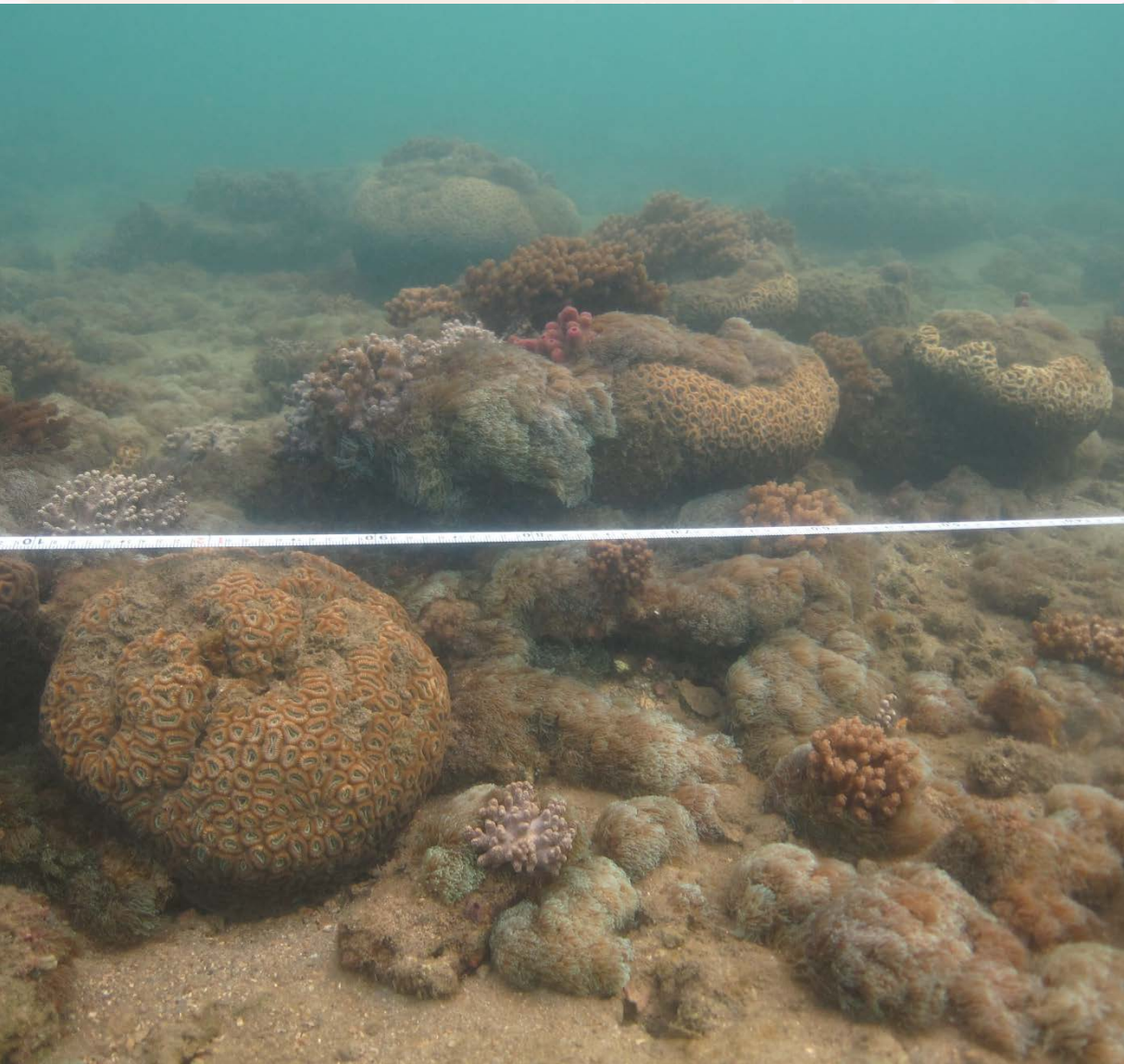


Reef Check Australia



Moreton Bay Reef Monitoring: Training & Survey Report



Prepared for SEQ Catchments Ltd and
Quandamooka Yoolooburrabee Aboriginal Corporation
www.reefcheckaustralia.org
Reef Check Foundation Ltd 2014

The Sea Country Management Program is coordinated by the Queensland Government Department of Environment and Heritage Protection through funding support from the Australian Government.

Caring for Quandamooka Country is a joint initiative of the Quandamooka Yoolooburrabee Aboriginal Corporation and SEQ Catchments.



Australian Government



Queensland Government

This project was a collaborative partnership with SEQ Catchments Ltd, Quandamooka Yoolooburrabee Aboriginal Corporation, Quandamooka Land & Sea Management Agency, Reef Check Australia and Queensland Parks and Wildlife, Department of National Parks, Recreation, Sport & Racing, with in-kind support from the University of Queensland's Biophysical Remote Sensing Group and Moreton Bay Research Station.



Queensland Government

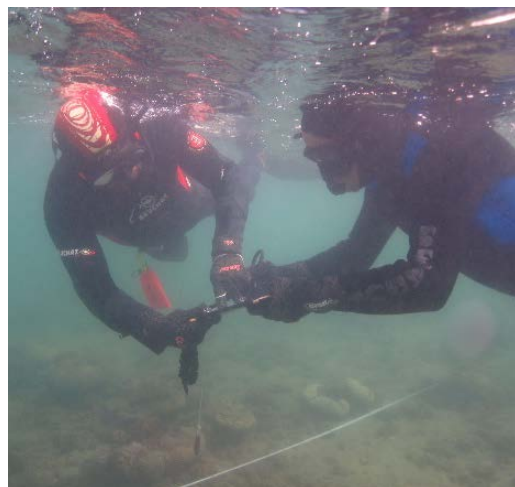


1.0 INTRODUCTION

The Quandamooka People are the Traditional Owners of Land and Sea Country within Moreton Bay. The goal of this collaborative project was to build capacity for reef monitoring activities using the globally standardised Reef Check Australia protocols, in order to increase available data about Moreton Bay reefs and support relevant land and sea management initiatives.

Moreton Bay is a unique marine habitat, as temperate, tropical and sub-tropical species co-exist (Perry & Larcombe 2003). While coral habitats represent only an estimated one percent of Moreton Bay (Lybolt 2010), they are important nurseries, breeding grounds and feeding grounds. To date, 63 species of hard corals have been documented in the Bay (Fellegara and Harrison 2008). Coral habitats are sensitive to environmental factors, and as such are excellent indicators for waterway and ecosystem health. As populations continue to rise in the SEQ region, so will pressures facing Moreton Bay marine environments. This highlights the importance of long-term reef monitoring to build understanding about how these unique marine systems may be changing over time. In fact, due to the unique assemblages of marine species and proximity to urban influences, SEQ has garnered recognition as an important area to study and protect (Wallace, Fellegara, Muir, & Harrison 2009).

The sea grants awarded to the Quandamooka Community support Traditional Owner involvement in cultural resource management activities and the future development and implementation of collaborative sea country management plans. The core values of the Quandamooka as they relate to these marine cultural & natural resource areas are intrinsic to the continued well being & sustenance of not only the Quandamooka but of all the interconnected living things that share space in the within & adjacent to Quandamooka region (Darren Burns, pers comms). RCA's monitoring program can contribute to long-term data for assessing changing reef health conditions and can be one tool for contributing to management responses to support reef conservation.



2.0 PROJECT summary

2.1 Key Training Outcomes

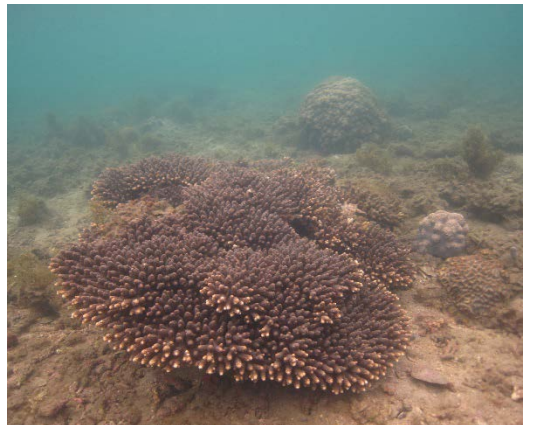
In total, 10 participants took part in elements of Reef Check surveyor training in December 2013 and June 2014. Reef Check training provides participants with the background to undertake globally standardised reef health monitoring protocols. The training has been developed specifically to allow non-marine biologists to collect meaningful and accurate reef health information. The training encompasses reef ecology theory, identification of reef health indicators, survey protocols and practical in-water skills. Six participants successfully completed the program and will be awarded with a Reef Check EcoDiver (snorkel) certification and are eligible to participate in Reef Check snorkel surveys.



2.2 Key Reef Monitoring Outcomes

Three new reef monitoring locations were established as part of the project. These sites were selected based on feedback from QYAC and to complement existing Reef Check Australia monitoring locations. This monitoring sites will form the basis for ongoing and expanding initiatives to collect reef health information for Moreton Bay.

- Shallow (1m) monitoring locations were established at Goat Island, Myora Reef and Peel Island.
- Myora Reef and Peel Island NE were dominated by hard coral (18% and 11% respectively). Goat Island was dominated by soft coral (29%)
- Coral scars (from unknown causes) were documented on all three sites, although Pel Island NE had the highest level (n=24). Low levels of coral bleaching were recorded at Goat Island and Peel Island NE (1% or less). Peel Island NE was the only site where rubbish (n=4) and Drupella snail scars (n=3) were recorded.
- All sites had low levels of indicator invertebrates.
- Siltation was recorded on all sites, ranging from low (Goat Island and Myora Reef) to medium (Peel Island NE).



3.0 REEF MONITORING

3.1 Monitoring Sites

Three new shallow snorkel monitoring locations were established at Goat Island, Myora Reef and Peel Island (see Figure 1). These sites compliment existing Reef Check Australia SCUBA monitoring locations (see 2013 Reef Check Australia SEQ Season Summary Report for further details).

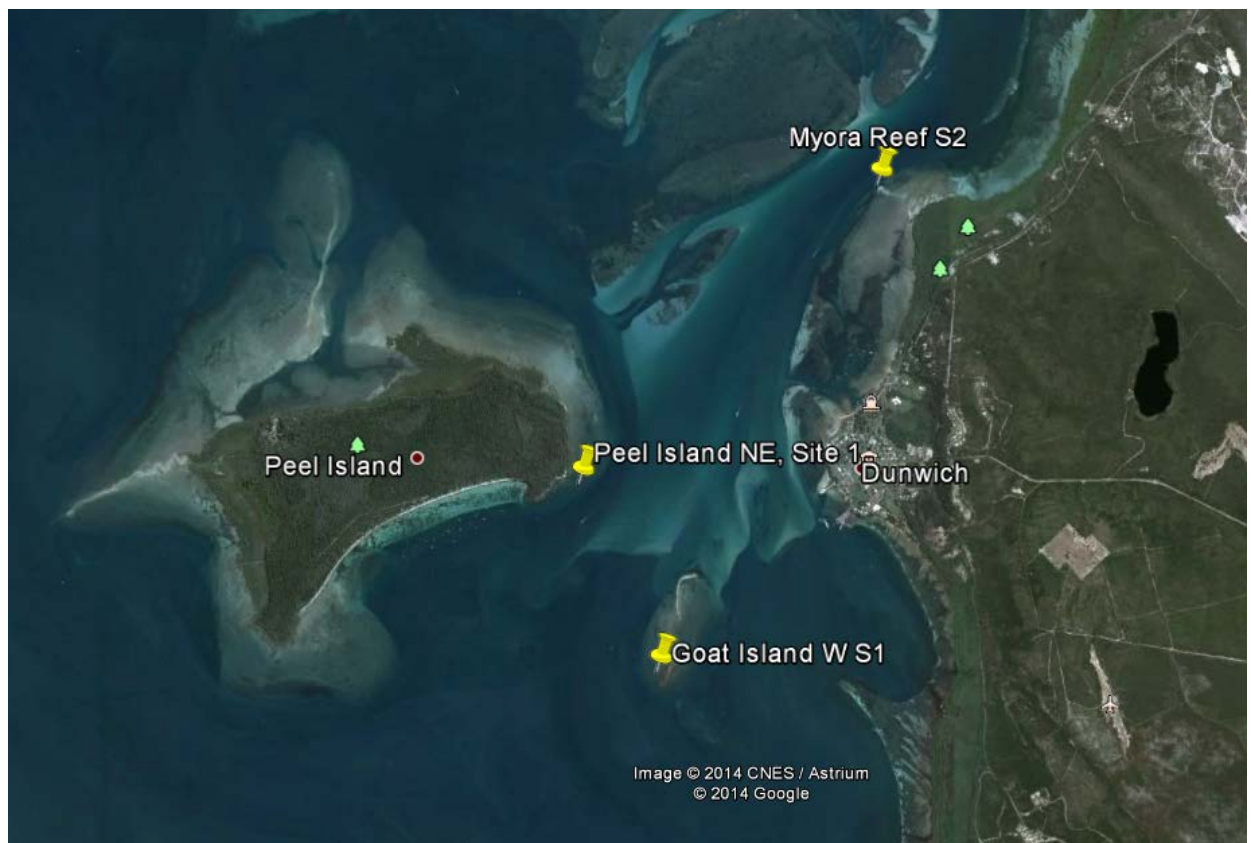


Figure 1. Map of 3 new Reef Check Australia snorkel monitoring sites (Google Earth).

Additional data and details can be found on the RCA online Reef Health Database and Google Map Interface:

www.reefcheckaustralia.org/data.html

REEF CHECK

AUSTRALIA

3.2 Goat Island (West), Site 1

Location: -27.516555°, 153.382862°

Depth: 1m

Zoning: Conservation Park (yellow zone)



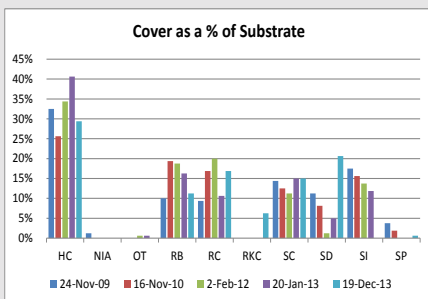
Site photo, Goat Island (West), Site 1



Bleached massive hard coral, Goat Island (West), Site 1



Ray, Goat Island (West), Site 1



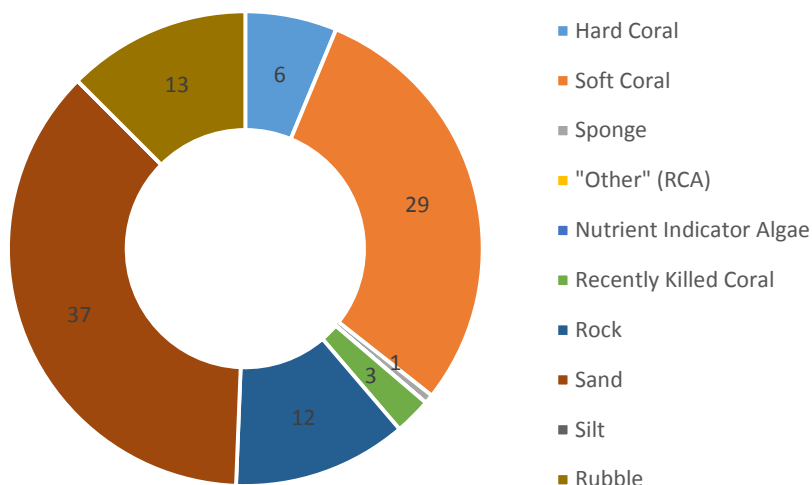
Benthic cover as a % of total substrate for nearby existing RCA monitoring site at Goat Island (East) 2009-2013.

A shallow sandy reef fringes Goat Island. This location has been recognised as an important location due to coral diversity (Fellegara & Harrison 2008). This site is exposed to regular boating traffic, including surge from the nearby boat channel.

Soft coral dominated this site (29%), with hard coral accounting for 6% of substrate cover. Approximately a quarter of soft corals were leathery growth forms, the majority were ornate. The small numbers of hard corals recorded were massive, encrusting or submassive growth forms. Recently killed coral accounted for 3% of substrate. Most of the non-living substrate is composed of sand (37%), rubble (13%) and rock (12%). This site does show differing substrate composition when compared with the established Reef Check Australia monitoring location on the eastern side of Goat Island, which had an average of 33% hard coral cover and 14% of soft coral cover between the period of 2009-2013.

Low levels of both hard and soft bleached corals were recorded on the survey, with an estimated 1% of the coral population impacted and an average of 37% of each bleached colony affected. The only other reef impact recorded on the survey were 2 coral scars from unknown causes.

There were no invertebrates found on this survey.



Benthic cover as a % of substrate, for Goat Island (West), Site 1. This graph represents the 10 basic Reef Check International substrate categories, additional data can be found on www.reefcheckaustralia.org.

REEF CHECK

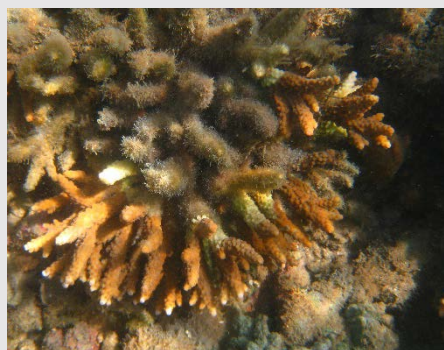
AUSTRALIA



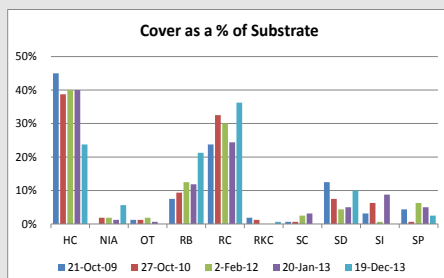
Site photo, Myora Reef, Site 2



Diadema Urchin, Myora Reef, Site 2



Unknown coral scar, Myora Reef, Site 2



Benthic cover as a % of total substrate for nearby existing RCA monitoring site at Myora Reef 2009-2013.

3.3 Myora Reef, Site 2

Location: -27.473800°, 153.404900°

Depth: 1m

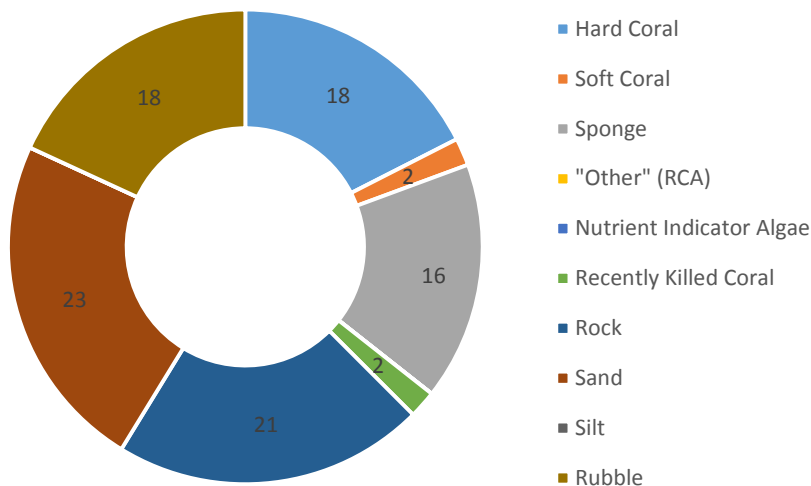
Zoning: Marine National Park (Green Zone)

Myora Reef is a unique reef habitat in Moreton Bay, as it is the only location dominated by *Acropora* corals (Fellegara & Harrison 2008).

Hard coral (18%) and sponge (16%) accounted for most of the living substrate at this new monitoring site. Hard corals were mainly clumped growth forms of *Acropora* (RCA HC category). Soft coral (2%) was recorded in low levels. There were low levels of recently killed coral (2%). Sand (23%), rock (21%) and rubble (18%) accounted for most of the non-living reef substrate. This site has lower hard coral cover (38%) than the recorded average for the established Reef Check Australia monitoring location, which is located nearby, but slightly deeper (3m).

2 *Diadema* urchins were recorded on the survey.

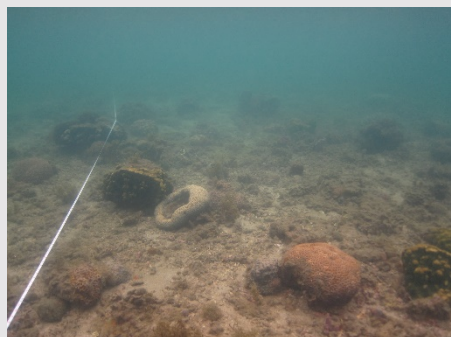
Twelve coral scars from unknown causes and 2 counts of coral damage were recorded on the survey.



Benthic cover as a % of substrate, for Myora Reef, Site 2. This graph represents the 10 basic Reef Check International substrate categories, additional data can be found on www.reefcheckaustralia.org.

REEF CHECK

AUSTRALIA



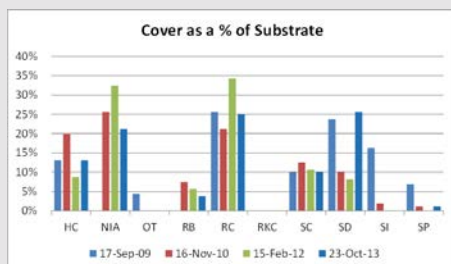
Site photo, Peel Island (NE), Site 1



Unknown coral damage, Peel Island (NE), Site 1



Rubbish, Peel Island (NE), Site 1



Benthic cover as a % of total substrate for nearby existing RCA monitoring site at Peel Island (South) 2009-2013.

3.4 Peel Island (NE), Site 1

Location: -27.499992°, 153.375261°

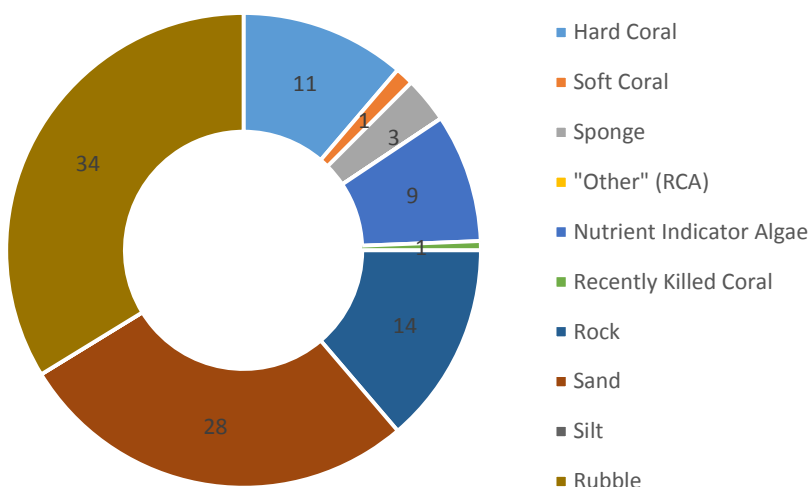
Depth: 1m

Zoning: Conservation Park (yellow zone)

This monitoring site is located on the shallow fringing reef in the area to the north of the Platypus wreck.

Hard coral represented 11% of substrate cover at this site, with low levels of soft coral (1%) and sponge (3%). Recently killed coral accounted for 1% of benthic cover. Nutrient indicator algae (9%, mostly *Lobophora*) represented high cover at this location than the other 2 monitoring locations. Rubble (34%), sand (28%) and rock (14%) made up the remainder of the non-living reef substrate. Reef Check Australia currently has two established monitoring locations around Peel Island, one just south of this site, near Horseshoe Bay and one on the northern tip of Peel Island. Both of these established sites have slightly higher average cover of hard coral (18% and 14% respectively) and soft coral (20% and 11% respectively) than the new monitoring location.

Eight *Drupella* snails were recorded on the transect, along with three *Drupella* scars. Additional recorded reef impacts at this site included 24 counts of unknown coral scars, 3 instances of coral damage, 4 counts of rubbish and very low levels of coral bleaching (<1% of coral population and an average of 28% of coral colony impacted).



Benthic cover as a % of substrate, for Peel Island (NE), Site 2. This graph represents the 10 basic Reef Check International substrate categories, additional data can be found on www.reefcheckaustralia.org.

4.0 LITERATURE CITED

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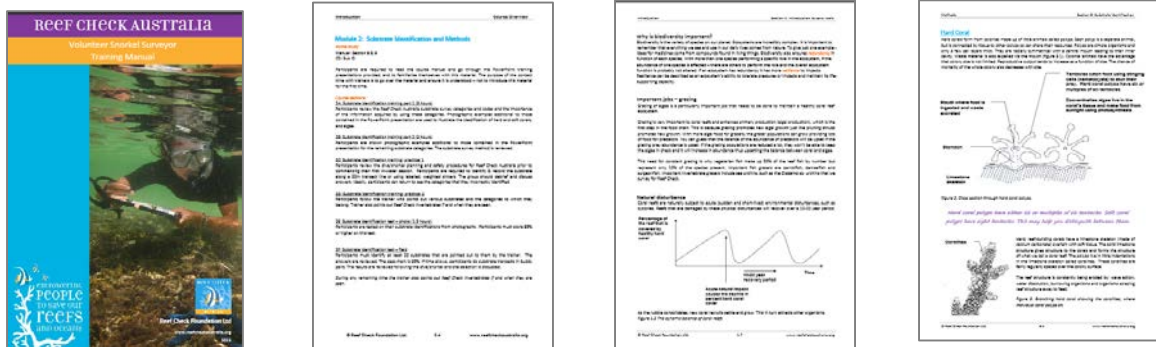
Wallace, C. C., Fellegara, I., Muir, P. R., & Harrison, P. L. (2009). The scleratinian coral of Moreton Bay. eastern Australia: high latitude, marginal assemblages with increasing coral richness. In P. Davie, & J. Phillips, *Proceedings of the 13th International Marine Biological Workshop, The Marine Flora and Fauna of Moreton Bay, Queensland. Memoirs of the Queensland Museum--Nature* 54(2) (pp. 1-118).

5.0 APPENDIX

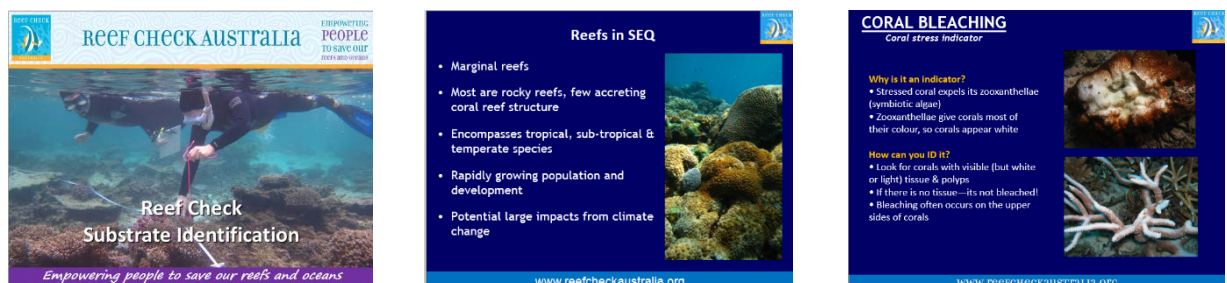
5.1 Reef Check Australia Training Course

The Reef Check Australia training course is based on the globally standardized Reef Check EcoDiver training, with additional regional and National indicators. During the 4 day training course, participants learn basic reef ecology, the importance of reef monitoring, survey protocols and identification skills. During 2 field days, students practice and demonstrate competence in survey methods to include the point intercept substrate method, belt transect invertebrate and impact method. To complete the course, participants must demonstrate their skills through identification photo exams (85% pass mark), in-situ identification of indicators (95% pass rate) and knowledge reviews to reiterate key points.

Example of training manual

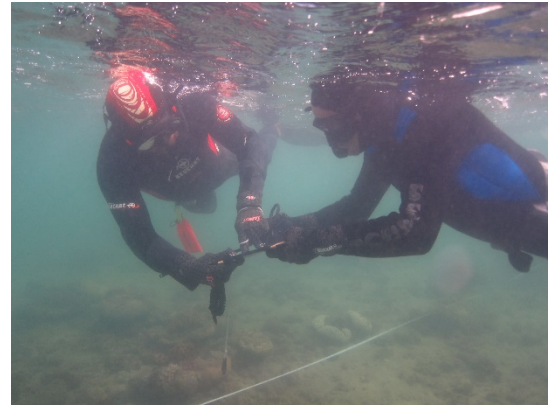


Example of training slides



5.0 APPENDIX

Images of trainees



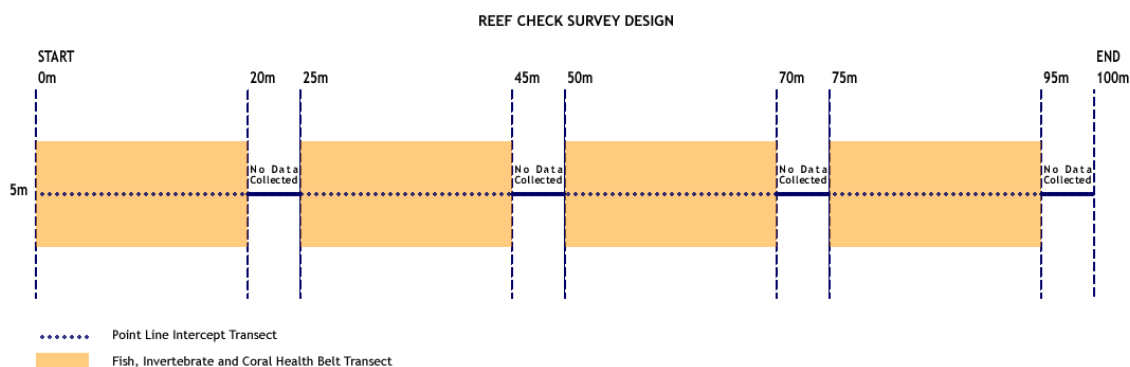
Images (left to right from top): Instructor reviewing categories during field sessions; team has a debrief and review of categories on the boat; team ready to hop in for snorkel sessions; course participants practice substrate identification; participant rolling up transect tape; and participants on the surface with underwater survey slates.

5.0 APPENDIX

5.2 Summary of RCA Monitoring Protocols

A set of biological indicators was chosen for Reef Check, to serve individually as indicators of specific types of human impacts, and collectively as a proxy for ecosystem health. These indicators fall into the following categories:

- Anecdotal site description (conducted in the 'site survey')
- Coral Communities (conducted in the 'substrate survey')
- Macro-invertebrates (conducted in the 'invertebrate survey')
- Impacts (conducted in the 'impact survey')



Reef Check surveys are conducted along a transect line marked by a graduated tape measure that is laid along a constant depth and reef habitat. The transect length that is surveyed is 80m, divided into four 20m sections or transect replicates (Figure 1). Each 20m sections is separated by 5m or more to create independent replicates that can be compared within surveys as well as between surveys.

Additional information about monitoring protocols can be found in the RCA Methods Manual: http://www.reefcheckaustralia.org/files/documents/44/rca_monitoring_methods.pdf

We recognise that a key question for users of community-based monitoring data is how well the data reflects real patterns and can detect temporal change. A study to look at the observer effects of Reef Check surveyors found that differences between observers and subsequent transect deployments is low, with average deployment effect across all benthic categories of only 6.14% (Done et al 2012 in draft). In summary, the standard error of the cover estimate across all categories was of the order of 1-2%. We have confidence that observer errors are only minor contributors to the variability among pooled samples at the scales of individual reefs and across many reefs. This means with adequate training and suitable maps, Reef Check participants can be trained to collect useful reef health monitoring information, but that small changes in substrate cover are not detectable.

5.0 APPENDIX

Substrate Survey

The substrate survey collects information about the percentage cover of bottom-dwelling (benthic) organisms and substrate on the reef. Each of these reef health indicator groups has a functional role on the coral reef. Reef Check Australia has 25 substrate category groups that have been expanded from the basic Reef Check International substrate categories. These expanded categories collapse to fit into the broader Reef Check International categories, allowing data cohesion while capturing additional levels of substrate detail.

A “point sampling” method is used for this survey. The team records the substrate type that is directly below the tape measure every 0.5m along each of the four 20m sections interval. These points allow us to calculate percent cover for each substrate type within the survey area. A “point sampling” method is used for this survey. The team records the substrate type that is directly below the tape measure every 0.5m along each of the four 20m sections interval. These points allow us to calculate percent cover for each substrate type within the survey area. To determine which part of the reef is directly below the line at each 0.5m interval, a weighted line (called a plumb line) is dropped at each interval and the substrate the weight lands on is recorded. This removes bias, which ensures the data represent the real abundance of each substrate category on the reef.

Reef Check Belt Transect - Substrate SEQ

Reef name: _____
 Date: _____
 Time: _____
 Data recorded by: _____
 Camera ID: _____

SC - Soft Coral
 SCL - Leathery soft coral
 SCZ - Zoanthids
 SCB - Bleached soft coral
 OT - Other
 RC - Rock
 RCTA - Turf algae
 RCCA - Coralline algae

RKC - Recently Killed Coral
 RKCNA - Recently killed coral & NIA
 RKCTA - Recently killed coral & turf algae
 NIA - Nutrient Indicator Algae
 SI - Silty/Clay
 RB - Rubble
 SD - Sand

0-20m				25-45m				50-70m				75-95m			
0	10	25	35	50	60	75	85								
0.5	10.5	25.5	35.5	50.5	60.5	75.5	85.5								
1	11	26	36	51	61	76	86								
1.5	11.5	26.5	36.5	51.5	61.5	76.5	86.5								
2	12	27	37	52	62	77	87								
2.5	12.5	27.5	37.5	52.5	62.5	77.5	87.5								
3	13	28	38	53	63	78	88								
3.5	13.5	28.5	38.5	53.5	63.5	78.5	88.5								
4	14	29	39	54	64	79	89								
4.5	14.5	29.5	39.5	54.5	64.5	79.5	89.5								
5	15	30	40	55	65	80	90								
5.5	15.5	30.5	40.5	55.5	65.5	80.5	90.5								
6	16	31	41	56	66	81	91								
6.5	16.5	31.5	41.5	56.5	66.5	81.5	91.5								
7	17	32	42	57	67	82	92								
7.5	17.5	32.5	42.5	57.5	67.5	82.5	92.5								
8	18	33	43	58	68	83	93								
8.5	18.5	33.5	43.5	58.5	68.5	83.5	93.5								
9	19	34	44	59	69	84	94								
9.5	19.5	34.5	44.5	59.5	69.5	84.5	94.5								
MA (nully)				MA (nully)				MA (nully)							

Comments about "Other" category: _____

Please circle SI category for site:
 None (N), Low (L), Medium (M) = surfaces have thin SI layer; High (H) = surfaces have thick SI layer N L M H

Reef Check Basic Categories	Reef Check Australia Categories
HARD CORALS	HCBR: Branching Hard Coral
Growth Forms	HCF: Foliose Hard Coral
	HCM: Massive Hard Coral
	HCE: Encrusting Hard Coral
	HCP: Plate Hard Coral
	HC: gathers all other growth forms (digitate, columnar, etc.)
	HCB: Bleached Hard Coral
SOFT CORALS	SC: Leathery Soft Coral
	SCZ: Zoanthids
	SC: Other Soft Coral (tree or flower shaped)
	SCB: Bleached Soft Coral
RECENTLY KILLED CORAL	RKCTA: Recently killed coral covered with Turf Algae
	RKCNA: Recently Killed Coral covered with Nutrient Indicator Algae
	RKC: Recently killed coral (non covered with algae)
SPONGES	SPE: Encrusting sponge
	SP: All other sponges
OTHER	OT: All non-target life forms (ascidians, corallimorphs etc)
MACROALGAE	MA: <i>Padina</i> , <i>Sargassum</i> , <i>Turbinaria</i> (and <i>Asparagopsis</i> in SEQ)
NUTRIENT INDICATOR ALGAE	NIA: All other algae forms
ROCK	RCTA: Rock covered with Turf Algae
	RCCA: Rock covered with Coralline Algae
	RC: Rock (not covered with algae)
SAND	SD: Coarse grain particulate matter
SILT	SI: Fine particulate matter
RUBBLE	RB: Un-consolidated substrate

RCA Substrate data collection sheet and table of 25 substrate categories.

5.0 APPENDIX

Invertebrate Survey

Invertebrate and impact abundance surveys are conducted using the same transect as the substrate survey, using a 5m wide belt transect area using a u-shaped search pattern to search for target indicators.

Selected invertebrate indicators represent organisms that have an economically or ecologically important role. See Table 3 for a list of these indicators and why they have been selected. Economically important species are generally harvested for food, decoration or the aquarium trade. Ecological indicators are important for the health and functioning of the reef system.

Reef Check Belt Transect - Invertebrates SEQ

		Dive site name: _____		Reef name: _____	
		Depth: _____		Habitat: _____	
		Time: _____		Site number: _____	
		Data recorded by: _____		Team leader: _____	
		Camera ID: _____			

		0-20m	25-45m	50-70m	75-95m	Photo No. *
Anemone	With Fish					
	Without Fish					
Banded Coral Shrimp						
COIS	≤ 5cm					
	6-15cm					
	16-25cm					
	26-35cm					
	≥ 36cm					
Giant Clams	≤ 10cm					
	10-20cm					
	20-30cm					
	30-40cm					
	≥ 40cm					
Lobster (spiny & slipper)						
Shells	Drapella					
	Triton					
	Trochus Shell					
Sea Cucumbers	Pink fish					
	Prickly Greenfish					
	Prickly Redfish					
	Collector					
Sea Urchins	Diadema					
	Pencil					
	Star					

*Note: Take a photo of the top part of the slate before doing the survey. Then number your photos sequentially (i.e. 1, 2, 3, ...).

RCA Invertebrate data collection sheet and table of categories.

Indicator Invertebrates

Banded coral shrimp (*Stenopus hispidus*)

Crown-of-thorns starfish
(*Acanthaster planci*)

Spiny lobster & Slipper Lobster
(*Panulirus* spp.)

Long-spined black sea urchins
(*Diadema* and *Echinothrix* spp.)

Giant clams (*Tridacna* spp.)

Pencil urchin (*Heterocentrotus mammillatus*)

Sea cucumbers (*Thelenota ananas*, *Stichopus chloronotus*, *Holothuria edulis*)

Triton (*Charonia tritonis*)

Drapella spp. snails

Collector urchins (*Tripneustes* spp.)

Trochus (*Trochus niloticus*)

Anemone (All species)


5.0 APPENDIX

Reef Impact Survey

Reef impact surveys are conducted using the same 5m belt transect, searching for visual evidence of reef health impacts. Photographs are taken of reef impacts for further documentation.

Impact surveys are conducted to record reef health impacts observed on a transect. Examples of impacts include hard coral bleaching and disease, but also fishing line and trash. Relevant information can be passed on to scientists or managers who can then investigate further.

Reef Check Belt Transect - Reef Impacts



Dive site name: _____
 Date: _____
 Time: _____
 Data recorded by: _____
 Camera ID: _____

Reef name: _____
 Depth: _____
 Habitat: _____
 Site number: _____
 Team leader: _____

	0-20m	25-45m	50-70m	75-95m	Photo #
Coral Bleaching	Estimate % impact for each bleached colony				
	Estimate % total coral population				
Coral Damage	Coral damage: Boat / anchor				
	Coral damage: Dynamite				
	Coral damage: Other				
	Coral Disease				
Coral Scars	Crown of Thorns scars				
	Drupella Scars				
	Unknown / Other scars				
Trash	Fishing line				
	Trash: Fish nets				
	Trash: General				
	Rare Animals				

Record three dominant algae: 1. _____ Photo #: 2. _____ Photo #: 3. _____ Photo #: _____

Is any coral visible?

Coral Bleaching
Is any living coral present?

Coral Disease
Is coral banded in appearance or has distinct tissue loss?

Coral Predation
Is coral being eaten?

Coral Scars
Is the cause of tissue loss unknown?

Estimate % bleaching for each colony.


At each 20m, estimate % coral cover, then % of bleached corals within total population.

Record # of colonies with disease.


Record COTS or Drupella scars if organism is present.

Record # of colonies with scars.


Bleached coral tissue




Bleaching Colony




Bleaching Population




Coral disease




Drupella Scars



COTS Scars



Unknown Scars



Other Photos

Subject: _____ Photo #: _____

Site: _____

Reef Health Impacts

Coral damage
Boat/anchor, dynamite, other

Trash:
Fishing line, fishing nets, general

Bleaching:
Percent of coral population and each impacted colony

Coral Disease:
Incidents of coral disease

Coral Scars:
Drupella sp. scars, Crown-Of-Thorns scars, other scars

RCA Reef Impact data collection sheet and table of categories.