Reef Check Australia

2013 Heron Island Reef Health Report

empowering people to save our reefs and oceans

Reef Check Foundation Ltd

www.reefcheckaustralia.org

REEF CHECK
AUSTRALIA

Reef Check Australia
greatly appreciates all of the people and
organizations who have helped to make this new initiative possible.

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THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CENTRE FOR SPATIAL ENVIRONMENTAL RESEARCH
BIOPHYSICAL REMOTE SENSING GROUP

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TABLE OF CONTENTS

1.0 Introduction

1.1 Reef Check Australia Overview

1.2 Reef Check Methodology

1.3 Heron Island

1.4 Site Location Map

2.0 Summary of Findings

3.0 GIS Maps

4. Survey Site Reports

4.1 Site: Canyons

4.2 Site: Cappuccino Express

4.3 Site: Coral Cascade

4.4 Site: Coral Gardens

4.5 Site: Coral Grotto

4.6 Site: Harry's Bommie

4.7 Site: Heron Bommie

4.8 Site: Jetty Flat

4.9 Site: Last Resort

4.10 Site: Libby's Lair

4.11 Site: Research Zone

5.0 Further Information

6.0 Acknowledgments

7.0 Appendix

1.0 INTRODUCTION

1.1 Reef Check Australia Overview

Reef Check Australia's (RCA) monitoring program is a peer-reviewed, volunteer reef health monitoring program that trains volunteers to collect data using a globally standardized protocol. Annual surveys provide regionally-specific long-term data sets that can be used for local and regional reef management and are part of the global Reef Check program comparing reef health on a global scale. Both can 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.

1.2 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.

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: Zoanthids SC: Other Soft Coral (tree or flower shaped) SCB: Bleached Soft Coral
Recently Killed Coral	RKCTA: Recently killed coral with Turf Algae RKCNIA: 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

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

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.

Building on the success of previous years, 3 additional reef health monitoring sites were established this year to allow for more replicates, and a more detailed representation of reefs surrounding Heron Island. The 11 Reef Check Australia monitoring sites were selected to represent diverse management and use areas on Heron Reef. Five are located in protected Green zones, three are located in general use areas and three are located in a scientific research zone that allows extraction for experimental & educational purposes.

Reef Check transects overlapped with UQ Biophysical Remote Sensing Group geo-referenced benthic photo-transects that are visited annually as part of a research project that started in 2001. The research project involves using the collected field data for calibration and validation of benthic community maps derived from high spatial resolution satellite imagery (e.g. Worldview 2, Phinn et al 2010, and Roelfsema et al 2013). Coral Watch coral colour assessments, spectral reflectance signatures and sediment analysis projects were also conducted.

1.3 Heron Island

Heron Island is a coral cay located on Heron Reef in the southern section of the Great Barrier Reef, approximately 80km off the coast of Gladstone, Queensland. The island sits on a 27km^2 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.

The resort is a popular location for scuba diving and snorkelling and accommodates up to 200 guests and 100 staff members. The Research Station (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 Gladstone region and global climate change may also pose threats to this marine ecosystem.

Summary findings for 12 Reef Check Australia surveys conducted around Heron Island from November 1 to 8, 2013 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 useful information for Island managers, researchers and resource users (including staff and guests).

1.4 Site Location Map

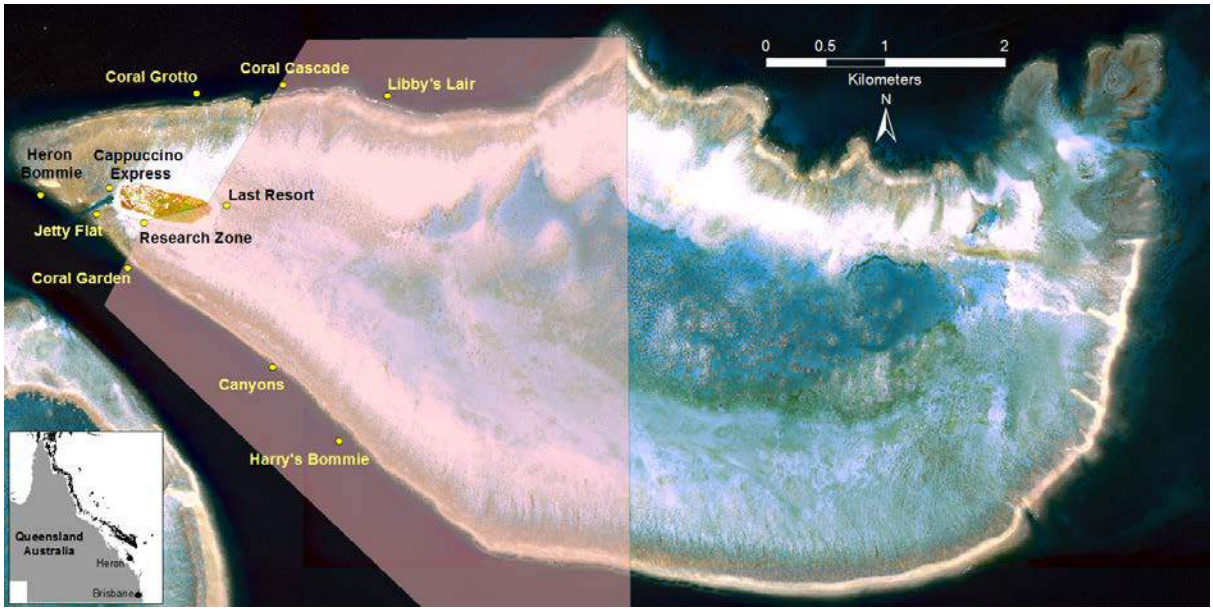

Image 1. Reef Check field sites and the conservation zone overlayed on the WorldView 2 pan sharpened image acquired on 5 November 2013 over Heron Reef.

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) and habitat type

Site	Depth (m)	HC % at site	Site Designation	Habitat Type
Canyons	5	70	Scientific Zone	Reef slope
Cappuccino Express	2	19	Marine Natl Park	Sandy reef flat with micro atolls
Coral Cascade	6	43	Conservation Park	Reef slope
Coral Garden	5	69	Conservation Zone	Reef slope
Coral Grotto	6	29	Marine Natl Park	Reef slope
Harry's Bommie	9	63	Scientific Zone	Reef slope
Heron Bommie	5	66	Marine Natl Park	Reef slope
Jetty Flat	2	35	Marine Natl Park	Reef flat with micro atolls
Last Resort	2	9	Conservation Park	Sandy reef flat
Libby's Lair	6	49	Conservation Park	Reef slope
Research Zone	1	6	Scientific Zone	Sandy reef flat

2.0 SUMMARY OF FINDINGS

RCA survey teams monitored 11 fringing reef sites around Heron Island over the period of November 1 to 8, 2013. Substrate line transects and invertebrate and impact belt transects were conducted at each site. Fish surveys were completed at each of the snorkel survey sites (3 in total). Underwater cameras were used to document visual evidence of key site features, reef impacts and invertebrates.

- Hard coral cover ranged from 6 to 70 percent across monitoring sites. Total average hard coral cover across all sites was 41.6%, increasing slightly overall from the average 37% recorded in 2012. Four sites had coral cover greater than 50%, four sites had cover between 25-50% and three sites had cover less than 25%.

- Sites had low levels of soft coral (found on 7 sites, averaging 3.5%) and sponge (only found on 4 sites, averaging 2%).

- No lobster or Crown of Thorns starfish were recorded on any transect. One long spined sea urchin was recorded. These results support previous survey findings (only one urchin was found in 2011 at Jetty Flats).

- Indicator sea cucumbers were found in higher abundances on sandy inshore sites (>10 individuals on Cappuccino Express) although some sandy inshore sites showed a decrease in the number of edible sea cumbers (Research zone and Jetty Flat dropped from >10 to 4, and 1 per 400m² respectively).

- Giant clams were found on all sites. Recorded total abundances ranged from 1 to 9 per 400m². The smallest recorded was 6cm in length, at Last Resort.

- Four sites had low levels of macroalgae (5 or less counts per 400m²). All other sites had zero counts of macroalgae.

- Four sites had rubbish recorded. One piece of discarded fishing gear was found just off transect at Coral Gardens. Research associated debris items were found at 4 locations: marking tape, a ruler, a chisel and several star pickets.

- Low levels of coral bleaching occurred on all 11 sites. The highest level of bleaching impacted an estimated 8.8% of the coral populations and an average of 17.5% of each coral colony.

- Coral disease was recorded on 9 of the 11 sites. Of these, four had low levels (6 or less counts), and five had 10 or more recorded incidents. Heron Bommie showed the highest count with 56 per400m².

- *Drupella* sp. (a coral eating snail) was recorded at Harry's Bommie and Canyons only. A total of 3 *Drupella* and 2 *Drupella* Scars were recorded at these sites.

- All 11 sites had hard coral damage, ranging from 2 to 15 incidents per 400m². The highest abundance (15 counts) was found at Libby's Lair.

- Coral scarring from unknown causes was reported on all of the 11 sites, with the highest record of 31 counts per 400m² at Canyons. Twenty-eight counts were recorded at Libby's Lair and 23 counts at Coral Garden (an increase from 17 in 2012).

Table 3. Summary table of RCA monitoring findings for each of the 11 surveys conducted on Heron Island.

	Hard Coral Coverage (%)	Macro Algae	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 Surface (%)	Silt Level
Canyons	70	-	NA	-	9	-	-	3	1	1	31	8	12	2.3	17.3	L
Cappuccino Express	19	5	NA	28	5	-	-	-	-	-	8	2	4	2.8	19.5	L
Coral Cascade	43	-	NA	2	1	-	-	-	-	-	12	3	2	1.0	17.8	L
Coral Garden	69	-	↑	-	2	-	-	-	-	-	23	2	22	0.8	28.8	N
Coral Grotto	29	-	↓	-	4	-	1	-	1	-	4	4	2	4.5	20.3	N
Harry's Bommie	63	-	↑	-	2	-	-	1	1	1	13	5	10	1.0	26.3	N
Heron Bommie	66	5	↑	-	2	-	-	-	-	-	21	6	56	0.5	12.5	N
Jetty's Flat	35	-	↓	1	1	-	-	-	-	-	12	3	6	1.0	16.3	N
Last Resort	9	4	NA	9	5	-	-	-	-	-	2	5	-	8.8	15.5	M
Libby's Lair	49	-	↑	1	2	-	-	-	-	-	28	15	4	2.8	32	L
Research Zone	6	4	↓	4	3	-	-	-	-	-	1	8	-	0.8	6.0	N

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.

3.0 GIS Maps

Maps were created using the Reef Check data for each individual site for each 20 m transect component overlayed with a high spatial resolution pan sharpened WorldView 2 image as a backdrop which was acquired in 2013 over Heron Reef. Maps help to illustrate broad-spatial scale trends in the Reef Check data collected during the 2013 surveys.

Figure 1. Map of Heron Island with Reef Check hard coral cover and population level bleaching data. Each survey site is represented by four circles, each displaying summary data for one of the four 100m^2 areas that makes up a full 400m^2 transect.

All 11 sites showed instances of bleaching, although trend data indicates slightly higher levels of coral bleaching on the northern side of Heron Island, although higher coral cover was found on the southern side of the island. This is consistent with the findings from the 2011 report. Of note, the number of bleached corals was higher at all sites compared with 2011. Last Resort and Coral Grotto both showed 10% of coral colonies bleached in one or more of the 4 transects. Libby's Lair, Canyons and Cappuccino Express all had one transect with 5% coral bleaching.

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 100m^2 areas that makes up a full 400m^2 transect.

All 11 sites showed instances of unknown scars, although Research Zone and Last Resort had low numbers (1 and 2 respectively). Trend data indicates higher levels of coral scars on the southern side of Heron Island, compared with the northern side. The southern side also has higher average coral cover. This is consistent with the findings from the 2011 Heron report.

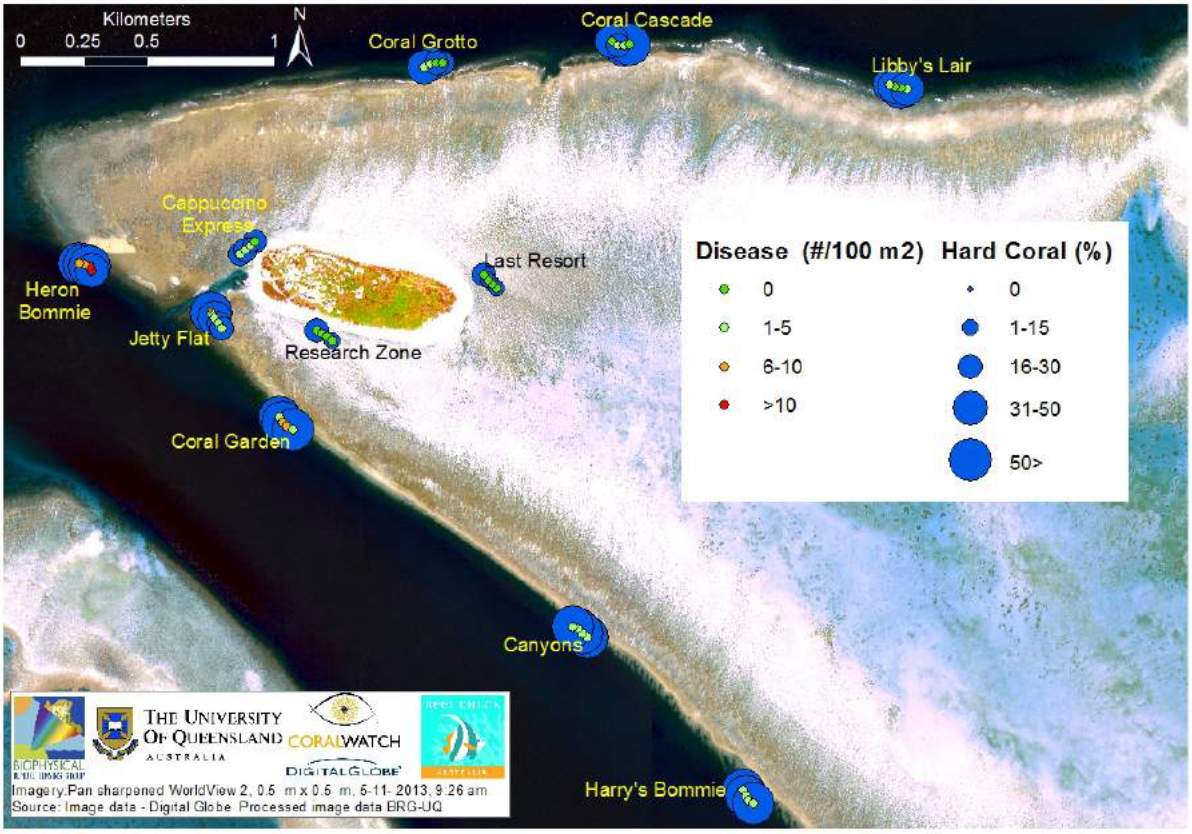

Figure 3. Map of Heron Island with Reef Check hard coral cover and coral disease data. Each survey site is represented by four circles, each displaying summary data for one of the four 100m^2 areas that makes up a full 400m^2 transect.

Nine of the 11 sites had instances of disease. Trend data indicates a higher concentration of coral disease at Heron Bommie (site furthest to the left hand side of map). There are also higher concentrations of coral disease in specific transects at Coral Gardens, Harry's Bommie and Canyons.

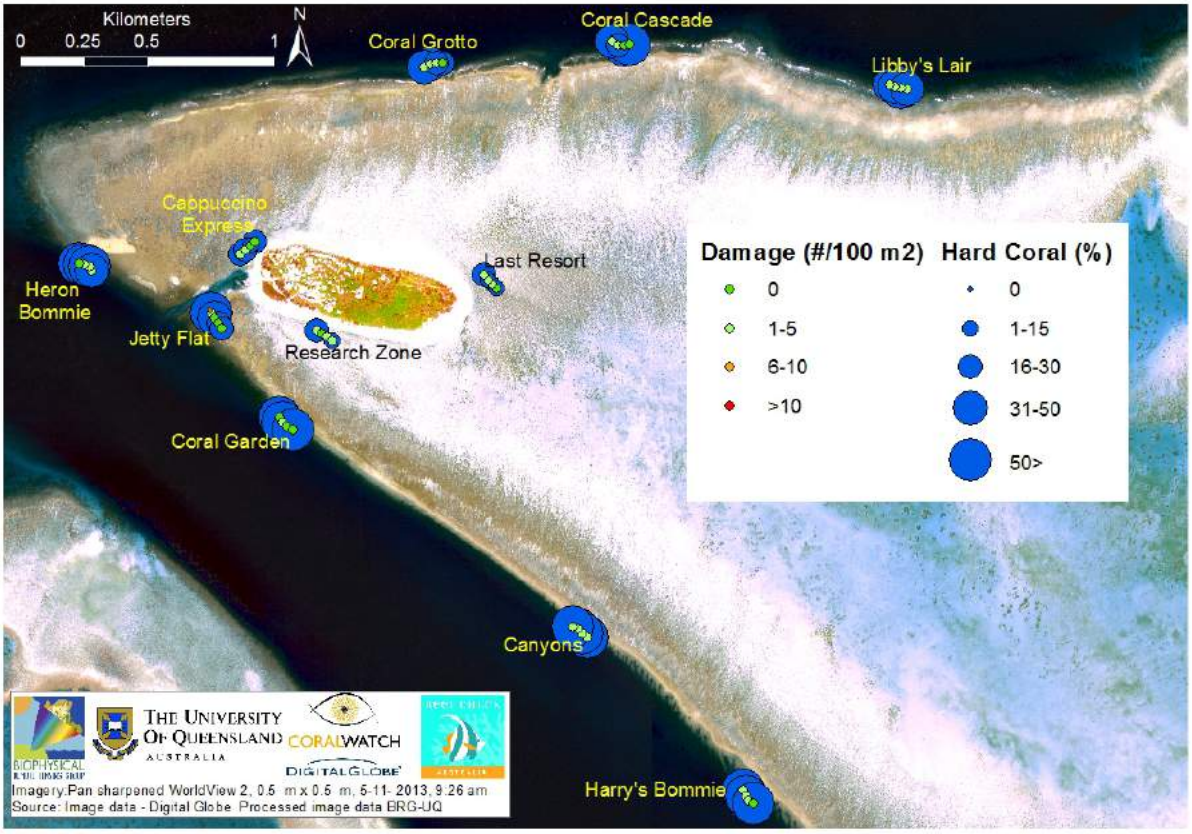

Figure 4. Map of Heron Island with Reef Check hard coral cover and coral damage data. Each survey site is represented by four circles, each displaying summary data for one of the four 100m^2 areas that makes up a full 400m^2 transect.

Trend data indicates a higher concentration of coral damage at Libby's Lair (site in the top right hand side of map). There are also higher concentrations of coral damage in specific transects at Last Resort and Research Zone- both shallow sandy reef flat areas.

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 100m^2 areas that makes up a full 400m^2 transect. Trend data seems to indicate higher concentrations of giant clams around the near shore areas, as well as at Canyons (second from the lower right of map).

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 100m^2 areas that makes up a full 400m^2 transect. Trend data seems to indicate higher concentrations on near shore, sandy reef areas, with particularly high concentrations found at Cappuccino Express.

4.0 SURVEY SITE REPORTS

4.1 Site: Canyons

Canyons is a new survey site for 2013. This site was added to the Reef Check reef health survey list to gain a better spread of the northern reefs. The Canyons site is situated south east of the island and 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 70% of the total substrate cover at the Canyons survey site- the highest hard coral cover recorded of all the surveyed sites at Heron Island. Of this, branching growth forms made up 70% of the overall Hard Coral category. Rock was the next greatest contributor to substrate (20%), consisting of Rock with Coralline algae (11%) and Rock with Turf Algae (9%).

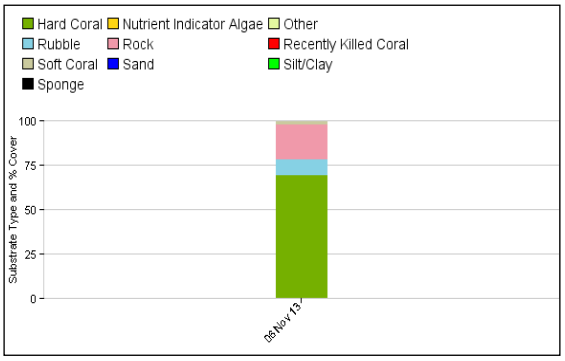

Figure 7. Benthic type and percent cover: Canyons, 2013

Canyons had the highest number of Giant Clams (9) and Drupella snails (3) recorded on transect of any of the Heron Island sites. One anemone and one long spined black urchin were also recorded.

Bleaching affected an average of 2% of the coral population on the transect, with an average of 17% of each coral colony.

Eight incidents of coral damage, 12 incidents of disease, and one Drupella scar were recorded at Canyons. This site also had the highest number of unknown scars recorded with 31 incidents being documented.

A fish survey was not carried out.

Image 2: Canyons Site Photo

Image 3: Hard Coral Bleaching- interesting bleach pattern on this mushroom coral.

Image 4: Coral Damage

4.2 Site: Cappuccino Express

Cappuccino Express is a new site for the 2013 survey season. This site was added to the Reef Check reef health survey list 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 situated on the north western corner of the island and is characterised by small coral atolls and sandy patches.

Hard Coral represented 19% of the total substrate at this site. Over 90% of this was branching growth forms. Rock (including Rock with Turf Algae and Rock with Coralline Algae) made up 46% of the substrate. Sand accounted for 26%. Five counts of macro algae were recorded at this site.

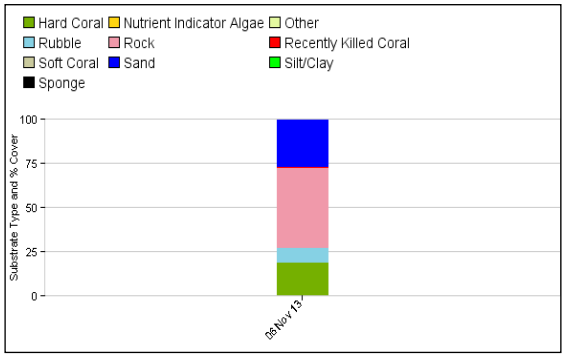

Figure 8. Benthic type and percent cover: Cappuccino Express, 2013

Five giant clams and 28 sea cucumbers (27 of them being *Holothuria edulis*) were recorded on the invertebrate survey. This was the highest abundance of sea cucumbers recorded on a Reef Check survey site on Heron Island this year.

Coral bleaching affected approximately 3% of the coral population, with an average of 19.5% of coral surfaces bleached.

Two counts of coral damage, 4 incidents of disease and 8 unknown scars were recorded at Cappuccino Express.

A fish survey was completed at this site. Five butterfly fish and five snapper were recorded.

Image 5: Cappuccino Express site photo

Image 6: Coral disease at Cappuccino Express

Image 7: Reef Check Australia surveyor on site

4.3 Site: Coral Cascade

Coral Cascade is a new site for 2013. It is situated on the northern wall, to the east of North Bommie (Note: Marker buoys for North Bommie are missing). The survey site is situated on the reef slope at 7m depth. Coral Cascade is a site dived often by tourists and researchers alike. It is situated north east of the island and is characterised by a high abundance of hard coral- hence the name.

Hard coral cover represented 43% of the substrate at this site. This sloping reef site consists of a mixture of hard coral growth forms with foliose (33%) and encrusting (30%) being the highest contributors. Rock (including Rock with Turf Algae and Rock with coralline Algae) made up 39% of the substrate, and rubble accounted for 16%. The 'other' category recorded on this survey consisted primarily of gorgonian soft corals.

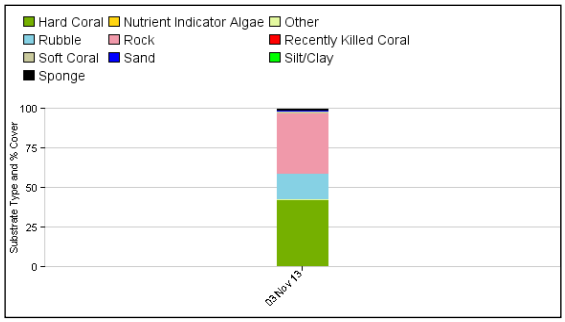

Figure 9. Benthic type and percent cover: Coral Cascade, 2013.

One giant clam and two sea cucumbers (*Sitchopus chloronotus*) were recorded on the invertebrate survey.

Bleaching was recorded on 1% of the coral population, with an average 18% of each affected coral surface bleached. Other reef impacts recorded at this site include 3 counts of coral damage, 2 incidents of disease, 12 unknown scars, and 4 counts of trash (research related debris).

One white tip reef shark, a turtle, and an octopus were observed at this site.

A fish survey was not carried out in 2013.

Image 8: Coral Cascade site photo.

Image 9: Turtle at Coral Cascade

Image 10: Octopus at Coral Cascade

4.4 Site: Coral Gardens

Coral Gardens is located on the southern side of Heron Island. It is characterised by high hard coral cover; particularly branching 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 69% of the benthos at this site and was made up almost exclusively of branching coral growth forms (90%). The Rock category accounted for 22%. The 2013 survey shows a higher abundance of recently killed coral (0 counts in 2011, and 5 counts (3% of substrate) in 2013). No macro algae were recorded at this site in 2013 compared to 6 counts of macro algae in 2011.

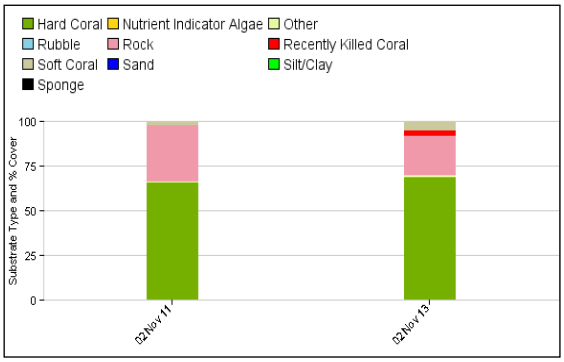

Figure 10. Benthic type and percent cover: Coral Gardens, 2013.

The only invertebrates recorded on the transect were two giant clams.

Coral Gardens had the greatest mean colony bleaching of all the survey sites at Heron Island (29%). This is greater than the 20% recorded in 2012. However, less than 1% of the entire coral population was bleached, which is among the lowest recorded population bleaching for the island in 2013.

Reef Impacts recorded at Coral Gardens included 2 incidences of trash, 2 incidences of coral damage, 22 incidents of disease and 23 unknown scars.

A fish survey was not conducted in 2013.

Image 11: Site photo from Coral Gardens

Image 12: Coral disease on branching hard coral

Image 13. Surveyors on Coral Gardens

4.5 Site: 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. The 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 29% of substrate at consisting primarily of encrusting (64%) and branching growth forms (26%). Compared to the 2011 survey, there was less rubble (25% in 2011 and 11% in 2013), but more rock (30% in 2011 and 56% in 2013).

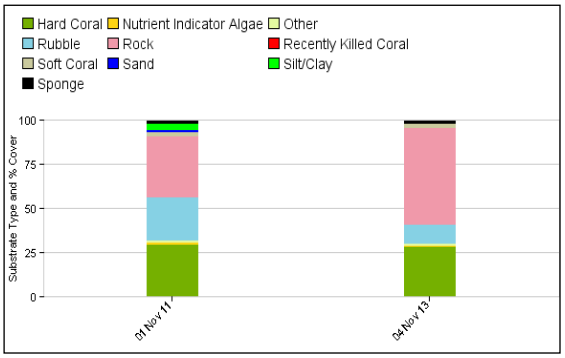

Figure 11: Benthic type and percent cover: Coral Grotto, 2013.

The 'Other' substrate category (1%) was recorded as ascidians and gorgonians.

One anemone, 4 giant clams and 1 trochus were recorded during the invertebrate survey.

Coral bleaching was estimated to affect 4.5% of the total coral population, an increase from 1.5% in 2011. Coral bleaching at this site impacted approximately 20% of each colony surface. Additional impacts recorded include 4 unknown coral scars, 4 coral damage, and 2 incidents of disease.

A fish survey was not conducted in 2013.

Image 14: Site Photo from Coral Grotto

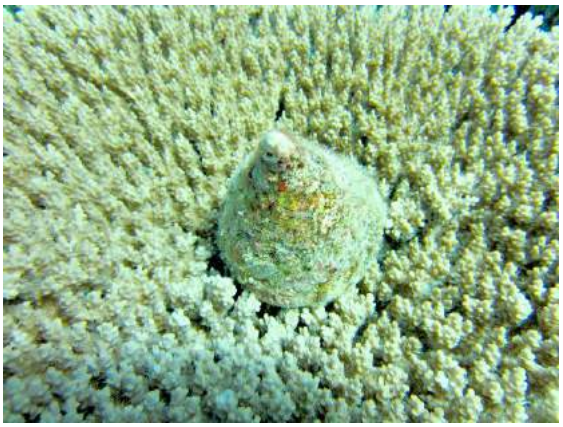

Image 15: One Trochus was found on transect

Image 16: A member of the 'Other' category

4.6 Site: Harry's Bommie

Harry's Bommie is located on the southern side of Heron Island, on the south east 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 63% of the benthos. Of this, 77% was branching growth forms, and 15% was foliose. Bare Rock made up 29% of the total substrate, and rubble accounted for 4%. No sand was recorded on the 2013 survey (6% recorded in 2011).

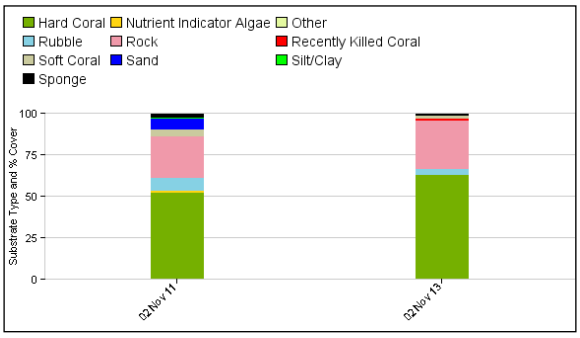

Figure 12. Benthic type and percent cover: Harry's Bommie, 2013.

Two giant clams, 1 anemone, and 1 Drupella snail were recorded during the invertebrate survey.

Coral bleaching was estimated to affect only 1% of the total coral population, although this 1% had an average of 26% surface bleaching. Five incidents of coral damage, 10 incidents of disease, 1 Drupella scar, and 13 unknown scars were recorded. One piece of fishing line was found on the survey.

A fish survey was not conducted in 2013.

Image 17: Site photo of Harrys Bommie

Image 18: Soft coral at Harrys Bommie

Image 19: Anemone with fish at Harrys Bommie

4.7 Site: 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, and is situated at a depth of 6m, on the reef slope.

Hard coral cover represented 66% of the substrate at Heron Bommie in 2013. Of this, 70% consisted of branching growth forms, and 12% foliose. The abundance of bleached hard coral on the transect increased to 9% (0% in 2011). Five counts of macro algae were recorded, an increase from zero in 2011.

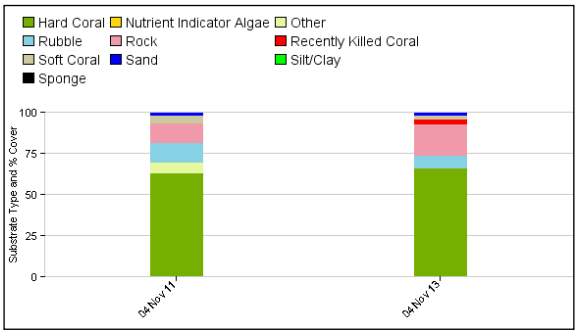

Figure 13. Benthic type and percent cover: Heron Bommie, 2013

Two giant clams were recorded at this site. No other indicator invertebrates were recorded.

This site had the greatest number of disease incidents (56) of the 2013 Reef Check Australia Heron Island sites surveyed. Additional impacts recorded include 6 incidents of coral damage and 21 unknown scars. An average of 12.5% bleaching per coral surface was seen with only 0.5% of the population being bleached overall.

A fish survey was not conducted in 2013.

Image 20: Heron Bommie site photo

Image 21: Coral disease

Image 22: A nudibranch found along the transect

4.8 Site: 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 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 35% of the benthos, an increase from that recorded 2011 (29%). Of that, 94% consisted of branching growth forms. Rock attributed 58% to the substrate in 2013 (81% Rock with Turf Algae and 19% Rock with Coralline Algae) and Sand accounted for just 2%- less than previous years.

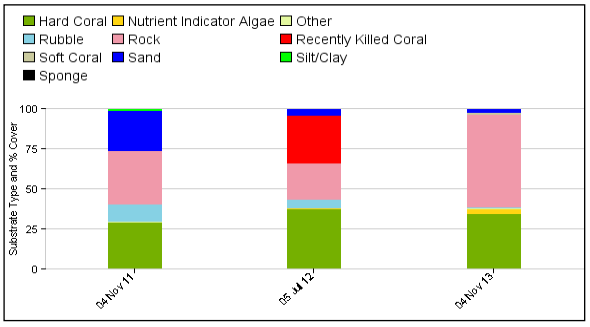

Figure 14. Benthic type and percent cover: Jetty Flat, 2013

One giant clam and 1 sea cucumber were recorded on the invertebrate survey. Two hawksbill turtles were also seen at this site.

Reef impacts recorded during the 2013 survey at Jetty Flat included 3 counts of coral damage, 12 counts of unknown scars and 6 counts of coral disease. An average of 16% bleaching per coral surface was recorded with only 1% of the population being bleached overall.

A fish survey was completed at this site. Fourteen butterflyfish and 2 parrotfish were recorded.

Image 23: Jetty Flat site photo.

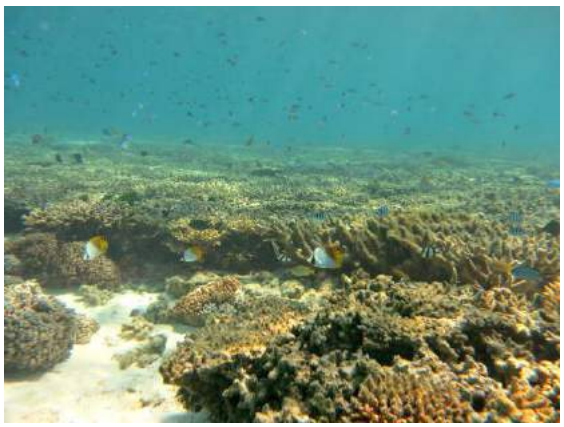

Image 24: Jetty Flat site photo with fish

Image 25: Coral Damage

4.9 Site: Last Resort

Last Resort is a new site for the 2013 Heron Island survey season. This site 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 near shore reef sites. This reef area is situated off the islands easternmost tip, and is accessible on snorkel and is frequented by tourists as it is a popular spot for shark and ray sightings.

Nine percent of the benthos recorded at Last Resort was hard coral. Almost 50% of the substrate was sand and 38% was Nutrient Indicator Algae (*Hydroclatharus sp*). Of the hard coral at this site, 85% consisted of branching growth forms. The encrusting and the general Hard Coral category were the only additional growth forms recorded. Last Resort had the highest silt loading recorded during the 2013 Heron Island surveys.

Four counts of macroalgae were recorded.

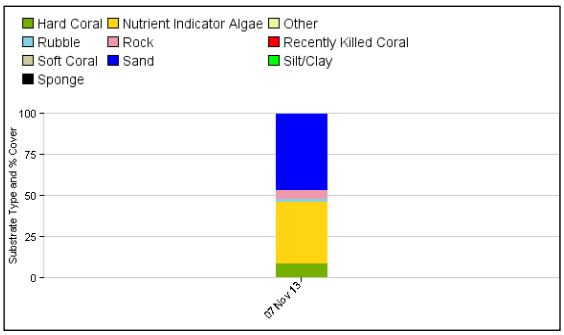

Figure 15. Benthic type and percent cover: Last Resort, 2013

Five giant clams and 9 sea cucumbers (eight *Stichopus chloronotus*) were recorded on the invertebrate survey.

Coral bleaching affected almost 9% of the coral population at Last Resort- the highest recorded during the 2013 surveys. Of these corals, an average of 15.5% of each coral surface was bleached.

Five incidents of coral damage and 2 unknown scars were recorded.

A fish survey was completed and 3 butterfly fish were recorded on the survey.

Image 26: Last Resort site photo

Image 27: A non-target sea cucumber and a prickly greenfish *(stichopus chloronatus)*

Image 28: Coral at Last Resort

4.10 Site: 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. It is situated at a depth of 6m.

Hard coral accounted for 49% of the benthos at Libby's Lair, an increase from 33% in 2011. Rock (encompassing both Rock with Turf Algae and Rock with Coralline Algae) made up 27% of the substrate. Rubble accounted for 10%. 2011 data shows a majority of encrusting growth forms (55%), although 2013 records show a mixture of plate (27%), encrusting (30%), and branching growth forms (24%) accounting for the hard coral substrate. Libby's Lair had the highest abundance of both Soft Coral (9%) and Sponge (3%) of any of the Heron Island sites for the 2013 survey season.

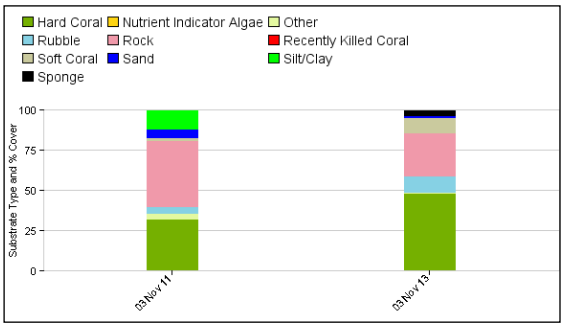

Figure 11. Substrate type and percent cover at Figure 16: Benthic Analysis of Libby's Lair 2013.

One giant clam and 1 sea cucumber were the only indicator invertebrates recorded at this site.

Coral bleaching affected an average 3% of the coral population; however the surface of each affected coral averaged 32%, the highest surface bleaching recorded of all the Heron Island sites for 2013. Additional impacts recorded included 6 incidents of coral damage and 17 unknown scars.

A fish survey was not conducted.

Image 29: Libby's Lair site photo.

Image 30: Sponge on hard coral

Image 31. Hard Coral bleaching

4.11 Site: 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 (73%), with hard coral contributing just 6% of the substrate, the lowest hard coral cover of any of the Reef Check sites at Heron Island. There were four counts of macroalgae at this site.

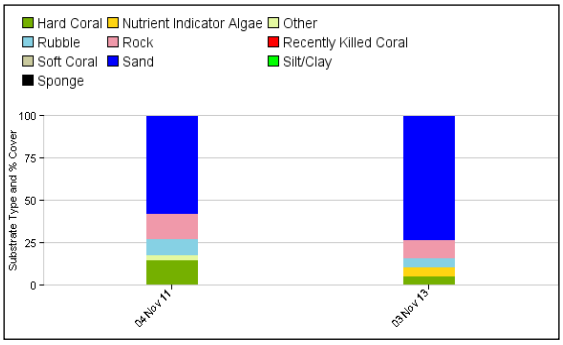

Figure 17. Benthic type and percent cover: Research Zone 2013.

Three giant clams and 4 sea cucumbers were recorded on the invertebrate survey.

Coral bleaching affected less than 1% of the coral population, and an average of 6% of the coral surfaces of these affected corals. Eight incidents of coral damage, one unknown scar, and two counts of trash were also recorded on the transect.

A fish survey was completed at this site. Two butterflyfish, 5 parrotfish, and 4 snapper and one emperor were recorded.

One wobbegong and one cow tail ray were also recorded during the survey.

Image 32: Giant clam

Image 33: Anemone

Image 34: Site photo at Research Zone

5.0 FURTHER INFORMATION

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

6.0 ACKNOWLEDGEMENTS

Reef Check Australia would like to thank all of the people and organisations that made the Heron Island surveys possible. Without the assistance of each and every one of you, this project would not have been possible. Thankyou.

The 2013 Heron Island Research team (left to right): Megan Saunders, Javier Leon, Eva Kovacs, Josh Passenger, Stuart Phinn, Andy Findlay, Jodi Salmond and Chris Roelfsema,

7.0 APPENDIX

2011 GIS MAPS

Reef Check data was used to create summary spatial data layers for high resolution imagery of Heron Island. These maps help to illustrate broad-scale trends in the data collected during the 2011 surveys.

Figure 18. Map of Heron Island with Reef Check hard coral cover and population level bleaching data from 2011. 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. Trend data seems to indicate slightly higher levels of coral bleaching on the northern side of Heron Island, despite sites with higher coral cover on the southern side.

Figure 19. Map of Heron Island with Reef Check hard coral cover and unknown scar data from 2011. 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. Trend data seems to indicate slightly higher levels of coral scars on the southern side of Heron Island, compared with the northern side. The southern side also has higher average coral cover.

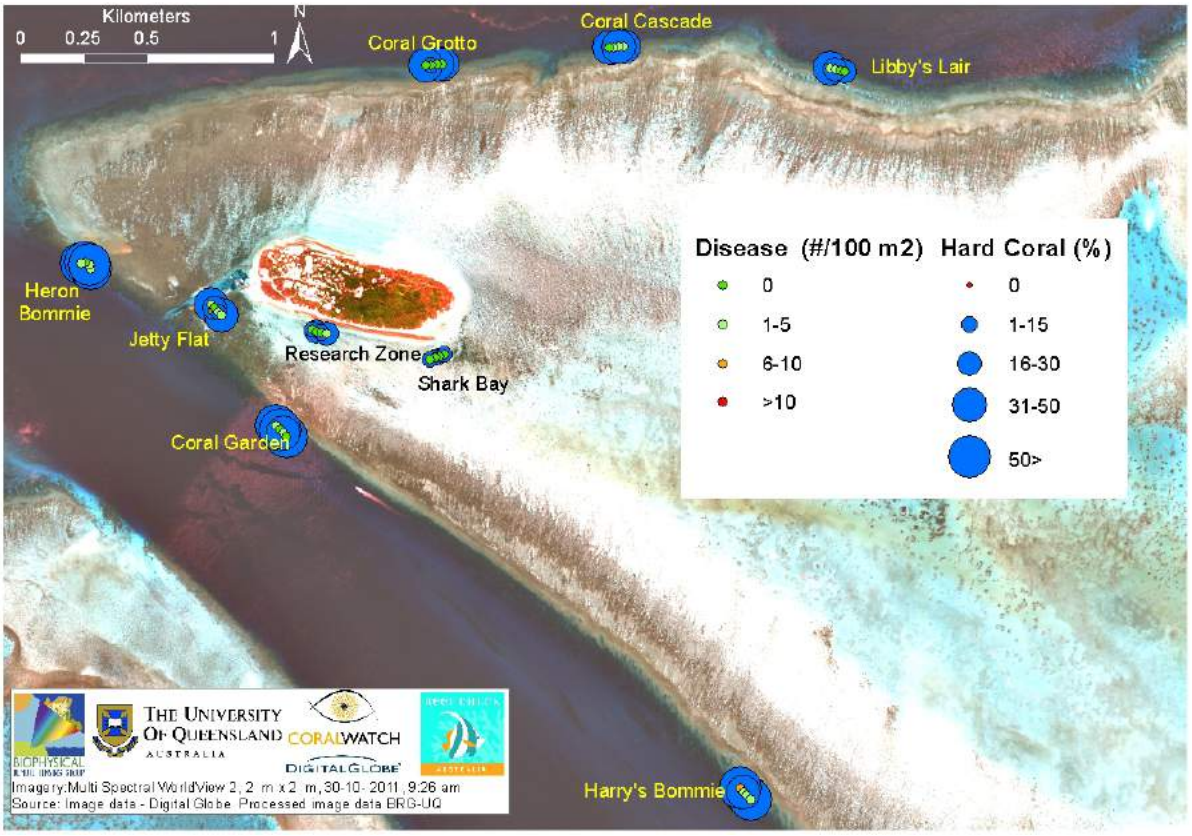

Figure 20. Map of Heron Island with Reef Check hard coral cover and coral disease data from 2011. Each survey site is represented by four circles, each displaying summary data for one of the four 100m2 areas that makes up a full 400m2 transect. Trend data seems to indicate higher concentration of coral disease at Harry's Bommie (lower right hand side of map). There are also some higher concentrations of coral disease in specific transects at Heron Bommie and Libby's Lair.

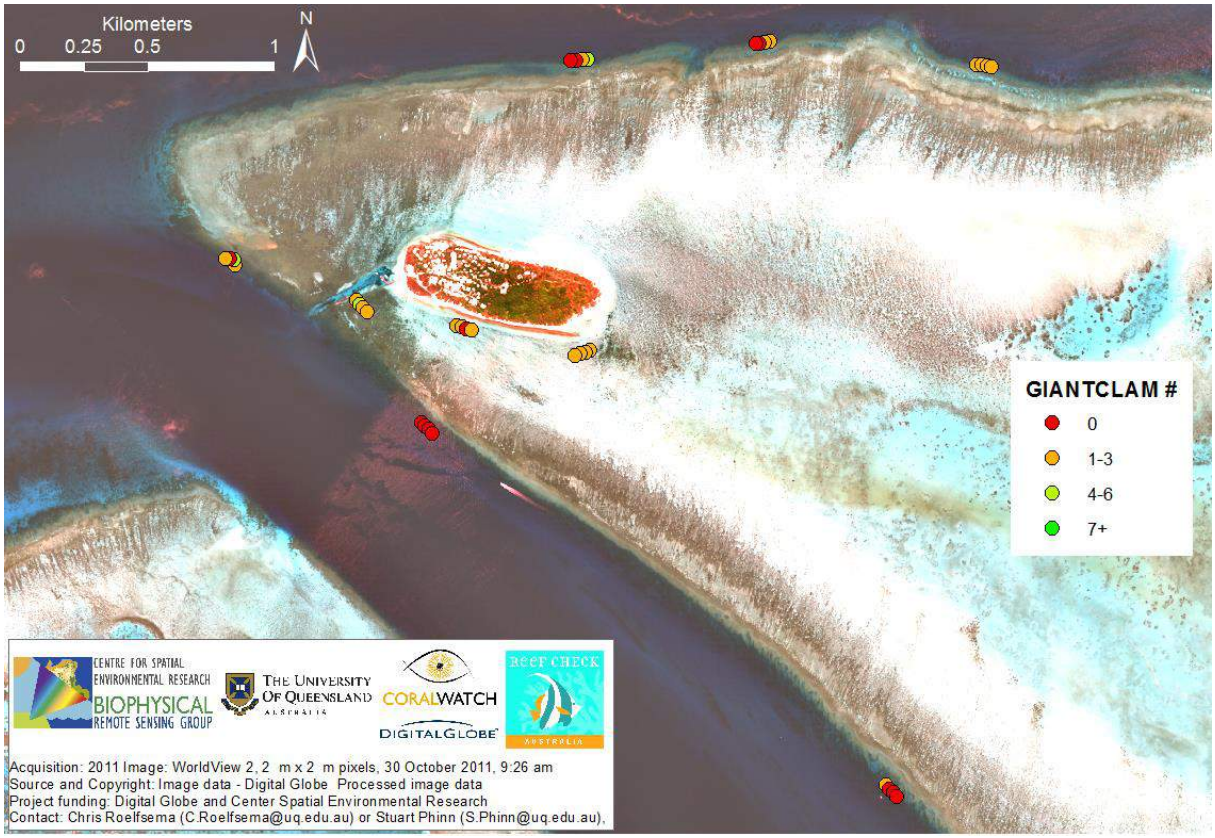

Figure 21. Map of Heron Island with Reef Check hard Giant Clam numbers from 2011. Each survey site is represented by four circles, each displaying summary data for one of the four 100m2 areas that makes up a full 400m2 transect. Trend data seems to indicate higher concentrations of giant clams around the nearshore areas, as well as at Harry's Bommie (lower right hand side of map).

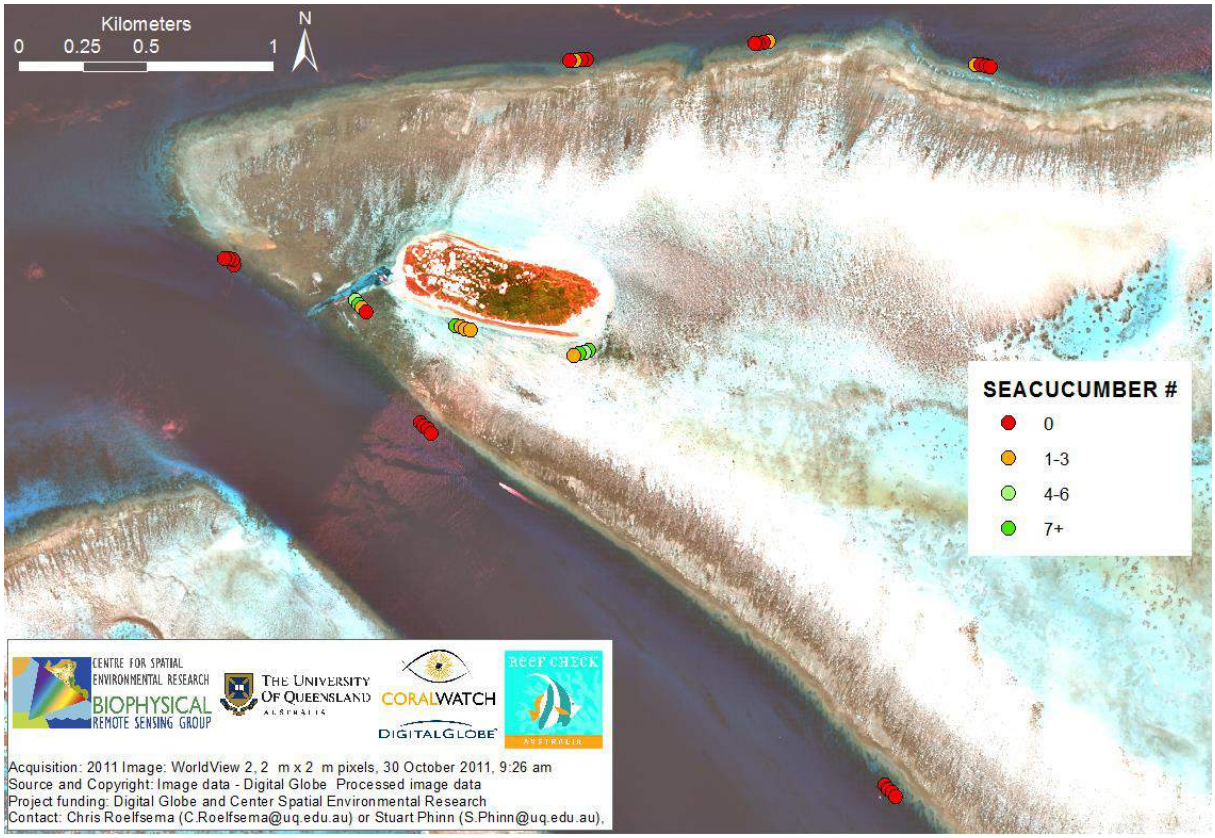

Figure 22. Map of Heron Island with Reef Check hard sea cucumbers numbers from 2011. Each survey site is represented by four circles, each displaying summary data for one of the four 100m2 areas that makes up a full 400m2 transect. Trend data seems to indicate higher concentrations on nearshore, sandy reef areas.