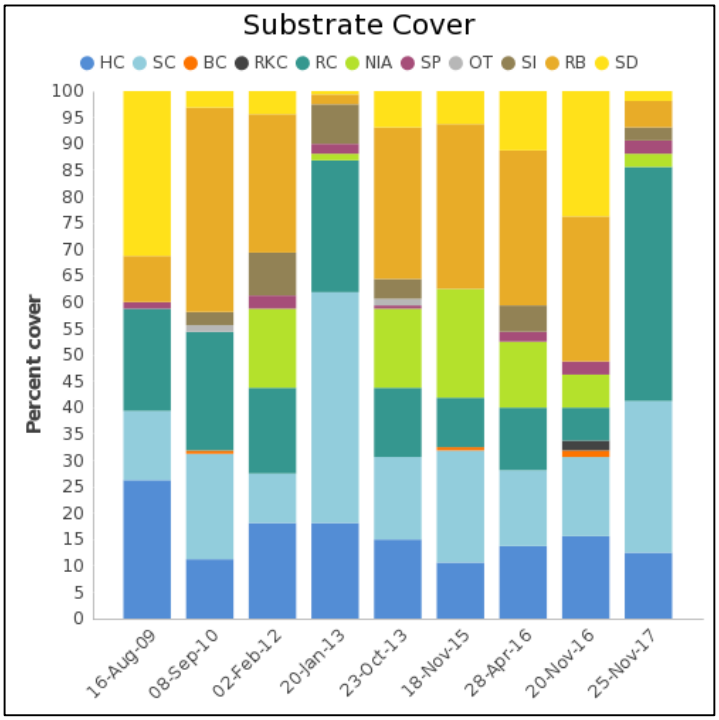


Figure 51. Benthic type and percent cover: Peel Island North, Site 1; 2009- 2018.

3.0 Inshore Moreton Bay Sites

3.13 Peel Island North East Site 1

This shallow site was established in 2014. The site is located at 1 meter depth on the shallow fringing reef to the north of the Platypus wreck. Peel Island North East, like Peel Island North and Peel Island East, is easily accessible, and experiences heavy boat traffic due to its proximity to a deep channel. The site is dominated by massive hard corals.

Hard coral accounted for 11% of the substrate (a decrease from 18% in 2016). Soft coral made up 5%, which is the highest recorded at this site. The majority of the substrate was made up of rock (37.5%) and sand (29%), while the remaining benthic cover was recorded as nutrient indicator algae (10%), sponge (5%), and rubble (3%).

An average of 3% of the overall coral population, and 19% of individual colonies, were recorded as bleached. Additional impacts recorded included 2 instances of unknown coral damage, 1 instance of coral disease, and 1 item of fishing line. A fish survey recorded 7 snapper but no other target species, and an invertebrate survey recorded no target species.

Our monitoring of this site is done in partnership with Quandamooka Yoolooburrabee Aboriginal Corporation and Quandamooka Land and Sea Management Agency.

Survey site with foliose coral, NE Peel Island S1

Fishing line in coral, NE Peel Island S1

Boats at surface, NE Peel Island S1

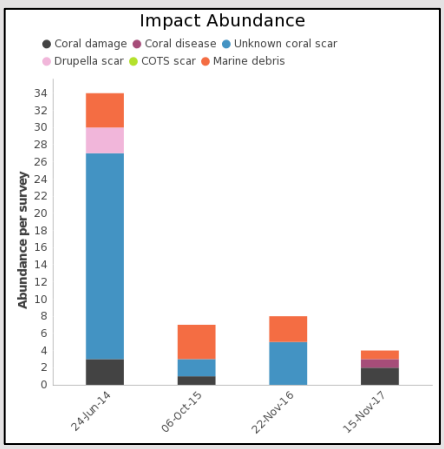


Figure 54. Invert abundance over time at Peel Island North East, Site 1; 2014-2018.

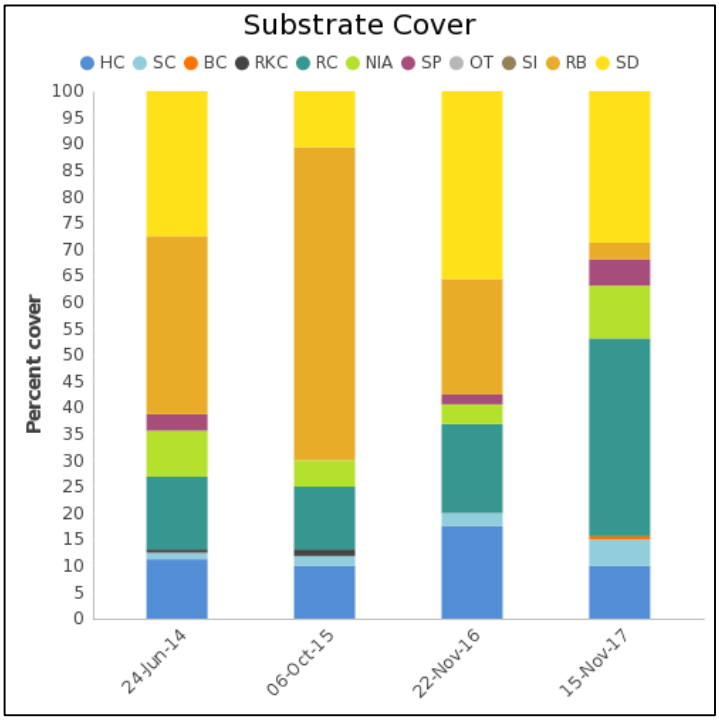


Figure 53. Benthic type and percent cover: Peel Island North East, Site 1; 2014- 2018.

3.0 Inshore Moreton Bay Sites

3.14 St Helena Palindrome Site 1

This site was surveyed for the first time in 2018. The area was identified through reef habitat mapping (Roelfsema et al 2017) that indicated relatively higher areas of coral cover. The site is located close to the St Helena jetty in a soft sediment/sandy bottom with very patchy coral cover.

The first survey conducted by RCA at St Helena Palindrome, Site 1, recorded both hard coral (4%) and soft coral (7%) coverage. The site had a high silt loading, accounting for exactly half of the substrate, the highest amount of all SEQ sites this season. St Helena Palindrome, Site 1, also recorded the highest nutrient indicator algae amount (27%), at any Inshore Moreton Bay site. The remaining substrate was made up of rubble (6%), rock (3%), sponge (1%), and recently killed coral (<1%).

The impact survey recorded 2% of the overall coral population affected by bleaching, and the average surface bleaching of individual colonies at 70%, the highest recorded across all SEQ sites this season. The impact survey also recorded 2 unknown scars.

No target species were recorded on the invertebrate species, and no fish survey was conducted, although 1 wobbegong was recorded.

Survey site, St Helena Palindrome S1

Sargassum and filefish, St Helena S1

Wobbegong, St Helena Palindrome S1

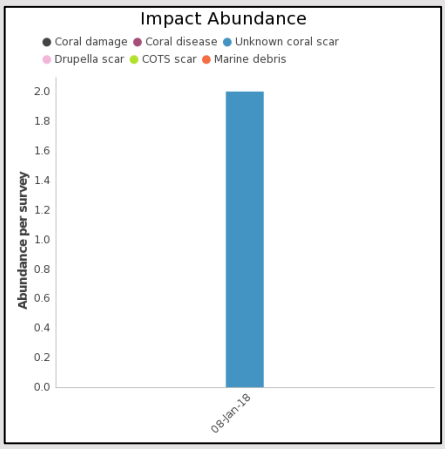


Figure 56. Impact abundance at St Helena Palindrome Site 1: 2018.

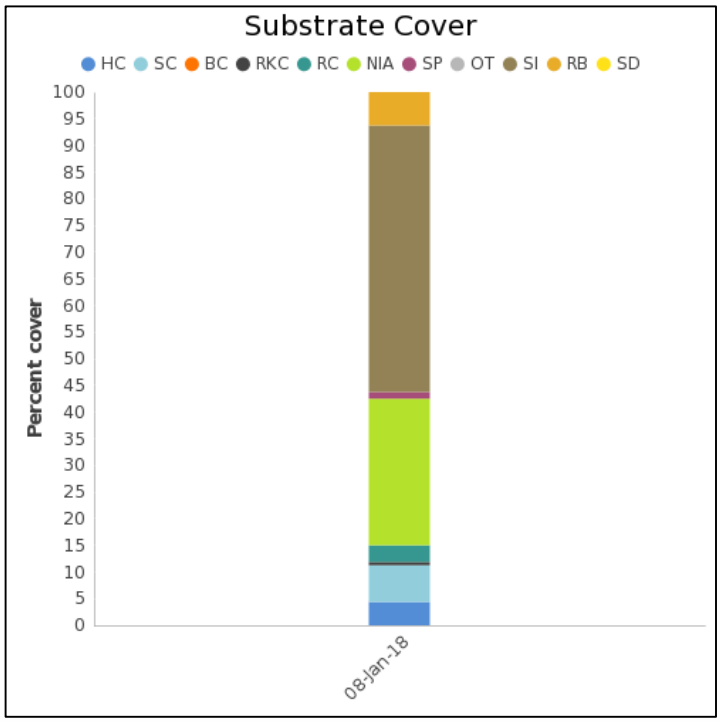


Figure 55. Benthic type and percent cover: St Helena Palindrome, Site 1; 2018.

3.0 Inshore Moreton Bay Sites

3.15 St Helena Ray of Sunshine Site 1

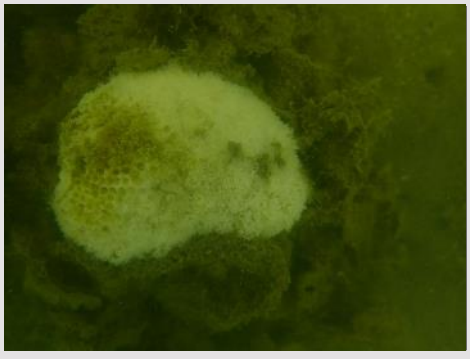
This site was surveyed for the first time in 2018. Several eagle rays were observed at the surface.

Hard coral coverage was recorded as 12% at St Helena Ray of Sunshine, Site 1, and 16% of the substrate was soft coral. This St Helena site also recorded a high silt loading (36%), with the substrate survey also recording rock (17%), nutrient indicator algae (12%), rubble (2%), sponge (2%), and other (<1%), which was noted as ascidian.

An average of 55% of the total coral population was affected by bleaching, the highest out of any Inshore Moreton Bay site, and an average of 41% of individual colonies exhibited signs of bleaching. Other impacts included 2 instances of unknown coral damage, and 1 unknown scar. The invertebrate survey recorded 2 *Drupella* scars. No fish survey was conducted this season.

Soft coral at survey site, Ray of Sunshine S1

Branching hard coral, Ray of Sunshine S1



Coral bleaching and mortality, Ray of Sunshine S1

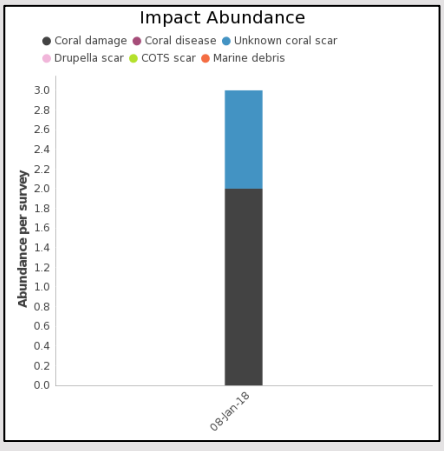


Figure 58. Impact abundance at : St Helena Ray of Sunshine, Site 1; 2018

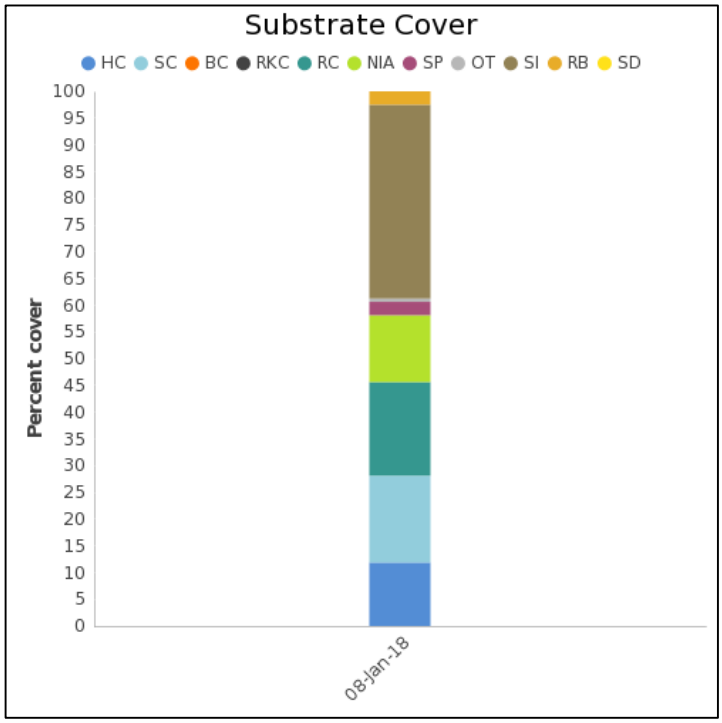


Figure 57. Benthic type and percent cover: St Helena Ray of Sunshine, Site 1; 2018.

3.0 Outer Moreton Bay Sites

3.16 Flat Rock Island Shark Gulley Site 1

Flat Rock is a popular recreational diving and boating location to the north of Point Lookout on North Stradbroke Island. Shark Gulley, Site 1, was added to the RCA survey list in 2009, and lays at 9 meters on the seaward side of the fringing reef, sitting above a common gathering area for Grey Nurse Sharks.

The substrate survey recorded 26% hard coral coverage, and 2.5% soft coral coverage. The majority of the substrate was rock (59%), with nutrient indicator algae (8%), other (2.5%), and recently killed coral (1%), accounting for the rest.

Bleaching affected 0.5% of the overall population, with individual colonies exhibiting an average surface bleaching of 10%. Other impacts recorded were unknown scarring (12), unknown coral damage (3), and fishing line (1).

Invertebrates recorded this season included 3 *Diadema*, 2 giant clams, and 2 anemone. A fish survey was conducted this season, recording 18 butterflyfish, and 2 parrotfish.

Start of Site 1 at Flat Rock Shark Gulley

Coral Scarring, Flat Rock Shark Gulley Site 1

Bleached hard coral, Shark Gulley Site 1

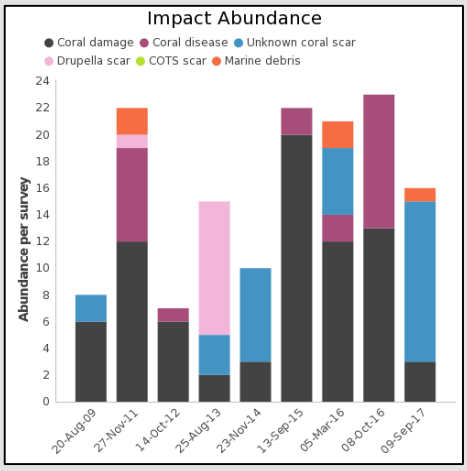


Figure 60. Impact abundance over time at Flat Rock Shark Gulley, Site 1; 2009-2018.

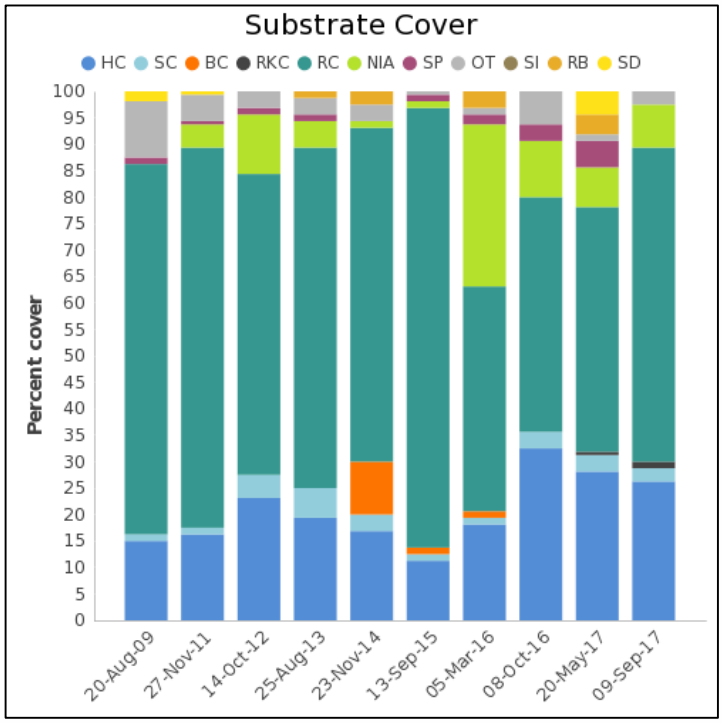


Figure 59. Benthic type and percent cover: Flat Rock Shark Gulley, Site 1; 2009- 2018.

3.0 Outer Moreton Bay Sites

3.17 Flat Rock Island The Nursery Site 1

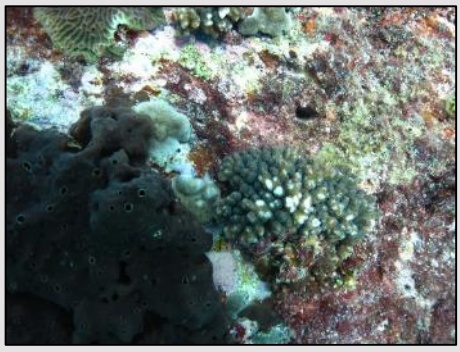
The Nursery, Site 1, was established in 2008, and is situated within a fully protected marine park, with a no-fishing zone within 1.2km radius of the reef. It is also a Grey Nurse Shark Protection area. This site sits at a depth of six meters on the leeward side of the fringing reef.

Hard coral accounted for 19% of the substrate, and soft coral for 2%. Rock made up the majority of the benthic cover (61%), while sponge (10%), nutrient indicator algae (7%, recorded as *Lobophora*), and rubble (1%) accounted for the remainder.

Bleaching affected less than 1% of the overall coral population, while individual corals suffered from an average of 12.5% surface bleaching. There were 9 instances of unknown coral damage recorded, and 4 unknown scars.

An invertebrate survey recorded 4 *Diadema*, and 1 lobster. A fish survey was also conducted, recording 20 snapper, 19 butterflyfish, and 11 parrotfish, which was the highest fish abundance recorded in any SEQ survey this season, after Myora Reef Site 1.

Boulder at Flat Rock Nursery, Site 1



Coral scarring at Flat Rock Nursery, Site 1

Bleached zoanthids at Flat Rock Nursery, Site 1

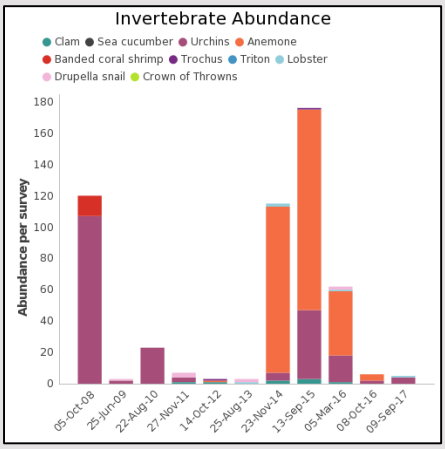


Figure 62. Impact abundance over time at Flat Rock The Nursery, Site 1; 2009-2018.

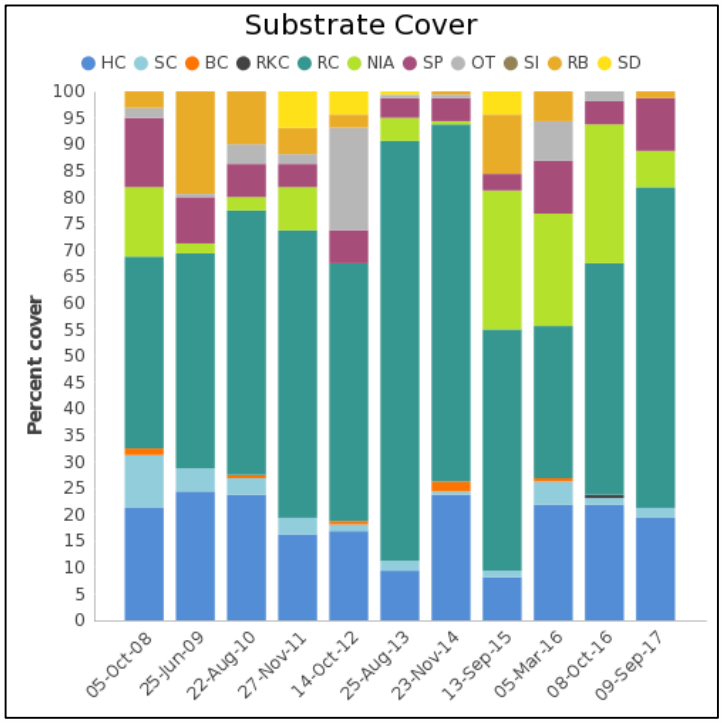


Figure 61. Benthic type and percent cover over time: Flat Rock The Nursery, Site 1; 2009-2018.

3.0 Outer Moreton Bay Sites

3.18 Flinders Reef Alden's Cave Site 1

Flinders Reef is an established Marine National Park (Green) zone located approximately five kilometres north of Moreton Island, and is popular dive locale. Alden's Cave is situated at the southerly end of Flinders Reef, at a depth of 10 meters. Alden's Cave, Site 1 was established in 2008.vThis southerly site tends to be more exposed to prevailing ocean swell than the protected Nursery area on the opposite side of the reef.

Hard coral accounted for 24% of the substrate, and 18% was soft coral. Rock (23%), sponge (18%), sand (15%), other (1%), and rubble (<1%), accounted for the remaining substrate.

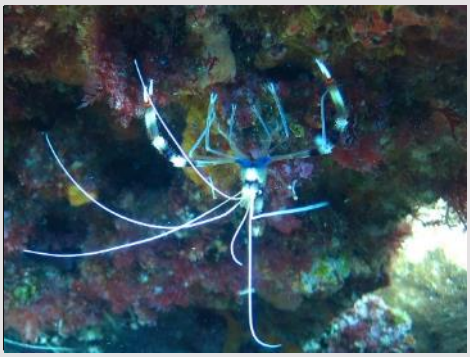
An average of 10% of the overall coral population was bleached, with individual colonies suffering an average of 50% surface bleaching. There were 7 instances of coral disease also recorded during the impact survey.

On the invertebrate survey, two banded coral shrimp, 3 giant clams and 5 anemones were recorded (two hosting anemone fish).

A fish survey was not completed this season.

Survey site, Aldens Cave Site 1

Egg cowrie, Aldens Cave Site 1



Banded coral shrimp, Aldens Cave Site 1

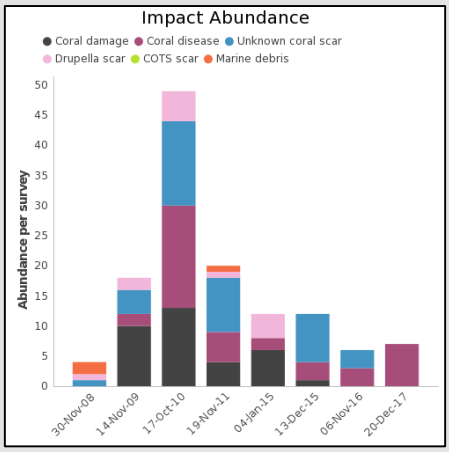


Figure 64. Impact abundance over time at Flinders Reef Alden's Cave , Site 1; 2008-2018.

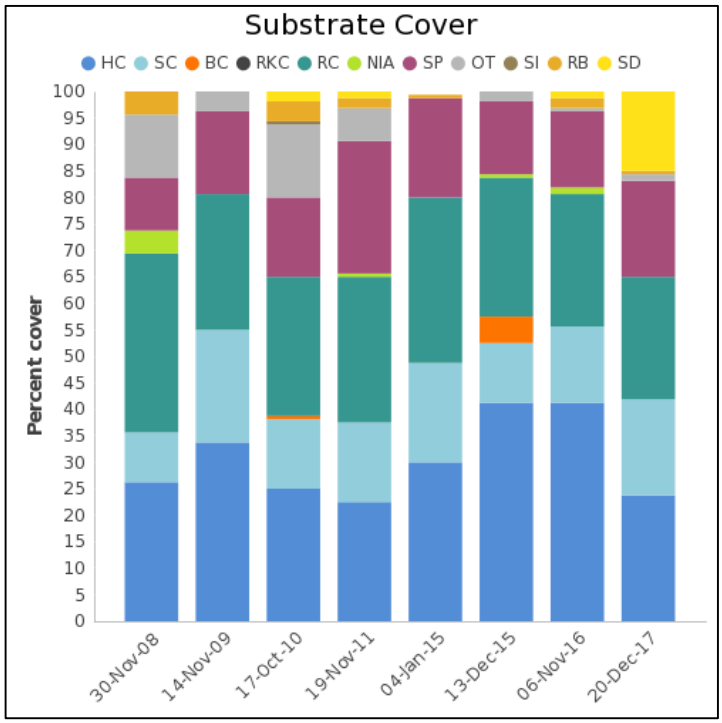


Figure 63. Benthic type and percent cover over time: Flinders Reef Alden's Cave , Site 1; 2008- 2018.

3.0 Outer Moreton Bay Sites

3.19 Flinders Reef The Nursery Site 1

The Nursery, Site 1, is a long-term site that has been surveyed annually by Reef Check since its establishment in 2007. The site is situated at a depth of six meters on the northern side of Flinders Reef.

The substrate survey recorded 17% hard coral coverage, and 5% soft coral coverage at Flinders Reef The Nursery Site1. The majority of the substrate was rock (57%), with sand (10%), other (10%), and nutrient indicator algae (<1%) also recorded.

Impacts recorded at this site included unknown coral damage (24), unknown scarring (8), and coral disease (6).
Target invertebrate species included *Diadema* (5), sea cucumbers (4), and lobster (4). A fish survey was conducted this season, recording 21 butterflyfish, 1 sweetlip, 1 snapper, 1 parrotfish, and 1 moray eel. Surveyors also noted that 2 wobbegong were recorded at this site.

In 2017, the UniDive Flinders Reef Ecological Assessment team (FREA) surveyed 11 sites around Flinders Reef in Autumn and Spring, collecting Reef Check Australia survey data, CoralWatch data and habitat mapping data (Roelfsema et al 2017). Summary results are reported here, as three of the sites were long-term Reef Check Australia monitoring location.

More detailed information can be found at: https://www.unidive.org/unidive-projects/frea/.

Flinders Reef Nursery S1 photo (C Roelfsema)

Flinders Reef Nursery S2 *Asparagopsis* (C Roelfsema)

Flinders Reef Nursery S1 surveyor (C Roelfsema)

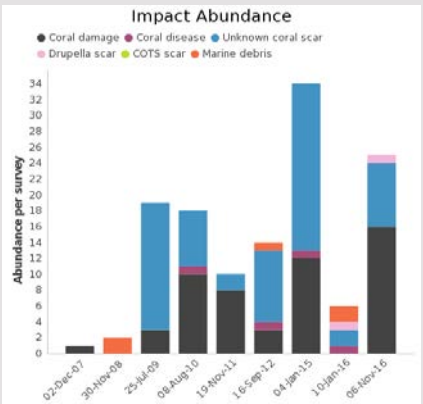


Figure 66. Impact abundance over time at Flinders Reef, The Nursery Site 1; 2009-2016.

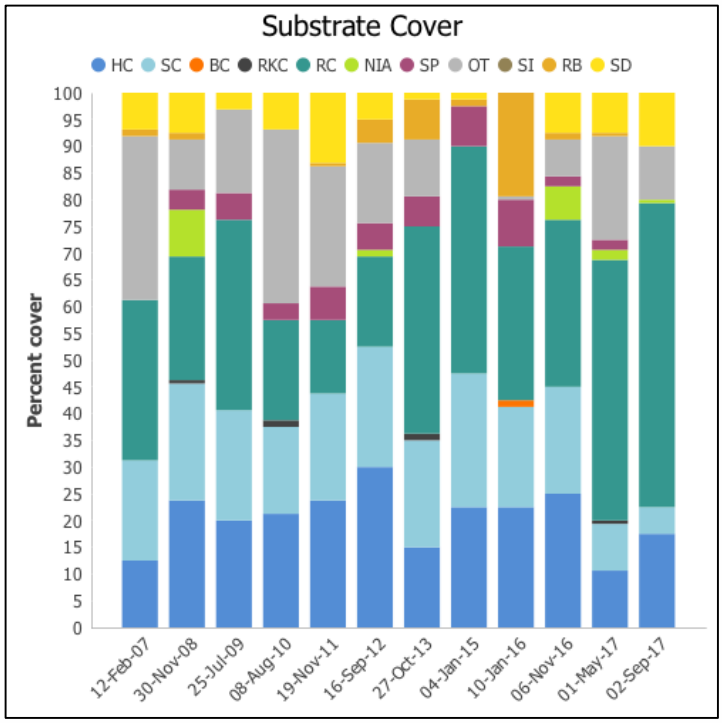


Figure 65. Benthic type and percent cover over time: Flinders Reef, The Nursery, Site 1; 2007- 2018.

3.0 Outer Moreton Bay Sites

3.20 Flinders Reef The Nursery Site 2

The Nursery, Site 2 was added to the RCA survey list in 2009. A large patch of branching Acropora makes up the majority of the survey area.

Flinders Reef The Nursery Site 2 recorded the highest hard coral coverage our of any SEQ site this season (79%). The site also recorded rock (16%), nutrient indicator algae (2%), recently killed coral (1%), soft coral (<1%), and rubble (<1%) on the substrate survey.

Nursery Site 2 was one of the most heavily impacted sites in the SEQ regions, recording 56 counts of coral disease (the highest at any SEQ site this season). Also recorded were 7 instances of unknown coral damage.

The invertebrate survey recorded 20 anemones, but no other target species. A fish survey was conducted, recording 21 butterflyfish, 3 sweetlips, and 1 parrotfish.

Flinders Reef Nursery S2 photo (C Roelfsema)

Flinders Reef Nursery S2 batfish (C Roelfsema)

Flinders Reef Nursery S2 surveyor (C Roelfsema)

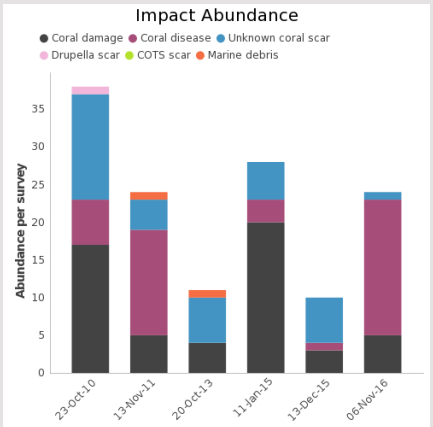


Figure 68. Impact abundance over time at Flinders Reef, The Nursery, Site 2; 2009-2016.

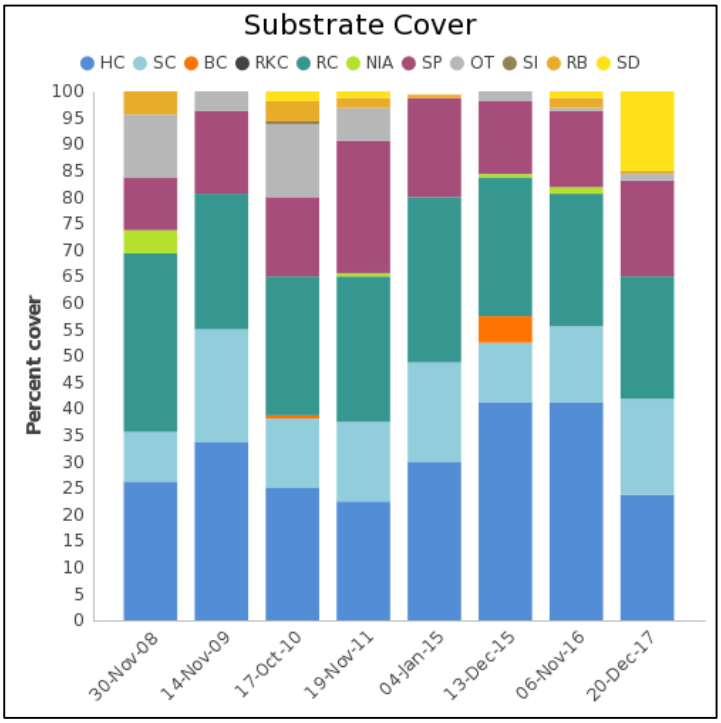


Figure 67. Benthic type and percent cover over time: Flinders Reef, The Nursery Site 2; 2008- 2018.

3.0 Outer Moreton Bay Sites

3.21 Flinders Reef The Nursery Site 3

This site was established in 2009 and is located northeast from the end of the turtle cleaning station area.

Hard coral accounted for 16% of the substrate, and soft coral for 20% (the highest recording for soft coral at Outer Moreton Bay sites). The remaining substrate comprised of rock (34%), other (17%), sand (6%), sponge (6%), nutrient indicator algae (<1%), recently killed coral (<1%), and rubble (<1%).

Flinders Reef The Nursery Site 3 recorded 29 counts of unknown coral damage, the highest at any SEQ site this survey season. Other impacts included coral disease (4), and unknown scarring (2).

The only target species recorded on the invertebrate survey were 4 *Drupella*. A fish survey was conducted this season, recording just 25 butterflyfish, and no other target species.

Flinders Reef Nursery S3 photo (C Roelfsema)

Green turtle at Flinders Reef Nursery S3

Surveyor at Turtle Cleaning Site 1
(C Roelfsema)

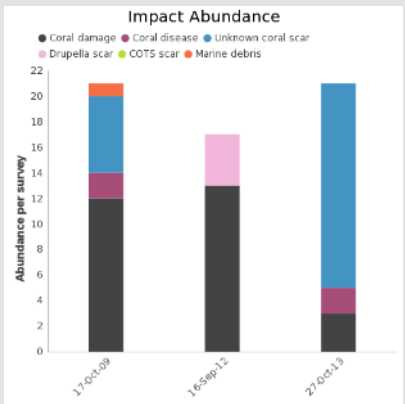


Figure 70. Impact abundance over time at : Flinders Reef The Nursery, Site 3; 2009-2016.

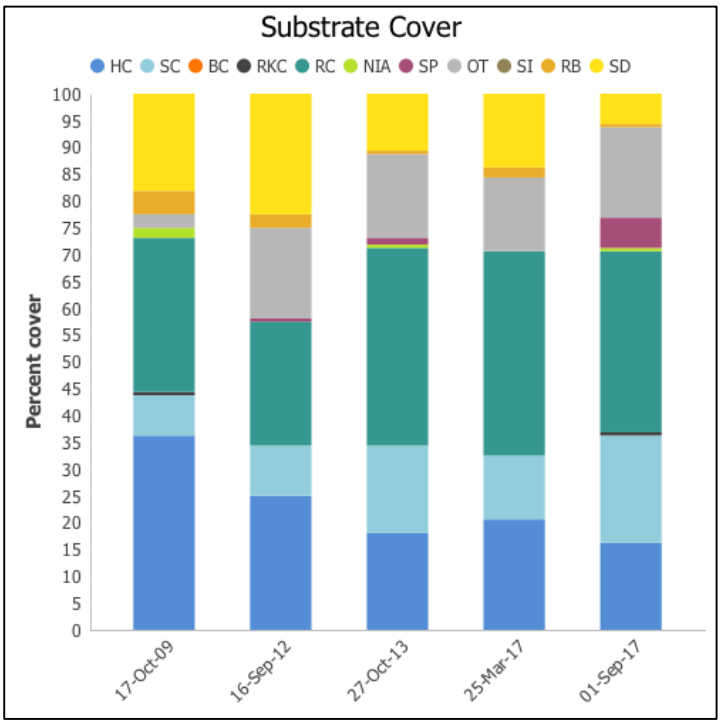


Figure 69. Benthic type and percent cover over time: Flinders Reef The Nursery, Site 3; 2009- 2018.

3.0 Outer Moreton Bay Sites

3.22 Shag Rock Island East Site 1

Shag Rock is a twin rock located on the north-eastern edge of North Stradbroke Island. Shag Rock East, Site 1, is situated in a relatively sheltered cove on the southern area of Shag Rock, and sits at a depth of five meters on the reef slope. This site was established in 2008. It is a popular locale for diving, fishing and boating.

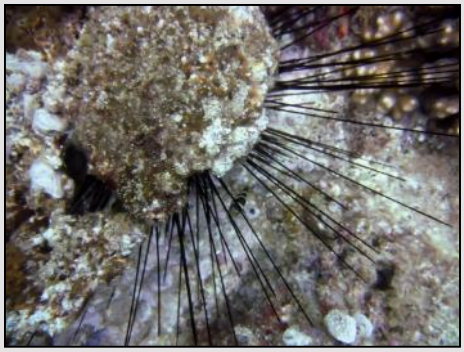
Hard coral accounted for 24% of the substrate at Shag Rock East, Site 1, and soft coral accounted for 9%.of the benthos (the substrate survey in 2016 recorded the same figure for soft coral). Rock (34%), nutrient indicator algae (13%), rubble (7.5%), other (7%), sand (4%), and sponge completed the remaining substrate. In this instance 'other' was recorded as ascidians and corallimorphs.

Shag Rock East, Site 1, was the most heavily impacted Outer Moreton Bay site, recording 16 unknown scars, 14 instances of unknown coral damage, 5 cases of coral disease, 4 pieces of fishing line, and 2 *Drupella* scars. This high level of impacts is in life with previous years, as the site recorded over 35 impacts in 2016, and over 50 in 2015.

The site also recorded the highest number of invertebrates of any SEQ site surveyed this season. Invertebrates included 100 *Diadema,* 56 collector urchins, 10 anemones, 4 pencil urchins, 3 *Drupella*, 2 giant clams, and 1 Crown of Thorns starfish.

A fish survey recorded 8 butterflyfish, 1 sweetlip, and 1 ray was also spotted.

Site photo, Shag Rock East, Site 1



Diadema, Shag Rock East, Site 1

Anemone, Shag Rock East, Site 1

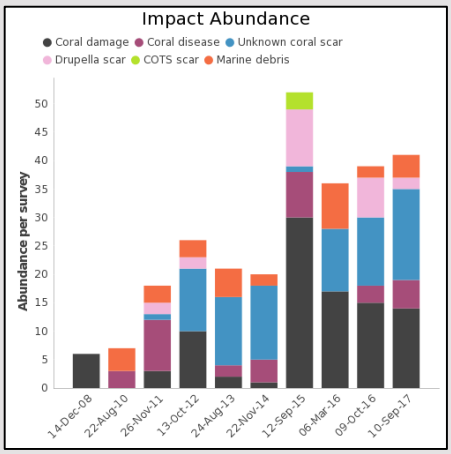


Figure 72. Impact abundance over time at Shag Rock East, Site 1; 2009-2018.

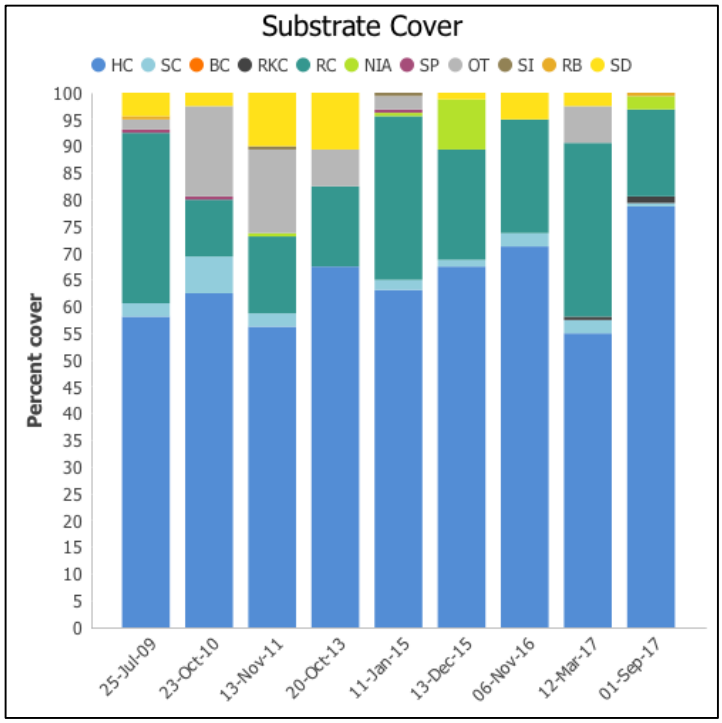


Figure 71. Benthic type and percent cover over time: Shag Rock East, Site 1; 2009- 2018.

3.0 Outer Moreton Bay Sites

3.23 Shag Rock Island West Site 1

Shag Rock West, Site 2 is located on the exposed northern side of Shag Rock, and sits at a depth of 6 meters on the fringing reef. This site was established in 2009 to gain a better understanding of the contrasting habitats surrounding Shag Rock. According to locals who frequent Shag Rock, a small boat crashed on the site in 2015, resulting in high counts of boat and anchor damage that year.

Shag Rock West, Site 1, recorded 7% hard coral coverage, and 1% soft coral coverage, much less than the eastern site. This is also in keeping with previous years' results, with an average of 9% hard coral coverage over the previous 8 years. Most of the other substrate was recorded as rock (41%), with nutrient indicator algae (27%), sand (12%), rubble (11%), and sponge (0.6%) also being recorded.

This site was one of the few sites in SEQ to not record any signs of bleaching. Impacts recorded were unknown coral damage (14), and unknown scarring (5). Invertebrates included 67 collector urchins, 24 *Drupella,* 8 *Diadema,* 2 anemones, and 1 pencil urchin.

A fish survey recorded 3 butterflyfish, 2 snapper, and 2 parrotfish. Several rare animals were also observed, including a tawny nurse shark, a wobbegong, an octopus, and a flathead.

Collector urchin, Shag Rock West, S1

Unknown coral damage, Shag Rock West, Site 1

Wobbegong, Shag Rock West, Site 1

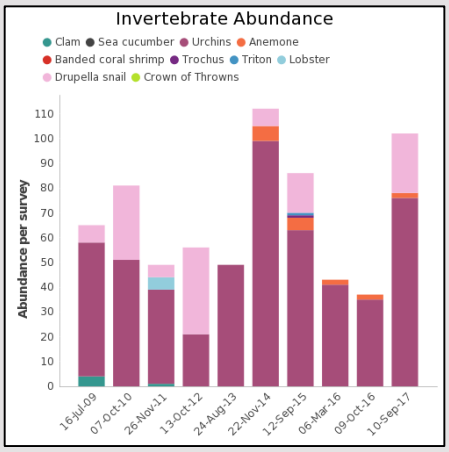


Figure 74. Invert abundance over time at Shag Rock West, Site 1; 2009-2018.

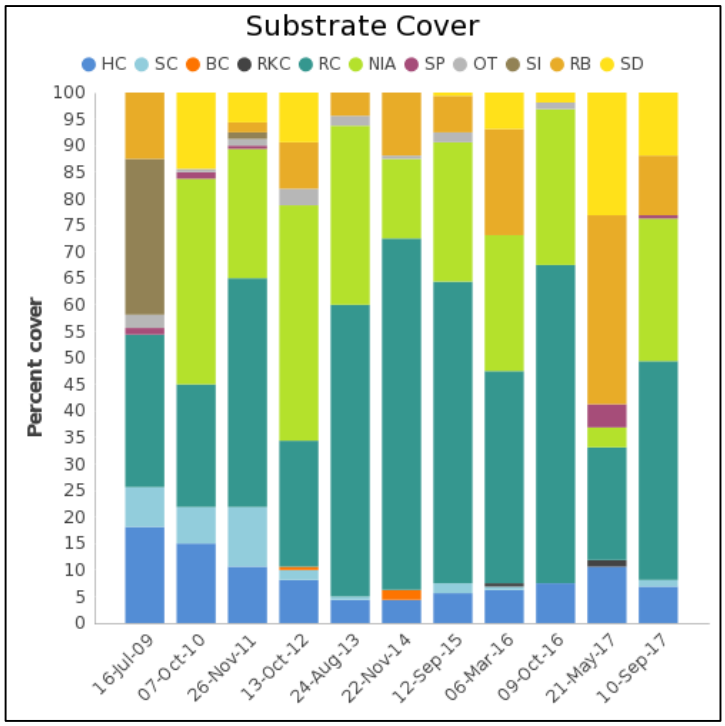
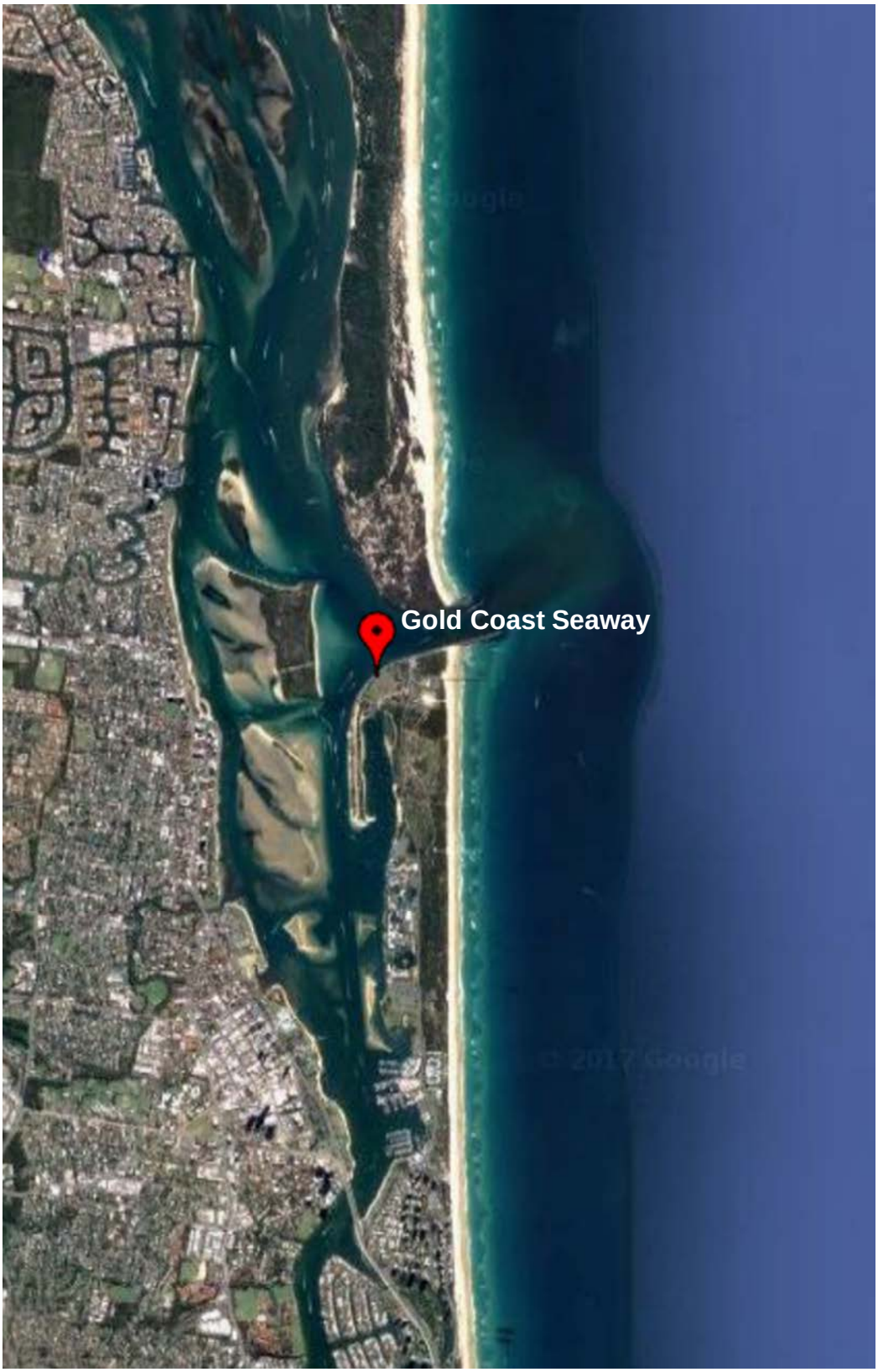


Figure 73. Benthic type and percent cover over time: Shag Rock West, Site 1; 2009-2018.

4.0 Gold Coast



Map: Gold Coast, South East Queensland
Image courtesy of Google Earth

4.0 Gold Coast Sites

4.1 Gold Coast Seaway South West Wall Site 1

The Gold Coast Seaway was built in 1971 and is the main navigation entrance from the Pacific Ocean into the Southern Moreton Bay and the Gold Coast Broadwater. The site is characterised by high silt loading, but divers report numerous unique marine species making it a popular diving and fishing location. The Southwest Wall, Site 1, was established in 2007 to better understand and record impacts on this heavily utilized site. The site is situated at a depth of 2 meters on the sandy slope parallel to the artificial rock wall on the southwest side of Gold Coast Spit.

No coral was recorded at this site, with the majority of the substrate comprising of rock (44%) and silt (32%). Although surveyors did note that several small hard coral recruits were sighted along the transect. Other substrate recorded was nutrient indicator algae (12.5%), sand (11%), and rubble (0.6%). Padina was recorded as the dominant macroalgae.

Impacts included 8 pieces of fishing line and 4 pieces of other marine debris. This is in line with previous years, where marine debris has been the only recorded impact.

The only invertebrates recorded were 7 banded coral shrimp, which was more than any other site in SEQ this season, and one of only 4 sites to recorded this target species.

A fish survey recorded just 1 moray eel, although other species sighted included rabbitfish leatherjacket surgeon fish trevally morwong.

Survey site, Gold Coast South West Wall S1

Nudibranch, Gold Coast South West Wall S1

Banded coral shrimp (Photo from The Pipe)

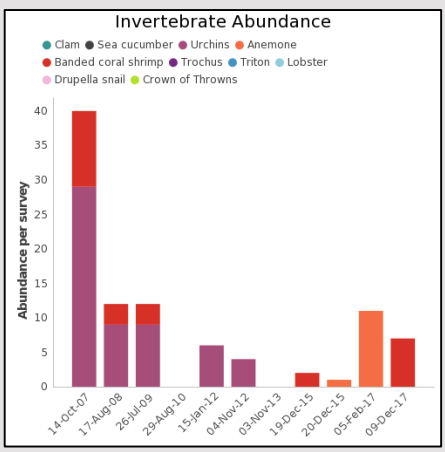


Figure 76. Invert abundance over time at Gold Coast Seaway South West Wall, Site 1; 2007- 2018.

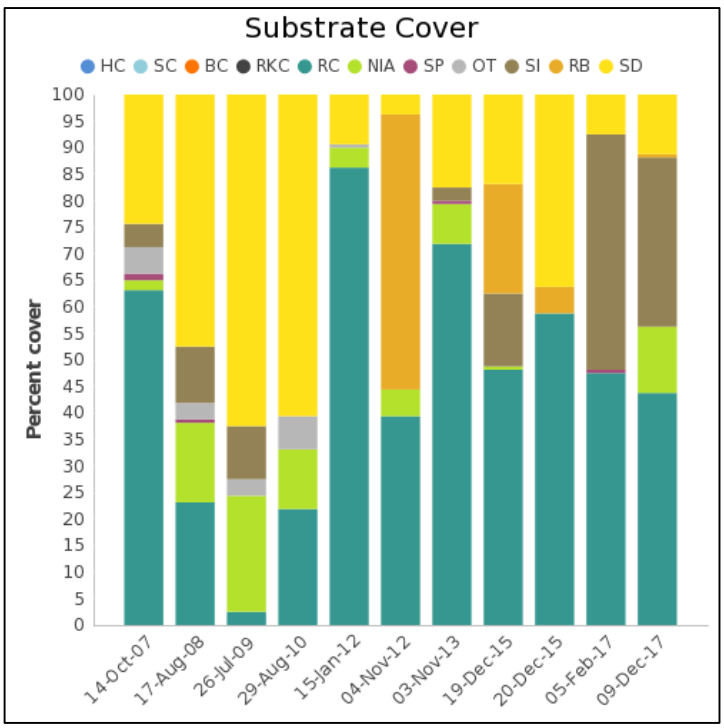


Figure 75. Benthic type and percent cover over time: Gold Coast Seaway South West Wall, Site 1; 2007- 2018.

4.0 Gold Coast Sites

4.2 Gold Coast Seaway The Pipe Site 1

The Pipe, Site 1, is situated at a depth of 4 meters in the heavily utilised Gold Coast Seaway, at the main diving a fish site, The Pipe. This site is exposed to heavy boat traffic and tides on a daily basis. The Pipe, Site 1, was established in 2015, to better document the anthropogenic impacts facing this heavily utilised site, particularly effects from fishing.

No hard coral was recorded on the substrate survey, as has been the result for all previous surveys at this site, although some soft coral was recorded on the transect (0.6%) for the first time. There were also several small non reef-building hard coral recruits observed in the transect area for the first time. The vast majority of the benthos at this site was sand (62%), with rock (34%), rubble (2%), recently killed coral (0.6%), and nutrient indicator algae (<1%) also recorded.

No bleaching was observed, although 91 pieces of fishing line were recorded, the most at any SEQ site this season. Previous surveys have also recorded high numbers of fishing line (figure 78).

Invertebrates included 5 banded coral shrimp (more than at any other site apart from Gold Coast Seaway South West Wall, Site 1) and 1 anemone. These were the first target invertebrates recorded here since RCA began surveying this site.

A fish survey was also conducted this season, recording 12 butterflyfish, 4 parrotfish, and 1 moray eel.

Survey site, Gold Coast The Pipe S1

Hard coral recruit, Gold Coast The Pipe S1

Marine debris, Gold Coast The Pipe S1

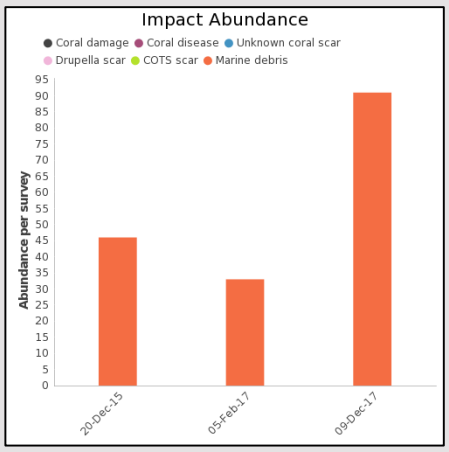


Figure 78. Impact abundance at Gold Coast

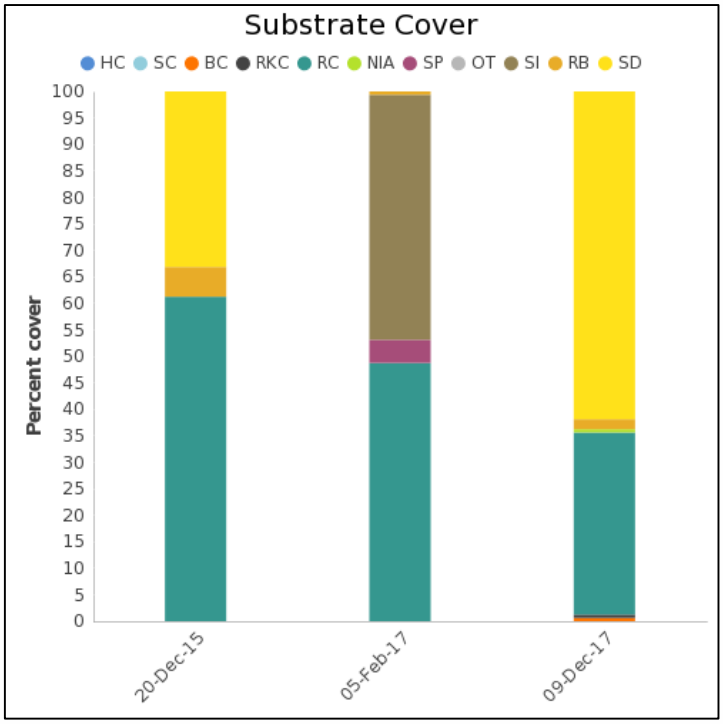


Figure 77. Benthic type and percent cover over time: Gold Coast Seaway The Pipe, Site 1; 2015-2018.

6.0 Team Survey Photos

Our survey activities are made possible by our trained citizen scientists who donate their time, energy and skills! Thank you all!

6.0 Team Survey Photos

Our survey activities are made possible by our trained citizen scientists who donate their time, energy and skills! Thank you all!

6.0 Literature Cited

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