

REEF CHECK AUSTRALIA

2015 Heron Reef Health Report



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Reef Check Australia
greatly appreciates all of the people and organizations
who have helped to make this year's project possible.



Gladstone Ports Corporation

Growth, Prosperity, Community.

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1.0 PROJECT INTRODUCTION

Reef Check Australia's (RCA) monitoring program is a peer-reviewed, volunteer reef health monitoring program that trains volunteers to collect data on reef composition, abundance of indicator organisms (invertebrates and fish) and reef health impacts, using a globally standardized protocol. RCA monitoring sites were established on Heron Island in 2011. Heron Reef (28 km²) is located approximately 80 km East of Gladstone in the Capricorn Bunker Group, in Queensland Australia. Heron Island is a small coral cay (.62km²) situated on the west of Heron Reef. The island hosts the University of Queensland (UQ) Heron Island Research Station and the Heron Island Resort, allowing hundreds of tourists and researchers to visit each year.

This ongoing monitoring initiative has been undertaken in collaboration with UQ's Remote Sensing Research Centre (RSRC). The RSRC team has been monitoring benthic composition of Heron Reef annually since 2001, using geo-referenced photo transects and other field data to create and validate habitat maps using satellite image data. Data from RCA augments this substantial dataset by offering further information on impact severity and abundance of key organisms, as well as allowing a field-based comparison of benthic composition.

Summary findings for 14 Reef Check Australia surveys conducted around Heron Island from November 23 to 30, 2015 are presented in this report. This data builds on the findings from the baseline surveys, implemented in 2011. This project is intended to continue as part of the long-term monitoring program at Heron Island, with the goal of providing important information in regards to the Health Status for Marine Park Managers, Island managers, researchers and resource users (including staff and guests) and the broader community.

Heron Reef is uniquely situated to provide valuable reef health information, as it is a relatively isolated reef system, yet situated nearby to areas with extensive coastal development and also subject to potential global effects from climate change. The system has already proven that it is not immune to marine health threats, with up to 21% of sea birds on the Island found to ingest marine debris (Verlis et al; 2013). Sea turtle numbers have also declined in recent years due to flood impacts on seagrass beds. Yet, undeniably, this system hosts incredible examples of iconic Australian reef systems and has been highlighted by Jacques Cousteau as one of his top ten dives.

Heron Reefs are highly studied, with hundreds of researchers visiting the Island annually through the University of Queensland's Research Station. Yet, there are limited programs that consistently document long-term reef health, which is essential to understand natural and human impacts on reefs. Hence the RSRC and RCA initiative can offer a valuable perspective on these reefs, combining a variety of techniques for long-term, cohesive studies.

This project demonstrates the value of citizen-science initiatives as a powerful tool to contribute useful information for science, management and education initiatives. The Heron Reef project brings together a range of stakeholders to engage the community in hands-on citizen science and education initiatives empower communities to take an active role in appreciating, understanding and protecting reef resources.



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2.0 SUMMARY OF FINDINGS

Reef Check Australia survey teams' monitored 14 fringing reef sites around Heron Island over the period of November 23 to 30, 2015. Substrate line transects in addition to invertebrate and impact belt transects were conducted at each site. Fish surveys were completed at 9 sites in total; each of the snorkel surveys and 3 of the dive surveys. Underwater cameras were used to document visual evidence of key site features, reef impacts and invertebrates.

Since the RCA Heron Reef program started in 2011 (with assistance from the University of Queensland's Remote Center Research Centre), additional sites have been added to allow for a wider spread of survey locations around the island and to gather more information on the large reef area. A total of 15 RCA Heron Reef Sites are now monitored as part of a long term monitoring program. A summary of key findings for the 2015 season are listed below.

- Total average hard coral cover across all sites was 39.5%; this is consistent with 2014 results (37.6%). Hard coral cover ranged from 7.5% to 74% across monitoring sites. Six sites had coral cover greater than 50%, four sites had between 25-50% cover and four sites had less than 25% coral cover.
- Most sites had low levels of soft coral (present at 8 of 14 sites and averaging 2.3% coverage) and sponge (present at 4 of 14 sites, averaging 0.9%).
- No Crown of Thorns starfish or long spined sea urchins were recorded on any transect.
- Indicator sea cucumbers were found in higher abundances on sandy inshore sites. Sites with >50% sand coverage (4 out of 14 sites) had an average abundance of 8 sea cucumbers compared with 2 cucumbers on sites with <50% sand. One exception was Cappuccino Express which had 18 cucumbers and 29.4% sand coverage.
- Giant clams were found on all sites except Coral Garden and Libby's Lair. White Wedding had the highest abundance with 28 (per 400m²).
- *Trochus* snails were recorded at Half Way (2), Canyons (1), and Libby's Lair (1) in 2015. No *Trochus* were recorded at any site in 2014.
- Rare animal sightings included blacktip reef sharks at Cappuccino Express, Coral Garden and Last Resort, a shovelnose ray at Shark Bay, an eagle ray at Jetty Flat, and four turtles at Coral Garden.
- Hard coral damage was recorded at 12 out of 14 sites. The highest abundance (23 counts) was recorded at Jetty's Flat.
- Low levels of coral bleaching occurred on all sites. The highest level of bleaching was recorded at White Wedding and impacted approximately 6% of the coral population (with 4% of each colony bleached on average). Canyons had the highest individual colony bleaching average (45.5%) although population bleaching levels were low (1%). Total average coral population bleaching across all sites was 1.7%; a decrease from 7.4% in 2014.
- Coral disease was recorded at 10 of the 14 sites. Of these, six had low levels (6 or fewer counts), and three had high levels (10 or more) recorded. Harry's Bommie and Half Way had the highest counts of coral disease, with 21 and 18 per 400m² respectively. Average coral disease counts across all other sites was 5 per 400m². Coral Gardens had a decrease in coral disease from 106 counts per 400m² in 2014 to 8 counts per 400m².
- Coral scarring from unknown causes was reported at 10 of the 14 sites, with the highest record of 14 counts per 400m² at Harry's Bommie. An average of 6 counts per 400m² were recorded for all other sites (excluding Harry's Bommie).
- One piece of general rubbish was recorded at Research Zone.

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3.0 INTRODUCTION

3.1 Reef Check Australia Overview

Trained Reef Check Australia (RCA) volunteers have been monitoring the ecological health of coral reefs around Australia since 2001. Annual surveys provide regionally-specific long-term data sets that can be used for local and regional reef management and are part of the globally standardised Reef Check program comparing reef health on a worldwide scale. These multiple levels of information can help reveal important patterns over time.

The Reef Check program is intended to supplement government and academic monitoring efforts, filling spatial and temporal gaps in reef monitoring, providing a globally relevant data set and providing an opportunity for community members to play an active role in reef monitoring, education and conservation. Broad-scale reef data from Reef Check can act as an early warning system for changes in the health of coral habitats.

Reef Check surveys include quantitative data about substrate cover, as well as abundance of key invertebrate species and target fish species. RCA also documents natural and anthropogenic impacts that affect coral habitats.

3.2 Reef Check Methodology

Reef Check uses a globally standardised protocol to collect data on 25 categories of substrate cover, as well as the abundance of 14 indicator invertebrates and 10 reef health impacts. Reef Check surveys are conducted along a transect line marked by a graduated tape measure and laid at a constant depth. The transect length that is surveyed is 80m, divided into four 20m sections, each separated by 5m. This design allows for data comparisons within sites using the 4 independent replicates, as well as between sites.

The substrate survey collects information about the percentage cover of bottom-dwelling (benthic) organisms and substrate on the reef using a point-intercept method. The diver records the substrate type that is directly below the tape measure every 0.5m along each of the four 20m sections interval.

Table 1. Codes and distribution of Reef Check Australia substrate categories

Hard Coral	HCBR: Branching Hard Coral HCF: Foliose Hard Coral HCM: Massive Hard Coral HCE: Encrusting Hard Coral HCP: Plate Hard Coral HC: All other growth forms (digitate, columnar, etc.) HCB: Bleached Hard Coral
Soft Coral	SCL: Leathery Soft Coral SCZ: Zooanthids SC: Other Soft Coral (tree or flower shaped) SCB: Bleached Soft Coral
Recently Killed Coral	RKCTA: Recently killed coral with Turf Algae RKCNI: Recently Killed Coral with Nutrient Indicator Algae RKC: Recently Killed Coral (bare)
Rock	RCTA: Rock covered with Turf Algae RCCA: Rock covered with Coralline Algae RC: Rock (not covered with algae)
Sponge	SPE: Encrusting Sponge SP: All other Sponges

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The invertebrate & impacts survey is conducted along the same transect line using a 5m wide belt transect methodology. Divers spend 7-10 minutes on each 20m replicate using a u-shaped search pattern to look for indicator invertebrates and reef impacts. The 14 invertebrate indicators have been selected based on their economic and/or ecological importance. Reef health indicators include 10 (both human and natural) reef impacts, focussing on issues that may be addressed through the right strategies.

The 15 Reef Check Australia monitoring sites were established to allow for a detailed representation of reefs surrounding Heron Island. The sites were selected to represent diverse management and use areas on Heron Reef. Five are located in protected Green zones, five are located in general use areas and five are located in a scientific research zone that allows extraction for experimental & educational purposes. During the 2015 RCA surveys, 14 of these 15 sites were revisited.

Reef Check transects are co-located with UQ Remote Sensing Research Center survey sites. At these survey sites geo-referenced benthic photo-transects (Roelfsema et al 2010) are conducted annually as part of a coral reef monitoring research project that started in 2001. The research project involves using the collected benthic field data in combination with high spatial resolution satellite imagery to create and validate benthic community maps of Heron Reef (e.g. Roelfsema et al 2013).

Coral Health Chart surveys were also collected at each site to specifically assess coral colour as an indicator of coral stress (www.coralwatch.org) (Siebeck et al 2006).

REEFSearch surveys were also conducted at the 14 survey locations to ensure the use of a diverse array of data collection tools.

3.3 Heron Island

Heron Island (.62km²) is a coral cay located on the southern section of the Great Barrier Reef, approximately 80km off the coast of Gladstone, Queensland. The island sits on a 27km² platform reef. The waters surrounding Heron Island are divided into one of three management designations, including Marine National Park (Green Zone), Conservation Park or Scientific Research zones.

Heron Island plays host to both the Heron Island Resort and the University Of Queensland's Research Station (HIRS). Heron Island Resort is a popular location for scuba diving and snorkelling that accommodates up to 200 guests and 100 staff members- and the HIRS is a heavily utilised research station with visiting schools, researchers and universities from Australia and the world. HIRS can accommodate up to 150 people.

The fringing reefs are well-utilised for snorkel and diving tourism as well as reef research. These activities may be having some unintended impacts. Factors such as extensive development in the nearby Gladstone region and global climate change may also pose threats to this marine ecosystem.

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3.4 Site Location Map

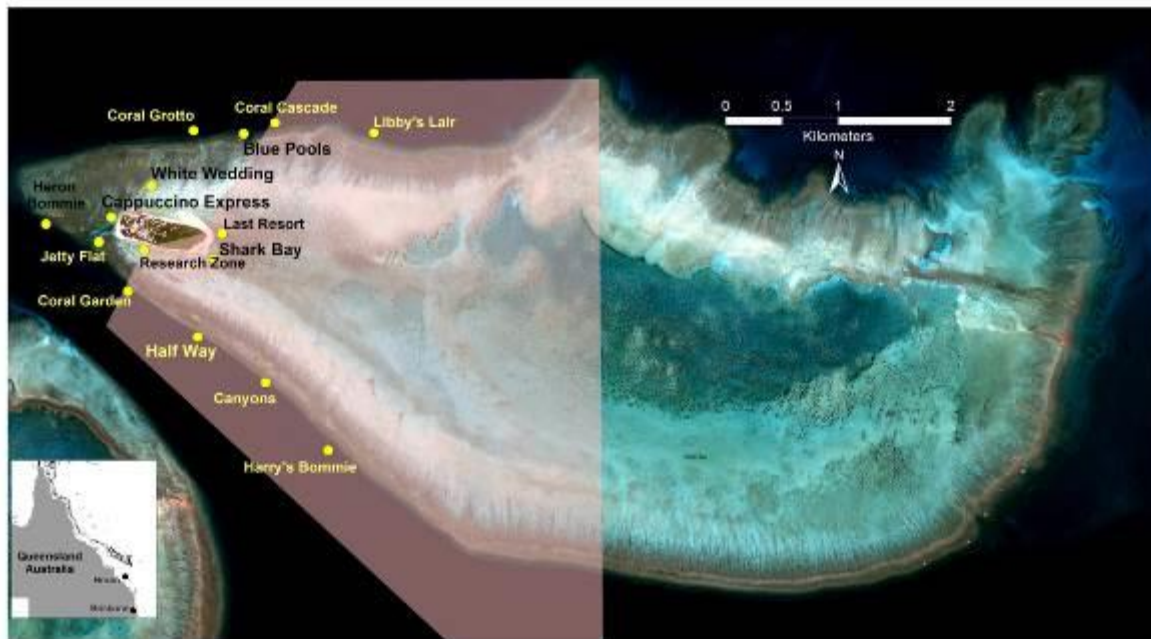


Image 1. Reef Check field sites and the conservation zone overlaid on the WorldView 2 pan sharpened image acquired on 1 November 2011 over Heron Reef (Image source: Digital Globe).

Table 2. Table of RCA monitoring locations on Heron Island, including site depth, average hard coral cover, site designation (Marine National Park, Conservation Park, or Scientific Zone), habitat type and the years in which each site was surveyed.

Site	Depth (m)	HC % at site	Site Designation	Habitat Type	Year(s) Site Surveyed
Blue Pools	5	40	Conservation Park	Reef slope	2014
Canyons	5	63	Scientific Zone	Reef slope	2013, 2014, 2015
Cappuccino Express	2	28	Marine Natl Park	Sandy reef flat with micro atolls	2013, 2014, 2015
Coral Cascade	6	49	Conservation Park	Reef slope	2013, 2014, 2015
Coral Garden	5	49	Marine Natl Park	Reef slope	2011, 2013, 2014, 2015
Coral Grotto	6	34	Conservation Park	Reef slope	2011, 2013, 2014, 2015
Halfway	6	33	Scientific Zone	Reef slope	2014, 2015
Harry's Bommie	9	74	Scientific Zone	Reef slope	2011, 2013, 2014, 2015
Heron Bommie	5	76	Marine Natl Park	Reef slope	2011, 2013, 2014, 2015
Jetty Flat	2	33	Marine Natl Park	Reef flat with micro atolls	2011, 2012, 2013, 2014, 2015
Last Resort	2	4	Conservation Park	Sandy reef flat	2013, 2014, 2015
Libby's Lair	6	56	Conservation Park	Reef slope	2011, 2013, 2014, 2015
Research Zone	1	9	Scientific Zone	Sandy reef flat	2011, 2012, 2013, 2014, 2015
Shark Bay	2	6	Scientific Zone	Sandy reef flat	2011, 2012, 2013, 2014, 2015
White Wedding	1	10	Marine Natl Park	Sandy reef flat	2014, 2015

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4.0 Summary Survey Report

Table 3. Summary table of RCA monitoring findings for each of the 14 surveys conducted on Heron Reef comparing 2015 with 2014 findings. Information includes: average hard coral cover (%), total macro algae abundance, abundance of invertebrates (collector urchin, sea cucumbers, giant clams, Triton, *Trochus*, *Drupella* snails, anemones); abundance of reef impacts (*Drupella* scars, unknown scars, coral damage, average coral bleaching of population %, average coral bleaching for colony surface %); and silt levels (N=none, L=low, M=medium, H=high). Categories are listed as abundance counts unless otherwise specified. The above information depicts information collected over a standard survey as described in section 3.2.

	Substrate			Invertebrates						Impacts						
	Hard Coral Coverage (%)	Macro Algae Total (#)	Change in HC%	Edible Sea Cucumbers (#)	Giant Clam (#)	Triton (#)	Trochus (#)	Drupella Snail (#)	Anemone (#)	Drupella Scar (#)	Unknown Scar (#)	Coral Damage (#)	Coral Disease (#)	Coral Bleaching Population (%)	Coral Bleaching Colony (%)	Silt Level
Canyons	63	0	↑	0	4	0	1	0	0	0	7	5	6	1	45.5	N
Cappuccino Express	29	0	↑	18	10	0	0	0	0	0	0	5	5	1	25	N
Coral Cascade	57	0	↑	0	3	0	0	0	1	0	5	2	2	1	16	N
Coral Garden	66	0	↑	0	0	0	0	0	0	0	11	3	8	0.75	16.5	N
Coral Grotto	43	0	↑	2	5	0	0	0	1	0	4	1	1	1	20	N
Halfway	31	0	↓	0	2	0	2	0	0	1	6	0	18	1	25	N
Harry's Bommie	62.5	1	↓	0	3	0	0	0	0	0	14	2	21	1	25.5	L
Heron Bommie *	74	0	↓	0	2	0	0	0	0	0	4	3	14	1	17	N
Jetty's Flat	36	0	↑	0	1	0	0	0	0	0	5	23	0	4	7	N
Last Resort	7.5	10	↑	11	2	0	0	0	0	0	0	19	2	1	5.5	N
Libby's Lair	52.5	0	↓	3	0	0	1	0	0	0	6	0	4	1	18	N
Research Zone	9	28	↑	3	6	0	0	0	0	0	0	8	0	1	2.5	L
Shark Bay	8.75	10	↑	16	2	0	0	0	0	0	0	17	3	1	6	N
White Wedding	14	0	↑	3	28	0	0	0	0	0	0	8	0	6	4	N

* The Heron Bommie Invertebrates and Impacts survey was conducted over two transects only (not four) due to time limitations and caution should be taken when discussing results from this site.

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To illustrate broad-spatial scale trends in the Reef Check data collected during the 2015 surveys the Reef Check data from each individual site was overlaid on a high spatial resolution pan sharpened WorldView 2 image (acquired 1 10 October 2014, source Digital Globe).

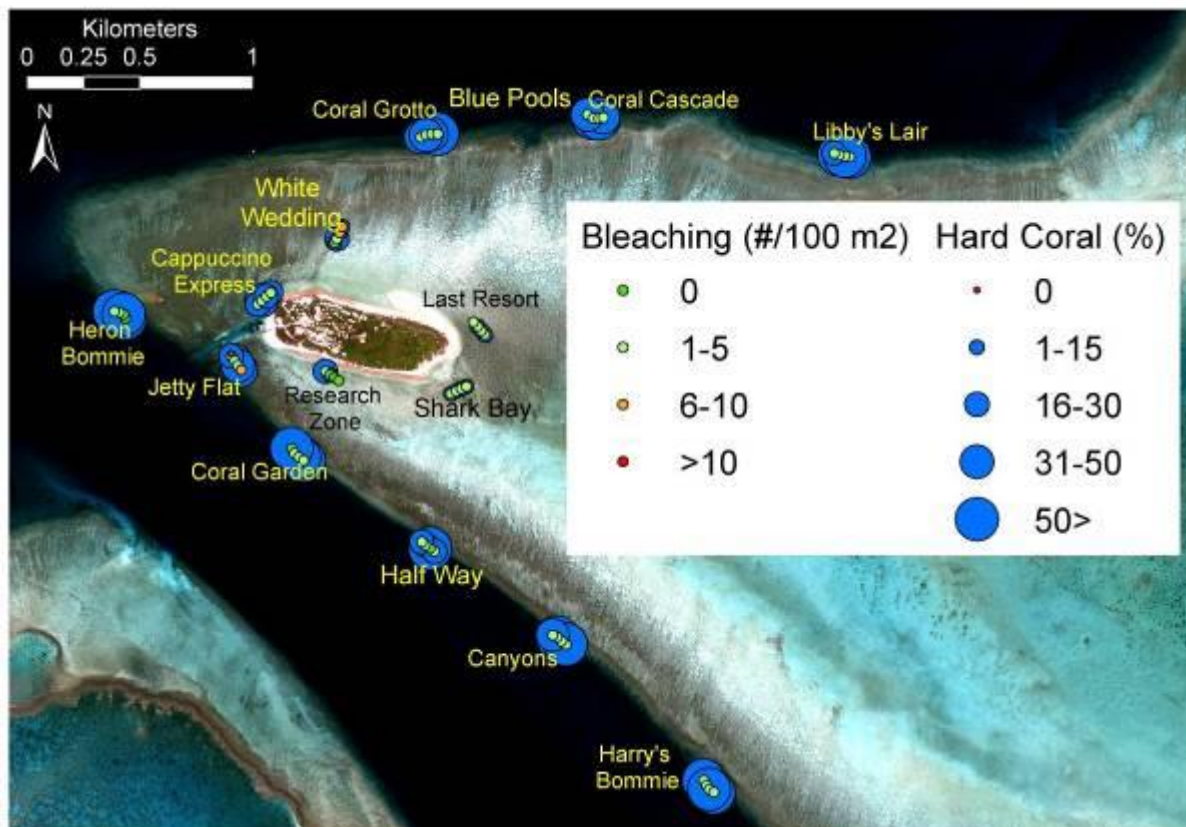


Figure 1. Map of Heron Island with Reef Check hard coral cover and population level bleaching data for 2015 surveys, overlaid on Worldview 2, satellite image (acquired 1 10 October 2014, source Digital Globe). Each survey site is represented by four circles, each displaying summary data for one of the four 100m² areas that makes up a full 400m² transect. Note that invertebrate and impact data was collected along only 2 of the 4 replicate transects at Heron Bommie and for this reason, Heron Bommie invertebrate and impact data is not included in any data analysis.

Coral bleaching levels decreased from 2014 to 2015. The 2015 data indicates low level bleaching recorded at all 14 sites. Slightly higher levels of coral bleaching were recorded on the northern side of Heron Island (average of 1.8% coral population bleaching for northern sites compared to 1.3% for southern sites) despite higher coral cover found on the southern side of the island). This is a decrease from 2014 bleaching levels recorded (10.5% coral population bleaching for northern sites compared to an average of 5.1% for southern sites). White Wedding and Jetty Flats were the only two sites to have any transect with >1% of coral colonies bleached (12 sites with >1% were documented in 2014). The highest average bleaching across a single site was White Wedding with 5.7%- a decrease from 42.5% recorded in 2014.

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Figure 2. Map of Heron Island with Reef Check hard coral cover and unknown scar data. Each survey site is represented by four circles, each displaying summary data for one of the four 100m² areas that makes up a full 400m² transect. Note that invertebrate and impact data was collected along only 2 of the 4 replicate transects at Heron Bommie and for this reason, Heron Bommie invertebrate and impact data is not included in any data analysis.

Nine of the 14 sites showed instances of unknown scars. Of these, Harrys Bommie and Coral Gardens were the only sites with more than 10 scars recorded per 400m² (14 and 11 respectively). The 2015 data indicates higher levels of coral scars on the southern side of Heron Island (average of 6.14 counts per 400m²) compared with the northern side (average of 2.5 counts per 400m²). This is consistent with findings from 2014 (southern side with an average of 10.28 counts per 400m², and the northern side with an average of 4.28 counts per 400m²). The southern side also has higher average coral cover (39.5% compared to 33.9%); a finding consistent with previous reports.

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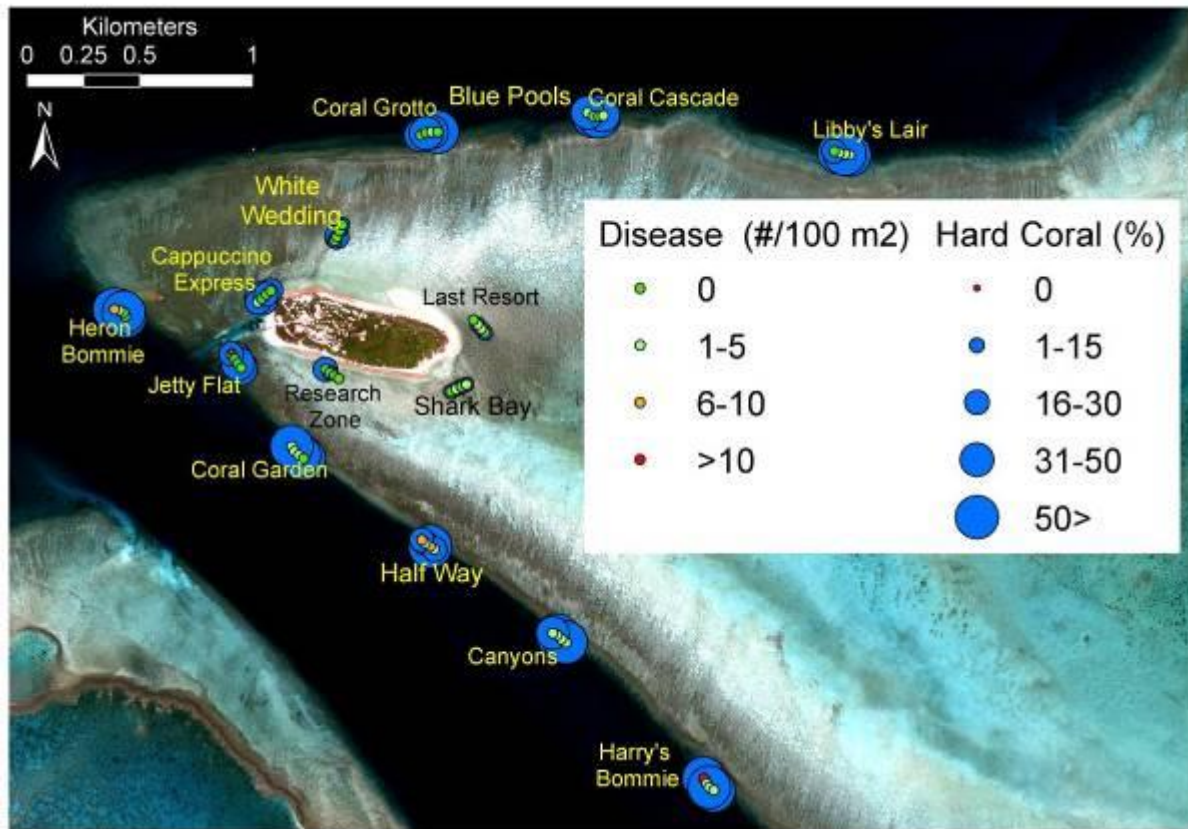


Figure 3. Map of Heron Island with Reef Check hard coral cover and coral disease data. Each survey site is represented by four circles, each displaying summary data for one of the four 100m² areas that makes up a full 400m² transect. Note that invertebrate and impact data was collected along only 2 of the 4 replicate transects at Heron Bommie and for this reason, Heron Bommie invertebrate and impact data is not included in any data analysis.

Eleven of the 14 sites had instances of coral disease. The 2015 data indicates a higher concentration of coral disease at Harry's Bommie (21 counts) and Halfway (18 counts) than at other survey locations (average of 2.8 counts per 400m² when excluding the above mentioned sites). Sites on the southern side of the island had a higher average incidence of disease (8 counts per 400m²) when compared to the northern sites (2.3 counts per 400m²). As mentioned previously, southern sites also have a higher average coral cover (39.5%) than northern sites (33.9%).

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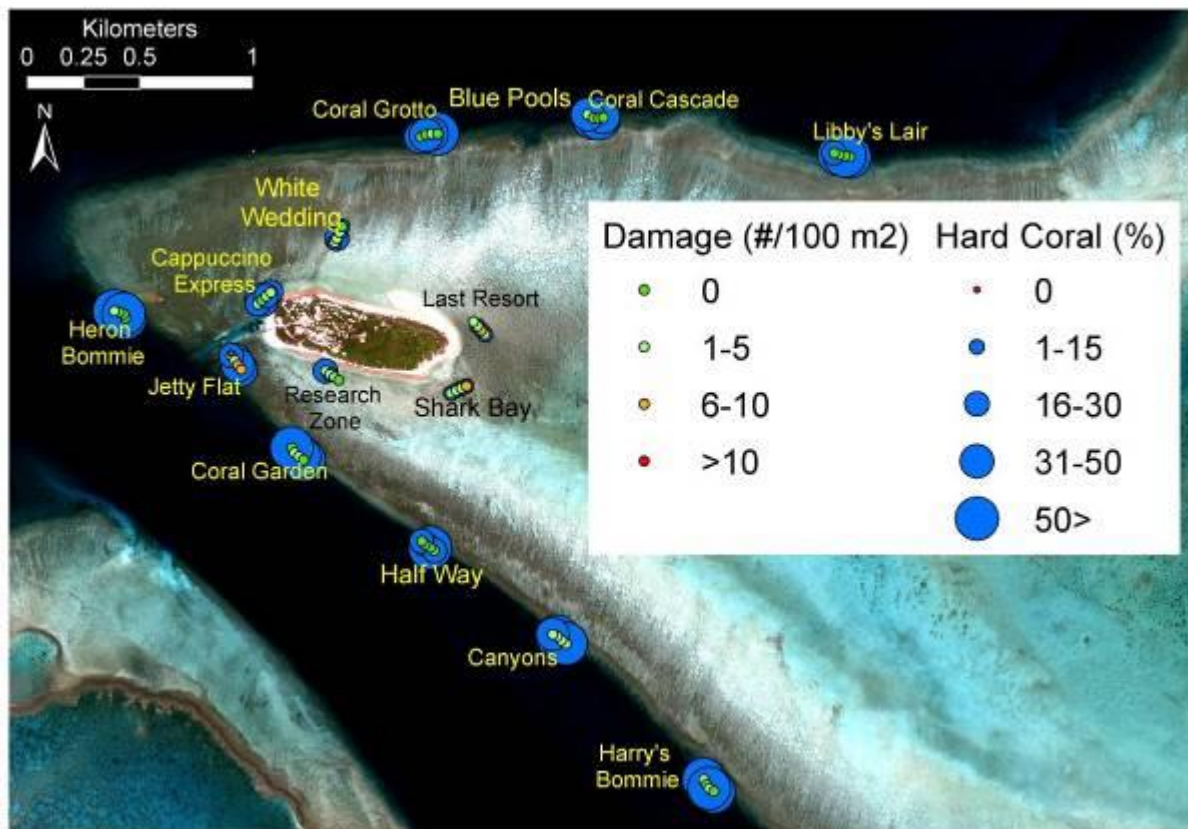


Figure 4. Map of Heron Island with Reef Check hard coral cover and coral damage data. Each survey site is represented by four circles, each displaying summary data for one of the four 100m² areas that makes up a full 400m² transect. Note that invertebrate and impact data was collected along only 2 of the 4 replicate transects at Heron Bommie and for this reason, Heron Bommie invertebrate and impact data is not included in any data analysis.

Twelve of the 14 sites had instances of coral damage. Libby's Lair and Half Way were the only sites with no examples of coral damage found along the transect. The 2015 data indicates a higher than average (average over 13 sites excluding Heron Bommie is 7.1 counts per 400m²) concentration of coral damage at White Wedding, Research Zone, Shark Bay, Last Resort and Jetty Flat (8, 8, 17, 19 and 23 counts per 400m² respectively). Shallow inshore, easily accessible sites had a much higher average of coral damage occurrence (13.3 counts per 400m²) when compared to deeper, reef crest/slope sites accessible only by boat (1.9 counts per 400m²).

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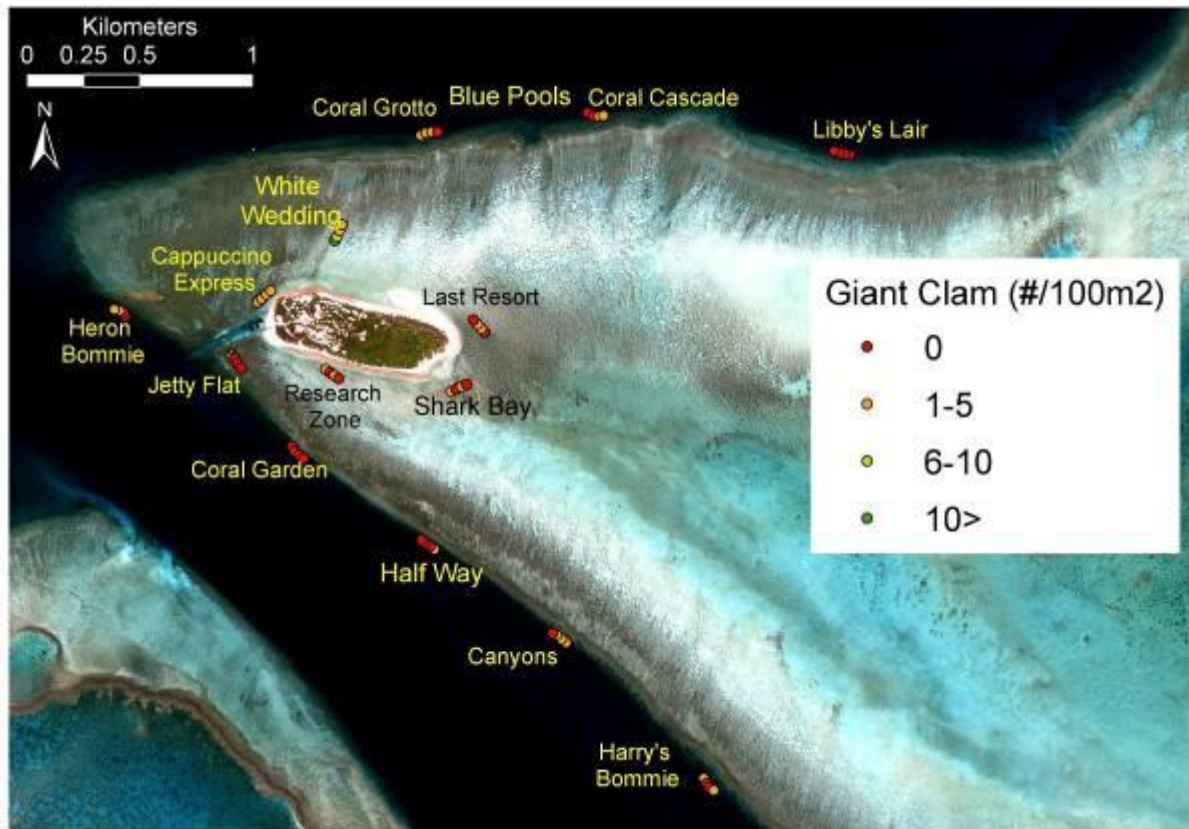


Figure 5. Map of Heron Island with Reef Check Giant Clam abundance. Each survey site is represented by four circles, each displaying summary data for one of the four 100m² areas that makes up a full 400m² transect. Note that invertebrate and impact data was collected along only 2 of the 4 replicate transects at Heron Bommie and for this reason, Heron Bommie invertebrate and impact data is not included in any data analysis.

The 2015 data indicates higher concentrations of giant clams on the northern side of the island (average of 8 clams per 400m² compared to 2.8 clams per 400m² found on the southern side). Northern near shore sites White Wedding and Cappuccino Express had the highest concentrations of giant clams with 28 and 10 found on the transect, respectively. Coral Garden and Libby's Lair were the only two sites with no giant clams recorded along the transect.

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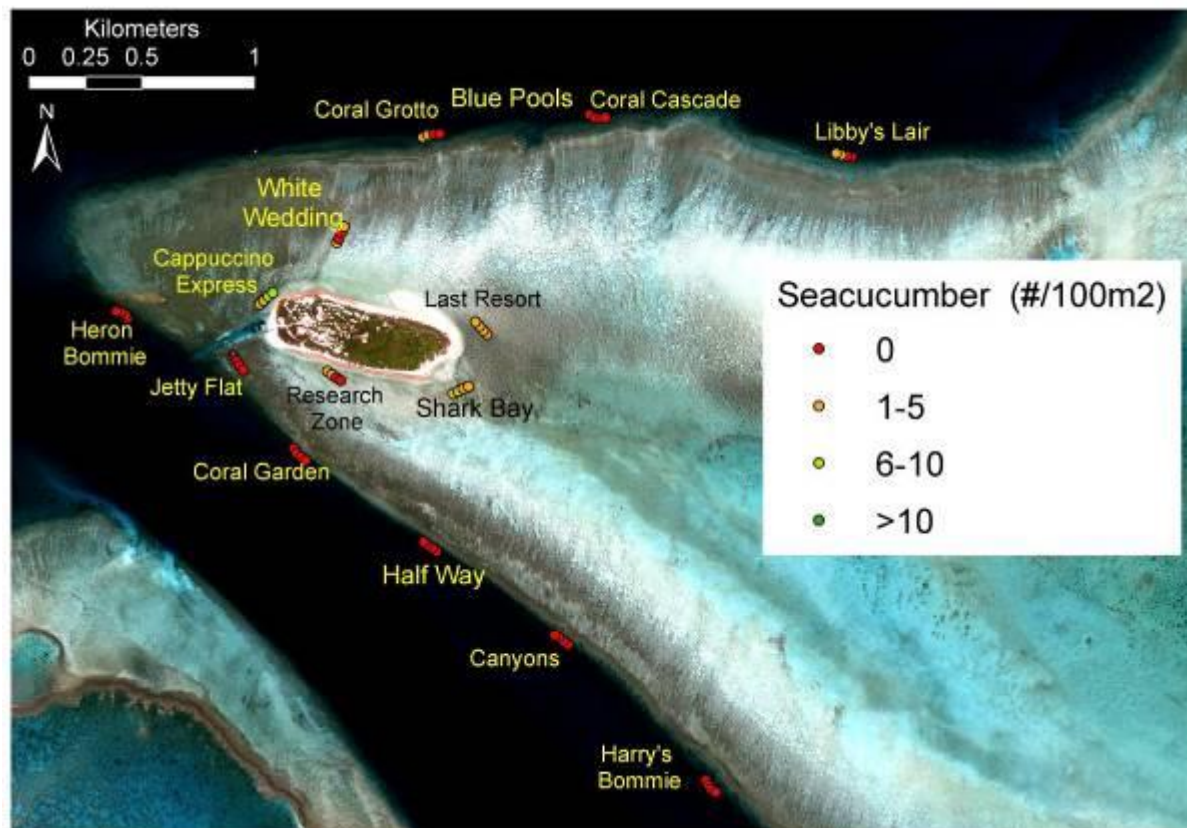


Figure 6. Map of Heron Island with Reef Check sea cucumbers abundance. Each survey site is represented by four circles, each displaying summary data for one of the four 100m² areas that makes up a full 400m² transect. Note that invertebrate and impact data was collected along only 2 of the 4 replicate transects at Heron Bommie and for this reason, Heron Bommie invertebrate and impact data is not included in any data analysis.

Target sea cucumbers were recorded at 7 of the 14 sites for 2015. The 2015 data indicates higher concentrations of sea cucumbers on near shore, sandy reef areas, when compared with survey sites along the reef crest- a finding consistent with all previous reports. Higher than average concentrations (more than 4.3 per 400m²) of target sea cucumbers were found at Last Resort (11 per 400m²), Shark Bay (16 per 400m²) and Cappuccino Express (18 per 400m²). Sites found to the north of the island had an average of 6.2 target sea cucumbers recorded per 400m² compared with an average of 2.7 per 400m² recorded for southern sites.

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5.0 INDIVIDUAL SITE REPORTS

5.1 Canyons

Canyons is situated at 6m along the reef crest, on the southern side of Heron Island. The site was added to the Reef Check reef health survey list in 2013, to gain a better spread of the southern reefs. This site is characterised by a series of shallow canyons cutting into the edge of the reef, with scattered bommies out deeper, away from these ridges.

Hard coral represented 63% of the total substrate cover at the Canyons survey site, one of the highest hard coral cover's recorded of all the sites surveyed at Heron Island. Of this, branching growth forms made up 67% of the overall hard coral category. Rock with turf algae was the next greatest contributor to substrate, contributing 35%.

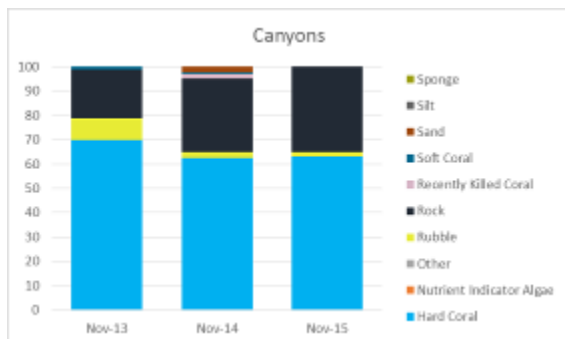


Figure 7. Benthic type and percent cover: Canyons, 2013- 2015.

A total of four giant clams were recorded on the invertebrate survey. One *Trochus* was also recorded. No other invertebrates were recorded on the survey.

Bleaching affected an average of 1% of the coral population on the transect, with an average of 45% of each coral colony affected (up from 21% in 2014). This was the highest average bleaching of colony surface recorded at the Heron Island reef transect sites in 2015.

Five incidents of coral damage, six incidents of disease and seven scars of unknown origin were recorded at Canyons in 2015, compared to nine, six and six respectively in 2014.

A fish survey was not carried out.



Image 2: Canyons Site Photo



Image 3: Anemone at Canyons



Image 4: Coral Damage at Canyons

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5.2 Cappuccino Express

Cappuccino Express was added to the Reef Check reef health survey list in 2013, to gain more information on the near reefs. This reef area is easily accessible on snorkel visited by tourists as it is situated close to the resort. A strong current passes this area for much of the day. The site is characterised by small coral atolls and sandy patches and sits in 2m.

Hard Coral represented 29% of the total substrate at this site. Ninety-one percent of this was branching growth forms. Rock consisting exclusively of rock with turf algae made up 27% of the substrate. Sand accounted for 29%.

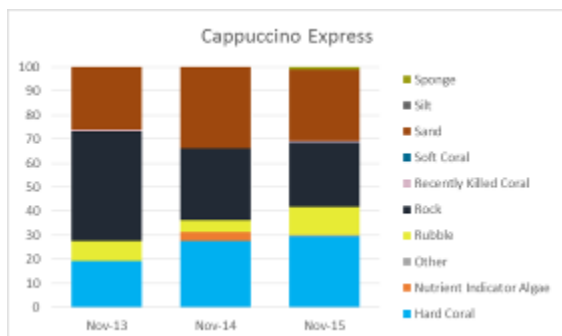


Figure 8. Benthic type and percent cover: Cappuccino Express, 2013- 2015.

Ten giant clams and eighteen sea cucumbers were recorded on the invertebrate survey. No other indicator invertebrates were recorded.

Coral bleaching affected approximately 1% of the coral population, with an average of 25% of coral surfaces bleached; less than 2014 levels recorded (19% of coral population and 28% of coral surfaces).

Five counts of coral damage and 5 incidents of disease were recorded at Cappuccino Express in 2015. No unknown scars were recorded in 2015, compared to 10 documented in 2014.

A fish survey was completed at this site; 10 butterfly fish, 1 snapper, and 2 other parrotfish were recorded. A black tip reef shark was also recorded on transect.



Image 5: Cappuccino Express site photo



Image 6: Coral disease at Cappuccino Express



Image 7: RCA surveyors on site

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5.3 Coral Cascade

Coral Cascade is situated on the northern wall. The survey site is situated on the reef slope at 7m depth. Coral Cascade is a dive site often utilised by tourists and researchers alike. It is characterised by a high abundance of hard coral- hence the name.

Hard coral cover represented 57% of the substrate at this site. This sloping reef site consists of a mixture of hard coral growth forms with branching (49%) and encrusting (41%) being among the highest contributors. Rock (including rock with turf algae and rock with coralline algae) made up 34% of the substrate, and rubble accounted for 4%. Soft coral attributed just 1.3% of the substrate cover.

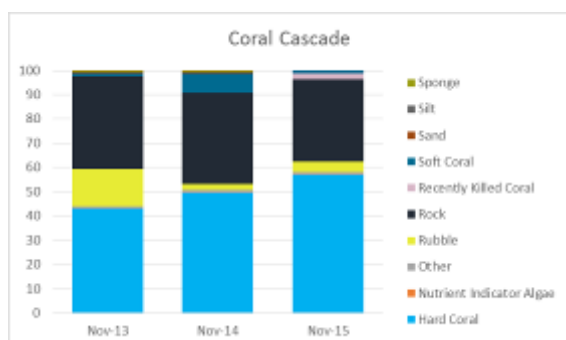


Figure 9. Benthic type and percent cover: Coral Cascade, 2013- 2015.

Three giant clams, one anemone and one lobster were recorded on the invertebrate survey.

Bleaching was recorded on 1% of the coral population, with an average 16% of each affected coral surface bleached (down from 22.5% recorded in 2014).

Other reef impacts recorded at this site include 2 counts of coral damage, 2 incidents of disease and 5 unknown scars.

A fish survey was not carried out in 2015.



Image 8: Coral Cascade site photo



Image 9. Coral Disease at Coral Cascade



Image 10: Epauvette Shark

REEF CHECK

AUSTRALIA

5.4 Coral Gardens

Coral Gardens is located on the southern side of Heron Island. It is characterised by high hard coral cover; particularly branching coral growth forms. It is a popular dive destination for the resort. The Reef Check site was first set up in 2011, and is situated at a depth of 5m, on the reef slope.

Hard coral accounted for 66% of the benthos at this site and was made up almost exclusively of branching coral growth forms (88%). The rock category accounted for 29%. Rubble accounted for 3% of the total substrate composition, and soft coral attributed just 1%. No macro algae has been recorded at this site since 2011 (6 counts).

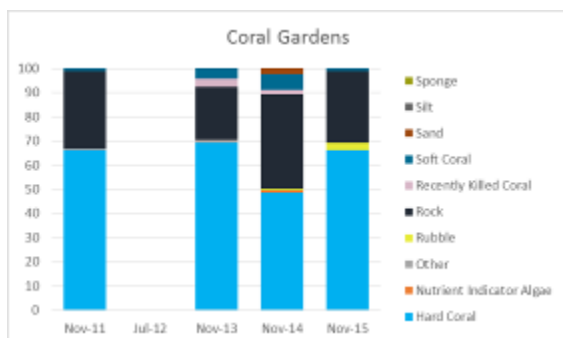


Figure 10. Substrate type and percent cover at Coral Gardens, 2011- 2015.

No indicator invertebrates were recorded within the transect in 2014 or 2015.

Coral Gardens had an average of 16% coral colony bleaching; a decrease from the 20% recorded in 2014 and 29% in 2013. Less than 1% of the entire coral population showed signs of bleaching.

Reef Impacts recorded at Coral Gardens included 3 incidences of coral damage, 8 incidents of disease and 11 unknown scars;

a decrease from 19, 106 and 38 recorded in 2014 respectively.

A fish survey was completed at this site; 7 snapper, 6 butterfly fish, 6 other parrotfish and 3 grouper were recorded.



Image 11: Site photo from Coral Gardens



Image 12: Nudibranch at Coral Gardens



Image 13. Green Sea Turtle at Coral Gardens

REEF CHECK

AUSTRALIA

5.5 Coral Grotto

The Coral Grotto is located on the northern side of Heron Island. It is characterised by high hard coral cover; particularly branching growth forms. This Reef Check site was first set up in 2011, and is situated at a depth of 6m, on the reef slope.

Hard coral accounted for 43% of substrate in 2014 (an increase from 34% in 2011), consisting primarily of branching (45%) and encrusting growth forms (32%). Compared to previous surveys, the amount of rubble recorded was less (25% in 2011, 11% in 2013, 9% in 2014 and 7.5% in 2015), as was rock (48% in 2015, 53% in 2014, 56% in 2013 and 30% in 2011).

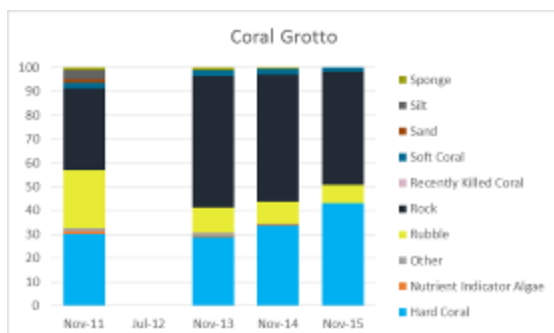


Figure 11: Benthic type and percent cover: Coral Grotto, 2011-2015.

Five giant clams, two sea cucumbers and one anemone were recorded during the invertebrate survey.

Coral bleaching was estimated to affect 1% 4.3% of the total coral population; less than 2014 (4.25%) and 2013 (4.5%) levels. Coral bleaching at this site impacted approximately 20% of each colony surface; similar to 2014 levels (21%). Additional impacts recorded include 4 unknown coral scars, 1 incident of coral damage, and 1 of disease.

A fish survey was not conducted in 2015.



Image 14. Site Photo from Coral Grotto



Image 15. Unknown Coral Scar



Image 16: NIA: Nutrient Indicator Algae

5.6 Half Way

REEF CHECK

AUSTRALIA

Half Way was added to the Reef Check reef health survey list in 2014 to allow for a wider spread of survey locations around the island, and to gather more information on the southern side of the reef. The RCA site is situated on the reef crest at a depth of 6m, on the southern side of Heron Island.

Hard coral represented 31% of the total substrate cover at the Half Way survey site. The hard coral category was dominated by branching hard coral growth form (96%). Rock made up 64% of the substrate, with 93% of the category consisting of rock with turf algae.

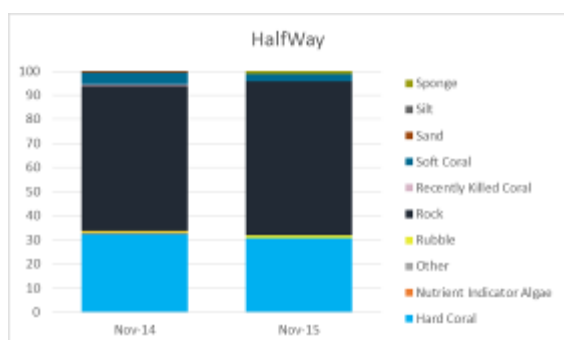


Figure 12: Benthic type and percent cover: Half Way, 2014 and 2015.

Two giant clams and two *Trochus* snails were recorded on the invertebrate survey.

Bleaching affected 1% of the coral population and affected an average of 25.3% of the surface of colonies. This is a decrease from 2014 recorded levels (4.5% of the coral population and 32.5% of the surface of colonies).

Other reef impacts recorded included six counts of unknown scars, one *Drupella* scar and eighteen counts of disease (the second highest count recorded for 2015).

A fish survey was not conducted in 2015.



Image 17: Halfway site photo with coral disease.



Image 18: Encrusting Hard Coral on transect



Image 19: Green Turtle at Half Way

REEF CHECK

AUSTRALIA

5.7 Harry's Bommie

Harry's Bommie is located on the southern side of Heron Island, on the reef wall. It is characterised by large coral bommies and high hard coral cover; particularly branching growth forms. The Reef Check site was first set up in 2011, and is situated at a depth of 9m, on the reef slope.

Hard coral cover at this site accounted for 62.5% of the benthos. Of this, 54% was branching growth forms, and 28% was foliose. Rock with turf algae accounted for 35% of the total substrate. Sand and rubble accounted for just 1% each.

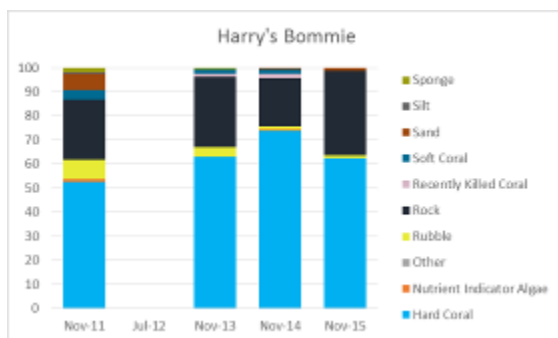


Figure 13. Benthic type and percent cover: Harry's Bommie, 2011- 2015.

Three giant clams were recorded during the invertebrate survey. No other invertebrates were recorded on the transect.

Coral bleaching affected approximately 1% of the total coral population, within an average of 26% of each colony showing surface bleaching.

Two incidents of coral damage, 21 incidents of disease, and 14 unknown scars were recorded, compared to 8, 26 and 15 recorded in 2014 respectively.

A fish survey was completed at this site; 10 butterfly fish, 1 snapper, and 1 sweetlip and 5 other parrotfish were recorded.



Image 20. Site photo of Harrys Bommie



Image 21. Coral Disease at Harrys Bommie

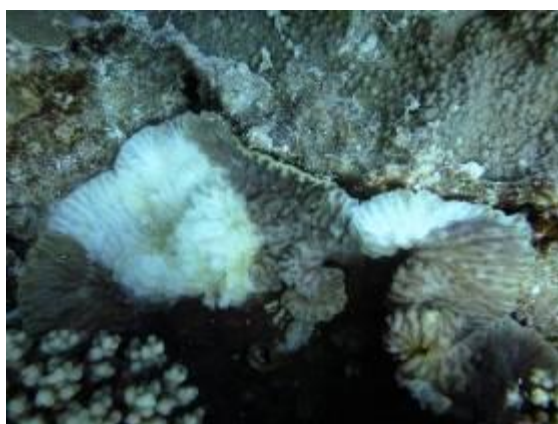


Image 22. Unknown Scar at Harrys Bommie

REEF CHECK

AUSTRALIA

5.8 Heron Bommie

Heron Bommie is located on the south west of Heron Island fringing reef. It is characterised by a large coral bommie and high hard coral cover; particularly branching growth forms. Heron Bommie is a popular dive site with the resort due to its close proximity and high coral cover. The Reef Check site was first set up in 2011, on the reef slope at a depth of 6m.

Hard coral represented 74% of the substrate for 2015- the highest hard coral cover recorded at any of the 2015 Heron Island sites surveyed. Of this, 72% consisted of branching growth forms. Bleached hard coral accounted for 13%. Rubble attributed 9% overall.

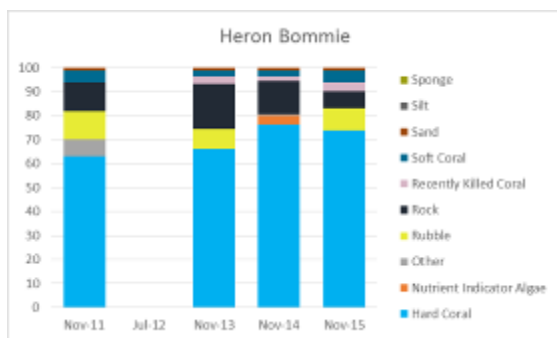


Figure 14. Benthic type and percent cover: Heron Bommie, 2011- 2015.

Two giant clams were recorded at this site. No other indicator invertebrates were recorded, although only two invertebrate transects were completed at this site (instead of 4).

In 2014 Heron Bommie had one of the greatest number of disease incidents (90) of Reef Check Australia Heron Island sites surveyed. In 2015, only two impact replicates were completed (instead of 4), so caution must be made when analysing these results. Impacts recorded include 14 incidents of coral disease, 3 of coral damage and 4 unknown scars. An average of 9% of bleaching per coral

surface was recorded with less than 1% of the coral population bleached overall, compared to 14% and 2% respectively for 2014.

A fish survey was completed at this site; 8 grouper, 5 other parrotfish, 1 butterfly fish, and 1 barramundi cod were recorded.



Image 23. Heron Bommie site photo



Image 24. Rubble covered in Turf Algae



Image 25. Coral Disease at Heron Bommie

REEF CHECK

AUSTRALIA

5.9 Jetty Flat

Jetty flat is located on the southern side of Heron Island, on the south east reef flat near the boat channel. It is a shallow site often visited by snorkelers due to its location and ease of access. It is characterised by large areas of branching corals with flat, eroded tips (due to tidal extremes) and sandy patches. The Reef Check site was first set up in 2011, and is situated at a depth of 2m.

Hard corals accounted for 36% of the benthos; 98% of this consisting of branching growth forms. Rock attributed 62% to the substrate in 2015, all of which was rock with turf algae. Sand and rubble accounted for just 1% each.

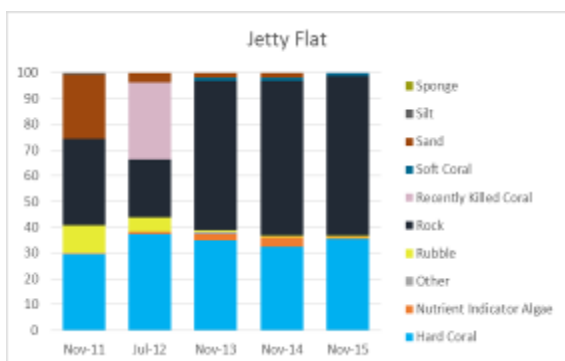


Figure 15. Benthic type and percent cover: Jetty Flat, 2011 to 2015.

One giant clam was the only invertebrate recorded on the invertebrate survey.

Reef impacts recorded during the 2014 survey at Jetty Flat included 23 counts of coral damage, 2 counts of unknown scars and 5 counts of coral disease. An average of 7% (down from 25% in 2014) bleaching per coral surface was recorded with 4% of the population being bleached overall.

A fish survey was completed at this site; 20 butterflyfish were recorded.



Image 26. Jetty Flat site photo



Image 27. Cowrie on transect



Image 28. Unknown Scar at Jetty flat

REEF CHECK

AUSTRALIA

5.10 Last Resort

Last Resort was added to the Reef Check reef health survey list in 2013 to allow for a wider spread of survey locations around the island, and to gather more information on near shore reef sites. This reef area is located on the north east corner of the island, and is accessible on snorkel. It is frequented by tourists as it is a popular spot for shark and ray sightings.

Eight percent of the benthos recorded at Last Resort in 2015 was hard coral. This is the lowest coral cover recorded at any Heron Island site in 2015. Of this, 92% consisted of branching growth forms, with massive growth forms being the only additional growth form recorded. Over 80% of the substrate was made up of sand and rubble, with 10% was nutrient indicator algae (*Hydroclatharus sp.*). Last Resort had a macro algal count of 10 (the second highest macro algal count for 2015).

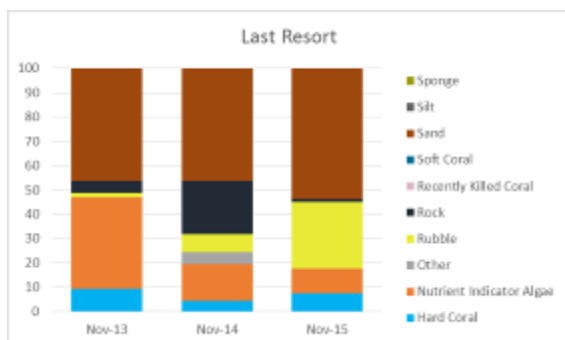


Figure 16. Benthic type and percent cover: Last Resort, 2013- 2015.

Two giant clams and eleven sea cucumbers were recorded on the invertebrate survey.

Coral bleaching affected 1% of the coral population at Last Resort. Of these corals, an average of 6% of each coral surface was bleached. This is slightly less than 2014 recorded levels of 2 and 8% respectively.

Nineteen incidents of coral damage was recorded (an increase from 2 recorded in 2014), and two incidents of coral disease were recorded during the 2015 impact survey.

A fish survey was completed and 2 snapper were recorded on the survey.

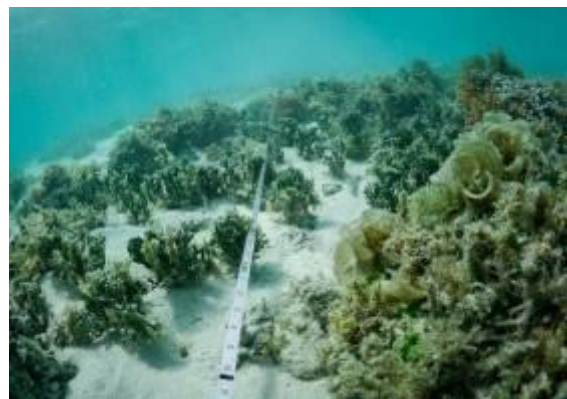


Image 29. Last Resort site photo



Image 30. Hard Coral showing bleaching



Image 31. Last Resort, surveyor on transect

REEF CHECK

AUSTRALIA

5.11 Libby's Lair

Libby's Lair is located on the northern side of Heron Island, on the north east reef slope. It is characterised by high coral diversity and few deep gulleys. The Reef Check site was first set up in 2011 and is situated at a depth of 6m along the reef slope.

Hard coral accounted for 53% of the benthos at Libby's Lair. Rock (encompassing both rock with turf algae and rock with coralline algae) made up 35% of the substrate. Branching growth forms attributed 64% to the hard coral substrate, with encrusting (20%), foliose (11%), massive (1%) and plate (1%) attributing the remainder.

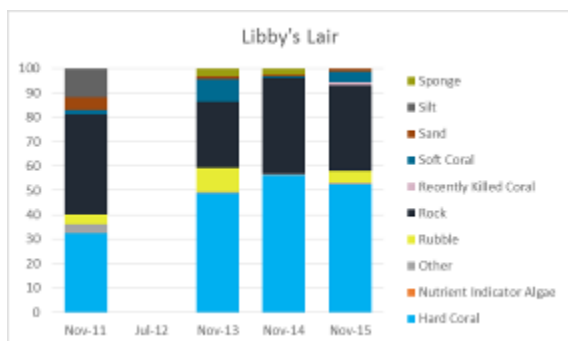


Figure 17: Benthic type and percent cover: Libby's Lair, 2011- 2015.

Three sea cucumbers and one *Trochus* were recorded at this site.

Coral bleaching affected an average of just 1% of the coral population; however the surface of each affected coral averaged 18.5%. Additional impacts recorded included 4 incidents of coral disease and 6 unknown scars.

A fish survey was not conducted in 2015.



Image 32. Libby's Lair site photo.



Image 33: Unknown Scar at Libbys Lair



Image 34. *Trochus* at Libby's Lair

REEF CHECK

AUSTRALIA

5.12 Research Zone

The Research Zone site is located on the southern side of Heron Island, within the scientific zone. It is utilised for harvesting of samples for scientific and educational purposes. It is a shallow site utilised by both researchers and tourists on snorkel due to its accessibility, and shallow depth (max 2m). This Reef Check site was first set up in 2011.

The majority of the substrate at this site is sand (63%), with hard coral contributing just 9% to the benthos. Nutrient indicator algae was not recorded at this site for 2015, a decrease from 11% of the cover recorded in 2014. This site had the highest count of macro algae (28) found in 2015 (also the highest count in 2014 with 19).

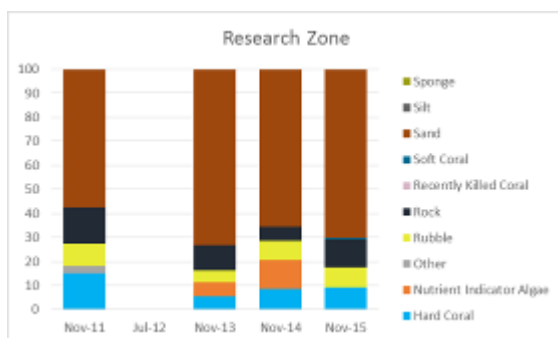


Figure 18. Benthic type and percent cover: Research Zone 2011- 2015.

Six giant clams, and three sea cucumbers were recorded on the invertebrate survey.

Coral bleaching affected less than 1% of the coral population, and an average of 3%, down from 2014 levels recorded (18% and 14% respectively). Eight incidents of coral damage and one piece of general trash were also recorded on the transect.

A fish survey was completed at this site. Two butterfly fish and 2 parrotfish were recorded.



Image 35. Research Zone site photo



Image 36. Unknown Scar at Research Zone



Image 37: Stingray at Research Zone

REEF CHECK

AUSTRALIA

5.13 Shark Bay

Shark Bay site is located on the eastern side of Heron Island. It is a shallow site frequented by tourists on snorkel due to its accessibility, and shallow depth (max 2m). This reef area is a popular spot for shark and ray sightings. This Reef Check site was first set up in 2013.

Hard coral accounted for almost 9% of the benthos at this sandy reef flat location. Branching growth forms attributed 86%, with the general hard coral category and encrusting growth forms both attributing 7%. No other growth forms were recorded. Sand accounted for 62.5% of the benthic survey. nutrient indicator algae (*Hydroclatharus sp.*) accounted for 22%. This site had the second highest macro algal count for 2015 (10).

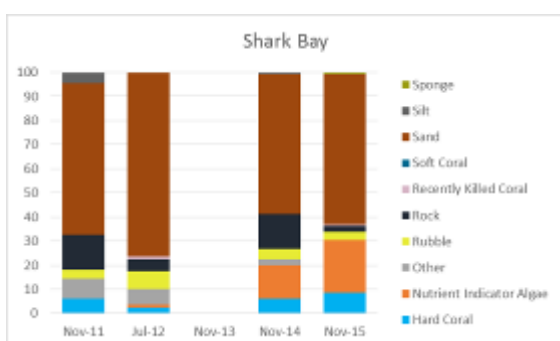


Figure 19. Benthic type and percent cover: Shark Bay, 2011- 2015.

Two giant clams and sixteen sea cucumbers were found during the invertebrate survey.

Coral bleaching affected 1% of the coral population, and an average of 6% of each affected coral colony. This is less than 2014 recorded levels of 4% and 26% respectively. Seventeen incidents of coral damage (an increase from 1 recorded in 2014), and three incidents of disease were also recorded on the transect.

A fish survey was completed at this site. Fifteen butterflyfish, four snapper, two coral trout, one grouper, and one other parrotfish were recorded.



Image 38: Shark Bay Site Photo



Image 39: Hard Coral Bleaching



Image 40: Shovel Nose Ray at Shark Bay

REEF CHECK

A U S T R A L I A

5.14 White Wedding

White Wedding was added to the Reef Check reef health survey list to allow for a wider spread of survey locations around the island, and to gather more information on the northern side of the reef. This area of reef flat is close to the resort and regularly frequented by tourists on snorkel and also reef walking.

Hard coral accounted for 14% of the benthic substrate. Branching hard coral growth forms made up 55% of the coral cover, with massive (23%), encrusting (18%) and bleached (4%) making up the remainder. Almost 60% of the substrate cover was made up of sand and 16% consisting of rock with turf algae.

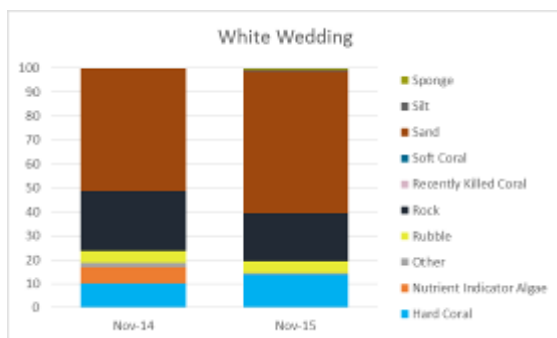


Figure 20. Benthic type and percent cover: White Wedding 2014 and 2015.

Twenty-eight giant clams and three sea cucumbers were recorded on the invertebrate survey. This was the highest number of giant clams recorded on any RCA Heron Island reef health survey for 2015 and 2014 (31 clams recorded).

Coral Bleaching on average, affected 6% of the coral population, and 4% of the surface of coral colonies (a decrease from 42.5% the coral population, and 17% of the surface of coral colonies in 2014). Eight counts of coral damage were also recorded.

A fish survey was conducted at this site. Three butterfly fish, six parrotfish and one snapper and were counted.



Image 41: White Wedding site photo



Image 42: Giant Clam on transect



Image 43: Dominant Algae, *Padina* at White Wedding.

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6.0 FURTHER INFORMATION

For more information on Reef Check Australia, survey methods, sites and previous reports, please go to www.reefcheckaustralia.org.

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The 2015 Heron Reef Research Team (left to right): Jodi Salmond, Andy Findlay, Eva Kovacs, Rebekah Christensen, Stuart Phinn, Douglas Stetner, Julie Schubert, Amanda Delaforce and Chris Roelfsema.

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