Part 2: Cay summaries (islands, islets and cays)

Southern reef systems

Central reef systems

Southern Reef Systems

2.1 Cato Island, Cato Reef

Figure 15 Cato Island Jake Sanders © Queensland Government

2.1.1 Drone imagery

25 May 2022:

- Drone – Phantom 4 RTK
- Image capture height 100m. Inclement weather necessitated a fast capture time
- Resolution 2.8cm/px
- Map stitching software – Drone Deploy

2.1.2 Physical description

- Low tide extent 855m x 337m
- Approximate high tide extent 814m x 264m
- Vegetated area 14.8ha

Cato Island, shown in *Figure 15,* is located at 480 km ENE of Gladstone at-23.251 degrees latitude and 155.54 degrees longitude. The cay rises from the shoreline to a central plateau with a depression in the central interior. An automated weather station (AWS), visible in *Figure 15,* is located at the highest point on the island in the northeast. *Figure 16* contains surface elevation profiles of Cato Island.

2.1.3 Vegetation

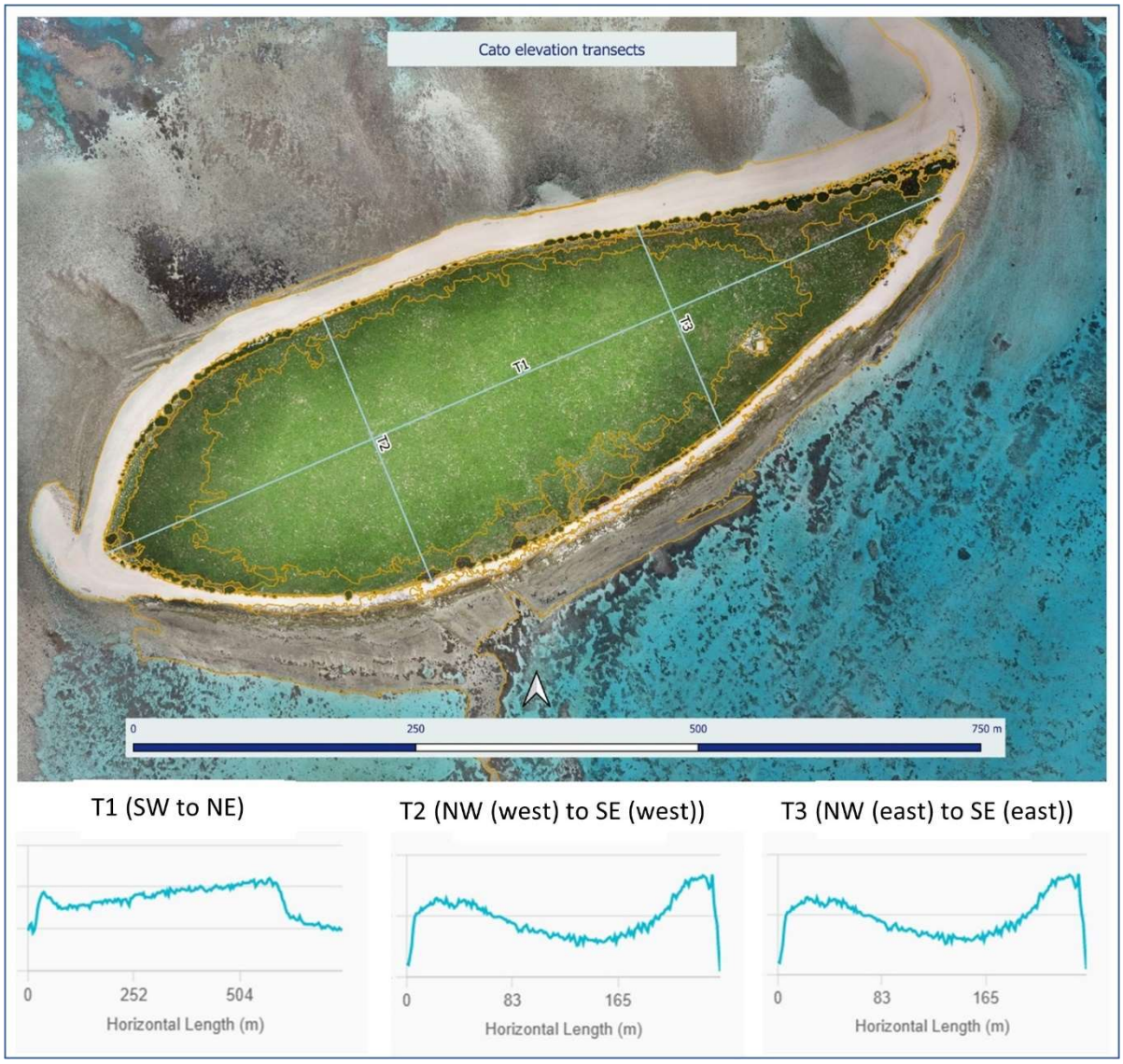


Figure 16 Surface profiles of Cato Island

Note: Maximum height is approximately six metres above sea level (ASL). Vertical heights and scale are not included in surface profile diagrams as accurate vertical datum information was not available.

Survey intensity

Two people each spent 7.6 hours surveying the vegetation of Cato Island. Vegetation data was recorded at 25 ground-truthing sites and two permanently marked BioCondition monitoring sites (M16 and M17). Locations of these sites are shown in *Figure 17*. The yellow lines are the boundaries of the vegetation communities shown on the vegetation map in *Figure 18.*

As a result of extreme weather conditions, the ground truthing survey could not be completed and the traverses and surveyed locations did not include some parts of the island, particularly the northern central section and parts of the southern coastal areas of the cay. Areas without sites (refer to *Figure 17*) give an indication of sections of the cay that were not surveyed. Attributes applied to the vegetation polygons in these areas are based solely on interpretation of the drone imagery. Refer to the shapefile database table for estimated reliability of the vegetation attributes.

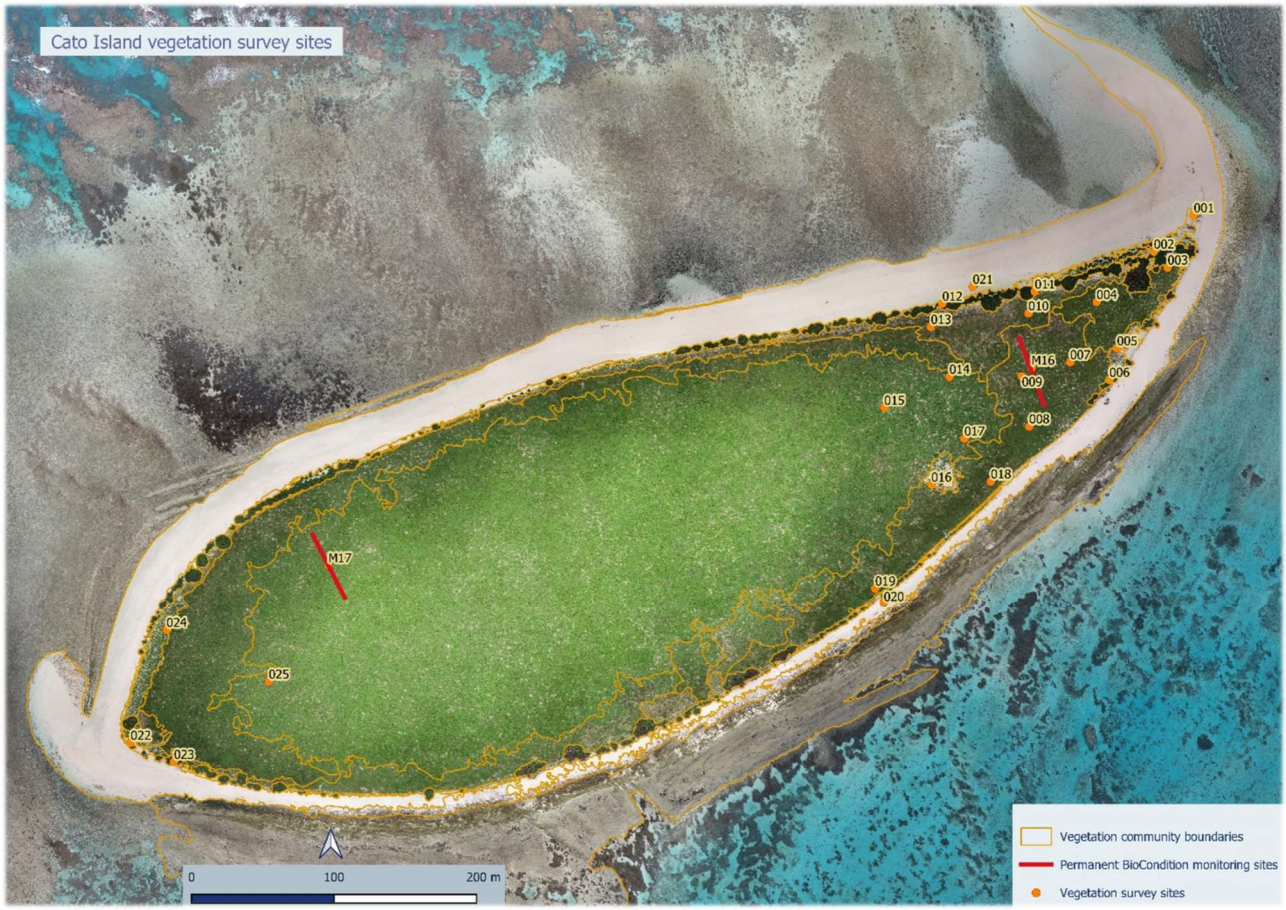


Figure 17 Cato Island showing the number and location of ground-truthing vegetation survey sites and the BioCondition monitoring sites relative to the vegetation map unit boundaries

Vegetation condition

There was some dieback in a number of *Argusia argentea* (octopus bush) shrubs along the eastern and southeastern shorelines (shown in *Photo 11*) and an occasional dead *Argusia argentea* plant was also present in these areas. This is likely due to over wash by waves and/ or salt water incursion in the root zone caused by cyclonic or storm surges.

Otherwise, the vegetation on the cay was in very good condition at the time of the survey.

Photo 11 Minor dieback in *Argusia argentea*
Joy Brushe ©

Floristic data

Seven native cay plant species were recorded on Cato Island. *Argusia argentea* (octopus bush) was the only woody plant species present. The most abundant and widespread species was *Portulaca oleracea* (pig weed). *Lepturus repens* (stalky grass) *and Boerhavia albiflora* var. *albiflora* (tar vine) were also widespread in sites across the cay. *Achyranthes aspera* (chaff flower) was widespread and abundant in the interior of the cay. No weed species were observed.

Plant species recorded during the survey of Cato Island are listed in *Table 1* together with frequency in sites, the averaged cover for each species for sites in which the species was present and their averaged cover over the entire cay. Data for species cover at each site plus occurrence of each species in relation to vegetation community and landform are contained in *Table 3*.

Table 1 Plant Species recorded on Cato Island (25-26/05/2022)

Layer: (G) = ground
Lifeform: G = grass, Ga = annual grass, H = herb, Ha = annual herb, Hp = perennial herb, ST = large shrub/small tree

Scientific Name	Common name	Family	Life form	Presence in sites (% of sites)	Average % cover for each layer (averaged cover only for sites in which species was present	Overall average % cover for each layer- (averaged cover over all sites including 0% covers at sites where species was absent
Achyranthes aspera	chaff flower	Amaranthaceae	Ha	40.7%	17.5% (G)	7.1% (G)
Argusia argentea	octopus bush	Boraginaceae	ST	37.0%	62.1% (S1), 2.5% (G)	16.1% (S1), 0.7% (G)
Boerhavia albiflora var. *albiflora*	tar vine	Nyctaginaceae	Hp	70.4%	9.6% (G)	6.8% (G)
Lepturus repens	stalky grass	Poaceae	G	77.8%	10% (G)	7.8% (G)
Portulaca oleracea	pig weed	Portulaceae	H	92.6%	26.7% (G)	24.7% (G)
Stenotaphrum micranthum	beach buffalo grass	Poaceae	Ga	37.0%	7.5% (G)	2.8% (G)
Tribulus cistoides	bulls head burr	Zygophyllaceae	Hap	63.0%	13.2% (G)	8.3% (G)
Total no of species = 7						

Vegetation communities

Argusia argentea (octopus bush) shrubs formed an interrupted zone around the entire perimeter of the cay.

No *Pisonia grandis* (pisonia) or other tree or shrub communities were present.

The interior vegetation consisted of vegetation communities dominated by forbs, predominantly *Achyranthes aspera* (chaff flower) and *Portulaca oleracea* (pigweed) at the time of the survey.

Flat areas and swales landward of the coastal *Argusia argentea* shrublands consisted of more open grassland or herbland communities variously dominated by *Portulaca oleracea, Boerhavia albiflora* var. *albiflora* (tar vine)*, Stenotaphrum micranthum* (beach buffalo grass) and *Lepturus repens* (stalky grass).

Vegetation communities present on Cato Island in May 2022, the area of each and representative survey sites within each vegetation community are listed in *Table 2*. The spatial distribution and extent of the vegetation communities are shown in the vegetation map in *Figure 18*.

Comparisons with equivalent and similar communities on other Coral Sea cays are shown in *Appendix 3.*

Table 2 Vegetation communities on Cato Island

Veg Map Unit	Summary description	Additional description	Total area (ha)	Sites
Unvegetated areas				
A	sandy shores		4.626	
B	lithified shores		4.192	
C	rubble banks		0.310	
Vegetation of shorelines, beaches and sand spits				
1a	sparse to open grassland or herbland on sandy shores	sparse grassland/ herbland dominated by Lepturus repens and seedlings of *Argusia argentea* on sandy shorelines	0.171	1, 21
1b	sparse herbland on shoreline rubble banks		0.016	
2a	*Argusia argentea* open shrubland to isolated shrubs on shorelines and sand spits		0.117	22
2b	coastline *Argusia argentea* communities	coastline *Argusia argentea* dwarf shrubland/ shrubland to closed shrubland with a very sparse to sparse ground layer typically composed of a mixture of *Lepturus repens, Portulaca oleracea, Stenotaphrum micranthum* and seedlings of *Argusia argentea*	0.533	2, 6, 11, 12, 20, 23
Grasslands				
3a	*Lepturus repens* grassland to closed grassland	*Lepturus repens* grassland/ closed grassland +/- *Achyranthes aspera* +/- *Boerhavia albiflora* var. *albiflora* +/- *Portulaca oleracea*	0.008	
3e	*Lepturus repens/ Portulaca oleracea* grassland	*Lepturus repens/ Portulaca oleracea* open grassland +/- *Argusia argentea* seedlings present	0.067	5
5a	*Stenotaphrum micranthum* open grassland	*Stenotaphrum micranthum* open grassland with *Boerhavia albiflora* var. *albiflora*	0.023	
5b	*Stenotaphrum micranthum* closed grassland	*Stenotaphrum micranthum* closed grassland with *Boerhavia albiflora* var *albiflora* +/- *Achyranthes aspera* +/-*Tribulus cistoides*	0.001	
Herblands				
6a	*Boerhavia albiflora* var. *albiflora/ Portulaca oleracea* herbland	*Boerhavia albiflora* var. *albiflora/ Portulaca oleracea/ Tribulus cistoides* herbland	0.003	?9
6c	*Boerhavia albiflora* var. *albiflora/ Achyranthes aspera/ Portulaca oleracea* open herbland		0.181	16
8	*Achyranthes aspera/Portulaca oleracea/ Boerhavia albiflora* var. *albiflora* herbland to closed herbland	*Achyranthes aspera/ Portulaca oleracea* herbland/ *Boerhavia albiflora var. albiflora* to closed herbland with *Tribulus cistoides* +/- *Lepturus repens*	9.051	14, 15, 17, 25, M17
16a	*Portulaca oleracea* herbland to closed herbland	*Portulaca oleracea* herbland to closed herbland +/- *Achyranthes aspera* +/- *Boerhavia albiflora* var. *albiflora* +/- *Tribulus cistoides*	0.956	3, 4, 10, M16
16b	*Portulaca oleracea/Lepturus repens* closed herbland	*Portulaca oleracea/ Lepturus repens* closed herbland +/- *Boerhavia albiflora* var. *albiflora* +/- *Stenotaphrum micranthum* +/- *Tribulus cistoides*	3.139	7, 8, 18, 19
16c	*Portulaca oleracea/ Stenotaphrum micranthum/ Boerhavia albiflora* var. *albiflora* herbland	*Portulaca oleracea/ Stenotaphrum micranthum/ Boerhavia albiflora* var. *albiflora* herbland +/- *Tribulus cistoides* +/- *Lepturus repens*	0.542	13, 24
Human use – infrastructure				
I	Infrastructure	Automated weather station	0.006	
		Total vegetated area (ha)	23.943	

Note: Areas of sandy shores and rocky shores, particularly those of the rocky shores are only approximate due to the difficulty in determining the location of the boundary between the edge of the shoreline and the surrounding reef flat using the imagery.

The following pages contain photographs and descriptions of all the vegetation communities observed at the time of the May 2022 survey.

Photographs and descriptions of Cato Island vegetation communities

Shoreline, beaches and sand spit vegetation

1a **Sparse to open-grassland or herbland on sandy shorelines**

ground truthing sites: 1 and 21

Photo 12 Veg map unit 1a, Site 1, Cato Is.
Note *Argusia argentea* seedlings
Joy Brushe ©

Vegetation community 1a was present just above the high tide level and was more prevalent along the sandy leeward (northern) shoreline than on the more exposed windward shoreline. Vegetation in this community was dominated by *Lepturus repens* (stalky grass) and seedlings of *Argusia argentea* (octopus bush).

Vegetation in this community is highly dynamic, with plants constantly recruiting and establishing during periods of accretion and low intensity wave action and then disappearing as a consequence of high energy wave action, beach erosion and turtle nesting activity.

1b **sparse herbland on shoreline rubble banks**

No site data or photographs available for this unit

2a ***Argusia argentea* open shrubland to isolated shrubs on shorelines and sand spits**

ground truthing site: 22

Photo 13 Veg map unit 2a, site 22 Cato Is.
Joy Brushe ©

The shrubs in vegetation community 2a were quite low, one metre or lower and partially buried by sand. The sparse ground layer was dominated by *Lepturus repens* (stalky grass) in Site 22. *Argusia argentea* (octopus bush) seedlings were present in this community in most places along the shoreline.

2b **Coastline *Argusia argentea* dwarf shrubland/ shrubland to closed shrubland with a very sparse to sparse ground layer typically composed of a mixture of *Lepturus repens, Portulaca oleracea, Stenotaphrum micranthum* and seedlings of *Argusia argentea***

ground truthing sites: 2, 6, 11, 12, 20, 23

These shrublands were located on low dunes along the shoreline. The height of the shrubs varied from one to 2 metres and many of the shrubs were partially buried by sand.

Photo 14 Veg map unit 2b, Site 2 Cato Is.
Joy Brushe ©

Photo 15 Veg map unit 2b, site 12 Cato Is.
Joy Brushe ©

Grasslands and herblands

3a ***Lepturus repens* grassland/ closed grassland +/- *Achyranthes aspera* +/- *Boerhavia albiflora* var. *albiflora* +/- *Portulaca oleracea***

No site data available for this unit

Photo 16a (above) and b (below) Veg map unit 3a (foregrounds), western end of the Cato Is.
Joy Brushe ©

3e ***Lepturus repens/ Portulaca oleracea*** **open grassland +/-** ***Argusia argentea*** **seedlings**

ground truthing site: Site 5

Photo 17 a (above) and b (below) Veg map unit 3e, Site 5 Cato Is. Joy Brushe ©

This vegetation community was present on flats adjacent to the shoreline. The presence of dead shrub branches indicates that the vegetation in this community is pioneer vegetation re- establishing following death of previous shoreline *Argusia argentea* shrubland by either wave or turtle disturbance.

5a ***Stenotaphrum micranthum*** **open grassland with** ***Boerhavia albiflora*** **var.** ***albiflora***

No photos or site data available for this unit

5b *Stenotaphrum micranthum* closed grassland with *Boerhavia albiflora* var*. albiflora* +/- *Achyranthes aspera* +/-*Tribulus cistoides*

No photos or site data available for this unit

6a *Stenotaphrum micranthum* open grassland with *Boerhavia albiflora* var. *albiflora*

ground truthing site 9:

Photo 18 Veg map unit 6a, Site 9 Cato Is.
Joy Brushe ©

This site was present on a mid-slope. Soil was light brown sand with high organic content.

6c *Boerhavia albiflora* var. *albiflora/ Achyranthes aspera/ Portulaca oleracea* open herbland

ground truthing site 16:

Photo 19 Veg map unit 6c, Site 16 Cato Is.
Joy Brushe ©

This site was present on the crest of the interior plateau. Soil was light brown sand with some organic content and occasional fine coral rubble surface fragments.

8 *Achyranthes aspera/ Portulaca oleracea / Boerhavia albiflora* var. *albiflora* herbland to closed herbland with *Tribulus cistoides* +/- *Lepturus repens*

ground truthing sites: 14, 15, 17, 25 and BioCondition monitoring site M17

Photo 20 Veg map unit 8, Site 15 Cato Is. Joy Brushe ©

Photo 21 Veg map unit 8, Site 14 Cato Is Joy Brushe ©

Vegetation community 8 was by far the most abundant vegetation community on the cay, forming a dense cover over most of the central interior. Soil was typically light brown sand with high organic content.

16a ***Portulaca oleracea herbland to closed herbland +/- Achyranthes aspera +/- Boerhavia albiflora* var. *albiflora +/- Tribulus cistoides***

ground truthing sites: 3, 4, 10 and BioCondition monitoring site M16

Photo 22 Veg map unit 16a, site 3, Cato Is. Joy Brushe ©

This vegetation community was most prevalent on the windward side of the cay on the slopes to the central plateau. Soil was typically light grey-brown sand with some organic content and contained some fine coral fragments.

16b ***Portulaca oleracea/ Lepturus repens* closed herbland *+/- Boerhavia albiflora* var. *albiflora +/- Stenotaphrum micranthum +/- Tribulus cistoides***

ground truthing sites: 7, 8, 18, 19

Photo 23 Veg map unit 16b, Site 7, Cato Is. (AWS) in the background) Joy Brushe ©

Photo 24 Veg map unit 16b, Site 18, Cato Is. Joy Brushe ©

Vegetation community 16b covered large areas of the cay on the slopes to the central plateau. *Tribulus cistoides* was abundant in some places. Soil was typically light brown sand with some organic content.

16c ***Portulaca oleracea/ Stenotaphrum micranthum/ Boerhavia albiflora* var. *albiflora* herbland *+/- Tribulus cistoides +/- Lepturus repens***

ground truthing sites: 13, 24

Photo 25 Veg map unit 16c, Site 13, Cato Is. Joy Brushe ©

Photo 26 Veg map unit 16c, Site 24, Cato Is.
Joy Brushe ©

Vegetation community 16c was located in swales at the base of the slopes to the central plateau adjacent to the coastal communities on the leeward side of the cay. Soil was light coloured sand with some organic content and some coral rubble surface fragments.

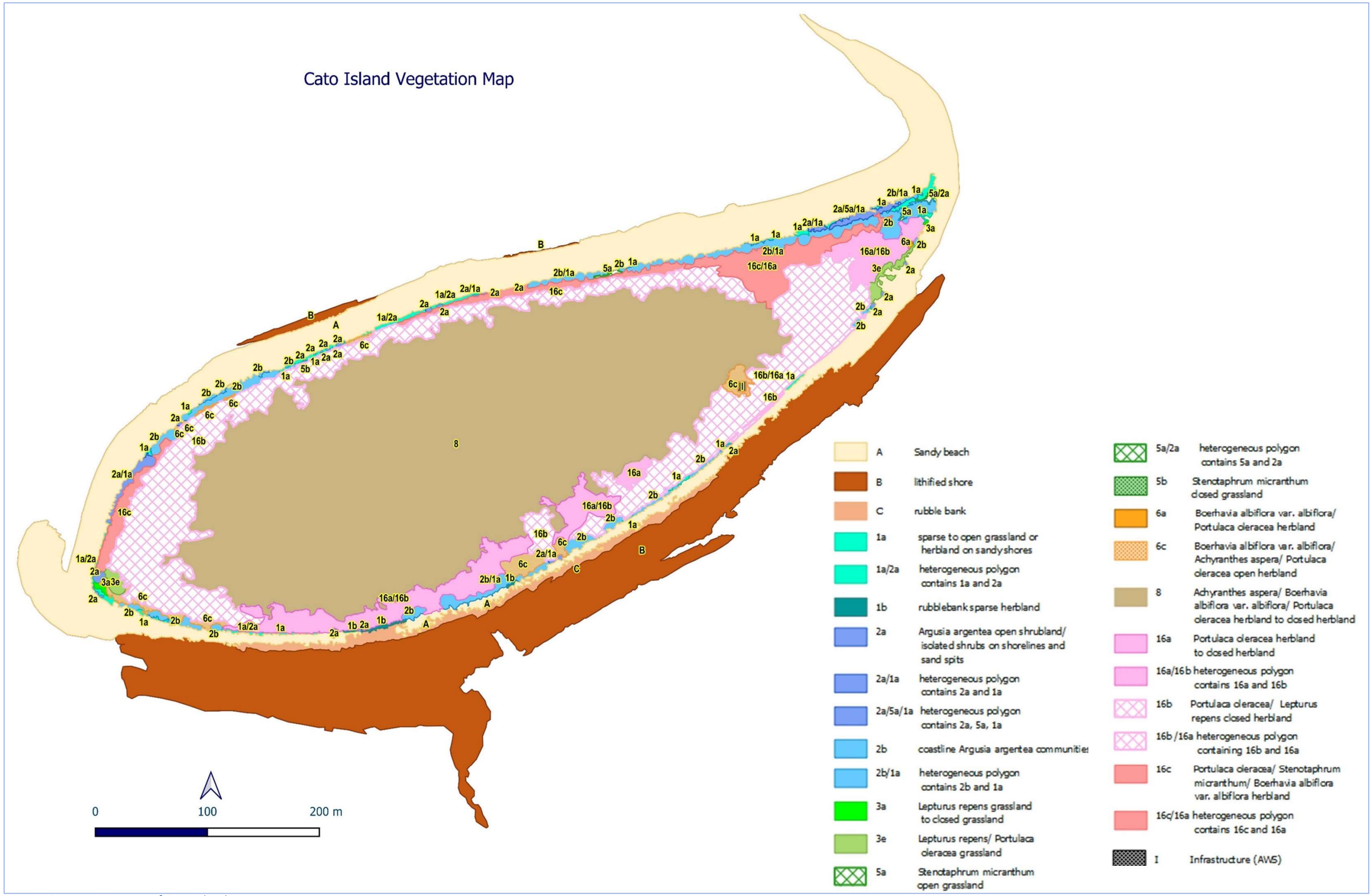


Figure 18 Vegetation map of Cato Island

Table 3 Site data recorded at Cato Island 25-26/05/2022

Datum = WGS 84; green shading = site dominants

											Upper Shrub Layer	Ground Layer															
Site	Lat	Long	Number of photos	Landform	Aspect	Estimated altitude	Soil Description	Total weed cover %	Veg map unit code	Community	Argusia argentea	Achyranthes aspera	Argusia argentea	Boerhavia albiflora var. albiflora	Lepturus repens	Portulaca oleracea	Stenotaphrum micranthum	Tribulus cistoides	Litter	Plant specimens collected	Notes	Birds	Start	Finish	Dominant growth form	Shrub Layer Height	T/S Canopy Crown Cover	Ground FPC
001	-23.248587	155.543548	2	beach	N	0	white sand with occasional medium coral rubble surface fragments	0	1a	sparse grassland dominated by Argusia argentea seedlings and Lepturus repens			trace-5%	trace-5%	trace-5%	trace-5%			trace-5%				12:14:06	12:25:13	grass			very sparse (<10%)
002	-23.248816	155.543296	2	dune		1	white sand with medium coral rubble surface fragments	0	2b	Argusia argentea shrubland with very sparse ground layer dominated by Stenotaphrum micranthum	50-75%				trace-5%	trace-5%	5-25%		5-25%			some red-footed boobies, some frigatebirds, some masked boobies	12:27:59	12:42:56	shrub 1-2m	1	mid-dense (>50-80%)	very sparse (<10%)
003	-23.248916	155.543383	3	flat		1	light coloured sand with fine coral rubble surface fragments	0	16a	Portulaca oleracea closed herbland						75-95%			trace-5%			some masked boobies, occasional brown boobies	12:45:10	12:52:27	forb			dense (>70)
004	-23.249134	155.542935	3	lower slope	N	2	light grey sand with some organic content	0	16a	Portulaca oleracea/ Tribulus cistoides closed herbland					trace-5%	50-75%		25-50%	trace-5%	Tribulus cistoides		large numbers masked boobies	12:57:09	13:03:40	forb			dense (>70)
005	-23.249425	155.543064	3	flat		2	white sand with medium coral rubble surface fragments	0	3e	Lepturus repens/ Portulaca oleracea open herbland; Argusia seedlings present		trace-5%	trace-5%	trace-5%	5-25%	5-25%		trace-5%	trace-5%		Dead Argusia argentea at this site	some masked boobies, some brown boobies	13:07:55	13:18:16	herb			sparse (10-30%)
006	-23.249623	155.543016	2	dune		1	white sand with fine coral rubble surface fragments	0	2b	Argusia argentea shrubland with very sparse ground layer dominated by Portulaca oleracea	50-75%				trace-5%	trace-5%			5-25%		Dead Argusia argentea at this site	large numbers red-footed boobies	13:20:48	13:32:20	shrub 1-2m	1	sparse (20-50%)	very sparse (<10%)
007	-23.249512	155.542768	3	lower slope	NE		light grey-brown sand with high organic content	0	16b	Portulaca oleracea/ Tribulus cistoides/ Lepturus repens closed herbland				5-25%	5-25%	25-50%		25-50%	trace-5%			large numbers masked boobies, some wedgetail shearwater burrows	13:35:59	13:48:30	herb			dense (>70)
008	-23.249917	155.542510	3	mid slope	NE	4	brown sand with high organic content	0	16b	Portulaca oleracea closed herbland				trace-5%	trace-5%	50-75%		5-25%	trace-5%			some masked boobies	13:53:46	14:02:31	forb			dense (>70)
009	-23.249601	155.542464	2	mid slope	N	3	light brown sand with high organic content	0	6a	Boerhavia albiflora var. albiflora/ Portulaca oleracea/ Tribulus cistoides herbland		trace-5%		5-25%	trace-5%	5-25%		5-25%	trace-5%			some masked boobies	14:08:56	14:15:20	forb			mid-dense (>30-70%)
010	-23.249205	155.542505	2	Depress-ion		2	light grey-brown sand with some organic content	0	16a	Portulaca oleracea/ Tribulus cistoides herbland				trace-5%		25-50%	trace-5%	5-25%	trace-5%			some brown noddies, some masked boobies	14:23:25	14:29:00	forb			mid-dense (>30-70%)
011	-23.249068	155.542545	2	dune		1	white sand with occasional fine coral rubble surface fragments	0	2b	Argusia argentea shrubland with very sparse ground layer dominated by Lepturus repens and Portulaca oleracea. Argusia seedlings present	50-75%		trace-5%		5-25%	5-25%	trace-5%		5-25%	Argusia argentea, Portulaca oleracea, Lepturus repens		some red-footed boobies	14:42:01	14:51:44	shrub 1-2m	2	mid-dense (>50-80%)	very sparse (<10%)
012	-23.249144	155.541962	3	dune		1	white sand	0	2b	Argusia argentea closed shrubland with very sparse ground layer dominated by Lepturus repens; Argusia seedlings present	75-95%		trace-5%		trace-5%	trace-5%	trace-5%	trace-5%	trace-5%	5-25%			large numbers red-footed boobies	14:53:56	15:01:52	shrub 1-2m	2	dense (>80%)	very sparse (<10%)
013	-23.249290	155.541890	3	swale		2	light coloured sand with some organic content	0	16c	Portulaca oleracea/ Stenotaphrum micranthum open herbland		trace-5%		trace-5%		5-25%	5-25%	trace-5%	5-25%	Stenotaphrum micranthum		occasional masked boobies	15:04:04	15:11:23	herb			sparse (10-30%)
014	-23.249604	155.542007	3	mid slope	NW	4	light brown sand with high organic content	0	8	Achyranthes aspera/ Portulaca oleracea/ Boerhavia albiflora var. albiflora closed herbland		25-50%		5-25%	trace-5%	25-50%	trace-5%	5-25%	5-25%	Achyranthes aspera Boerhavia albiflora var. albiflora		some masked boobies, occasional brown boobies, occasional brown noddies, abundant wedgetail shearwater burrows	15:13:42	15:21:52	herb			dense (>70)
015	-23.249799	155.541596	3	upper slope	NW	5	light brown sand with high organic content	0	8	Achyranthes aspera/ Boerhavia albiflora var. albiflora/ Portulaca oleracea closed herbland		25-50%		25-50%		25-50%		5-25%	trace-5%			some masked boobies, abundant wedgetail shearwater burrows, occasional brown boobies	15:26:07	15:32:58	forb			dense (>70)

											Upper Shrub Layer	Ground Layer																	
Site	Lat	Long	Number of photos	Landform	Aspect	Estimated altitude	Soil Description	Total weed cover %	Veg map unit code	Community	Argusia argentea	Achyranthes aspera	Argusia argentea	Boerhavia albiflora var. albiflora	Lepturus repens	Portulaca oleracea	Stenotaphrum micranthum	Tribulus cistoides	Litter	Plant specimens collected	Notes	Birds	Start	Finish	Dominant growth form	Shrub Layer Height	T/S Canopy Crown Cover	Ground FPC
016	-23.250283	155.541893	3	crest		6	light brown sand with some organic content, occasional fine coral rubble surface fragments	0	6c	Boerhavia albiflora var. albiflora/ Achyranthes aspera/ Portulaca oleracea open herbland		5-25%		5-25%	5-25%	5-25%	trace-5%	5-25%	trace-5%		Disturbed area. Site of Automated Weather Station	occasional brown boobies, occasional masked boobies, abundant wedgetail shearwater burrows	15:45:21	15:54:03	herb			sparse (10-30%)
017	-23.249994	155.542101	3	upper slope	NNE	6	brown sand with high organic content	0	8	Achyranthes aspera/ Portulaca oleracea closed herbland		25-50%		5-25%	5-25%	25-50%		5-25%	5-25%			some brown boobies, some masked boobies, abundant wedgetail shearwater burrows	15:57:42	16:09:35	forb			dense (>70)
018	-23.250264	155.542268	2	mid slope	ESE	5	light brown sand with some organic content	0	16b	Lepturus repens/ Portulaca oleracea closed herbland		trace-5%		trace-5%	25-50%	25-50%		trace-5%	trace-5%			some brown noddies, some masked boobies, some wedgetail shearwater burrows	16:11:42	16:18:05	herb			dense (>70)
019	-23.250938	155.541539	2	mid slope	E	4	light brown sand with some organic content	0	16b	Portulaca oleracea/ Lepturus repens/ Stenotaphrum micranthum closed herbland				trace-5%	25-50%	25-50%	5-25%	trace-5%	5-25%			occasional brown noddies, occasional wedgetail shearwater burrows	16:22:31	16:30:32	grass			dense (>70)
020	-23.251025	155.541593	3	lower slope	E	1	white sand	0	2b	Argusia argentea shrubland with very sparse ground layer dominated by Portulaca oleracea; Argusia seedlings present	50-75%		trace-5%		trace-5%	trace-5%			5-25%				16:31:32	16:37:01	shrub 1-2m	2	mid-dense (>50-80%)	very sparse (<10%)
021	-23.249037	155.542154	3	beach		0	white sand with occasional fine coral rubble surface fragments	0	1a	sparse grassland dominated by Argusia argentea seedlings and Lepturus repens			trace-5%	trace-5%	trace-5%								8:57:24	9:02:11	herb			very sparse (<10%)
022	-23.251916	155.536844	3	dune		1	white sand with coral rubble fragments in soil occasional medium coral rubble surface fragments	0	2a	Argusia argentea dwarf shrubland with sparse ground layer dominated by Lepturus repens; Argusia seedlings present	25-50%		trace-5%	trace-5%	5-25%	trace-5%	trace-5%		trace-5%			occasional red-tailed tropic birds	9:19:07	9:30:36	shrub <1m	1	sparse (20-50%)	sparse (10-30%)
023	-23.252036	155.537117	2	dune		1	white sand	0	2b	Argusia argentea shrubland with very sparse ground layer dominated by Lepturus repens; Argusia seedlings present	50-75%		trace-5%		trace-5%				5-25%			large numbers red-footed boobies	9:33:47	9:46:08	shrub 1-2m	1	mid-dense (>50-80%)	very sparse (<10%)
024	-23.251205	155.537070	3	swale		1	light coloured sand with occasional medium coral rubble surface fragments	0	16c	Portulaca oleracea/ Stenotaphrum micranthum herbland				trace-5%	5-25%	25-50%	5-25%		5-25%			some masked boobies	9:47:16	9:53:23	herb			mid-dense (>30-70%)
025	-23.251531	155.537715	3	mid slope	WSW	4	light brown sand with high organic content	0	8	Achyranthes aspera/ Boerhavia albiflora var. albiflora/ Portulaca oleracea/ Tribulus cistoides closed herbland		5-25%		5-25%	trace-5%	5-25%		5-25%	5-25%			some masked boobies, abundant wedgetail shearwater burrows	9:57:47	10:10:24	forb			dense (>70)
M16	-23.249548	155.542525	10	mid slope	N	3	light brown sand with high organic content	0	16a	Portulaca oleracea herbland		trace-5%		5-25%	trace-5%	25-50%		5-25%	5-25%			shearwater burrows present, some masked boobies	11:00:00	12:00:00	forb			mid-dense (>30-70%)
M17	-23.250792	155.538091	10				light brown sand with high organic content	0	8	Achyranthes aspera/ Portulaca oleracea/ Boerhavia albiflora var. albiflora closed herbland		25-50%		5-25%		5-25%		5-25%	5-25%			abundant shearwater burrows	12:20:00	13:00:00	forb			dense (>70)

Comparison with previous vegetation surveys

In 1979, Heatwole described the vegetation of Cato Island as “covered with coarse tufted grass and creeping plants which are in parts 3 to 4 feet high, affording cover to numerous birds”. The Australian Pilot (in Heatwole, 1979) noted that in 1902 there appeared to be little or no vegetation on the island and that wells sunk on the island failed to find any fresh water.

According to Stokes and McNamara (1979) there was only one young plant of *Argusia argentea* (octopus bush), named *Messerschmidia argentea* at that time, on Cato Island. The location of this plant is shown in *Figure 19*. Shaughnessy and Hill (1983) also noted that, “The solitary bush of *Argusia argentea* on Cato Island was very stunted (about 30cm high). It covered an area of about two square metres.” Since 1983, large numbers of *Argusia argentea* have established and have formed shrubland communities growing around most of the shoreline These can be seen in the 2022 drone images in *Figure 15, Figure 16 and Figure 17* and the vegetation community photos in the previous section. Current recruitment of this species was evident in the large numbers of *Argusia argentea* seedlings present in vegetation community 1a along the shoreline at the time of the 2022 survey.

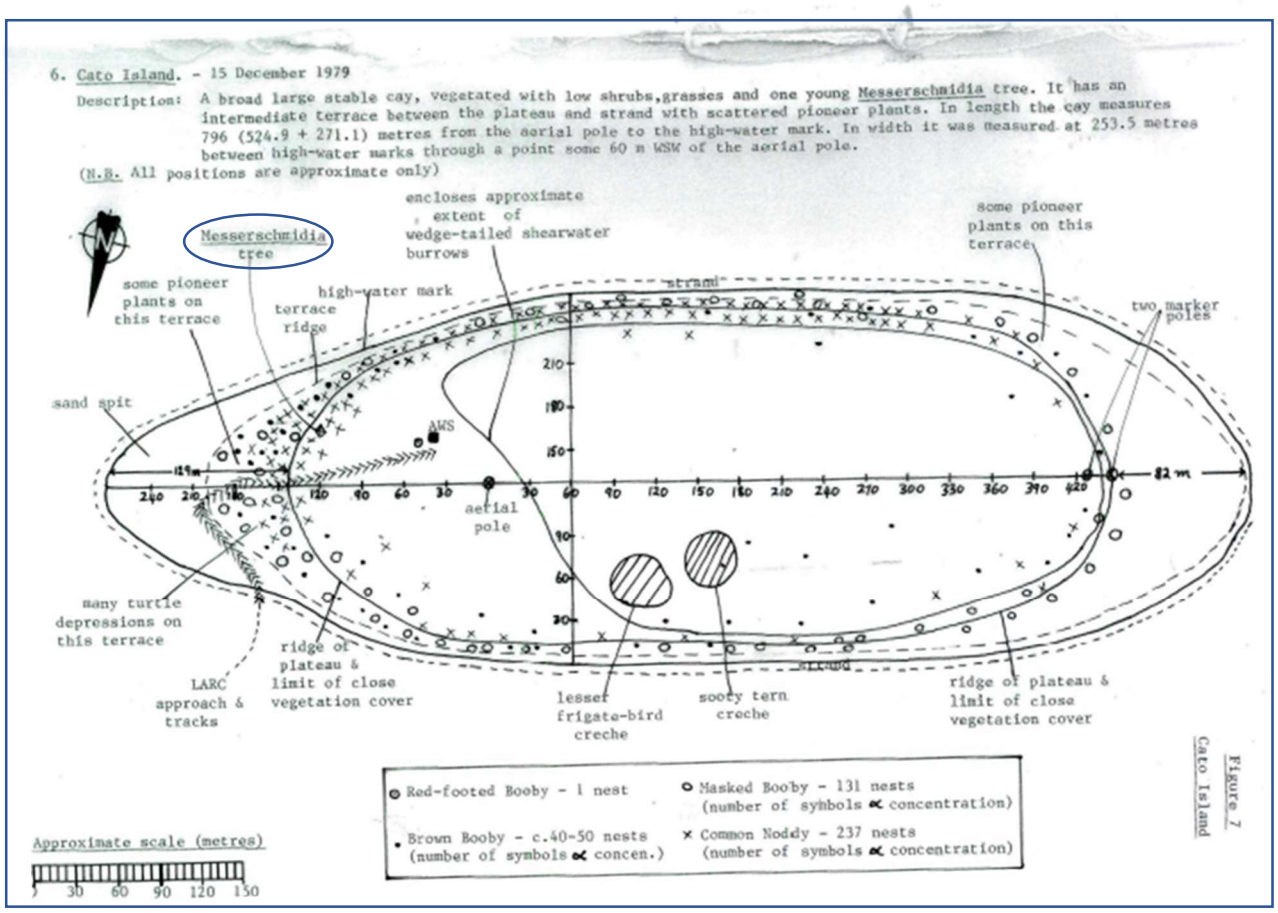


Figure 19 Vegetation, bird and marine turtle data recorded on Cato Island in 1979 (source Stokes and McNamara, 1979) – note the location of the single young Argusia argentea plant adjacent to the eastern shoreline (circled)

Shaughnessy and Hill (1983) noted that. “The grass, *Lepturus repens* was common and dominant everywhere”. They recorded and collected 7 species on Cato Island in 1983. These species were confirmed by the National Herbarium in Canberra as *Argusia argentea, Achyranthes aspera* (chaff flower), *Boerhavia albiflora* (tar vine)*, Portulaca oleracea* (pig weed), *Tribulus cistoides, Lepturus repens* (stalky grass) and *Stenotaphrum micranthum* (beach buffalo grass). These species were the same as those recorded during the 2022 survey.

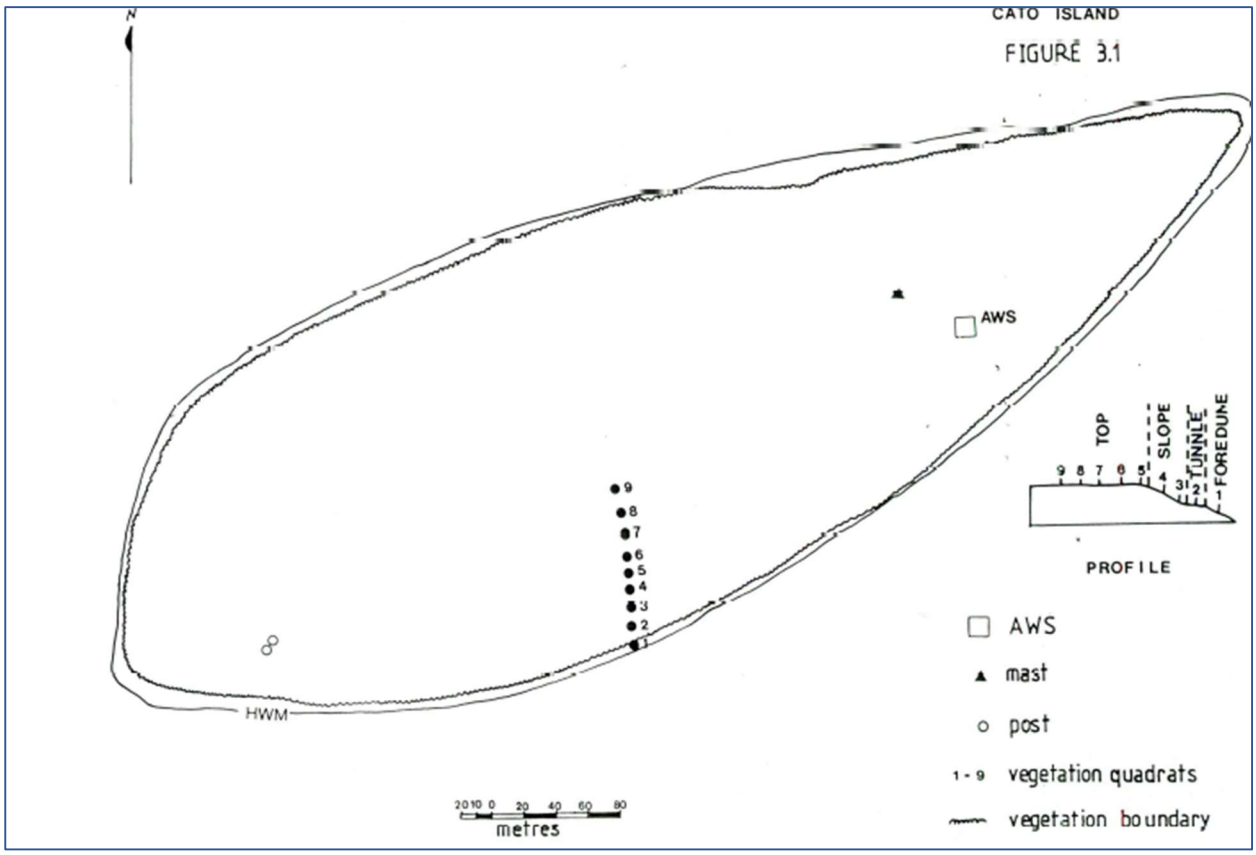


Figure 20 Map showing location of 1983 vegetation transects (Hill, 1984)

Shaughnessy and Hill recorded the average percentage cover of all plant species in nine quadrats across the cay. The average percentage covers and the number of quadrats in which the species was recorded for these species were:

Argusia argentea	0% (0)
Achyranthes aspera	0% (0)
Boerhavia albiflora	10% (8)
Portulaca oleracea	1% (1)
Tribulus cistoides	7% (3)
Lepturus repens	45% (8)
Stenotaphrum micranthum	6% (2)

The location of the 9 quadrats is shown in *Figure 20*. As Shaughnessy and Hill noted in their report, nine quadrats would not be a statistically valid sample. Although data was recorded from a larger number of sites (25 sites) during the 2022 survey these sites did not include some large sections of the island, so the cover data in *Table 1* may also not accurately represent the average covers of individual species across the entire island. So, although it appears that there have been considerable increases in the covers of *Argusia argentea, Achyranthes aspera* (chaff flower) and *Portulaca oleracea* (pigweed) and a considerable decrease in the cover of *Lepturus repens* (stalky grass) since 1989, these observations cannot be conclusive.

BioCondition monitoring site data

Two permanently marked BioCondition monitoring sites (M16 and M17) were established and surveyed on Cato Island. The location of the centre transect of these sites are shown as the red lines in *Figure 17*. *Table 4* and *Table 5* contain the data recorded at these sites. The photographs included with the BioCondition attribute data are four of the 10 site photographs taken at each of these sites. Photographs shown are all taken from the centre point of the centre transect, the first facing along the transect bearing and then consecutively facing 90°, 180^0 and 270^0 from the direction of the centre transect bearing.

BioCondition attributes

Table 4. BioCondition attribute data recorded in monitoring site M16, Cato Island on 26 May 2022

Site M16	
Cay	Cato Island
Vegetation community description	*Portulaca oleracea* herbland
Transect start (WGS 84)	-23.249362 155.542444
Transect Centre (WGS84)	-23.249548 155.542525
Transect end (WGS 84)	-23.249778 155.542601
Transect bearing (degrees)	153
Median canopy height/range (metres)	0.25/0.05-0.3
Tree canopy cover %	n/a
Shrub canopy cover %	n/a
Basal area m^2/ha (at 30 cm height, calculated	n/a
Total number of large trees/ha	0
Total no of trees per ha	n/a
Total number of tree stems/ha	n/a
Total no. shrubs/ha	0
Total no. shrub stems/ha	n/a
Large shrubs – mean diameter at 30 cm height	n/a
Recruitment of ecologically dominant layer (%)	n/a
Tree species richness	0
Tree species present	n/a
Shrub species richness	0
Shrub species present (layer in brackets)	n/a
Median ground layer height/range (metres)	0.25/0.05-0.3
Total ground layer cover of native cay species	61.2%
Grass species richness	1
Grass cover (%)	3.6%
Grass species present in order of decreasing	*Lepturus repens* (3.6%)
Forb (including vines) species richness	4
Forb species cover (%)	57.6%
Forb species present in order of decreasing cover – most abundant first (cover in brackets)	*Portulaca oleracea* (36.6%), *Tribulus cistoides* (11.8%), *Boerhavia albiflora* var. *albiflora* (9.2%), *Achyranthes aspera* (<0.1%)
Native shrub ground cover (%)	0%
Non-native plant cover (all strata) (%)	0%
Litter cover (%)	5.4%
Bare ground (%)	33.4%
Woody debris (m/ha of Logs >0.5m long and	0
Soil pH	8.54 (average for 0-30cm depths)

Photo 27
Monitoring site M16, Cato Island facing SSE

Photo 28
Monitoring site M16, Cato Island facing WSW

Photo 29
Monitoring site M16, Cato Island facing NNW

Photo 30
Monitoring site M16, Cato Island facing ENE

Joy Brushe ©

Table 5 BioCondition attribute data recorded in monitoring site M17, Cato Island on 26 May 2022

Site M17	
Cay	Cato Island
Vegetation community description	closed herbland dominated by *Achyranthes aspera*, *Portulaca oleracea* and *Boerhavia albiflora* var. *albiflora*
Transect start (WGS 84)	-23.250598 155.53799
Transect Centre (WGS84)	-23.250792 155.538091
Transect end (WGS 84)	-23.250997 155.538193
Transect bearing (degrees)	153
Median canopy height/range (metres)	0.25/0.15-0.4
Tree canopy cover %	n/a
Shrub canopy cover %	n/a
Basal area m^2/ha (at 30 cm height, calculated from stem diameters)	n/a
Total number of large trees/ha	0
Total no of trees per ha	n/a
Total number of tree stems/ha	n/a
Total no. shrubs/ha	0
Total no. shrub stems/ha	n/a
Large shrubs – mean diameter at 30 cm height	n/a
Recruitment of ecologically dominant layer (%)	n/a
Tree species richness	0
Tree species present	n/a
Shrub species richness	0
Shrub species present (layer in brackets)	n/a
Median ground layer height/range (metres)	0.25/0.15-0.4
Total ground layer cover of native cay species (%)	78.6%
Grass species richness	2
Grass cover (%)	0.4%
Grass species present in order of decreasing cover – most abundant first (cover in brackets)	*Lepturus repens* (0.2%), *Stenotaphrum micranthum* (0.2%)
Forb (including vines) species richness	4
Forb species cover (%)	78.2%
Forb species present in order of decreasing cover – most abundant first (cover in brackets)	*Achyranthes aspera* (35%), *Portulaca oleracea* (24.4%), *Boerhavia albiflora* var. *albiflora* (13%), *Tribulus cistoides* (5.8%)
Native shrub ground cover (%)	0%
Non-native plant cover (all strata) (%)	0%
Litter cover (%)	5%
Bare ground (%)	16.4%
Woody debris (m/ha of logs >0.5m long and >10cm wide)	0
Soil pH	8.22 (average for 0-30cm depths)

Photo 31
Monitoring site
M17, Cato Island
facing SSE

Photo 32
Monitoring site
M17, Cato Island
facing WSW

Photo 33
Monitoring site
M17, Cato Island
facing NNW

Photo 34
Monitoring site
M17, Cato Island
facing ENE

Joy Brushe ©

Soil data

Soil samples were collected from BioCondition monitoring sites M16 and M17 on Cato Island.

Refer to *Appendix 5* for results of all the soil analyses for M16 and M17 and the other sites sampled during the 2022 voyage. For comparison of M16 and M17 soil analysis data with data from previous Coral Sea and Southern GBR soil surveys, refer to the Soils section under the *Methodologies, general results and discussion* in this report.

Total sulphur levels at all 2022 sample sites were high – Refer to *Figure 13* and explanatory text in the Soils section under *Methodologies, general results and discussion* in this report.

M16

Organic carbon levels at M16 were higher and total sodium levels were slightly higher than at all other locations previously sampled.

Total phosphorus levels were higher than at all other sites (except for the grey water outlet site and the Coastal *Argusia argentea* site on South Islet (Willis Islets) which had much higher total phosphorus than all the other sites).

Total potassium levels were higher than in the interior herblands of the Willis islets, Diamond Islets, Lihou Reef cays and Bird Islet.

Other interior herbland locations had slightly higher aluminium levels than soils at M16 (except for the grey water outlet site on South Islet (Willis Islets) which had much higher total aluminium than all the other interior herbland locations.

pH, electrical conductivity, total nitrogen, total carbon, total and Colwell phosphorus, total calcium, exchangeable potassium, total and exchangeable magnesium and exchangeable sodium levels were similar to those of other Interior herbland locations.

Exchangeable calcium, cation exchange capacity and levels of all the trace elements (copper, iron, manganese and zinc) were similar to other Interior herbland locations except for the grey water outlet site on South Islet (Willis Islets) sites which had higher exchangeable calcium, cation exchange capacity and considerably higher levels of all trace elements (particularly iron) than all the other locations.

M17

Total phosphorus and all trace elements (copper, iron, manganese and zinc) levels were higher and electrical conductivity levels were slightly higher than at all other interior herbland locations except for the grey water outlet site on South Islet (Willis Islets) which had higher total phosphorus and much higher trace element levels (particularly iron) than all other interior herbland locations.

Colwell phosphorus and total potassium levels were higher than soils on all other internal herblands except for the interior herbland site on Bird Islet (M19).

Organic carbon levels were higher than those in herbland sites on the Willis Islets, Diamond Islets and Lihou Reef cays.

Total sodium levels were slightly higher than those in most interior herbland locations. Exchangeable sodium levels were higher than in most interior herbland locations except for the averaged interior herbland sites on the Coringa Herald cays and the grey water outlet site on South Islet (Willis Islets) both of which had only slightly higher levels.

Exchangeable calcium and cation exchange capacity had similar levels to other sites except for the grey water outlet site on South Islet (Willis Islets) which had higher exchangeable calcium and cation exchange capacity than all the other interior herbland locations.

Total and exchangeable magnesium levels were lower than those in other interior herbland locations.

pH, electrical conductivity, total nitrogen, total carbon, total calcium levels were similar to those of other interior herbland locations except for the North Cay (Willis Islets) site which had a much higher pH than the other interior herbland locations.

Exchangeable calcium, exchangeable potassium levels , cation exchange capacity levels and total aluminium levels were similar to those of other interior herbland locations except for the Coringa Herald cays which had higher average exchangeable potassium than the other interior herbland locations and the grey water outlet site on South Islet (Willis Islets) which had higher exchangeable calcium, higher cation exchange capacity and much higher aluminium levels than all the other interior herbland locations.

2.1.4 Birds

Table 6 Bird species and their breeding status – Cato Island

Cato Island	25/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	<10	<10	0
great frigatebird	*Fregata minor*	25		2	27	28
lesser frigatebird	*Fregata ariel*	408		103	511	474
masked booby	*Sula dactylatra dactylatra*	239		1	240	1003
brown booby	*Sula leucogaster*	327	19	47	393	373
red-footed booby	*Sula sula*	388			388	526
sooty tern	*Onychoprion fuscatus*	0	0	0	0	>8750
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	0	0	13
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	0
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	P	0	0	P	P
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	≥1	≥1	P
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	2
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	1
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	13
ruddy turnstone	*Arenaria interpres*	0	0	0	0	7
wandering tattler	*Tringa incana*	0	0	0	0	1
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- Drone footage was required to complete the lesser frigatebird breeding count. Accurate ground counts were hindered by thick vegetation.
- The majority of brown noddies were adolescents and adults. Some adults were nest building while others had nests with eggs on the southern edge of the cay.
- Two female great frigatebirds with red orbital rings were observed. One on a nest. Most female great frigatebirds in the Pacific Ocean have blue orbital rings. These birds could be from Indian Ocean colonies.
- A small number of fledged wedge-tailed shearwaters were at burrow entrances. Most had perished. These are the last of the birds from the previous breeding event.
- No nesting sooty terns were observed. Adult numbers increased dramatically from midday. The adult numbers shown in the table were an estimation with more arriving after the survey.

- Two sacred kingfishers were observed. This species is common on islands in the Great Barrier Reef, but less so on the remote Coral Sea cays.
- A freshly deceased (probably the morning of the survey) white-faced heron was recorded. Hermit crabs would be on the carcass if the bird had died the previous day.

Photo 35 Last of the fledged wedge-tailed shearwaters Collette Bagnato © Queensland Government

Photo 36 Deceased white-faced heron Collette Bagnato © Queensland Government

Photo 37 Masked booby colony on the island and incoming sooty terns
Collette Bagnato © Queensland Government

Photo 38 Drone imagery showing part of the lesser frigatebird colony
Jake Sanders © Queensland Government

2.1.5 Pest and invertebrate sampling

(Refer to Health Check section for map)

25-26 May 2022

Table 7 Rodents, Cato Island

Collection period	Sampling methods	Sampling sites	Species
overnight	baited tunnel traps/ink pads	11	0

Rodent sampling was spread across Cato Island and included several vegetation types, island infrastructure and typical island landing/access areas. Hermit crabs *Coenobita* sp. were collected at several trap sites. No evidence of rodents was observed.

Table 8 Invertebrates, Cato Island

Collection period	Sampling methods	baited sites	Species
daylight search	Bait station and ground search	24	See below

Order	Family	Spp ID	Common name
Hymenoptera	Formicidae	*Pheidole megacephala*	African big-headed ant
Ixodida	Argasidae	*Ornithodoros capensis*	Argasid tick

Multiple specimens of a single species of ant, *Pheidole megacephala,* were collected at 13 of the 24 collection sites. This exotic species has been associated with ecosystem changing events on islands in the Great Barrier Reef Marine Park, notably the *Pisonia grandis* forest at Tryon Island in the Capricornia Cays (Olds, 2018). The species has been recorded on Willis Island (Olds et al., 2020) and on many other islands within the Great Barrier Reef Marine Park, including islands with *Pisonia* forest. Not all islands have shown adverse impacts at this point. It is however an introduced species and further consideration to its actual threat at Cato Island warrants further discussion.

The Argasid tick is a widespread species associated with seabirds. There is no concern around its presence at Cato Island.

2.1.6 Health Checks and Island Watch

Ten Health Checks (HC) assessed the condition of vegetation communities across Cato Island. *Table 10* summarises vegetation communities at each site.

The overall condition class of the island's vegetation communities was **Good** (the highest rating, see Table 9 Assessed condition class for each HC site *Table 9*). Detailed criteria for each HC site are included in *Appendix 8*.

Table 9 Assessed condition class for each HC site

	Cato Island, Cato Reef			
HC Site	Overall condition class			
HC01	Good	Good with concern	Significant concern	Critical
HC02	Good	Good with concern	Significant concern	Critical
HC03	Good	Good with concern	Significant concern	Critical
HC04	Good	Good with concern	Significant concern	Critical
HC05	Good	Good with concern	Significant concern	Critical
HC06	Good	Good with concern	Significant concern	Critical
HC07	Good	Good with concern	Significant concern	Critical
HC08	Good	Good with concern	Significant concern	Critical
HC09	Good	Good with concern	Significant concern	Critical
HC10	Good	Good with concern	Significant concern	Critical

Table 10 Summary of vegetation communities around each HC site (reference with *Table 2* and *Figure 21*)

HC Site	Ecosystems/vegetation communities				
HC01	1a	2b	5a	6a	
HC02	16a	16b	16c		
HC03	2b	6c	16b		
HC04	2a	3a	3e	6c	16b
HC05	1a	1b	2b	16a	16b
HC06	8				
HC07	2b	16b	16c	8	
HC08	16a	16b			
HC09	8				
HC10	15a	16b	16c		

Some dieback was noted in *Argusia argentea* communities, but this was not considered unusual. Probably the result of natural weather or biological conditions (bushes heavily used by roosting birds often display some sort of defoliation or dieback).

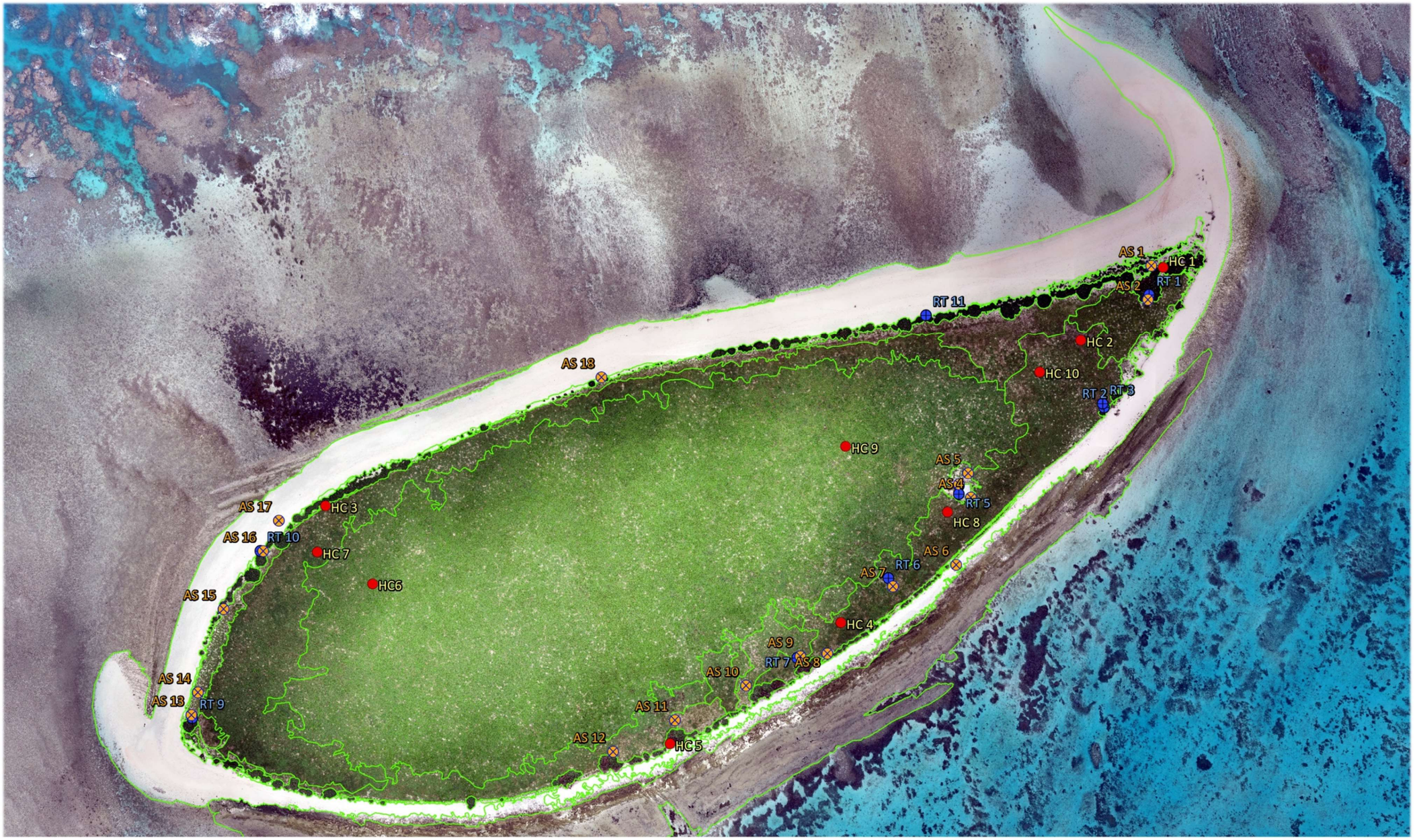
Island Watch

A summarised table of all Island Watch information gathered throughout the trip can be found at *Appendix 9.*

The full series of HC photos will be provided to PAD. Examples are provided below.

Photo 39 HC01 South

Photo 40 HC06 East



Cato Island, Cato Reef

Area: 14.8 ha (area above HAT)

- Vegetation communities
- Health check
- Rodent tunnel
- Ant bait station

Figure 21 Cato Island Health Check and pest station sites

2.2 West Islet, Wreck Reefs

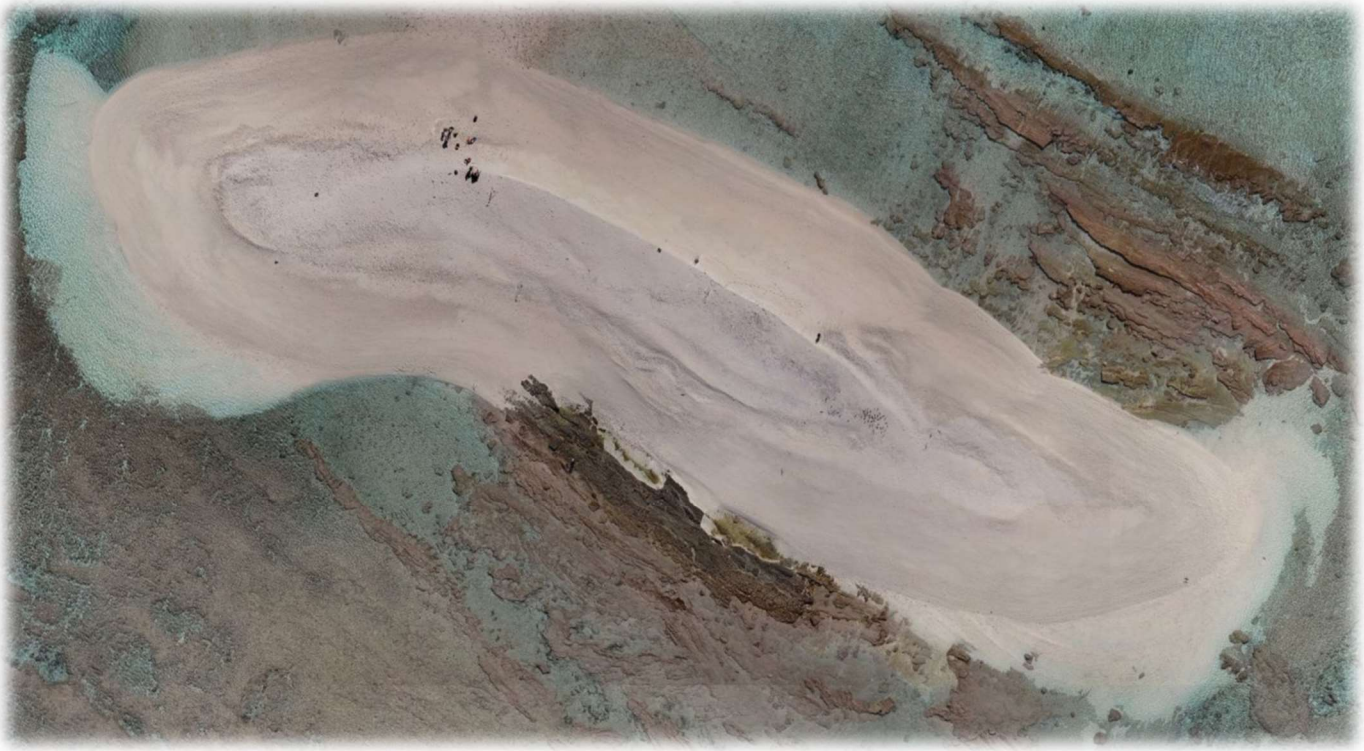


Figure 22 West Islet Jake Sanders © Queensland Government

2.2.1 Drone imagery

Capture date - 27 May 2022

Drone - Phantom 4 RTK

- Image capture height 60m
- Resolution 1.7cm/px
- Map stitching software – Drone Deploy

2.2.2 Physical description

- Low tide extent 171m x 43m
- Approximate high tide extent 123m x 14m
- Approximate area above high tide 0.19ha

West Islet, shown in *Figure 22,* is an unvegetated sand and coral rubble cay located at 441km north-east of Gladstone, Queensland at -22.1888 degrees latitude and 155.1758 degrees longitude.

2.2.3 Vegetation

On the 27th of May 2022, West Islet was unvegetated.

Photo 41 Dubois' sea snake *Aipysurus duboisii* Andrew McDougall © Queensland Government

Photo 42 Pale edged scales of Dubois' sea snake. Two specimens were observed on West Islet.
Andrew McDougall © Queensland Government

2.2.4 Birds

Table 11 Bird species and their breeding status – West Islet, Wreck Reefs

West Islet	27/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	0
lesser frigatebird	*Fregata ariel*	0	0	0	0	0
masked booby	*Sula dactylatra dactylatra*	0	0	0	0	2
brown booby	*Sula leucogaster*	0	0	0	0	19
red-footed booby	*Sula sula*	0	0	0	0	0
sooty tern	*Onychoprion fuscatus*	0	0	0	0	6
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	11	17	0	28	41
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	0
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	6	1	1	8	230
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	0
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- Seabird breeding effort is governed by the availability of suitable nesting habitat. This unvegetated islet is susceptible to physical changes through wind and water movement. Direct comparison of breeding effort (breeding trends) over time is not recommended without taking into consideration the available habitat during each survey.
- The breeding absence of large seabird species may reflect the dynamic characteristics of this cay and the birds' requirements for a stable breeding substrate over the several months of their breeding cycle.

Photo 43 Crested tern chick with adults Andrew McDougall © Queensland Government

Photo 44 Brown noddy young with adult Andrew McDougall © Queensland Government

2.2.5 Pest and invertebrate sampling

Rodents – unvegetated cay, no rodent tunnels deployed

Table 12 Invertebrates West Islet, Wreck Reefs

Collection period	Sampling methods	Sampling sites	Species
daylight search	ground search	not applicable	Nil

2.2.6 Health Checks and Island Watch

One Health Check was assessed at West Islet, Wreck Reefs.

The overall condition class of the island's ecosystem was Good (the highest rating, see *Table 13*). Detailed criteria for each HC site are included in *Appendix 8*.

Table 13 Assessed condition class for each HC site

	West Islet, Wreck Reefs			
HC Site	Overall condition class			
HC11	Good	Good with concern	Significant concern	Critical

Table 14 Summary of ecosystem type around each HC site (refer to *Figure 23)*

HC Site	Ecosystems/vegetation communities
HC11	Unvegetated, sandy substrate, fine sediments with coral rubble

Photo 45 West Islet, HC11 West

Island Watch

A summarised table of all Island Watch information gathered throughout the trip can be found at *Appendix 9*.

West Islet, Wreck Reefs

Area: Approx. 0.772 ha (area above HAT)
Approx. 1.284 ha (total area of cay)

- Health check

0 5 10 20 30 40 50 Metres

Printed on: 17/11/2022

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS1984

Figure 23 Health Check sites on West Islet, Wreck Reefs

2.3 Hope Cay, Wreck Reefs

Figure 24 Hope Cay, Wreck Reefs Jake Sanders © Queensland Government

2.3.1 Drone imagery

27 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 50m
- Resolution 1.4cm/px
- Map stitching software – Drone Deploy

2.3.2 Physical description

- Low tide extent 230m x 36m
- Approximate high tide extent 143m x 18m
- Approximate area above high tide 0.21ha

Hope Cay, shown in *Figure 24,* is an unvegetated sand and coral rubble cay located at 447km north-east of Gladstone at -22.213 degrees latitude and 155.248 degrees longitude.

2.3.3 Vegetation

On the 27th of May 2022, Hope Cay was unvegetated.

2.3.4 Birds

Table 15 Bird species and their breeding status – Hope Cay, Wreck Reefs

Hope Cay	27/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	0
lesser frigatebird	*Fregata ariel*	0	0	0	0	0
masked booby	*Sula dactylatra dactylatra*	0	0	0	0	2
brown booby	*Sula leucogaster*	0	0	0	0	37
red-footed booby	*Sula sula*	0	0	0	0	0
sooty tern	*Onychoprion fuscatus*	0	0	0	0	1
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	0	0	0
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	0
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	280-320	0	0	280-320	510
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	0
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- Brown noddy nests (with eggs) were positioned at the highest section of the cay.
- This area also contained turtle pits, the undulations making an accurate count of breeding pairs difficult (keeping in mind distance to minimise disturbance was maintained). Some birds appeared to be on nests but were only roosting in a similar manner. The numbers in the table are a confidence range of the true number of breeding pairs.
- Cay stability may be too variable and unstable at this time for larger seabirds to attempt nesting.

Photo 46 Brown noddy colony at Hope Cay Collette Bagnato © Queensland Government

2.3.5 Pest and invertebrate sampling

Rodents – unvegetated cay, no rodent tunnels deployed.

Table 16 Invertebrates, Hope Cay, Wreck Reefs

Collection period	Sampling methods	Bait stations	Species
daylight search	ground search	0	Nil

2.3.6 Health Checks and Island Watch

Two Health Checks were assessed at Hope Cay, Wreck Reefs.
The overall condition class of the cay's ecosystem was **Good** (the highest rating, see *Table 17*). Detailed criteria for each HC site are included in *Appendix 8*.

Table 17 Assessed condition class for each HC site

Hope Cay, Wreck Reefs				
HC Site	Overall condition class			
HC12	Good	Good with concern	Significant concern	Critical
HC13	Good	Good with concern	Significant concern	Critical

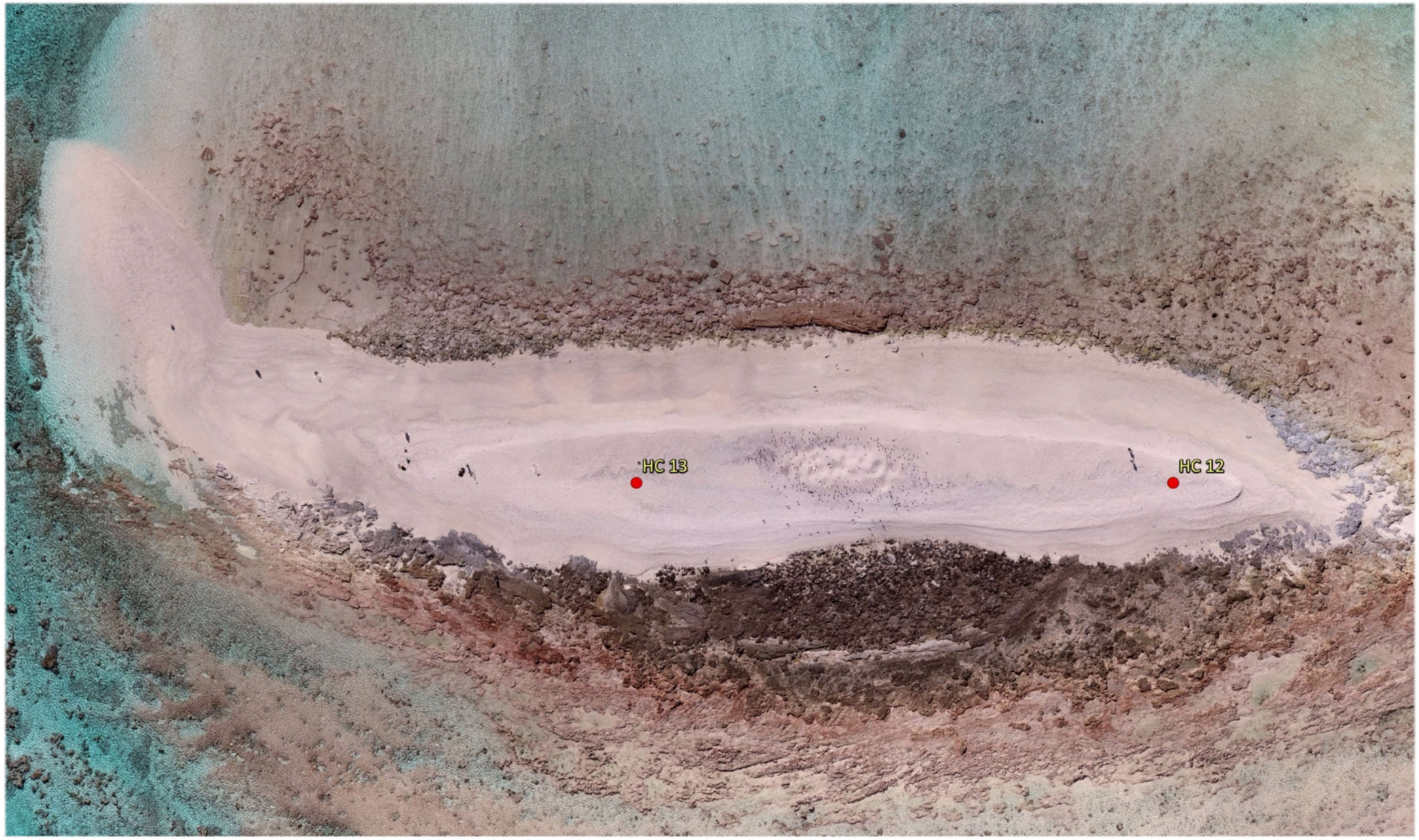
Table 18 Summary of ecosystem type around each HC site (refer to *Figure 25*)

	Ecosystems/vegetation communities
HC12	Unvegetated, sandy substrate, fine sediments with coral rubble
HC13	Unvegetated, sandy substrate, fine sediments with coral rubble

Photo 47 Hope Cay HC12 West

Island Watch

A summarised table of all Island Watch information can be found at *Appendix 9*.



Hope Cay, Wreck Reefs

Area: Approx. 0.245 ha (area above HAT)
Approx. 0.929 ha (total area of cay)

- Health check

0 5 10 20 30 40 50 Metres

Printed on: 17/11/2022

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS1984

Figure 25 Health Check sites on Hope Cay, Wreck Reefs

2.4. Porpoise Cay, Wreck Reefs

Figure 26 Porpoise Cay Jake Sanders © Queensland Government

2.4.1 Drone imagery

27 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 50m
- Resolution 1.5cm/px
- Map stitching software – Drone Deploy

2.4.2 Physical description

- Low tide extent (sand) 151m x 57m
- Approximate high tide extent 126m x 40m
- Approximate area above high tide 0.38ha
- Approximate vegetated extent 85m x 25.5m
- Vegetated area 0.2ha

Porpoise Cay, shown in *Figure 26,* is located 492 km NE of Gladstone on Wreck Reefs at -22.191 degrees latitude and 155.351 degrees longitude. It is the smallest vegetated cay in the Coral Sea. *Figure 27* shows surface elevation profiles of Porpoise Cay.

2.4.3 Vegetation

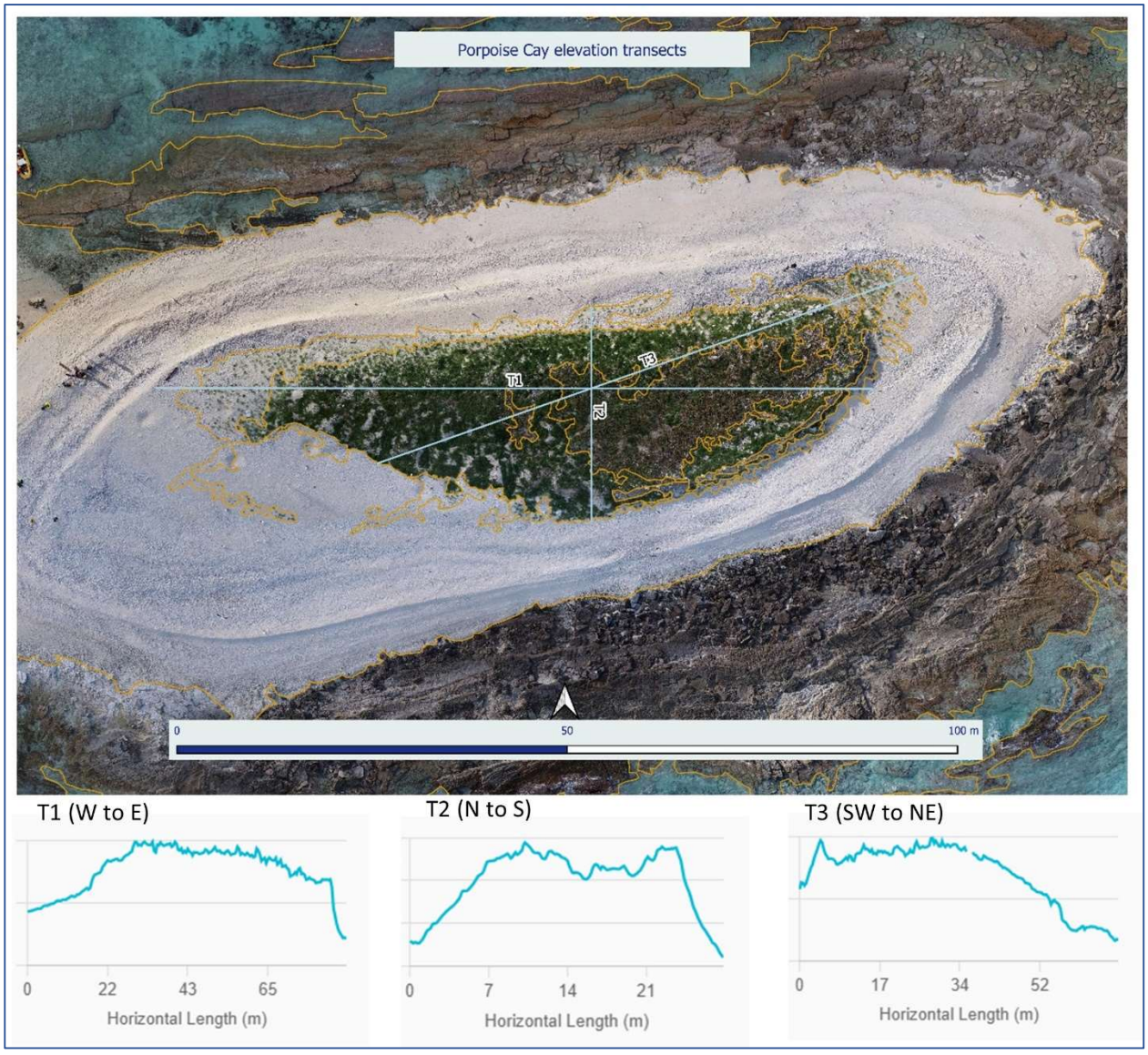


Figure 27 Surface profiles of Porpoise Cay

Note: Maximum height is approximately 3m. Vertical heights and scale are not included in the surface profile diagram as accurate datum information was not available.

Survey intensity

Two people each spent 1.3 hours surveying the vegetation of Porpoise Cay. Vegetation data was recorded at 10 ground-truthing sites. The locations of these sites are shown in *Figure 28*. The yellow lines are the boundaries of the vegetation communities shown on the vegetation map in *Figure 29.*

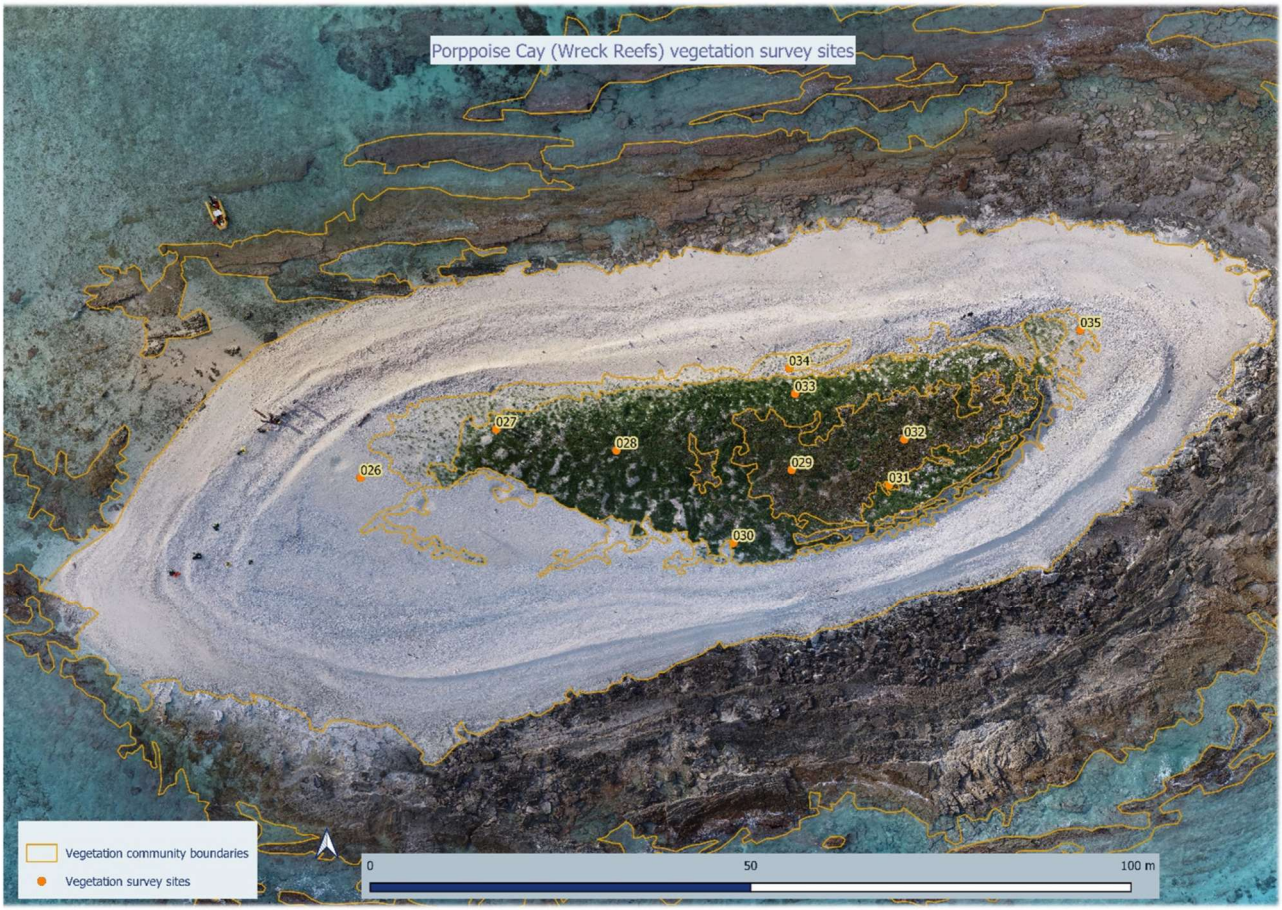


Figure 28 Porpoise Cay showing the number and location of ground-truthing vegetation survey sites relative to the vegetation map unit boundaries

Vegetation condition

The vegetation on the cay was all in good condition at the time of the survey.

Floristic data

Only four plant species were recorded on Porpoise Cay, the lowest species richness of the 20 vegetated Coral Sea cays surveyed.

Lepturus repens (stalky grass) and *Portulaca oleracea* (pigweed) were the most abundant species present. *Boerhavia albiflora* var. *albiflora* (tar vine) was also relatively common. Unlike most of the other Coral Sea cays, the interior vegetation contained very little *Achyranthes aspera* (chaff flower).

Plant species recorded during the 2022 survey are listed in *Table 19* together with frequency in sites, the averaged cover for each species for sites in which the species was present and their averaged cover over the entire cay. Data for species cover at each site plus occurrence of each species in relation to vegetation community and landform are contained in *Table 21*.

Table 19 Plant species recorded on Porpoise Cay, Wreck Reefs (27/05/2022)

Layers: (G) = ground Lifeform: G = grass, Ha = annual herb, Hp = perennial herb

Scientific name	Common name	Family	Life form	Presence in sites (% of sites)	Average % cover for each layer (averaged cover only for sites in which species was present	Overall average % cover for each layer- (averaged cover over all sites including 0% covers at sites where species was absent
Achyranthes aspera	chaff flower	Amaranthaceae	Ha	30%	2.5% (G)	0.75% (G)
Boerhavia albiflora var. *albiflora*	tar vine	Nyctaginaceae	Hp	60%	6.7% (G)	4.0% (G)
Lepturus repens	stalky grass	Poaceae	Gp	100%	36% (G)	36% (G)
Portulaca oleracea	pig weed	Portulaceae	H	50%	14.5% (G)	7.25% (G)
Total no of species = 4						

Vegetation communities

The vegetation was poorly developed with low diversity, probably due to the small size of the cay and regular disturbance by turtle nesting and periodic tidal over-wash.

No *Pisonia grandis* (pisonia) communities or other tree or shrub communities were present on the cay.

The vegetation communities of the cay were dominated by the grass, *Lepturus repens* (stalky grass) and/or the succulent forb, *Portulaca oleracea* (pig weed).

Vegetation communities present on Porpoise Cay in May 2022, the area of each and representative survey sites within each vegetation community are listed in *Table 20.* The spatial distribution and extent of these vegetation communities are shown in the vegetation map in *Figure 29*. Comparisons with equivalent and similar communities on other Coral Sea cays are shown in *Appendix* 3.

Table 20 Vegetation communities on Porpoise Cay, Wreck Reefs

Veg map unit	Summary description	Additional description	Total area (ha)	Sites
Unvegetated areas				
A	sandy shores		0.5318	
B	lithified shores		0.8898	
C	rubble banks			
Vegetation of shorelines, beaches and sand spits				
1a	*Lepturus repens* sparse grassland on sandy shorelines		0.0455	26, 34, 35
Grassland communities				
3a	*Lepturus repens* grassland to closed grassland	*Lepturus repens* grassland to closed grassland with *Boerhavia albiflora* var. *albiflora* +/- *Portulaca oleracea* +/- *Achyranthes aspera*	0.0972	27, 28, 30, 33, 31
3e	*Lepturus repens/ Portulaca oleracea* grassland	*Lepturus repens/ Portulaca oleracea* grassland with *Boerhavia albiflora* var. *albiflora* +/- *Achyranthes aspera*	0.0391	29, 32
		Total vegetated area (ha)	0.1818	

Note: Areas of sandy shores and rocky shores, particularly those of the rocky shores are only approximate due to the difficulty in determining the location of the boundary between the edge of the shoreline and the surrounding reef flat using the imagery.

The following pages contain photographs and detailed descriptions of the vegetation communities present at the time of the May 2022 survey.

Photographs and descriptions of Porpoise Cay vegetation communities

Shoreline, beaches and sand spit vegetation

1a ***Lepturus repens* sparse grassland on sandy shorelines**

ground truthing sites: 26, 34, 35

Photo 48 Veg map unit 1a, Site 26 Porpoise Cay
Joy Brushe ©

Vegetation community 1a consisted of newly establishing plants of *Lepturus repens* (stalky grass) growing in coarse sand containing fine to medium coral rubble on the shoreline and beach.

Grassland communities

3a ***Lepturus repens* grassland to closed grassland with *Boerhavia albiflora* var. *albiflora* +/- *Portulaca oleracea* +/- *Achyranthes aspera***

ground truthing sites: 27, 28, 30, 33, 31

Vegetation community 3a was located adjacent to the shoreline and in the interior of the western end of the cay. Soil was light coloured coarse sand containing coral rubble with organic content in some places.

Photo 49 Veg map unit 3a, Site 30 Porpoise Cay
Joy Brushe ©

Photo 50 Veg map unit 3a, Site 28 Porpoise Cay
Joy Brushe ©

3e ***Lepturus repens*** **and** ***Portulaca oleracea*** **herbland with** ***Boerhavia albiflora*** **var.** ***albiflora*** **+/-** ***Achyranthes aspera***

ground truthing sites 29, 32

Photo 51 Veg map unit 3e, Site 32 Porpoise Cay
Joy Brushe ©

Vegetation community 3e was present in the interior flats at the eastern end of the cay. Soil was dark brown coarse sand with high organic content and contained coral rubble.

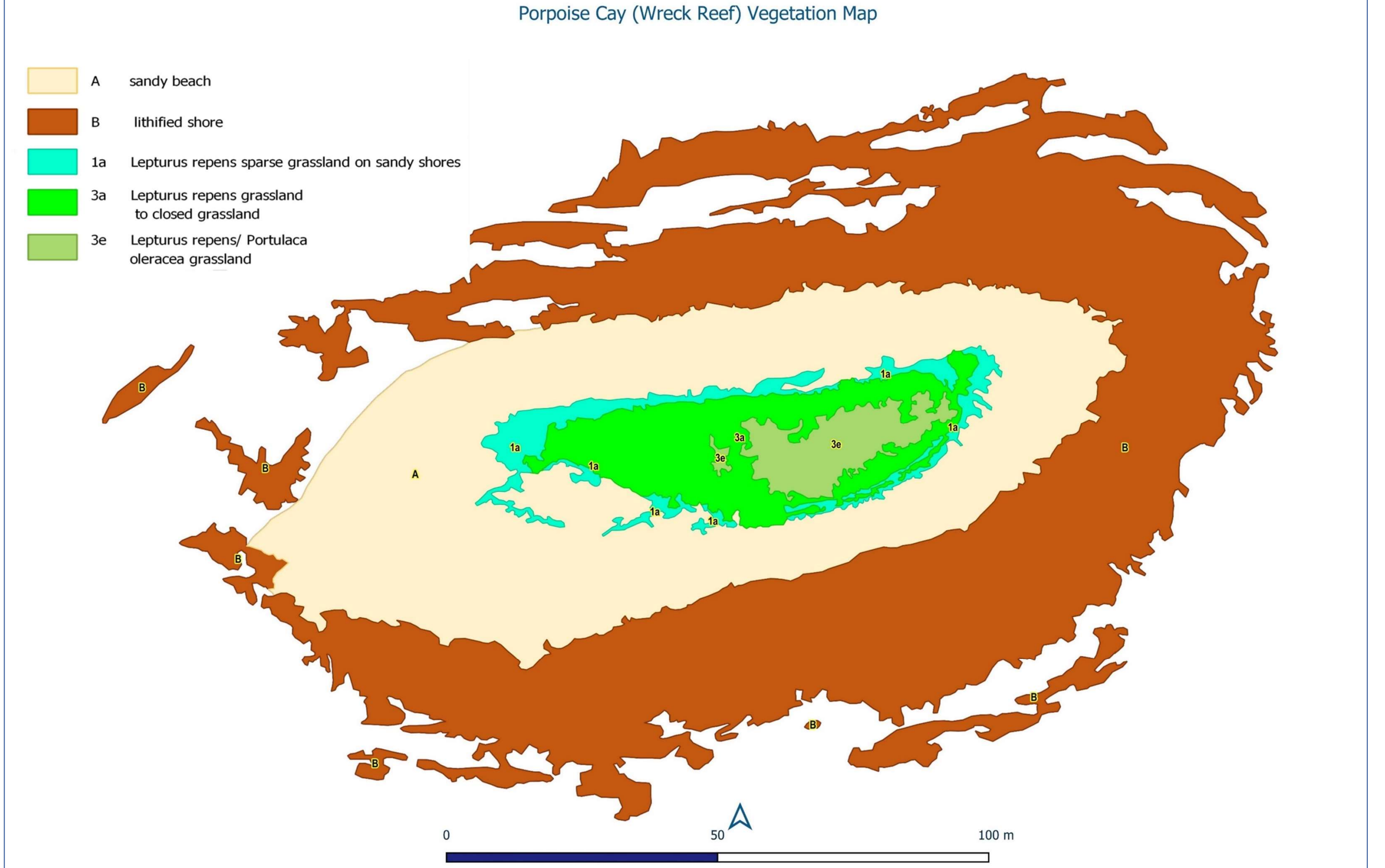


Figure 29 Vegetation map of Porpoise Cay, Wreck Reefs

Table 21 Site data recorded on Porpoise Cay, Wreck Reefs (27/05/2022)

Datum = WGS 84; Green shading = site dominants

											ground layer										
Site	Lat	Long	Number of photos	Landform	Aspect	Estimated altitude	Soil Description	Total weed cover %	Veg map unit code	Community	Achyranthes aspera	Boerhavia albiflora var. albiflora	Lepturus repens	Portulaca oleracea	Litter	Plant Specimens Collected	Birds	Turtle activity	Start	Finish	Dominant growth form	Ground FPC
026	-22.191224	155.350573	5	beach		1	white coarse sand with abundant fine coral rubble fragments in soil abundant medium coral rubble surface fragments	0	1a	Lepturus repens sparse grassland			5-25%				some masked boobies, some brown boobies	low	15:19:55	15:26:11	grass	very sparse (<10%)
027	-22.191167	155.350733	2	mid slope	WNW	2	light coloured coarse sand with abundant fine coral rubble fragments in soil abundant medium coral rubble surface fragments	0	3a	Lepturus repens grassland		5-25%	25-50%		trace-5%		large numbers brown noddies, large numbers brown boobies		15:28:44	15:36:18	grass	mid-dense (>30-70%)
028	-22.191192	155.350875	4	crest		4	brown coarse sand with high organic content, occasional fine coral rubble fragments in soil, abundant medium coral rubble surface fragments	0	3a	Lepturus repens closed grassland	trace-5%	5-25%	50-75%	trace-5%	5-25%		large numbers brown boobies, large numbers brown noddies		15:37:48	15:43:05	grass	dense (>70)
029	-22.191215	155.351082	3	flat		3	dark brown coarse sand with high organic content, occasional fine coral rubble fragments in soil, abundant medium coral rubble surface fragments	0	3e	Lepturus repens/ Portulaca oleracea grassland	trace-5%	trace-5%	25-50%	25-50%	25-50%	Lepturus repens, Portulaca oleracea, Boerhavia albiflora var albiflora, Achyranthes aspera	large numbers brown boobies, abundant brown noddies	low	15:45:00	15:52:35	herb	mid-dense (>30-70%)
030	-22.191301	155.351013	3	mid slope	S	2	light brown coarse sand with some organic content, occasional fine coral rubble fragments in soil, abundant medium coral rubble surface fragments	0	3a	Lepturus repens open grassland			25-50%	5-25%	trace-5%		abundant brown noddies		15:56:19	16:01:49	grass	sparse (10-30%)
031	-22.191233	155.351197	2	flat		4	light brown coarse sand with some organic content, abundant fine coral rubble fragments in soil, abundant large coral rubble surface fragments	0	3a	Lepturus repens closed grassland	trace-5%	trace-5%	50-75%	trace-5%	5-25%		abundant brown noddies		16:04:09	16:08:23	grass	dense (>70)
032	-22.191179	155.351215	3	flat		3	dark brown coarse sand with high organic content, abundant coral rubble fragments in soil, abundant coral rubble surface fragments	0	3e	Lepturus repens/ Portulaca oleracea grassland		trace-5%	5-25%	5-25%	25-50%		abundant brown noddies, some brown boobies	low	16:10:26	16:17:01	herb	mid-dense (>30-70%)
033	-22.191125	155.351086	3	mid slope	N	2	light coloured coarse sand with occasional fine coral rubble fragments in soil abundant coral rubble surface fragments	0	3a	Lepturus repens closed grassland		trace-5%	50-75%		trace-5%		abundant brown noddies, some brown boobies		16:18:34	16:25:10	grass	dense (>70)
034	-22.191095	155.351079	2	lower slope	N	1	light coloured coarse sand with abundant fine coral rubble fragments in soil abundant coral rubble surface fragments	0	1a	Lepturus repens sparse grassland			5-25%				some masked boobies		16:25:41	16:29:40	grass	very sparse (<10%)
035	-22.191050	155.351423	2	beach		1	white coarse sand with abundant fine coral rubble fragments in soil abundant medium coral rubble surface fragments	0	1a	Lepturus repens sparse grassland			5-25%				occasional masked boobies	low	16:33:36	16:37:07	grass	very sparse (<10%)

Comparison with previous vegetation surveys

The Australian Pilot (In Heatwole, 1979) recorded that Bird Islet was the only vegetated cay on Wreck Reef, suggesting that Porpoise Cay was unvegetated at the time the Australian Pilot document was published. The date of this publication is not known.

BioCondition monitoring site data

No permanent BioCondition monitoring sites were established on Porpoise Cay.

2.4.4 Birds

Table 22 Bird species and their breeding status – Porpoise Cay, Wreck Reefs

Porpoise Cay	27/05/2022	Breeding stages present			breeding pairs	Adolescents and adults
common name	**scientific name**	Nests	Chicks	Young		
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	0
lesser frigatebird	*Fregata ariel*	0	0	0	0	1
masked booby	*Sula dactylatra dactylatra*	10	0	0	10	62
brown booby	*Sula leucogaster*	48	0	0	48	106
red-footed booby	*Sula sula*	0	0	0	0	2
sooty tern	*Onychoprion fuscatus*	0	0	0	0	2
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	0	0	5
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	0
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	340	0	0	340	440
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	2
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- Vegetation was high enough to make counting brown noddies surprisingly difficult for such a small cay. Nests were not closely inspected to minimise disturbance.
- Bird diversity and breeding status was as expected.

Photo 52 Brown booby pair (male left, female at nest on right).
Collette Bagnato © Queensland Government

Photo 53 Brown noddy colony. Collette Bagnato © Queensland Government

2.4.5 Pest and invertebrate sampling

(Refer to Health Check section for map)

25-26 May 2022

Table 23 Rodents

Collection period	Sampling methods	Sampling sites	Rodent species
overnight	baited tunnel traps/ink pads	3	nil

Hermit crabs *Coenobita* sp. were present at each sampling site.

Table 24 Invertebrates

Collection period	Sampling methods	Sample sites	Species
daylight search	Bait station and ground search	9	See below

Order	Family	Spp ID	Common name
Orthoptera	Acrididae	*Aiolopus thalassinus*	grasshopper
Orthoptera	Gryllidae	*Telegryllus oceanicus*	black field cricket
Dermaptera		Dermaptera	earwig
Araneae	Lycosidae	*Hogna crispipes*	wolf spider
Not provided	Not provided	Isopoda	slater
Coleoptera	Coccinellidae	*Harmonia octomaculata*	ladybird

2.4.6 Health Checks and Island Watch

Three Health Check (HC) sites were assessed at Porpoise Cay, Wreck Reefs.

The overall condition class of the vegetation communities was **Good** (the highest rating, see *Table 25*).

Detailed criteria for each HC site are included in *Appendix 8*.

Table 25 Assessed condition class for each HC site

	Porpoise Cay, Wreck Reefs			
HC Site	Overall condition class			
HC14	Good	Good with concern	Significant concern	Critical
HC15	Good	Good with concern	Significant concern	Critical
HC16	Good	Good with concern	Significant concern	Critical

Table 26 Summary of vegetation community around each HC site (refer to *Table 20 and Figure 30*)

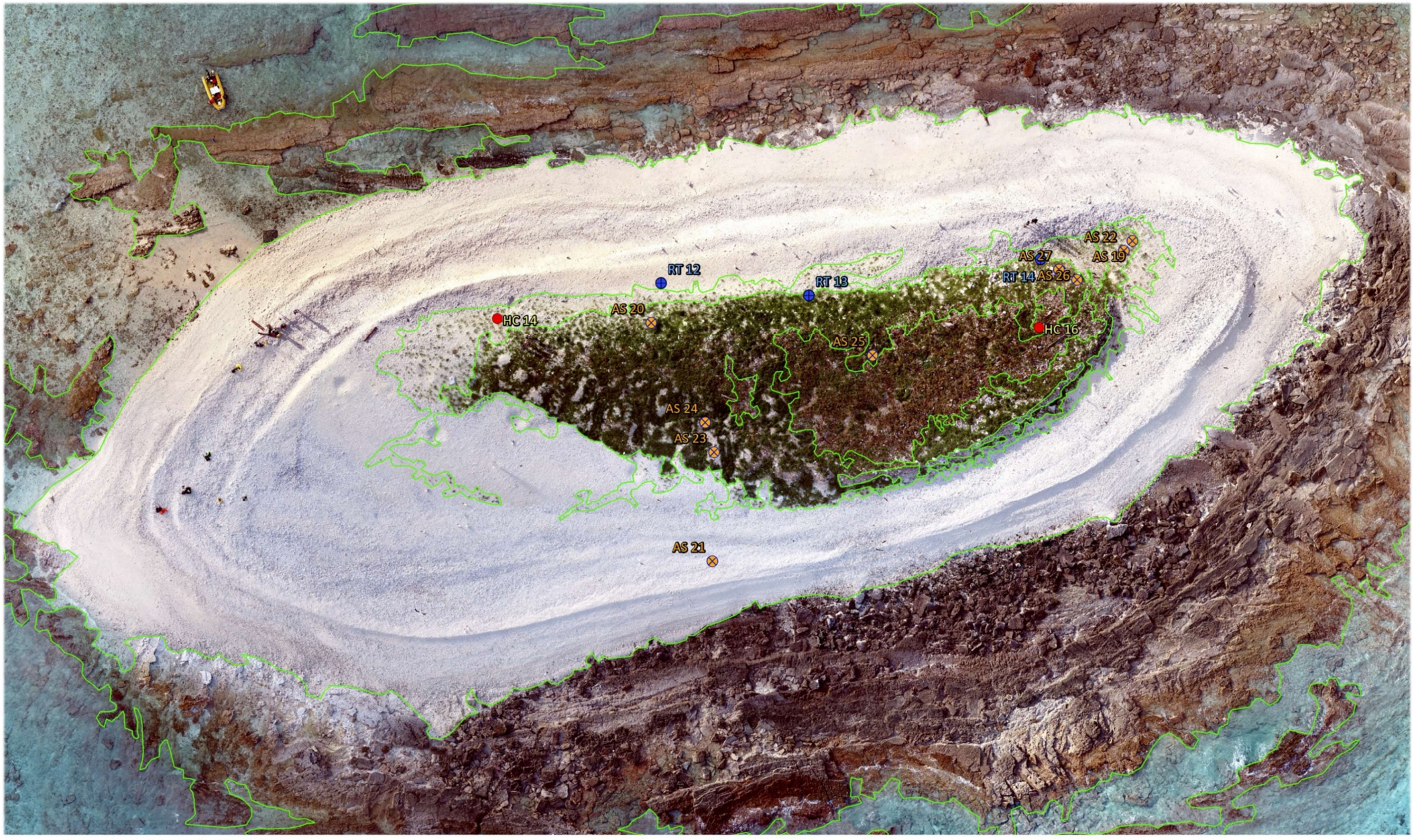
HC Site	Ecosystems/vegetation communities				
HC14	1a	3a			
HC15	3a	3e			
HC16	3a	3e			

Island Watch

A summarised table of all Island Watch information can be found in *Appendix 9*.

Photo 54 Porpoise Cay, Wreck Reefs HC16 North

Photo 55 Porpoise Cay, Wreck Reefs HC16 West



Porpoise Cay, Wreck Reefs

Area: 0.2 ha (area above HAT)

- Vegetation communities
- Health check
- Rodent tunnel
- Ant bait station

0 5 10 20 30 40 50 Metres

Printed on: 25/11/2022

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS1984

Figure 30 Health Check, rodent tunnel and ant bait station sites on Porpoise Cay, Wreck Reefs

2.5. Bird Islet, Wreck Reefs

Figure 31 Bird Islet Jake Sanders © Queensland Government

2.5.1 Drone imagery

28 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 50m
- Resolution 1.5cm/px
- Map stitching software – Drone Deploy

2.5.2 Physical description

- Low tide extent 496m x 277m
- Approximate high tide extent 126m x 40m
- Approximate area above high tide 8.8ha
- Approximate vegetated extent 430m x 235m
- Vegetated area 8.4ha

Bird Islet, shown in *Figure 31,* is a vegetated cay located 504 km north-east of Gladstone on Wreck Reefs at -22.172 degrees latitude and 155.460 degrees longitude. *Figure 32* shows surface elevation profiles of Bird Islet.

2.5.3 Vegetation

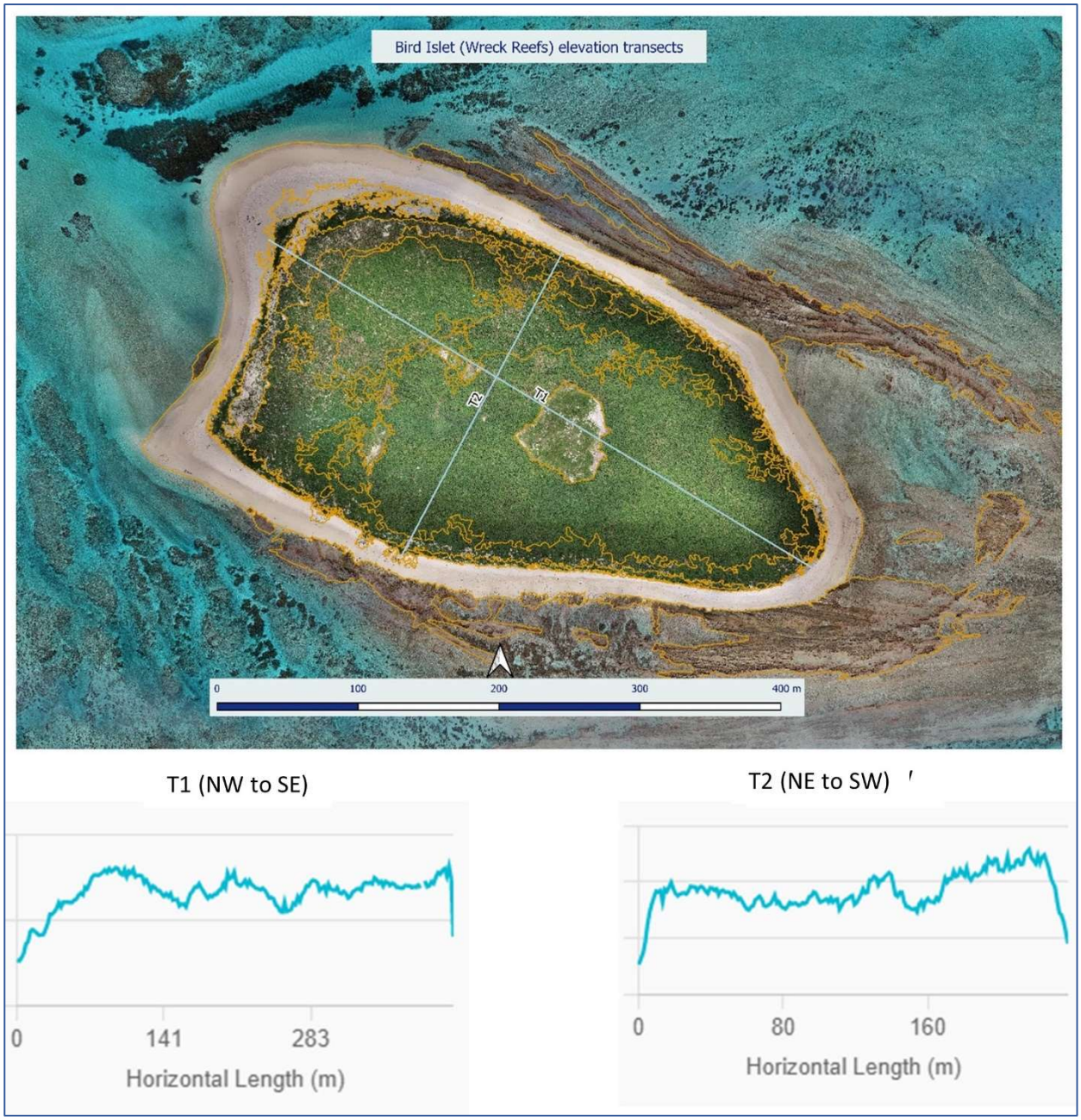


Figure 32 Surface elevation profiles of Bird Islet

Note: Maximum height is approximately 3.5 metres ASL. Vertical heights and scale are not included in the surface profile diagram as accurate datum information was not available.

Survey intensity

Two people each spent 7.4 hours surveying the vegetation of Bird Islet. Vegetation data was recorded at 20 ground-truthing sites and two permanent monitoring sites (M18 and M19). The locations of these sites are shown in *Figure 33*. The yellow lines are the boundaries of the vegetation communities shown on the vegetation map in *Figure 35.*

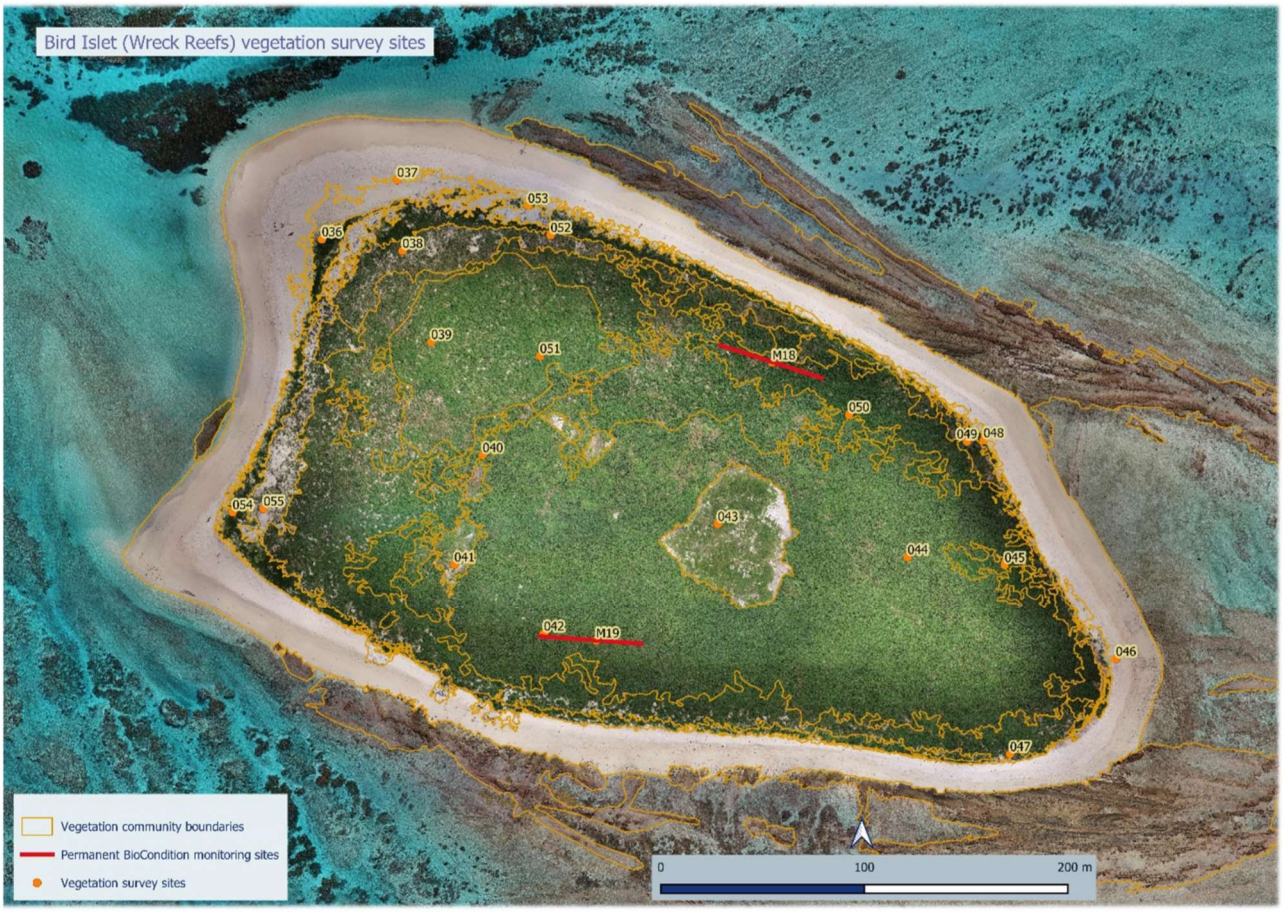


Figure 33 Bird Islet showing the number and location of ground-truthing vegetation survey sites and permanent monitoring sites relative to the vegetation map unit boundaries.

Vegetation condition

The natural vegetation on the cay was all in good condition at the time of the survey. Weeds are present on the cay and have displaced natural vegetation in a large area in the northwest interior of the cay.

Floristic data

Nine plant species were recorded on Bird Islet, six native cay species and three exotic naturalised weeds.

All the native species present were quite widespread across the cay and the most abundant species present at the time of the survey were *Achyranthes aspera* (chaff flower)*, Lepturus repens* (stalky grass)*, Boerhavia albiflora* var. *albiflora* (tar vine) and *Stenotaphrum micranthum* (beach buffalo grass).

Plant species recorded on Bird Islet are listed in *Table 27* together with frequency in sites, the averaged cover for each species for sites in which the species was present and their averaged cover over the entire cay. Data for species cover at each site plus occurrence of each species in relation to vegetation community and landform are contained in *Table 29*.

Table 27 Plant Species Recorded on Bird Islet, Wreck Reef (28/05/2022)

Layer: (G) = ground
Lifeform: G = grass, Ga = annual grass, Gp = perennial grass, H = herb, Ha = annual herb, Hp = perennial herb, H = herb, ST = large shrub/small tree
Data for weeds are shown in red; * = naturalized exotic species not native to Australia

Scientific name	Common name	Family	Life form	Presence in sites (% of sites)	Average % cover for each layer (averaged cover only for sites in which species was present	Overall average % cover for each layer- (averaged cover over all sites including 0% covers at sites where species was absent
Achyranthes aspera	chaff flower	Amaranthaceae	Ha	45.5%	35.8% (G)	16.25% (G)
Boerhavia albiflora var. *albiflora*	tar vine	Nyctaginaceae	Hp	81.8%	16.0% (G)	13.1% (G)
Lepturus repens	stalky grass	Poaceae	G	63.6%	22.3% (G)	14.2% (G)
Portulaca oleracea	pig weed	Portulaceae	H	81.8%	14.0% (G)	11.5% (G)
Stenotaphrum micranthum	beach buffalo grass	Poaceae	Ga	63.6%	19.5% (G)	12.4% (G)
Tribulus cistoides	bulls head burr	Zygophyllaceae	Ha	45.45%	5% (G)	2.3% (G)
**Amaranthus viridis*	green amaranth	Amaranthaceae	Ha	4.55%	2.5% (G)	0.11% (G)
**Cynodon dactylon* var. *dactylon*	common couch	Poaceae	Gp	4.55%	85% (G)	3.9% (G)
**Solanum americanum*	nightshade	Solanaceae	Ha	4.55%	2.5% (G)	0.11% (G)
Total no of species = 9 (6 native cay species, 3 non-cay species)						

Weeds

There is currently an infestation of *Cynodon dactylon* var. *dactylon* (common couch) densely covering approximately 7,000 square meters on the northwestern interior of the cay in the vicinity of the survey marker. The National Herbarium has a record of this species collected by K. Keith in 1961, so it has been present on the cay for some considerable time. The early record did not contain any information on the extent or location on the cay, so it is not known if it is currently spreading or at what rate.

Numbers of nesting seabirds were much lower within this vegetation than in the surrounding vegetation communities, possibly because of the high density and tightly rooted growth form of this species.

Amaranthus viridis (green amaranth) was also collected by Keith in 1961 on Bird Islet. This species is present in the same area as the *Cynodon dactylon var. dactylon* but was much less abundant. This is surprising given the length of time it has been present on the island and the extent to which it dominates the vegetation on southern GBR cays on which it is present. It is an annual species, however and may be more abundant in different seasons.

Both *Cynodon dactylon var. dactylon* and *Amaranthus viridis* are also present on South Islet (Willis Islets).

Solanum americanum (nightshade) was also recorded in the central eastern interior of Bird Islet during the 2022 survey. Although this species is a widespread problem weed on cays in the southern GBR, it has not previously been recorded on any Coral Sea cays. It is usually dispersed by fruit eating birds, which are rarely present (transients) on the Coral Sea cays. The area where this species was present was thoroughly searched and only a few plants were found. Although these were carefully hand pulled to prevent seed drop, bagged and removed from the cay, plants were quite large and had seeded, so it is likely that regrowth from these seeds will occur.

Although some seeding *Amaranthus viridis* was also hand pulled, bagged and removed from the cay, more seeding plants were observed just prior to departure but could not be removed as there was no time to obtain bags and return to the site prior to departure.

Figure 34 shows the location and extent of the weeds on Bird Islet in May 2022.

Figure 34 Weed map of Bird Islet, Wreck Reefs May 2022

Photo 56 *Cynodon dactylon* var. *dactylon* growing at site 39 on Bird Islet
Joy Brushe ©

Photo 57 *Solanum americanum* growing at site 44 on Bird Islet
Joy Brushe ©

Photo 58 Pressed specimen of *Amaranthus viridis* collected from Site 51 on Bird Islet
Joy Brushe ©

Recommendations for weed management:

Amaranthus viridis (green amaranth) and *Solanum americanum* (nightshade) can easily be hand pulled and would not require chemical treatment, but to achieve eradication, the seed banks as well as live plants need to be totally eliminated. This would require regular visits to the cay - a number of visits each year for at least two to three years (depending on amount and timing of seasonal rain) to ensure removal of all regrowth plants before they have a chance to seed.

Eradication or control of *Cynodon dactylon* var *dactylon* would not be achievable without chemical herbicide treatment. Although some herbicides may have some residual effectiveness, chemical herbicide treatment would also require repeat visits to the cay to control or eradicate the current infestation. Selective herbicides are available that kill grasses without killing other herbaceous species. QPWS is currently investigating which herbicides would be safe to use in the natural environment of the Coral Sea as well as requirements for special permits for off label use of these chemicals. The QPWS advice had not been received at the time of submission of this report and their recommendations will be passed onto PAD as soon as they are available.

Alternative control measures for *Cynodon dactylon* var. *dactylon* (common couch):

- no treatment at present; undertake annual monitoring to ensure the current infestation is not increasing in size or spreading to other parts of the island.
- spraying once per year which may be sufficient to prevent further spread and gradually decrease the dominance of the couch in its current location.

Regardless of control methods used, if any, it is important to minimise the risk of these weeds spreading to other Coral Sea cays. Therefore, it is recommended that no human visits to Bird islet be permitted other than those authorized by PAD for the purpose of monitoring and/or managing weeds.

Vegetation communities

No *Pisonia grandis* (pisonia) or other tree or shrub communities were present on the cay.

Narrow grasslands of *Lepturus repens* (stalky grass) and/or *Stenotaphrum micranthum* (beach buffalo grass) are present on dunes and terraces adjacent to the coastline around the entire cay.

Boerhavia albiflora var *albiflora* (tar vine) open herbland was present in swales and flats adjacent to the western coastline.

Stenotaphrum micranthum closed grasslands and closed herblands dominated by *Boerhavia albiflora* var. *albiflora* and/or *Achyranthes aspera* (chaff flower) were present on the northeastern slopes to and edges of the central plateau.

Achyranthes aspera communities dominated the interior of the centre and eastern end of the cay, with one large depression and a few smaller depressions dominated by *Portulaca oleracea* (pigweed) present within these *Achyranthes* communities.

Boerhavia albiflora var *albiflora* closed herblands were present between the coastal grasslands and the interior *Achyranthes aspera* communities with the most extensive area of this vegetation type located on flats at the western end of the cay.

Portulaca oleracea (pigweed) herblands to closed herblands were growing in small depressions in the central interior of the Cay.

A large infestation of the exotic grass, *Cynodon dactylon* var. *dactylon* (common couch) was present on the flats at the northwestern end of the cay. This is not a natural vegetation community and was completely dominated by the exotic naturalized species introduced species, *Cynodon dactylon* var. *dactylon* which formed a dense cover over approximately 7,000 square meters on the northwestern interior of the cay.

Vegetation communities present on Bird Islet in May 2022, the area of each and representative survey sites within each vegetation community are listed in *Table 28.* The spatial distribution and extent of these vegetation communities are shown in the vegetation map in *Figure 35*. Comparisons with equivalent and similar communities on other Coral Sea cays are shown in *Appendix 3.*

Table 28 Vegetation communities on Bird Islet, Wreck Reefs

Veg map units	Summary description	Additional description	Total area (ha)	Sites
A	sandy shores		2.787	
B	lithified shores		2.943	
C	rubble banks		0.024	
0	bare areas		0.004	
Vegetation of shorelines, beaches and sand spits				
1a	*Lepturus repens* sparse to open grassland on sandy shorelines	*Lepturus repens* sparse to open grassland +/- *Stenotaphrum micranthum* +/- *Boerhavia albiflora* var. *albiflora* +/- *Portulaca oleracea* on sandy shorelines	0.312	37, 46, 53
1b	shoreline rubble bank sparse herbland		0.002	
Grasslands				
3b	*Lepturus repens/ Achyranthes aspera* closed grassland to closed herbland (seasonally variable)	*Lepturus repens/ Achyranthes aspera* closed grassland to closed herbland (seasonally variable) with *Boerhavia albiflora* var. *albiflora, Portulaca oleracea and Stenotaphrum micranthum*	0.120	49
4	*Lepturus repens/ Stenotaphrum micranthum* closed grassland	*Lepturus repens/Stenotaphrum micranthum* closed grassland with *Boerhavia albiflora* var. *albiflora* and *Portulaca oleracea*	0.521	36, 47, 48, 54
5b	*Stenotaphrum micranthum* closed grassland	*Stenotaphrum micranthum* closed grassland with *Achyranthes aspera, Boerhavia albiflora* var. *albiflora* and *Tribulus cistoides* +/- *Lepturus repens* +/- *Portulaca oleracea*	0.760	50, M18
18	*Cynodon dactylon* var. *dactylon* naturalised closed grassland		0.674	39
Herblands				
6a	*Boerhavia albiflora* var. *albiflora/ Portulaca oleracea* open herbland		0.159	55
6e	*Boerhavia albiflora* var. *albiflora* closed herbland	*Boerhavia albiflora* var. *albiflora* closed herbland with *Portulaca oleracea, Stenotaphrum micranthum, Lepturus repens* and *Tribulus cistoides*	1.194	
8a	*Achyranthes aspera/ Boerhavia albiflora* var. *albiflora* closed herbland	*Achyranthes aspera/ Boerhavia albiflora* var. *albiflora* closed herbland with *Portulaca oleracea, Stenotaphrum micranthum* and *Tribulus cistoides*	1.674	42, 44, M19
8b	*Achyranthes aspera/Stenotaphrum micranthum/ Boerhavia albiflora* var. *albiflora* herbland	*Achyranthes aspera/Stenotaphrum micranthum/ Boerhavia albiflora* var. *albiflora* herbland closed herbland with *Lepturus repens, Portulaca oleracea* and *Tribulus cistoides*	2.206	40, 45
16a	*Portulaca oleracea* open herbland to herbland	*Portulaca oleracea* open herbland to herbland +/- *Achyranthes aspera* +/- *Boerhavia albiflora* var. *albiflora* +/- *Tribulus cistoides*	0.388	41, 43
16b	*Portulaca oleracea/Lepturus repens* herbland	*Portulaca oleracea/Lepturus repens* herbland with *Boerhavia albiflora* var. *albiflora*	0.355	38, 52
		Total vegetated area (ha)	8.368	

Note: Areas of sandy shores and rocky shores, particularly those of the rocky shores are only approximate due to the difficulty in determining the location of the boundary between the edge of the shoreline and the surrounding reef flat using the imagery.

The following pages contain photographs and detailed descriptions of all the vegetation communities observed at the time of the May 2022 survey.

Shoreline, beaches and sand spit vegetation

1a ***Lepturus repens*** **sparse to open grassland +/-*Stenotaphrum micranthum* +/- *Boerhavia albiflora* var. *albiflora*/+/- *Portulaca oleracea* on sandy shorelines**

ground truthing sites: 37, 46, 53

Photo 59 Veg map unit 1a, Site 46 Bird Islet
Joy Brushe ©

Photo 60 Veg map unit 1a, Site 53 Bird Islet
Joy Brushe ©

Vegetation community 1a also contained *Stenotaphrum micranthum* (beach buffalo grass, *Boerhavia albiflora* var. *albiflora* (tar vine) and *Portulaca oleracea* (pig weed)

1b **shoreline rubble bank sparse herbland**

no ground truthing sites or photographs for this community

Grasslands

3b ***Lepturus repens/ Achyranthes aspera*** **closed grassland to closed herbland (seasonally variable) with** ***Boerhavia albiflora*** **var.** ***albiflora, Portulaca oleracea and Stenotaphrum micranthum***

ground truthing site: 49

Photo 61 Veg map unit 3b, Site 49 Bird Islet
Joy Brushe ©

Vegetation community 3b was growing on the edge of the central plateau on the northeastern end of the cay. Soil was brown sand with high organic content and contained coral rubble fragments.

4 ***Lepturus repens/Stenotaphrum micranthum*** **closed grassland with** ***Boerhavia albiflora*** **var.** ***albiflora*** **and** ***Portulaca oleracea +/- Achyranthes aspera***
ground truthing sites: 36, 47, 48, 54

Vegetation community 4 was quite widespread on the cay growing mainly on low dunes adjacent to the coastline and adjacent slopes to the central plateau. Soil varied from beach sand to brown organic soil. Coral rubble surface fragments were present.

Photo 62 Veg map unit 4, Site 54 Bird Islet
Joy Brushe ©

5b ***Stenotaphrum micranthum*** **closed grassland with** ***Achyranthes aspera*****,** ***Boerhavia albiflora*** **var.** ***albiflora*** **and** ***Tribulus cistoides*** **+/-** ***Lepturus repens*** **+/-** ***Portulaca oleracea***

ground truthing site: 50, BioCondition monitoring site M18

Photo 63 Veg map unit 5b, Site 50 Bird Islet
Joy Brushe ©

Vegetation community 5b was present predominantly on the northern edge of the interior vegetation. Soil was brown organic sandy soil with some coral rubble.

18 *Cynodon dactylon* var. *dactylon* naturalised closed grassland

ground truthing site: 39

Photo 64 Veg map unit 18, Site39 Bird Islet
Joy Brushe ©

Vegetation community 18 was growing on the northwest interior of the cay in brown sand with some organic content and occasional fine coral rubble surface fragments.

Herblands

6a *Boerhavia albiflora* var. *albiflora*/ *Portulaca oleracea* open herbland

ground truthing site: 55

Photo 65 Veg map unit 6a in foreground, Site 55 Bird Islet
Joy Brushe ©

Photo 66 Veg map unit 6a in foreground, Site 55 Bird Islet
Joy Brushe ©

Vegetation community 6a was growing in swales adjacent to the western and southeastern shorelines on light brown sand with some organic content and fine coral rubble fragments on the surface.

6e Boerhavia albiflora var. albiflora closed herbland

No data for this unit

Photo 67 Veg map unit 6e, adjacent to the southern coastline, Bird Islet
Joy Brushe ©

8a ***Achyranthes aspera/ Boerhavia albiflora* var. *albiflora* closed herbland with *Portulaca oleracea*, *Stenotaphrum micranthum* and *Tribulus cistoides***

ground truthing sites: 42, 44, BioCondition monitoring site M19

Photo 68 Veg map unit 8a, Site 42 Bird Islet Joy Brushe ©

8b ***Achyranthes aspera/Stenotaphrum micranthum/ Boerhavia albiflora* var. *albiflora* herbland/ closed herbland with *Lepturus repens*, *Portulaca oleracea* and *Tribulus cistoides***

ground truthing sites 40, 45

Photo 69 Veg map unit 8b, Site 45 Bird Islet Joy Brushe ©

Photo 70 Veg map unit 8b, closer view of the vegetation in Site 45 showing the good condition of the vegetation at the time of the survey
Joy Brushe ©

Vegetation communities 8a and 8b were present on the central plateau on dark brown organic soil. More *Stenotaphrum micranthum* (beach buffalo grass was present in vegetation community 8b, otherwise the two communities were very similar and in places formed mosaics of the two communities that were difficult to separate and had to be mapped as heterogeneous polygons.

16a ***Portulaca oleracea*** **open herbland to herbland +/-** ***Achyranthes aspera*** **+/-** ***Boerhavia albiflora*** **var.** ***albiflora*** **+/-** ***Tribulus cistoides***

ground truthing sites 41, 43

Photo 71 Veg map unit 16a, Site 41 Bird Islet
Joy Brushe ©

Vegetation community 6a was growing in a number of low lying depressions in the cay interior. Soil is a fine dark brown sandy loam with high organic content. The bare areas present I these depressions may be due to high salinity.

16b ***Portulaca oleracea/Lepturus repens*** **herbland with** ***Boerhavia albiflora*** **var.** ***albiflora***

ground truthing sites 38 and 52

Vegetation community 16b was present adjacent to the coastal communities on the northern end of the cay on the northeastern facing slopes to the central plateau. Soil was light brown sand with some organic content and contained fine coral rubble fragments.

Photo 72 a and b Veg map unit 16b, Site 38 Bird Islet
Joy Brushe ©

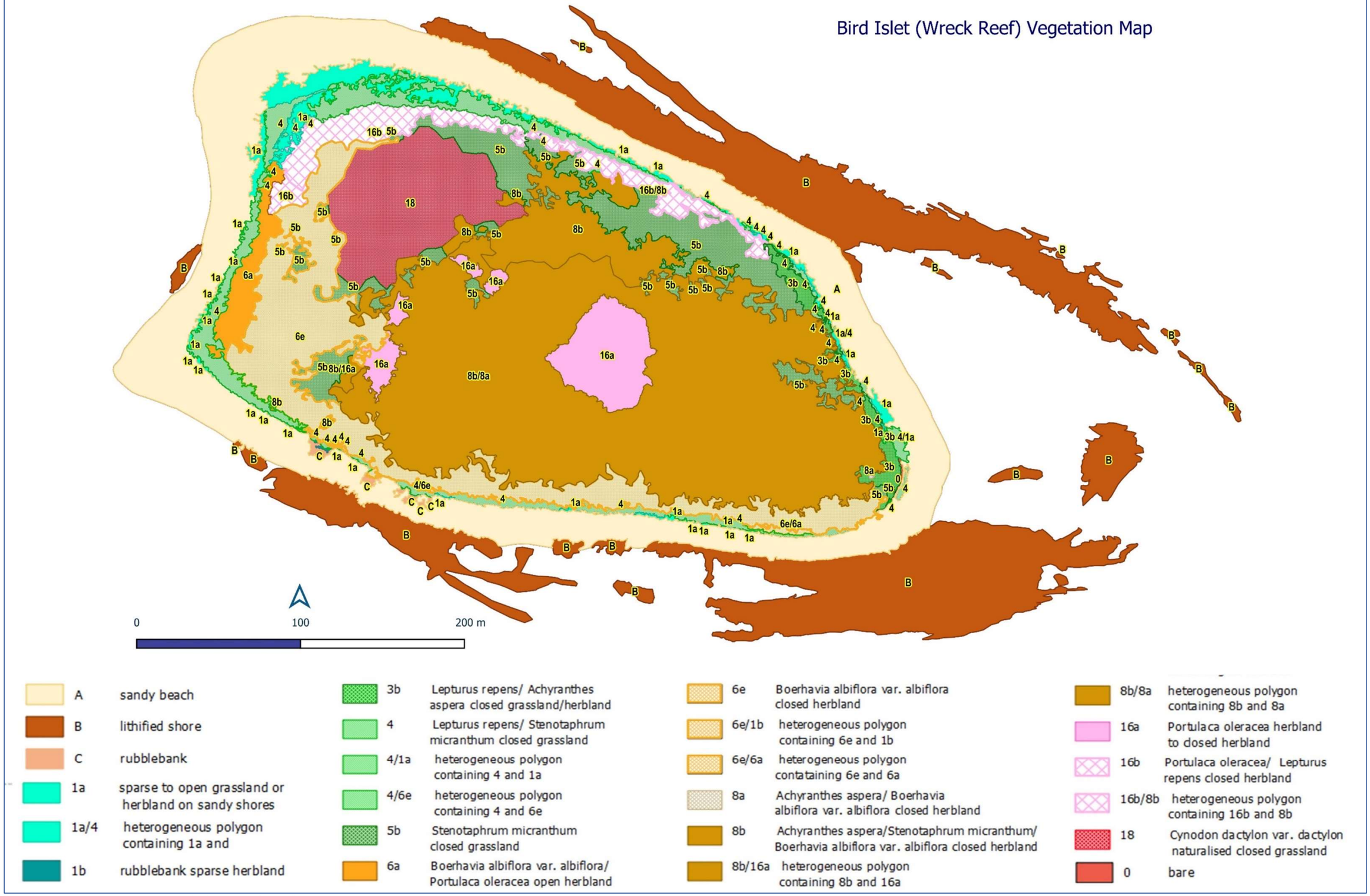


Figure 35 Vegetation Map of Bird Islet, Wreck Reefs

Table 29 Site data recorded on Bird Islet, Wreck Reefs 28/05/2022

Datum = WGS 84; green shading = site dominants

											Ground layer																	
Site	Lat	Long	Number of photos	Landform	Aspect	Estimated Altitude	Soil description	Total weed cover %	Veg map unit code	Community	Achyranthes aspera	Amaranthus viridis	Boerhavia albiflora var. albiflora	Cynodon dactylon var. dactylon$	Lepturus repens	Portulaca oleracea	Solanum americanum	Stenotaphrum micranthum	Tribulus cistoides	Litter	Plant specimens collected	Birds	Turtle activity	Start	Finish	Dominant growth form	Ground FPC
036	-22.170766	155.458391	3	swale		1	light coloured sand with occasional coral rubble surface fragments	0	4	Lepturus repens/ Stenotaphrum micranthum closed grassland			trace-5%		50-75%	trace-5%		25-50%		trace-5%		abundant brown noddies		8:25:28	8:32:09	grass	dense (>70)
037	-22.170504	155.458724	3	beach		1	white sand with occasional coral rubble surface fragments	0	1a	Lepturus repens sparse grassland					trace-5%									8:33:55	8:38:00	grass	very sparse (<10%)
038	-22.170817	155.458747	4	mid slope	NW	2	light brown sand with some organic content, occasional coral rubble surface fragments	0	16b	Portulaca oleracea/ Lepturus repens herbland			5-25%		5-25%	25-50%				5-25%	Portulaca oleracea Lepturus repens	abundant sooty terns, occasional masked boobies		8:41:06	8:47:47	herb	mid-dense (>30-70%)
039	-22.171219	155.458874	3	upper slope	NW	3	brown sand with some organic content, occasional fine coral rubble surface fragments	75-95%	18	Cynodon dactylon var. dactylon closed grassland	trace-5%		5-25%	75-95%		5-25%			5-25%	5-25%	Cynodon dactylon var. dactylon	some masked boobies, occasional sooty terns, large numbers wedgetail shearwater burrows		8:52:28	9:03:01	grass	dense (>70)
040	-22.171718	155.459101	3	depression		3	brown sand with high organic content, occasional coral rubble surface fragments	0	8b	Achyranthes aspera/ Boerhavia albiflora var. albiflora/ Stenotaphrum micranthum closed herbland	25-50%		25-50%		trace-5%	5-25%		5-25%	trace-5%	5-25%	Achyranthes aspera Boerhavia albiflora var. albiflora Stenotaphrum micranthum Tribulus cistoides	large numbers frigatebirds, large numbers brown noddies, large numbers wedgetail shearwater burrows		9:08:02	9:16:51	herb	dense (>70)
041	-22.172201	155.458976	2	depression		3	dark brown sandy loam with high organic content, occasional fine coral rubble surface fragments	0	16a	Portulaca oleracea open herbland	trace-5%		trace-5%			5-25%			trace-5%	trace-5%				9:22:29	9:27:43	forb	sparse (10-30%)
042	-22.172510	155.459371	3	plateau		3	dark brown sand with high organic content	0	8a	Achyranthes aspera/ Boerhavia albiflora var. albiflora closed herbland	75-95%		5-25%			trace-5%		trace-5%	trace-5%	5-25%		abundant brown noddies, some frigatebirds, occasional wedgetail shearwater burrows		9:32:28	9:37:15	forb	dense (>70)
043	-22.172022	155.460139	0	depression		3	dark brown clayey sandy loam with high organic content, ? saline, occasional coral rubble surface fragments	0	16a	Portulaca oleracea herbland						50-75%				5-25%		occasional brown boobies		9:47:33	10:01:05	forb	mid-dense (>30-70%)
044	-22.172168	155.460977	4	plateau		3	dark brown sandy loam with high organic content, occasional fine coral rubble fragments in soil, occasional fine coral rubble surface fragments	trace-5%	8a	Achyranthes aspera closed herbland	75-95%		5-25%			5-25%	trace-5%	trace-5%	trace-5%	5-25%	Solanum americanum	large numbers brown noddies, large numbers sooty terns, occasional wedgetail shearwater burrows		10:06:23	10:12:29	forb	dense (>70)
045	-22.172203	155.461405	3	plateau		3	brown sand with some organic content	0	8b	Achyranthes aspera/ Boerhavia albiflora var. albiflora/ Stenotaphrum micranthum closed herbland	25-50%		25-50%		trace-5%	trace-5%		25-50%	trace-5%	5-25%		some brown noddies, some wedgetail shearwater burrows		10:27:32	10:40:57	herb	dense (>70)
046	-22.172621	155.461896	4	beach		1	white sand with medium coral rubble surface fragments	0	1a	Lepturus repens sparse grassland					5-25%			trace-5%				some brown noddies		10:43:59	10:49:02	grass	very sparse (<10%)
047	-22.173040	155.461429	3	mid slope	S	2	light brown sand with some organic content, occasional coral rubble	0	4	Lepturus repens/ Portulaca oleracea closed grassland			5-25%		25-50%	5-25%		trace-5%		5-25%		abundant brown noddies		10:52:18	10:57:31	grass	dense (>70)

										Ground layer																
Site	Lat	Long	Number of photos	Landform	Aspect	Estimated Altitude	Soil description	Total weed cover %	Veg map unit code	Community	Achyranthes aspera	Amaranthus viridis	Boerhavia albiflora var. albiflora	Cynodon dactylon var. dactylon$	Lepturus repens	Portulaca oleracea	Solanum americanum	Stenotaphrum micranthum	Tribulus cistoides	Litter	Plant specimens collected	Birds	Turtle activity	Start	Finish	Dominant growth form	Ground FPC
							surface fragments and medium rock outcropping																				
048	-22.171653	155.461312	4	mid slope	NE	2	brown sand with some organic content, medium coral rubble fragments in soil, coral rubble surface fragments and medium rock outcropping	0	4	Lepturus repens closed grassland			5-25%		50-75%	5-25%		5-25%		trace -5%		some brown noddies		11:03:31	11:10:33	grass	dense (>70)
049	-22.171658	155.461239	4	plateau		4	brown sand with high organic content, fine coral rubble fragments in soil, fine coral rubble surface fragments	0	3b	Lepturus repens/ Achyranthes aspera/ Boerhavia albiflora var. albiflora/ Portulaca oleracea/ Stenotaphrum micranthum grassland to herbland	5-25%		5-25%		5-25%	5-25%		5-25%	trace -5%	5-25%		abundant sooty terns, some brown noddies, occasional masked boobies, some wedgetail shearwater burrows		11:13:15	11:19:02	forb	mid-dense (>30-70%)
050	-22.171539	155.460718	2	lower slope	SW	3	dark brown sandy loam with high organic content	0	5b	Stenotaphrum micranthum closed grassland	5-25%		5-25%			trace -5%		75-95%	trace -5%	trace -5%		some brown noddies		11:21:28	11:28:17	grass	dense (>70)
051	-22.171281	155.459354	0									trace -5%									Amaranthus viridis			12:14:19	12:15:57		
M18	-22.171310	155.460380	10				brown sand with organic content and some coral rubble	0	5b	Stenotaphrum micranthum/ Achyranthes aspera closed grassland	5-25%		5-25%		trace -5%			25-50%	5-25%	5-25%		Abundant shearwater burrows, some brown noddies		12:45:00	13:15:00	grass	dense (>70)
M19	-22.172540	155.459602	10	plateau		3	dark brown sand with high organic content	0	8a	Achyranthes aspera/ Boerhavia albiflora var. albiflora closed herbland	50-75%		25-50%			trace -5%		trace-5%	trace -5%	5-25%		abundant brown noddies, shearwater burrows present, frigatebirds nesting approx. 25m from site		13:45:00	14:15:00	forb	dense (>70)
052	-22.170747	155.459401	3	lower slope	NW	2	light brown sand with some organic content, fine coral rubble fragments in soil, coral rubble surface fragments	0	16b	Portulaca oleracea/ Lepturus repens/ /Boerhavia albiflora var. albiflora/ herbland			5-25%		5-25%	5-25%				5-25%		abundant sooty terns, some brown noddies, occasional masked boobies		15:49:44	15:54:49	herb	mid-dense (>30-70%)
053	-22.170618	155.459301	3	dune		1	white sand	0	1a	Lepturus repens open grassland			trace-5%		5-25%	trace -5%		trace-5%				some brown noddies, some masked boobies	low	15:56:09	15:59:55	grass	sparse (10-30%)
054	-22.171970	155.457997	3	dune		1	white coarse sand with occasional fine coral rubble fragments in soil occasional coral rubble surface fragments	0	4	Lepturus repens closed grassland			trace-5%		50-75%	trace -5%		5-25%		trace -5%		large numbers brown noddies	mediu m	16:06:21	16:10:39	grass	dense (>70)
055	-22.171954	155.458134	2	swale		1	light brown sand with some organic content, fine coral rubble fragments in soil, fine coral rubble surface fragments	0	6a	Boerhavia albiflora var. albiflora/ Portulaca oleracea open herbland			5-25%		trace -5%	5-25%				trace -5%		some brown noddies	mediu m	16:12:00	16:17:48	forb	sparse (10-30%)

Comparison with previous vegetation surveys

Bird Islet was mined for guano in the 1860s. This would have had a significant impact on the vegetation and surface profile at that time.

Two of the three weeds present, *Cynodon dactylon* var. *dactylon* (common couch) and *Amaranthus viridis* (green amaranth), are known to have been present for a long period as the National Herbarium holds specimens and records of these species collected from Bird Islet in 1961.

BioCondition monitoring site data

Two permanent BioCondition monitoring sites (M18 and M19) were established and surveyed on Bird Islet. The location of the centre transects of these sites are shown as the red lines in *Figure 33. Table 30* and *Table 31* contain the data recorded at these sites.

The photographs included with the BioCondition attribute data are four of the 10 site photographs taken at each of these sites. Photographs shown are all taken from the centre point of the centre transect, the first facing along the transect bearing and then consecutively facing 90°, 180^0 and 270^0 from the direction of the centre transect bearing.

BioCondition attributes

Table 30 BioCondition attribute data recorded in monitoring site M18, Bird Islet, Wreck Reefs on 28 May 2022

Site M18	
Cay	Bird Islet, Wreck Reefs
Vegetation community description	closed grassland/herbland dominated by *Stenotaphrum micranthum* and *Achyranthes aspera*
Transect start (WGS 84)	-22.171375 155.460598
Transect Centre (WGS84)	-22.17131 155.46038
Transect end (WGS 84)	-22.171233 155.46015
Transect bearing (degrees)	282
Median canopy height/range (metres)	0.4/0.15-0.5
Tree canopy cover %	n/a
Shrub canopy cover %	n/a
Basal area m^2/ha (at 30 cm height, calculated from stem diameters)	n/a
Total number of large trees/ha	0
Total no of trees per ha	n/a
Total number of tree stems/ha	n/a
Total no. shrubs/ha	0
Total no. shrub stems/ha	n/a
Large shrubs - mean diameter at 30 cm height	n/a
Recruitment of ecologically dominant layer (%)	n/a
Tree species richness	0
Tree species present	n/a
Shrub species richness	0
Shrub species present (layer in brackets)	n/a
Median ground layer height/range (metres)	0.4/0.15-0.5
Total ground layer cover of native cay species (%)	77.2%
Grass species richness	2
Grass cover (%)	29.6%
Grass species present in order of decreasing cover - most abundant first (cover in brackets)	*Stenotaphrum micranthum* (29.6%), *Lepturus repens* (<0.1%)
Forb (including vines) species richness	4
Forb species cover (%)	47.6%
Forb species present in order of decreasing cover - most abundant first (cover in brackets)	*Achyranthes aspera* (22.6%), *Boerhavia albiflora* var. *albiflora* (10.4%), *Portulaca oleracea* (8%), *Tribulus cistoides* (6.6%)
Native shrub ground cover (%)	0%
Non-native plant cover (all strata) (%)	0%
Litter cover (%)	5.6%
Bare ground (%)	17.2%
Woody debris (m/ha of logs >0.5m long and >10cm wide)	0
Soil pH	8.62 (average for 0-30cm depths)

Photo 73
Monitoring site
M18, Bird Islet
facing WNW

Photo 74
Monitoring site
M18, Bird Islet
facing NNE

Photo 75
Monitoring site
M18, Bird Islet
facing ESE

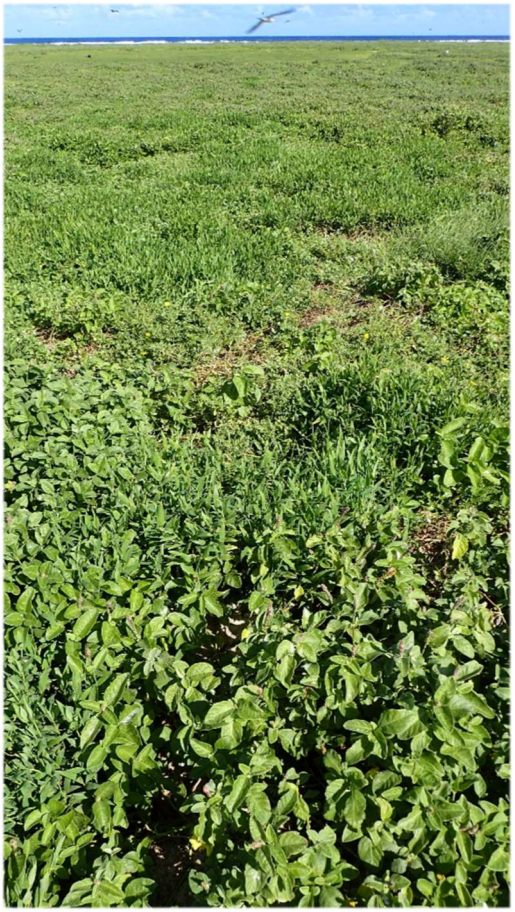


Photo 76
Monitoring site
M18, Bird Islet
facing SSW

Joy Brushe ©

Table 31 BioCondition attribute data recorded in monitoring site M19 on Bird Islet, Wreck Reefs 28 May 2022

Site M19	
Cay	Bird Islet, Wreck Reefs
Vegetation community description	closed forbland dominated by *Achyranthes aspera* and *Boerhavia albiflora* var. *albiflora*
Transect start (WGS 84)	-22.172521 155.459354
Transect centre (WGS84)	-22.17254 155.459602
Transect end (WGS 84)	-22.171044 155.458804
Transect bearing (degrees)	85
Median canopy height/range (metres)	0.4/0.1-0.6
Tree canopy cover %	n/a
Shrub canopy cover %	n/a
Basal area m^2/ha (at 30 cm height, calculated from stem diameters)	n/a
Total number of large trees/ha	0
Total no of trees per ha	n/a
Total number of tree stems/ha	n/a
Total no. shrubs/ha	0
Total no. shrub stems/ha	n/a
Large shrubs - mean diameter at 30 cm height	n/a
Recruitment of ecologically dominant layer (%)	n/a
Tree species richness	0
Tree species present	n/a
Shrub species richness	0
Shrub species present (layer in brackets)	n/a
Median ground layer height/range (metres)	0.4/0.1-0.6
Total ground layer cover of native cay species (%)	86.4%
Grass species richness	1
Grass cover (%)	<0.1%
Grass species present in order of decreasing cover - most abundant first (cover in brackets)	*Stenotaphrum micranthum* (<1.0%)
Forb (including vines) species richness	4
Forb species cover (%)	86.4%
Forb species present in order of decreasing cover - most abundant first (cover in brackets)	*Achyranthes aspera* (52%), *Boerhavia albiflora* var. *albiflora* (32.8%), *Portulaca oleracea* (1.2%), *Tribulus cistoides* (0.4%)
Native shrub ground cover (%)	0%
Non-native plant cover (all strata) (%)	0%
Litter cover (%)	11%
Bare ground (%)	2.6%
Woody debris (m/ha of logs >0.5m long and >10cm wide)	0
Soil pH	8.35 (average for 0-30cm depths)

Photo 77
Monitoring site M19, Bird Islet facing E

Photo 78
Monitoring site M19, Bird Islet facing S

Photo 79
Monitoring site M19, Bird Islet facing W

Photo 80
Monitoring
M19, Bird I
facing N

Joy Brushe ©

Soil data

Soil samples were collected from BioCondition monitoring sites M18 and M19 on Bird Islet.

Refer to *Appendix 5* for results of all the soil analyses for M18 and M19 and the other sites sampled during the 2022 voyage. For comparison of M18 and M19 soil analysis data with data from previous Coral Sea and Southern GBR soil surveys, refer to the Soils section under *Methodologies, general results and discussion* in this report.

Total sulphur levels at all 2022 sample sites were high – Refer to *Figure 13* and explanatory text in the *Soils* section under *Methodologies, general results and discussion* in this report.

M18

Organic carbon, total and Colwell phosphorus, total potassium and total sodium and all trace elements (copper, iron, manganese and zinc) levels were higher than levels obtained in other interior grassland soils.

pH, total nitrogen, total calcium, exchangeable potassium and total aluminium were similar to those of other interior grassland sites.

Electrical conductivity, exchangeable calcium, exchangeable sodium and cation exchange capacity were similar to that in other Coral Sea grassland soils except for the grey water outlet site on South Islet (Willis Islets) which had higher electrical conductivity, exchangeable calcium, exchangeable sodium and cation exchange capacity than all the other interior grassland sites.

Total and exchangeable magnesium levels were lower than those in all other interior grassland sites sampled.

M19

Colwell phosphorus and total potassium levels were higher than in any other soils sampled.

Total nitrogen levels were higher than at all other sites except for those of the Coringa Herald cays where total nitrogen was higher in all vegetation types sampled.

Total phosphorus and zinc were also quite high in comparison to other interior herbland locations except for the grey water outlet site on South Islet (Willis Islets) which had much higher total phosphorus and zinc than all the other interior herbland locations and one of the Cato Island Interior herbland sites which had slightly higher total phosphorus and zinc levels.

Total sodium was slightly higher than all interior herbland locations except for the Cato Island herblands.

Organic carbon levels were higher than those of interior herblands on the Willis Islets, Diamond Islets and Lihou Reef cays.

pH, electrical conductivity, total calcium, exchangeable potassium and exchangeable sodium levels were similar to other interior herbland sites.

Exchangeable calcium, cation exchange capacity, total aluminium levels and levels of the other trace elements (copper, iron and manganese) levels were similar to other interior herbland sites except for the grey water outlet site on South Islet (Willis Islets) which higher exchangeable calcium and cation exchange capacity and considerably higher levels of aluminium and trace elements (particularly iron) than all the other interior herbland sites.

Exchangeable magnesium levels were slightly lower than those in most other interior herbland locations whilst total magnesium levels were relatively higher than or similar to those of other interior herbland sites.

2.5.4 Birds

Table 32 Bird species and their breeding status – Bird Islet, Wreck Reefs

Bird Islet	28/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	0
lesser frigatebird	*Fregata ariel*	317	2	25	344	323
masked booby	*Sula dactylatra dactylatra*	0	0	0	0	20
brown booby	*Sula leucogaster*	1	0	0	1	165
red-footed booby	*Sula sula*	0	0	0	0	38
sooty tern	*Onychoprion fuscatus*	P	P	P	11890	12150
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	25	0	0	25	34
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	0
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	P	P	P	4490	4680
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	7-10
ruddy turnstone	*Arenaria interpres*	0	0	0	0	5
wandering tattler	*Tringa incana*	0	0	0	0	1
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- Crested tern breeding pairs were made up of two small colonies – 10 and 15 pairs.
- Lesser frigatebirds bred in scattered colonies. Drone footage matched ground counts.
- No great frigatebirds were nesting. This is due to a lack of shrubs and no available raised nesting platforms.
- Sooty tern breeding stages were combined as it was impossible to check on total numbers of nests versus chicks versus young.
- Recently fledged red-footed boobies were roosting in an area they were probably raised in. This was within a current lesser frigatebird nesting area. Both species tolerated each other.
- Pacific golden plover numbers were given a confidence interval as it was difficult to determine if some birds were counted twice.

- A patch of introduced grass had fewer nesting birds in it than an adjacent patch of natural vegetation. This however could be due to normal, variable selections in breeding areas i.e., sooty terns were not nesting in consistent densities across other contiguous vegetation types.
- The density of the introduced grass could influence burrow selection of wedge-tailed shearwaters and affect site selection of species preferring vegetation with patches of bare substrate.

Photo 81 Mixed seabird breeding colony Collette Bagnato © Queensland Government

Photo 82 Lesser frigatebird colony Andrew McDougall © Queensland Government

Photo 83 General view of vegetation Collette Bagnato © Queensland Government

2.5.5 Pest and invertebrate sampling

(Refer to Health Check section for map)
25-26 May 2022

Table 33 Rodents

Collection period	Sampling methods	Sampling sites	Rodent species
overnight	baited tunnel traps/ink pads	8	nil

Photo 84 Typical “consortium” of hermit crabs in shelter Collette Bagnato © Queensland Government

Table 34 Invertebrates

Collection period	Sampling methods	baited sites	Species
daylight search	Bait stations and ground search	7	See below

Order	Family	Spp ID	Common name
Diptera	Milichiidae	?*Leptometopa* sp.	freeloader fly
Orthoptera	Acrididae	*Aiolopus thalassinus*	Acrididae grasshopper
Coleoptera	Anthicidae	*Anthicius* sp.	flower beetle
Blattodea		Blattodea	cockroach
Hymenoptera	Formicidae	*Cardiocondyla nuda / atalanta*	ant
Dermaptera		Dermaptera	earwig
Araneae	Lycosidae	*Hogna crispipes*	wolf spider
		Isopoda	slater
Hymenoptera	Formicidae	*Monomorium pharaonis*	pharaoh ant
Hemiptera	Lygaeidae	*Nysius caledoniae*	Caledonia seed bug
Hemiptera	Pentatomidae	Pentatomidae	shield bug
Pseudoscorpiones		Pseudoscorpiones	false scorpion
Lepidoptera	Pterophoridae	Pterophoridae	plume moth
Blattodea	Blaberidae	*Pycnoscelus surinamensis*	Surinam cockroach
Orthoptera	Tettigoniidae	Tettigoniidae	katydid

2.5.6 Health Checks and Island Watch

Eight Health Checks (HC) were assessed at Bird Islet, Wreck Reefs.

Condition class at six of the eight sites were assessed as Good, one Good with some concern and one as Significant Concern (see *Table 35*).

The Significant Concern condition rating for HC19 was due to the potentially invasive *Cynodon dactylon* var. *dactylon* and its potential or current threat to the integrity of the natural vegetation communities and to seabird breeding habitat (see Bird Islet vegetation chapter).

The overall condition class for Bird Islet, Wreck Reefs is Significant Concern.

Detailed criteria for each Health Check site are included in *Appendix 8*.

Table 35 Assessed condition class for each HC site

	Bird Islet, Wreck Reefs			
HC Site	Overall condition class			
HC17	Good	Good with concern	Significant concern	Critical
HC18	Good	Good with concern	Significant concern	Critical
HC19	Good	Good with concern	Significant concern	Critical
HC20	Good	Good with concern	Significant concern	Critical
HC21	Good	Good with concern	Significant concern	Critical
HC22	Good	Good with concern	Significant concern	Critical
HC23	Good	Good with concern	Significant concern	Critical
HC24	Good	Good with concern	Significant concern	Critical

Table 36 Summary of vegetation communities around each HC site (reference with *Figure 36*)

HC Site	Ecosystems/vegetation communities				
HC17	16a				
HC18	8a	8b			
HC19	5b	8b	18		
HC20	1a	4	16b		
HC21	1a	4	6a	6e	
HC22	5b	8b	6e	16a	
HC23	6e	8a	8b		
HC24	3b	4	5b	16b	

Island Watch

A summarised table of all Island Watch information can be found at *Appendix 9*.

Photo 85 Health Check site HC18 South

Photo 86 Health Check site HC21 East

Photo 87 Health Check site HC24 West

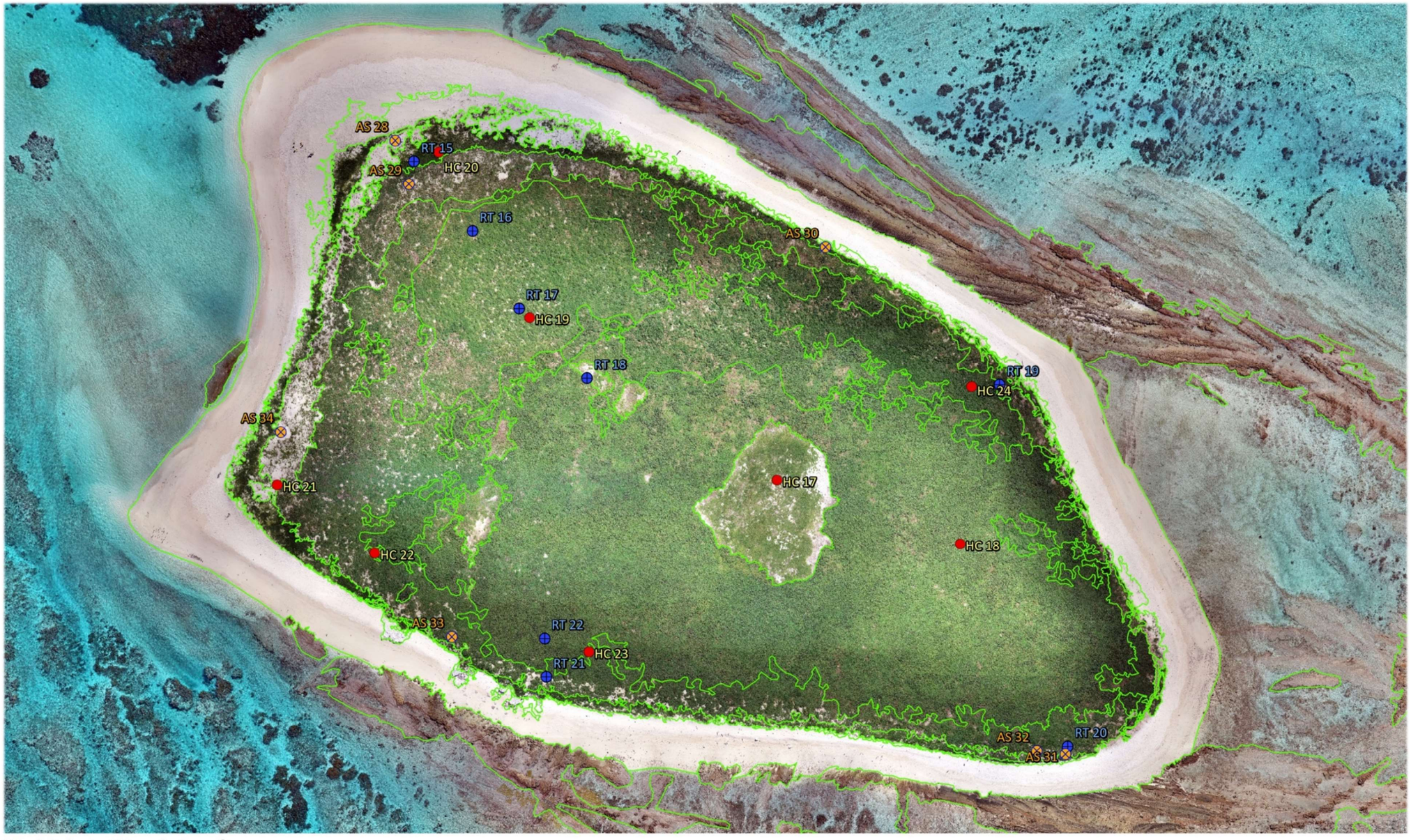


Figure 36 Health Check, rodent tunnel and ant bait station sites on Bird Islet, Wreck Reefs

2.6. South West (Boulder) Cay, Kenn Reefs

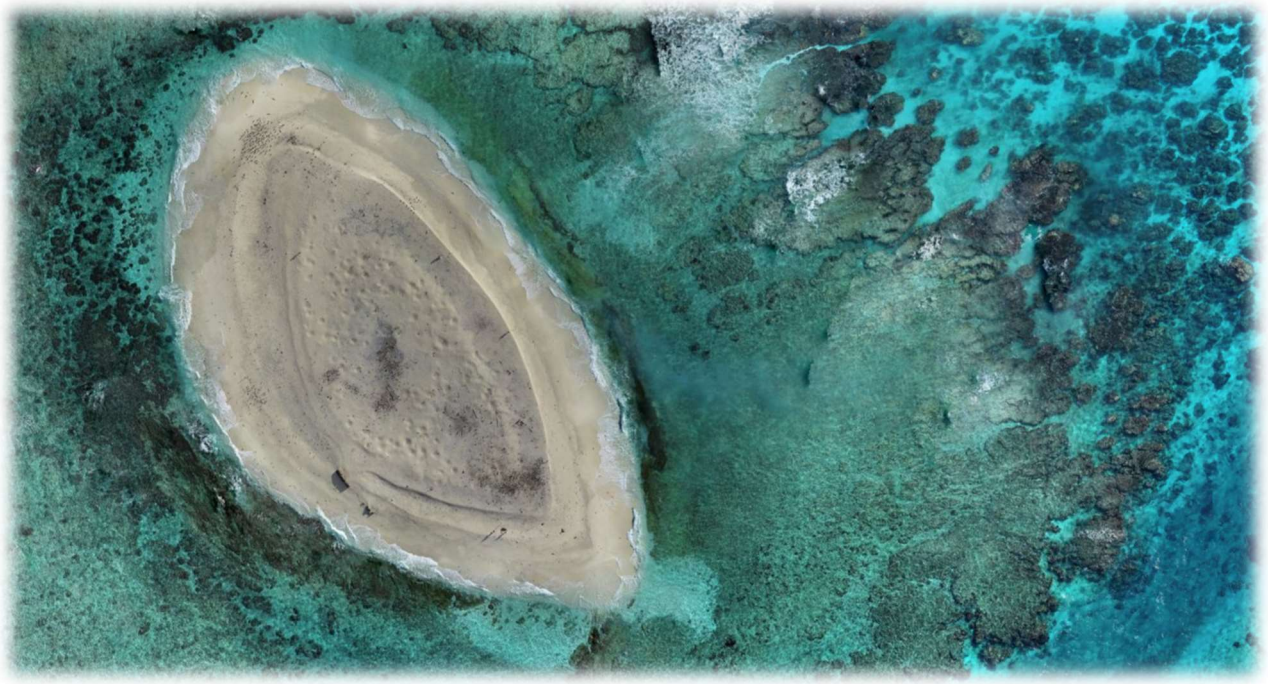


Figure 37 South West Cay Jake Sanders © Queensland Government

2.6.1 Drone imagery

29 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 60m
- Resolution 1.8cm/px
- Map stitching software – Drone Deploy

2.6.2 Physical description

- Low tide extent 204m x 111m
- Approximate high tide extent 140m x 72m
- Approximate area above high tide 0.7ha

South West Cay, shown in *Figure* 37, is an unvegetated sand and coral rubble cay located 677km east of Mackay, Queensland at -21.273 degrees latitude and 155.710 degrees longitude.

2.6.3 Vegetation

On 29 May 2022, South West Cay was unvegetated.

2.6.4 Birds

Table 37 Bird species and their breeding status – South West Cay, Kenn Reefs

South West Cay	29/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	0
lesser frigatebird	*Fregata ariel*	0	0	0	0	0
masked booby	*Sula dactylatra dactylatra*	14	5	1	20	28
brown booby	*Sula leucogaster*	1	2	45	48	71
red-footed booby	*Sula sula*	0	0	0	0	0
sooty tern	*Onychoprion fuscatus*	99	4	26	129	230
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	0	0	0
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	0
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	208	9	119	336	980
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	0
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- Brown noddy nests were observed in raised partitions of a shipwreck on the cay.
- Some inundation areas on the eastern side of the cay had claimed unidentified seabird chicks. The chicks were only recently hatched and would not have been capable of moving to higher ground.
- A mixed colony of sooty terns and brown noddies was located on the southern end of the cay.
- Smaller brown noddy colonies were located near the middle of the Cay.
- No threats were observed.

Photo 88 Young brown noddy in shipwreck Andrew McDougall © Queensland Government

Photos 89a and 89b Quarrels over coral. A young masked booby (L) and young brown booby (M) have a disagreement over trinkets. Andrew McDougall © Queensland Government.

2.6.5 Pest and invertebrate sampling

(Refer to Health Check section for map)

29 May 2022

Rodents – unvegetated cay, no rodent tunnels deployed. No rodents observed.

Table 38 Invertebrates

Collection period	Sampling methods	baited sites	Species
daylight search	ground search	0	0

2.6.6 Health Checks and Island Watch

Three Health Checks (HC) were assessed at South West Cay, Kenn Reefs.

The overall condition class of the cay's ecosystem was **Good** (the highest rating, see *Table 39*).

Detailed criteria for each HC site are included in *Appendix 8*.

Table 39 Assessed condition class for each HC site.

	South West Cay, Kenn Reefs			
HC Site	Overall condition class			
HC25	Good	Good with concern	Significant concern	Critical
HC26	Good	Good with concern	Significant concern	Critical
HC27	Good	Good with concern	Significant concern	Critical

Table 40 Summary of ecosystem type around each HC site (reference with *Figure 38*)

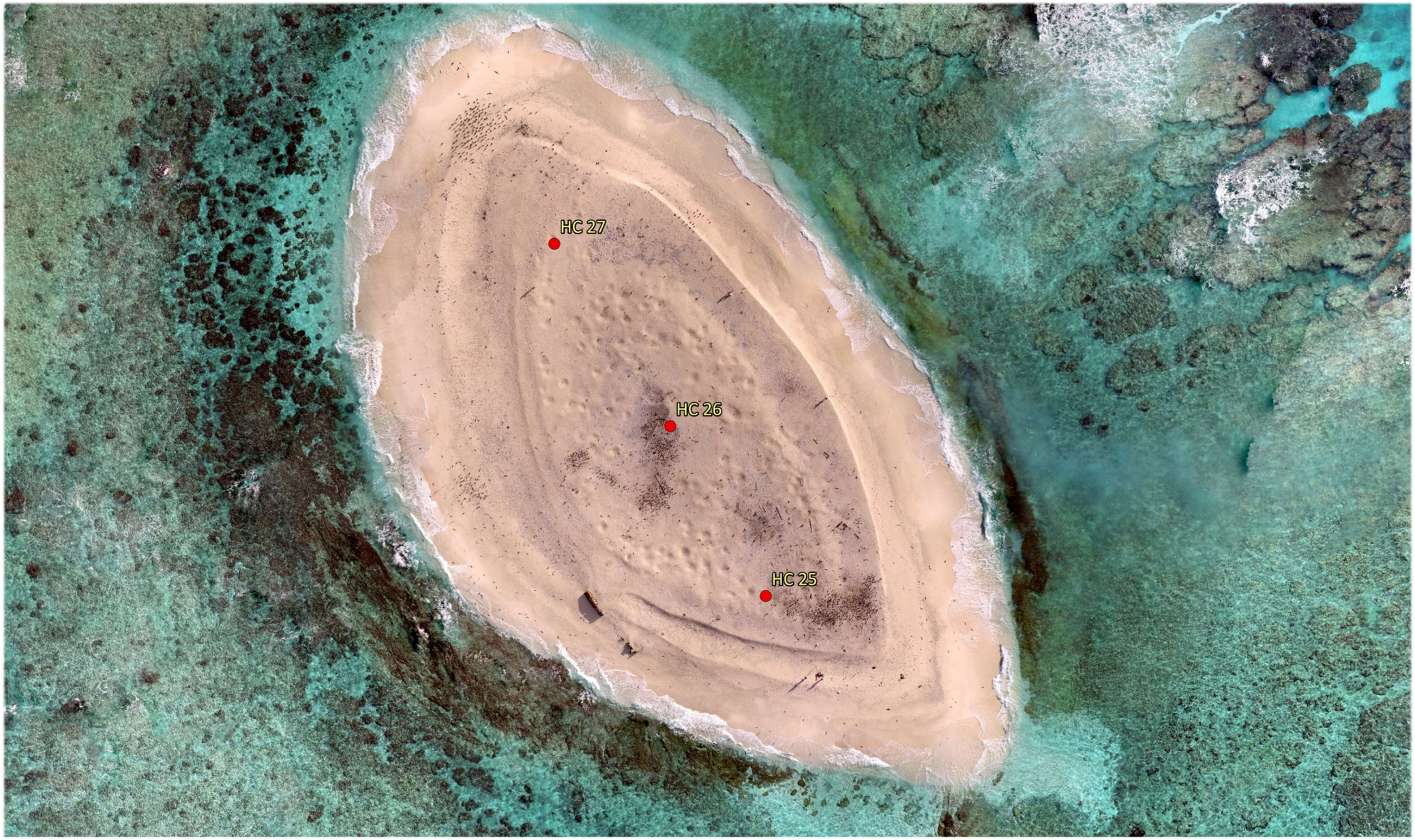
	South West Cay, Kenn Reefs
HC Site	Ecosystems/vegetation communities
HC25	Unvegetated, sandy substrate, fine sediments with coral rubble
HC26	Unvegetated, sandy substrate, fine sediments with coral rubble
HC27	Unvegetated, sandy substrate, fine sediments with coral rubble

Island Watch

A summarised table of all Island Watch information can be found at *Appendix 9*.

Photo 90 Health Check site HC26 South

Photo 91 Health Check site HC27 North



South West Cay (Boulder Cay), Kenn Reefs

Area: Approx. 0.698 ha (area above HAT)
Approx. 1.995 ha (total area of cay)

- Health check

0 5 10 20 30 40 50 Metres

Printed on: 17/11/2022

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS1984

Figure 38 Health Check sites on South West Cay, Kenn Reefs

2.7 Observatory Cay, Kenn Reefs

Figure 39 Observatory Cay Jake Sanders © Queensland Government

2.7.1 Drone imagery

29 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 69m
- Resolution 2cm/px
- Map stitching software – Drone Deploy

2.7.2 Physical description

- Low tide extent 124m x 72m
- Approximate high tide extent 70m x 36m
- Approximate area above high tide 0.18ha

Observatory Cay, Kenn Reefs, shown in *Figure 39*, is an unvegetated sand and coral rubble cay located 684km east of Mackay, Queensland at -21.255 degrees latitude and 155.771 degrees longitude.

2.7.3 Vegetation

On 29 May 2022, Observatory Cay was unvegetated.

2.7.4 Birds

Table 41 Bird species and their breeding status – Observatory Cay, Kenn Reefs

Observatory Cay	29/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	0
lesser frigatebird	*Fregata ariel*	0	0	0	0	2
masked booby	*Sula dactylatra dactylatra*	0	0	0	0	3
brown booby	*Sula leucogaster*	0	0	0	0	145
red-footed booby	*Sula sula*	0	0	0	0	0
sooty tern	*Onychoprion fuscatus*	155	0	0	155	0
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	55	55	43
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	0
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	320	485		805	1255
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	0
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- Sooty terns and brown noddies shared nesting areas.
- Crested tern young were mobile and located to beach rock areas to the north.
- Adult birds of several species moved from Observatory Cay to adjacent sand banks while research activities were conducted. These birds were not counted twice with all numbers reflected in the Observatory Cay totals.
- No threats were observed.

Photo 92 Brown noddy colony with the Kenn Reefs sand bank complex in the background.
Collette Bagnato © Queensland Government

2.7.5 Pest and invertebrate sampling

29 May 2022

Rodents – unvegetated cay, no rodent tunnels deployed. No rodents observed.

Table 42 Invertebrates

Collection period	Sampling methods	baited sites	Species
daylight search	ground search	0	Nil

2.7.6 Health Checks and Island Watch

One Health Check (HC) was assessed at Observatory Cay, Kenn Reefs.

The overall condition class of the cay's ecosystem was **Good** (the highest rating, see *Table 43*).

Detailed criteria for each HC site are included in *Appendix 8*.

Table 43 Assessed condition class for each HC site

	Observatory Cay, Kenn Reefs			
HC Site	Overall condition class			
HC28	Good	Good with concern	Significant concern	Critical

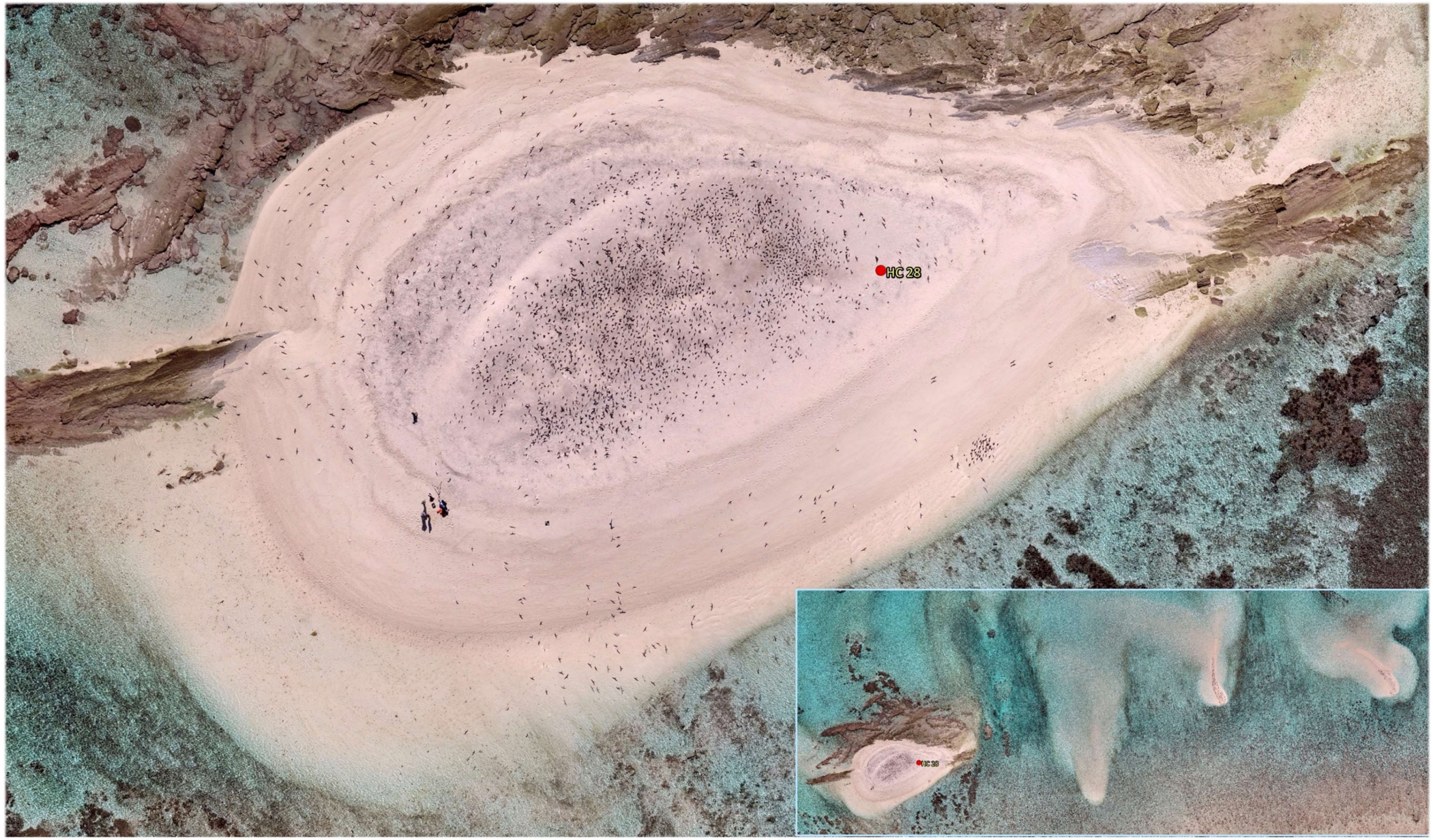
Table 44 Summary of each ecosystem type around HC sites (reference with *Figure 40*)

HC Site	Ecosystems/vegetation communities
HC28	Unvegetated, sandy substrate, fine sediments with coral rubble

Photo 93 Health Check site HC28 West

Island Watch

A summarised table of all Island Watch information can be found at *Appendix 9*.



Observatory Cay, Kenn Reefs

Area: 0.244 ha (area above HAT)
0.779 ha (total area of cay)

● Health check

0 5 10 20 30 40 50 Metres

Printed on: 30/11/2022

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS1984

Figure 40 Health Check sites on Observatory Cay, Kenn Reefs

2.8. Unnamed cay, northern end of Kenn Reefs

Figure 41 Unnamed cay, Kenn Reefs Jake Sanders © Queensland Government

2.8.1 Drone imagery

29 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 64m
- Resolution 1.9cm/px
- Map stitching software – Drone Deploy

2.8.2 Physical description

- Low tide extent 86m x 35m
- Approximate high tide extent 53m x 14m
- Approximate area above high tide 520m²

The unnamed cay at the northern end of Kenn Reefs, shown in *Figure 41*, is an unvegetated coral rubble cay located 684km east of Mackay, Queensland at -21.204 degrees latitude and 155.776 degrees longitude.

2.8.3 Vegetation

On 29 May 2022, unnamed cay at the northern end of Kenn Reefs was unvegetated.

2.8.4 Birds

Table 45 Bird species and their breeding status – unnamed cay, Kenn Reefs

unnamed cay	29/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	1
lesser frigatebird	*Fregata ariel*	0	0	0	0	0
masked booby	*Sula dactylatra dactylatra*	0	0	0	0	1
brown booby	*Sula leucogaster*	0	0	0	0	4
red-footed booby	*Sula sula*	0	0	0	0	51
sooty tern	*Onychoprion fuscatus*	0	0	0	0	0
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	0	0	0
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	3
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	old	0	0	0	36
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	0
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- This unnamed cay had been stable enough for brown noddies to at least attempt nesting. Old nests were observed. It is unknown if nesting was successful, although no dead chicks or young were seen.
- The cay was well used as a roost site, particularly by red-footed boobies. There was a substantial mat of guano on the northern end (darker stained patch in *Figure 42).*
- This cay would be suitable as a nesting site for black-naped terns and possibly New Caledonian fairy terns.

Photo 94 Old brown noddy nests were observed on this unnamed cay in the Kenn Reefs system
Collette Bagnato © Queensland Government

2.8.5 Pest and invertebrate sampling

29 May 2022

Rodents – unvegetated cay, no rodent tunnels deployed. No rodents observed.

Table 46 Invertebrates

Collection period	Sampling methods	baited sites	Species
daylight search	ground search	0	Nil

2.8.6 Health Checks and Island Watch

One Health Check (HC) was assessed at the unnamed cay, Kenn Reefs.

The overall condition class of the cay's ecosystem was **Good** (the highest rating, see *Table 47*).

Detailed criteria for each HC site are included in *Appendix 8*.

Table 47 Assessed condition class for each HC site

	unnamed cay, Kenn Reefs			
HC Site	Overall condition class			
HC29	Good	Good with concern	Significant concern	Critical

Table 48 Summary of each ecosystem type around HC sites (reference with *Figure 42*)

HC Site	Ecosystems/vegetation communities
HC29	Unvegetated coral rubble cay

Island Watch

A summarised table of all Island Watch information can be found at *Appendix 9*.

North Cay, Kenn Reefs

Area: Approx. 0.301 ha (area above HAT)
Approx. 0.104 ha (total area of cay)

- Health check

N
W E
S

0 5 10 20 30 40 50 Metres

Printed on:
17/11/2022

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS1984

Figure 42 Health Check sites on unnamed cay (“North Cay”) Kenn Reefs

2.9 Observatory Cay, Frederick Reefs

Figure 43 Observatory Cay. Jake Sanders © Queensland Government

2.9.1 Drone imagery

30 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 83m
- Resolution 2.3cm/px
- Map stitching software – Drone Deploy

2.9.2 Physical description

- Low tide extent (combined cays) 356m x 28m
- Approximate high tide extent 30m x 4m
- Approximate area above high tide 76m²

Observatory Cay, Frederick Reefs, shown in *Figure 43*, is an unvegetated sand and coral rubble cay located at 540km east of Mackay, Queensland at -22.022 degrees latitude and 154.376 degrees longitude.

The cay is one in a series of dynamic cays near the southern end of the reef complex. It is likely the size, structure and even location of the cays will be ephemeral, all dependent on weather and sea conditions.

2.9.3 Vegetation

On 30 May 2022 Observatory cay was unvegetated.

2.9.4 Birds

Table 49 Bird species and their breeding status – Observatory Cay, Frederick Reefs

Observatory Cay	30/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	0
lesser frigatebird	*Fregata ariel*	0	0	0	0	0
masked booby	*Sula dactylatra dactylatra*	0	0	0	0	0
brown booby	*Sula leucogaster*	0	0	0	0	4
red-footed booby	*Sula sula*	0	0	0	0	0
sooty tern	*Onychoprion fuscatus*	0	0	0	0	1
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	0	0	2
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	5
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	old	0	0	0	340
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	0
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- This cay and series of sand banks is highly dynamic and would only provide opportunistic and limited breeding substrate.
- Some old brown noddy nests were observed with most having been impacted by rubble washed over from storms or high tide events.

Photo 95 Brown noddies have bred or attempted to breed on this highly dynamic cay.
Collette Bagnato © Queensland Government

2.9.5 Pest and invertebrate sampling

30 May 2022

Rodents – unvegetated cay, no rodent tunnels deployed. No rodents observed.

Table 50 Invertebrates

Collection period	Sampling methods	baited sites	Species
daylight search	ground search	0	Nil

2.9.6 Health Checks and Island Watch

One Health Check (HC) was assessed at Observatory Cay, Frederick Reefs.

The overall condition class of the cay's ecosystem was **Good** (the highest rating, see *Table 51*)

Detailed criteria for each HC site are included in *Appendix 8*.

Table 51 Assessed condition class for each HC site

	Observatory Cay, Frederick Reefs			
HC Site	Overall condition class			
HC30	Good	Good with concern	Significant concern	Critical

Table 52 Summary of ecosystem type around each HC site (reference with *Figure 44*)

HC Site	Ecosystems/vegetation communities
HC30	Unvegetated, sandy substrate, fine sediments with coral rubble

Island Watch

A summarised table of all Island Watch information can be found in *Appendix 9*.

Photo 96 Health Check site HC30 East

Observatory Cay, Frederick Reefs

Area (west cay)
Approx. 0.063 ha (above HAT)
Approx. 0.217 ha (total area)

Area (east cay)
Approx. 0.208 ha (above HAT)
Approx. 0.573 ha (total area)

● Health check

N W E S

0 5 10 20 30 40 50 Metres

Printed on: 30/11/2022

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS1984

Figure 44 Health Check sites on Observatory Cay, Frederick Reefs

2.10. Lighthouse Cay, Frederick Reefs

2.10.1 Drone imagery

30 May 2022:

- Drone - Phantom 4 RTK
- Image capture height 60m
- Resolution 1.7cm/px
- Map stitching software – Drone Deploy

2.10.2 Cay description

- Low tide extent 331m x 68m
- Approximate high tide extent 60m x 8m
- Approximate area above high tide 310m²

Lighthouse Cay, shown in *Figure 45*, is an unvegetated sand and coral rubble cay located 542km east of Mackay, Queensland at -20.937 degrees latitude and 154.400 degrees longitude.

2.10.3 Vegetation

On 30 May 2022 Lighthouse Cay was unvegetated.

Figure 45 Lighthouse Cay Jake Sanders © Queensland Government

Photo 97 The 33m tower at Lighthouse Cay Andrew McDougall © Queensland Government

2.10.4 Birds

Table 53 Bird species and their breeding status – Lighthouse Cay, Frederick Reefs

Lighthouse Cay	30/05/2022	Breeding stages present				
common name	**scientific name**	Nests	Chicks	Young	Breeding pairs	Adolescents and adults
red-tailed tropicbird	*Phaethon rubricauda roseotinctus*	0	0	0	0	0
Herald petrel	*Pterodroma heraldica*	0	0	0	0	0
wedge-tailed shearwater	*Ardenna pacifica*	0	0	0	0	0
great frigatebird	*Fregata minor*	0	0	0	0	1
lesser frigatebird	*Fregata ariel*	0	0	0	0	0
masked booby	*Sula dactylatra dactylatra*	0	0	0	0	0
brown booby	*Sula leucogaster*	0	0	0	0	8
red-footed booby	*Sula sula*	0	0	0	0	95
sooty tern	*Onychoprion fuscatus*	0	0	0	0	0
bridled tern	*Onychoprion anaethetus*	0	0	0	0	0
crested tern	*Thalasseus bergii*	0	0	0	0	2
roseate tern	*Thalasseus bengalensis*	0	0	0	0	0
black-naped tern	*Sterna sumatrana*	0	0	0	0	2
New Caledonian fairy tern	*Sternula nereis exsul*	0	0	0	0	0
black noddy	*Anous minutus*	0	0	0	0	0
brown noddy	*Anous stolidus*	old	0	0	0	240
buff-banded rail	*Gallirallus philippensis tounelieri*	0	0	0	0	0
purple swamphen	*Porphyrio melanotus*	0	0	0	0	0
sacred kingfisher	*Todiramphus sanctus*	0	0	0	0	0
white-faced heron	*Egretta novaehollandiae*	0	0	0	0	0
Pacific golden plover	*Pluvialis fulva*	0	0	0	0	0
ruddy turnstone	*Arenaria interpres*	0	0	0	0	0
wandering tattler	*Tringa incana*	0	0	0	0	0
grey-tailed tattler	*Tringa brevipes*	0	0	0	0	0
lesser sand plover	*Charadrius mongolus*	0	0	0	0	0

Notes

- A highly dynamic cay offering limited breeding opportunities.
- Old brown noddy nests had been washed over.

2.10.5 Pest and invertebrate sampling

30 May 2022

Rodents – unvegetated cay, no rodent tunnels deployed. No rodents observed.

Table 54 Invertebrates

Collection period	Sampling methods	baited sites	Species
daylight search	ground search	0	Nil

2.10.6 Health checks and Island Watch

Two Health Checks (HC) were assessed at Lighthouse Cay, Frederick Reefs.

The overall condition class of the cay's ecosystem was Good (the highest rating, see *Table 55*).

Detailed criteria for each HC site are included in *Appendix 8*.

Table 55 Assessed condition class for each HC site

	Lighthouse Cay, Frederick Reefs			
HC Site	Overall condition class			
HC31	Good	Good with concern	Significant concern	Critical
HC32	Good	Good with concern	Significant concern	Critical

Table 56 Summary of ecosystem types around each HC site (reference with *Figure 46*)

HC Site	Ecosystems/vegetation communities
HC31	Unvegetated, coarse sands with coral rubble
HC32	Unvegetated, coarse sands with coral rubble

The condition of **Good** takes into consideration the natural dynamics of this site. It is not currently a valuable breeding area for seabirds but does hold value as a roosting site.

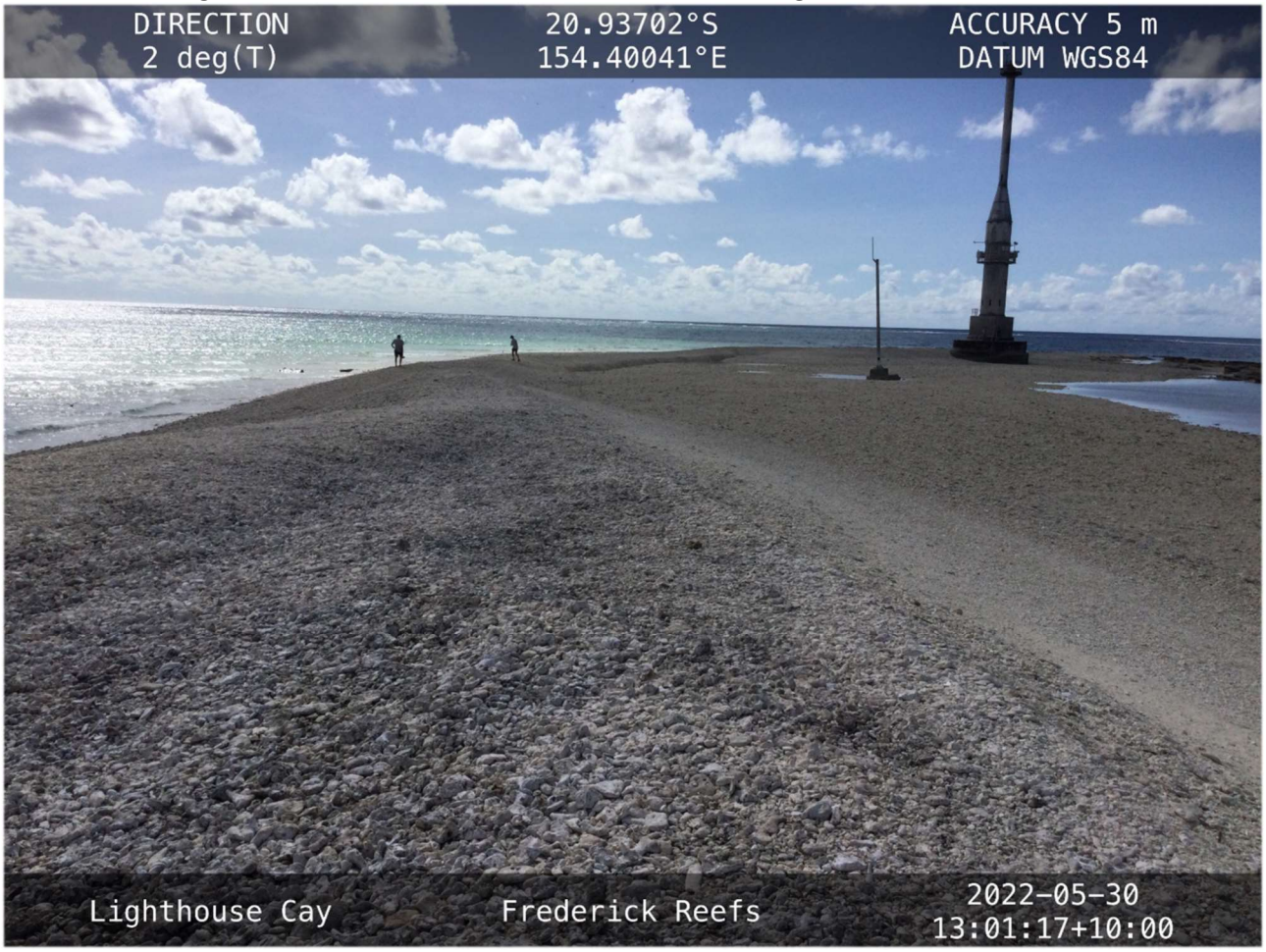


Photo 98 Health Check site HC31 North

Island Watch

A summarised table of all Island Watch information can be found at *Appendix 9*.