

# REEF CHECK AUSTRALIA

## Reef Check Australia Fraser Coast Project:

Establishing a baseline for long-term reef health monitoring on Fraser Coast subtropical reefs using the Reef Check global protocol



Reef Check Foundation Ltd

J. Loder, I. Butler, A. Delaforce, J. Salmond, K. Trim & M. Zann

[www.reefcheckaustralia.org](http://www.reefcheckaustralia.org)

2012

# REEF CHECK

## A U S T R A L I A

This project is supported by Reef Check Australia, through funding from the Australian Government's Caring for our Country.



CARING  
FOR  
OUR  
COUNTRY

This project is supported by in-kind assistance from Queensland Parks and Wildlife, Department of National Parks, Recreation, Sport & Racing:



QUEENSLAND  
GOVERNMENT

Thank you to our team of project volunteers, including:

Ian Butler, Amanda Delaforce, Terry Farr, Vanessa Taveras,  
Julie Schubert and Maria Zann.

This report should be cited as: Loder, J., Butler, I., Delaforce, A., Salmond, J., Trim, K., and Zann, M. (2012). *Reef Check Australia Fraser Coast Project: Establishing a baseline for long-term reef health monitoring using the Reef Check global protocol*. Reef Check Foundation Ltd.

# REEF CHECK

## A U S T R A L I A

### Executive Summary

Reef Check Australia was awarded funding through the Australian Government's Caring for Our Country program to establish four (4) new monitoring sites on the Fraser Coast to help monitor and address water quality in island water bodies.

A summary of the findings for five reef health surveys conducted from August 18-20, 2012 in the Fraser Coast region are presented in this report. This was the first year of implementing a long-term reef health monitoring program for the region.

Selected sites were surveyed August 18 to 20, 2012 and included two (2) sites within the Woongarra Marine Park (Burkitt's Reef and Barolin Rocks) as well as three nearshore sites within the Great Sandy Marine Park (Big Woody Island Reef, ESA Park and Gataker's Reef West).

Monitoring locations on the Woongarra coast seemed to be dominated by soft coral growth forms (accounting for 30-40% benthic cover), with low levels of hard coral (2-5%). Hervey Bay surveys found higher levels of hard coral cover (14-29 percent), with some soft coral (15-36%), although soft corals were still dominant to hard corals at Gataker's Reef West. Low levels of Reef Check indicator invertebrates were found during surveys (the three Hervey Bay sites had no target invertebrates recorded, where the Woongarra Coast sites had low numbers of anemones recorded). The sites also showed low levels of reef health impacts, although all sites had low levels of bleaching evident, impacting 0.5 to 2 percent of the population and impacting 10 to 65 percent of the coral surface at the colony level.

The Reef Check Australia Fraser Coast project aspires to build on previous and current reef monitoring and research projects that have been undertaken within the Fraser Coast Region. Results from the 2012 Reef Check Australia study support the 2010 DeVantier benthic cover findings. Reef Check surveys recorded living coral cover ranging from 32 to 50 percent (the DeVantier study found that most living coral cover typically ranged from 20 to 40 percent). The slightly higher live coral cover results from Reef Check surveys may be accounted for as Reef Check transect locations were specifically selected to focus on areas with substantial live coral cover. Reef Check results also supported the DeVantier finding that live coral cover was higher than cover of dead corals. Reef Check surveys did not record much cover of recently killed (dead) coral cover, but some colonies did show evidence of partial mortality and recorded impacts included scars and bleaching.

# REEF CHECK

## A U S T R A L I A

### 1.0 Background of Reef Check Australia

Reef Check Australia's (RCA) monitoring program helps to provide an early warning system for changes in the health of surveyed coral habitats. Annual surveys provide long-term data sets that can reveal important patterns over time. Quantitative data is collected in relation to substrate cover, as well as abundance of key invertebrate species and target fish species. RCA also monitors natural and anthropogenic impacts that affect coral habitats.

South East Queensland (SEQ) represents the marginal edge of coral growth (Perry & Larcombe, 2003) and a transitional area where tropical, sub-tropical and temperate species all exist within the same habitat area. Coral communities in these marginal regions are generally limited from accreting reef structures by environmental factors such as light, temperature, aragonite availability and/or turbidity (Kleypas, McManus & Menez 1999). Woongarra reefs are good examples of this where coral communities grow on basalt boulders. In contrast, Hervey Bay's substantial reef-forming reefs structurally resemble turbid water reefs of the Great Barrier Reef, and represent the southernmost accreting reefs on the mainland (Zann *et al.* 2012, Zann 2012). The region's reefs are the northernmost examples of the numerous individual coral communities which include a diverse and extensive range of coral growth forms within SEQ. Alternatively they are considered to be the southern-most reefs of the GBR Lagoon (Zann 2012, Butler et al 2013 in review).

Immense population growth and development within the region are increasing pressures on the marine ecosystem, both directly and indirectly. Stresses such as sediment and nutrient runoff, habitat loss, boating and anchoring impacts, waste disposal, overfishing, aquarium trade collection and climate change (e.g. 1998 and 2006 bleaching events; extreme weather e.g. 2011 flood and 2013 tornadoes and floods) all have the potential to negatively impact coral habitats.

Despite the unique assemblage of marine species and recognized threats to the health of coral habitats in SEQ, limited long-term monitoring of these habitats are currently being conducted. As habitat and species shifts may be likely as a result of climate change, as well as pressures from anthropogenic threats, these transitional areas are gaining recognition as an important places to study and protect (Wallace, Fellegara, Muir, & Harrison 2009, DeVantier 2010 and Zann 2011). The data that is being collected as part of RCA's monitoring program provides important baseline data which describes the current health condition of coral habitats within SEQ.



# REEF CHECK

## AUSTRALIA

### 2.0 Reef Check Australia protocols

Reef Check scientific methods have been peer reviewed by international scientists to create a consistent global protocol for community-based reef health monitoring. The goal of Reef Check monitoring is to determine how our reefs are changing through time and provide a system to alert reef managers and scientists of our findings.

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 and impact survey')
- Fish (conducted in the 'fish survey')
- Impacts (conducted in the 'invertebrate and impact survey')

Reef Check surveys are conducted along a transect line marked by a graduated tape measure and laid at a constant depth in a specific habitat area. The transect length that is surveyed is 80m. The 80m length is divided into four 20m sections or independent transect replicates, each separated by 5m (Figure 1).

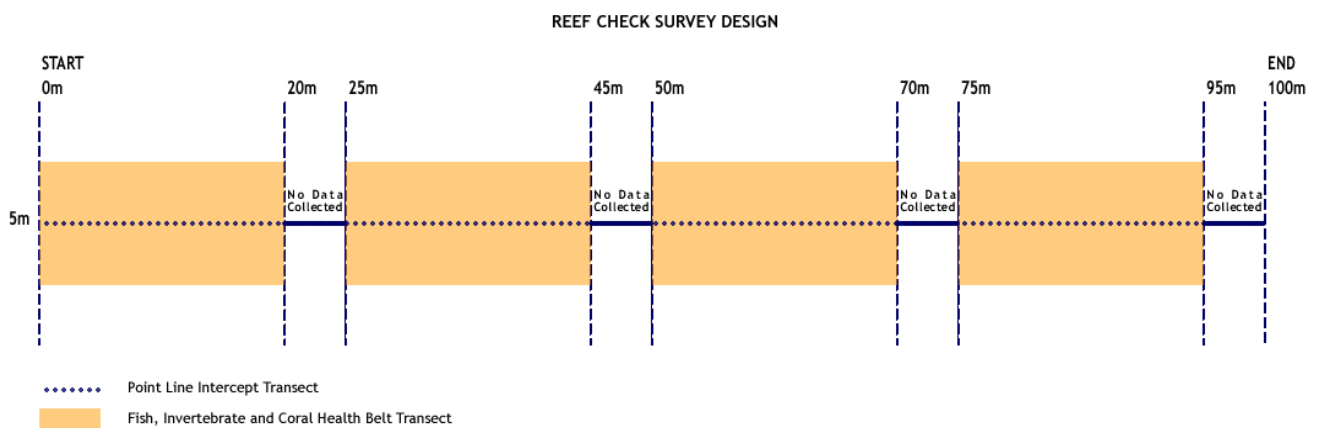


Figure 1: The Reef Check transect, showing the sampling design for the line-intercept substrate survey and the 5m wide belt transect area for invertebrates, reef impacts and fish.

Although Reef Check does not typically establish permanent transect locations, a system of detailed maps, GPS coordinates and mean tide times is used to return to the same location year after year. Reef Check partners with commercial dive operators to access sites at reduced rates and use the opportunity to educate their guests about our activities, for non-tourism sites a commercial charter vessel is used. Sites are typically visited annually by volunteer survey teams.

# REEF CHECK

## AUSTRALIA

### 2.1 Reef Check substrate survey

The substrate survey collects information about the percentage cover of bottom-dwelling (benthic) organisms and substrate on the reef. Each of these indicators of coral reef health has a function on the coral reef. Table 1 provides the key of codes used for the different types of substrate.

Table 1: The 25 Reef Check Australia Coral and Substrate Growth Form Codes (grouped under the 10 main substrate categories in Reef Check International protocols –in blue)

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

# REEF CHECK

## AUSTRALIA

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. 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.

## 2.2 Reef Check invertebrate survey

These surveys are conducted using the same transect as the substrate survey, however, invertebrate abundance data is collected on a 5m wide belt transect, using a u-shaped search pattern to search for target indicators.

These indicators represent economically or ecologically important invertebrates. See Table 2 for a list of the 14 RCA invertebrate indicators. Examples of ecological indicators are *Diadema* sp. urchins, which are important algae grazers. The presence or absence of these indicators does not necessarily mean there is a problem on a reef-by-reef scale. However, providing an overview of where indicators occur and changes in abundances can us help to understand changes to reefs over time and analyse the potential cause of threats to reef health.

Table 2. Reef Check Australia Indicator invertebrates

<b>INDICATOR INVERTEBRATES</b>	Banded coral shrimp ( <i>Stenopus hispidus</i> ) Crown-of-thorns starfish ( <i>Acanthaster planci</i> ) Spiny lobster and slipper lobster ( <i>Panulirus spp &amp; Scyllaridae spp.</i> ) Long-spined black sea urchins ( <i>Diadema spp.</i> ) Giant clams ( <i>Tridacna spp.</i> ) Pencil urchin ( <i>Heterocentrotus mammilatus</i> ) Sea cucumbers ( <i>Thelenota ananas, Stichopus Chloronotus, Holothoria edulis</i> ) Triton ( <i>Charonia spp.</i> ) <i>Drupella spp.</i> Snails <i>Collector Urchins (Tripneustes spp.)</i> <i>Trochus (Trochus niloticus)</i> Anemone (all species)
------------------------------------	--

# REEF CHECK

## AUSTRALIA

### 2.3 Impact survey

Reef impact surveys are conducted using the same 5m belt transect, searching for visual evidence of reef health impacts. See Table 3 for a list of the 12 reef health impacts that are recorded. Photographs are taken of reef impacts for further documentation.

Table 3. Reef Check Australia Indicator reef health impacts

<b>REEF IMPACT INDICATORS</b>	<p>Coral damage: boat/anchor, dynamite, other</p> <p>Trash: Fishing line, fishing nets, general</p> <p>Bleaching: percent of coral population and each colony</p> <p>Disease: Incidents of coral disease</p> <p>Coral Scars: <i>Drupella</i> sp. scars, Crown-of-thorns scars, other scars</p>
-------------------------------	--

### 2.4 Fish survey

Fish abundance data is recorded using the same transect line area, counting fish within a 5m wide belt and 5m tall tunnel from the benthos to the water column. Humphead wrasse and Bumphead parrotfish are also recorded when not on the transect area. RCA fish indicators represent economically or ecologically important fish species, such as those important for fisheries or maintaining reef system health. See Table 4 for a list of the 11 RCA indicator fish categories.

Table 4. Reef Check Australia indicator fish

<b>INDICATOR FISH</b>	<p>Butterflyfish (<i>Chaetodontidae</i>)</p> <p>Coral trout (<i>Plectropomus leopardus</i>)</p> <p>Queensland Grouper (<i>Epinephelus lanceolatus</i>)</p> <p>Grouper (&gt;30 cm) (<i>Serranidae</i>)</p> <p>Barramundi cod (<i>Cromileptes altivelis</i>)</p> <p>Snapper (<i>Lutjanidae</i>)</p> <p>Humphead wrasse (<i>Cheilinus undulates</i>)</p> <p>Bumphead parrot (<i>Bolbometopon muricatum</i>)</p> <p>Parrotfish (&gt;20cm) (<i>Scaridae</i>)</p> <p>Sweetlips (<i>Haemulidae</i> and <i>Plectrohincus spp.</i>)</p> <p>Moray eel (<i>Muraenidae</i>)</p>
-----------------------	---



# REEF CHECK

## A U S T R A L I A

### 3.0 Reef Check Fraser Coast 2012 surveys

Reef Check Australia was awarded funding through the Australian Government's Caring for Our Country program to establish new monitoring sites on the Fraser Coast to help monitor and address water quality in island water bodies.

The Fraser Coast area is located just to the south of the Great Barrier Reef Marine Park. Fraser Island is found to the east, forming the Great Sandy Strait and Hervey Bay. The region encompasses World Heritage listed Fraser Island and the Great Sandy Strait Ramsar area.

Although there is extensive coral in the region, the coral communities of the Fraser Coast are considered marginal for coral growth (DeVantier 2010). Corals here are exposed to extreme temperature fluctuations, turbidity and fresh-water stress from nearby Mary River and local Eli Creek as well as growing on predominately sandy/silted benthic substrate. In addition to their naturally extreme environmental conditions, these reefs are exposed to a rapidly growing coastal community and human use. Reef Check surveys are designed to collect data about visual reef health indicators to monitor long-term changes in trends and patterns over time. Due to the standardised nature of the monitoring protocols, surveys are comparable across regions as well as globally.

It is of note that marginal coral communities, like those on the Fraser Coast, are particularly important monitoring locations in light of changing climactic conditions, and thus Reef Check Australia seeks to increase their site connectivity along the Queensland coast through these locations.

Reef Check Australia long-term monitoring locations were selected to overlap sites with previous reef research, mapping or monitoring projects. Queensland Park and Wildlife Service (QPWS) provided extensive support in helping to identify sites and plan to project. The five established sites overlap with 7 locations that are monitored bi-annually by QPWS using the Reef Health Impact Survey (RHIS) protocols, and complement RHIS' rapid, qualitative approach by providing quantitative and standardised methods suitable for long-term monitoring. Selected sites were surveyed August 18 to 20, 2012 and included 2 sites within the Woongarra section of the Great Sandy Marine Park (Burkitt's Reef and Barolin Rocks) as well as three nearshore sites within the Great Sandy Marine Park (Big Woody Island Reef in the Great Sandy Strait adjacent to the Ramsar area; and ESA Park and Gataker's Reef West on Hervey Bay City's urban shoreline).

# REEF CHECK

## A U S T R A L I A

### 3.1 Building on background research

The Reef Check project aspires to build on other prior and ongoing coral research and monitoring within the area for improved information regarding long-term reef health condition data for management and education applications. The establishment of a Reef Check long-term monitoring program in the Fraser Coast region will help to build on available long-term data for key reef locations in the region, helping to document reef impacts and recovery after major events.

Reef substrate surveys were conducted at eight sites in Hervey Bay by Bennett (2004). This study documented hard coral communities using underwater video to calculate percent cover of benthic substrates (including coral genera) and characterise dominant benthic cover at each of the sites. Sites at Point Vernon, Gataker's Bay and Big Woody Island were found to have high algal cover and relatively low coral cover (11-18 percent and dominated by soft coral). These trends in benthic cover were attributed to exposure and siltation in these areas, which limited coral growth. Bennett compared hard coral species present in Hervey Bay and the Great Sandy Strait with those of Moreton Bay, finding some resemblance in turbid conditions and genera present.

In 2010, Lyndon DeVantier reported on coral species composition and ecological condition of eight sites in Hervey Bay for the Wildlife Preservation Society of Queensland, Fraser Coast Branch (DeVantier 2010). The report documents 46 species of reef-building corals recorded from 2007 to 2010, with Woody Island having the highest diversity (31 species). Overall, recorded low coral cover ranged between 20 to 40 percent, and dead coral accounted for less than 5 percent cover. The report notes that coral communities fringing the mainland coast are relatively rare in Eastern Australian waters, particularly so due to the marginal nature of the subtropical environments of the Fraser Coast, highlighting the importance of understanding and monitoring these reefs.

In 2005 Maria Zann commenced a research masters through the University of Queensland titled *"Use of Remote Sensing and Field Validation for Mapping Coral Communities of Hervey Bay and the Great Sandy Strait"* (Zann 2012)—Although a bleaching event occurred in 2006, overall the study captured baseline data of a largely healthy reef during a period favourable for coral growth between major flood episodes. Prior to the study major floods occurred in 1992, 1998 and a minor flood in 2004. Based on imagery and desktop assessment, a regional map of reefs was produced for the Burnett-Mary region, For Hervey Bay, detailed substrate maps were produced from Quickbird imagery and field work. Over 4500 benthic substrate photos were taken for 10km of transects over 5 years, using a photo-transect method modified after that of Reef Check's (Roelfsema et al 2011). The reefs appeared to be healthy and accreting rapidly, as at many locations the coral cover exceeded 85% e.g. mainland turbid-water *Turbinaria*-and *Goniopora*-dominated reefs. Diversity surveys were conducted at 29 localities based on abundance estimates (after DeVantier et al 1998, DeVantier 2010). High species diversity (>40spp) was recorded at biodiversity hotspots or refugia in the lee of headlands, points and sheltered bays (including Big Woody Island, and Gataker's West). 54 species of reef-building corals were recorded, Point Vernon East having the highest diversity (43 species). Gataker's West reef was the best-connected to seagrass and mangroves, important for coral health.

# REEF CHECK

## A U S T R A L I A

Reef, seagrass and mangroves form a continuous chain from Hervey Bay to Baffle Creek, the start of the Great Barrier Reef.

In 2011, Great Sandy Marine Park (GSMP) implemented Rapid Health Impact Assessments (RHIS) on four coral communities after the 2011 flood. RHIS provides simple broad-scale information to be used as an alert system for reef managers in the Field Management Program (FMP) for the Great Barrier Reef World Heritage Area (GBRWhA) and QLD Parks and Wildlife Service (QPWS), Marine Parks. All established RHIS locations were located within the boundary of the 2011 flood plume. Sites included the Sponge Gardens south of Little Woody Island and Big Woody Island, along with corals communities with known high biodiversity, high percentage of coral cover and species sensitive to sedimentation despite their near shore location including: Point Vernon (Gables), Gataker's, and the Woongarra Coast (Barolin Rocks and Hoffman's Rocks).

Surveys conducted in November 2011 in Great Sandy Marine Park show that outer reefs at Long Shoal and Keith's Reef are healthy and corals on inner reefs at Four Mile Reef as well as Hoffman and Barolin Rocks marine national park zones have shed sediment. Some coral colonies on inshore reefs still have pockets of sediment evident.

Additionally, a research program is being carried out by a PhD Student from The University of Queensland. The project aims to accurately calculate the actual effects from the 2011 Mary River flood on inshore coral communities at six of the Great Sandy Marine Park's key sites using pre and post flood data. Reef sites included: Pt. Vernon West (Gataker's reef West), Pt. Vernon East (Inman St), Pinalba, Big Woody Island (NE point), Burkitt's Reef and 4 Mile Reef. Results indicate that there was a 40% reduction in percent cover of hard and soft coral over all the sites. Mortality was variable based on proximity to the mainland due to the concentrating of the plume along the shore by coriolis effect, currents and wind. Four of the six reefs showed significant mortality (Pt. Vernon East, Pt. Vernon West, Pinalba and Burkitt's Reef) with the highest mortality occurring at Pt. Vernon East (89%). Publication of this research is expected in 2013 (Ian Butler, pers. com.).

Overall the RHIS surveys and PhD (photographic) work from 2011-2012 indicated that:

- there was up to 89% mortality in some of the fringing inshore coral reefs along the Hervey Bay coast (i.e. from the Gables to Scarness) where the 2011 flood plume pushed onto the inshore reefs from the south-east winds.
- the impacts of the flood were found to be patchy and mortality varied widely between reef locations.
- some of the inshore communities showed resistance to flooding with <20% mortality observed at the Woongarra Coast through RHIS, however this was an exception with Burkitt's reef which suffered 56% mortality.
- the Point Vernon East (Inman Street) inshore reef suffered massive coral mortality as a result of the flood with the loss of all soft corals and at least 89% of hard corals.

# REEF CHECK

## AUSTRALIA

In January and February of 2013, the coral reefs of Great Sandy Marine Park were again subject to low salinity, high turbidity and high nutrients as a result of two floods from the Mary River, one of which was the fourth highest on record. Preliminary visual assessments as a part of the above PhD project indicate there may be up to 80% mortality (on top of mortality from 2011 floods) at some locations from these most recent floods. Further assessments by will be carried out through 2013 to confirm the actual impacts.

Overall, the studies of Zann (2012) and DeVantier (2010) showed that the region's reefs are of biodiversity significance, and their connectivity to the GBR has implications for policy and management. For example under 'ReefPlan' the Mary catchment receives funding for improved land-use management, but because it is outside the Great Barrier Reef Marine Park its reefs are not monitored, and so the efficacy for the marine environment is unknown (Zann 2012). The study and that of Butler et al (2013 in review) demonstrate the importance of ongoing monitoring of these sites by Reef Check and others who play a vital role in measuring the success of catchment rehabilitation measures for reef health.

Table 5. Reef Check Fraser coast monitoring locations and general summary information including: site depth, zoning type (Marine National Park (MNP) or Conservation Park (CP)), Hard coral percent cover, soft coral percent cover, nutrient indicator algae (NIA) percent cover, silt percent cover, total unknown scars (per 400m<sup>2</sup>), total abundance of coral damage (per 400m<sup>2</sup>), total abundance of fishing line (per 400m<sup>2</sup>), total abundance of rubbish/trash and average percent impact of population level coral bleaching.

		Depth (m)	Zoning	Hard Coral %	Soft Coral %	NIA %	Silt %	Unknown Scar abundance	Coral Damage abundance	Fishing Line/net abundance	General Rubbish abundance	Coral Bleaching Population %
<b>Woongarra Coast</b>	Barolin Rocks	5	MNP	2	30	1	0	1	1	0	1	1
	Burkitt's Reef	6	MNP	5	40	6	0	3	0	0	0	1
<b>Hervey Bay</b>	Big Woody Island	6	CP	29	15	1	10	0	0	8	0	1
	ESA Park	3	CP	22	15	24	0	1	0	0	0	2
	Gataker's Reef West	3	CP	36	14	0	24	0	0	0	0	2

# REEF CHECK

## AUSTRALIA

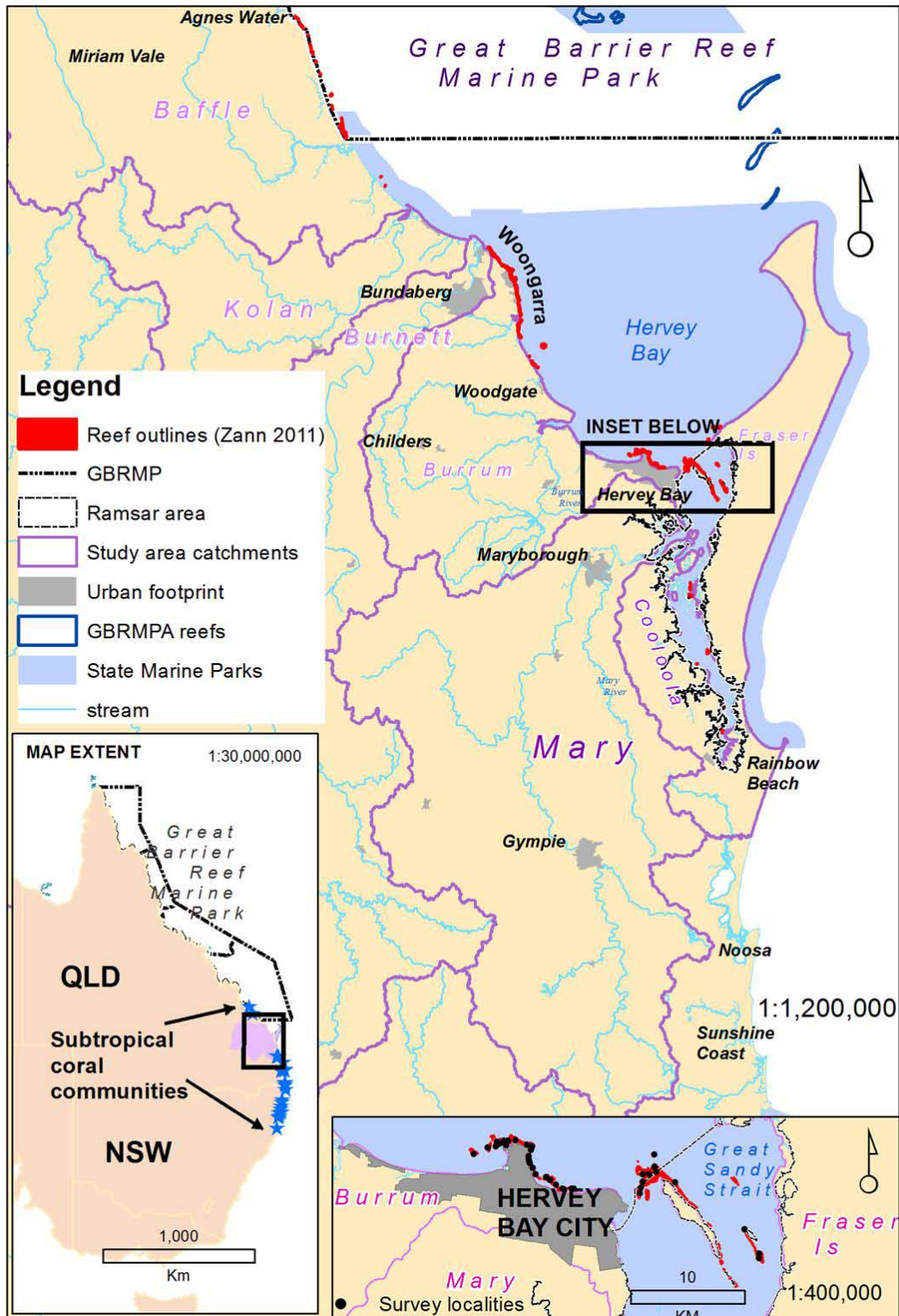


Figure 2. The map shows the Reef Check study areas of Woongarra Coast and Hervey Bay (top right), within the larger range of subtropical reefs (left), as well as surrounding catchments, management areas and reef areas mapped in the study by Zann *et al* 2012 (bottom right). Map courtesy of Zann *et al* 2012.



# REEF CHECK

## A U S T R A L I A

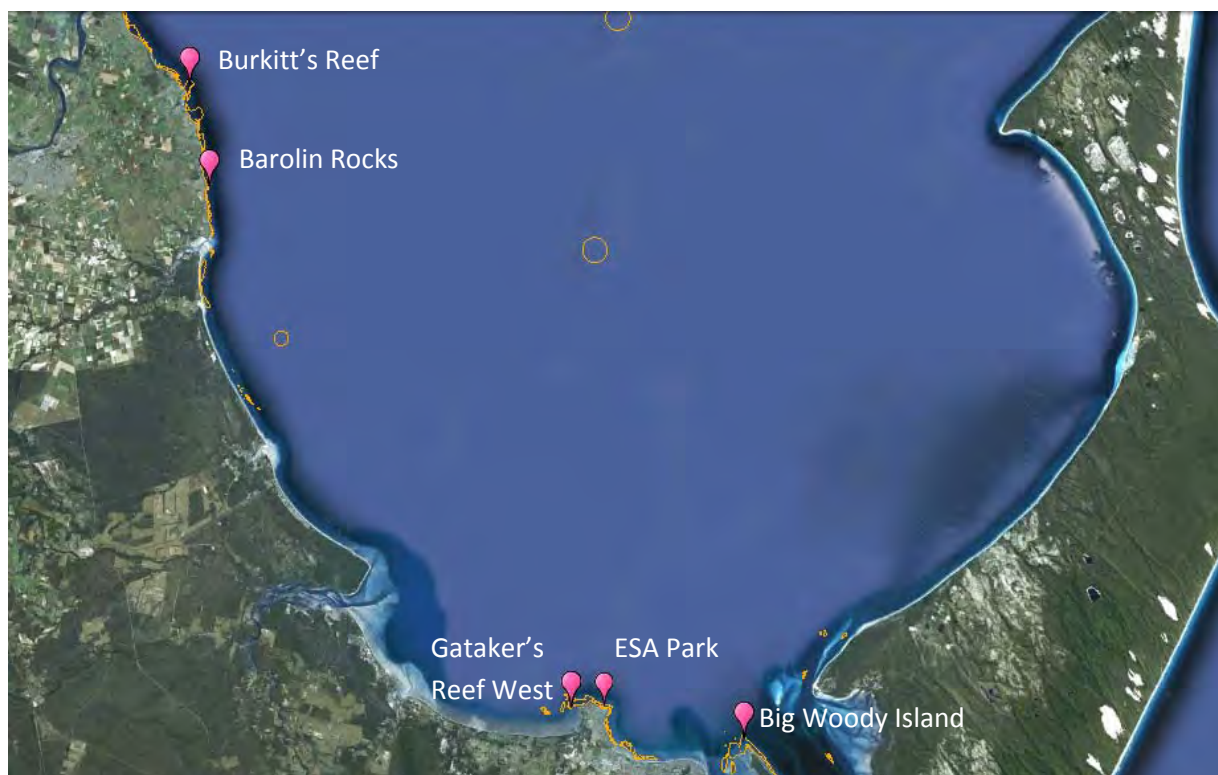


Figure 3. Pink pointers show the five new Reef Check Fraser Coast monitoring sites. Orange outlines indicate reef areas mapped in the Zann *et al* 2012 study.

# REEF CHECK

## AUSTRALIA

### 40 Woongarra Marine Park sites

#### Barolin Rocks, Site 2

(-24.883630, 152.491017)

Barolin Rocks is a rocky coastline dominated by a soft coral community. A Reef Check team had visited a nearby Barolin Rocks location in 2003 as part of a trial project, but Reef Check teams have not since been back to this area. The second monitoring site, established in 2012 was intended to overlap with Queensland Parks and Wildlife Rapid Health Impact Survey areas, but was also nearby to the 2003 site location. The area was selected as it is a unique near-shore fringing reef.

While low levels of hard coral were recorded at this site (2%), soft coral was far more abundant (30%). The soft coral community was composed of mostly leathery growth forms (90%). The remainder of the transect area was dominated by sandy (41%) and rocky (23%) substrate.

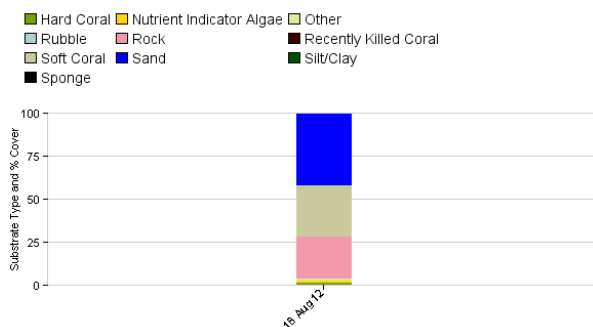


Figure 4. Substrate type and percentage cover at Barolin Rocks: Barolin Rocks Woongarra Marine Park: Site 2.

The substrate survey results were similar to those from the 2003 survey, with 49% soft coral cover (almost exclusively leathery soft coral) and 2% hard coral cover. However, this earlier survey took place on exclusively sandy habitat, where the 2012 survey was a mix of sandy and rocky habitat.



Photo 1 Barolin Reef site photograph.

Indicator invertebrate surveys documented one anemone.

During the reef impact survey, volunteers recorded one incident of coral damage and one occurrence of trash found at this site. There were low levels of coral bleaching recorded (average 12% of colony) with less than one percent of the coral population impacted.

There were 8 snapper and 1 grouper recorded during the fish survey.



Photo 2. Grouper recorded during fish abundance survey.

# REEF CHECK

## AUSTRALIA

### Burkitt's Reef

(-24.810410, 152.471180)

This shallow fringing reef is rocky with also selected due to its close proximity to the coast. The rocky area is surrounded by sand, creating a well-defined reef area.

Hard coral accounted for 5 percent of benthic cover. The site was dominated by soft coral (40%), mainly composed of ornate soft coral growth forms (63%). Nutrient Indicator Algae was recorded on 6 percent of surfaces. Encrusting sponge was the dominant sponge type to be seen at this site (11%).

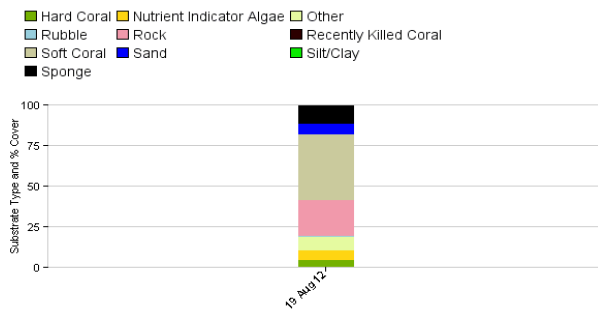


Figure 5. Substrate type and percentage cover at Burkitt's Reef: Burkitt's Reef, Woongarra Marine Park: Site 1



Photo 3. Burkitt's Reef site photo 2012

Four anemones were recorded on the transect area during the invertebrate abundance survey. No target fish were recorded during the survey.



Photo 4. Anemone recorded on invertebrate survey

Surveyors found 3 counts of unknown coral scarring. Coral bleaching was recorded on approximately less than one percent of the coral population, impacting each coral colony an average of 32%.

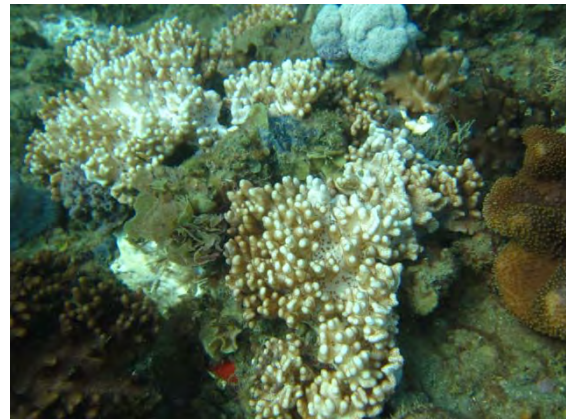


Photo 5. Bleached soft coral



# REEF CHECK

## AUSTRALIA

### 5.0 Inshore Hervey Bay

#### Big Woody Island

(-25.263050, 152.938110)

Big Woody Island is located in the sheltered waters between the coast of south east Queensland and Fraser Island. It has a rocky shore and at low tides, shallow corals are exposed. The area has extensive *Acropora* beds and is also a coral collecting area.

A study by DeVantier (2010) undertaken for the Wildlife Preservation Society of Queensland, found this to be a species rich site, with 46 species of reef-building corals recorded.

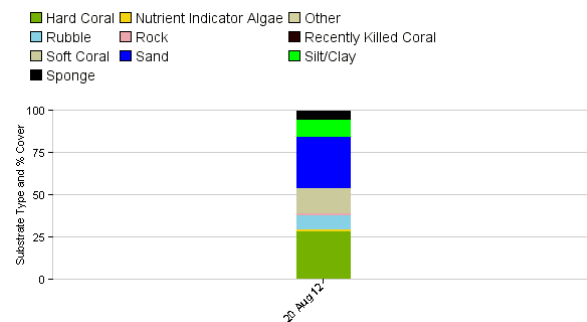


Figure 6. Substrate and percentage cover at Big Woody Park Zone: Site 1

Hard coral cover was recorded at 29 percent. Non-specific hard coral growth forms made up the majority of this category (75 percent). There was fifteen percent soft coral cover, with more than half of the growth forms being ornate (54%). Sand made up a high proportion of this benthic habitat (30%) and silt covered some surfaces (10%). Of note, rubble accounted for 8 percent of the benthos.

No indicator invertebrates were recorded at this site.

At this site, there were seven incidents of discarded fishing line recorded on the survey, along with one fishing net.



Photo 6. Fishing line at Big Woody Island



Photo 7. Big Woody Island site photo 2012

Low levels of coral bleaching were recorded, impacting one percent of the coral population and 31% of each colony on average.

The surveyors found one grouper at this site.

# REEF CHECK

## AUSTRALIA

### ESA Park

(-25.244710, 152.825550)

ESA Park is located at Point Vernon, which is enclosed around the in-shore coast of Fraser Island. This near-shore fringing reef has high with high species richness (DeVantier 2010) and also sees regular recreational use. This site recorded the highest percentage macroalgal cover when surveyed by Bennett (2004); by 2007 soft coral predominated (Zann 2012). The site consisted of rocky ridges and pools, creating a complex mosaic of substrates confounded by depth zones e.g. shallower macroalgae (*Lobophora*) preceding the soft coral zone, and then deeper the hard coral zone. To the east of this site, gorgonians and cowries were found under overhangs (Zann 2012).

The site had 22 percent hard coral cover recorded (mostly with encrusting growth forms). There was 15 percent soft coral cover, with three quarters being ornate soft coral growth forms. Nutrient indicator algae accounted for 24% (mostly composed of *Lobophora*). This was a predominately sandy habitat, with 30% of the site cover as sand.

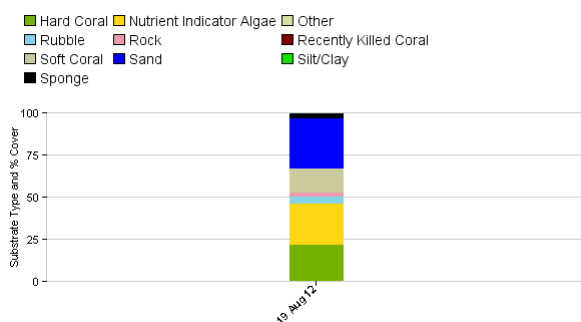


Figure 7. Substrate type and percent cover at ESA Park: Site 1

In January, 2011 a major flood in the Hervey Bay area resulted in coral sedimentation, mortality and bleaching (Zann 2011). ESA Park

would have been heavily impacted by this event, due to proximity to the flood plume. Coral damage was most severe at nearby Point Vernon East, resulting in almost complete loss of hard corals and soft corals (Butler 2013 in prep). However, the Point Vernon site was inaccessible during the Reef Check survey period to assess recovery.

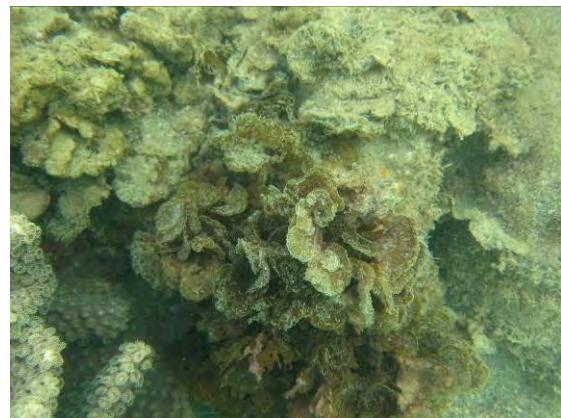


Photo 8. Nutrient Indicator Algae, *Lobophora* at ESA Park

There was less than one count of coral scarring across the transect. Low levels of bleaching were recorded on two percent of the coral population, impacting as average of 32% of each coral colony.

No invertebrates or fish were recorded during this site survey.



Photo 9. Site photo of ESA Park



# REEF CHECK

## AUSTRALIA

### Gataker's Reef West

(-25.247110, 152.799350)

Gataker's Reef is located within Gataker's Bay, a popular inshore fishing site and a regular dive site for commercial operators. This site is of note, due to the close proximity to the mainland and high coral diversity (DeVantier 2010). Although Bennett (2004) recorded *Acropora* as the dominant hard coral species at this site, substrate mapping showed the *Acropora* reef as an isolate. *Gonipora* dominated most of Gataker's Bay, where expanses of soft coral also occurred in the shallow waters (Zann 2012).

The Reef Check survey site found that soft corals were the dominant coral type, accounting for 36 percent of the benthos. Ornate growth forms dominated the soft coral community (68%). Hard coral accounted for 14 percent of the benthos, made up mostly of massive coral growth forms (74%). Silt accounted for 24% of benthic cover.

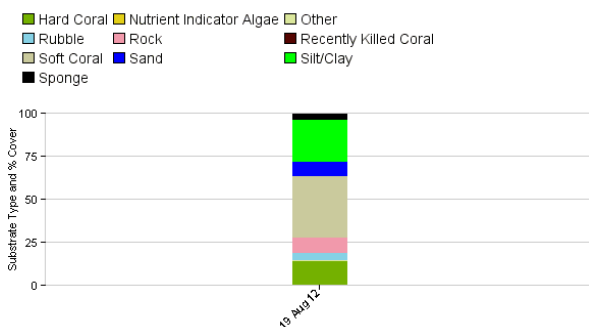


Figure 8. Substrate type and percentage cover at Gataker's Reef: Gataker's Reef West: Site 1

There were no indicator invertebrates or fish recorded at this site.



Photo 10. Site photo of West Gataker's Reef



Photo 11. Massive coral at West Gataker's Reef

Coral bleaching was found in low levels, impacting 2 percent of the coral population and impacting an average of 35% of each colony. No other reef impacts were found.



Photo 12. Bleached hard coral at Gataker's Reef

# REEF CHECK

## AUSTRALIA

### 6.0 Additional Survey Photographs



Photo 13. Collector Urchin at Barolin Rocks



Photo 14. Nudibranch on soft coral at Barolin Rocks



Photo 15. Snapper at Barolin Rocks



Photo 16. Bleached hard coral (*Goniopora* sp.) at Big Woody Island



Photo 17. Wobbegong at Burkitt's Reef

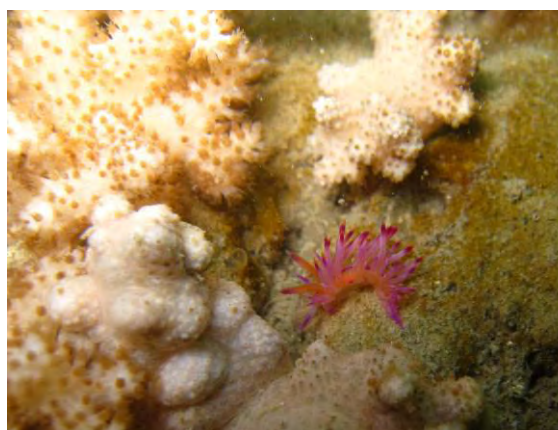


Photo 18. Nudibranch at ESA Park



# REEF CHECK

A U S T R A L I A



Photo 19. Nudibranch at Big Woody Island



Photo 20. Green turtle at ESA Park



Photo 21. Bleached soft coral ESA Park



Photo 22. Coral recruit at West Gataker's Reef



Photo 23. Unusual coral scar at West Gataker's Reef



Photo 24. Heavy siltation at West Gataker's Reef

# REEF CHECK

## A U S T R A L I A

### 7.0 Literature Cited

- Bennett, C. (2004). *A Quantitative Survey of Coral Communities in Hervey Bay, Queensland*. Unpublished Honours thesis, Southern Cross University, Lismore, NSW, Australia.
- Butler *et al.* (2013). The impacts of flooding on the high-latitude, terrigenoclastic influenced coral reefs of Hervey Bay, Queensland, Australia. In Review.
- DeVantier, Lyndon (2010). Reef-building corals of Hervey Bay, South-East Queensland: Report to the Wildlife Preservation Society of Queensland, Fraser Coast Branch, May 2010.
- Kleypas, J. A., McManus, J. W., & Menez, L. A. (1999). Environmental Limits to Coral Reef Development: Where Do We Draw the Line? *American Zoologist*, 39, 146-159.
- Perry, C., & Larcombe, L. (2003). Marginal and non-reef building coral environments. *Coral Reefs*, 22, 427-432.
- 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 13<sup>th</sup> International Marine Biological Workshop, The Marine Flora and Fauna of Moreton Bay, Queensland. Memoirs of the Queensland Museum--Nature 54(2)(pp. 1-118).
- Zann, Maria Christine (2011). The Use of Remote Sensing and Field Validation For Mapping Coral Communities Of Hervey Bay and the Great Sandy Strait And Implications for Coastal Planning Policy. A thesis submitted for the degree of Master of Philosophy at The University of Queensland in September 2011 School of Geography, Planning and Environmental Management.
- Zann, M. (2012). The use of remote sensing and field validation for mapping coral communities of Hervey Bay and the Great Sandy Strait and implications for coastal planning policy. Unpublished M.Phil. thesis, the University of Queensland, Brisbane.
- Zann, M., Phinn, S. and T. Done (2012). Towards marine spatial planning for Hervey Bay's coral reefs. Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia, 9-13 July 2012. Available online at: [http://www.icrs2012.com/proceedings/manuscripts/ICRS2012\\_18C\\_2.pdf](http://www.icrs2012.com/proceedings/manuscripts/ICRS2012_18C_2.pdf)

### 8.0 Additional Information

All Reef Check Australia data is utilised for the [Reef Check International](#) global reef database, for worldwide reef health comparisons. RCA data is also shared through our online [Reef Health Database](#). Summary data is available to the public through our summary Google Map interface and raw data is available for Data Users through an online portal.