Reef Check Australia

Heron Island Reef Health Report 2022

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Heron Island Reef Health Report 2022

A huge thank you and congratulations to the 2022 Heron Reef Research Teams:
Chris Roelfsema, Diana Kleine, Josh Passenger, Jodi Salmond, Jenni Calcraft, Aimee Brown, Susy James and Julie Schubert

Front cover Image:
Geonadir; A shallow Great Barrier Reef reef captured by drone.

Above images; Picture 1 from Chris Roelfsema; the UQ Remote sensing team with Reef Check Australia participants. Picture 2; The Reef Check Australia team.

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The University of Queensland's Remote Sensing Research Centre, Heron Island Research Station and Heron Island Resort.

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1.0 PROJECT INTRODUCTION

Around the world, reefs are under pressure from pollution, development, climate change and heavy human use of ocean environments. This past year has seen an increase in the frequency and intensity of heavy rainfall, increased winds and the after affects that come from them, including floods, pollution, increased sedimentation and nutrients, all leading to changes in coral community assemblages. Climate change continues to be the greatest threat to the future of coral reefs around the world; however we continue to do what we can to inspire, educate and engage those around us to make the best possible choices for the health of our oceans, and the future of our planet.

Reef Check Australia (RCA) established monitoring sites on Heron Island in 2011, when RCA was invited to collaborate by the University of Queensland's Remote Sensing Research Centre (RSRC). The RSRC team has been cataloging the benthic composition of Heron Reef annually since 2001 via geo-referenced photo transects (Roelfsema et al 2010, Roelfsema et al 2021). This and other field data, in combination with satellite imagery, is used to create and validate benthic habitat maps (Roelfsema et al 2018). RCA survey data augments this substantial spatial dataset by offering further information on impact severity and abundance of key organisms, as well as allowing field-based comparisons of benthic composition.

In 2022 Reef Check Australia's survey teams monitored all 17 sites (ten reef slope sites and seven reef flat sites) around Heron Reef. Substrate line transects, in addition to invertebrate and impact belt transects, were conducted at each site. Fish surveys were completed at all sites. Underwater cameras were used to document visual evidence of key site features, reef impacts and invertebrates. Summary findings for the 17 surveys conducted around Heron Island are presented in this report.

This project demonstrates the value of collaborative citizen-science initiatives as a powerful tool to contribute useful information for science, management and education initiatives. It is intended to continue the long-term monitoring program at Heron Island. This will provide important information in regard to the Health Status of the reef for Marine Park Managers, Island managers, researchers and resource users (including staff and guests), and the broader community.

2.0 SUMMARY OF FINDINGS

2.1 Key findings from the 2022 surveys:

- Total average hard coral cover across all sites was 41%; this is consistent with previous years but slightly lower than 2021 (43%). Hard coral cover ranged from 1.25% (at Stevo's Carbonara) to 74% at Gorgonian Hole and Harry's Bommie. Nine sites had coral cover greater than 50%, one site had between 25-50% cover and seven sites had less than 25% coral cover.
- Soft coral cover remained low (present at ten of 17 sites, ranging from 1% at Harry's Bommie, Jetty Flat and White Wedding to 4% at Halfway and Libby's Lair). However large patches of soft coral were observed at Jetty Flat off-transect.
- Only one Crown of Thorns starfish was observed over the 17 sites (Heron Bommie).
- Indicator sea cucumbers were recorded in higher abundances on sandy inshore reef flat sites. Six snorkel sites had sea cucumbers, whilst only two of the dive sites had sea cucumbers present. The highest abundance (34) was recorded at Shark Bay.
- Giant clams were recorded at 13 of the 17 sites. White Wedding and Heron Bommie again had the highest abundance with 17 and 10 counts recorded respectively per 400m².
- Coral scarring from unknown causes was reported at eight of the reef crest sites and three of the reef flat sites with the highest record of 27 counts per 400m² at Coral Gardens. An average of 13.8 counts per 400m² were recorded for all sites where scarring was present, a slight increase from 2021.
- Recorded debris was limited to abandoned researcher debris, with no general rubbish observed.
- Hard coral damage was recorded at all sites except Stevo's Carbonara, ranging from one count to 15 counts (Coral Grotto).
- Coral bleaching was recorded on 11 sites, but in relatively low levels. The highest population bleaching was recorded at Heron Bommie (1.5% of the population; 20.75% of each colony on average). Canyons had the highest individual colony bleaching average (21.75%) with population bleaching levels of just 1%. Total average coral population bleaching across all sites was 0.61%, a decrease on previous records.
- Coral disease was recorded at 11 of the 17 sites, an increase from 2021. Of these, Gorgonian Hole had the highest count of disease, with 10 incidents recorded per 400m². Remaining values ranged from one to nine counts.
- Refer to Appendix A for comparative graphical representation of 2022 results for all survey locations.

3.0 INTRODUCTION

3.1 Reef Check Australia Overview

Trained Reef Check Australia (RCA) volunteers have been monitoring reef health around Australia since 2001. Annual surveys provide long-term data sets that can be used for local and regional reef management that can be compared to Reef Check data around the world. This temporal 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. It also provides 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.

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 (Hill and Wilkinson, 2004). 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 80 m, divided into four 20 m sections, each separated by 5 m (Figure 1a). This design allows for data comparisons within sites using the four 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. A survey diver records the substrate type (Table 1) that is directly below the tape measure every 50 cm along each of the four 20 m sections interval (Figure 1b).

Invertebrate and impact surveys are conducted along the same transect line using a 5 m wide belt transect methodology. Divers search for indicator invertebrates and reef impacts on each 20 m replicate for 7 - 10 minutes using a u-shaped search pattern (Figure 1a). The 14 invertebrate indicators have been selected based on their economic and/or ecological importance. Reef health indicators include ten reef impacts, focusing on issues that may be addressed through management strategies. Similarly, fish surveys are conducted along a 5 m tunnel (Figure 1c).

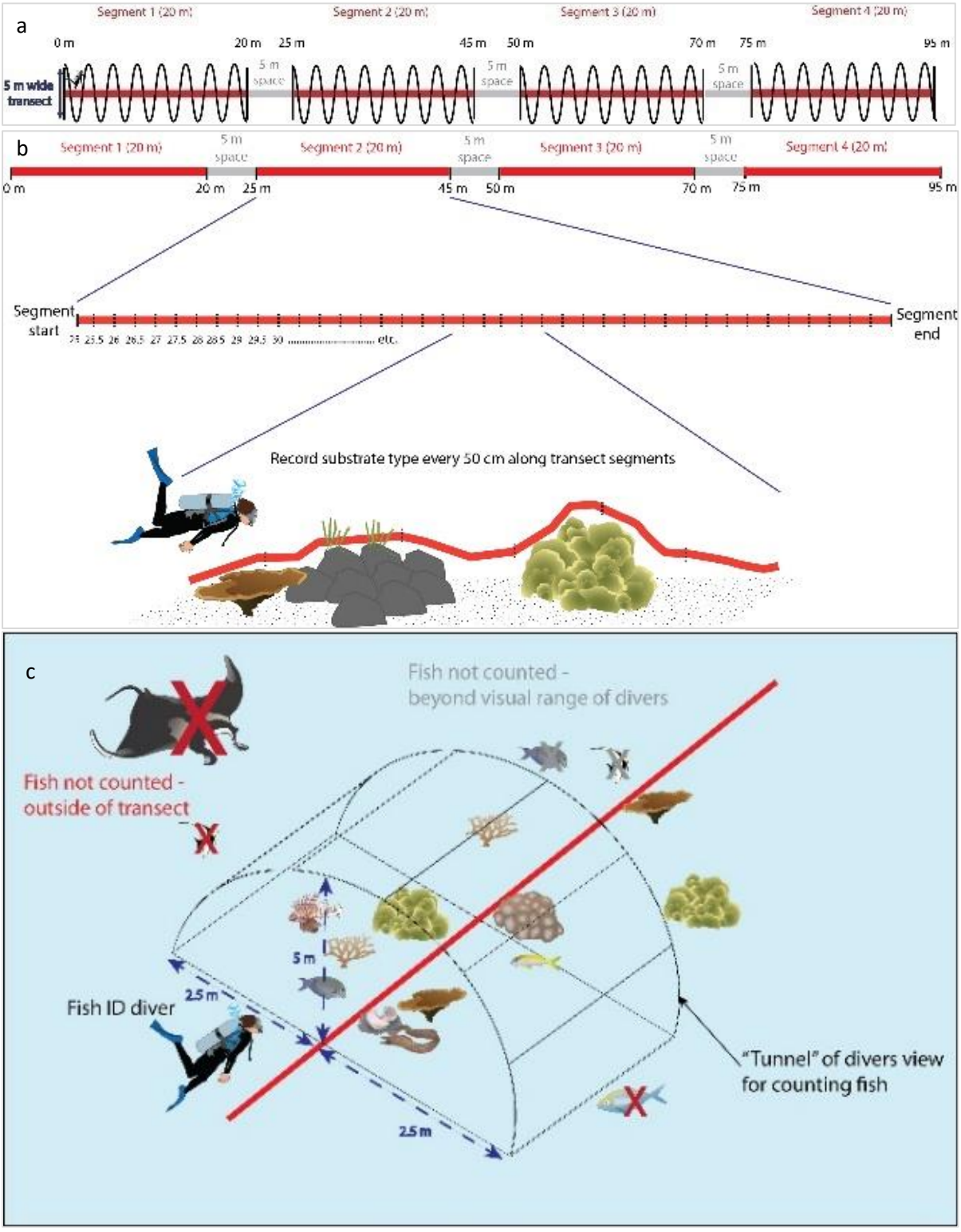

Figure 1: Reef Check survey methodology based on Hill and Wilkinson, 2004 showing (a) line intercept and belt survey transect layout consisting of 4 x 20 m replicates, (b) line intercept substrate survey protocol showing data collection points at 50 cm intervals, and (c) diagram of the belt transect tunnel for fish surveys (Image by Roelfsema et al, 2014).

Table 1. Codes for 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
	HCB: Bleached Hard Coral
Soft Coral	SCL: Leathery Soft Coral
	SCZ: Zooanthids
	SC: Other Soft Coral (ornate)
	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

There are a total of 17 sites at Heron Reef monitored by Reef Check Australia which were established to allow for a detailed representation of Heron Island reef habitats and were selected to represent diverse management and use areas - six sites are located in protected Green zones, six are located in general use areas, and five are located in a scientific research zone (allows extraction for experimental and educational purposes). During the 2022 RCA surveys, all 17 sites were revisited.

Reef Check transects are co-located with UQ Remote Sensing Research Centre survey sites. At these survey sites, geo-referenced benthic photo transects (Roelfsema et al 2021) 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).

Additionally, CoralWatch Coral Health Chart surveys were collected at survey sites to specifically assess coral colour as an indicator of coral stress (Siebeck et al 2006).

3.3 Heron Island: Location and Demographics

Heron Island (0.62 km^2) is a coral cay located on the southern section of the Great Barrier Reef, approximately 80 km off the coast of Gladstone, Queensland with a 27 km^2 platform reef. The surrounding waters are divided into one of three management designations, including Marine National Park (Green Zone), Conservation Park or Scientific Research zones (Figure 2).

Heron Island hosts 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. The HIRS is a heavily utilised research station with visiting universities, schools, and researchers from Australia and the world, accommodating up to 150 people.

The fringing reefs are well-utilised for snorkel and dive tourism as well as reef research. However, these activities may be having some unintended impacts. Factors such as extensive development in the nearby Gladstone region, and like other coral reefs, global climate change, also pose threats to this marine ecosystem. Thus, routine monitoring of this reef is essential. The 17 RCA survey sites are shown in Figure 2 and a summary of site demographics is represented in Table 2.

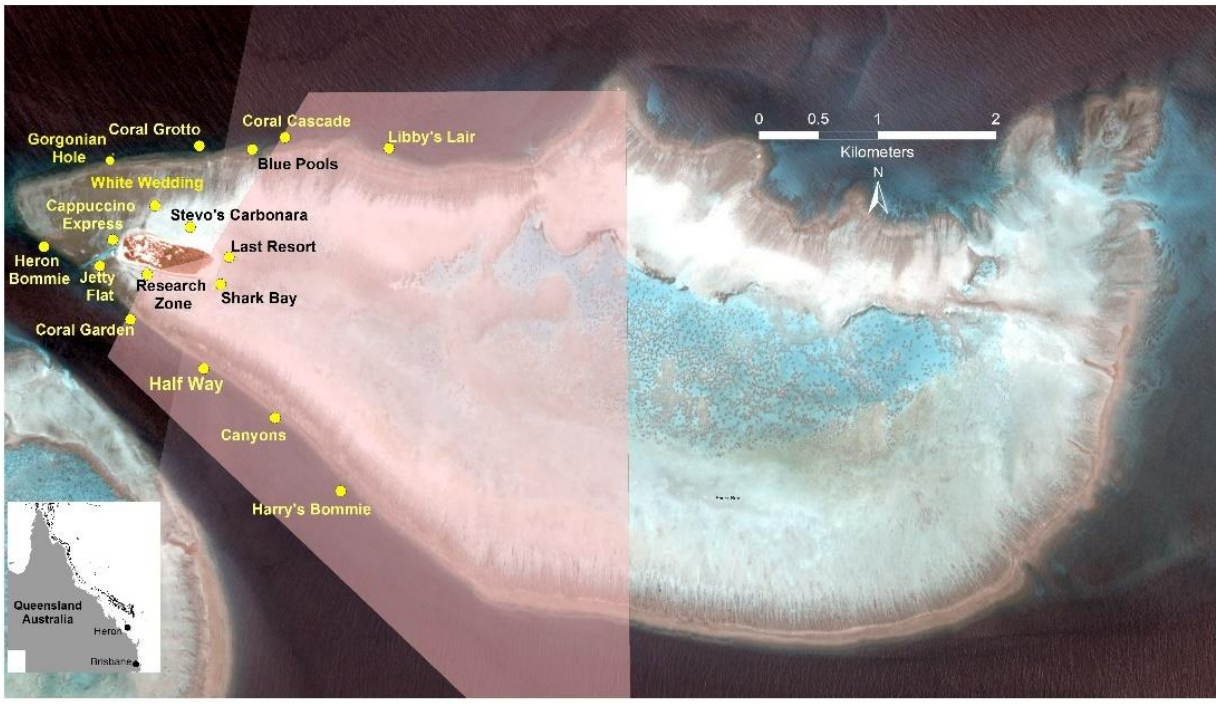

Figure 2. RCA field sites and the conservation zone overlaid on the Planet Dove image acquired on 9 November 2018 over Heron Reef, Southern Great Barrier Reef, Australia (Image source: Planet Ltd).

Table 2. RCA Heron Island monitoring locations, with depth, hard coral cover for the current survey year, designation of site (Marine National Park, Conservation Park, or Scientific Zone), habitat type and survey years.

Site	Depth (m)	HC %	Site Designation	Habitat Type	Year Surveyed											
					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Blue Pools	5	79	Conservation Park	Reef Slope												
Canyons	5	76	Scientific Zone	Reef Slope												
Cappuccino Express	2	18	Marine National Park	Sandy reef flat with micro atolls												
Coral Cascade	6	60	Conservation Park	Reef Slope												
Coral Gardens	5	70	Marine National Park	Reef Slope												
Coral Grotto	6	61	Conservation Park	Reef Slope												
Gorgonian Hole	6	69	Conservation Park	Reef Slope												
Halfway	6	26	Scientific Zone	Reef Slope												
Harry's Bommie	9	65	Scientific Zone	Reef Slope												
Heron Bommie	5	61	Marine National Park	Reef Slope												
Jetty Flat	2	31	Marine National Park	Reef flat with micro atolls												
Last Resort	2	3	Conservation Park	Sandy reef flat												
Libby's Lair	6	72	Conservation Park	Reef Slope												
Research Zone	1	9	Scientific Zone	Sandy Reef Flat												
Shark Bay	2	11	Scientific Zone	Sandy reef flat												
Stevo's Carbonara	2	0	Marine National Park	Sandy reef flat with micro atolls												
White Wedding	1	7	Marine National Park	Sandy reef flat												

4.0 SUMMARY 2022 SURVEY REPORT

A summary of the findings for the 2022 RCA monitoring is shown in Table 3. 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 percentage, average coral bleaching percentage for colony surface), and silt levels (N=none, L=low, M=medium, H=high). Categories are listed as abundance counts unless otherwise specified. The information represents data collected over a standard survey as described in section 3.2.

Table 3: Summarised RCA findings for Heron Reef survey sites in 2022.

Site	Substrate		Invertebrates								Impacts								
	Hard Coral Coverage (%)	Macro Algae (#)	Edible Sea Cucumbers (#)	Giant Clam (#)	Triton (#)	Trochus (#)	Drupella Snail (#)	Anemone (#)	Lobster (#)	Crown of Thorns Starfish (#)	Drupella Scar (#)	Unknown Scar (#)	COTS Scar (#)	Coral Damage (#)	Coral Disease (#)	Coral Bleaching Population (%)	Coral Bleaching Colony (%)	Marine debris (#)	Silt Level*
Blue Pools	70.63	0	10	7	0	2	0	0	0	0	0	6	0	10	3	0	0	0	N
Canyons	71.88	0	0	0	0	0	0	0	0	0	0	18	0	4	4	1	21.75	3	N
Cappuccino Express	15.63	0	28	4	0	0	0	0	0	0	0	5	0	3	0	0	0	0	N
Coral Cascade	55.63	0	0	2	0	0	0	1	0	0	0	0	0	8	1	0.75	10.75	0	N
Coral Gardens	61.88	0	0	0	0	2	0	0	1	0	0	27	0	6	5	1	14.5	3	N
Coral Grotto	66.88	0	1	3	0	0	0	0	0	0	0	10	0	15	4	0.25	12.5	0	N
Gorgonian Hole	74.38	0	0	0	0	0	0	1	0	0	0	22	0	13	10	0.25	12.5	0	N
Halfway	24.38	0	0	5	0	2	0	0	0	0	0	14	0	1	9	0.25	22.5	0	N
Harry's Bommie	74.38	0	0	3	0	0	0	0	0	0	0	10	0	2	4	0.25	0.25	0	N
Heron Bommie	55	0	0	10	0	0	3	0	0	1	1	0	1	5	9	1.5	20.75	0	N
Jetty Flat	28.75	0	0	8	0	0	1	0	0	0	0	26	0	12	3	0.5	12.5	0	N
Last Resort	3.75	4	23	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	L
Libby's Lair	69.38	0	0	0	0	0	0	0	0	0	0	8	0	8	3	0	0	0	N
Research Zone	10.63	6	6	6	0	0	0	0	0	0	0	6	0	2	0	0.75	4.25	0	L
Shark Bay	11.25	8	34	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	N
Stevo's Carbonara	1.25	1	2	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	L
White Wedding	7.5	8	10	17	0	0	0	0	0	0	0	0	0	1	0	0.25	12.75	0	L

* N=none, L=low, M=medium, H=high

To illustrate broad-spatial scale trends in the RCA data collected during the 2022 surveys, the data from each individual site was overlaid on ESRI image sourced through QGIS. Firstly, the percentage of hard coral coverage and bleaching incidence are depicted in Figure 3.

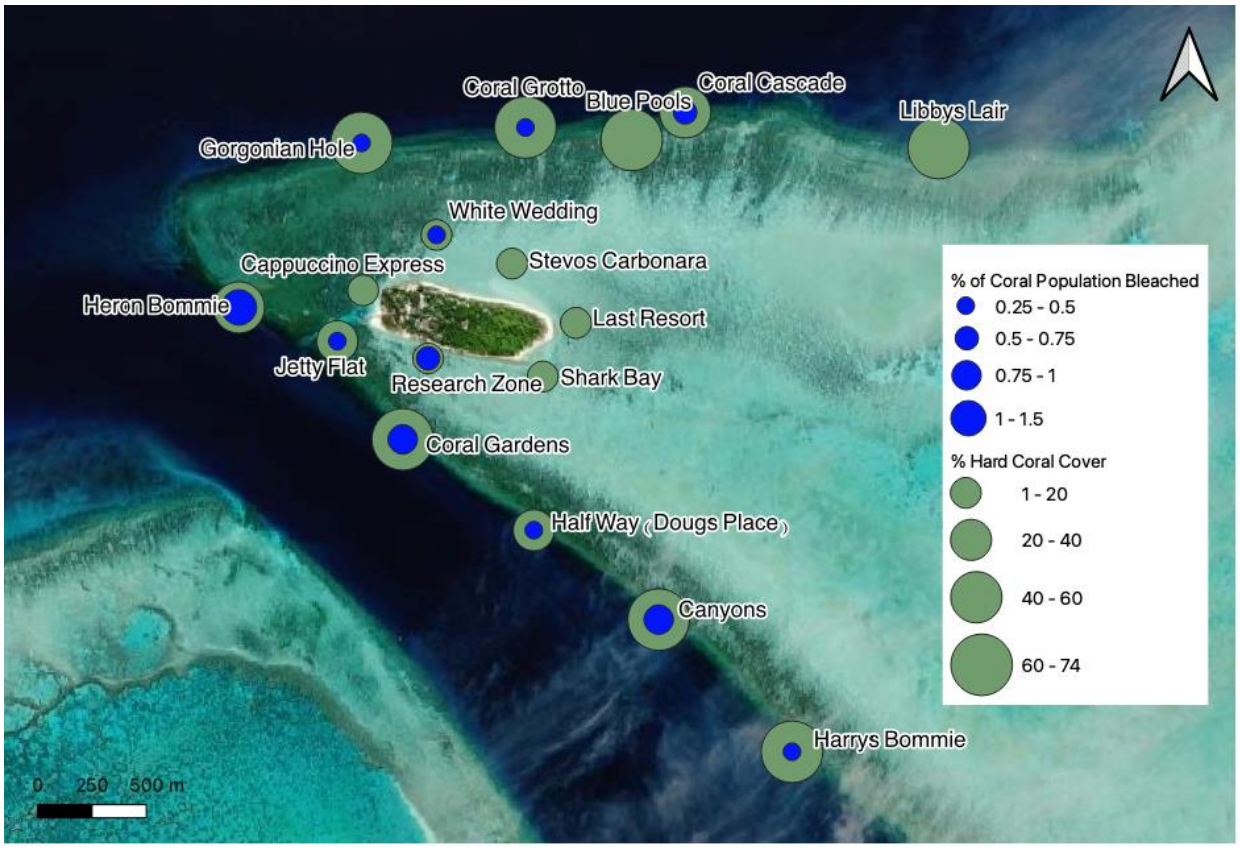

Figure 3. RCA hard coral cover and population level bleaching data for the 2022 surveys. Map created using QGIS software with an Esri basemap image acquired 13 December 2022.

For 2022, bleaching was recorded on 11 of the 17 sites. Coral population bleaching was low with the highest recorded at Heron Bommie (1.5%). The highest colony percentage bleached was 21.75% at Canyons, followed by Heron Bommie at 20.75%.

Figure 4 shows the hard-coral data compared to the incidence of scars.

Figure 4. RCA hard coral cover and scar data for the 2022 surveys. Map created using QGIS software with an Esri basemap image acquired 13 December 2022.

Instances of unknown scars were recorded at 11 of the 17 sites. An average of 14 scars were recorded on eight of the ten reef slope sites per 400m² (range from 6 to 27). The highest number of scars on reef flat sites was 26 at Jetty Flat. Crown of Thorns Starfish (CoTS) scars were observed at Heron Bommie. Drupella scars were only observed at Heron Bommie (1). The highest level of coral scars was recorded at Coral Gardens (27).

Figure 5 summarises the incidence of coral disease to hard coral cover recorded on the 2022 surveys.

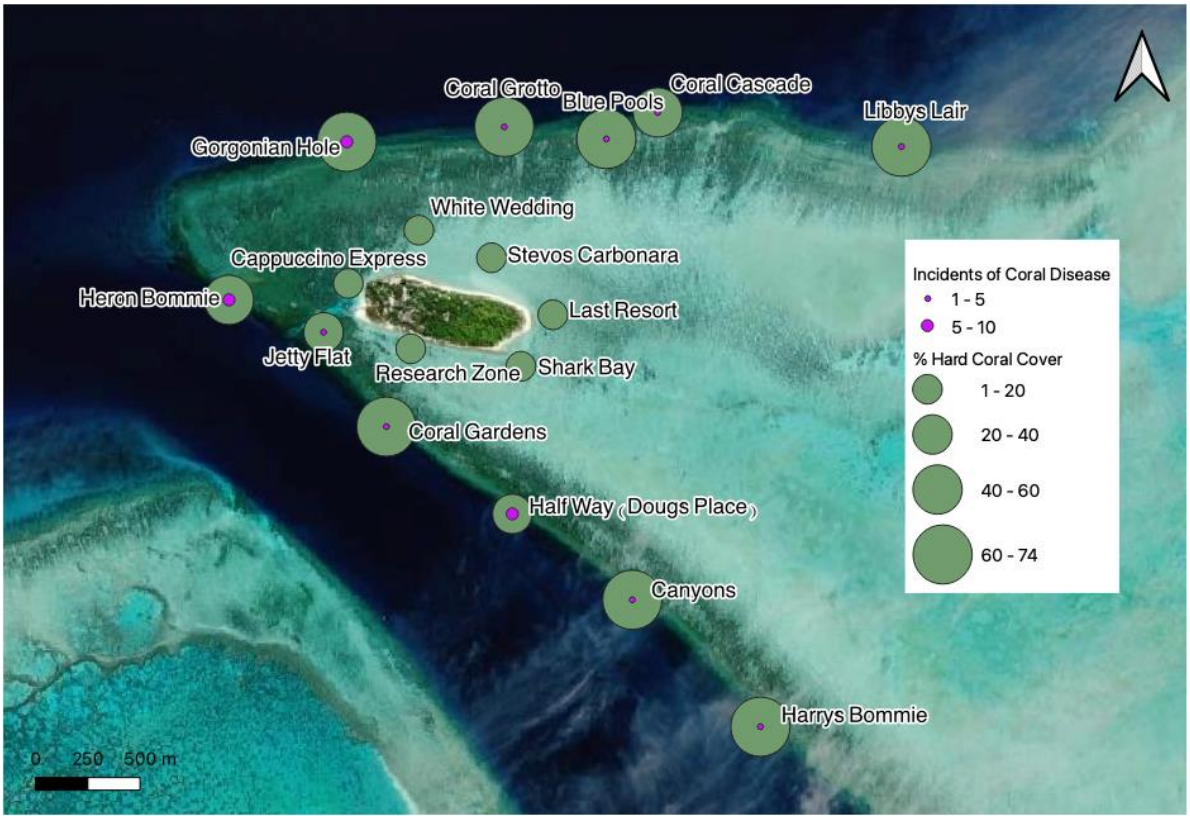

Figure 5. RCA hard coral cover and coral disease data for the 2022 surveys. Map created using QGIS software with an Esri basemap image acquired 13 December 2022.

Instances of coral disease were recorded on transect at 11 of the 17 sites. The highest count of coral disease was recorded at Gorgonian Hole (10 counts), with counts ranging from 1 to 10 where observed.

Coral damage is summarised relative to the percentage of hard coral cover in Figure 6.

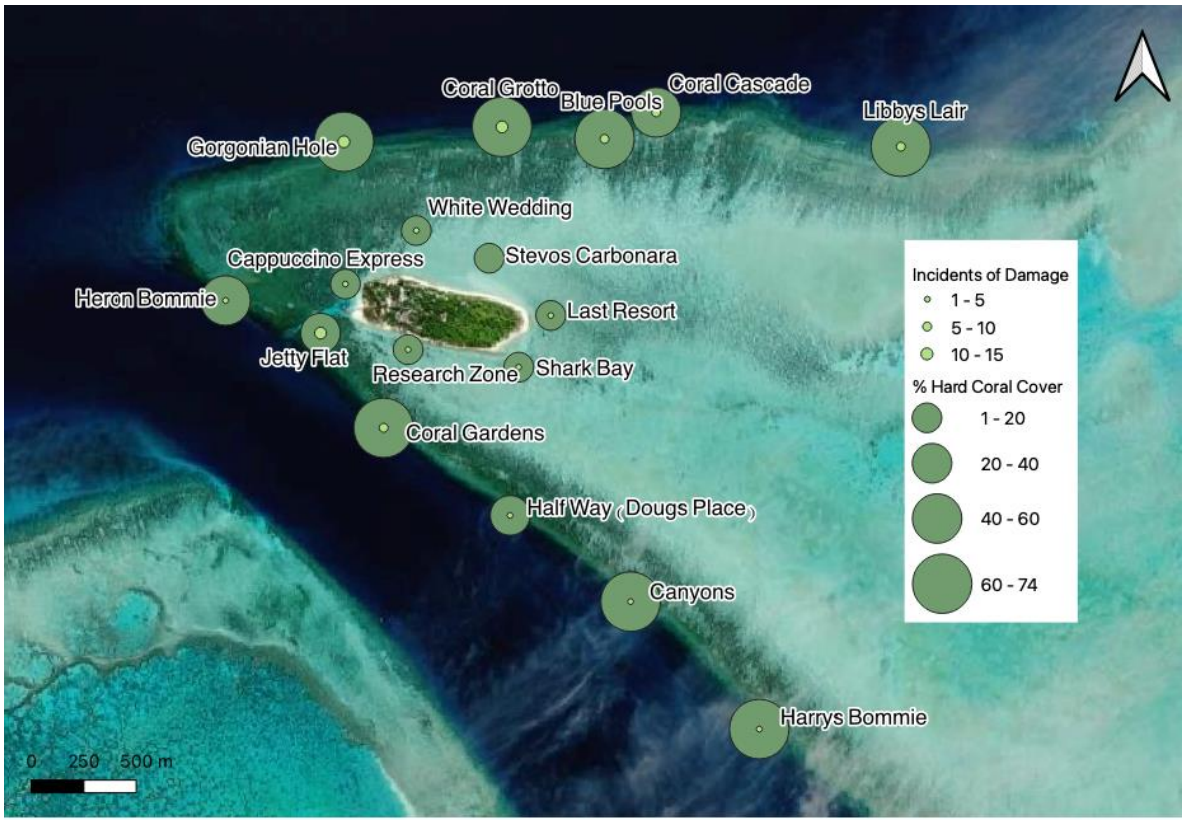

Figure 6. RCA hard coral cover and coral damage data for the 2022 surveys. Map created using QGIS software with an Esri basemap image acquired 13 December 2022.

Sixteen of the 17 sites had instances of coral damage. The average coral damage for all 16 sites was 5.75 counts per 400m². Coral damage was lower than observed in 2021, with the highest being 15 counts at Coral Grotto. Coral damage was not recorded at Stevo's Carbonara, however this site only has an average of 1.25% hard coral.

Invertebrate surveys record the abundance of indicator invertebrates along each transect. Figure 7 and Figure 8 show the abundance of giant clams and indicator sea cucumbers respectively, for each survey site along with the percentage of hard coral cover.

Figure 7. RCA hard coral cover and giant clam abundance for the 2022 surveys. Map created using QGIS software with an Esri basemap image acquired 13 December 2022.

Giant clams were recorded on six of the ten reef slope sites and all seven of the reef flat sites. Heron Bommie (southern reef slope) and White Wedding (northern reef flat) had the highest recorded numbers of giant clams with 10 and 17 (respectively) found on transect. This finding is consistent with 2021.

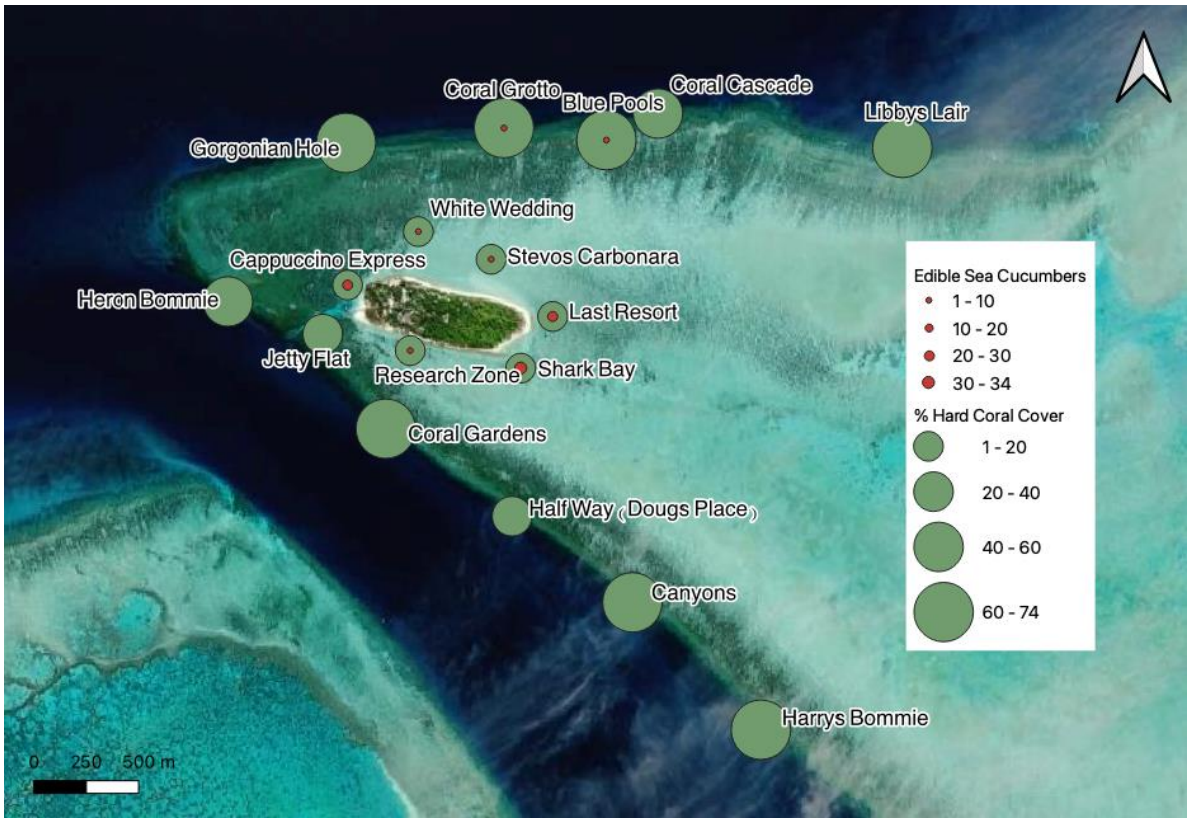

Figure 8. RCA hard coral cover and abundance of sea cucumber for 2022 surveys. Map created using QGIS software with an Esri basemap image acquired 13 December 2022.

Target sea cucumbers were recorded at eight of the 17 sites. The highest numbers of sea cucumbers were recorded on shallow near shore, sandy reef flat areas. The highest count of target sea cucumbers was at Shark Bay (34 per 400m^2), followed by Cappuccino Express (28 per 400m^2) and Last Resort (23 per 400m^2). These locations are consistent with the findings in 2020 and 2021. Jetty Flat was the only shallow near shore site that did not have target sea cucumbers recorded on transect although they were observed during the snorkel to the transect area.

5.0 INDIVIDUAL SITE REPORTS

5.1 Blue Pools

Blue Pools is situated along the reef slope, on the northern side of Heron Island. This site is characterised by a series of shallow canyons cutting into the edge of the reef, with patches of rubble out deeper, away from these ridges (Image 1).

Hard coral represented 71% of the total substrate cover (Figure 9 and Image 2). Rock (including rock with turf algae and rock with calcareous algae was the next greatest contributor to substrate at 15% cover. Rubble made up 8%, sand 4%, nutrient indicator algae 2% and recently killed coral just under 1%.

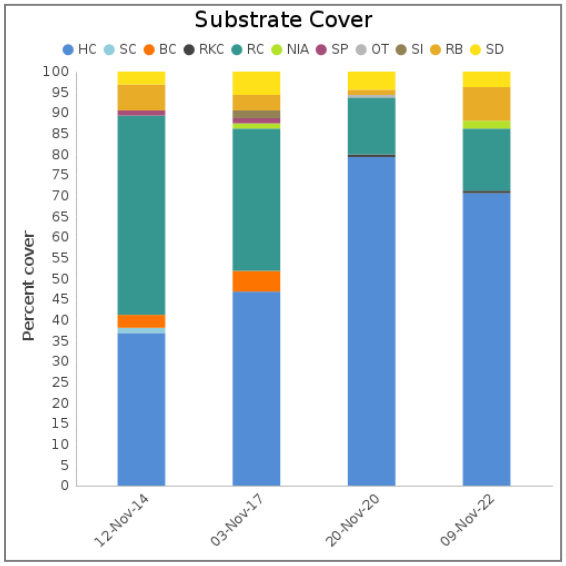

Figure 9. Benthic type and percent cover: Blue Pools, 2014 – 2022.

Ten sea cucumbers, seven giant clams and two Trochus snails were recorded on the invertebrate survey.

Bleaching was not recorded during the impact survey in 2022, although hard coral cover remained consistent.

Ten counts of coral damage, six unknown scars and three counts of disease were recorded.

A fish survey was conducted and 27 snapper, 15 butterflyfish, seven parrotfish, two sweetlips and one coral trout (Image 3) were recorded.

Image 1: Site Location – represented by circle

Image 2: Transect photo

Image 3: Coral Trout

5.2 Canyons

Canyons is situated along the reef slope, on the southern side of Heron Island. 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 (Image 4).

Hard coral represented 72% of the total substrate cover (Figure 10). Rock (including rock with turf algae and rock with calcareous algae was the next greatest contributor to substrate at 24% cover. Rubble made up 2.5%, recently killed coral just over 1% and nutrient indicator algae, just under 1%.

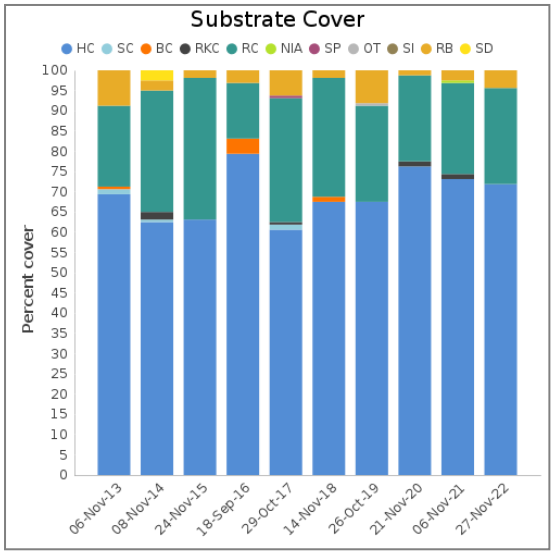

Figure 10. Benthic type and percent cover: Canyons, 2013 – 2022.

Target invertebrates were not recorded on the invertebrate survey.

Average coral colony bleaching of 21.75% was recorded during the impact survey in 2022 (Image 5), although the population average was only 1%.

Four counts of coral damage, four of coral disease and 18 unknown scars (Image 6) were recorded.

A fish survey was conducted and 12 butterflyfish, four snapper, five parrotfish, two grouper and one coral trout were recorded.

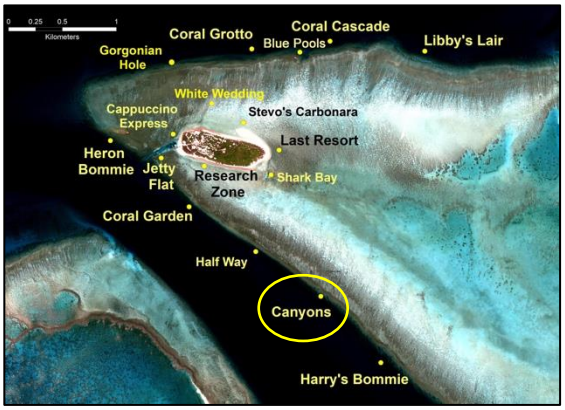

Image 4: Site Location – represented by circle

Image 5: Bleached coral

Image 6: Unknown scar

5.3 Cappuccino Express

Cappuccino Express is on the reef flat. The site is characterised by small coral atolls and sandy patches and is prone to strong currents (Image 7). This reef area is easily accessible on snorkel and often visited by tourists as it is situated close to the resort.

Hard Coral represented 16% of the total substrate at this site (Figure 11). Rock was again the greatest contributor to substrate, making up 35%. Sand constituted 30%, rubble attributed 12.5%, recently killed coral 4%, nutrient indicator algae 2% and bleached coral <1%.

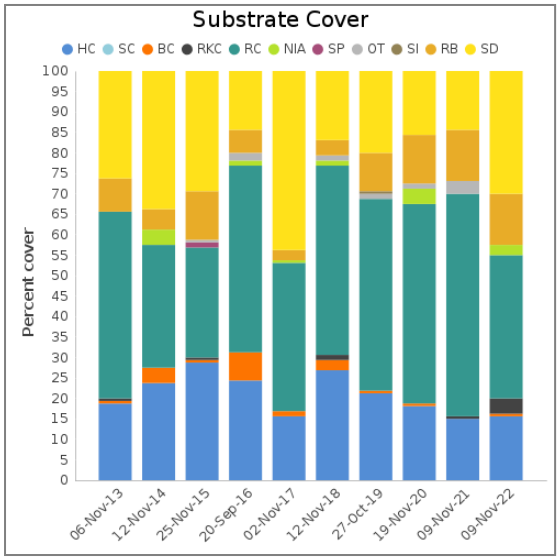

Figure 11. Benthic type and percent cover: Cappuccino Express, 2013 - 2022.

Four giant clams and 28 sea cucumbers were recorded on the invertebrate survey.

Coral bleaching was not recorded during the impact survey, although one incident was encountered on the substrate survey (image 8).

Five incidents of unknown scars and three counts of coral damage was recorded.

A fish survey was conducted and six snapper, one parrotfish, one moray eel and 13 butterflyfish were recorded. Dominant algae included turf algae, *Halimeda* spp. and *Chlorodesmis* spp. (Image 9).

Image 7: Site Location – represented by circle

Image 8: Bleached coral

Image 9: Dominant algae

5.4 Coral Cascades

Coral Cascades is situated on the reef slope on the northern side of Heron Reef (Image 10) Coral Cascades 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 56% of the substrate at this site (Figure 12 and Image 11). Rock (including rock with turf algae and rock with coralline algae) constituted 36% of the substrate, soft coral 3%, rubble 2%, bleached coral <1% and "other" (Halimeda) 2.5%.

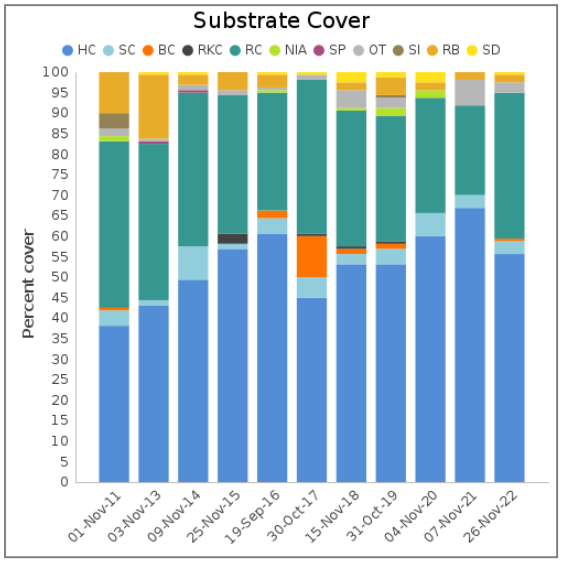

Figure 12. Benthic type and percent cover: Coral Cascades, 2011 - 2022.

Two giant clams and one anemone (Image 12) were recorded on the survey.

Bleaching was recorded on just 0.75% of the coral population, with an average 10.75% of each affected coral surface bleached.

Other reef impacts recorded at this site included eight counts of coral damage and one of disease.

A fish survey was conducted and eight parrotfish, 19 butterflyfish, one barramundi cod, one grouper, one bumphead parrotfish and two snapper were recorded.

Image 10. Site Location – represented by circle

Image 11: Site photo

Image 12: Anemone with fish

5.5 Coral Gardens

Coral Gardens is located on the southern side of Heron Island on the reef slope. It is characterised by high hard coral cover; particularly branching growth forms (Image 13). It is a popular dive destination for the resort.

Hard coral (Image 14) accounted for 62% of the benthos at this site and is made up almost exclusively of branching coral growth forms. Rock (including rock with turf algae and rock with calcareous algae) accounted for 36%, rubble constituted 5%, soft coral just over 1%, and recently killed coral <1% of total substrate (Figure 13).

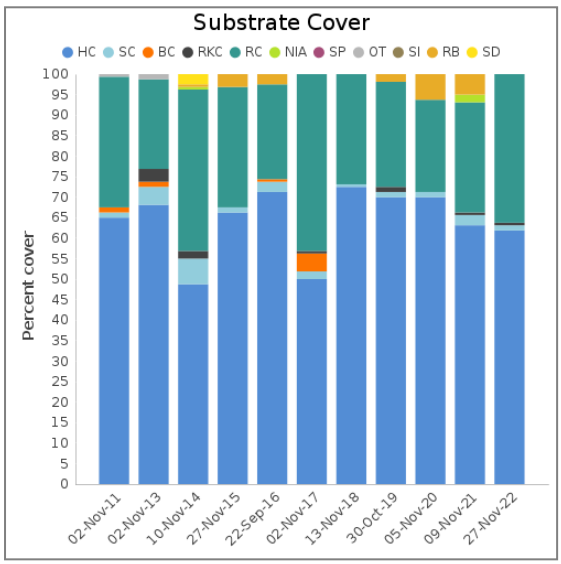

Figure 13. Substrate type and percent cover at Coral Gardens, 2011 - 2022.

Two Trochus shells were the only target invertebrates recorded on the invertebrate survey.

Bleaching was recorded on 1% of the coral population, with an average of 14.5% of each affected coral surface bleached.

Reef Impacts recorded at Coral Gardens were 27 unknown scars, six counts of coral damage and five of disease (Image 15).

A fish survey was conducted and eight butterflyfish, nine parrotfish, one coral trout, and one snapper were recorded. Several turtles were also observed on transect.

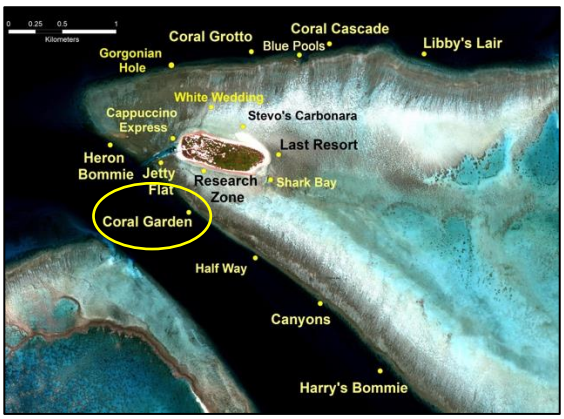

Image 13: Site Location – represented by circle

Image 14: Hard coral and Turtle

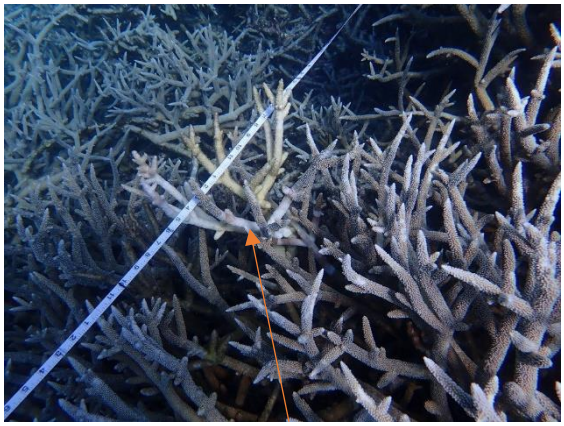

Image 15: Disease

5.6 Coral Grotto

Coral Grotto is located on the reef slope on the northern side of Heron Island (Image 16). It is characterised by high hard coral cover.

Hard coral accounted for 67% of substrate (Figure 14 and Image 17). Rock constituted 25% of substrate cover, soft coral 4%, rubble 2%, other 1% and sand < 1%.

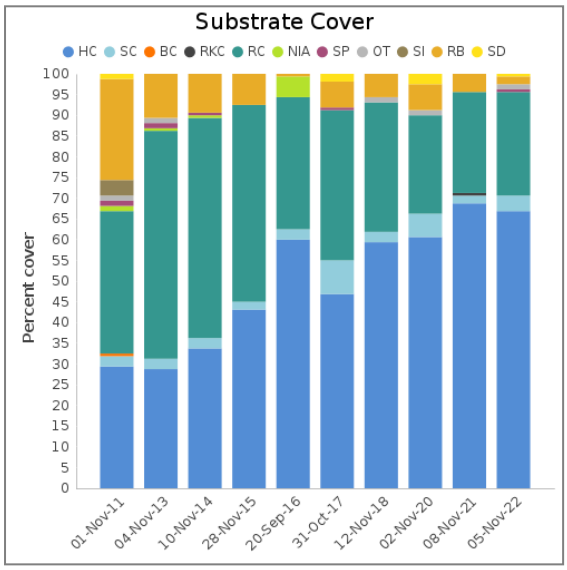

Figure 14: Benthic type and percent cover: Coral Grotto, 2011 - 2022.

Three giant clams and one sea cucumber were recorded for the invertebrate survey.

Coral bleaching (Image 18) affected an average of 12.5% of the coral surface, but 0.25% of the coral population. Ten unknown scars, four counts of disease and 15 incidences of coral damage were recorded.

A fish survey was conducted and 40 snapper, 32 butterfly fish, two coral trout and nine bumphead parrotfish were recorded.

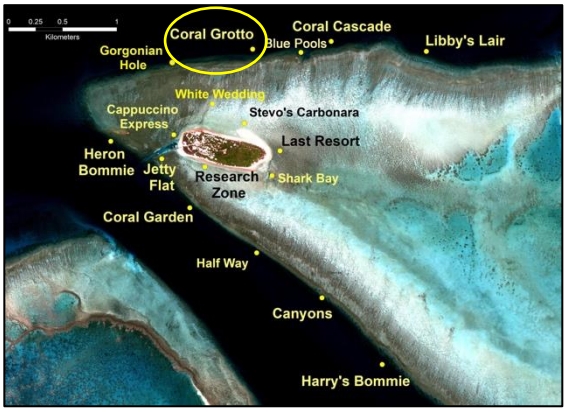

Image 16. Site Location – represented by circle

Image 17. Hard corals

Image 18: Bleaching

5.7 Gorgonian Hole

Gorgonian Hole is located on the reef slope on the northern side of Heron Island (Image 19). It is characterised by high hard coral cover, particularly branching growth forms.

Hard coral accounted for 74% of substrate (Figure 15 and Image 20). Rock constituted 21% of substrate cover and rubble and soft coral at 2%, with "other" and recently killed coral at less than 1% each.

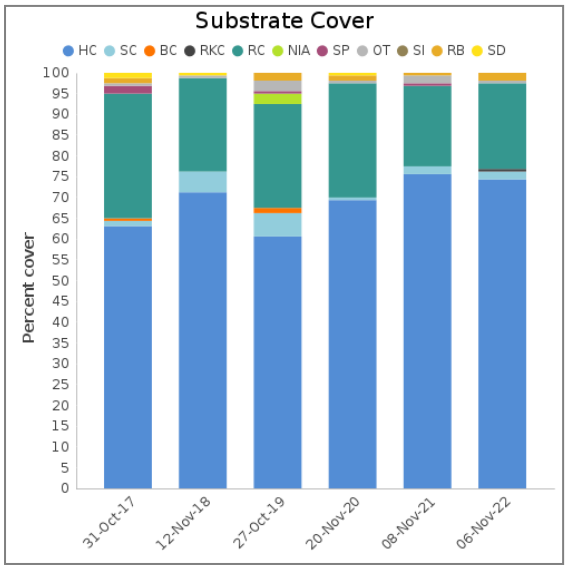

Figure 15: Benthic type and percent cover: Gorgonian Hole, 2017 - 2022.

One anemone was the only invertebrate recorded for the invertebrate survey.

Bleaching affected 0.25% of the coral population with an average of 12.5% of individual colonies bleached.

Coral damage, at 13 incidences was lower than 2021, with an increase in unknown scars (22) and coral disease (10) (Image 21) also recorded.

A fish survey was conducted and six butterfly fish, ten parrotfish, four snapper, four coral trout and one grouper were recorded.

Image 19. Site Location – represented by circle

Image 20. Site Photo

Image 21: Disease

5.8 Half Way

Half Way is located is located on the southern side of Heron Island, on the reef slope, halfway between Canyons and Coral Garden (Image 22). It is characterised by hard coral cover, but was observed to have a large amount of historically damaged coral.

Rubble accounted for 41% of the total substrate (Image 23), which is an increase from previous years. Rock including rock covered with turf algae or coralline algae made up 31%. Hard coral cover at this site accounted for 24% of substrate cover (Image 24) and soft coral 4%, (Figure 16).

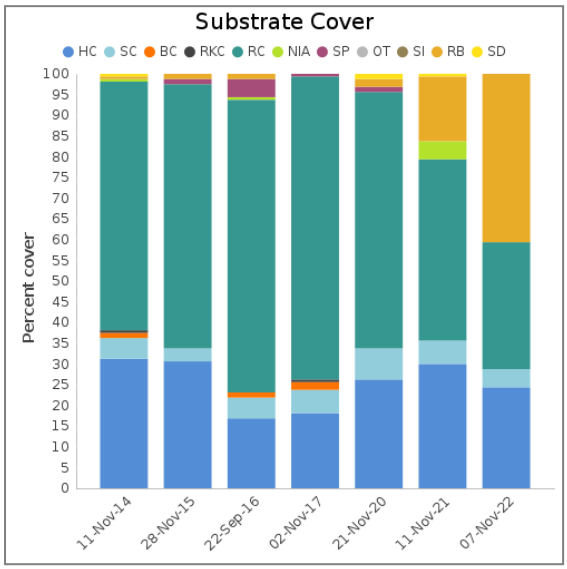

Figure 16. Benthic type and percent cover: Half Way, 2014 - 2021.

Five giant clams and two Trochus were recorded during the invertebrate survey.

Coral bleaching affected approximately 0.25% of the total coral population, with an average of 22.5% of each colony showing surface bleaching, an increase from last year.

One incident of coral damage, 14 unknown coral scars and nine of disease were recorded on the impact survey.

A fish survey was conducted and four butterflyfish, three coral trout, three snapper and 16 parrotfish were recorded.

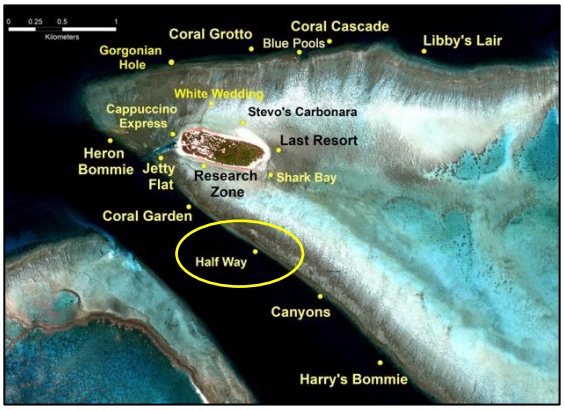

Image 22. Site Location – represented by circle

Image 23. Rubble

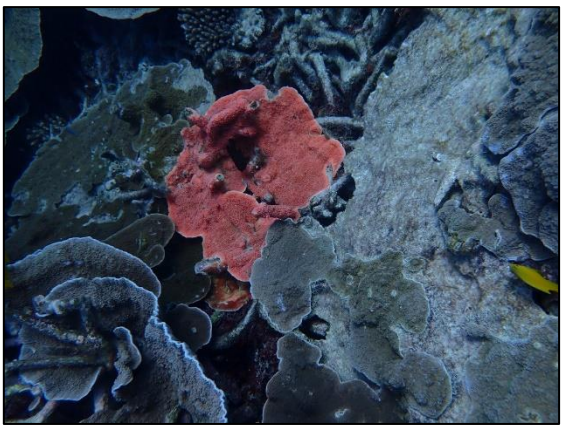

Image 24. Hard corals

5.9 Harry's Bommie

Harry's Bommie is located on the southern side of Heron Island, on the reef slope. It is characterised by large coral bommies and high hard coral cover, particularly branching growth forms (Image 25).

Hard coral cover at this site accounted for 74% of substrate cover (slightly higher than previous years), consisting predominantly of branching coral (Image 26). Rock (rock with turf algae and rock with calcareous algae) accounted for 17% of the total substrate, with soft coral, recently killed coral and "other" attributing just under 1%, each (Figure 17).

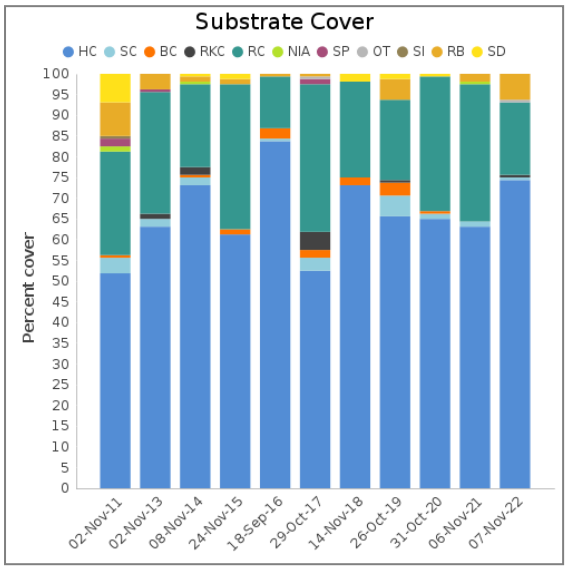

Figure 17. Benthic type and percent cover: Harry's Bommie, 2011 - 2022.

Three giant clams (Image 27) were recorded during the invertebrate survey.

Coral bleaching affected 0.25% of the total coral population, with an average of 0.25% of each colony showing surface bleaching.

Unknown coral scars ranked as the highest impact at 10 counts. Coral damage numbered two, with four counts of disease.

A fish survey was conducted and 12 butterflyfish, two coral trout, one moray eel, four parrotfish and one snapper were recorded.

Image 25. Site Location – represented by circle

Image 26. Hard coral

Image 27. Giant clam

5.10 Heron Bommie

Heron Bommie is located on the south west of Heron Island fringing reef slope (Image 28). 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.

Hard coral represented 55% of the substrate (Figure 18 and Image 29). Rock (including rock with turf algae and rock with calcareous algae) constituted 24% of substrate cover. Rubble attributed 9%, sand 5%, soft coral 3% with bleached coral and "other" (Halimeda) each at <1%.

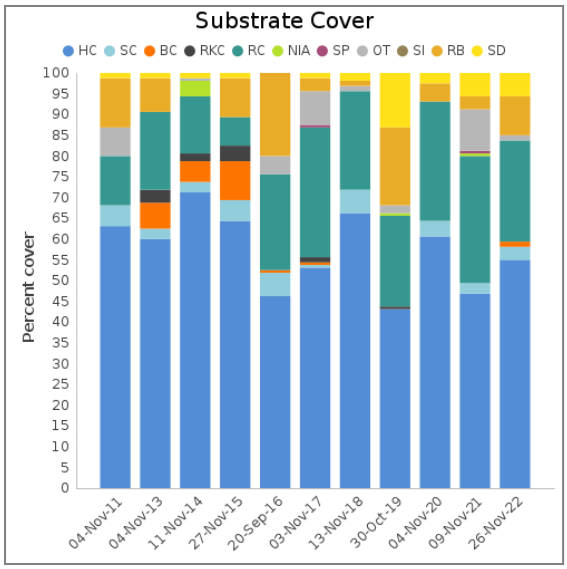

Figure 18. Benthic type and percent cover: Heron Bommie, 2011- 2021.

Ten giant clams and three *Drupella* snails were recorded on the invertebrate survey. A crown-of-thorns starfish was observed off-transect.

Coral bleaching affected 1.5% of the total coral population, with an average of 20.75% of each colony showing surface bleaching.

Coral disease (Image 30) was similar to last year with nine counts on this survey. There were five incidents of coral damage, one Crown-of-Thorns scar and one Drupella scar.

A fish survey was conducted and 16 butterflyfish, four grouper, nine parrotfish, seven snapper and five sweetlip were recorded.

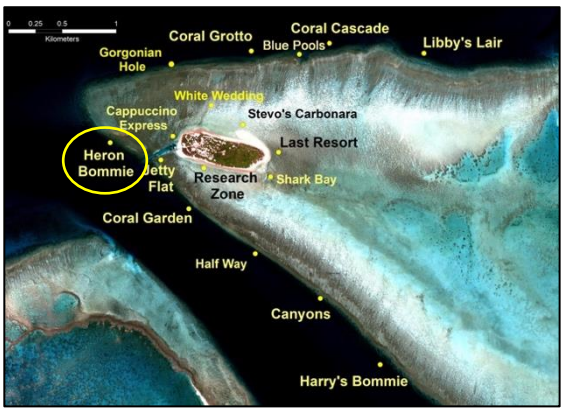

Image 28. Site Location – represented by circle

Image 29. Site photo

Image 30. Coral disease

5.11 Jetty Flat

Jetty flat is located on the south-western side of Heron Island, on the southeast 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 (Image 31).

Hard corals accounted for 29% of the benthos (Figure 19 and Image 32). Rock (including rock, rock with turf algae and rock with calcareous algae) constituted 70% of the substrate (an increase from last year), rubble and soft coral (Image 33) made up less than 1% each.

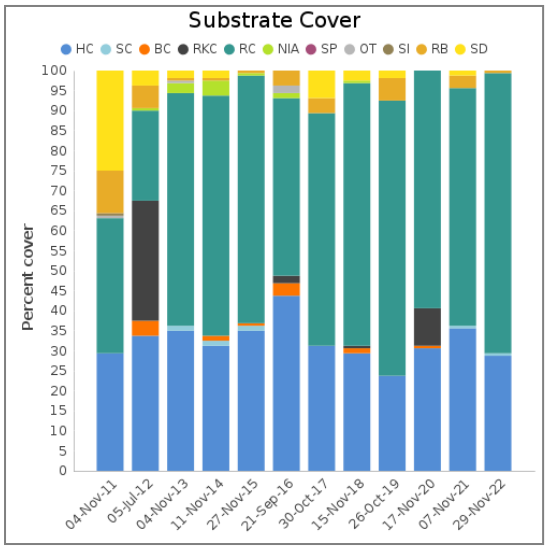

Figure 19. Benthic type and percent cover: Jetty Flat, 2011 - 2022.

Eight giant clams and one *Drupella* snail were recorded on the invertebrate survey.

Coral bleaching affected 0.5% of the total coral population, with an average of 12.5% of each colony showing surface bleaching.

Reef impacts recorded included 26 unknown scars, 12 counts of coral damage and three of coral disease.

A fish survey was conducted and six butterflyfish, one coral trout, one parrotfish and four snapper were recorded. Numerous rays and turtles were observed off-transect.

Image 31. Site Location – represented by circle

Image 32. Site Photo

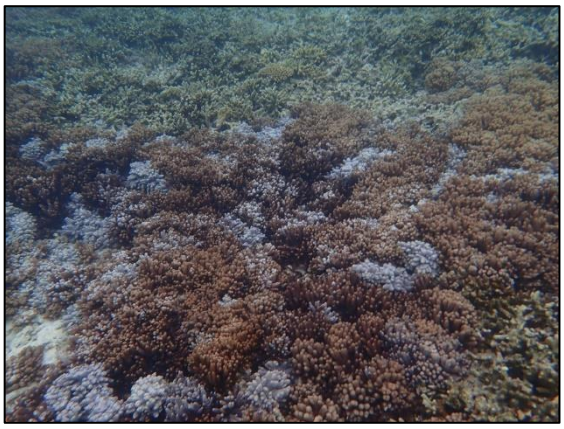

Image 33. Soft corals

5.12 Last Resort

Last Resort is a lagoonal site accessible on snorkel, located at the north-east corner of the island (Image 34). It is frequented by tourists as it is a popular spot for shark and ray sightings.

Hard corals accounted for 4% of the benthos (Figure 20). Rock (including rock with turf algae and rock with calcareous algae) constituted 22% of the substrate, whilst sand contributed the most at 52%. Nutrient indicator algae attributed 16%, rubble 4% and "other" 1%. Four counts of macro algae were also recorded.

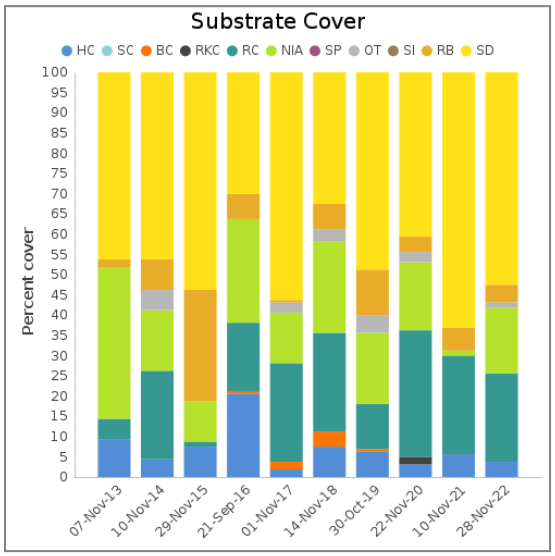

Figure 20. Benthic type and percent cover: Last Resort, 2013 - 2022.

Twenty-three sea cucumbers and four giant clams were recorded on the invertebrate survey. Non-target nudibranchs were also observed on transect (Image 36).

Coral bleaching was not observed, but one count of coral damage was recorded.

A fish survey was conducted and eight snapper and one butterflyfish were recorded.

Image 34. Site Location – represented by circle

Image 35. Site Photo

Image 36. Nudibranch – *Plakobranchus* spp.

5.13 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 deep gullies (Image 37).

Hard coral accounted for 69% of the benthos, (Figure 21 and Image 38). Rock (encompassing both rock with turf algae and rock with coralline algae) made up 21% of the substrate, with soft coral 4%, and sand at 5%.

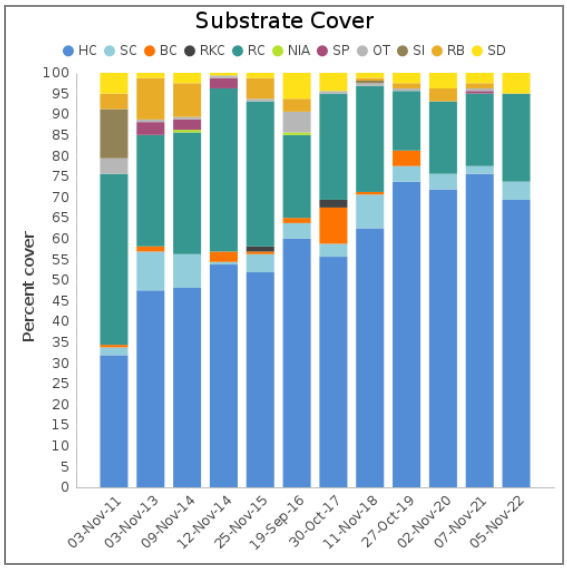

Figure 21: Benthic type and percent cover: Libby's Lair, 2011 - 2022.

No target invertebrates were recorded on the invertebrate survey, although a giant clam was observed off-transect.

Coral bleaching was not recorded. Impacts recorded included eight incidents of coral damage, three of coral disease and eight unknown scars.

A fish survey was conducted and 18 butterflyfish, 22 snapper, 19 coral trout, 11 parrotfish, three humphead parrotfish and one grouper were recorded.

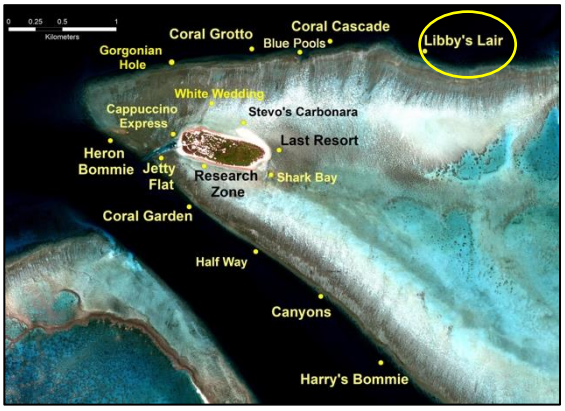

Image 37. Site Location – represented by circle

Image 38. Hard coral

Image 39. Giant clam (off-transect)

5.14 Research Zone

The Research Zone site is located on the southern side of Heron Island, within the scientific zone (Image 40). This area is designated for the 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.

Sand remained the dominant substrate (64%) (Figure 22 and Image 41). Rock (including rock with turf algae and rock with coralline algae) contributed 14% of the substrate, hard coral just over 10% and rubble 7%. Nutrient indicator algae attributed 4% to the benthos and sponge just under 1%. Six counts of macro algae were recorded.

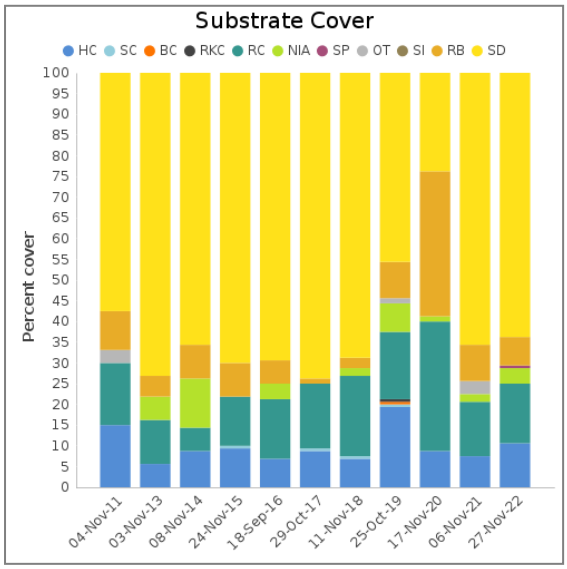

Figure 22. Benthic type and percent cover: Research Zone 2011 - 2022.

Six sea cucumbers (Image 42) and six giant clams were recorded on the invertebrate survey.

Coral bleaching affected 0.75% of the coral population with an average of 4.25% of the surface of each affected coral.

Six unknown scars and two incidents of coral damage were recorded on the impact survey.

A fish survey was conducted, and two butterflyfish and one parrotfish were recorded.

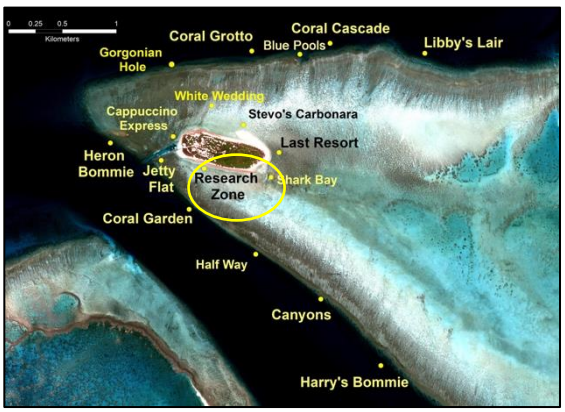

Image 40. Site Location – represented by circle

Image 41. Site photo

Image 42. Target sea cucumber (Pinkfish)

5.15 Shark Bay

The 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. This reef area is a popular spot for shark and ray sightings (Image 43).

Hard coral accounted for 11% of the benthos, whilst sand remained the dominant substrate at 44% (Figure 23, Image 44). Rock (including rock with turf algae and rock with calcareous algae) attributed 24%, rubble 2% and other <1%. Nutrient indicator algae increased slightly from last year (up from 9% to 17%) of the substrate. Eight counts of macro algae were recorded.

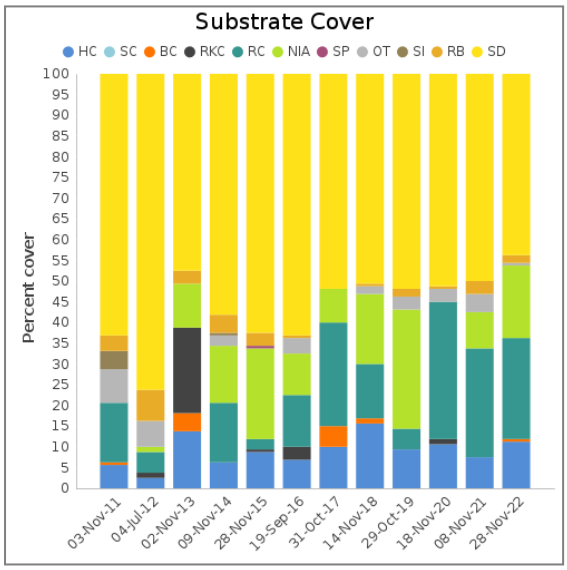

Figure 23. Benthic type and percent cover: Shark Bay, 2011- 2022.

Thirty four sea cucumbers (Image 45) (slightly less than last year) and four giant clams were recorded during the invertebrate survey.

Coral bleaching was not recorded.

Impacts were limited to one incident of coral damage recorded on the impacts survey.

A fish survey was conducted and 43 snapper, eight butterflyfish, three parrotfish and one sweetlips were recorded. Stingrays were also observed on site.

Image 43. Site Location – represented by circle

Image 44: Site Photo

Image 45: Target sea cucumber (Prickly greenfish)

5.16 Stevo's Carbonara

Stevo's Carbonara is located on the reef flat on the northern side of the island (Image 46). It is close to the resort and regularly frequented by tourists on snorkel and also reef walkers.

Hard coral (1.25%) was recorded on the substrate transect in 2022 (Figure 24). Sand again dominated the substrate at 66%, however this was lower than 2021. Nutrient indicator algae levels increased to 23% (Image 47). Rock made up 4%, "other" 3% and rubble just over 1% of the substrate. One count of macro algae was recorded.

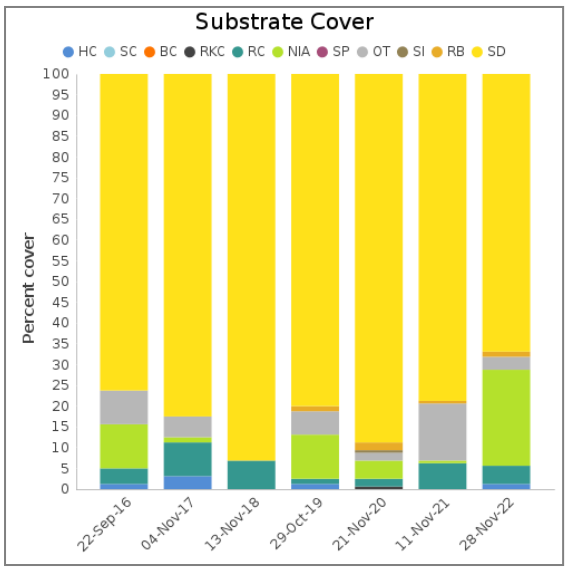

Figure 24. Benthic type and percent cover: Stevo's Carbonara, 2016 - 2022.

Two sea cucumbers, three giant clams and one anemone were recorded on the invertebrate survey.

Impacts were not observed during the impacts survey.

A fish survey was conducted but no target fish were recorded.

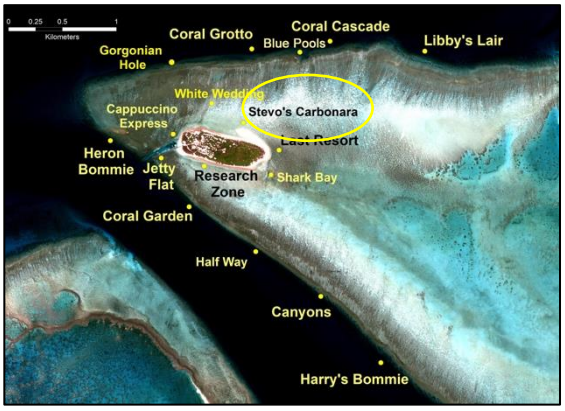

Image 46. Site Location – represented by circle

Image 47: Site photo showing nutrient indicator algae and macro algae

Image 48: Anemone

5.17 White Wedding

White Wedding is located on the reef flat on the northern side of the island (Image 49). It is close to the resort and regularly frequented by tourists on snorkel and also reef walking.

Hard coral accounted for 7% of the benthic substrate (Figure 25 and Image 50). Rock (consisting of rock, rock with turf algae and rock with calcareous algae) made up 26%, "other" (Halimeda, calcareous algae and giant clam) 16% and sand 41% (Image 51). Rubble attributed 8% to the substrate composition, with soft coral and nutrient indicator algae <1% each. Eight counts of macro algae were recorded.

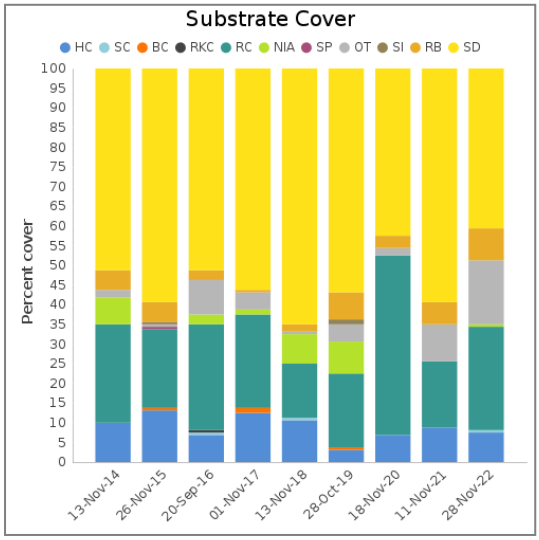

Figure 25. Benthic type and percent cover: White Wedding 2014-2022.

Seventeen giant clams and ten sea cucumbers were recorded on the invertebrate survey.

Coral Bleaching affected <1% of the coral population and an average of 13% of the surface of affected coral colonies.

One incident of coral damage was recorded on the impact survey.

A fish survey was conducted and seven parrotfish, six snapper, two grouper and one butterflyfish were recorded.

Image 49. Site Location – represented by circle

Image 50: Hard coral

Image 51: Transect and algae

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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Image 52: Stingrays in Shark Bay

APPENDIX A COMPARATIVE ISLAND WIDE GRAPHS FOR 2022 DATA