Status of Coral Reefs in Malaysia, 2015

Reef Check Malaysia

Contents

Executive Summary

1. A total of 242 sites were surveyed in 2015 (2014: 184), 84in Peninsular Malaysiaand 158 in East Malaysia.The surveys are a continuation of a successful National Reef Check Survey Programme that has now run for ninthyears.

2. The surveys were carried out by trained volunteers as well as government officials from the Department of Marine Parks Malaysia and Sabah Parks, reflecting commitment from the Government in further improving management of Malaysia's coral reefs. Surveys were carried out on several islands off Peninsular Malaysia's East and West coast, covering both established Marine Protected Areas and non-protected areas, and invarious parts of East Malaysia, both Sabah and Sarawak.

3. The results indicate that Malaysian reefs surveyed have a relatively high level of living coral, at 45.95% (2014: 48.10%). The low level of recently killed corals indicates continuing recovery from the 2010 bleaching event that killed coral reefs around South East Asia.

4. Low levels of abundance of high-value species of fish (such as grouper) and shellfish (such as lobster) were recorded, indicating slow recovery from past overfishing and possible continuing problems with poaching inside Marine Protected Areas.

5. Some coral reefs show increasing amounts of algae, suggesting that they are suffering from an ecosystem imbalance due to elevated nutrient inputs, possibly from sewage and agriculture activities (particularly plantations), coupled with low herbivory by fish and sea urchins.

6. A series of recommendations is provided with a focus onbetter education and enforcement of existing laws to protect and conserve coral reefs.

7. Of particular importance is the need to build resilience of coral reefs, in the face of growing global threats from climate change (bleaching and ocean acidification). Managing local threats will ensure coral reefs are in the best possible condition to resist these growing external threats.

8. The government is asked to support further survey programmes, to take steps to build resilience of coral reefs and to establish a comprehensive Bleaching Response Plan as well as Reef Resilience Surveys to enable it to better respond to future mass coral bleaching events.

9. While tourism is a valuable source of income, the government is asked to require hotels and dive facilities to follow best practices including careful attention to sewage treatment and discharge, and education of clients so as to avoid damage to reefs.

10. Coral reefs are a valuable economic and biological resource in Malaysia, where they are a major attraction for the tourism industry, serve as a protein source for millions of people and are a major source of biodiversity. One estimate puts the economic value of well-managed coral reefs in Malaysia at RM150 billion per annum. Coral reefs are threatened by global warming, overfishing, pollution and sedimentation.

11. Reef Check is a coral reef monitoring methodology used worldwide to assess the health of coral reefs in over 90 countries and territories worldwide, and in Malaysia since 2001. The non-profit Reef Check Malaysia (RCM) is available to oversee training and surveys in Malaysia.

This report is available for download at:

http://www.reefcheck.org.my/media-information/annual-survey-reports

For further information, please contact Reef Check Malaysia at: ecoaction@reefcheck.org.my

Please note: Each Annual Survey Report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this and the following section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

1. Introduction

Coral reefs are an important ecological and economic resource in many countries around the world, providing a range of valuable ecosystem services to millions of people. Coral reefs provide jobs, food and coastal protection, among other benefits, to over 100 million people in South East Asia. They are the most diverse marine ecosystems on earth.

Despite being recognised for their economic and aesthetic value, coral reefs are being damaged by a variety of both local and global threats:

- The 2008 "Status of Coral Reefs of the World" report stated that the world has effectively lost 19% of the original area of coral reefs and that 15% are seriously threatened with loss within the next 10-20 years, with a further 20% under threat of loss in the next 20-40 years.
- In 2011, "Reefs at Risk Revisited" stated that more than 60% of the world's reefs are under immediate and direct threat from one or more local sources.

These threats arise largely as a result of human activities and land use changes along coastlines adjacent to coral reefs. Local threats to coral reefs are many, and are reasonably well understood. They include:

- Over-fishing, which can result in detrimental changes to reef ecology
- Destructive fishing(such as dynamite and cyanide fishing), which destroy the reef structure
- Coastal development, releasing silt and sediment that can smother reefs and altering hydrological flows
- Pollution, from industrial and agricultural activities as well as sewage pollution
- Physical impacts from tourism, including divers, snorkelers and boats.

In Malaysia, the Department of Marine Parks (Federal), Sabah Parks and Sarawak Forestry are tasked with managing these local threats to their protected reef areas.

However, against these *local* threats, mass coral reef bleaching has emerged over recent years as a *global* threat that is difficult to manage locally and which can have potentially devastating effects. The first significant mass coral reef bleaching event reported in Malaysia was in 1998, as a result of which an estimated 40% of corals in reefs around Peninsular Malaysia died. Reefs had barely recovered before the 2010 mass coral reef bleaching event occurred, which fortunately saw lower coral death rates.

Scientists agree that mass coral reef bleaching is likely to occur with increasing frequency in the coming decades, and there is an urgent need to put in place plans to:

- Respond effectively to mass coral reef bleaching events with management interventions to protect reefs during bleaching events
- Build the "survivability" of coral reefs to better withstand future bleaching events.

Reef Check Malaysia Bhd (RCM) works with various stakeholders to conserve coral reefs. Since it was registered in 2007, RCM has established an annual, national coral reef monitoring programme. This report presents the results of coral reef surveys conducted in Malaysia during 2015, the ninth year of surveys.

2. Reef Check

2.1 Background

Reef Check Malaysia is part of the world wide Reef Check network. Established in 1997 in the USA, Reef Check now has Coordinators in over 80 countries worldwide. Reef Check was established by a group of scientists who developed a simple, rapid method of surveying coral reefs. It is the name both of the organisation and the survey methodology.

Reef Check Malaysia (RCM) was registered in Malaysia as a non-profit company in 2007, and since then has established an annual survey programme to assess the health of coral reefs around Malaysia (reports are available for download from the website: www.reefcheck.org.my). In the last eight years RCM has trained over 550 divers to conduct reef surveys at over 150 permanent monitoring sites on coral reefs off the East coast of Peninsular Malaysia and at sites around East Malaysia.

RCM is also active in education and awareness programmes, and has a long term education programme for schools. In addition, we have worked with stakeholders in the Perhentian islands and in Pangkor to involve local communities in coral reef management.

In 2010, RCM established its first coral reef rehabilitation programme in Pangkor, to assist local snorkelling guides to improve sites. In 2011 and 2012, the programme was replicated, on a larger scale, in Tioman, Perhentian and Redang. These rehabilitation programmes were continued in 2014 and have contributed to our understanding of coral reef ecology, and provide an ideal vehicle to educate local populations, businesses and tourists on the benefits and value of coral reefs and how human activities are damaging them.

In 2014, RCM initiated the Cintai Tioman Campaign in Tioman, with funding from Yayasan Sime Darby and HSBC Amanah Takaful. The goal of the programme is to build ecological and social resilience on the island, with particular emphasis on involving the local community in managing the islands' reefs. In 2015, EcoKnights joined RCM in the programme, with funding support from the Small Grants Programme to implement a number of economic and social development programmes.

This report is the ninthannual Malaysia coral reef survey report and details the results of Reef Check surveys carried out during 2015. It represents a continuation of the reef monitoring effort started by RCM in 2007. The information shown highlights key concerns and identifies steps that need to be taken to contribute to the conservation of Malaysia's coral reefs.

2.2 Survey Methodology

Reef Check surveys are based on the philosophy of "Indicator Species". These are marine organisms that:

- are widely distributed on coral reefs
- are easy for non-scientists to identify
- provide information about the health of a coral reef.

Using a standardized methodology, data from surveys in different sites can be compared, whether it be on an island, regional, national or international basis (see www.reefcheck.orgfor more details).

The Reef Check monitoring methodology allows scientists and managers to track changes to coral reefs over time. By surveying reefs on a regular basis, deleterious changes can be highlighted early, before they become problems. This gives managers the opportunity to intervene, carry out additional more detailed studies and/or initiate management actions to try to reverse the change before permanent damage is done to the reef.

Reef Check surveys are conducted along two depth contours (3 m to 6 m and 6 m to 12 m depth). A 100 m transect line is deployed and along it four 20 m transects are surveyed, each separated by 5m, which provides four replicates per transect (8 per complete survey) for statistical analysis (see Figure 1).

Four types of data are collected:

- Fish abundance: the fish survey is carried out by swimming slowly along the transect line counting the indicator fish within each of the four 20 m long x 5 m wide x 5 m high corridors
- Invertebrate abundance: divers count the indicator invertebrates along the same four 20 m x 5 m belts
- Substrate cover: collected by the Point Intercept method whereby the substrate category such as live coral is noted every 0.5 m.
- Impact: the impact survey involves the assessment of damage to coral from bleaching, anchoring, destructive fishing, corallivores such as *Drupella* snails or crown-of-thorns starfish, and trash.

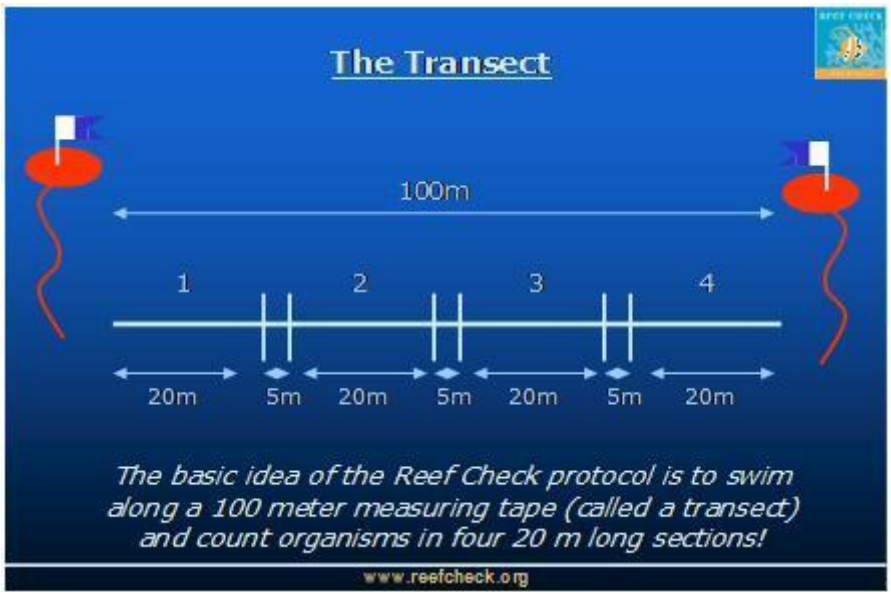


Figure 1: The Transect

2.3 Survey Sites

In 2015, a total of242sites were surveyed,84of which were in Peninsular Malaysia andthe remaining 158in East Malaysia. As far as possible, the same sites are visited each year to provide consistent data over time.

In Peninsular Malaysia, surveys were conducted at sites around several islands off the East coast (Bidong, Yu, Kapas,Pemanggil, Perhentian, Redang, Sibu, Tinggi, Tenggol,and Tioman). Numerous sites were also surveyed around islands off the West coast (Sembilan, Pangkor Laut and Payar). In East Malaysia, a large percentage of the surveys were conducted by a number of dive operators, notably in Lankayan andMataking in Sabah and Miri in Sarawak,and by Sabah Parks, in Pulau Tiga, Pulau Penyu,TSMP, TARP and Sipadan in Sabah. This is one of the success stories of getting local stakeholders, especially governments, dive operators and local community, to be involved in monitoring and management of their own local reefs.

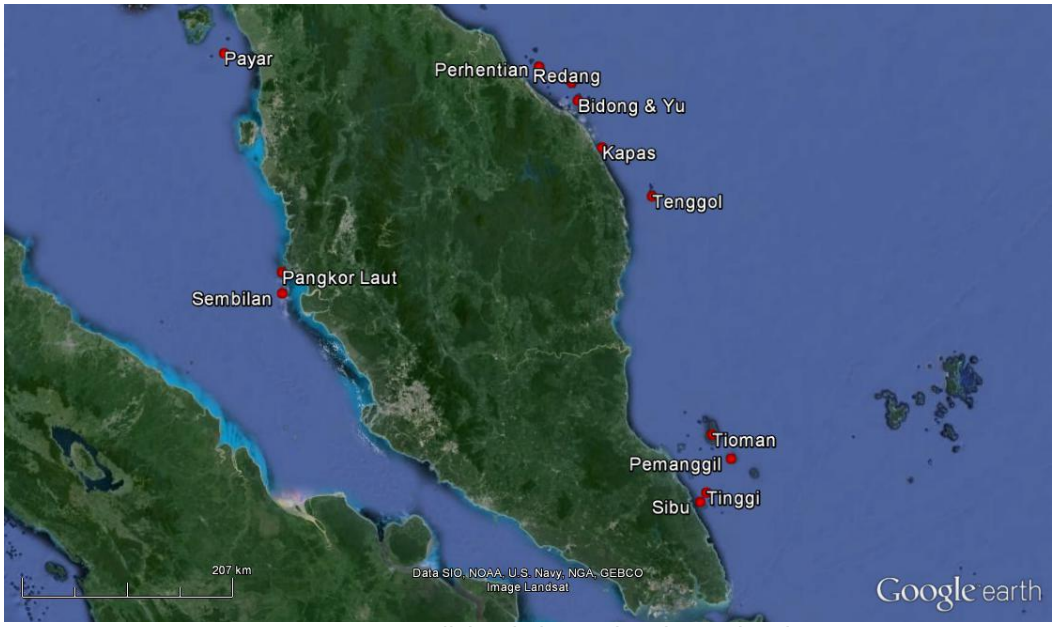
The list of sites surveyed is shown in appendix 1.

3. 2015 Survey Results and Analysis

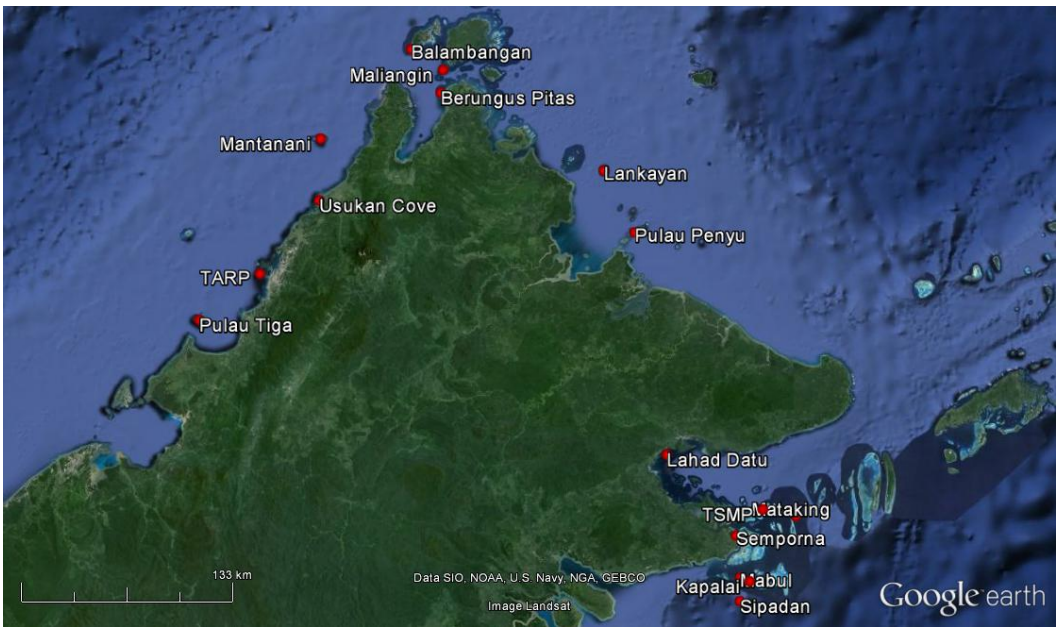
This section presents the results from surveys conducted in 2015, providing an overview of the condition of coral reefs in Malaysia as a whole, and a detailed analysis of the health of reefs in surveyed reef areas.

3.1 Status of Coral Reefs in Malaysia 2015

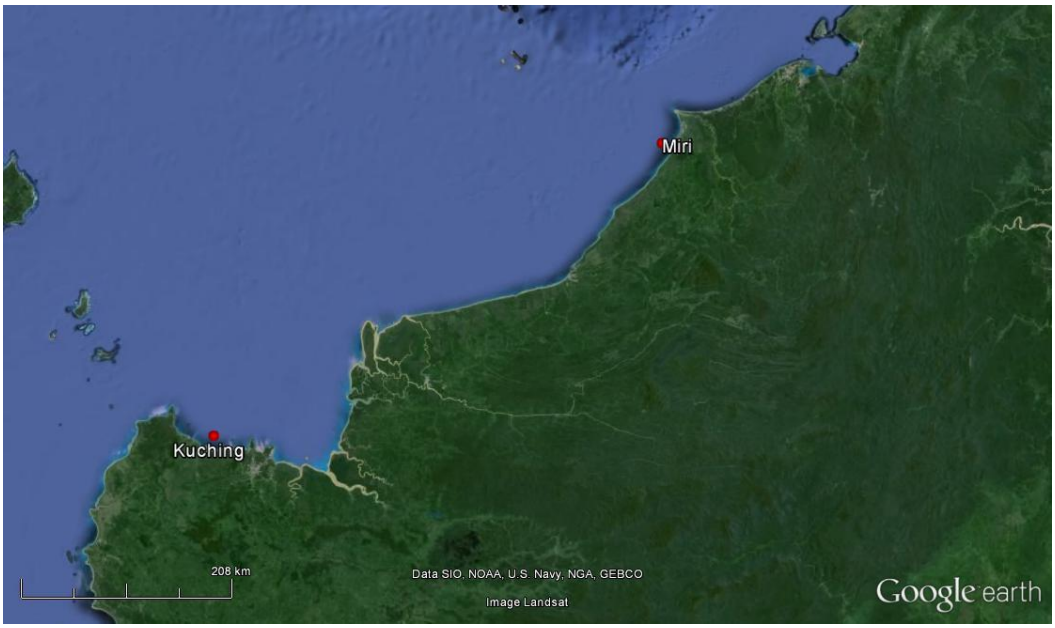
The results from all 242 surveys were compiled to provide an overview of the status of coral reefs around Malaysia. Sites surveyed off peninsular Malaysia are mostly islands which are important tourist destinations while the islands and reefs off Sabah and Sarawak are less frequently visited but face other problems such as destructive fishing practices.



Map 1: Surveyedislands in Peninsular Malaysia



Map 2: Surveyed islands in Sabah
(Note: TSMP= Tun Sakaran Marine Park; TARP= Tunku Abdul Rahman Park)



Map 3: Surveyed islands in Sarawak

3.1.1 Substrate

The table below shows the Coral Reef Health Criteria developed by Chou *et al*, 1994.

Table 1: Coral Reef Health Criteria

Percentage of live coral cover	Rating
0-25	Poor
26-50	Fair
51-75	Good
76-100	Excellent

According to these ratings Malaysian reefs are considered to be in “fair” condition, with an average live coral cover (Hard Coral + Soft Coral – see Chart 1) of 45.95% (48.11% in 2014). The decrease in LCC from 2014 is likely to reflect the addition of new survey sites in 2015, rather than a decline in reef health.

Recently Killed Coral (RKC) shows the amount of coral killed within the last 12 months due to a variety of impacts, including bleaching, predation (e.g. by Crown of Thorns starfish, Drupella snails) and other local stressors (e.g. sedimentation, disease). The low level of RKC (1.73%) in 2015 mirrored that of 2014 (1.05%).

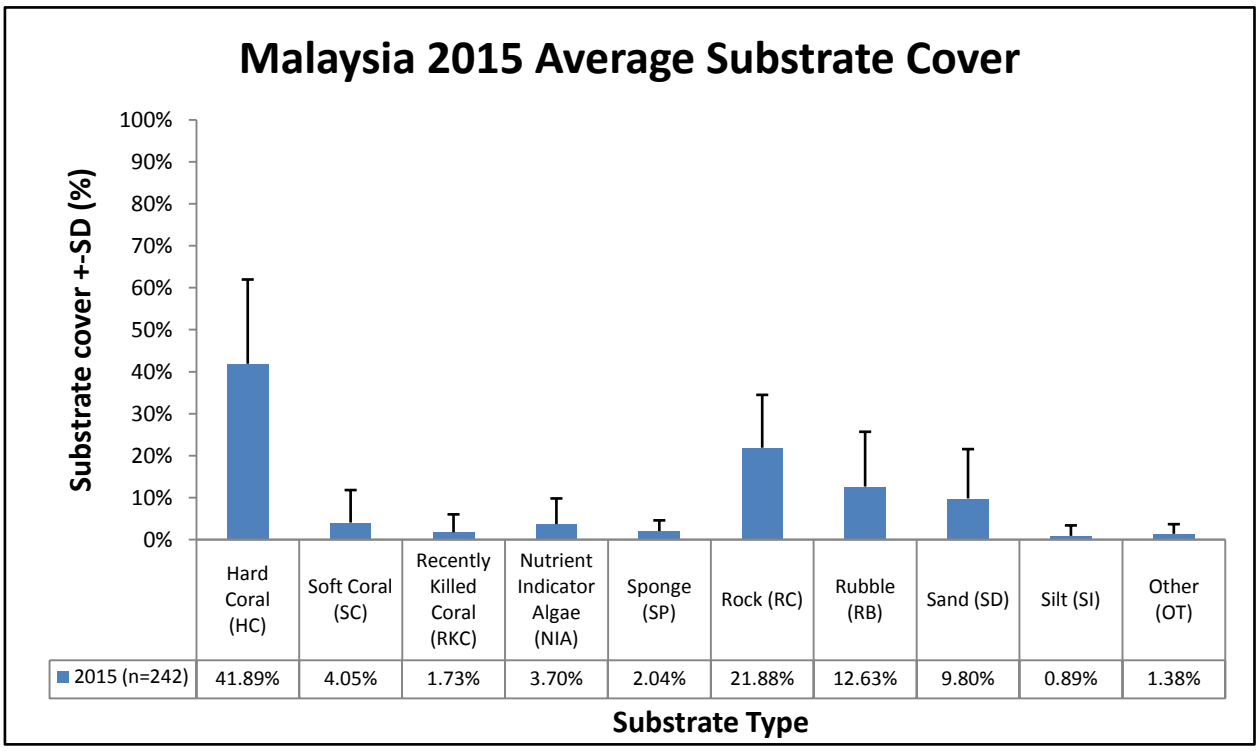
Nutrient Indicator Algae (NIA) is a measure of the amount of algae growing on reefs, and can provide an indication of the health of herbivorous fish and invertebrate populations on reefs and of the level of nutrient input to reefs. Algae area natural and essential part of the coral reef, but if allowed to grow un-checked algae can shade corals from the sunlight they need for photosynthesis, smothering and eventually killing them. This can lead eventually to a phase shift from coral- to algae-dominated reefs, which are much less productive than coral-dominated reefs. NIA level in 2015 (3.70%) also mirrored that of 2014 (3.13%); low and does not appear to be a threat in most places. However, it should be noted that this average figure masks a wide range and there are some siteswhere the proliferation of algae is becoming an issue that needs more attention, for example 36.25% at Hand Rock (Semporna)and 32.50% at Berungus Pitas 3 (Berungus).

Sponges (SP) are another normal component of coral reefs that, under the right conditions, can proliferate in the presence of high levels of nutrients. At 2.04%, the level of SP does not appear to be a threat.

Rock (RC) comprises both natural rock and dead coral. Bare RC can be recolonised by coral recruits and is critical for reef recovery, regeneration and extension. In 2015 the average cover of RC on Malaysian reefs was 21.88%. It should be noted that new coral recruits cannot settle onto RC that has significant algae

cover; and under these conditions settlement of new recruits will be reduced. This demonstrates the importance of healthy herbivore populations, which graze on algae and keep it under control, providing clean surfaces for coral recruits.

Chart 1: Substrate Cover



Rubble (RB) comprises small pieces of rock, coral fragments, dead shells and other small pieces of substrate. RB is created by a number of factors, some natural such as wave action and storms,while others result from human activities, including fishing, boating and SCUBA diving.On reefswith high levels of RB, coral regeneration is slow due to the difficulty of corals recruiting onto a mobile substrate: recruits are easily damaged or displaced from mobile substrate moving around on the seabed.The average cover of RB on reefs around Malaysia was 12.63% in 2015, and this has not changed much over the last fouryears.This relatively high average level of RB is in part due to very high RB levels at some sites. Although 54% of reefs surveyed had RB level below 10%, at some sites it was significantly higher, including 71.88% at Labas (Tioman), 66.25% at Cahaya Way (Mataking) and 65% at Ira's Reef(Lahad Datu).

Sand (SD) is a natural component of reefs, and can be expected to be found on any survey. Increasing amounts of SD in a given coral reef can be an indication of disturbance as dead coral breaks off and is eroded into fine particles (sand) by wave action. The average has not differed much since 2012 and is considered normal.

Silt (SI) arises from a variety of natural sources (e.g. mangroves and mud flats) as well as from land use changes, including agriculture, forestry and development. Silt can smother corals, depriving them of sunlight and causing coral death. The average level of SI for Malaysia is low at 0.89%. It appears that corals in some areas (e.g. West coast of Peninsular Malaysia) have adapted to high natural levels of SI, so average levels of SI are not necessarily a good indicator of reef health. However, changing levels of SI in a specific area can indicate a local impact.

The category Other (OT) includes all other sessile organisms that do not indicate any impacts, but are natural components of coral reefs. The average level of OT in Malaysia was 1.38% in 2015.

3.1.2 Fish

Reef Check indicator fish species were chosen because of their desirability for various types of fishing, for example:

- Targeted for the aquarium trade: Butterflyfish
- Targeted as food fish: Sweetlips, Snapper, Barramundi Cod, Parrotfish, Moray Eel, Grouper
- Targeted for the live-food fish trade: Humphead Wrasse, Bumphead Parrotfish

The average abundances of indicator fish counted during the 2015 surveys are shown below (Chart 2).

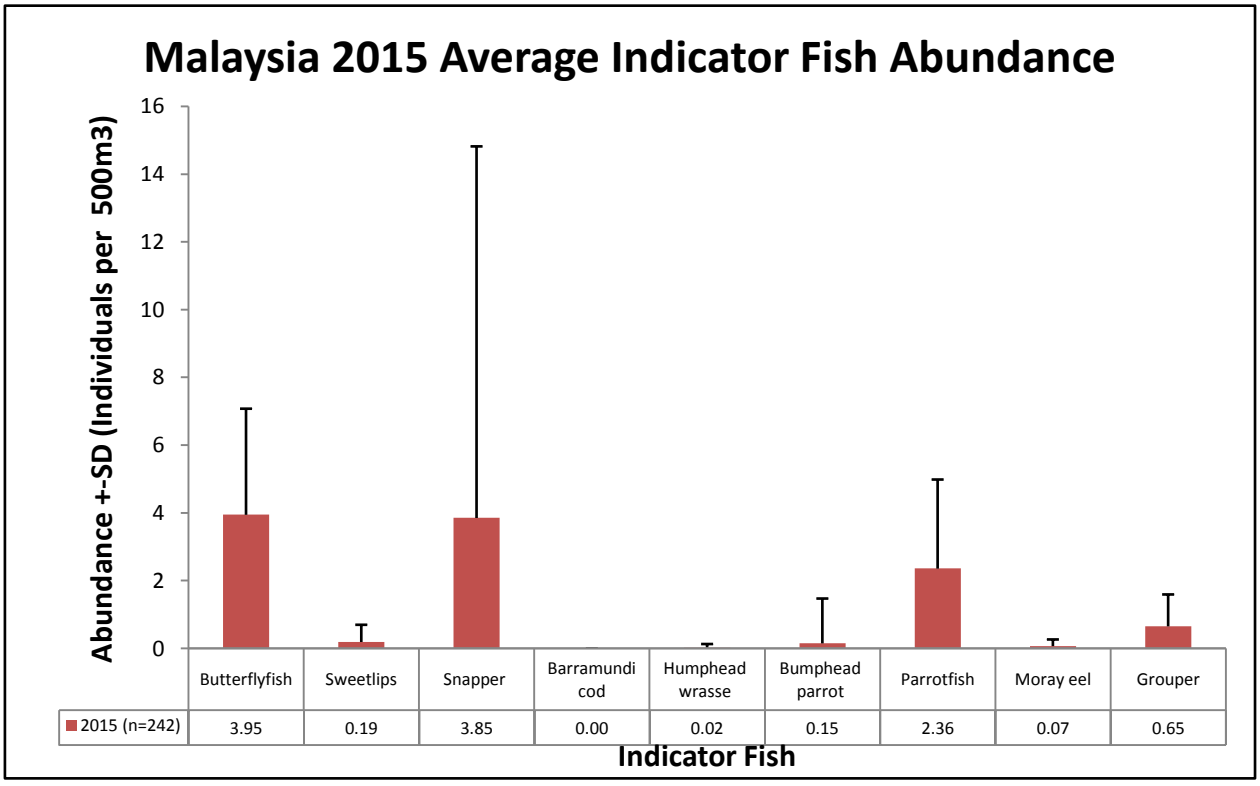
Barramundi cod, Humphead wrasse, Bumphead parrotfish, Groupers, Sweetlips, and Moray eels recorded an average abundance of less than 1 individual per 500m^3 survey transect. High value fish such as these, which are specially targeted for the international live food trade, recorded the lowest average abundance and were absent on most surveys.

With restaurants willing to pay up to US$ 10,000 for a single adult Humphead wrasse, it is not surprising that poachers target these fish, even inside marine protected areas. Greater protection (including enforcement of Marine Park regulations and trade restrictions) will be necessary to aid recovery of populations of these iconic species, and on-going monitoring will help to track recovery in populations.

Butterflyfish recorded a national average of 3.95 individuals per 500m^3 in 2015,similar to the average abundance of 2014. Butterflyfish is used as an indicator of fishing pressure for the aquarium trade as well as an indicator of reef health as they feed on coral polyps, and only healthy reefs can sustain a large population of these fish.

Parrotfish are important herbivores, controlling algal growth on reefs thus avoiding competition with corals. The national average in 2015 was 2.36 individuals per 500m^3 which is similar to that of 2014.

Chart 2: Indicator Fish Abundance



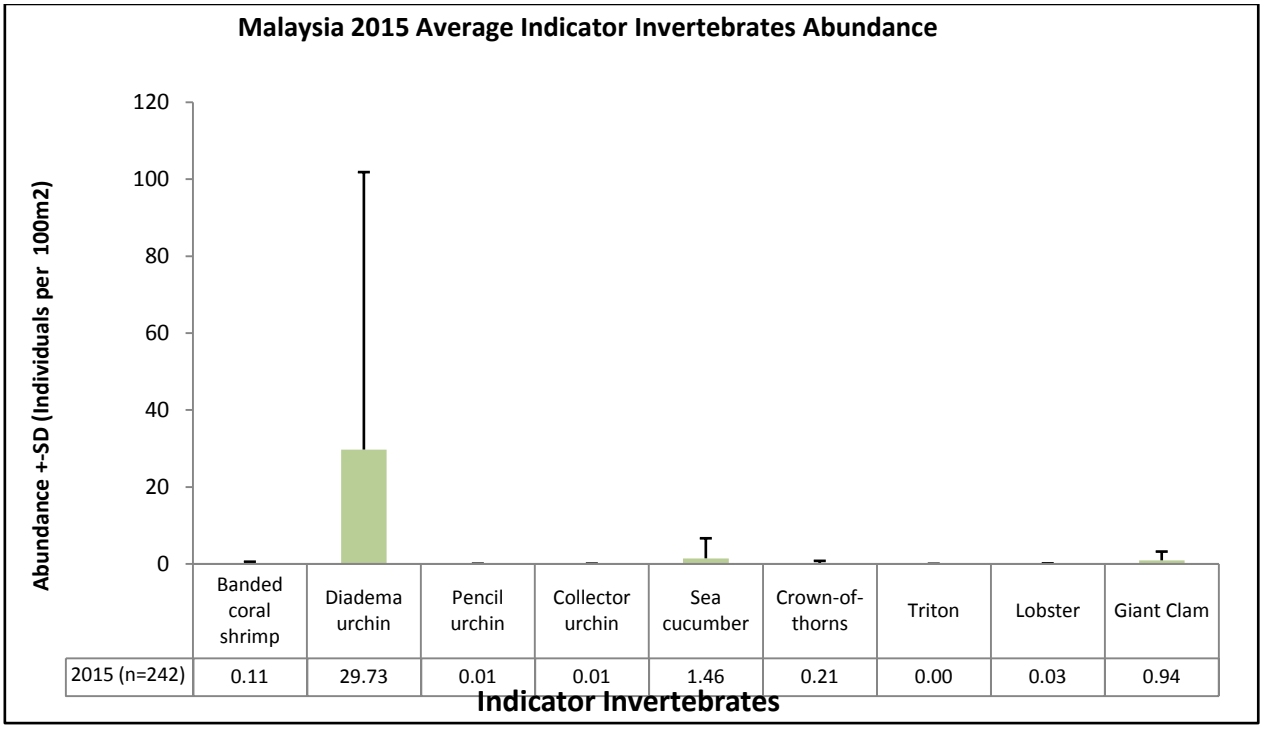
3.1.3 Invertebrates

The invertebrate indicators are targeted for different reasons:

- Collected for Curio trade: Pencil Urchin, Triton Shell
- Collected for Food: Banded Coral Shrimp, Collector Urchin, Sea Cucumber, Lobster, Giant Clam
- Ecological Imbalance/predator outbreaks: *Diadema* Urchin, Crown of Thorns

The abundance of indicator invertebrates documented during the 2015 surveys is shown in Chart 3 below.

Chart 3: Indicator Invertebrate Abundance



The average abundance of invertebrates targeted for the aquarium and curio trade was less than one individual per 100m^2. While this may be partly explained by low natural abundance and cryptic behaviour, historical overexploitation of invertebrates such as Tritons and Pencil urchins may have had a significant impact on their populations.

Similarly, several species targeted for the food trade are at or near zero (Lobster 0.03 individuals per 100m^2 survey transect; Collector Urchin – 0.01 individuals per 100m^2). The abundance of Sea Cucumber is low at 1.46 individuals per 100m^2. Giant Clam recorded an average of 0.94 individuals per 100m^2. This includes both mature breeding adults as well as juveniles. The low numbers of giant clams within 100m^2 is something to take note of as the sessile nature of these organisms would make breeding difficult if distances between breeding adults are too large.

The abundance of long-spined sea urchins *(Diadema sp.)* varies widely between survey sites, and in some sites they are present in unusually high numbers. In a balanced reef ecosystem, the numbers of *Diadema* urchins, in combination with herbivorous fish, keep algal growth in check. However, these urchins can reproduce rapidly in conditions in which their main food source (micro- and macroalgae, which proliferate in nutrient rich water) is abundant. Thus, high numbers of *Diadema* could indicate eutrophication or overfishing of herbivores.

While grazing algae on coral reefs, *Diadema* cause some damage to reefs, scraping the top layer of the coral skeleton. However, in high numbers, Diadema can have two further negative impacts. First, if algae are scarce, their feeding preference can change to coral tissue, and large numbers actively grazing can cause a weakening of the hard coral structure. Secondly, their spines scrape corals as they move over the surface of the reef, potentially damaging the reef structure if the rate of bio-erosion exceeds the rate of coral growth. Controlling nutrient pollution as well as maintaining a healthy population of herbivores fish can contribute to reducing the scale of this problem.

Crown-of-thorns starfish (COT) feed on corals and can cause significant damage to coral reefs, destroying large areas in a short period of time. According to CRC Reef Research Centre (Australia), a healthy coral reef can support a population of 20-30 COT per hectare (10,000m^2), or 0.2-0.3 per 100m^2 (Harriott et al., 2003) The abundance of COTs found during surveys, 0.21 per 100m^2, suggested that COT numbers are not a threat to the reefs. On some of the islands off the East coast of Peninsular Malaysia, considerable efforts have been made by Marine Park authorities and local dive centres to control COT numbers by organising annual COT extractions to reduce the threats posed by these creatures. Continued monitoring is essential to track and help to manage significant outbreaks of this corallivore.

3.2 Status of Coral Reefs in Key Eco-regions in Malaysia

The data below provide an overview of the health of coral reefs surveyed in three Eco-regions in Malaysia, using Live Coral Cover as a key indicator. An Eco-region is defined as an area of relatively identical species composition, clearly distinct from adjacent regions (Spalding et al, 2007).

The Eco-regions for Malaysia are based on the "Marine Eco-regions of the World" system(Spalding et al, 2007). They are:

- Malacca Strait (West coast of Peninsular Malaysia, Eco-region 118)
- Sunda Shelf (East coast of Peninsular Malaysia and Sarawak, Eco-region 117)
- North Borneo (Sabah, Eco-region 126)

Focusing management efforts at an eco-region level can provide benefits as reefs in a given region are similar; therefore the results of this report have been delineated into these three eco-regions.

Figure 2: Eco-regions of Malaysia; 118 = Malacca Strait, 117 = Sunda Shelf and 126 = North Borneo

The results highlight the different problems each island/area is facing.Islands/regions covered in each Ecoregion are shown in table2 below.

Data on LCC indicate that in general sites in Peninsular Malaysia have higher LCC than in East Malaysia. Furthermore, sites in protected areas (e.g., Marine Parks, SIMCA,TSMP, Sipadan Island Park) have higher LCC than sites outside protected areas (e.g., Sembilan, Kapalai, Mabul), suggesting that protected areas are having some beneficial impacts on coral reefs in Malaysia.

Table 2: Site Coverage by Ecoregion

Islands/Areas	No. of sites	Protection Status	LCC (%)
Sunda Shelf			
Perhentian	10	Marine Park	50.13
Redang	12	Marine Park	64.11
Tioman	18	Marine Park	61.39
Kapas	5	Marine Park	53.63
Bidong/Yu	6	Marine Park	62.50
Tenggol	6	Marine Park	58.65
Pemanggil	4	Marine Park	55.47
Tinggi	4	Marine Park	70.00
Sibu	6	Marine Park	51.35
Miri	6	No protection	45.73
Kuching	2	No protection	69.69
Malacca Strait			
Sembilan	9	No protection	31.81
Pangkor Laut	1	No protection	68.75
Payar	3	Marine Park	40.42
North Borneo			
Lankayan	15	SIMCA	48.21
Mataking	6	No protection	33.65
Semporna	13	No protection	31.30
Mabul	5	No protection	20.13
Kapalai	5	No protection	7.63
Mantanani	11	No protection	41.88
Usukan Cove	5	No protection	35.63
Lahad Datu	15	No protection	32.88
Tunku Abdul Rahman Park	13	Tunku Abdul Rahman Park	32.69
Tun Sakaran Marine Park	12	Tun Sakaran Marine Park	54.11
Sipadan Island	12	Sipadan Island Park	53.33
Pulau Tiga	6	Pulau Tiga Park	29.58
Pulau Penyu	9	Turtle Islands Park	41.46
Balambangan	3	No protection	72.29
Maliangin	16	No protection	46.68
Berungus	4	No protection	54.22
Total	**242**	**Average**	**45.95**

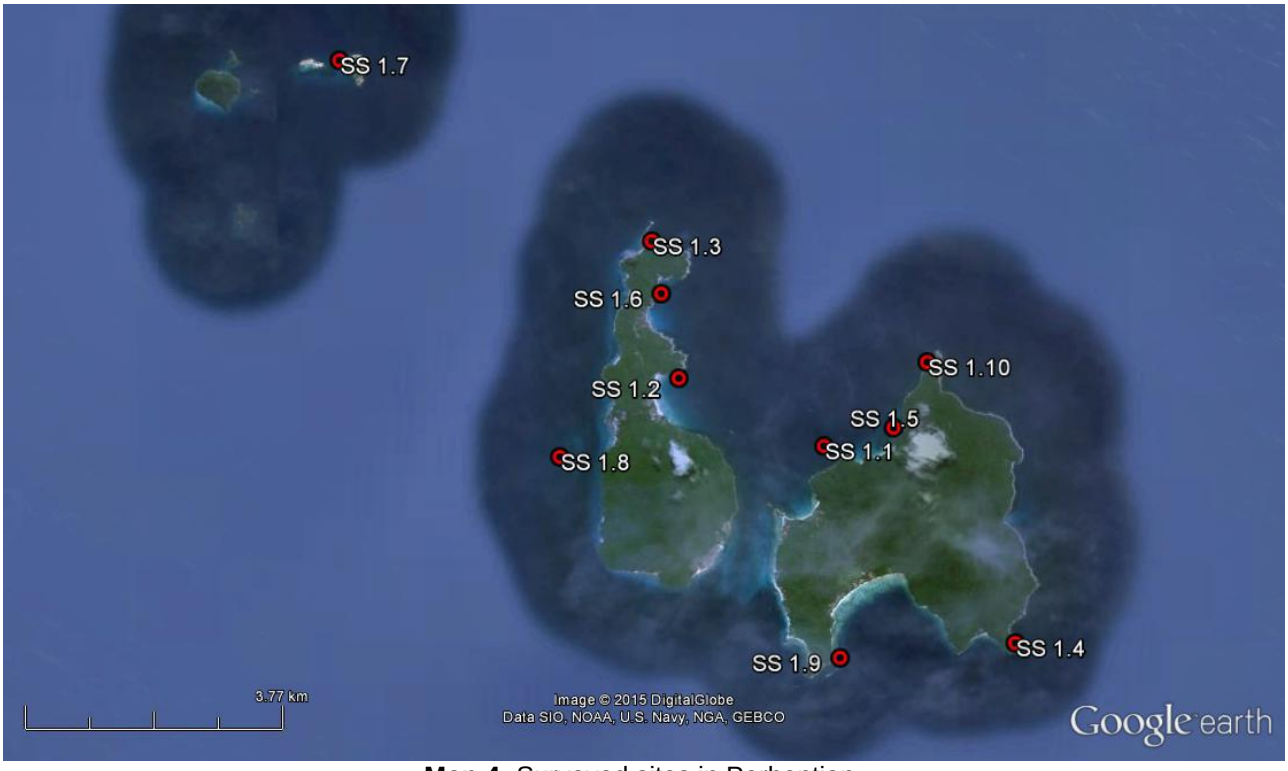
Sunda Shelf Region

3.2.1 Perhentian

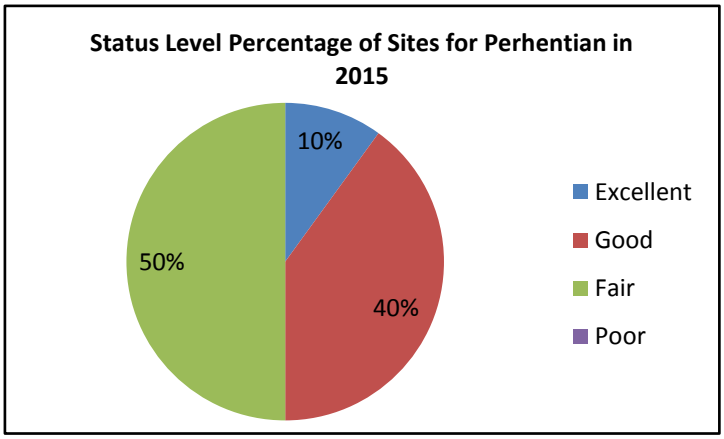
The Perhentian islands are located some 20km from Kuala Besut off the East coast of Terengganu, Malaysia. The islands have one village with a population of approximately 1,500, most of who work in tourism, the main industry on the islands. The islands are gazetted as a Marine Park (since 1994).

A popular tourist destination, particularly among backpackers, there are some 40 resorts, mainly small, family run chalets with a couple of large resorts, and 15 dive operators, spread around the two main islands. Diving and snorkelling are the main tourist activities.Growth in tourism has been rapid on the islands, and resort development continues. There is no grid-supplied electricity,norcentralised sewage treatment;groundwater supplies are limited in Perhentian and fresh water is supplied from the mainland.

Reefs are mainly fringing off-shore reefs, with some submerged reefs.

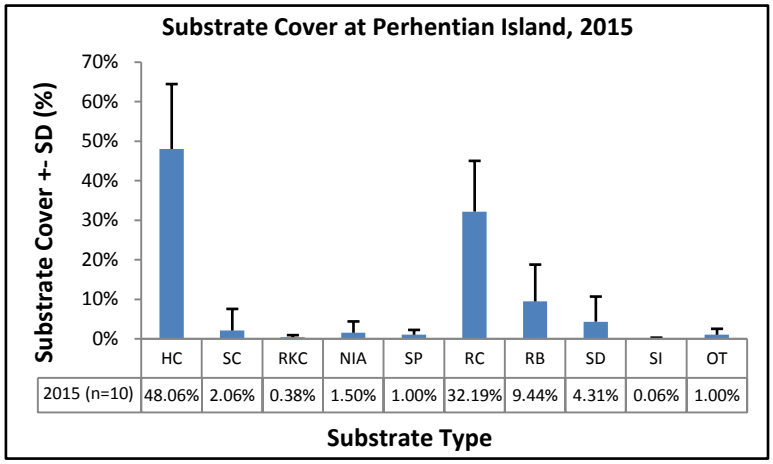


Map 4: Surveyed sites in Perhentian



A total of 10 coral reef sites were surveyed in Perhentian and 50% of the sites were in fair condition. Only 10% were in excellent condition, while 40% were in good condition. No reefs were in poor condition.

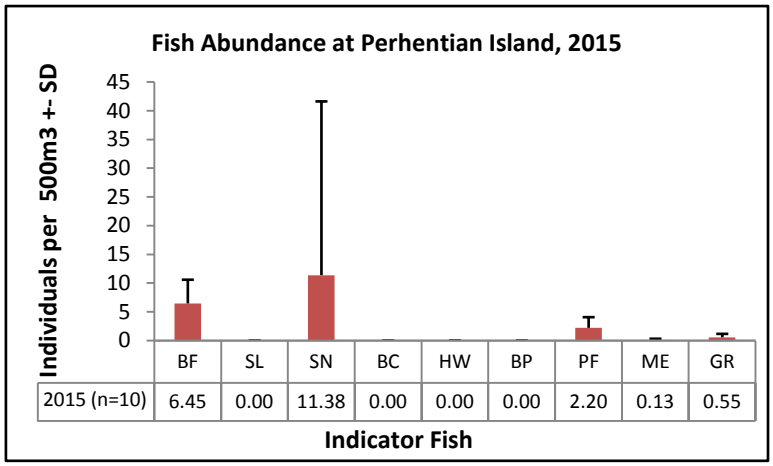
Substrate



Coral reefs around the Perhentian islands are considered to be in 'Good' condition, with 50.13%live coral cover, belowthe average (58.16%) for reefs withinthe Sunda Shelf region.

The level of RB was high, especially at SS1.2 Batu Nisan (25.63%) and SS1.8 Sea Bell (23.13%).Although the average level of NIA is acceptable for Perhentian islands, the level was exceptionally high at SS1.7 Pulau Rawa (9.38%). These indicate recent disturbances present on reefs in Perhentian.

Fish

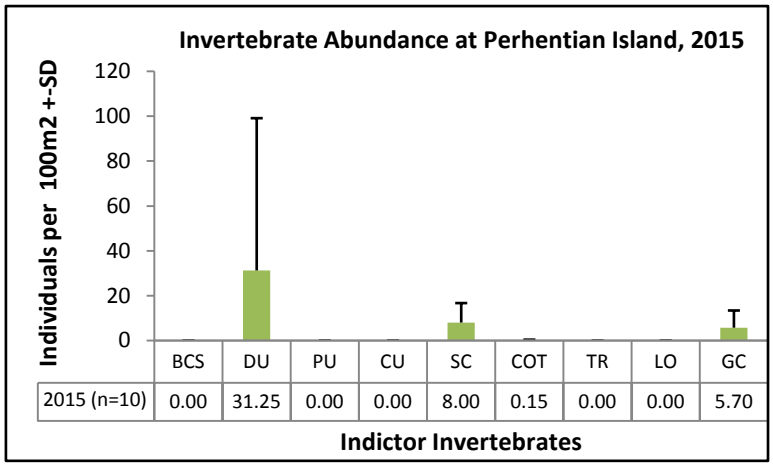


The most abundant fish were Snapper (the third highest in the region), followed by Butterflyfish.

High value fish such as Barramundi Cod, Humphead Wrasse and Bumphead Parrotfish were completely absent from surveys.

Other fish were present in low number (Parrotfish, Moray Eel and Grouper).

Invertebrates



Five out of nine indicator invertebrate were absent from all surveys (Banded Coral Shrimp, Pencil Urchin, Collector Urchin, Triton and Lobster).

Diadema Urchin, Sea Cucumber and Giant Clam were common on most reefs. Same like last year, the abundance of Giant Clamin Perhentian was the highest in Sunda Shelf region.

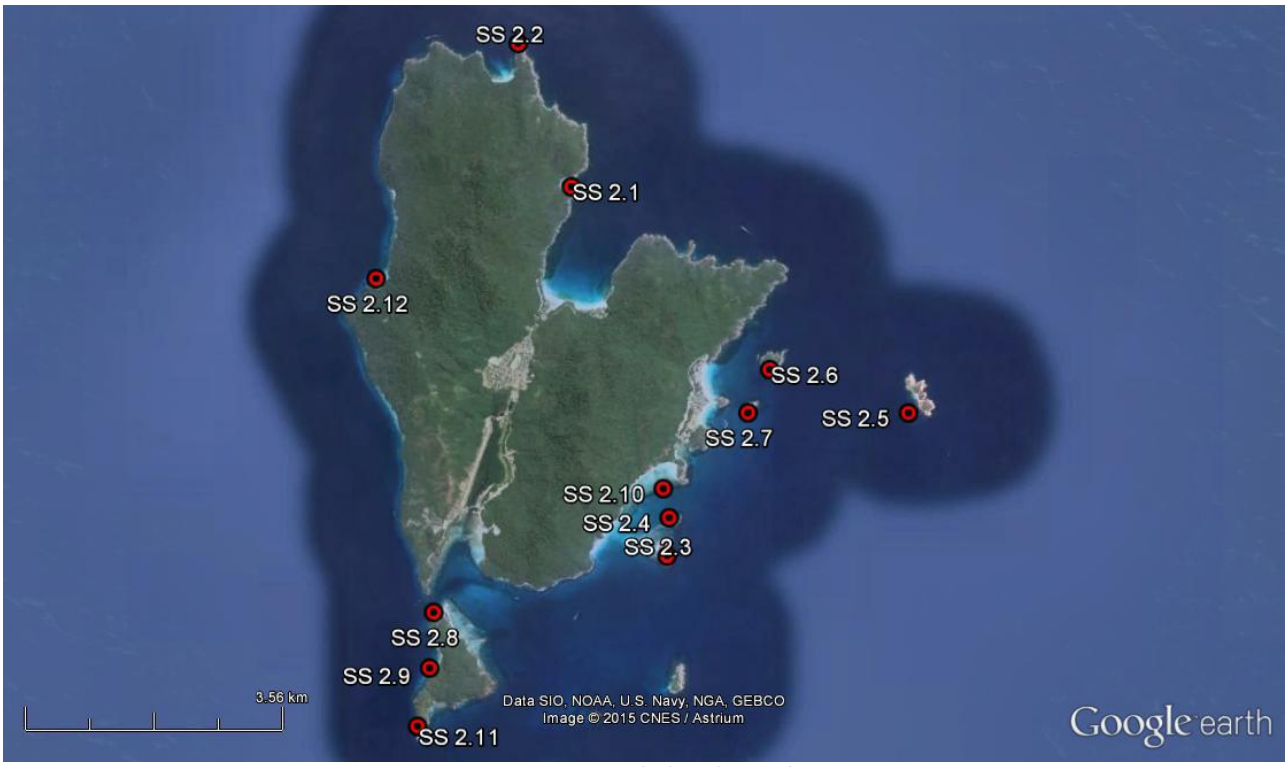
Rare animals were not sighted during surveys and white band disease was the only damage observed during surveys, at SS1.7 Pulau Rawa.

3.2.2 Redang

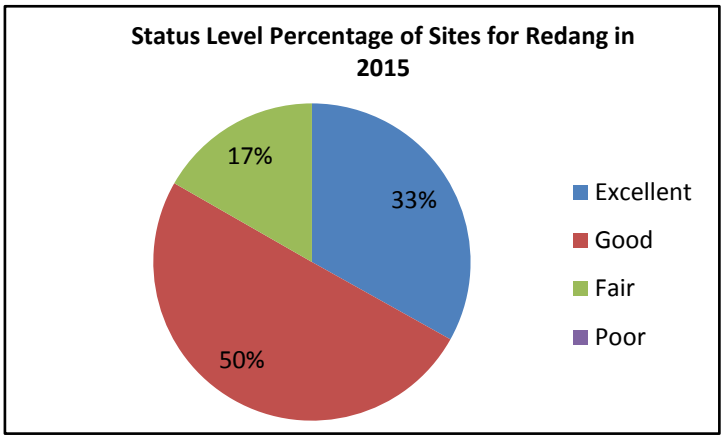
Redang Island is located some 25km from Merang, off the East coast of Terengganu, Malaysia. The islandhas a population of approximately 1,500, only a small proportion of whowork in tourism, the main industry on the islands. The islands are gazetted as a Marine Park (since 1994).

The island is a popular resort destination, with a more upmarket image than nearby Perhentian. Diving and snorkelling are the main tourist activities. There are 10 medium-large size resorts, mainly on Pasir Panjang. Most resorts have an in-house dive operator. There is no mains electricity, water is supplied by pipeline from the mainland and each resort has its own sewage treatment facilities. The island is served by an airport as well as boat services.

Both fringing off-shore reefs and submerged reefs can be found in the area.

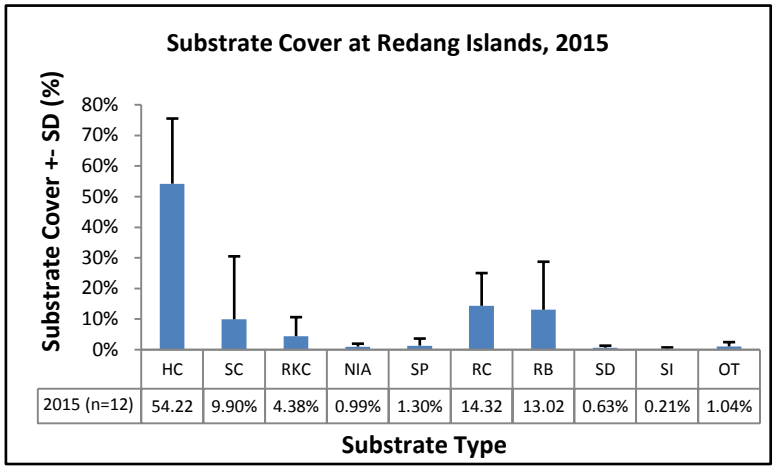


Map 5: Surveyed sites in Redang



A total of 12 coral reef sites were surveyed in Redang and 33% of the sites were in excellent condition. 50% were in good condition and the remaining 17% were in fair condition. No reefs were in poor condition.

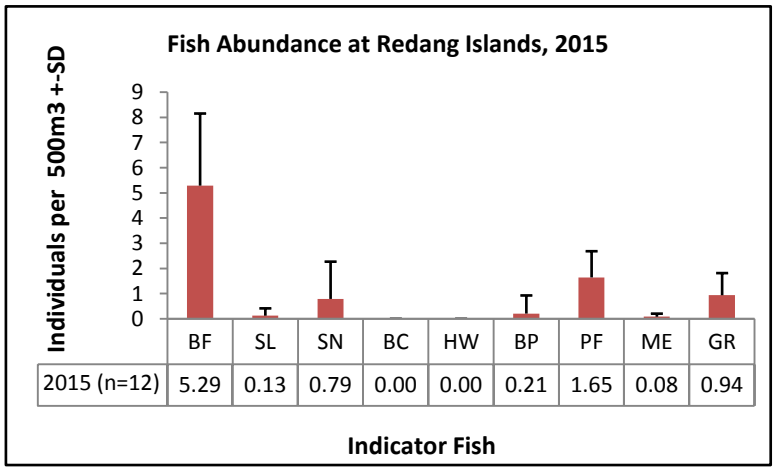
Substrate



The reefs around Redang islands are considered to be in 'Good' condition, with live coral cover of64.11% and above the average (58.16%) for reefs within the Sunda Shelf region.

The level of RB was high (second highest in the region);especially atSS2.6 Pulau Paku Besar(52.50%), SS2.7 Pulau Paku Kecil (28.13%) and SS2.4 Kerengga Kecil (27.50%). This indicates high recent disturbances in the area.

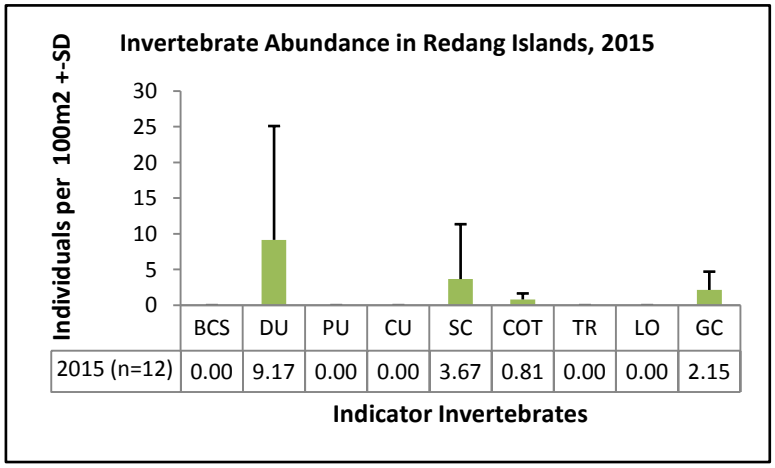
Fish



Butterflyfish recorded the highest number, followed by Parrotfish. Sweetlips, Snapper,Moray Eel and Grouper were recorded in low abundance.

Bumphead Parrotfish were observed at SS2.6 Pulau Paku Besar (2.5 ind./500m^3).

Invertebrates



Numerous targeted species were absent, including Banded Coral Shrimp, Pencil and Collector Urchin, Triton and Lobster.

Although DMPM conducts annual COT cleanups around the island, COT abundance was still high at 0.81 ind./100m^2, and the number is way above what a healthy reef can sustain (0.2-0.3 ind./100m^2). Nutrient runoff into the sea must be managed and fish feeding must be stopped to avoid COT blooms in the future.

Shark and turtle were observed in many of the survey sites; blacktip reef shark in 3 survey sites,green turtle in 3 survey sites and hawksbill turtle in 1 survey site. No damage was observed during surveys.

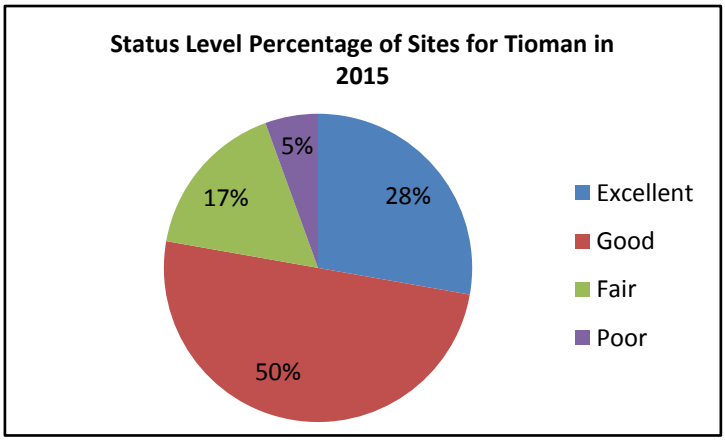
3.2.3 Tioman

Tioman Island is located some 50km from Mersing, off the East coast of Pahang. It is the largest island off the East coast of Peninsular Malaysia. The island has five villages, with a total population of approximately 3,000 most of whom work in the tourismindustry, the main industry on the islands. The island has been gazetted as a Marine Park since 1994. Reefs are mainly fringing off-shore reefs with some submerged reefs.

Diving and snorkelling are the main tourist activities. The island has long been a popular tourist destination, though in recent years it has been eclipsed by other destinations (particularly Redang and Perhentian). As a result, resort development has been at a slower pace, with no significant new resorts in the last 12 years. There are some 60 resorts on the island, mainly small family run operations, and 15 dive operators.

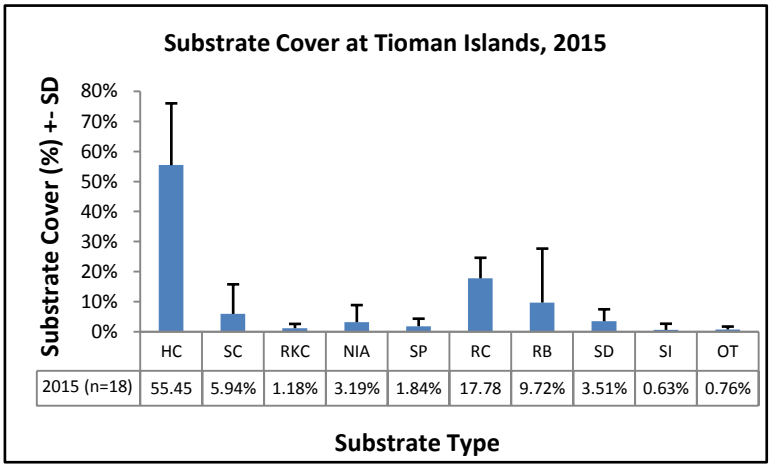
There is a small power generation station on the island, supplying electricity to all areas. The island has abundant fresh water, and a municipal incinerator was constructed some years ago. The island is served by an airport as well as boat services.

Map 6: Surveyed sites in Tioman



A total of 18 coral reef sites were surveyed in Tioman and 28% of the reefs were in excellent condition. 50% were in good condition, while 17% were in fair condition. 5% of the reefs were in poor condition.

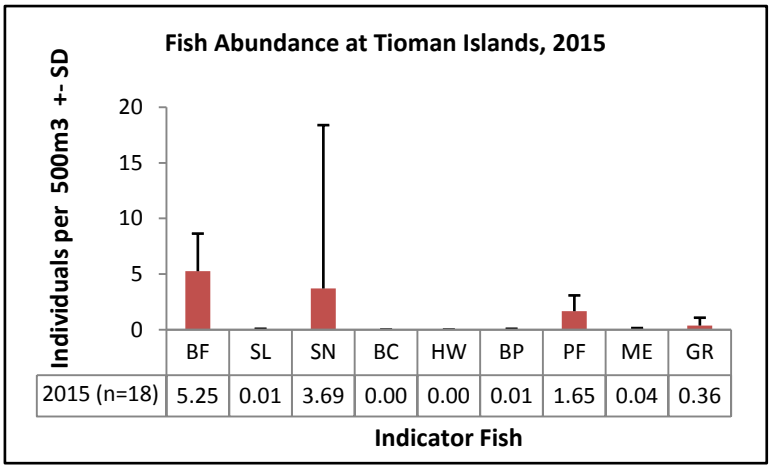
Substrate



The reefs in Tioman are considered to be in 'Good' condition, with 61.39% live coral cover,above the averagefor reefs of theSunda Shelf region (58.16%).

Level of RB was high and this reflects some recent disturbances in Tioman.Four of the survey sites recorded more than 15% of RB and the level was exceptionally high at SS3.12 Labas, recording as much as 71.88% (a big increase from last year 50.63%). The level of NIA was also high, especially at SS3.16 Nayak (23.13%).

Fish

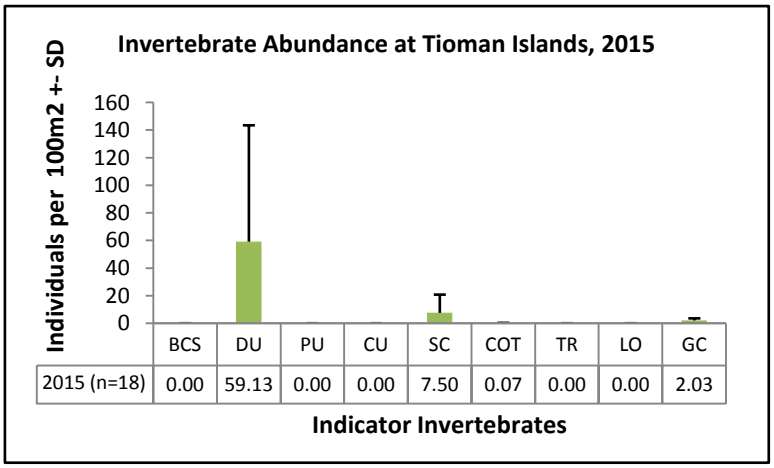


All indicator fish were observed except for Barramundi Cod and Humphead Wrasse.

Butterflyfish recorded the highest number, followed by Snapper and Parrotfish.Other indicators were present in low number.

Bumphead Parrotfish were observed at SS3.14 Jahat East (2.5 ind./500m^3).

Invertebrates



Several targeted species were absent, includingPencil Urchin, Collector Urchin, Triton and Lobster.

The number of Diademawas high (the second highest of all islands surveyed in the Sunda Shelf region).Diadema abundance was exceptionally high at SS3.4 Soyak South, recording as many as 305 ind./100m^2.

FrequentCOT cleanuparound the island, conducted by dive shop in Tioman had managed to keep COT numbers within the natural range.

Boat anchor damage and discarded fish nets were recorded during surveys. At SS3.11 Tumuk, fish net was discarded while divers were conducting survey. Shark and turtle were observed at two survey sites.

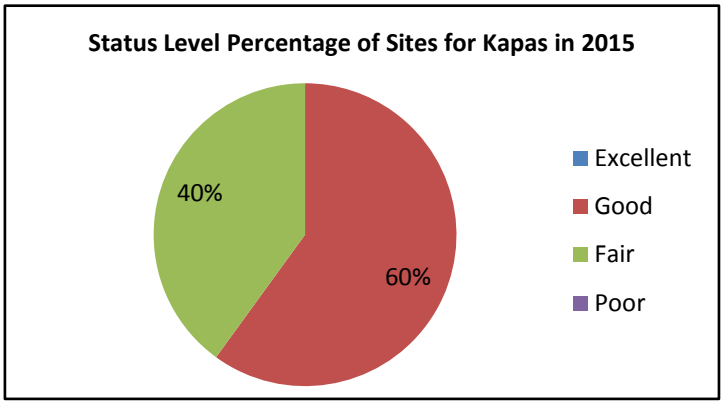
3.2.4 Kapas

Kapas Island is located just 6km from Marang, off the East coast of Terengganu, Malaysia. This small island has no local population. The islands are gazetted as a Marine Park (since 1994).

The island is not a major tourist destination due to its small size, but does have an established tourist market, with four resorts and one dive operator. Diving and snorkelling are the main tourist activities. There is no mains electricity, groundwater supplies are limited and there is no centralised sewage treatment.

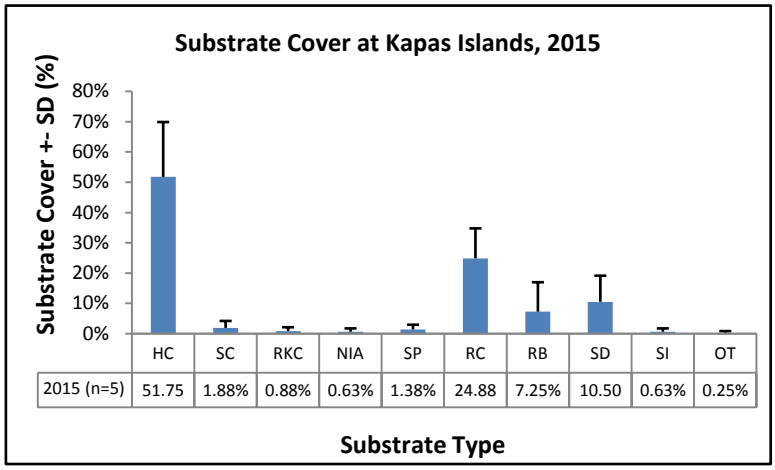
Reefs are mainly fringing off-shore reefs, with some submerged reefs.

Map 7: Surveyed sites in Kapas



A total of 5 coral reef sites were surveyed in Kapas. 60% of the sites were in good condition, while 40% were in fair condition.

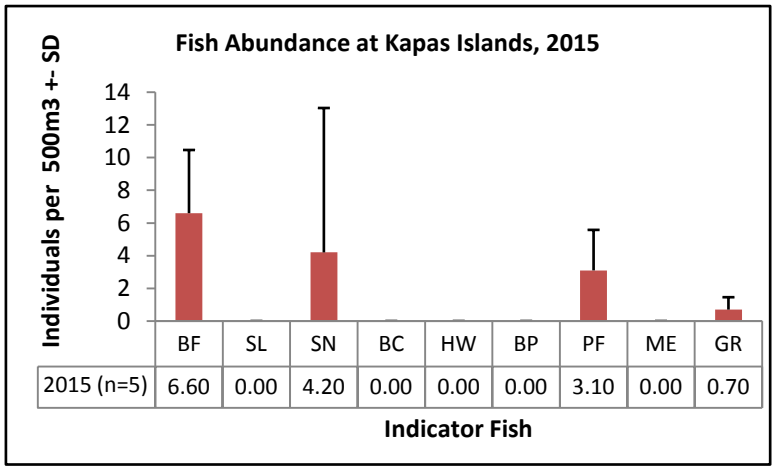
Substrate



Coral reefs around Kapas islands are considered to be in 'Good' condition, with 53.63% live coral cover, below the average (58.16%)for all islands surveyed in the Sunda Shelf region.

Although the level of SI has decreased compared to 2014 (1.72%), it stills need to be monitored closely.

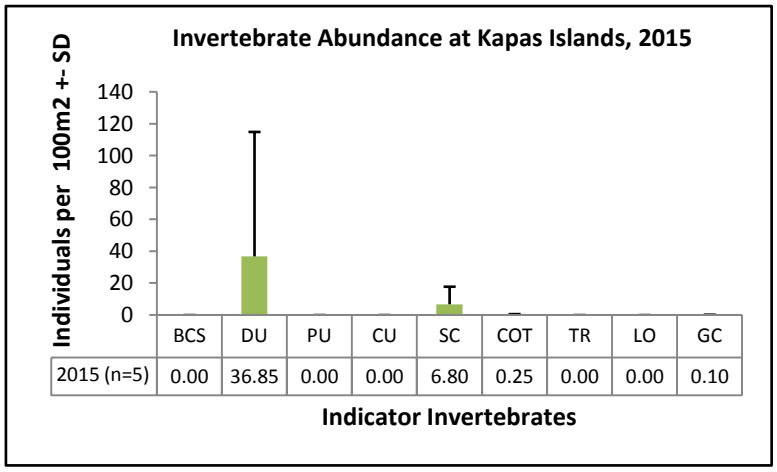
Fish



The most abundant fish were Butterflyfish, followed by Snapper and Parrotfish. The abundance of Grouper was low.

High value fish such as Barramundi Cod, Humphead Wrasse and Bumphead Parrotfish were completely absent from surveys.

Invertebrates



Fourtargeted species were present, including Diadema Urchin, Sea Cucumber, Crown-of-thorns and Giant Clam.

Abundance of Diadema Urchin was the highest, followed by Sea Cucumber.Giant Clam was present in low number. COT number was within the natural range.

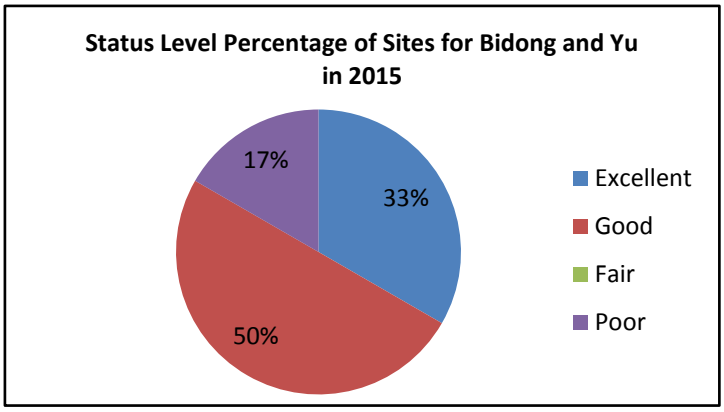
Natural and human damage to the reefs were observed during surveys. Damage due to warm water bleaching was observed at 3 sites whileboat anchor damage, discarded fish netand trash were found at most of the survey sites. Porcupine ray and hawksbill turtle were observed at SS4.5 Jellyfish City.

3.2.5 Bidong and Yu

The Bidong and Yu archipelago comprises several small islands, located 15-25km from Marang, off the East coast of Terengganu, Malaysia. The islands are unpopulated, though from 1978 to 1991 Bidong was a centre for Vietnamese refugees. The islands are now gazetted as a Marine Park.

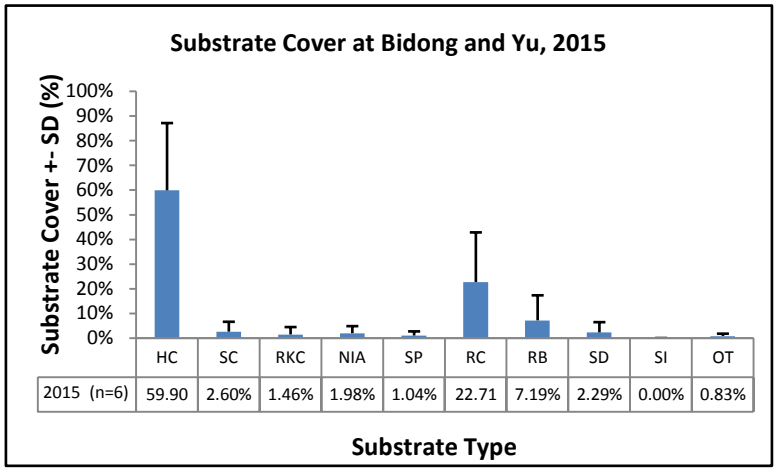
Bidong has mainly been a research base for University Malaysia Terengganu but has recently grown in popularity as a diving destination. Bidong has some sandy beaches and fringing reefs while Pulau Yu Besar and Kecil are mainly small rocky islands, with boulder slopes dropping to 25-30m, with some coral reef areas.

Map 8: Surveyed sites in Bidong and Yu



A total of 6 coral reef sites were surveyed in Bidong and Yu. 33% of the sites were in excellent condition, while 50% were in good condition. The remaining 17% were in poor condition.

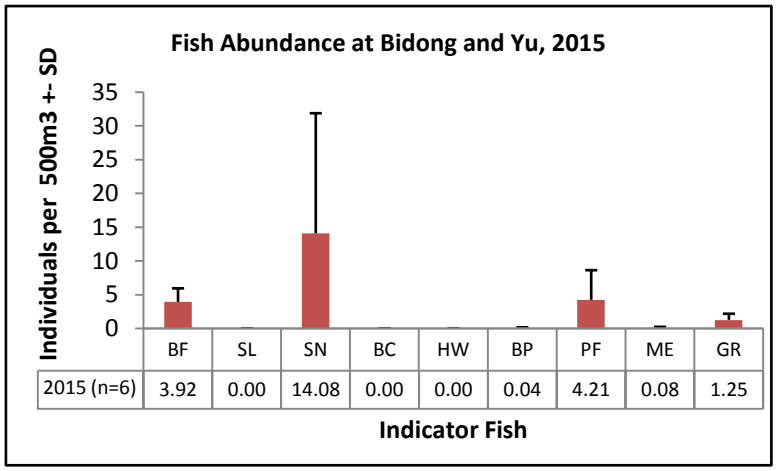
Substrate



Coral reefs around Bidong and Yu islands are considered to be in 'Good' condition, with 62.50% live coral cover, above the average (58.16%) for reefs inSunda Shelf region.

Level of NIA has increased slightly from 2014 (0.83%) after it has decreased significantly in 2014 compared to 2013 (7.29%). High level of NIA was recorded at SS5.1 Heritage Row (5%) and SS5.2 Pasir Tenggara (6.25%). The level of NIA needs to be monitored closely.

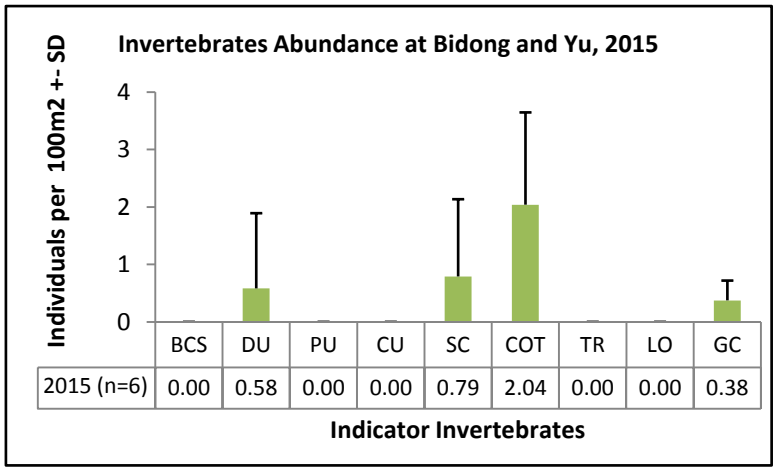
Fish



Three indicator species were completely absent from surveys (Sweetlips, Barramundi Cod and Humphead Wrasse).

Abundance of Snapper in Bidong and Yuis thesecond highest of all islands surveyed in Sunda Shelf region.

Invertebrates



As in most sites, several targeted species were absent, including Banded Coral Shrimp, Pencil and Collector Urchin, Triton and Lobster.

The abundance of COThas increased compared to 2014 (0.54 ind./100m^2) and was above acceptable limits (0.2-0.3 ind./100m^2). Their population in Bidong and Yu was the highest of all islands surveyed in Sunda Shelf region and must be closely monitored. Nutrient runoff into the sea must be managed to avoid further COT blooms.

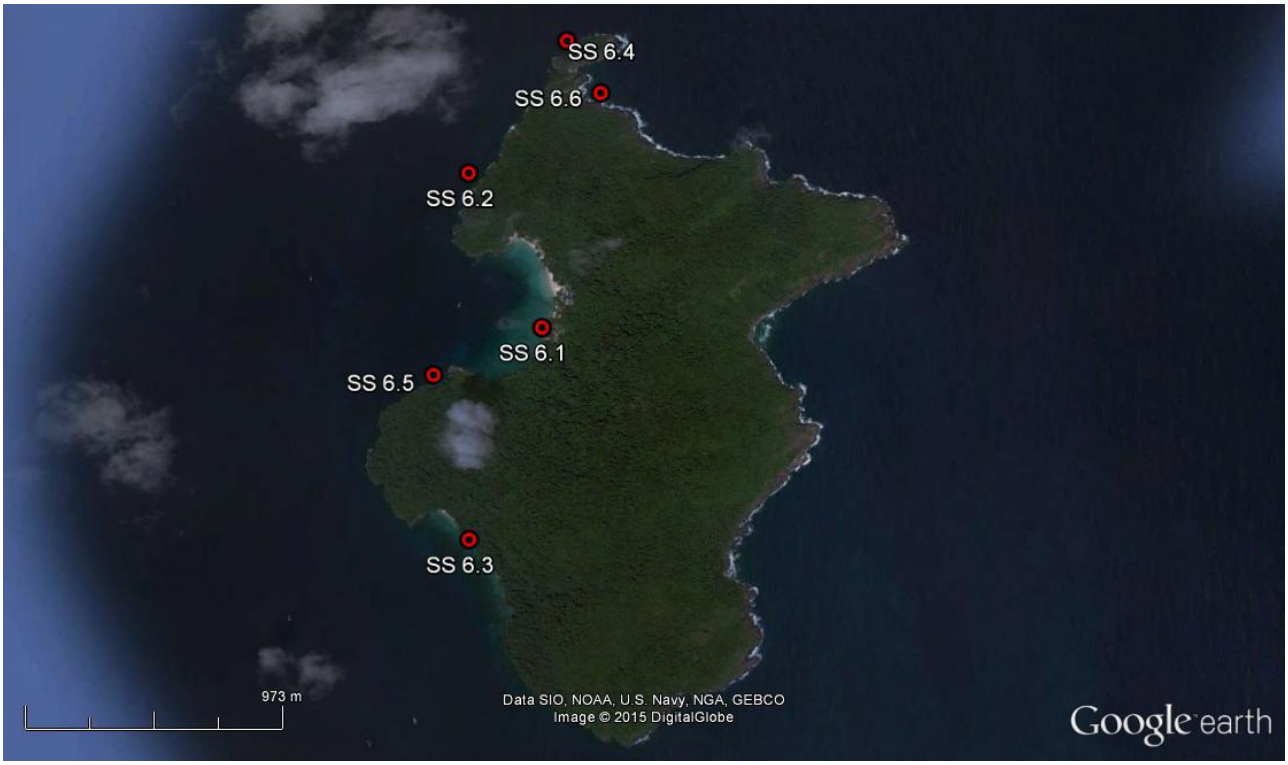
Natural damage to the reefs was observed during surveys, mainly predation by COT which was observed at all sites except for SS5.5 Pulau Yu Besar. One site was affected by warm water bleaching (SS5.3 Pulau Karah). Damage by boat anchor and trash were also recorded during surveys.

3.2.6 Tenggol

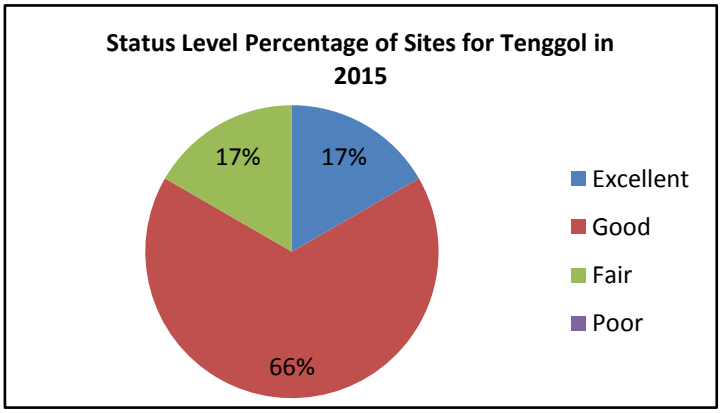
Tenggol Island is located approximately 30km from Dungun, off the East coast of Terengganu, Malaysia. This small island has no local population. The islandis gazetted as a Marine Park (since 1994).

The island is a popular diving destination due to the surrounding deep water which attracts more mega fauna than other islands (whale sharks are common around the island). There are four resorts on the island, each with its own dive operator. There is no mains electricity, groundwater supplies are limited and there is no centralised sewage treatment.

Much of the islands' coastline is rocky, besides a couple of sandy beaches. The reefs are mainly fringing reefs and rocky reefs.

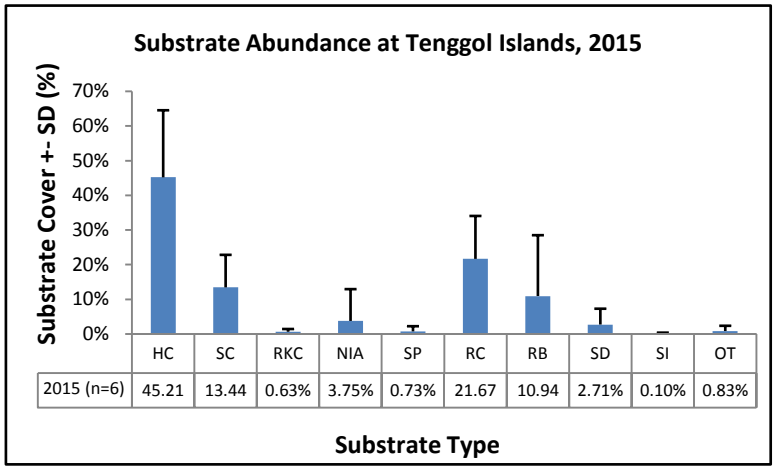


Map 9: Surveyed sites in Tenggol



A total of 6 coral reef sites were surveyed in Tenggol. 66% of the sites were in good condition, while 17% were in excellent condition. The remaining 17% were in poor condition.

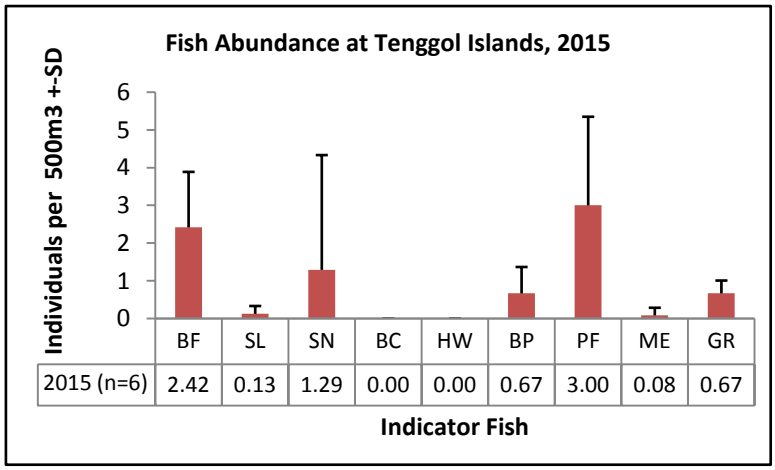
Substrate



The reefs in Tenggol were considered to be in 'Good' condition, with 58.65% live coral cover, slightlyabove the average (58.16%) for reefs of the Sunda Shelf region.

The level of NIA has decreased from 5.31% in 2014 to 3.75% in 2015; all of which were recorded from SS6.1 Freshwater Bay, 22.50% (31.88% in 2014), where all the resorts are located. This may indicatesa source of sewage pollution and still needs to be monitored closely.

Fish



Only two indicator species were completely absent from surveys (Barramundi Cod and Humphead Wrasse).

Abundance of Parrotfishwas the highest, followed by Butterflyfish and Snapper. Other indicators such as Sweetlips, Moray Eel and Grouper were present in low number.On a positive note, Bumphead Parrotfish wasrecorded at 4 out of 6 sites surveyed.

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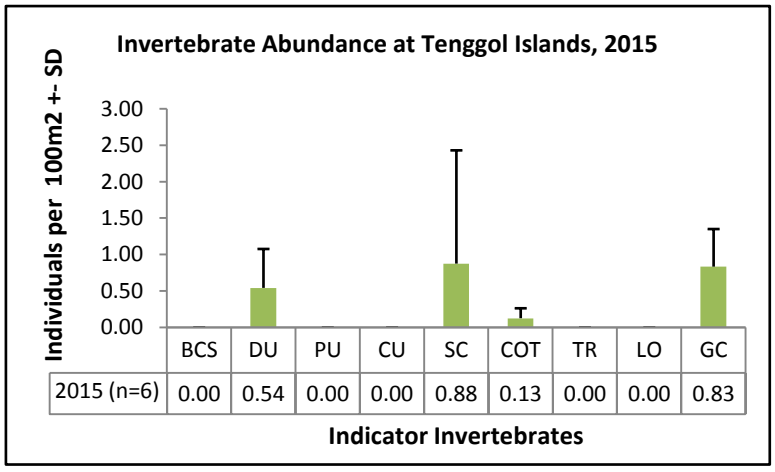
Invertebrates



Five targeted species were absent, including Banded Coral Shrimp, Pencil and Collector Urchin, Triton and Lobster.

Abundance of other indicator specieswas very low, including Diadema Urchin, Sea Cucumber and Giant Clam.The abundance of COT decreased from 0.33 ind./100m^2 in 2014 to 0.13 ind./100m^2 in 2015,within the range which a healthy reef can supports.

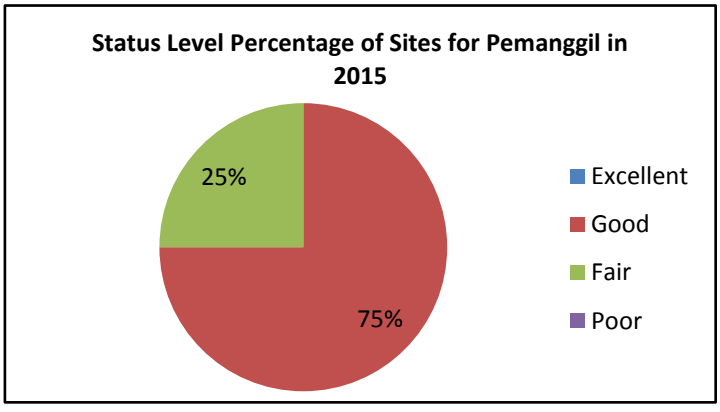
Damage due to warm water bleaching was observed at SS6.1 Freshwater Bay. Trash was recorded at SS6.2 Gua Rajawali. Blacktip shark and hawksbill were observed during surveys.

3.2.7 Pemanggil

PemanggilIslandis approximately45km east of Mersing off the East coast of Peninsular Malaysia. The island and its surrounding waters were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

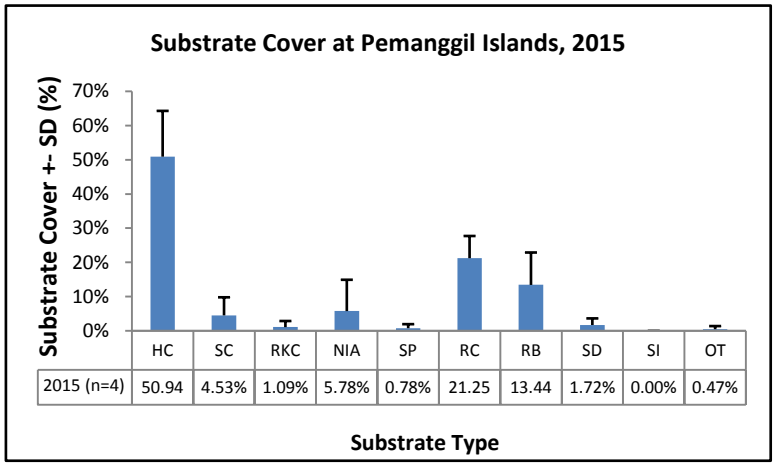
The island is sparsely populated and has for many years been a frequent stopover point forfishermen.

Map 10: Surveyed sites in Pemanggil



A total of 4 coral reef sites were surveyed in Pemanggil and 75% of the sites were in good condition and the remaining 25% were in fair condition.

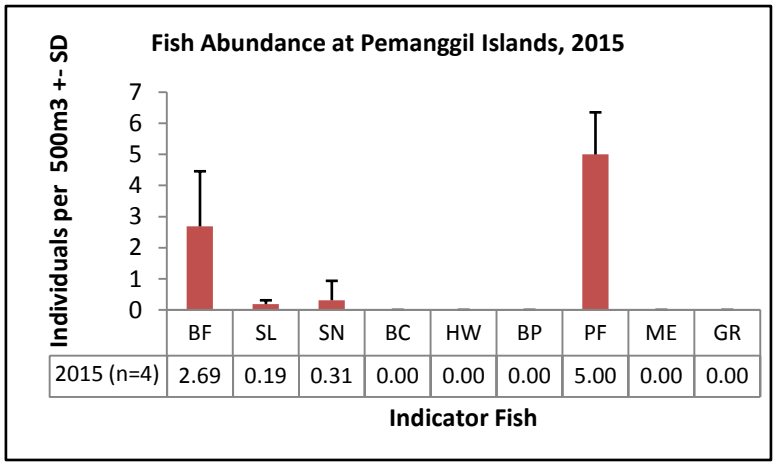
Substrate



The reefs in Pemanggil are considered to be in 'Good' condition, with 55.47% live coral cover, below the average (58.16%)for reefs of the Sunda Shelf region.

Although the level of NIA has decreased from 8.91% in 2014 to 5.78% in 2015, the level of RB has greatly increased from 5.78% in 2014 to 13.44% in 2015 and was the highest of all islands surveyed in Sunda Shelf region.This is probably due to the massive flood and landslide that happened during last monsoon.

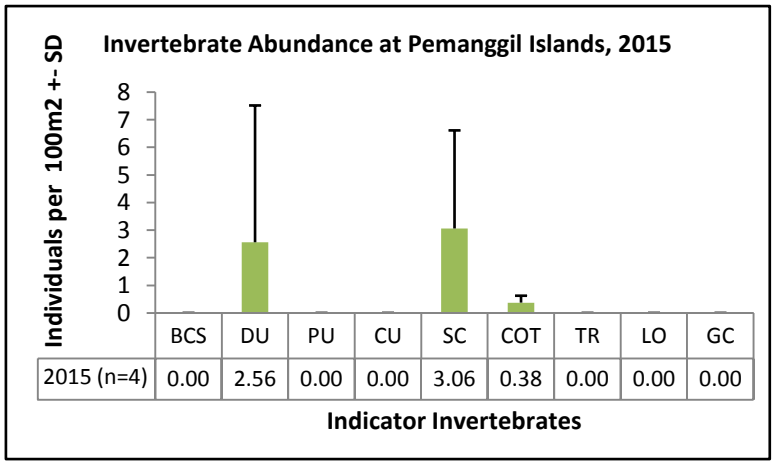
Fish



Only four indicator species were observed during surveys (Butterflyfish, Sweetlips, Snapper and Parrotfish).

The abundance of Parrotfish was the highest of all islands surveyed in Sunda Shelf region. Other indicators such as Sweetlips and Snapper were present in low number.

Invertebrates



Similar to other islands, several targeted species were absent, including Banded Coral Shrimp, Pencil and Collector Urchin, Triton and Lobster.

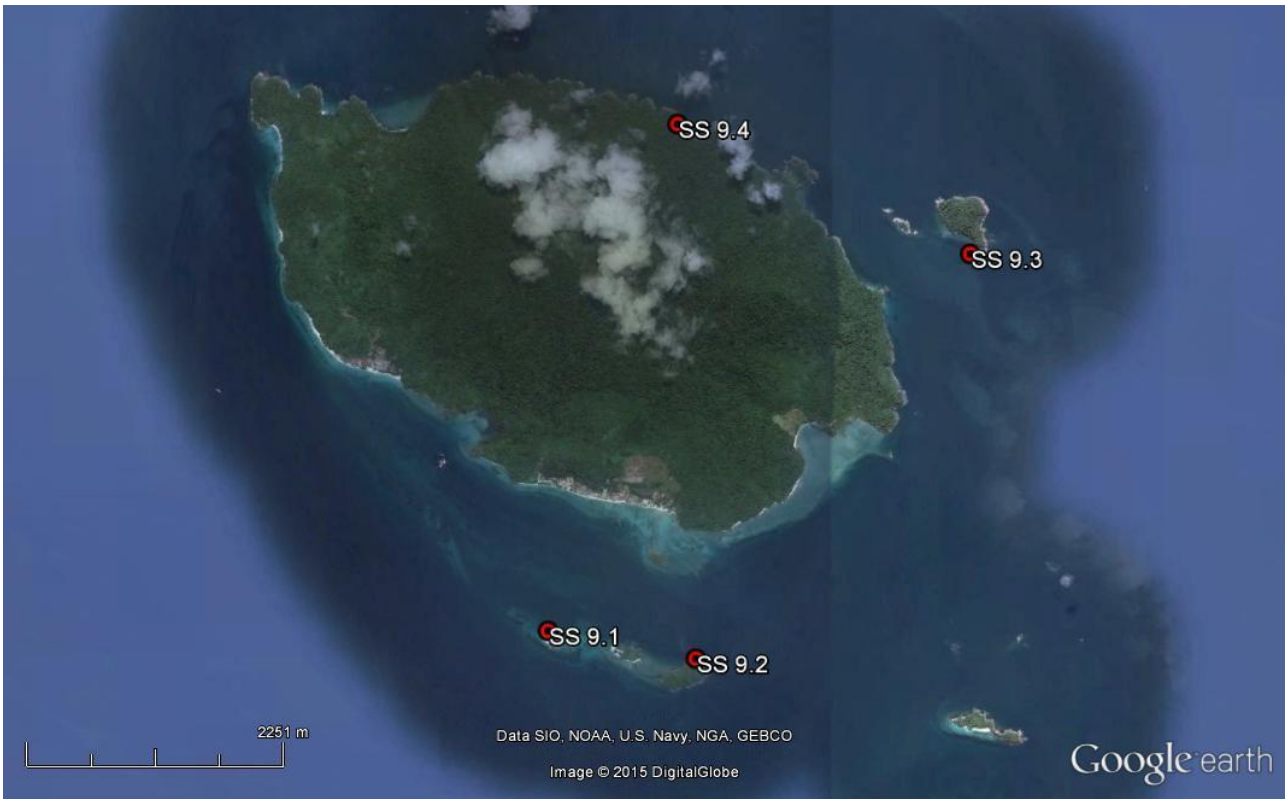
Sea Cucumber recorded the highest number, followed by Diadema Urchin. The abundance of COT has dropped slightly from 2014 (0.44 to 0.38 ind./100m^2), however the abundance is still slightly above what a healthy reef can sustain (0.2-0.3 ind./100m^2).

Neither damage nor rare animals were observed during surveys.

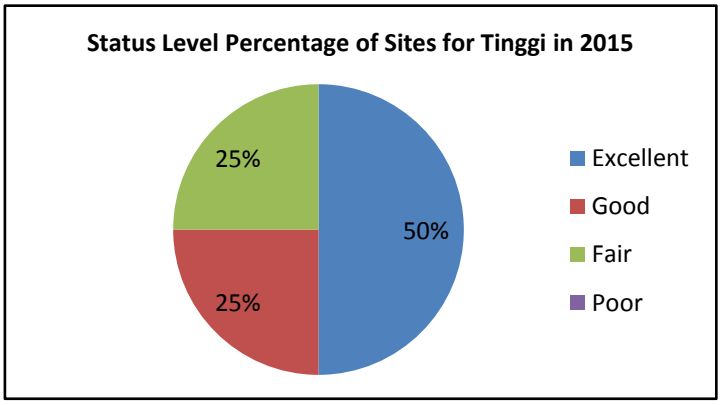
3.2.8Tinggi

TinggiIsland is located less than 15km off the East coast of mainland Peninsular Malaysia. The island and its surrounding waters were gazetted as Marine Parks in 1994 under the Fisheries Act 1985 (Amended 1993).

The island is not as popular among touristsas other islands off the East coast, but the tourism industry here is growing. There is nodive operator on Tinggi Island.

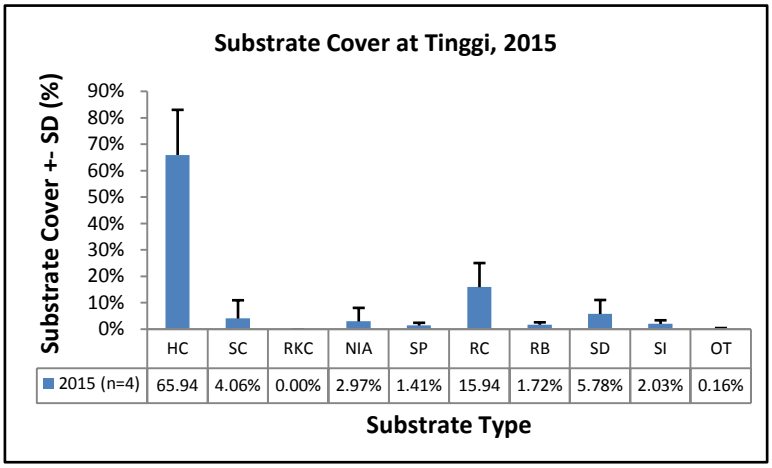


Map 11: Surveyed sites in Tinggi



A total of 4 coral reef sites were surveyed in Tinggi. 50% of the sites were in excellent condition. 25% were in good condition and 25% were in fair condition.No reefs were in poor condition.

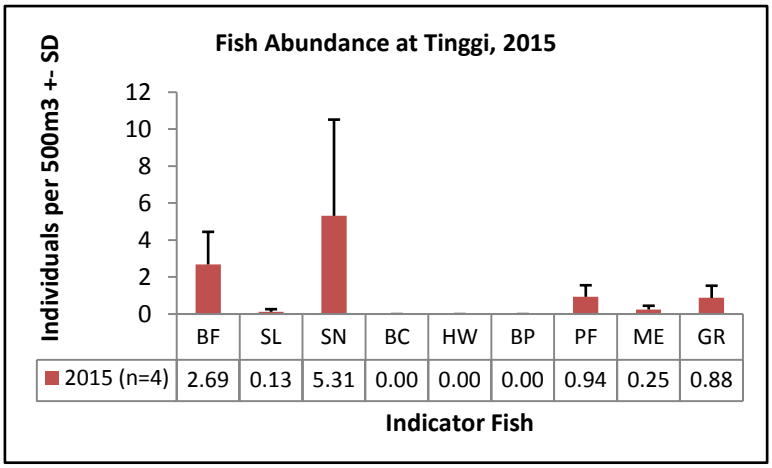
Substrate



Coral reefs around Tinggi Islandwere in 'Good' condition, with 70%live coral cover,above the average (58.16%) for reefs in the Sunda Shelf region.

The level of SI is high, probably due to the close proximity of Tinggi Islandto the mainland and a likely source of this high SI level is the rivers and other terrestrial runoff from Tanjung Leman. The level of NIA is also high, especially at SS9.4 Tanjung Gua Sumbang (10.63%).

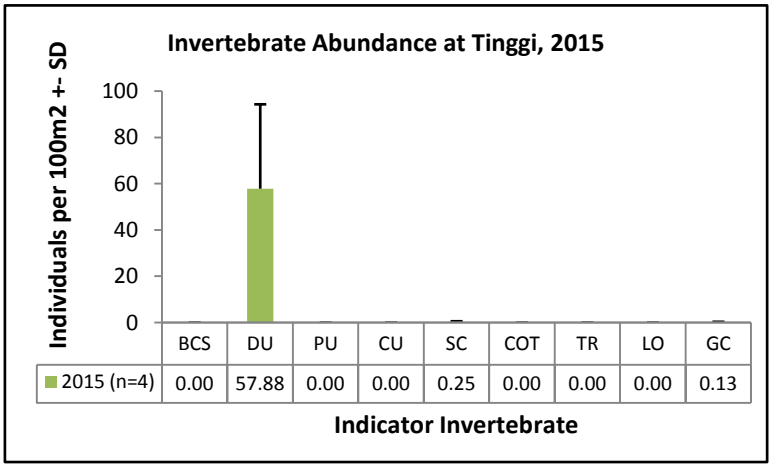
Fish



Three indicator species were absent from surveys (Barramundi Cod, Humphead Wrasse and Bumphead Parrot).

Snapperwas the most abundant targeted fish, followed by Butterflyfish. Abundance of other indicators is very low, including Sweetlips, Parrotfish, Moray Eel and Grouper, less than 1 ind./500m^3.

Invertebrates



Most of the indicators were absent from surveys (Banded Coral Shrimp, Pencil and Collector Urchin, Crown-of-thorns, Triton and Lobster).

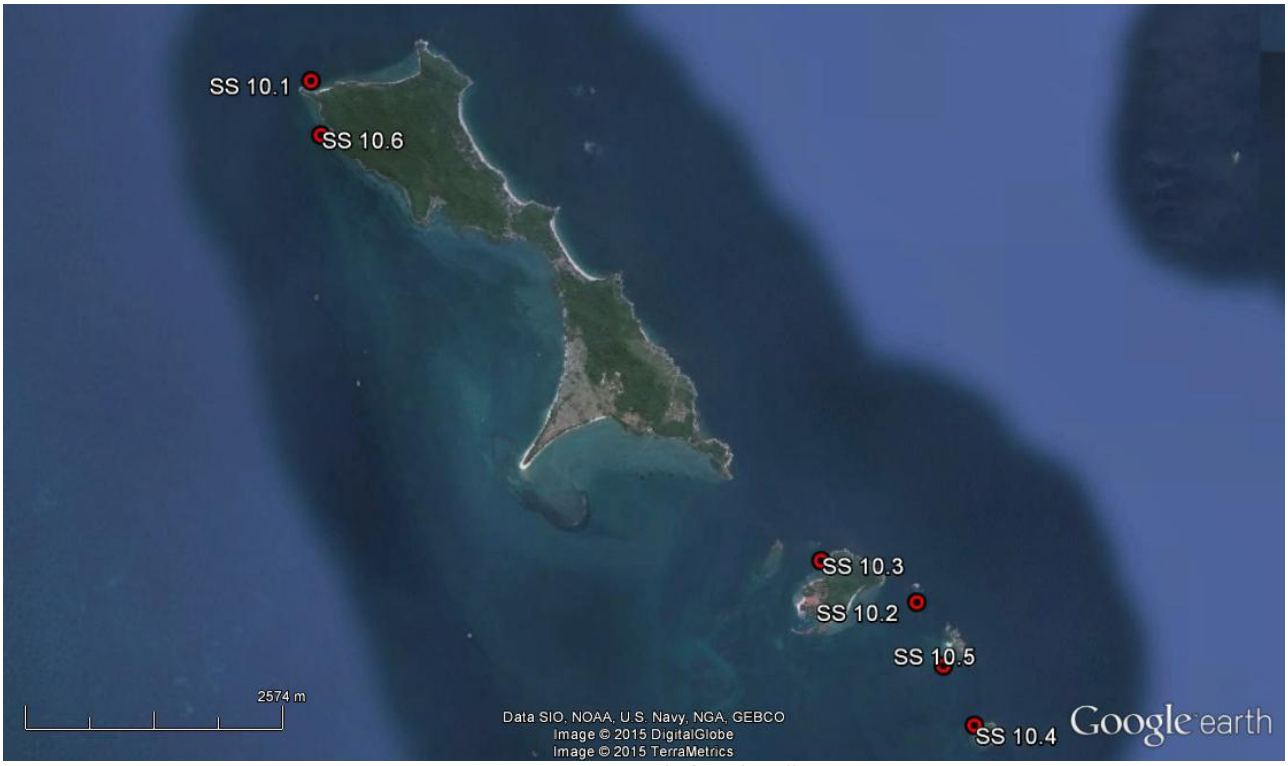
Abundance of Diadema Urchin was high (the third highest of all islands surveyed in Sunda Shelf region). The abundance of Sea Cucumber and Giant Clam was very low, less than 0.5 ind./100m^2.

Neither naturalnor human impacts were recorded during surveys. Rare animals were not observed during surveys too.

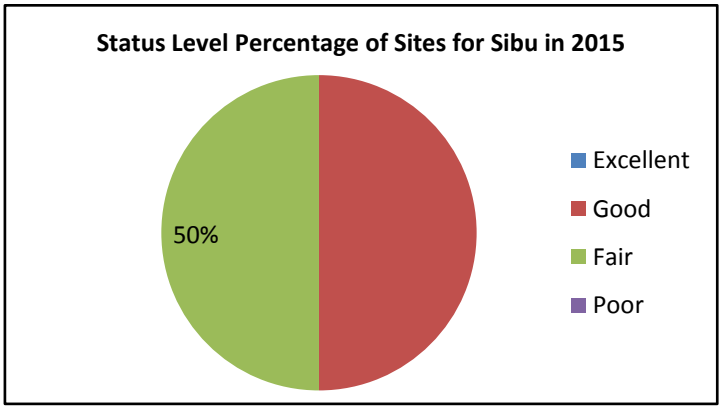
3.2.9 Sibu

Sibu Island is located less than 10km off the East coast of mainland Peninsular Malaysia. The island and its surrounding waters were gazetted as Marine Parks in 1994 under the Fisheries Act 1985 (Amended 1993).

The islands are not as popular among tourists as other islands off the East coast, but the tourism industry here is growing. The islands are sparsely populated with few villages and a number of small resorts, typically used as a weekend or short vacation destination from Singapore.

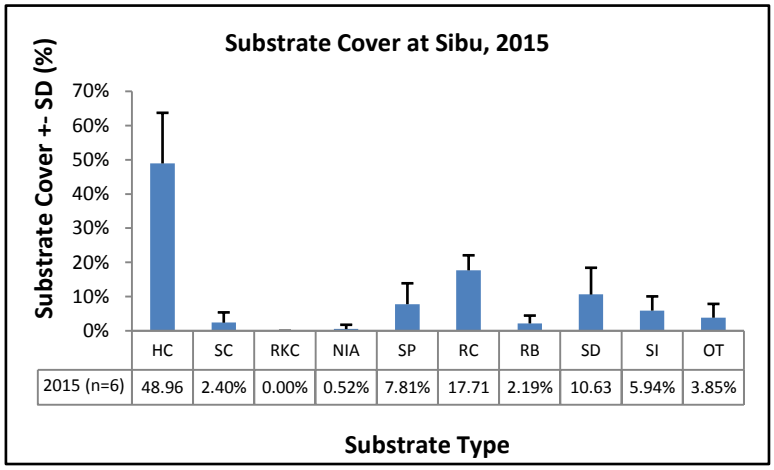


Map 12: Surveyed sites in Sibu



A total of 6 coral reef sites were surveyed in Sibu Islands. 50% of the sites were in good condition and 50% of the sites were infair condition.

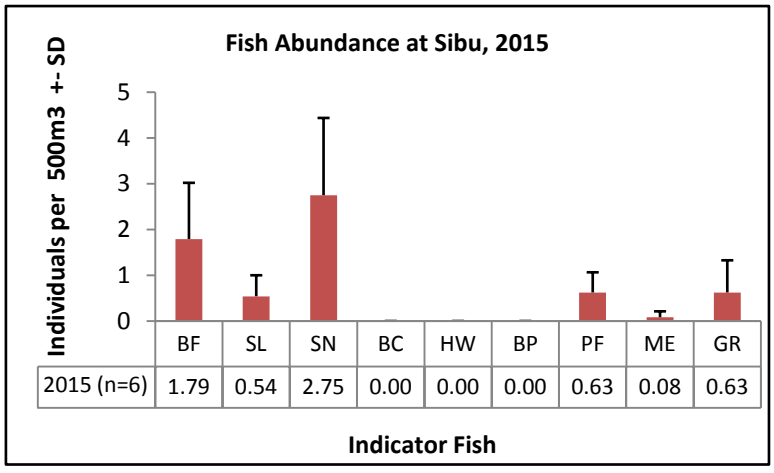
Substrate



Coral reefs around Sibu Islandwere in 'Good' condition, with 51.35% live coral cover, below the average (58.16%)for reefs in the Sunda Shelf region.

Although the level of SI has dropped from 7.92% in 2014 to 5.94% in 2015, the level of SI at Sibu Island is the highestof all islands surveyed in Sunda Shelf. This probably due to the close proximity of these islands to the mainland and a likely source of this high SI level is the rivers and other terrestrial runoff from Tanjung Leman.

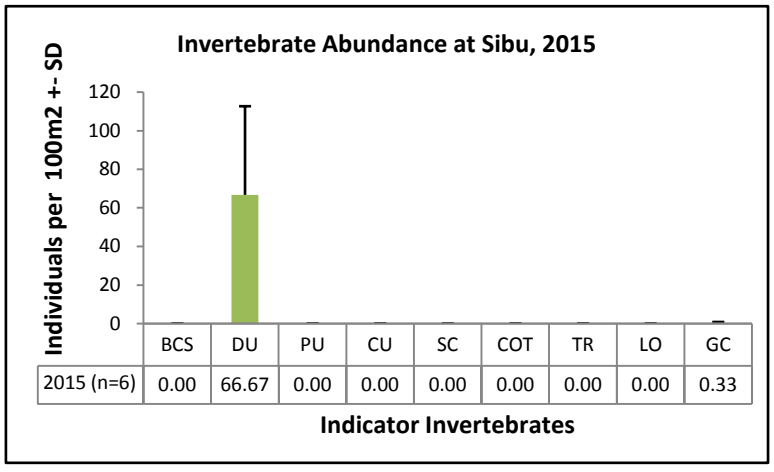
Fish



Three indicator species were absent from surveys (Barramundi Cod, Humphead Wrasse and Bumphead Parrot).

Snapper was the most abundant targeted fish, followed by Butterflyfish. Abundance of other indicators was very low, including Sweetlips, Parrotfish, Moray Eel and Grouper.

Invertebrates



Most of the indicators were absent from surveys. Only two indicators were observed, Diadema Urchin and Giant Clam.

Abundance of Diadema Urchin was high and was the highest of all the islands surveyed in Sunda Shelf region. The abundance of Giant Clam was very low.

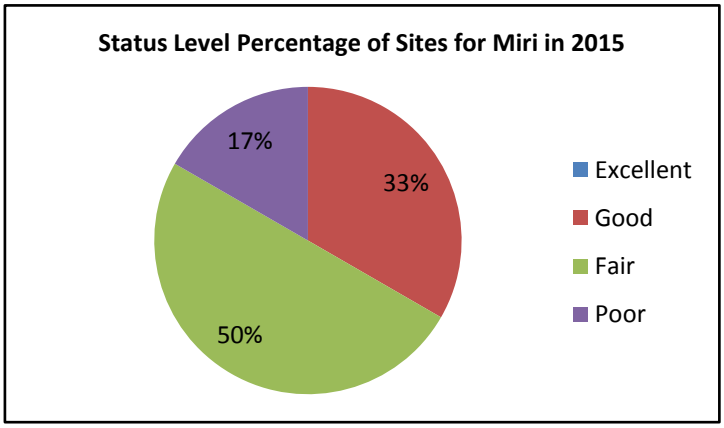
Human impacts were observed during the surveys, fish net and a trap full of indicator fish – 2 Sweetlips and 4 Snappers. Hawksbill turtle was observed at SS10.2 Malang Acha.Although the scale of the damage is considered low, it is evidence that illegal fishing is present inside the Marine Park.

3.2.10 Miri

Miri is located at the northern end of Sarawak and is the State's second largest city. Miri is the birthplace of Malaysia's petroleum industry, which remains the major industry in the city, alongside timber and oil palm production and a growing tourism sector.

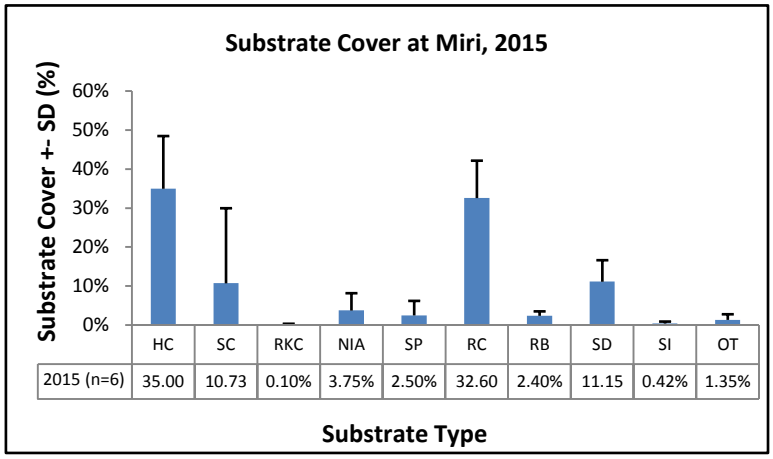
Miri has extensive submerged off-shore reefs, generally flat in profile, in depths ranging from 7 to 30m. In many areas, the presence of oil production facilities creates effective Marine Protected Areas, as boats are not allowed in the area due to security concerns.

Map 13: Surveyed sites in Miri



A total of 6 coral reef sites were surveyed in Miri and50% of the sites were in fair condition.Only 33% were in good condition and the remaining 17% were in poor condition.

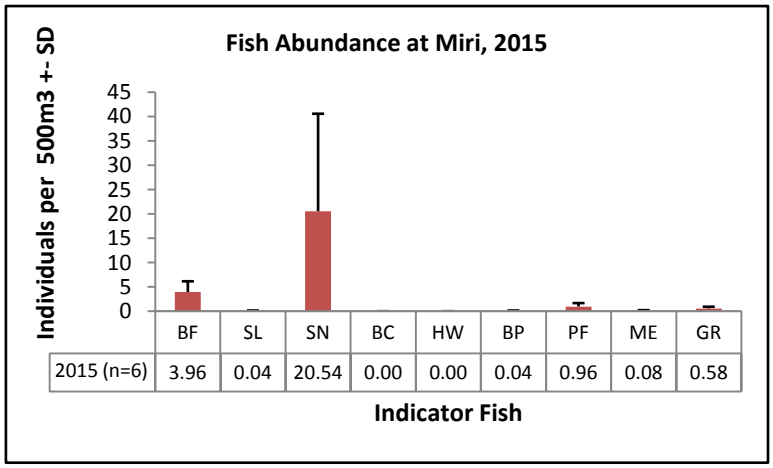
Substrate



Coral reefs around Miri were in 'Fair' condition with 45.73% of live coral cover, below the average (58.16%) for Sunda Shelf region.

Both the level forNIA and RB had decreased, from 8.33% in 2014 to 3.75% in 2015 for NIAand from 3.65% in 2014 to 2.40% in 2015 for RB. However, the level of SP had increased from 0.63% in 2014 to 2.50% in 2015. Therefore, the level of NIA stillneed to be monitored closely as SP is an indicator of nutrient pollution.

Fish

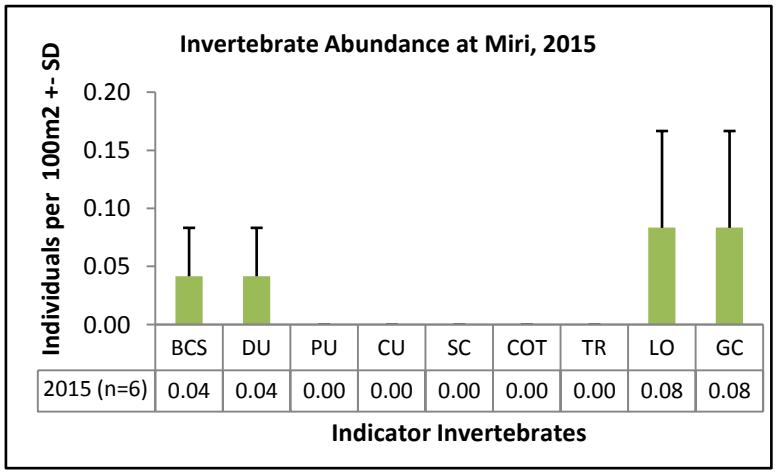


Only two indicator species were absent from surveys (Bumphead Parrotfish and Humphead Wrasse).

Same as last year and the year before, Snapper in Miri was the highestof all islands surveyed in Sunda Shelf region

Abundance of other indicators was generally low.

Invertebrates



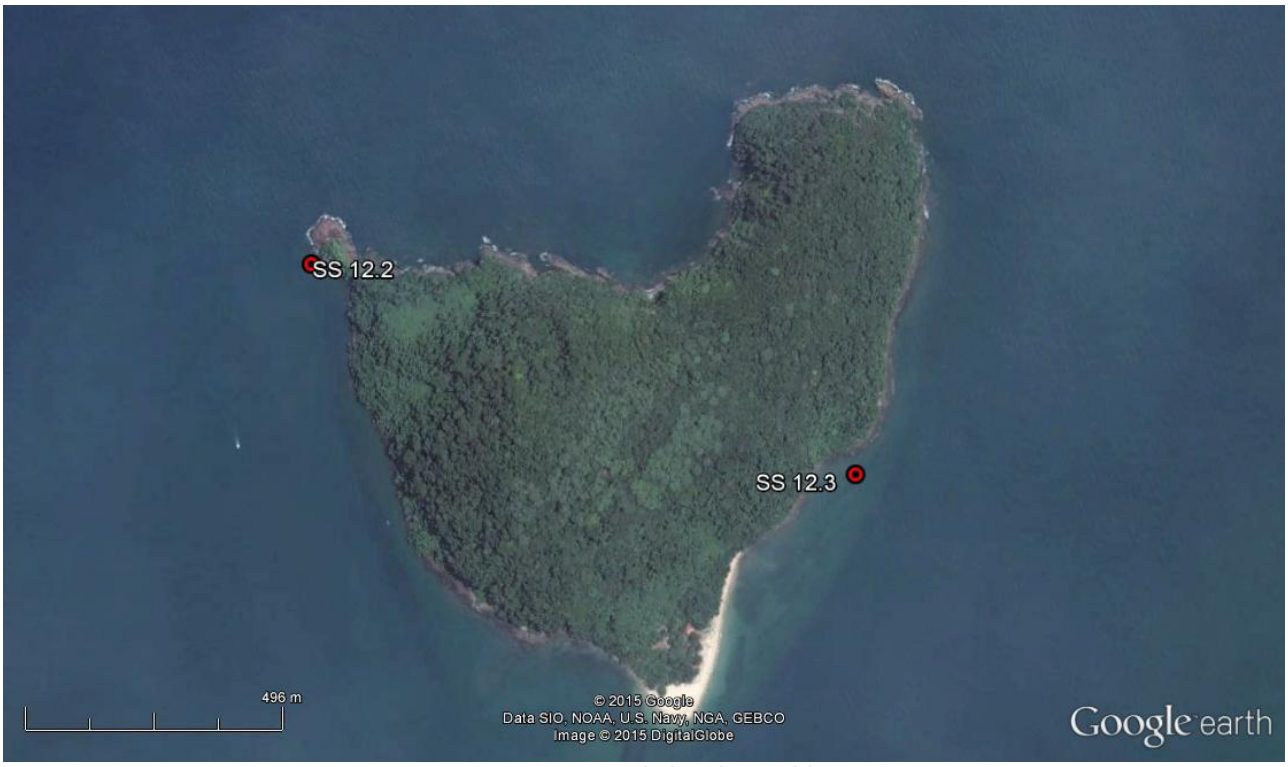
Only four indicators were observed during surveyed, including Banded Coral Shrimp, Diadema Urchin, Lobster and Giant Clam. The abundance of these four indicators was very low.

Damage due to warm water bleaching was the main impacts seen on reefs during surveys, observed at all sites. Boat anchor damage, fish nets and trash were also observed. On a positive note, coral cat shark was observed during surveys.

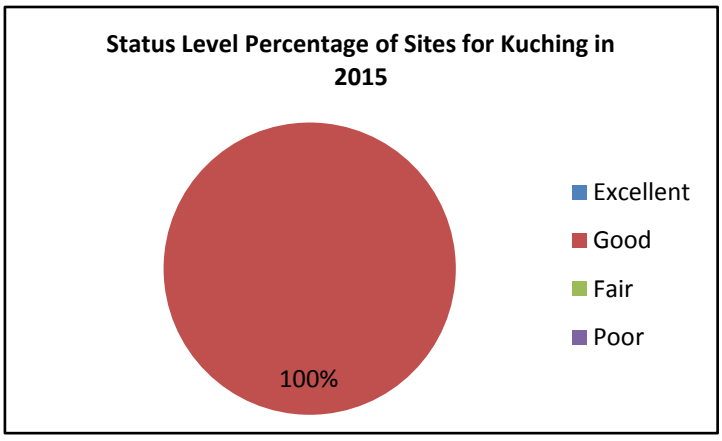
3.2.11Kuching

Kuching is located at the southern end of Sarawak and is the capital of the state. This developed city is also the most highly populated area in Sarawak.

Kuching is not well known for diving but there are some fringing and submerged reefs off the shores of this city.

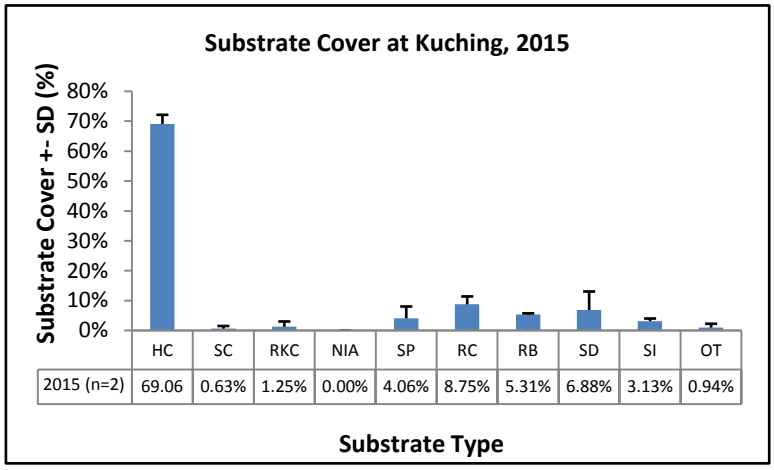


Map 14: Surveyed sites in Kuching



A total of 2 coral reef sites were surveyed in Kuching. 100% of the sites were in good condition.

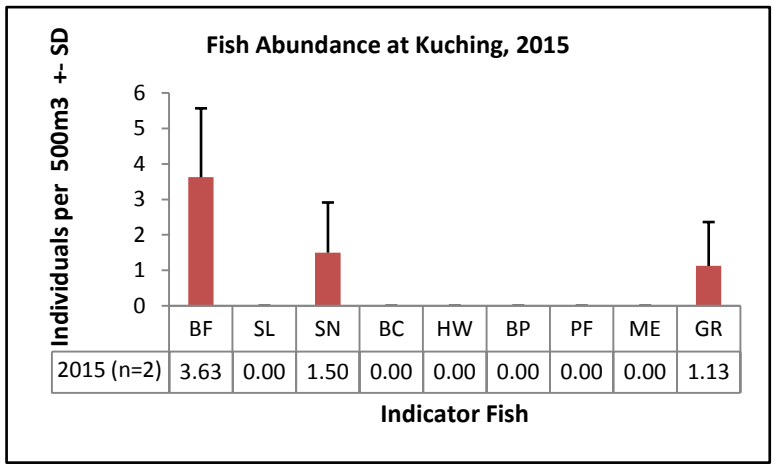
Substrate



Coral reefs around Kuching are considered to be in 'Good'condition, with 69.69% live coral cover, abovethe average (58.16%) for reefs of the Sunda Shelf region.

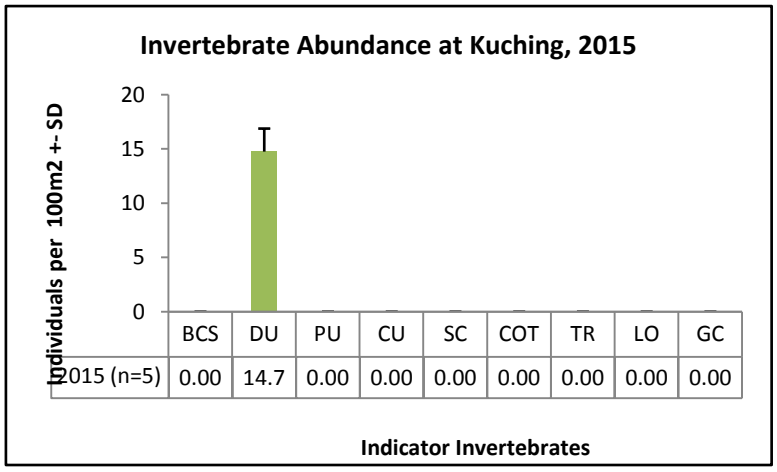
Level of RBwas very high, indicating recent disturbances in the area.The level of SI was also high.

Fish



Only three indicator fish were observed during the surveys (Butterflyfish, Snapper and Grouper). Abundance of Butterflyfish was the highest, followed by Snapper and Grouper

Invertebrates



Only Diadema Urchin was recorded during the surveys and the abundance was high.

Damage due to warm water bleaching was observed at all survey sites. Fish nets and trash were also recorded.

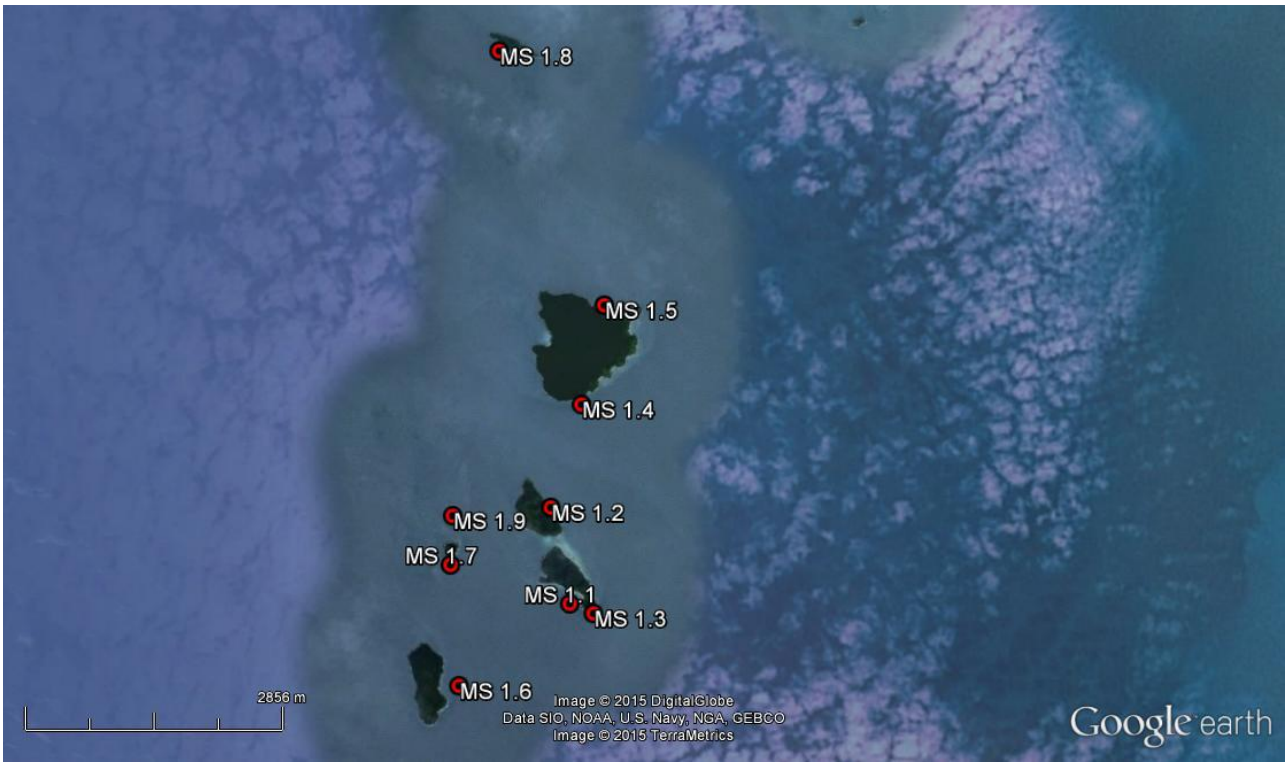
Straits of Malacca

3.2.12 Sembilan Islands

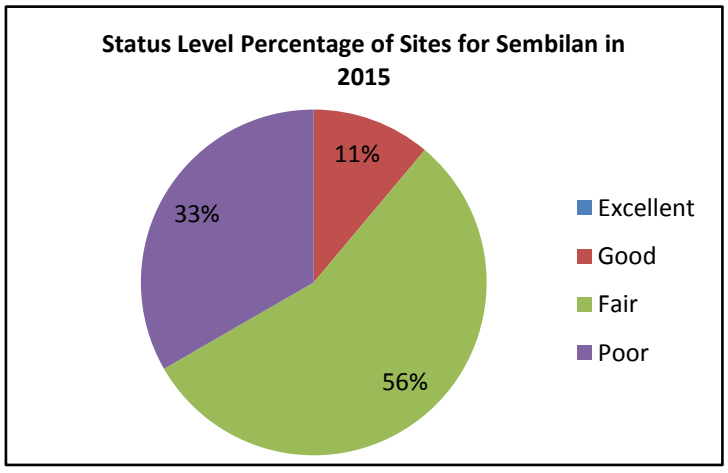
The Sembilan Islands consist of a cluster of nine islands (Pulau Agas, Pulau Payong, Pulau Nipis, Pulau Rumbia, Pulau Lalang, Pulau Saga, Pulau Buluh, Black Rock and White Rock) which are located some 20km from the coast of Perak (Lumut), off the west coast of Peninsular Malaysia, in the Straits of Malacca.

The islands are uninhabited and the only structures on the islands are small rest areas on Pulau Saga, constructed for the use of tourists and fishermen. The islands are a favourite fishing spot among sport and commercial fishermen. They are also occasionally visited by snorkelers and divers from Pangkor and Lumut. They have no protected status; hence tourist and fishing pressure are neither controlled nor monitored.

Pangkor Laut Island is an island off the coast of Perak, reached by ferry either from the old jetty or from Marina Island jetty both located in Lumut. It is promoted as a low-key tourist destination by the Malaysian government, but fishing, seafood and other fishing-related products remain major industries.

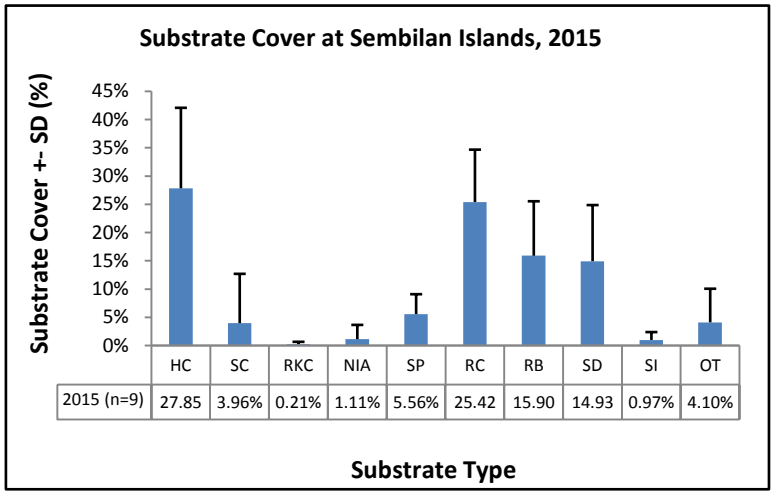


Map 15: Surveyed sites in Sembilan



A total of 9 coral reef sites were surveyed in Sembilan islands and only 11% of the reefs were in good condition. 56% of the reefs were in fair condition, while the remaining 33% were in poor condition.No reefs were in excellent condition.

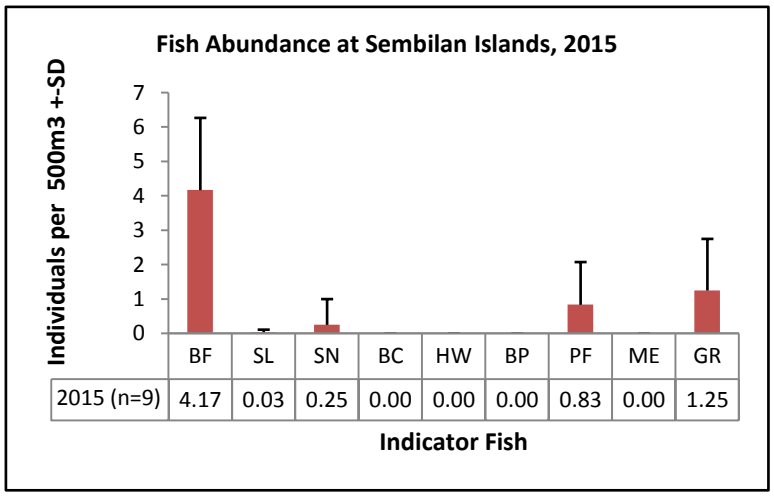
Substrate



Coral reefs around Sembilan islands are considered to be in 'Fair' condition, with 31.81% live coral cover, lower than the average (36.63%) for reefs of the Malacca Strait region.

The islands in general have high level of RC and SD.The level of RB was also high, indicating high level of recent disturbances in the area. Sembilan islands are not gazetted as a Marine Protected Area and are heavily impacted by development (on the mainland), fishing pressure as well as shipping activity in the Malacca Strait.

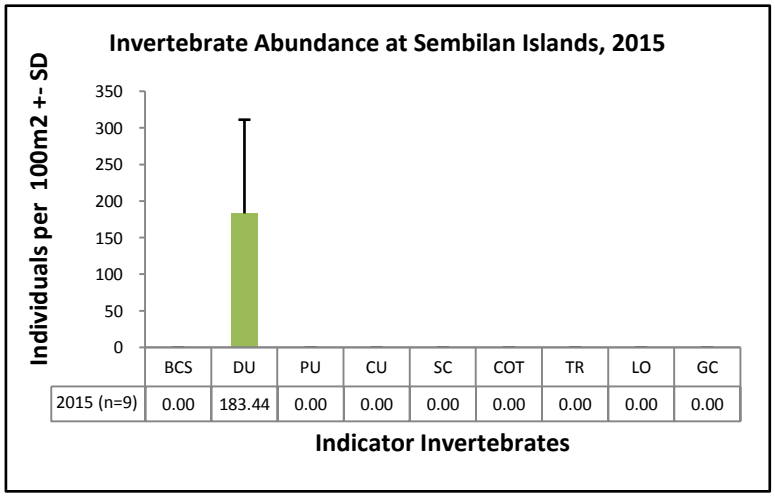
Fish



Five indicator species were present during surveys (Butterflyfish, Sweetlips, Snapper, Parrotfish and Grouper).

Abundance of Butterflyfish was the highest, followed by Grouper. Other indicator species were present in very low number, less than 1 ind./500m^3. On a positive note, 56% of the sites surveyed recorded many juvenile groupers, thus indicating a possible recovery in population abundance. However this can only happens if the fishing pressure in Sembilan islands is controlled.

Invertebrates



Only two indicator species were observed, Diadema Urchinand Lobster.

The abundance of Diadema Urchin was very high while the abundance of Lobster was very low.

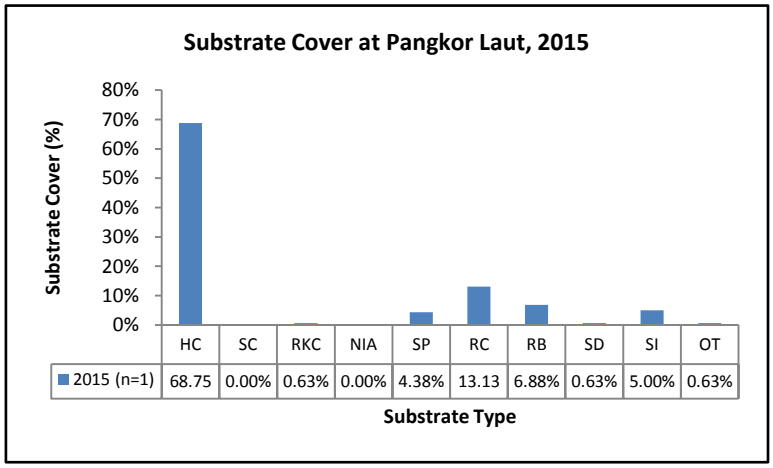
Fishing net was the only impact found on the reefs in Sembilan Island.

3.2.13 Pangkor Laut Island

Pangkor Laut Island is a small island, privately owned and located 3 miles off the West Coast of Malaysia along the Straits of Malacca. Of the island's 300 acres, a fraction has been developed to house a premier resort.

Map 16: Surveyed sites in Pangkor Laut

Substrate

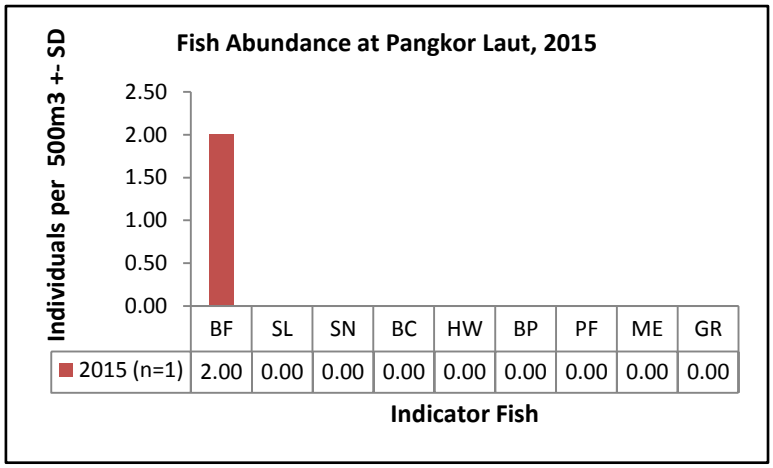


Coral reefs around Pangkor Laut are considered to be in 'Good' condition, with 68.75% live coral cover.

The island has very high level of SI. This is due to the fact that Pangkor Laut is very near to the mainland and is heavily impacted by shipping activities in the Malacca Strait.

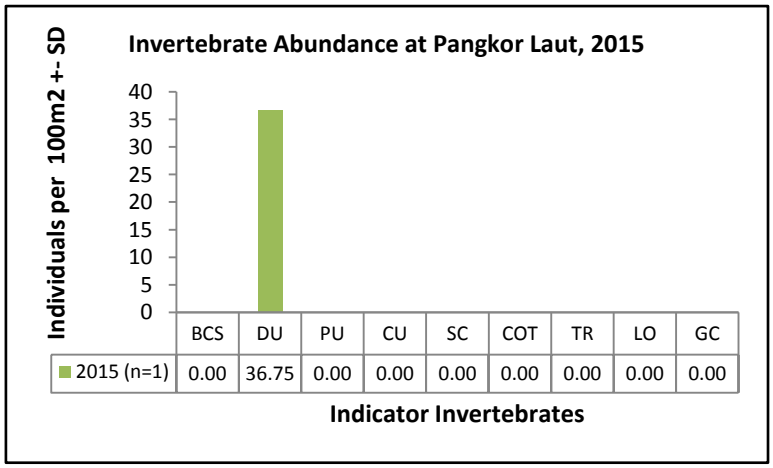
The level of RB was also considerably high, indicating high level of recent disturbances in the area.

Fish



Only Butterflyfish was present during surveys and the abundance was low.

Invertebrates



The only indicator species observed was Diadema Urchin and the abundance was high.

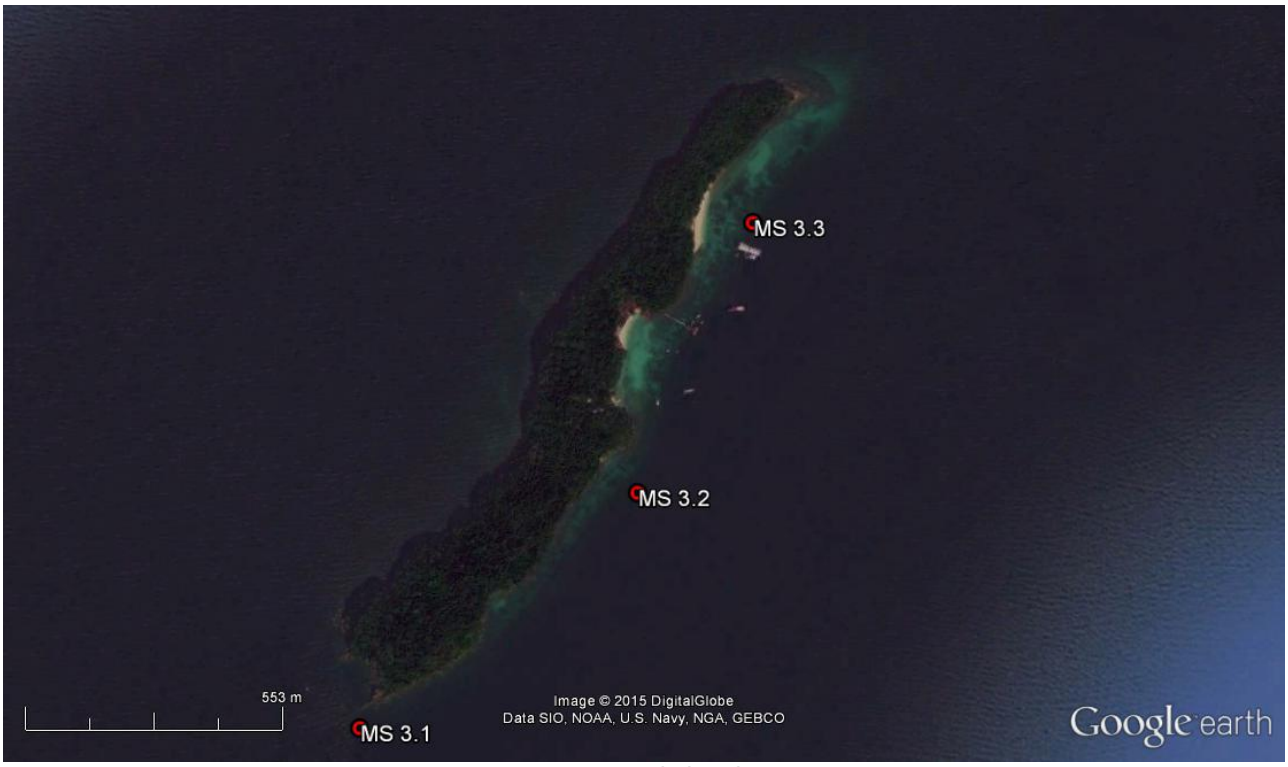
No damage was observed on the reef.

3.3.14 Payar

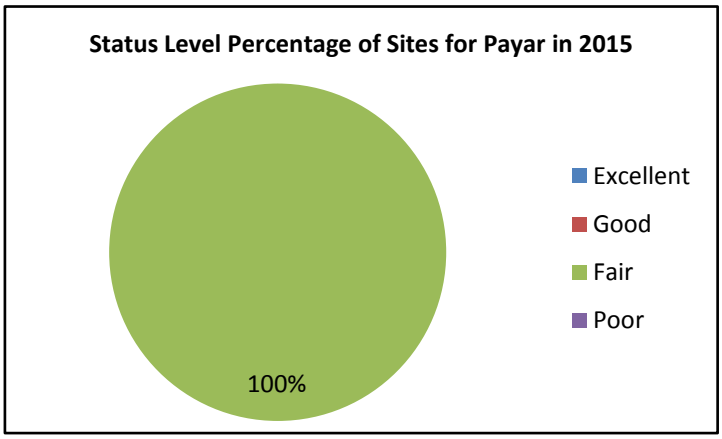
Payar is one of many islands off the West coast of mainland Kedahin theStraits of Malacca. It is situated 35km south of Langkawi, 59km north of Penang and 28km west of Kuala Kedah. It was gazetted as a marine park in 1994 under the Fisheries Act 1985 (Amended 1991).

The island is a popular destination for tourists (mainly from Langkawi) famous for its corals and reef fishes. Measuring 2km long and 0.25km wide, its sheltered waters are ideal for snorkelling, diving and swimming.

The island is uninhabited and the only operating structures on the island are the marine park centre with facilities for day trip visitors such as gazebos, picnic table and restroom facilities at selected areas. There is also an old abandoned resort. A floating platform moored just off Payar serves as a restaurant and dive platform for tourists.

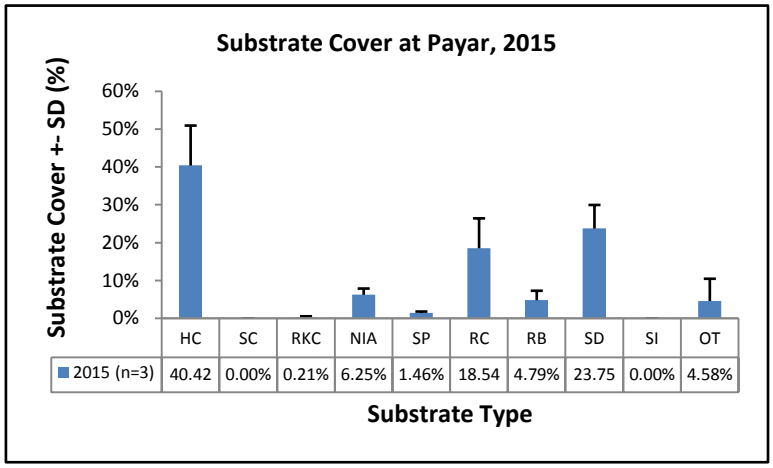


Map 17: Surveyed sites in Payar



A total of 3 coral reef sites were surveyed in Payar and 100% of the reefs were in fair condition.

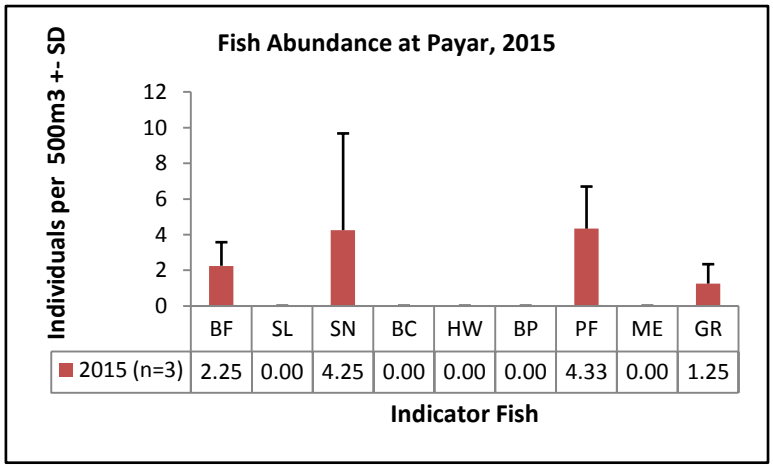
Substrate



Coral reefs around Payar are considered to be in 'Fair' condition, with 40.42% live coral cover, higher than the average (36.63%) for reefs of the Malacca Strait region.

The island in general has high level of SD and RC.The level of NIA and RB was also high, indicating high level of recent disturbances in the area, probably due to the high level of tourism activities around the island.

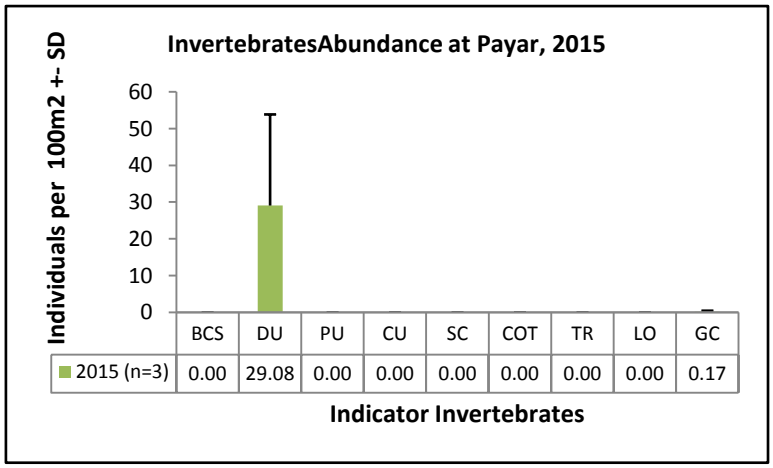
Fish



Only four indicator fish were recorded during surveys(Butterflyfish, Snapper, Parrotfish and Grouper).

The abundance of Parrotfish was the highest, followed by Snapper, Butterflyfish and Grouper.

Invertebrates



The only indicator species observed was Diadema Urchin and the abundance was high.

Only naturalimpact was observed on the reefs; warm water bleaching at all sites except for MS3.2 Singapore Bay. Shark and turtle were also observed during the surveys.

North Borneo

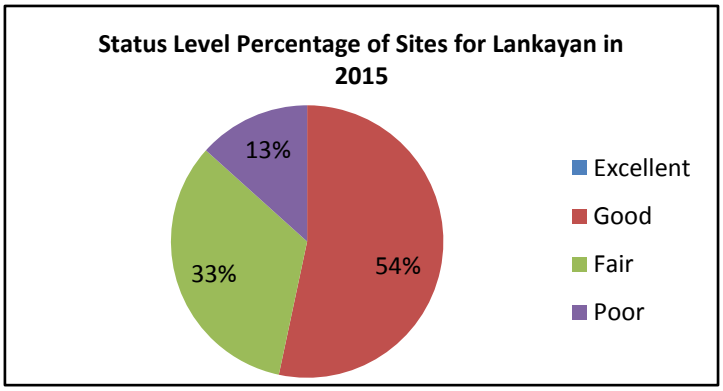
3.2.15 Lankayan

Lankayan is asmall island in the Sulu Sea, a 1.5 hour boat ride north of Sandakan. A resort island, Lankayan is part of the Sugud Islands Marine Conservation Area (SIMCA), a large, privately managed MPA off the East coast of Sabah.

SIMCA is remote and distant from populated areas and no communities exist on the islands within the protected area. However, the SIMCA area is known to be a traditional fishing ground and is fished by both artisanal and commercial fishersfrom Sandakan, Kudat and the Philippines.

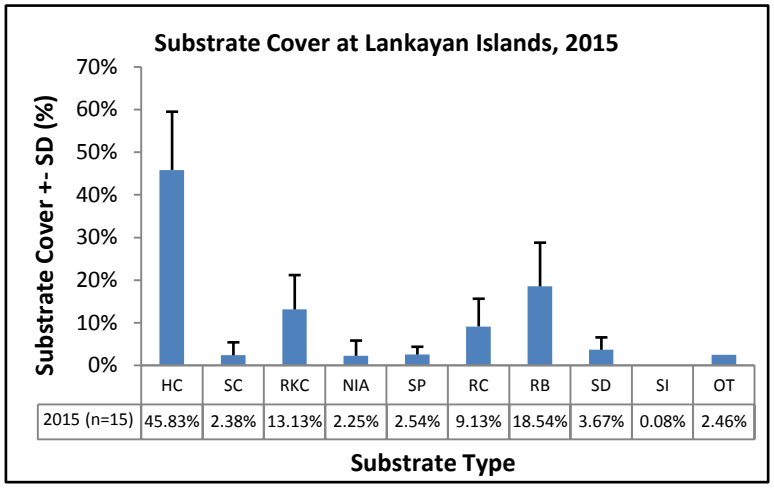
Before the creation of SIMCA, blast fishing was a constant problem, and turtle eggs were poached on a regular basis.Lankayan Island is the only developed island within SIMCA. The 0.05 km^2 island is the site of the Lankayan Island Dive Resort (LIDR), which is the only structure on the otherwise uninhabited island.

Map 18: Surveyed sites in Lankayan



A total of 15 coral reef sites were surveyed in Lankayan islands and 54% of the reefs were in good condition.33% were in fair condition and the remaining 13% of the reefs were in poor condition.

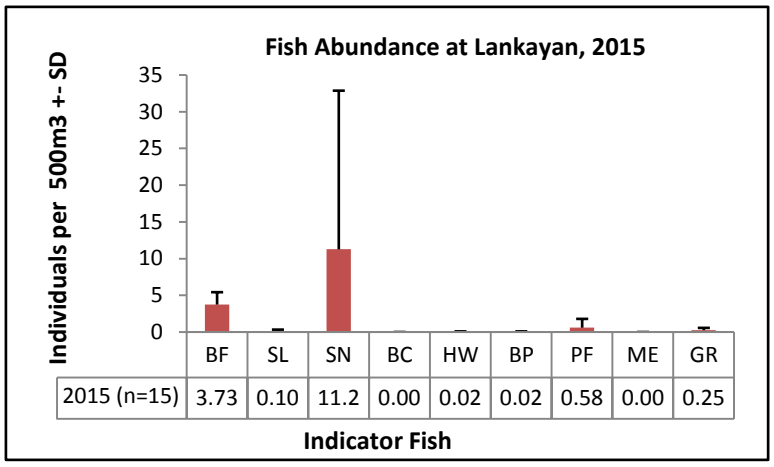
Substrate



The reefs in Lankayan islandsare considered to be in 'Fair' condition, with 48.21% live coral cover, above the average (40.32%) for reefs withinthe North Borneo region.

RKC level has increasedsignificantly from 6.96% in 2014to 13.13% in 2015 and was the highest of all islands surveyed in North Borneo region. The level of NIA was also high, especially at NB1.15 Zorro (13.75%).

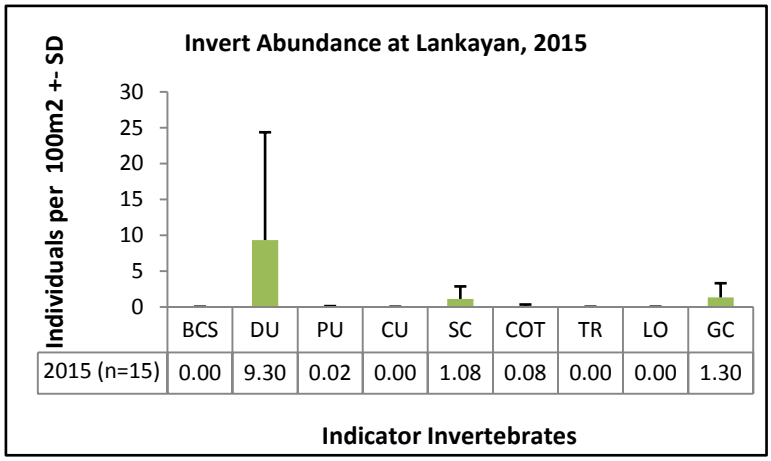
Fish



All indicator fish except for Barramundi Codand Moray Eel were seen during surveys.

However, the abundance of most species was generally low, with the exception of Butterfly fish and Snapper. The abundance of Snapper was high and was highest of all islands surveyed in the North Borneo region.

Invertebrates



Four indicator invertebrateswere present during surveys, Diadema Urchin, Sea Cucumber, Crown-of-thornsand Giant Clam.

The abundance of Diadema Urchin was the highest. Other indicators were present in low number.

Damage due to warm water bleaching was observed at 6 sites. Sharks and turtles were observed in many survey sites.

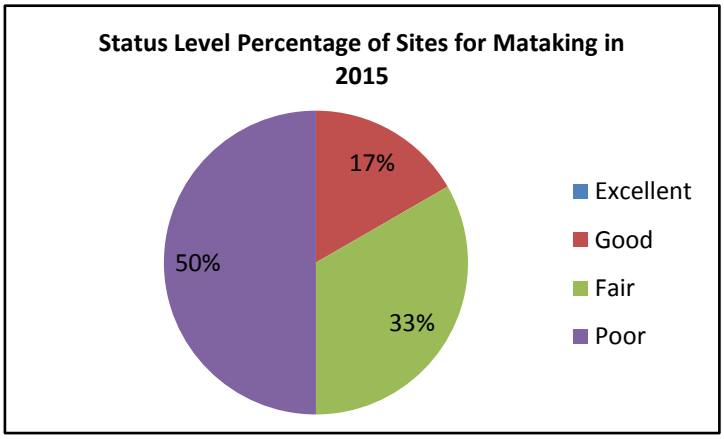
3.2.16 Mataking

Mataking Island isapproximately 35kmeast from the major town of Semporna in the South of Sabah. It is a well known tourist spot and has one resort. Diving and snorkelling are the main activities on the island.

While the island has no legal protected status, the presence of the resorts has effectively created small protected areas, keeping fishermen (including fish bombers) away from parts of the reefs surrounding the island.

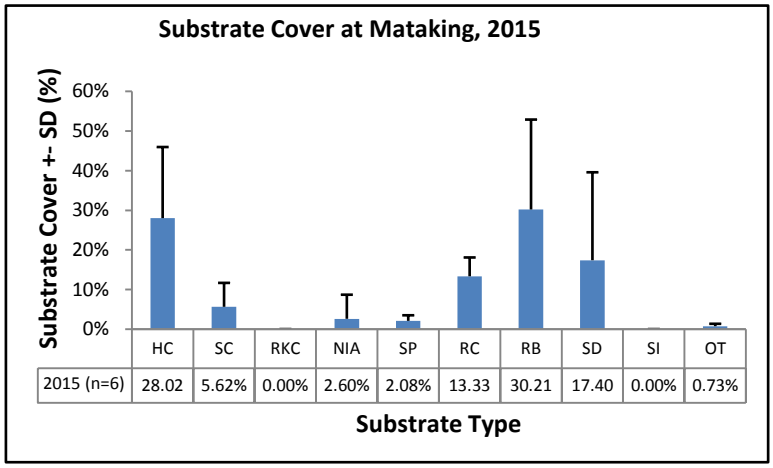
The island has fringing reefs, and coral extends down to almost 30m. Coral reefs around this, and surrounding, islands have been extensively damaged by fish bombing in the past, and fish bombing continues in some areas nearby.

Map 19: Surveyed sites in Mataking



A total of 6 coral reef sites were surveyed in Mataking. 50% of the reefs were in poor condition. 33% were in fair condition and only 17% were in good condition. No reefs were in excellent condition.

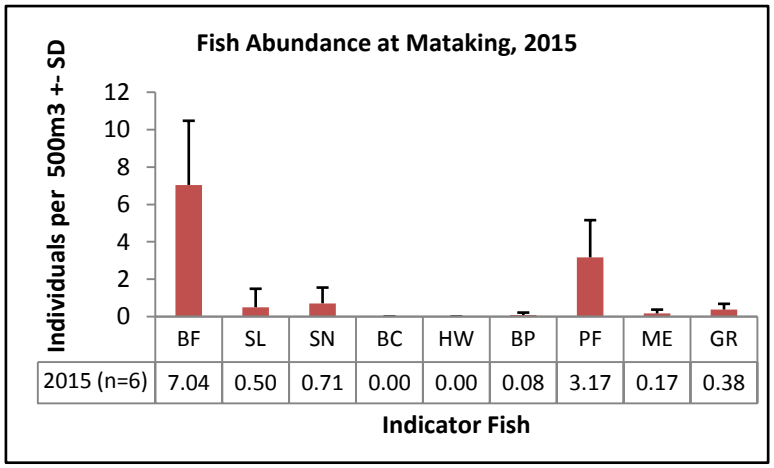
Substrate



The reefs around the island were considered to be in 'Fair' condition, with 33.65% live coral cover, below the average (40.32%) in the North Borneo region.

The reef in Mataking had very high amount of RB (the second highest in North Borneo region), with an average of 30.21%, rising to as high as 66.25% at NB2.2 Coral Garden Mataking and 43.13% at NB2.4 Pandanan Bay. This is probably due to extensive fish bombing over a long period of time.

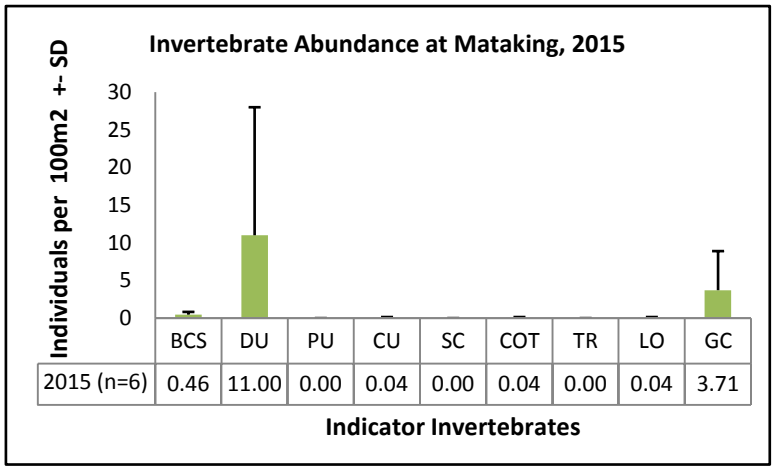
Fish



Only two indicator fish were absent during the surveys (Barramundi Cod and Humphead Wrasse).

The abundance of Butterflyfishwas the highest (second highest in North Borneo region), followed by Parrotfish. Other indicator fish were present in low number.

Invertebrates



Three indicatorswere absent from surveys (Pencil Urchin, Sea Cucumber and Triton).

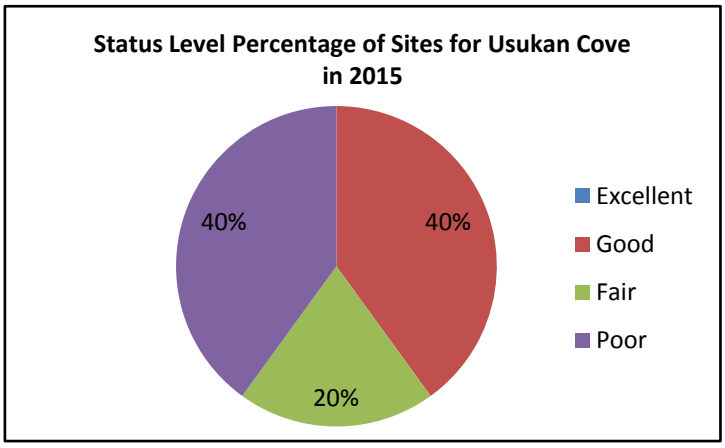
The abundance of Diademawas the highest, followed by Giant Clam. Abundance of other indicator waslow.

No impacts were seen on reefs during surveys. Mataking recorded the second highest number of turtle sighting during surveys. Frogfish was also seen at one of the sites, NB2.5 Stingray City.

3.2.17Usukan Cove

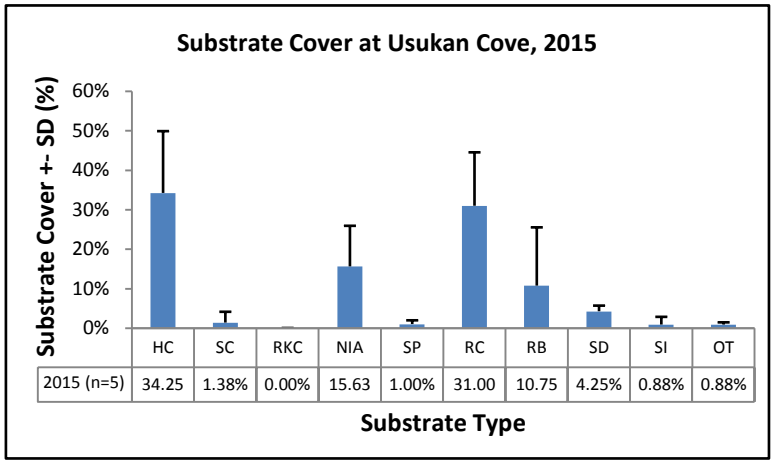
Usukan Cove is located on the North West coast of Sabah approximately half way between Kota Kinabalu and Kudat, in a district called Kota Belud, just beside Kampung Kuala Abai where the jetty to Mantanani Island is situated. Diving and snorkelling as well as fishing are the main activities offered in Usukan Cove.

Map 20: Surveyed sites in Usukan Cove



A total of 5 coral reef sites were surveyed in Usukan Cove and 40% of the reefs were in good condition. 20% were in fair condition while the remaining 40% were in poor condition. No reefs were in excellent condition.

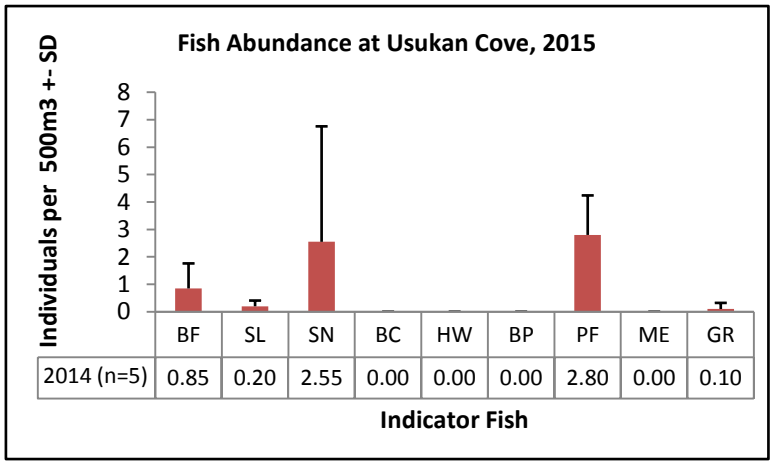
Substrate



Reefs in Usukan Cove are considered to be in 'Fair' condition with 35.63% live coral cover, below the average (40.32%) for North Borneo region. Large area of the reefs consists mainly of dead coral (RC and RB). Fish bombing was likely to have caused the damage.

NIA level has increased significantly from 0.73% in 2014 to 15.63% in 2015, and is the second highest in North Borneo region. This has to be monitored closely especially at NB3.3 Pandan-Pandan, NB3.5 Lok Liak and NB3.6 Keramat; all recorded more than 20%.

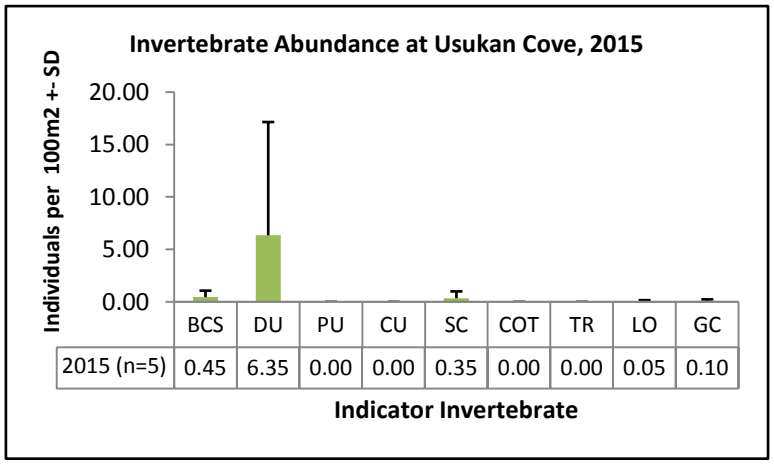
Fish



Four indicator fish were absent from surveys (Barramundi Cod, Humphead Wrasse, Bumphead Parrotfish and Moray Eel).

Other indicator fish were present in low abundance.

Invertebrates



Five indicator invertebrates were observed during surveys (Banded Coral Shrimp, Diadema, Urchin, Sea Cucumber, Lobster and Giant Clam) and their abundance was very low except for Diadema Urchin.

All survey sites were affected by warm water bleaching. Extensive human impacts were also seen on the reefs with signs of boat anchor damage, trash, discarded fishing nets and lines and dynamite fishing.

3.2.18Mantanani

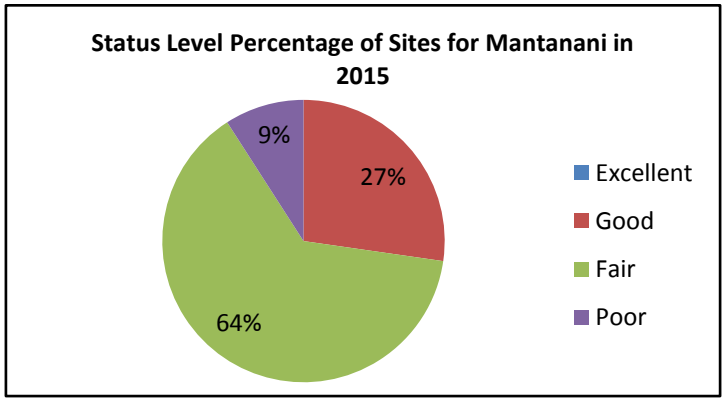
The Mantanani archipelago is located some 30km off the north-west coast of the state ofSabah, opposite the town ofKota Belud. The largest island is Mantanani Besar; the other two are Mantanani Kecil and Linggisan.

Mantanani is mainly populated by Bajau Ubian, with a small population of about 1,000 in two villages. The three main economic activities are fishing, drying salted fish and collecting shellfish.

Mantanani is an increasingly popular snorkelling and diving destination, and tourist numbers have grown four-fold in the last three years, mainly day trippers from Kota Kinabalu. The number of resorts is increasing and there are plans for further development.

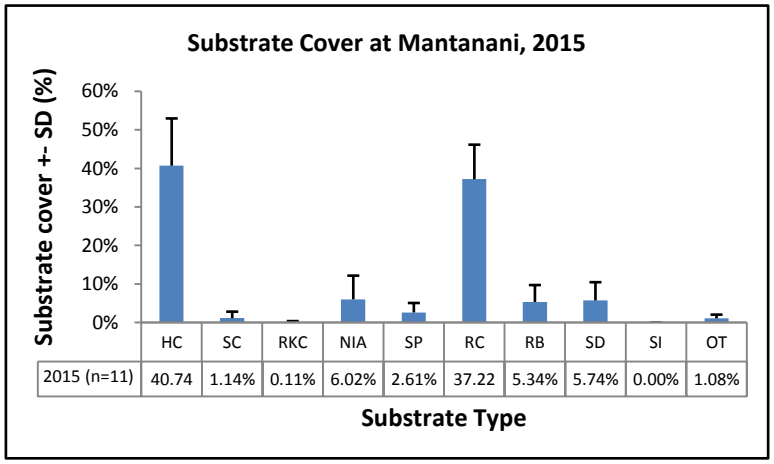
Fish bombing is a major problem in the area. This destructive fishing method has damaged large areas of reef around the islands.

Map 21: Surveyed sites in Mantanani



A total of 11 coral reef sites were surveyed in Mantanani islands and 64% of the reefs were in fair condition.27% were in good condition and the remaining 9% of the reefs were in poor condition.No reefs were in excellent condition.

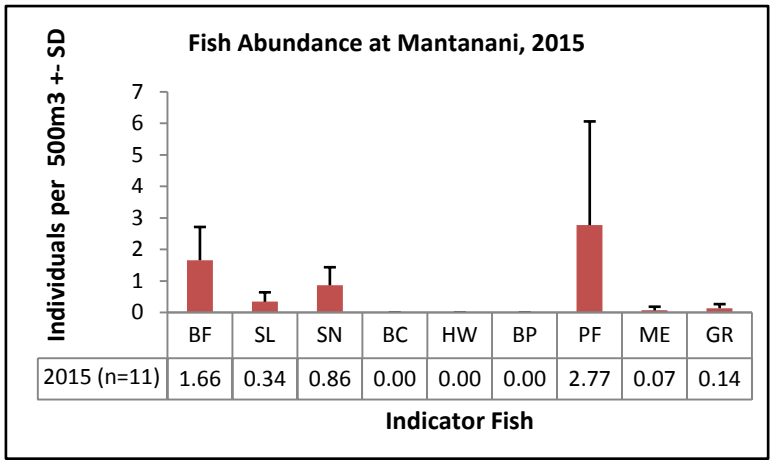
Substrate



Coral reefs around Mantanani islands are considered to be in 'Fair' condition, with 41.88% live coral cover, above the average (40.32%) for reefs in the North Borneo region.

The level of RC has further increased from 32.22% in 2014 to 37.22% in 2015, a significant proportion of which is dead coral and recorded as RB in 2014.NIA level has increased from 4.66% in 2014 to 6.02% in 2015.This has to be monitored especially at NB4.2 Abalone and NB4.11 Kolam; both recorded more than 16%.

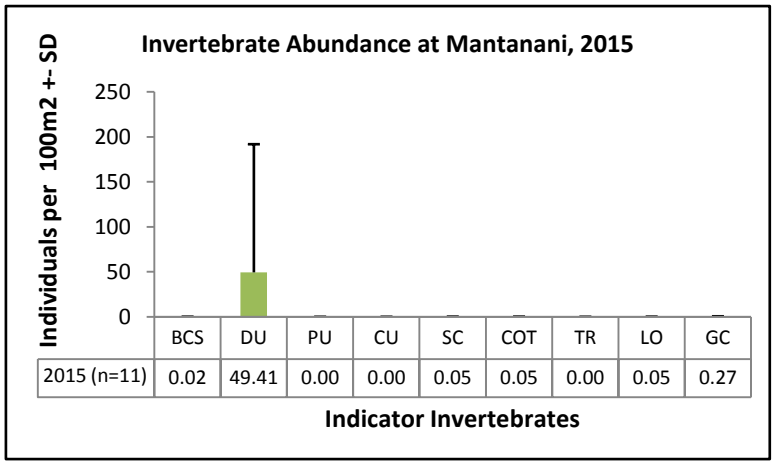
Fish



Three indicator species were completely absent from surveys (Barramundi Cod, Humphead Wrasse and Bumphead Parrotfish).

The abundance of Parrotfish was the highest, followed by Butterflyfish. Other indicators werepresent in very low number. These islands are not gazetted as a Marine Protected Area and are impacted by fishing pressure and destructive fishing method (fish bombing).

Invertebrates



Threeindicator species were absent, including Pencil and Collector Urchin, and Triton.

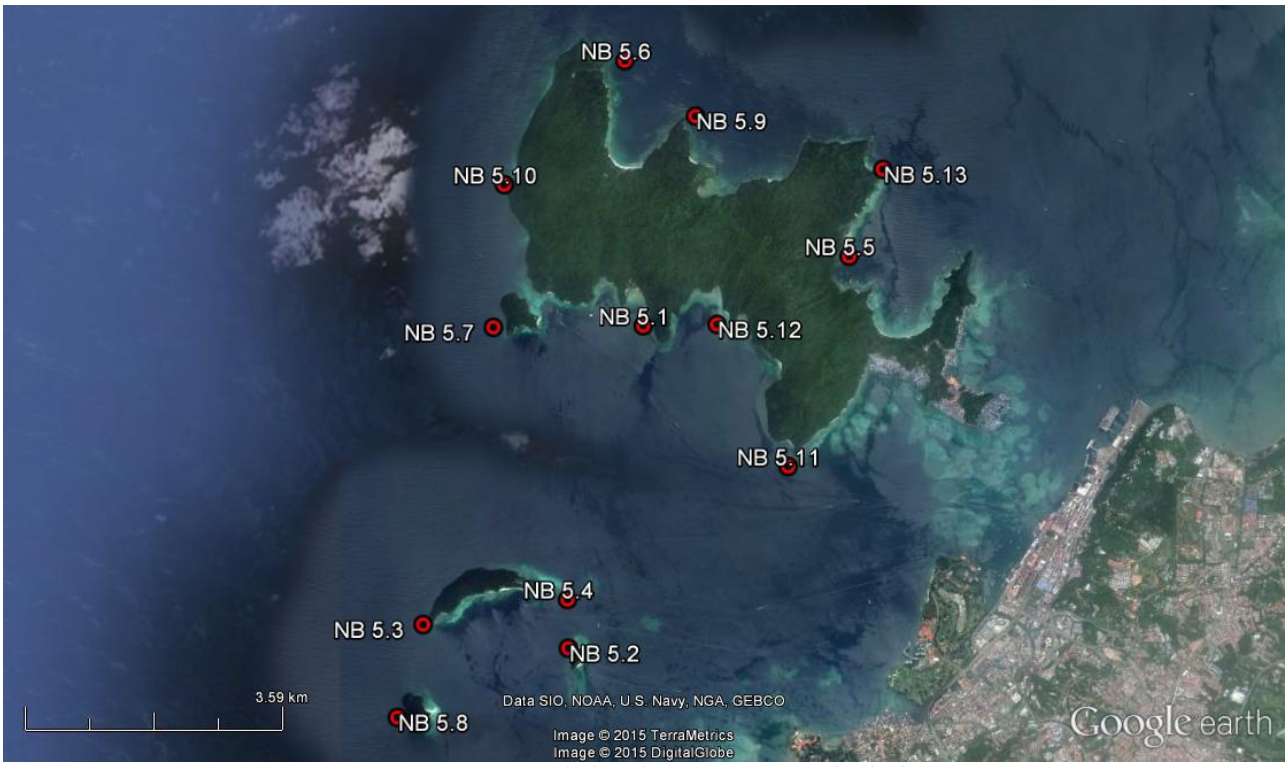
Abundance of Diadema Urchin was high. Other indicator species were present invery low number (Banded Coral Shrimp, Sea Cucumber, Crown-of-thorns, Lobster and Giant Clam).

Extensive human impacts were seen on most of the reefs. Signs of boat anchor damage, dynamite fishing, discarded fishing nets and trash were visible during surveys. Fish bombing blast was heard at one site during surveys. Damage due to warn water bleaching was also observed at few sites. On a positive note, turtle was recorded at NB4.5 Riza Garden.

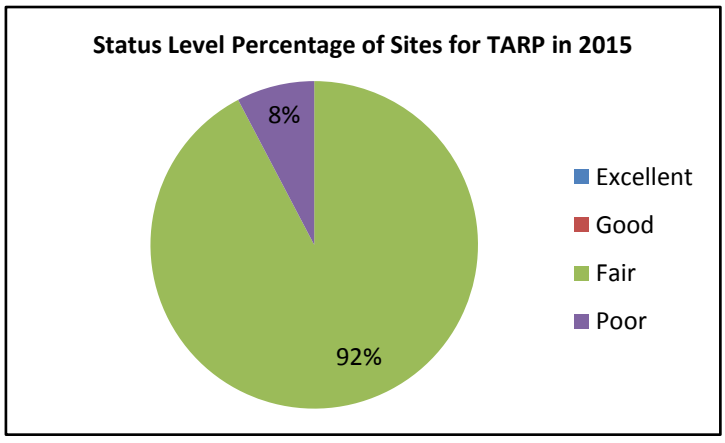
3.2.19Tunku Abdul Rahman Park, Kota Kinabalu

Tunku Abdul Rahman Park is located between 3 to 8 km off Kota Kinabalu, the capital of Sabah,and covers an area over 4,929 hectares, two thirds of which covers the sea. There is a cluster of islands in the Park comprising Pulau Gaya, Pulau Sapi, Pulau Manukan, Pulau Mamutik and Pulau Sulug. The reefs generally lie in shallow water with little current.

All five islands have tourist facilities such as chalets/resthouse, jetty, picnic shelters, barbecue pits, tables, changing rooms and toilets, except for Pulau Sulug which isrelatively untouched, remote and undeveloped. The islands receive large numbers of day tourists from Kota Kinabalu.

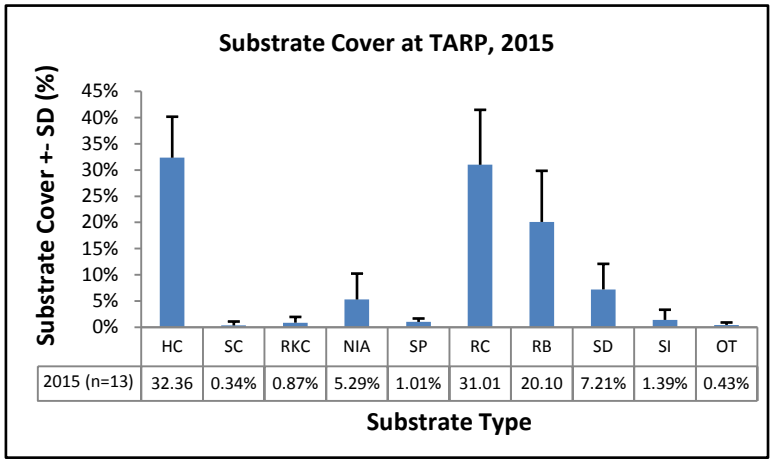


Map 22: Surveyed sites in TARP, Kota Kinabalu



A total of 13 coral reef sites were surveyed in TARP and 92% of the reefs were in fair condition. 8% were in poor condition and no reefs were in excellent or good condition.

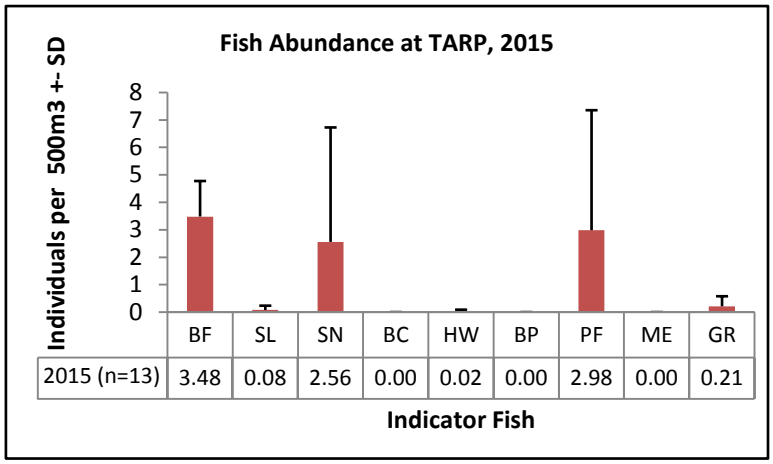
Substrate



Coral reefs around the islands are considered to be in 'Fair' condition with 32.69% live coral cover, below the average (40.32%) for reefs within the North Borneo region.

The level of RB had increased from 15.58% in 2014 to 20.10% in 2015 (the third highest of all islands recorded in North Borneo region),indicating recent disturbances to the reefs, and two sites recorded more than30%. This is a cause for concern and needs to be monitored closely.

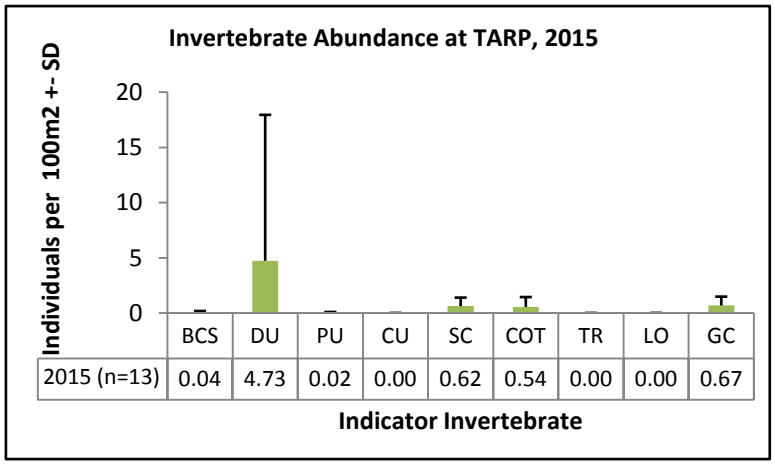
Fish



Only three indicator species were absent from surveys (Barramundi Cod, Bumphead Parrotfish and Moray Eel).

Butterflyfishwas the most abundant indicator fish, followed by Parrotfish and Snapper. Abundance of other indicators were very low (Sweetlips, Humphead Wrasse and Grouper).

Invertebrates



Three indicators were absent from surveys (Collector Urchin,Triton and Lobster).

Diadema Urchin was the most abundance indicator invertebrate. Abundance of other species was low (Banded Coral Shrimp, Pencil Urchin, Sea Cucumber, Crown-of-thorns and Giant Clam).

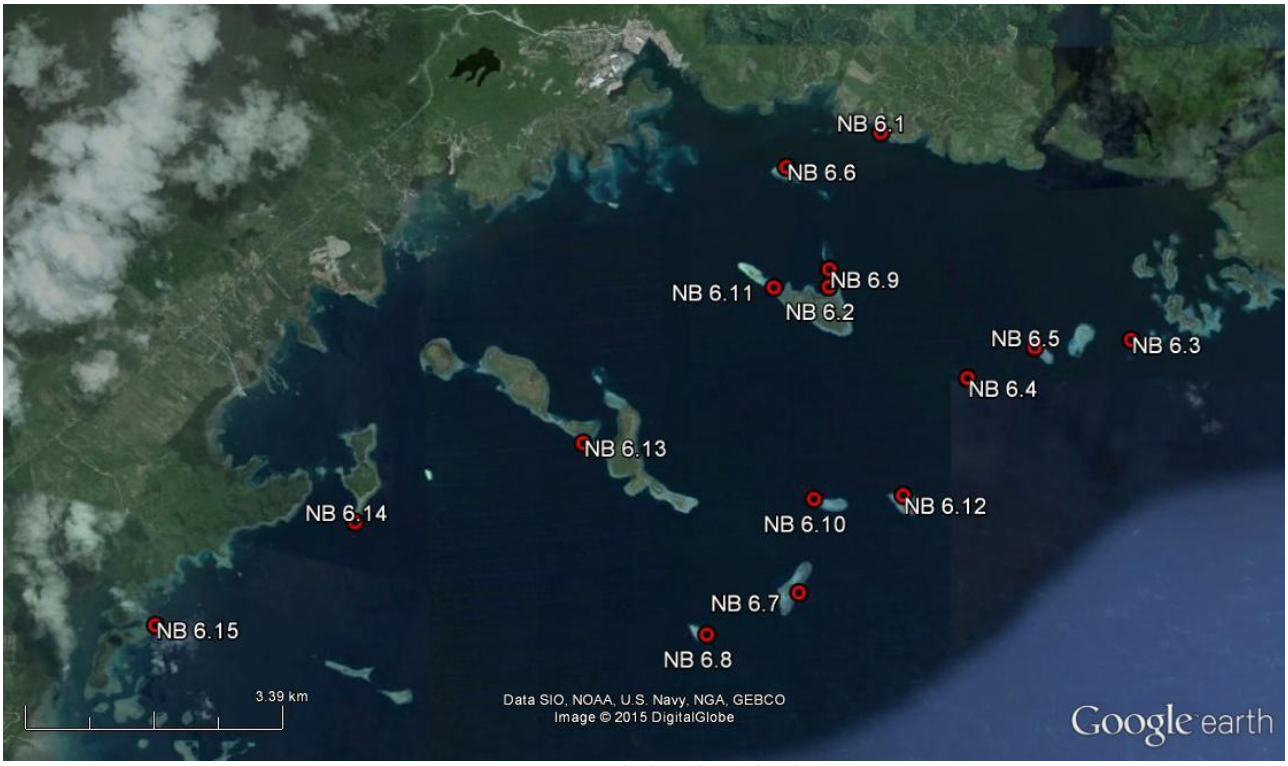
Human impacts were seen on most of the reefs. Signs of boat anchor damage, dynamite fishing, discarded fishing nets and trash were visible during surveys. Damage due to warn water bleaching was also observed at many sites. On a positive note, shark wasalso recorded during the surveys.

3.2.20 Lahad Datu

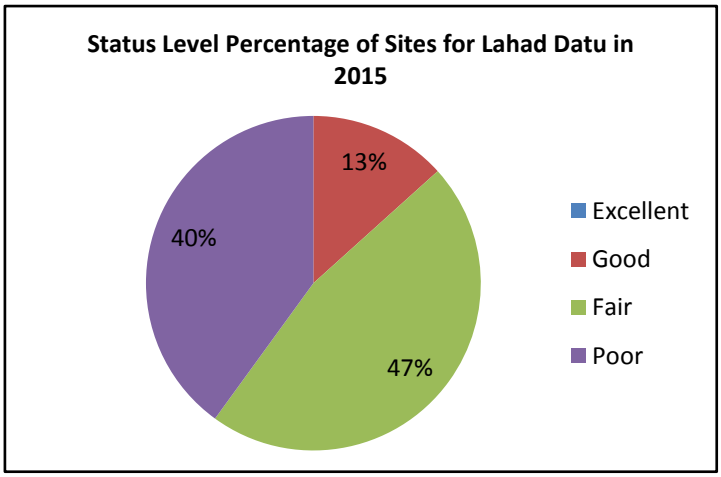
Lahad Datu is a town located in the east of Sabah, Malaysia, on the island of Borneo. It occupies the peninsula on the north side of Darvel Bay – the largest semi-enclosed bay on the east coast of Borneo islands. Administratively, it falls within the Tawau Division and is estimated to have a population of over 156,000 (2000 census).

Currently, there is little development along the coastal areas of Lahad Datu. In Lahad Datu itself, tourism is still limited, though Sabah Urban Development Corporation is trying to promote greater investment in infrastructure. There are two well known nature-based tourism attractions near to Lahad Datu: Tabin Wildlife Reserve and the Danum Valley Conservation Area, and the wider Kinabatangan river basin is also nearby.

Darvel Bay has yet to become established as a popular diving destination.The area includes both fringing and submerged reefs.

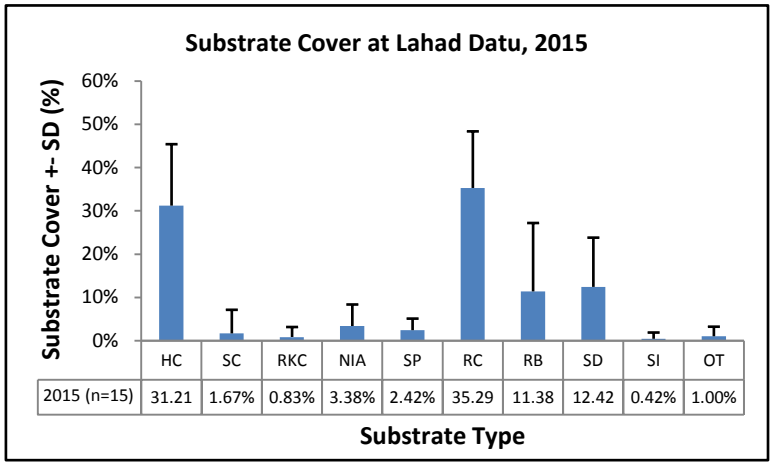


Map 23: Surveyed sites in Lahad Datu



A total of 15 coral reef sites were surveyed in Lahad Datu and only 13% of the reefs were in good condition. 47% of the reefs were in fair condition and the remaining 40% were in poor condition. No reefs were in excellent condition.

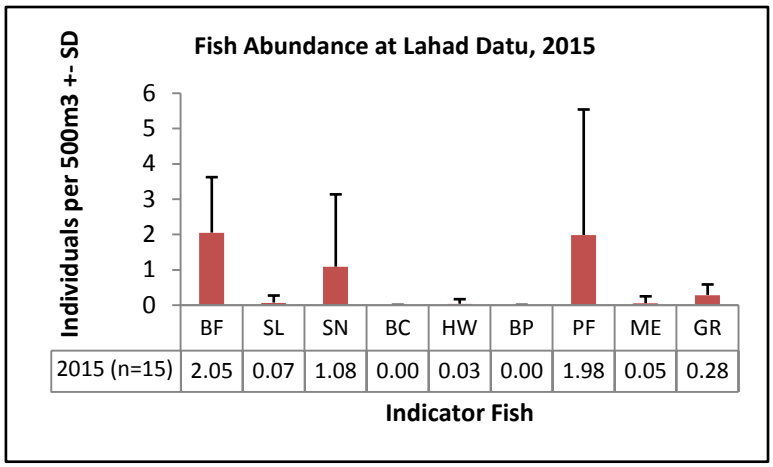
Substrate



Reefs in Lahad Datu are considered to be in 'Fair' condition with live coral cover of 32.88%,below the average (40.32%)for reefs in the North Borneo region.

RB level was high, especially at NB6.10 Ira's Reef (65%). This is probably due to destructive fishing method occurring around that area.

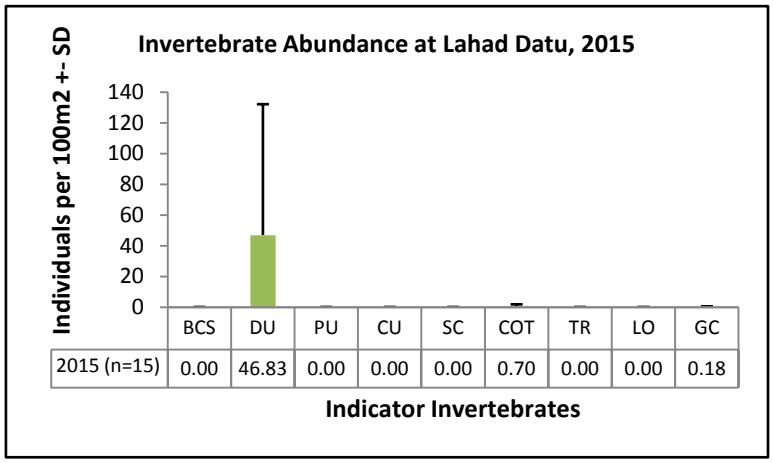
Fish



Only two indicator fish were absent during surveys (Barramundi Codand Bumphead Parrotfish).

Butterflyfish recorded the highest number, followed by Parrotfishand Snapper. Other indicatorswere present in very low number.

Invertebrates



Only three indicator invertebrates were present during surveys, Diadema Urchin, Crown-of-thorns and Giant Clam. The abundance of Diadema Urchin was highwhile the abundance of Giant Clam was low.

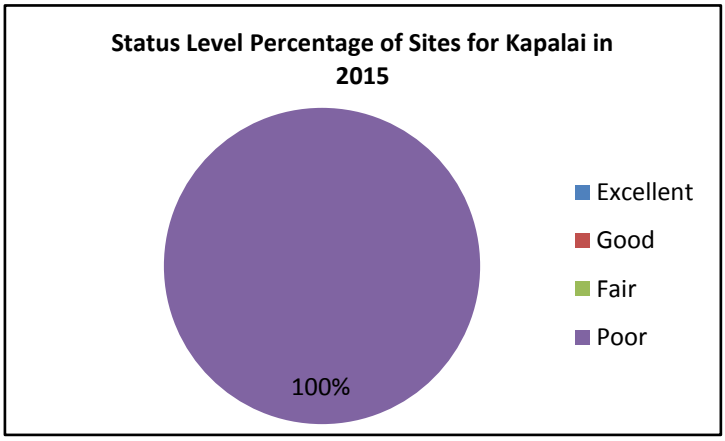
The abundance of Crown-of-thorns was high and the number is way above what a healthy reef can sustain (0.2-0.3 ind./100m^2).

Fish nets and trash were seen on many of the survey sites and many sites were damaged by Crown-of-thorns. On a positive note, mandarin was observed at NB6.2 Cabbage Reef and turtle was observed at NB6.6 Fish Eye and NB6.3 Paradise.

3.2.21Kapalai

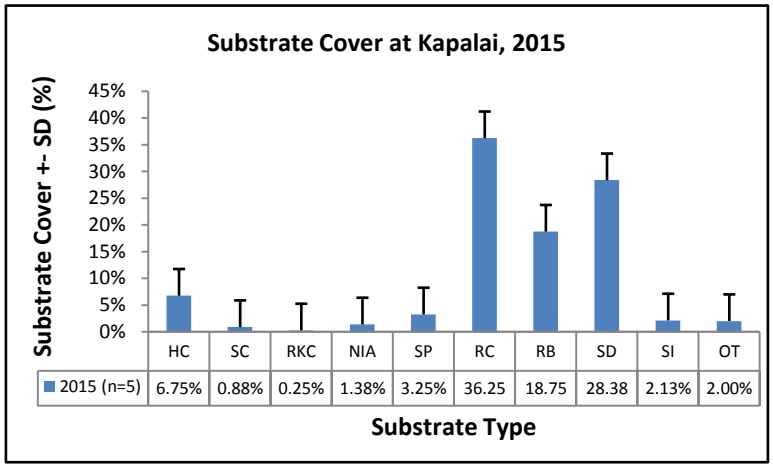
Kapalai Island is located in Tawau, Sabah and 15 kilometres off Sipadan Island. It is known for its scuba diving resorts. Though it is called and island it is actually a sandbar situated on Ligitan Reef. Kapalai used to be a real island with vegetation however erosion over the last few hundred years has reduced the island to sea level. All of the buildings are on stilts resting on the underwater reef.Kapalai is mostly known for its scuba diving. There is only one private resort on the island while the rest is of the island uninhabited.

Map 24: Surveyed sites in Kapalai Island



A total of 5 coral reef sites were surveyed in Kapalai Island and 100% of the reefs were in poor condition.

Substrate

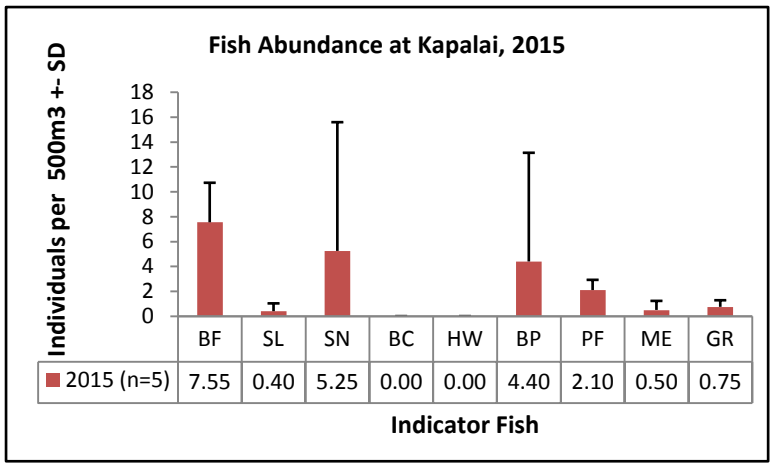


Reefs in Kapalai were considered to be in 'Poor' condition with 7.63% live coral cover and were way below the average (40.32%) for North Borneo Region.

The high level of RB was likely due to the ongoing practice of fish bombing within the region.

The level of SD was also high and was the highest of all islands surveyed in North Borneo region.

Fish

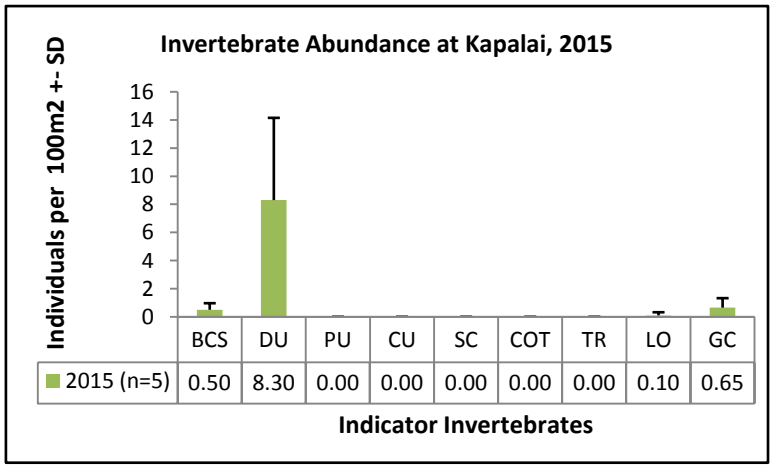


Only two fish were absent during surveys (Barramundi Cod and Humphead Wrasse).

The most abundance fish was Butterflyfish (the highest of all islands surveyed in North Borneo region), followed by Snapper. Other indicators such as Sweetlips, Moray Eel and Grouper were present in low number.

Bumphead Parrotfish abundance was high and was the highest of islands surveyed in Malaysia.

Invertebrates



Four indicator invertebrates were observed during surveys, including Banded Coral Shrimp, Diadema Urchin, Lobster and Giant Clam.

Abundance of Diadema Urchin was the highest. The abundance of other indicators were very low, less than 1 ind./100m^2.

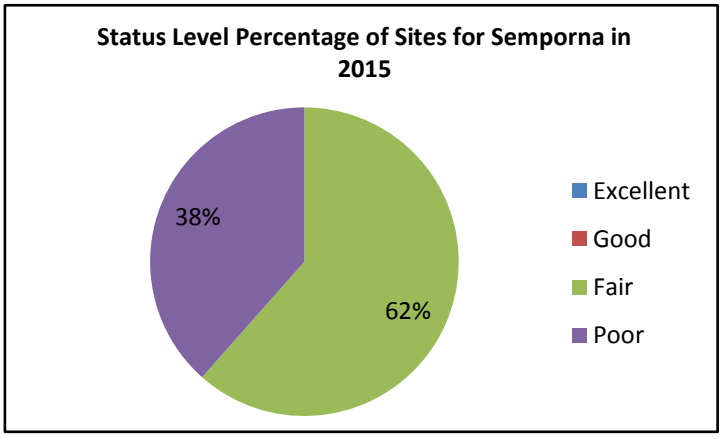
Kapalai recorded the highest number of turtle sighting during surveys in whole Malaysia. Both natural and human damage were observed at all surveys site. Damage due to warm water bleaching was observed at 4 sites, same goes to damage due to dynamite fishing practices. Damage due to boat anchor was observed at 2 sites.

3.2.22Semporna

Semporna is located at the South Western tip of Sabah, south of Lahad Datu. The economy of this town is driven by marine products especially pearl farming and seaweed farming.

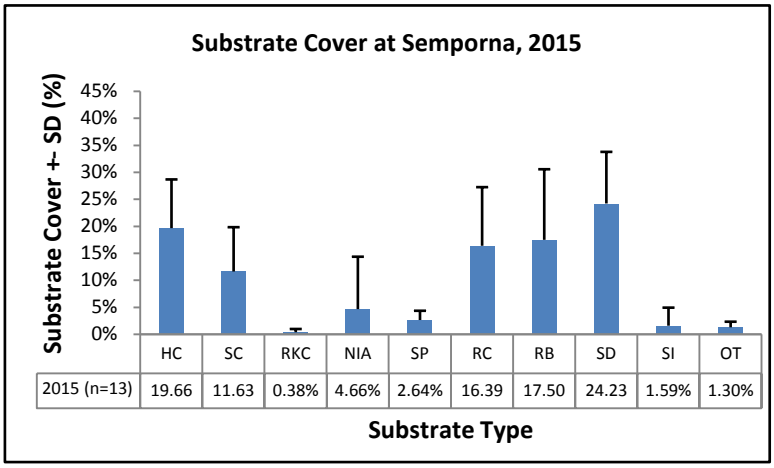
Tourism is also an important element of the economy. Semporna is a popular base for tourists visiting Sipadan, Mabul and other islands nearby.

Map 25: Surveyed sites in Semporna



A total of 13 coral reef sites were surveyed in Semporna and only 62% of the reefs were in fair condition. The remaining 38% were in poor condition. No reefs were in excellent and good condition.

Substrate

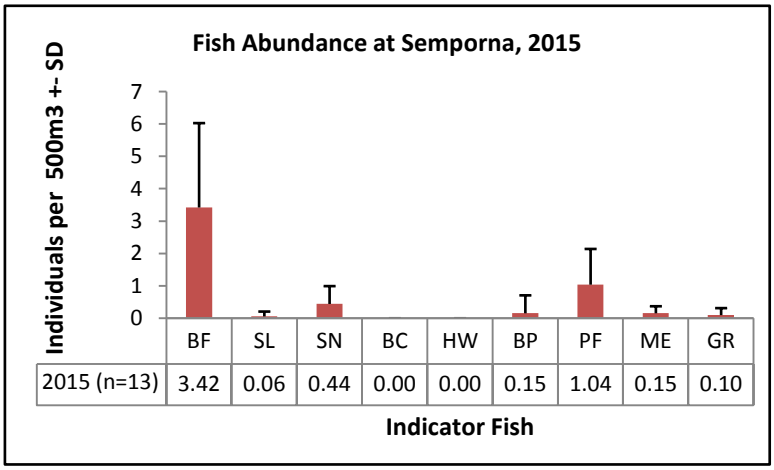


Reefs in Semporna were considered to be in 'Fair' condition with 31.30% live coral cover and were below the average (40.32%) for North Borneo Region.

The high level of RB was likely due to the ongoing practice of fish bombing within the region.

The high level of NIAindicates that the waters around Semporna are rich in nutrients.

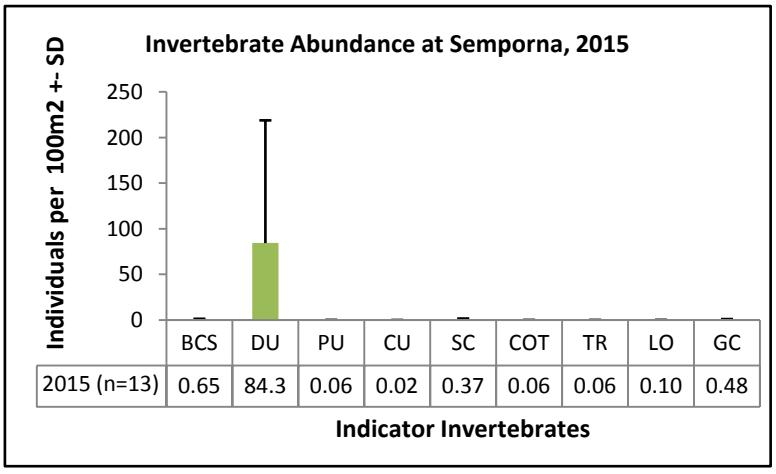
Fish



The abundance of Butterflyfish was the highest. Food fish such as Sweetlip, Snapper, Parrotfish and Grouper were recorded in low number.

Prize food fish such as Barramundi Cod and Humphead Wrasse were absent. Bumphead Parrotfish was recorded in low number. This reflects the fishing pressure around Semporna, with edible fish rarely seen.

Invertebrate



All indicator invertebrates were observed during surveys.Abundance of Diadema Urchin washigh and was the highest of all islands surveyed in North Borneo region.The abundance of other indicators wasvery low, less than 1 ind./100m^2.

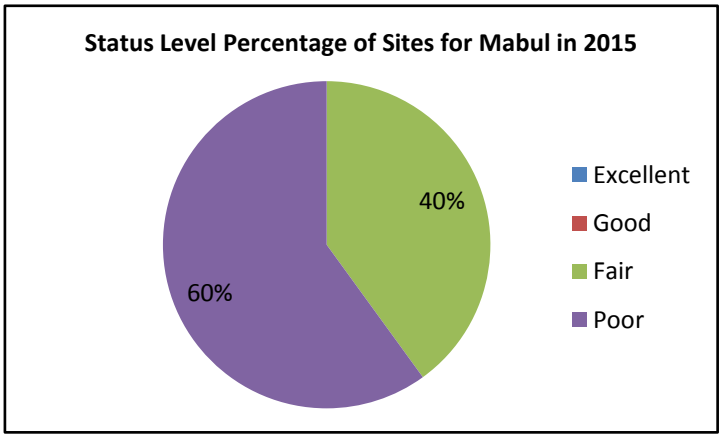
Extensive damage by human and natural impactswas observed during surveys. Signs of coral damage due to boat anchor, dynamite fishing, trash, discarded fishing gear and warm water bleaching were seen at most sites. Turtles were also recorded during surveys.

3.2.23Mabul

Mabul is a small island off the south-eastern coast of Sabah. The island has been a fishing village since the 1970s. In the 1990s, it first became popular to divers due to its proximity to Sipadan Island. Located 15 km from Sipadan, this 20-hectare piece of land surfaces 2–3 m above sea level, consists mostly flat grounds and the aerial view is oval-shaped. Surrounding it are sandy beaches, perched on the northwest corner of a larger 2 km^2 reef.The reef is on the edge of the continental shelf and the seabed surrounding the reef slopes out to 25 to 30 m deep.

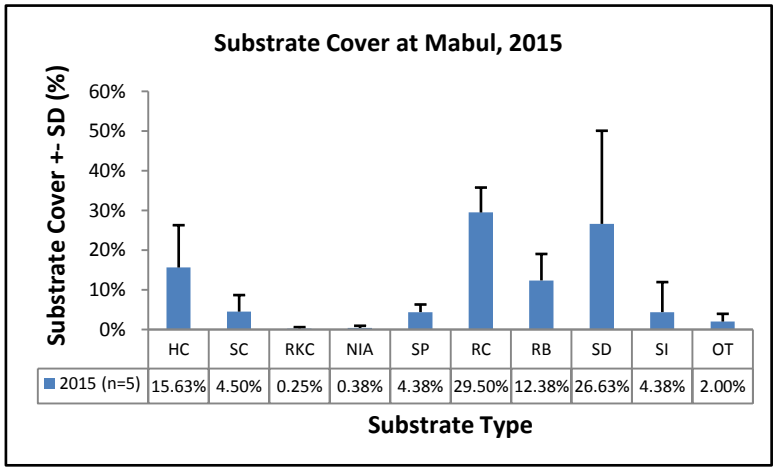
There are several dive resorts operating on Mabul island, which provides accommodation for scuba divers - most located on the island or on stilts over the water, while one is on a converted oil platform about 500 meters from the beach. There are also several home stay and backpacker accommodations which also arrange diving.

Map 26: Surveyed sites in Mabul



A total of 5 coral reef sites were surveyed in Semporna and only 40% of the reefs were in fair condition. The remaining 60% were in poor condition. No reefs were in excellent and good condition.

Substrate

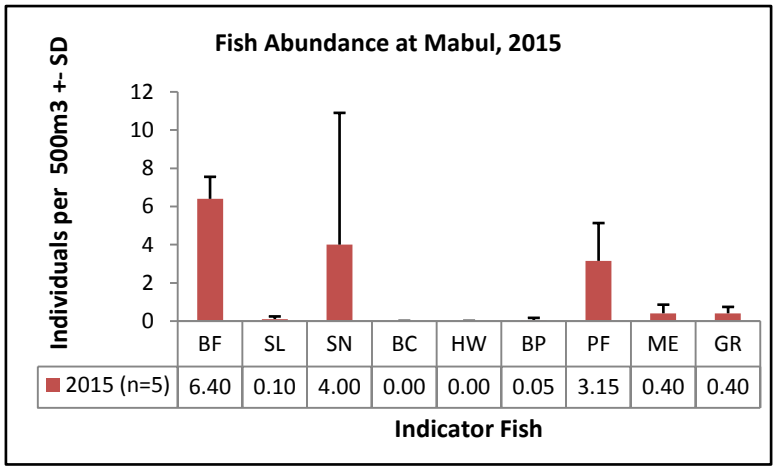


Reefs in Mabul were considered to be in 'Poor' condition with 20.13% live coral cover and were way below the average (40.32%) for North Borneo Region.

The high level of RB was likely due to the ongoing practice of fish bombing within the region.

SI level was considered high and this need to be monitored closely.

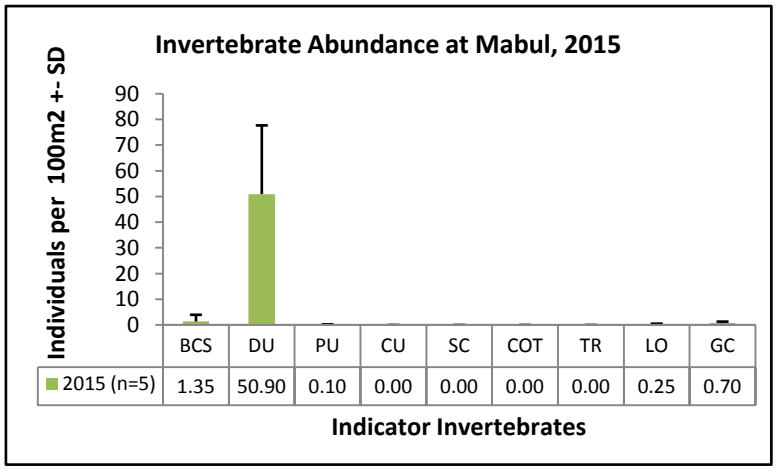
Fish



The abundance of Butterflyfish was the highest, followed by Snapper and Parrotfish. Sweetlip, Bumphead Parrotfish, Moray Eel and Grouper were recorded in low number.

Prize food fish such as Barramundi Cod and Humphead Wrasse were absent.

Invertebrate



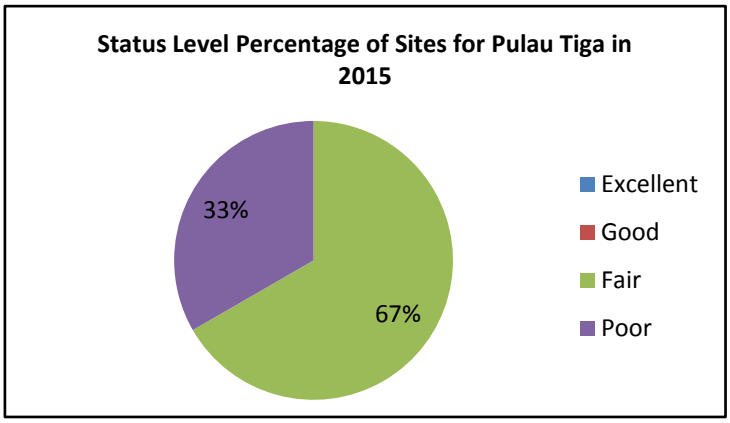
Five indicator invertebrates were observed during surveys.Abundance of Diadema Urchin was high.The abundance of other indicators was very low.

Damage by human and natural impacts was observed during surveys. Signs of coral damage due to boat dynamite fishing, trash, discarded fishing nets, trash and warm water bleaching were seen at many sites. Turtle was also recorded during surveys.

3.24 Pulau Tiga

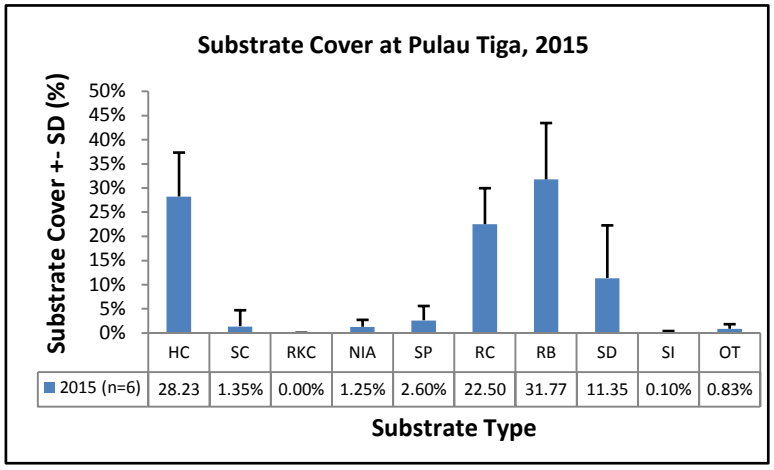
Pulau Tiga is one of a group of small uninhabited islands in Kimanis Bay off the western coast of Sabah. The islands were formed on 21 September 1897, when an earthquake on Mindanao caused a volcanic eruption near Borneo. The island is 607 hectares in size and has a couple of active mud volcanoes at the highest part of the island. Pulau Tiga is one of the three islands that make up Tiga Island National Park. The Park Headquarters are on the island, comprising an office complex and accommodation for the park staff and visiting scientists.

Map 27: Surveyed sites in Pulau Tiga



A total of 6 coral reef sites were surveyed in Pulau Tiga and 67% of the reefs were in fair condition. The remaining 33% were in poor condition. No reefs were in excellent or good condition.

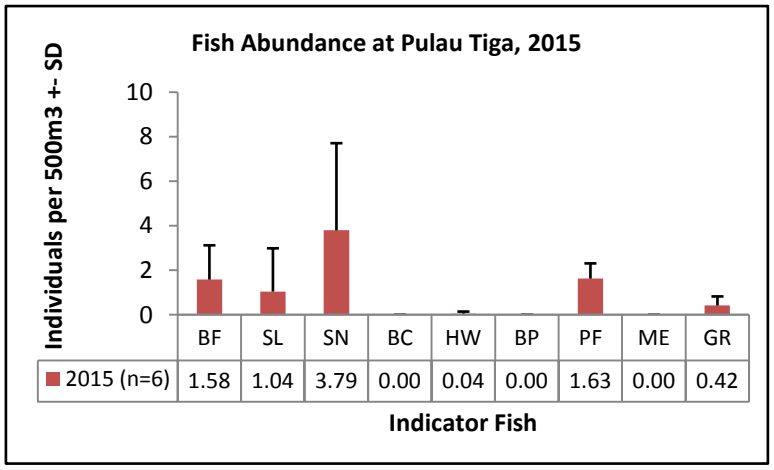
Substrate



Reefs in Pulau Tiga were considered to be in 'Fair' condition with 29.58% live coral cover and were below the average (40.32%) for North Borneo Region.

The level of RB was high (the highest of all islands surveyed in North Borneo region) with 4 sites recorded more than 30%. This indicates recent disturbances to the reefs and is a cause for concern and needs to be monitored closely.

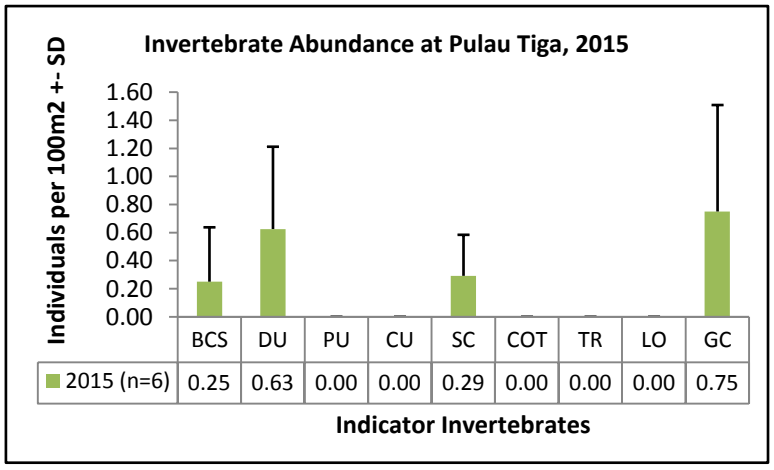
Fish



Three indicators were absentfrom surveys (Barramundi Cod, Bumphead Parrotfish and Moray Eel).

The abundance of Snapperwas the highest. Butterflyfish, Sweetlips, Parrotfish and Grouper were present in low number.Abundance of Humphead Wrasse and Grouper were very low.

Invertebrate



Four indicator invertebrates were observed during surveys, including Banded Coral Shrimp, Diadema Urchin, Sea Cucumber and Giant Clam. Their abundance was very low, less than 1 ind./100m^2.

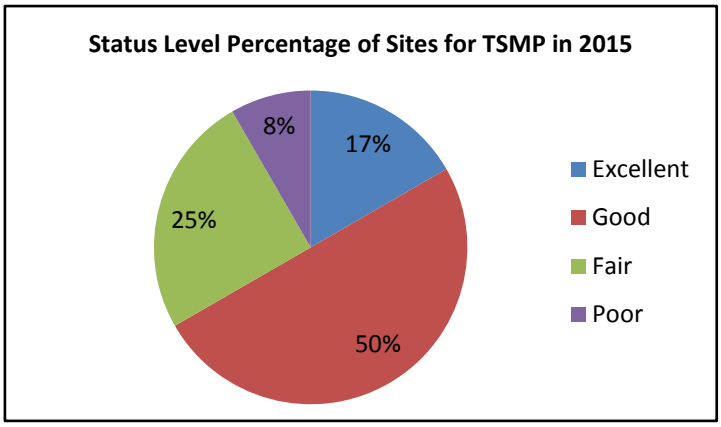
Discarded fishing nets and trash were observed at many sites. Damages due to warm water bleaching and dynamite fishing were observed at some sites.

3.2.25Tun Sakaran Marine Park, Semporna

Tun Sakaran Marine Park is a marine park located off the east coast of the state of Sabah in Malaysia. It consists of the islands of Bodgaya, Boheydulang, Sabangkat, and Salakan, the sand cays of Maiga, Sibuan, and Mantabuan, and the patch reefs of Church and Kapikan.

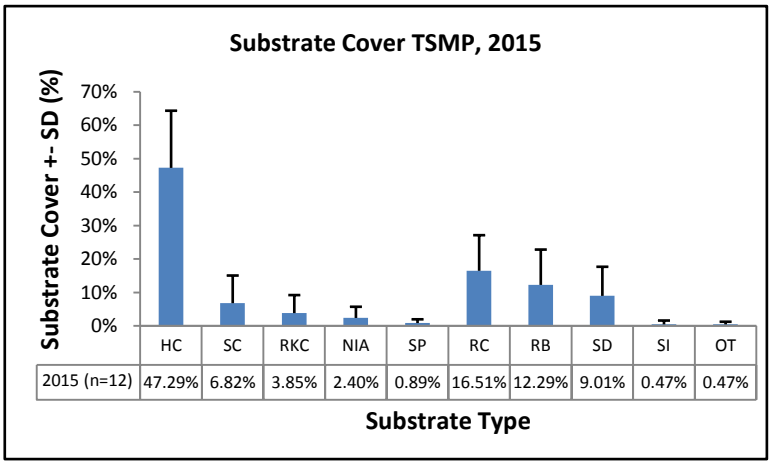
In 2004, the park became the seventh gazetted area under Sabah Parks with a total area of 100.8 km². There are approximately 2,000 people living within the park.

Map 28: Surveyed sites in Tun Sakaran Marine Park, Semporna



A total of 12 coral reef sites were surveyed in TSMP and 17% of the reefs were in excellent condition. 50% were in good condition and 25% were in fair condition. The remaining 8% of the reefs were in poor condition.

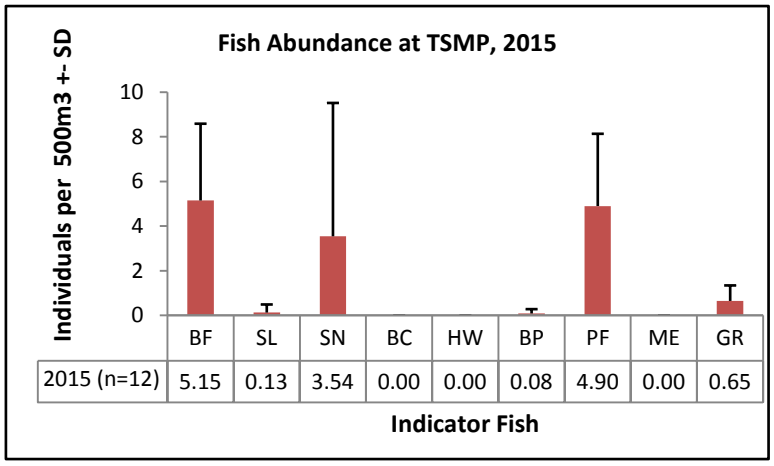
Substrate



Coral reefs within the TSMP were considered to be in 'Good' condition with 54.11% live coral cover, above the average (40.32%) for reefs within the North Borneo region.

High amount of RB was also recorded and this may be due to illegal fish bombing activities that are known to occur. Level of RKC was also high, especially at NB11.4 Ribbon Reef and NB11.6 Sibuan which recorded 10% and 17.50% respectively. This is a cause for concern and the level needs to be monitored closely.

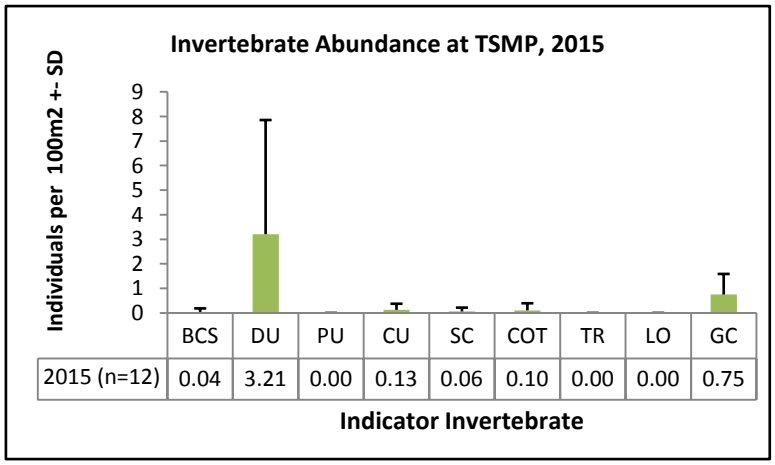
Fish



Butterflyfish was the most abundant indicator recorded during surveys, followed by Parrotfish and Snapper.

Barramundi Cod, Humphead Wrasse and Moray Eel were absent during surveys while other indicators were present in low number.

Invertebrates



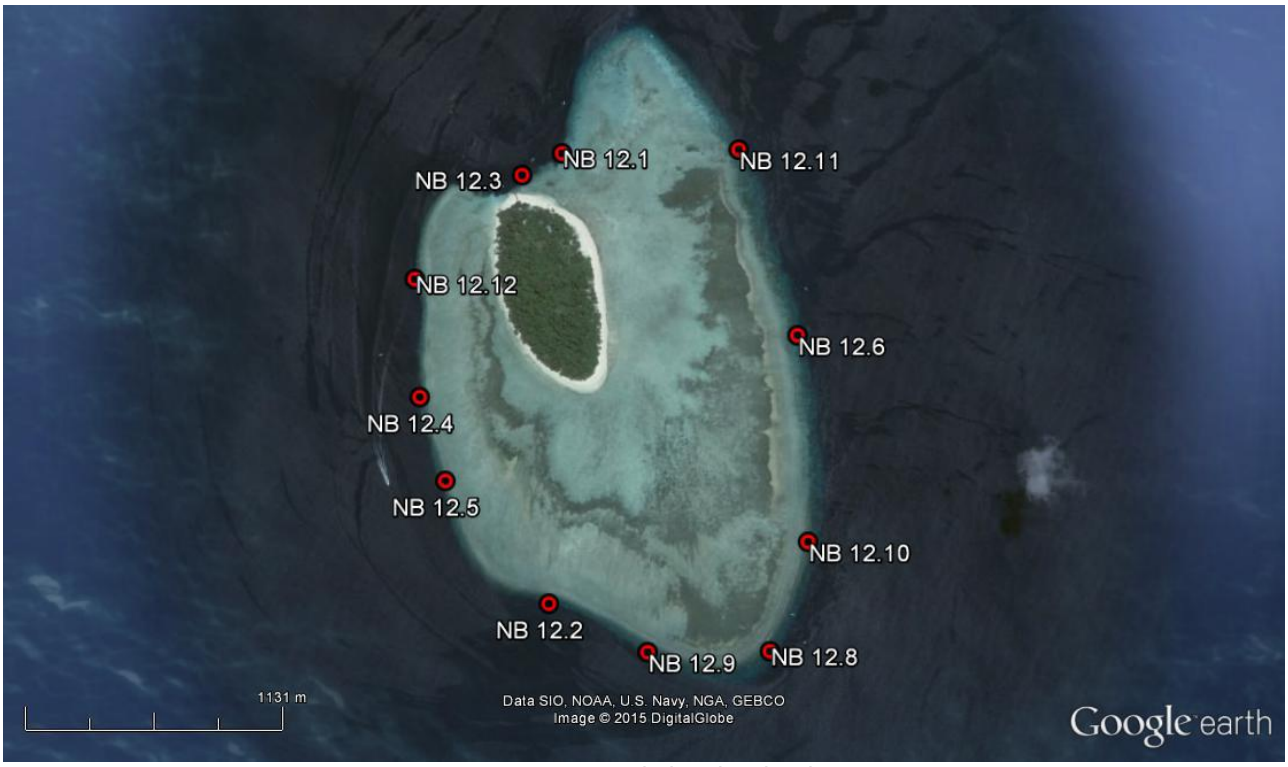
Diadema Urchin was the most abundant indicator invertebrate. Other indicators were recorded inlow abundance.

Turtle, giant stingray and large school of barracuda were observed during the surveys.

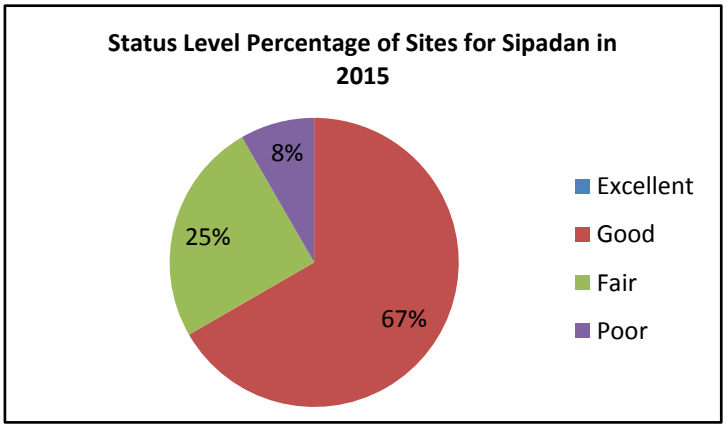
3.2.26Sipadan

Sipadan is the only oceanic island in Malaysia, rising 600 metres from the seabed. Sipadan is located in the Celebes Sea off the east coast of Sabah, Malaysia. It was formed by living corals growing on top of an extinct volcanic conethat took thousands of years to develop.

Sipadan is located at the heart of the Indo-Pacific basin, the centre of one of the richest marine habitats in the world. More than 3,000 species of fish and hundreds of coral species have been classified in this ecosystem. Sipadan has been rated by many dive journals as one of the top destinations for diving in the world

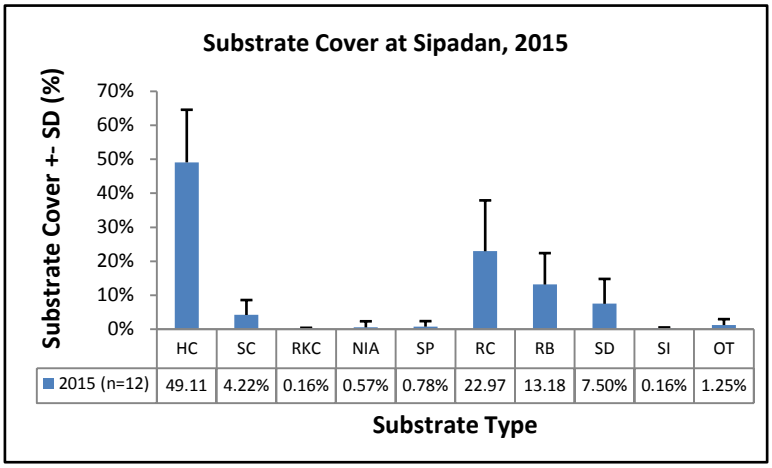


Map 29: Surveyed sites in Sipadan



A total of 12 coral reef sites were surveyed in Sipadan and 67% of the reefs were in good condition. 25% were in fair condition and the remaining8% were in poor condition. No reefs were in excellent condition.

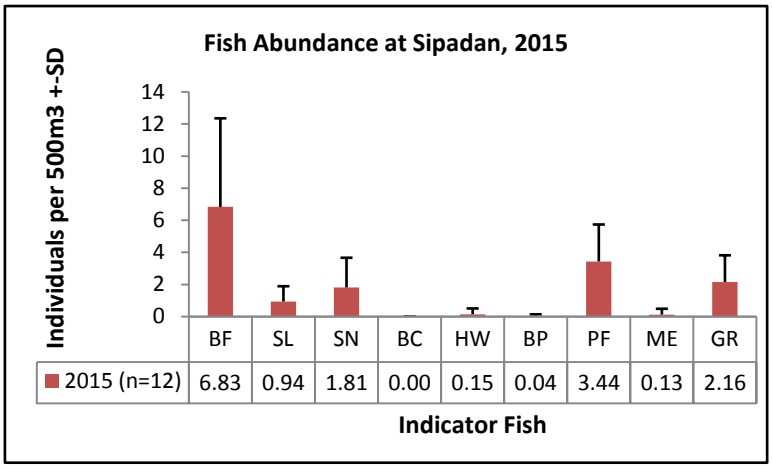
Substrate



Coral reefs within the Sipadan were considered to be in 'Fair' condition with 53.33% live coral cover and above the average (40.32%) of reefs within the North Borneo region. However, LCC has dropped quite a lot compared to 2014 which recorded 60.40%.

High amount of RBwas recorded and this may be due to the high number of tourists visiting the island. Level of SD has increased from 3.69% in 2015 to 7.50%.These are a cause for concern and needs to be monitored closely.

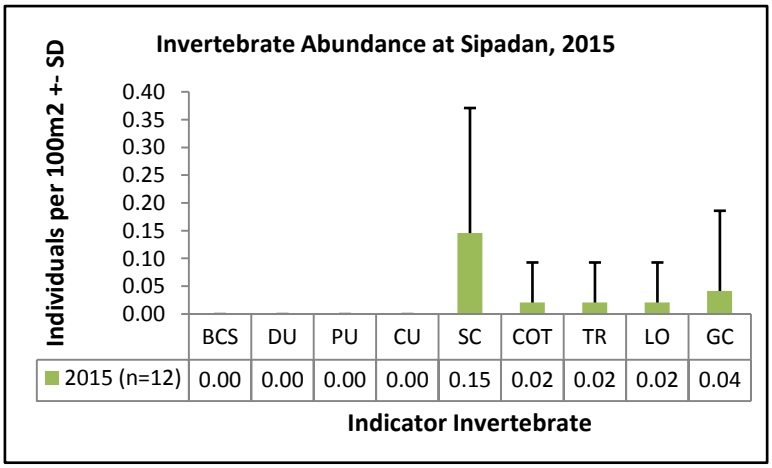
Fish



Butterflyfish was the most abundant indicator recorded during surveys, followed by Parrotfish, Grouper and Snapper. Sipadan recorded the highest number of Grouper of all islands surveyed in the North Borneo region.

Sweetlips, Humphead Wrasse, Bumphead Parrotfish and Moray Eel were present in low number.

Invertebrate



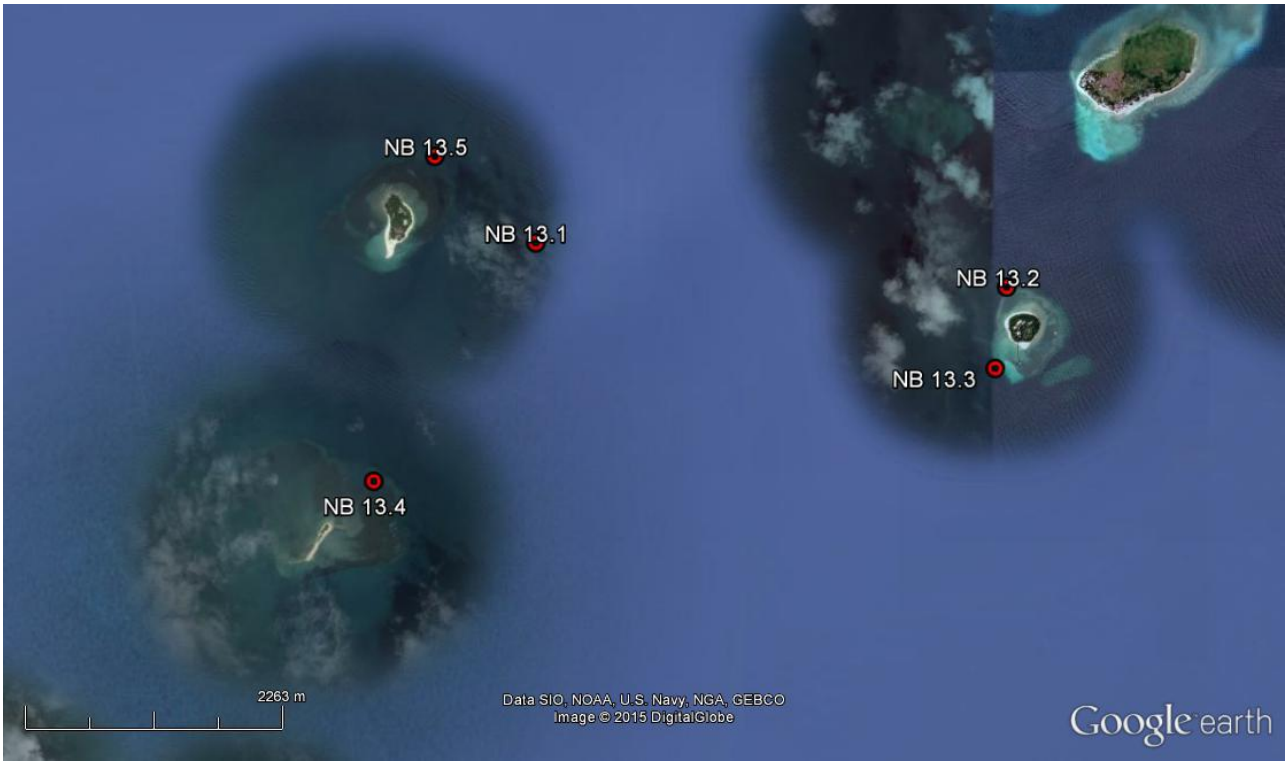
All indicator invertebrate were recorded in low abundance, less than 1 ind./100m^2.

Neither damages (human and natural impacts) nor rare animals were recorded during surveys.

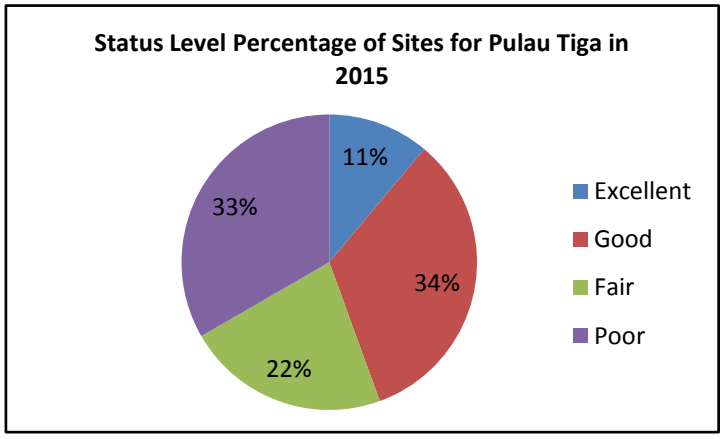
3.2.27Pulau Penyu

Pulau Penyu lies in the Sulu Sea some 40km north of Sandakan, Sabah. It comprises of three islands; Pualau Selingan, Pulau Bakungan Kecil and Pulau Gulisan. The park gained its popularity from the green and hawksbill turtles which lay their eggs on the beaches of the islands. All the three islands are protected within marine parks on both sides of the Malaysian and Philippine borders. The park covers an area of 17.4km^2 and administered by Sabah Parks.

Only on Selingan are there chalets for overnight visitors, and those who wish to see the turtles laying eggmust stay overnight. However, park rules and regulations are strictly enforced and visitors are not allowed on the beach from sunset to sunrise so as not to disturb the turtles. A ranger will call all visitors to observe only one turtle laying eggs per night.

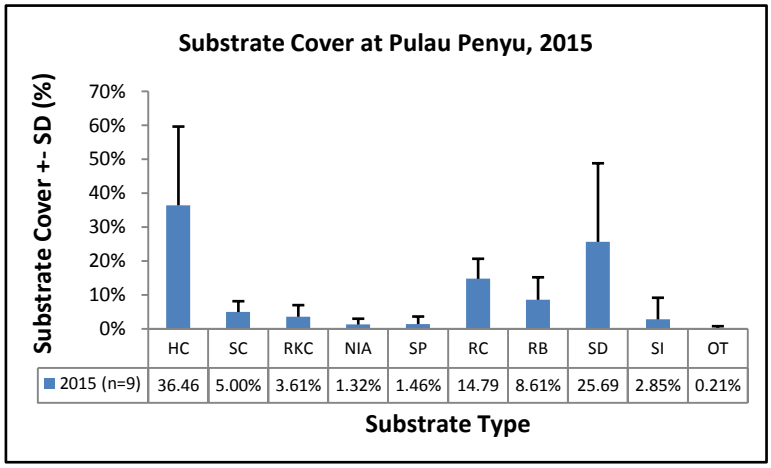


Map 30: Surveyed sites in Pulau Penyu



A total of 9 coral reef sites were surveyed in Pulau Penyu and 11% of the reefs were in excellent condition. 34% were in good condition, 22% in fair condition and33% in poor condition.

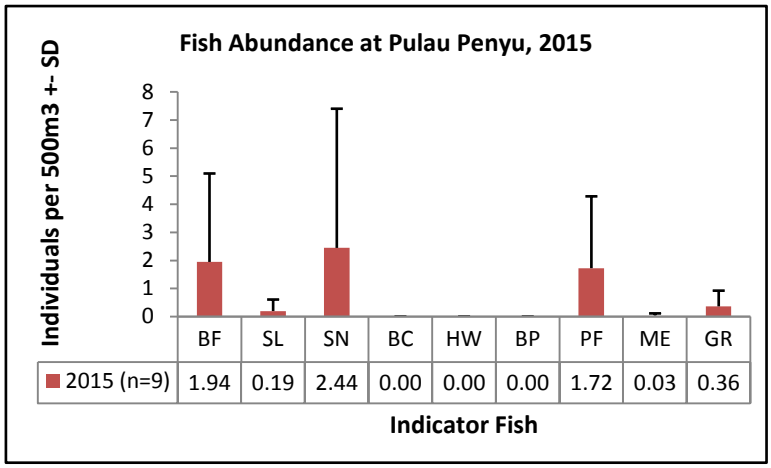
Substrate



Coral reefs in Pulau Penyu were considered to be in 'Fair' condition with 41.46% live coral cover and above the average (40.32%) of reefs within the North Borneo region.

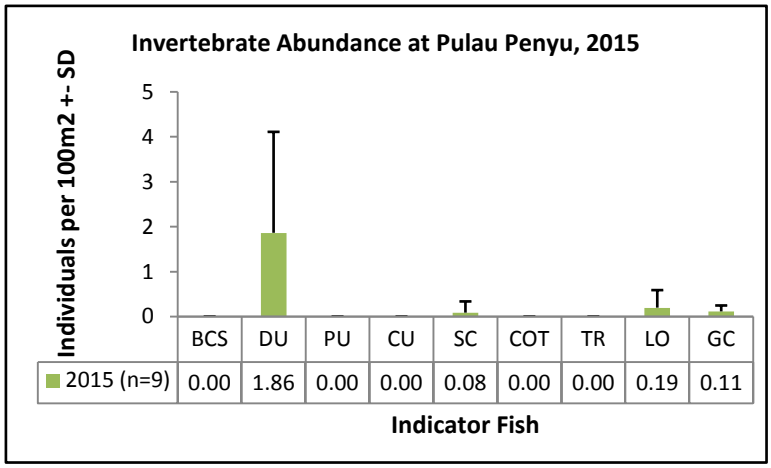
The islands in general have high level of SD. The level of RB was also high, indicating high level of recent disturbances in the area.

Fish



Snapper was the most abundant indicator recorded during surveys, followed by Butterflyfish and Parrotfish.Sweetlips, Moray Eel and Grouper were present in low number.

Invertebrate

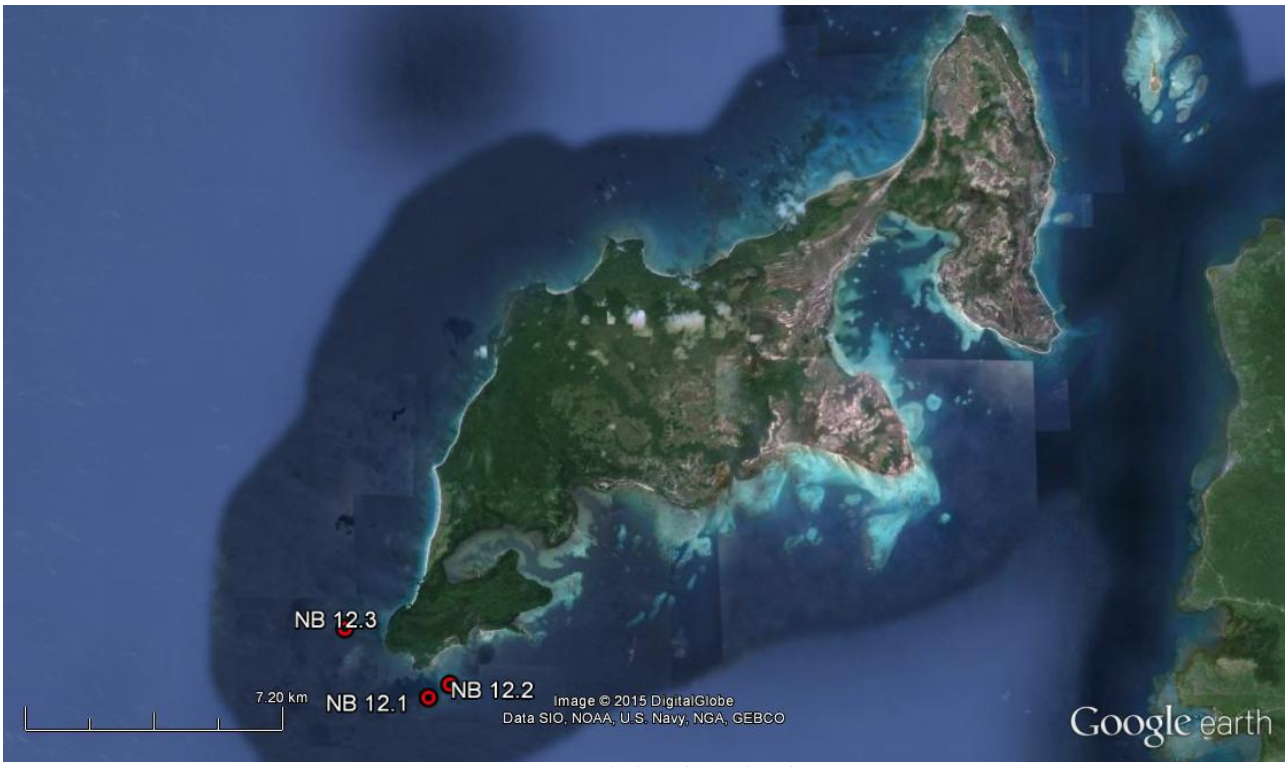


Only four indicator invertebrates were observed during surveys, including Diadema Urchin, Sea Cucumber, Lobster and Giant Clam, and were recorded in low abundance, less than 1 ind./100m^2, except for Diadema Urchin.

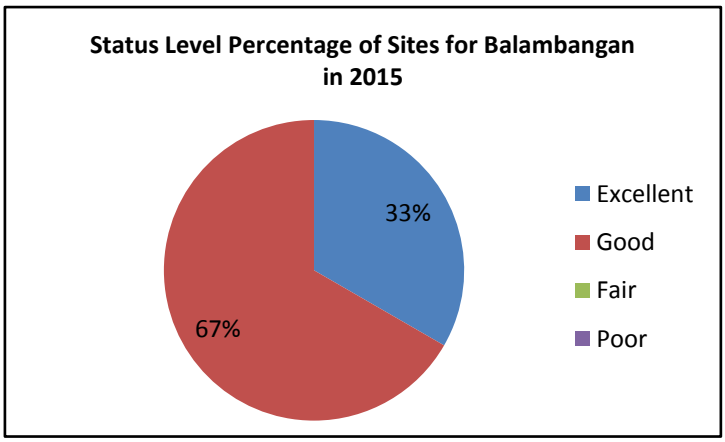
Fish net was observed and fish bomb blast was heard during surveys. On a positive note, turtle was observed during surveys.

3.2.28 Balambangan

Balambangan Island is an island in Kudat Division, Sabah. It is located off the northern tip of Sabah and is situated just about 3 km west of Banggi.

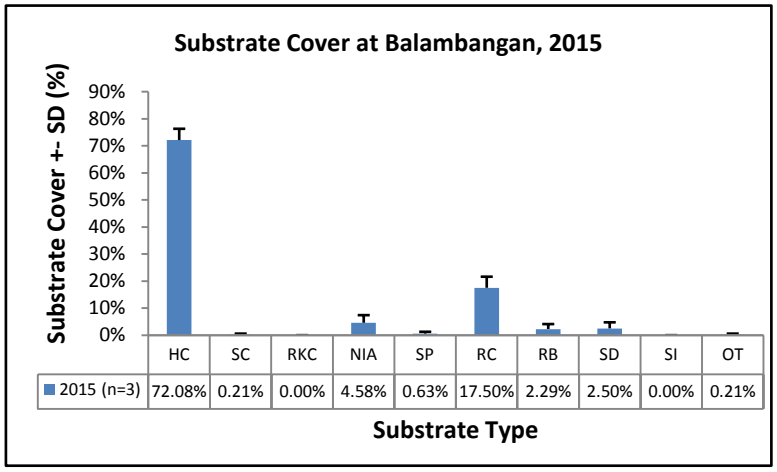


Map 31: Surveyed sites in Balambangan



A total of 3 coral reef sites were surveyed in Balambangan and 33% of the reefs were in excellent condition. The remaining 67% were in good condition. No reefs were in fair and poor condition.

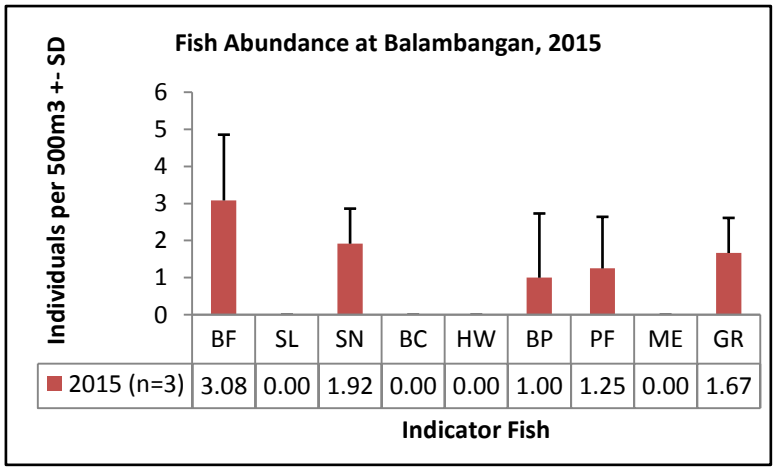
Substrate



Coral reefs within the Balambangan were considered to be in 'Good' condition with 72.29% live coral cover, above the average (40.32%) and the highest of all reefs surveyed within the North Borneo region.

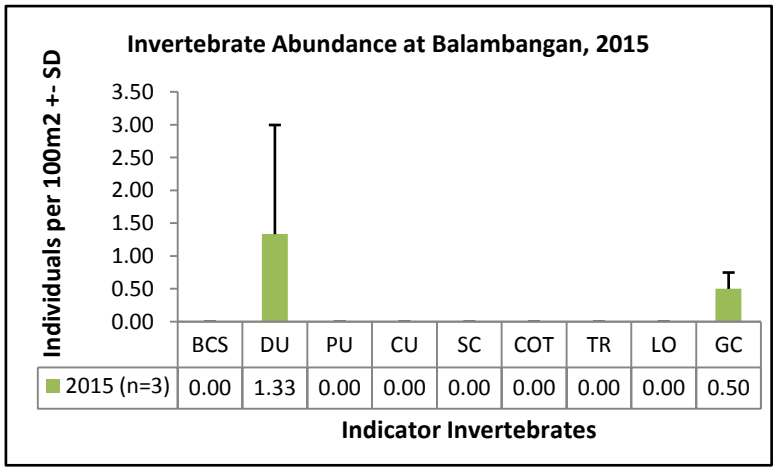
Reasonable amount of RC was recorded and this indicates that there is suitable substrate for coral recruits to settle and grow.

Fish



Butterflyfish was the most abundant indicator recorded during surveys. Abundance of Snapper, Bumphead Parrotfish, Parrotfish and Grouper were low.

Invertebrate

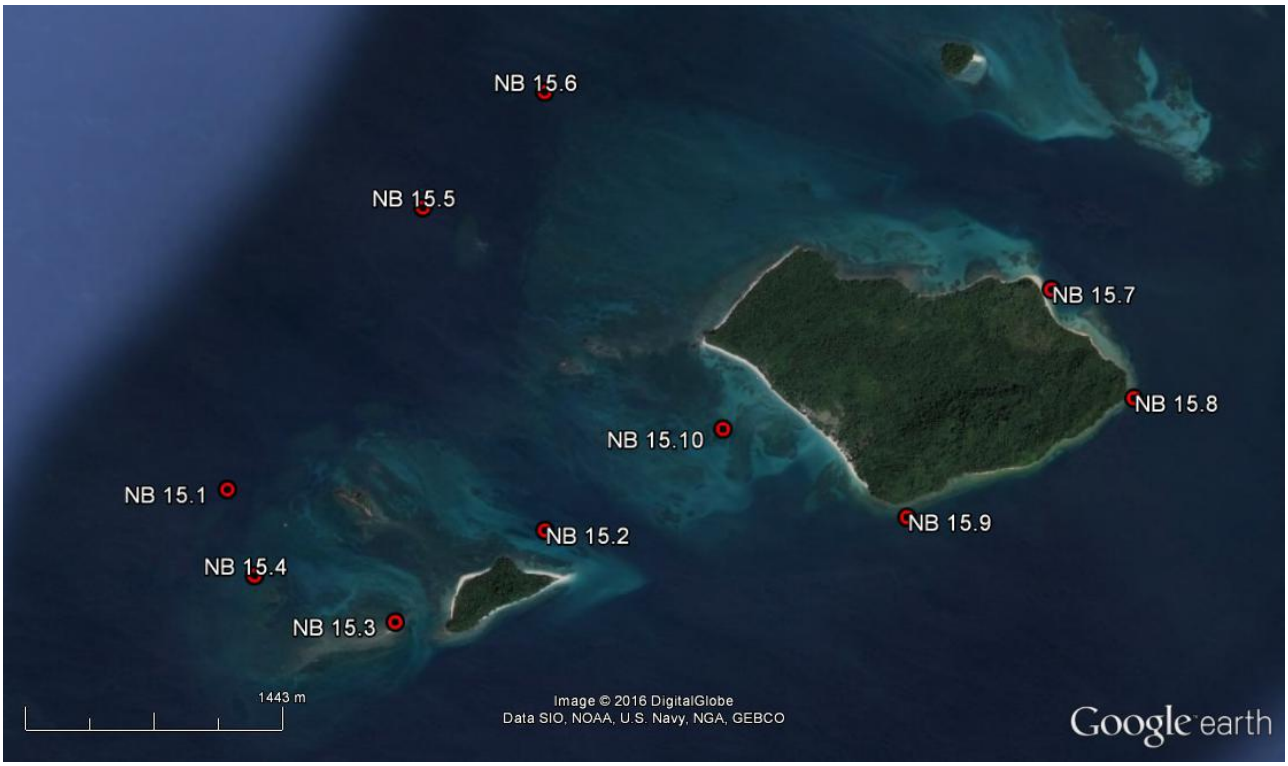


Only two indicator invertebrates (Diadema Urchin and Giant Clam) were observed and their abundance was low.

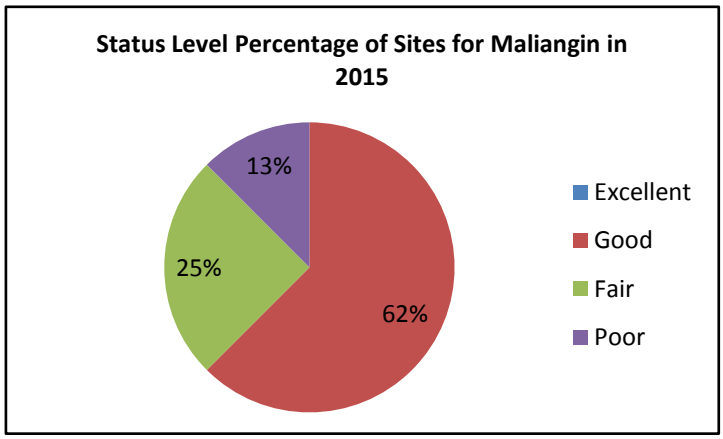
Damage by human and natural impacts was observed during surveys. Signs of coral damage due to boat anchor, dynamite fishing, trash, discarded fishing nets, trash and warm water bleaching were seen at many sites.

3.2.29 Maliangin

Maliangin is a small island located 26 nautical miles northeast of Kudat and about 1.5 km^2 south of Banggi Island. Several tour operators offer holidays and tours to or near to Pulau Maliangin Kechil.

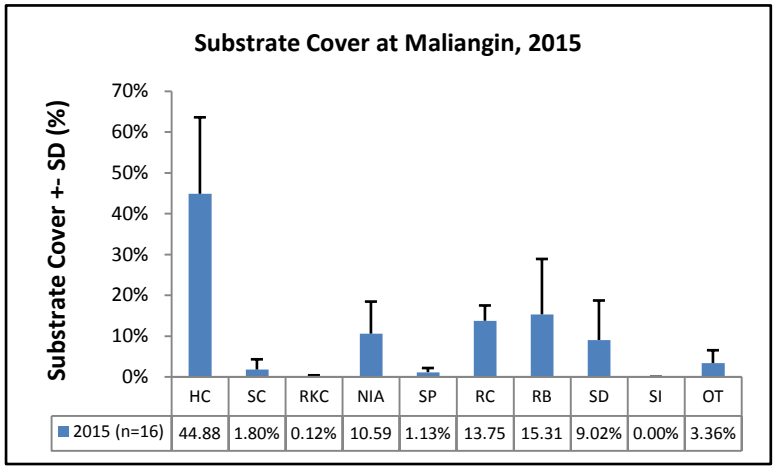


Map 32: Surveyed sites in Maliangin



A total of 16 coral reef sites were surveyed in Maliangin and 62% of the reefs were in good condition. 25% were in fair condition and the remaining 13% were in poor condition. No reefs were in excellent condition.

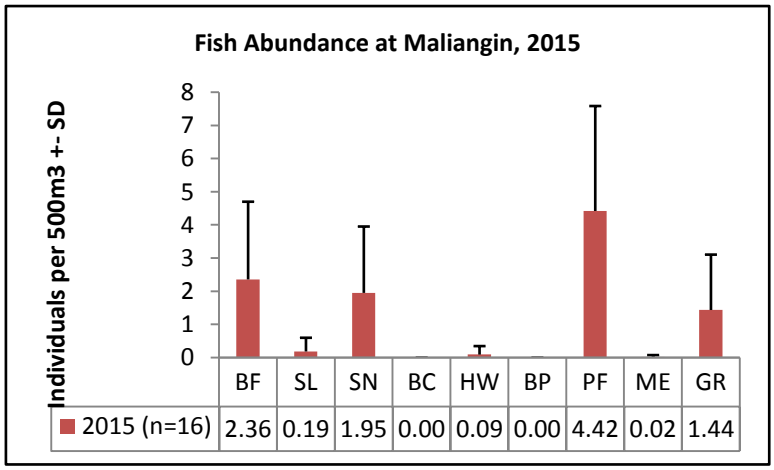
Substrate



Coral reefs around Maliangin were considered to be in 'Fair' condition with 46.68% live coral cover, above the average (40.32%) of reefs surveyed within the North Borneo region.

Level of RB and NIA is high.This is a cause for concern and should be monitored closely.

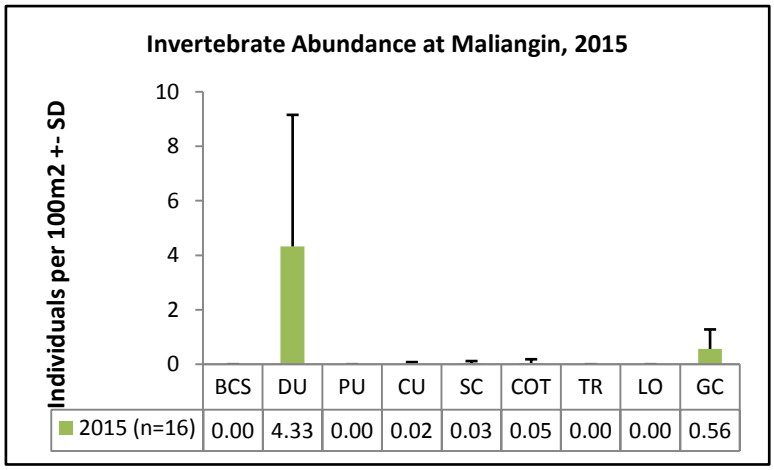
Fish



Parrotfish was the most abundant indicator recorded during surveys, followed by Butterflyfish, Snapper and Grouper.

Abundance of Sweetlips, Humphead Wrasse and Moray Eel were very low.

Invertebrate

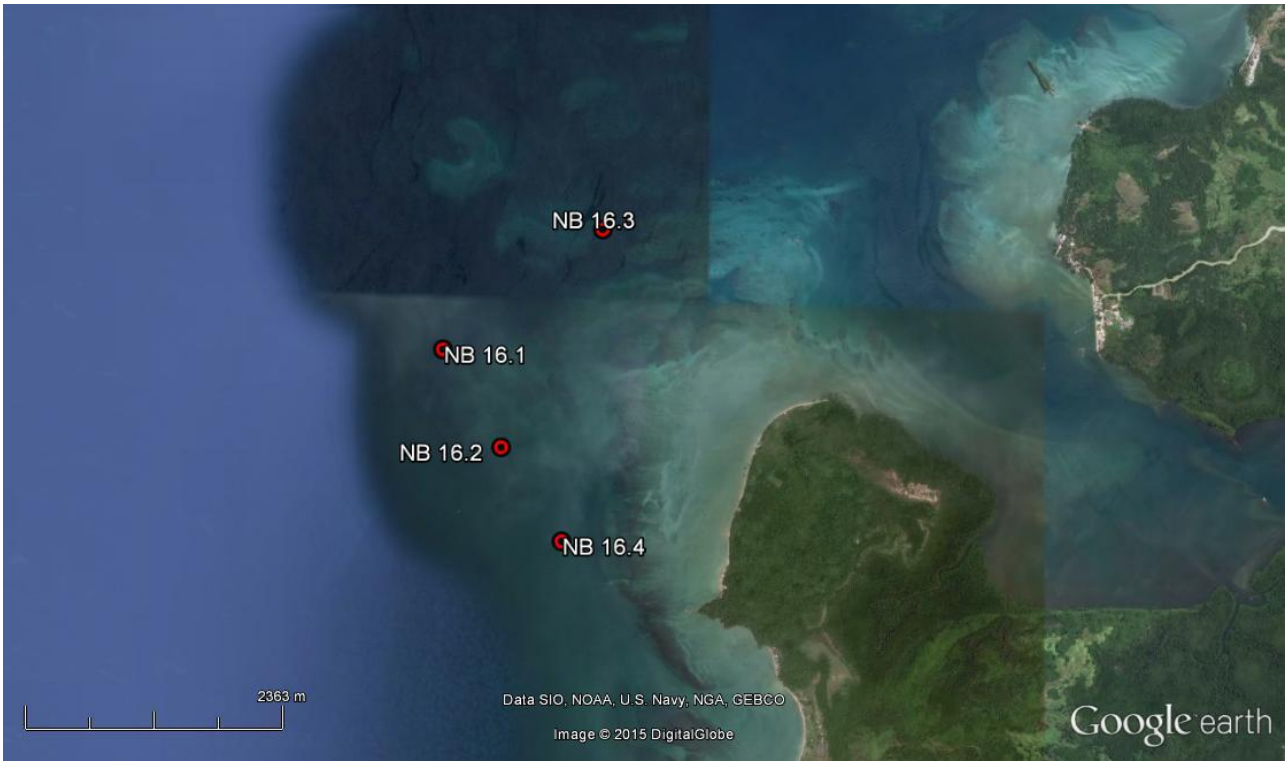


Abundance of Diadema Urchin was the highest. Collector Urchin, Sea Cucumber, Crown-of-thorns and Giant Clam were present in low number.

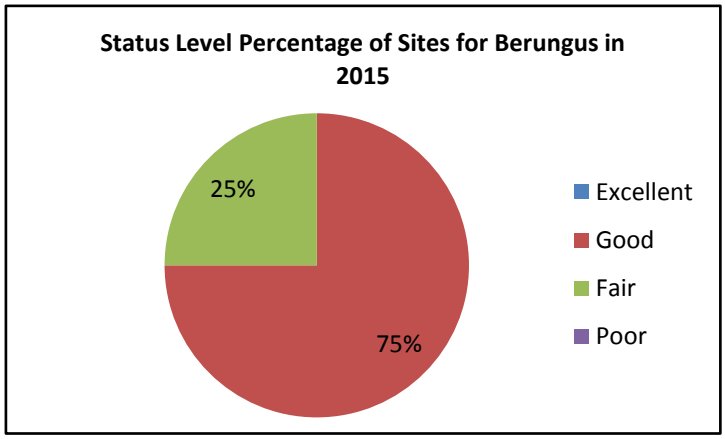
Many of the sites were affected by warm water bleaching. Only a few sites were affected by human impacts such as boat anchor damage, dynamite fishing, discarded fish nets and trash. One bamboo shark was observed during surveys.

3.2.30 Berungus

Berungus is located in a district in the Kudat division of Sabah.

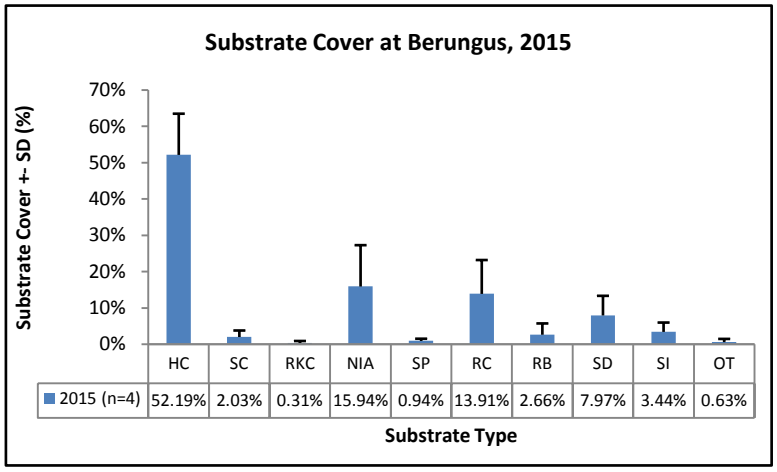


Map 33: Surveyed sites in Berungus



A total of 4 coral reef sites were surveyed in Berungus and 75% of the reefs were in good condition. The remaining 25% were in fair condition. No reefs were in excellent and poor condition.

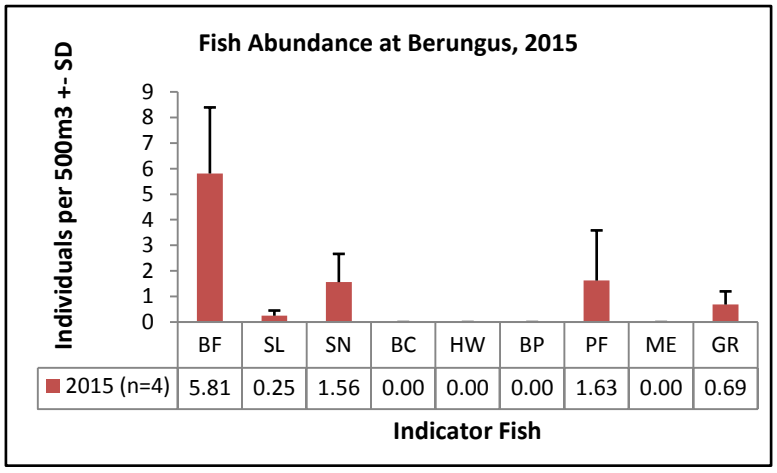
Substrate



Coral reefs within the Berungus were considered to be in 'Good' condition with 54.22% live coral cover, above the average (40.32%) of reefs surveyed within the North Borneo region.

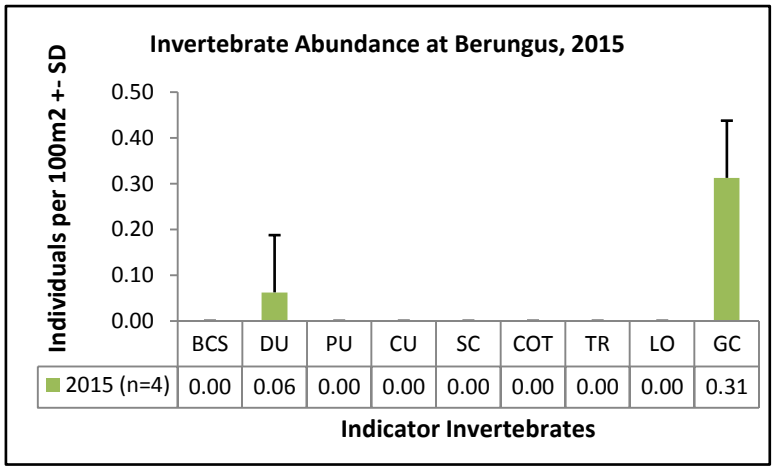
Level of NIA is very high and is the highest of all islands surveyed in the North Borneo region.This has to be monitored closely especially at NB16.1 Berungus Pitas 1 and NB16.3 Berungus Pitas 3, recorded 14.38% and 32.50% respectively.

Fish



Butterflyfish was the most abundant indicator fish recorded during surveys, followed by Parrotfish and Snapper. Abundance of Sweetlips and Grouper were low.

Invertebrate



Only two indicator invertebrates (Diadema Urchin and Giant Clam) were observed and their abundance was very low.

Damage due to fish bombing and warm water bleaching was observed during surveys.

3.3 Five Year Comparison

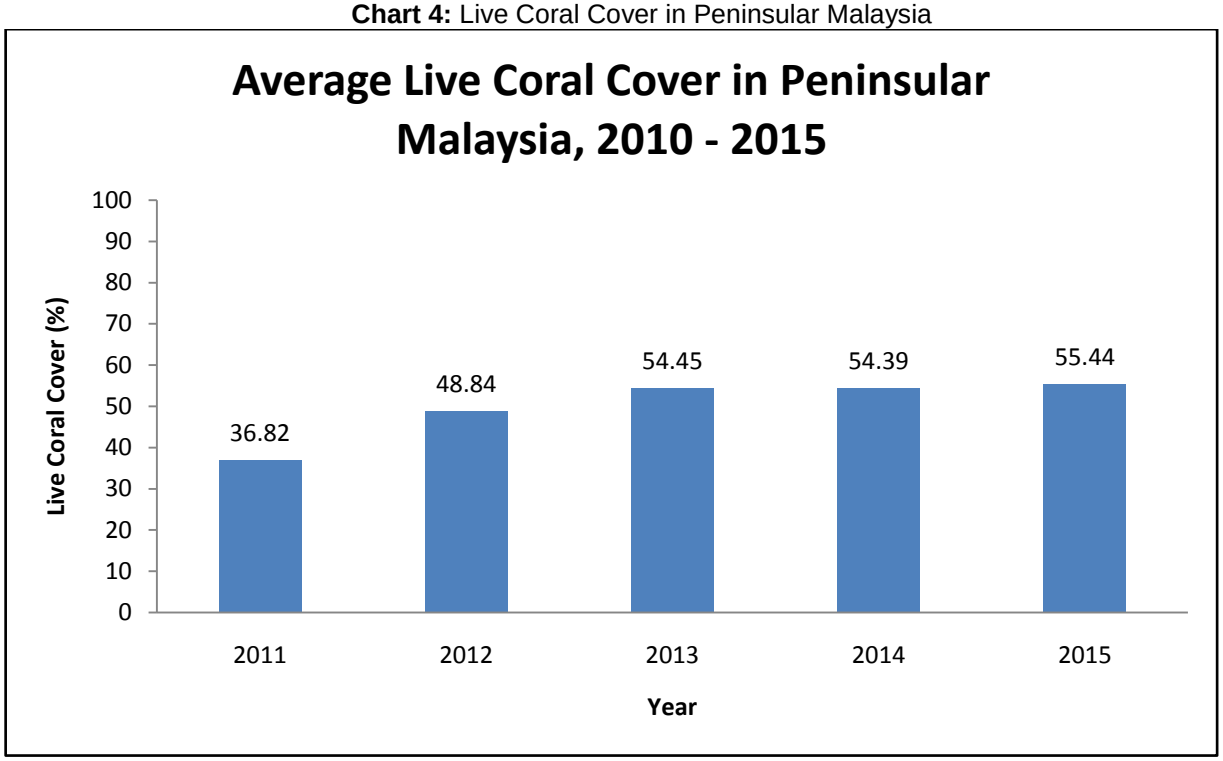
Reef Check data are primarily used for monitoring coral reef health and comparisons of data over time can highlight significant changes and indicate potential problems. This section reviews data collected over the last five years to assess changes to Malaysia's reefs over the period.

3.3.1 Changing LCC: Peninsular vs East Malaysia

As stated above, LCC can be used as a broad indicator of coral reef health. The charts below show changing LCC over the last five years, separated into Peninsular Malaysia and East Malaysia.

Over the last five years, LCC in Peninsular Malaysia has increased from 37% in 2011 to 55% in 2015 (see chart 4). This reflects recovery of reefs from the 2010 bleaching event, which led to coral mortality at a number of sites around Peninsular Malaysia. LCC now appears to have stabilised at around 55%.

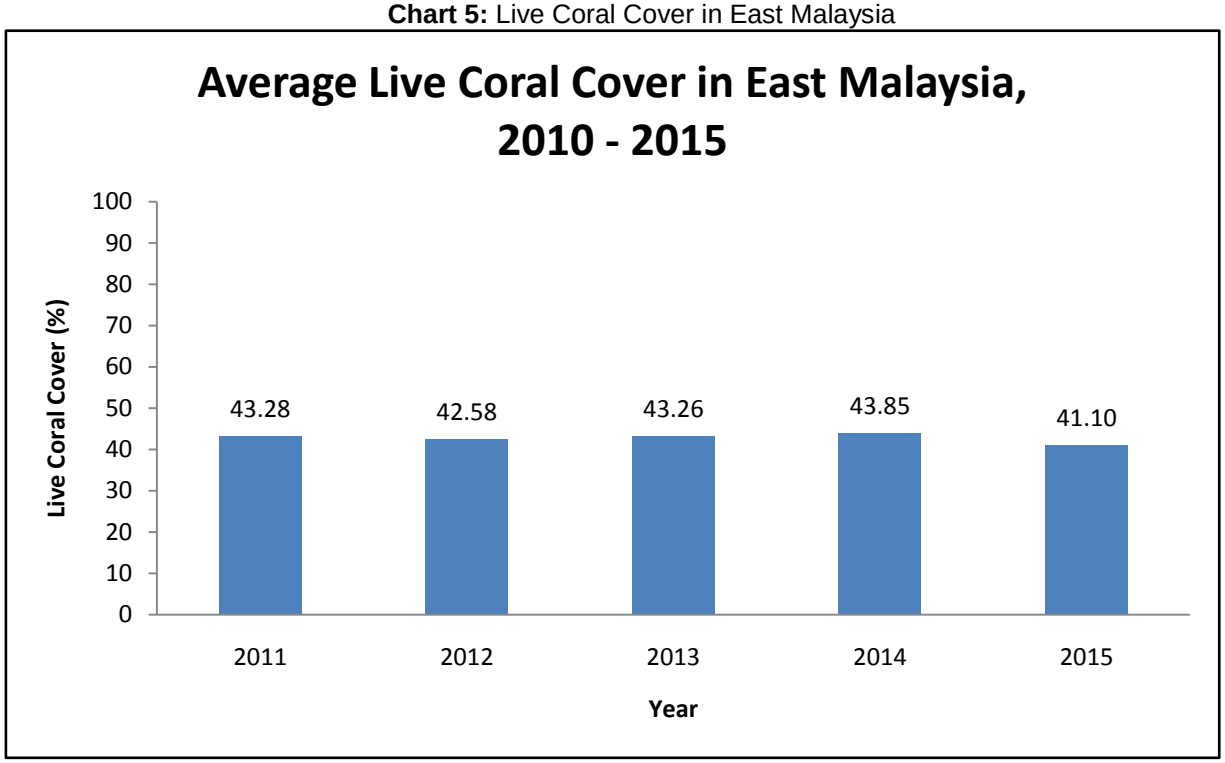
Chart 4: Live Coral Cover in Peninsular Malaysia



In East Malaysia, LCC has been consistently in fair condition, with very little variation from year to year (see chart 5). The 2010 bleaching event was much less pronounced in East Malaysia compared to Peninsular Malaysia, and there was very little coral mortality, hence no recovery pattern from 2010 to 2012 similar to that seen in Peninsular Malaysia.

The slight reduction in LCC in 2015 most likely reflects the addition of a number of new survey sites in East Malaysia during the year, many of which have lower hard coral cover than sites surveyed previously. Some are in areas affected by fish bombing, others in areas affected by development, both of which can adversely affect the health of coral reefs, leading to a decline in average LCC.

Chart 5: Live Coral Cover in East Malaysia



3.3.2 Changing Reef Health in Selected Areas

This section provides details of the health of selected coral reefs in nine reef areas around Malaysia over the five year period from 2011 to 2015. Only sites that were surveyed every year over the period are included in this section, as listed below:

Perhentian (10) Batu Nisan, D' Lagoon, Sea Bell, Tanjung Besi, Batu Layar, Sharkpoint, Batu Tabir, Tukas Laut, Tiga Ruang and Pulau Rawa

Redang (10) Chagar Hutang East, Pulau Lima Southern Tip, P. Paku Kecil, P. Pinang, P. Paku Besar, Redang Kalong House Reef, P. Kerengga Besar, P. Kerengga Kecil, Pasir Akar and Terumbu Kili

Tioman (12) Teluk Kador, Batu Malang, Pirate Reefs, Renggis North, Soyak, Soyak South, Tekek House Reef, Sepoi, Chebeh, Tomok, Labas and Fan Canyon

Tenggol (6) Turtle Point, Gua Rajawali, Teluk Rajawali, Rajawali Reef, Freshwater Bay and Pasir Tenggara

Bidong & Yu (6) Heritage Row, P. Karah, P. Tengkorak, Pasir Tenggara, P. Yu Kecil and P. Yu Besar

Kapas (4) Teluk Jawa, Coral Garden 1, Silent Reef, Coral Garden 3

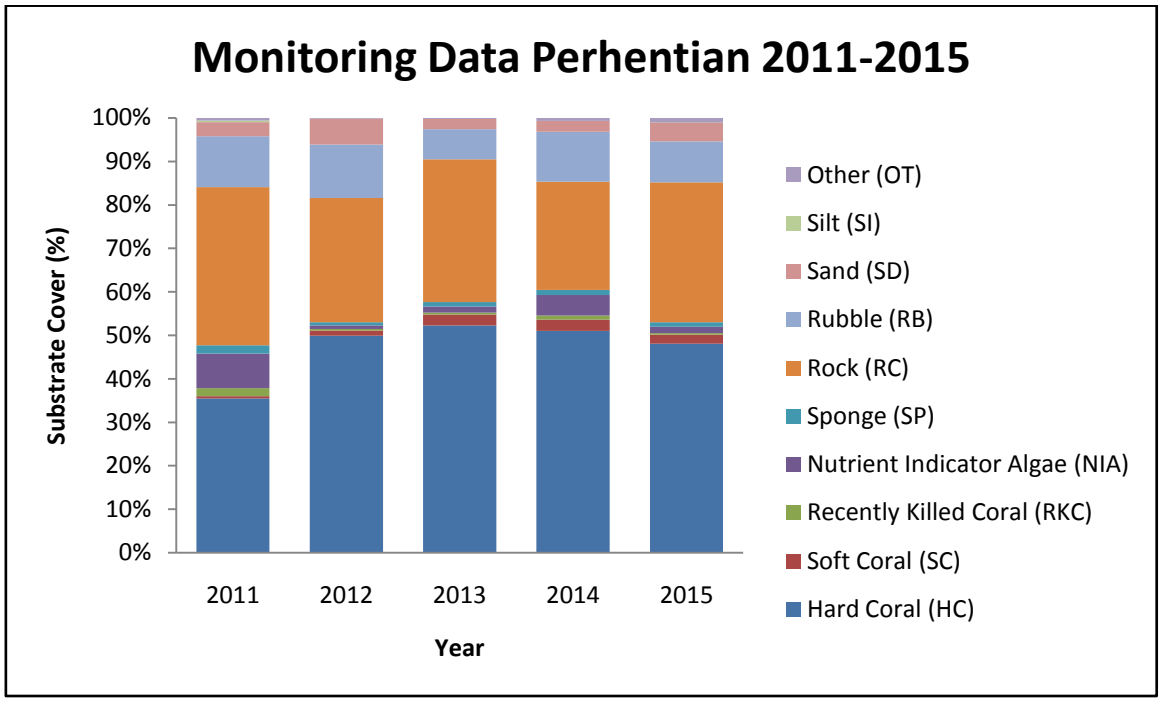
Mataking (6) Cahaya Way, Sting Ray City, Pandanan Bay, Coral Garden, Mataking House Reef and Sweetlips Rock

Lankayan (15) Bimbo Rock, Edwin Rock, Froggie Fort, Goby Rock, Jawfish, Ken's Rock, Lycia Garden, Mel's Rock, Moray Rock, Pegaso, Reef 38, Reef 77, Sandbar S, Veron and Zorro

Miri (6) Siwa 4A, Siwa Penyu, Anemone Centre, Anemone North, Eve's Garden and Sunday Reef

3.3.2.1 Perhentian

The data from surveys conducted on Perhentian over the five years show that there has been some variation in reef health over that period of time. The low HC cover in 2011(35.38%) probably reflects the impact of the major bleaching event experienced in 2010. 2012 surveys then show a substantial recovery, with HC cover increasing tojust over 50% in 2013. However, there is then a slight decline to 2015, perhaps indicating the impact of continuing growth in tourism to the islands.



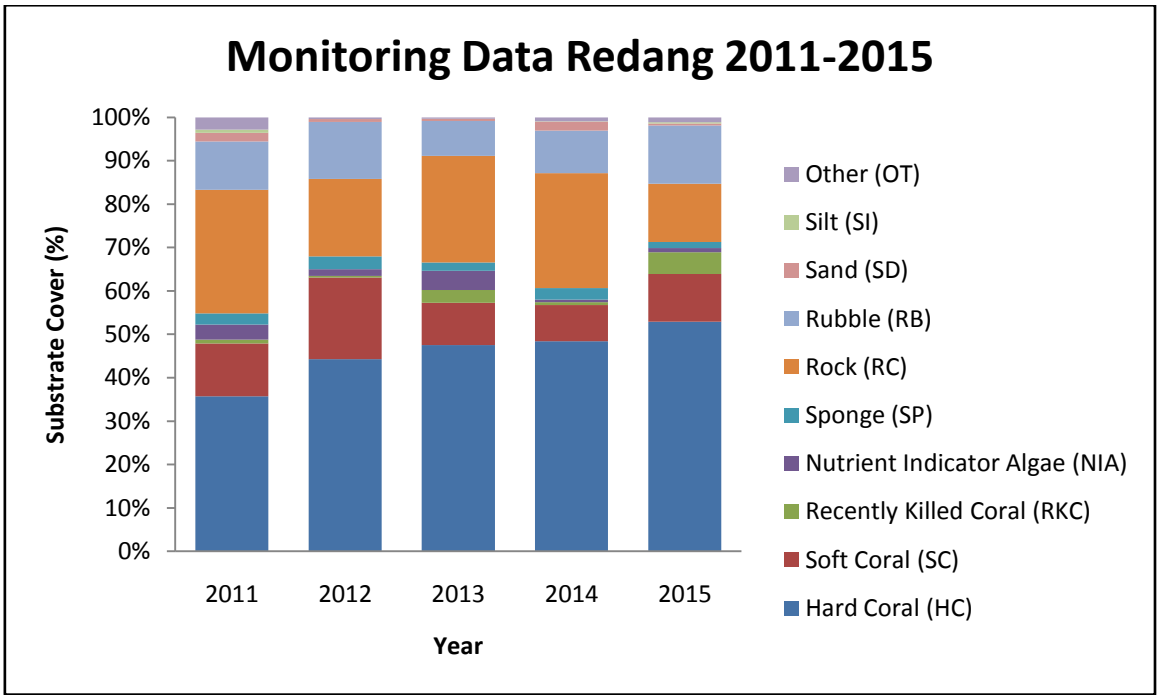
The inconsistent factor is the level of NIA detected during surveys. In 2011the level of NIA was high at 7.94%, followed by a substantial decrease in 2012 to 0.75% and increased again in 2013 and 2014 to 4.75% in 2014. In 2015, NIA level decreased again to 1.5%. These relatively high levels of NIA are probably indicative of raised levels of nutrient in the waters around the islands. This is supported by water testing data (2009) that indicate the presence of sewage pollution around Perhentian, and a review of sewage treatment systems (2011) that highlighted the inadequate sewage treatment systems at many resorts.

From a management perspective, this wide variation presents some challenges as it suggests that the reefs, while being damaged by anthropogenic impacts (particularly sewage pollution) can recover quickly once stressors (e.g., bleaching) are removed. Control of development and improving sewage treatment could have significant benefits for coral reefs around the islands.

3.3.2.2Redang

The overall condition of coral reefs around Redang Island has generally been good since 2011 with average LCC at or above 50% in most years. The increase in HC level in Redang in 2011 is similar to that for Perhentian, indicating recovery from the 2010 bleaching event. The wider variation in SC, from a high of nearly 20% in 2012 to a more typical 10% after 2013 perhaps reflects opportunistic growth of SC in some areas damaged by the bleaching event, which has subsequently been re-colonised by HC.

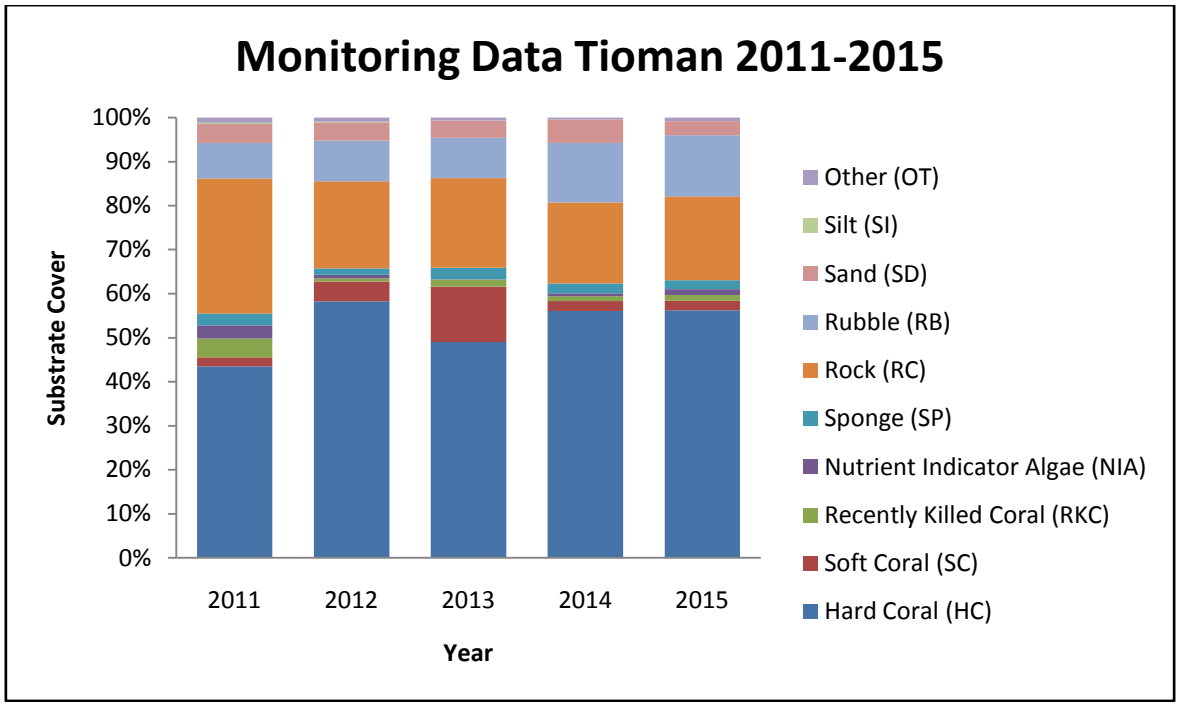
The level of RB has remained high in the range 9 to 17% in the last 5 years, from 2011 to 2015. The sites of most concern are Pulau Paku Besar, Pulau Kerengga Kecil, Pulau Paku Keciland Teluk Mat Delah where RBlevel recorded during the 2015 survey ranges from 16 to 53%. This situation needs to be monitored to ensure no continuing recent damage as it could have a negative impact on the reefs over the long term.



There is only one significant anomaly in the data–the spike in RKC in 2013 and 2015, which showed a significant increase from 0.31% in 2012 to 3.59% in 2013 and from 0.63% in 2014 to 5.86% in 2015. The data is indicative of the value of long term monitoring, which allows changes like this to be tracked and provides opportunities for intervention if necessary.

3.3.2.3 Tioman

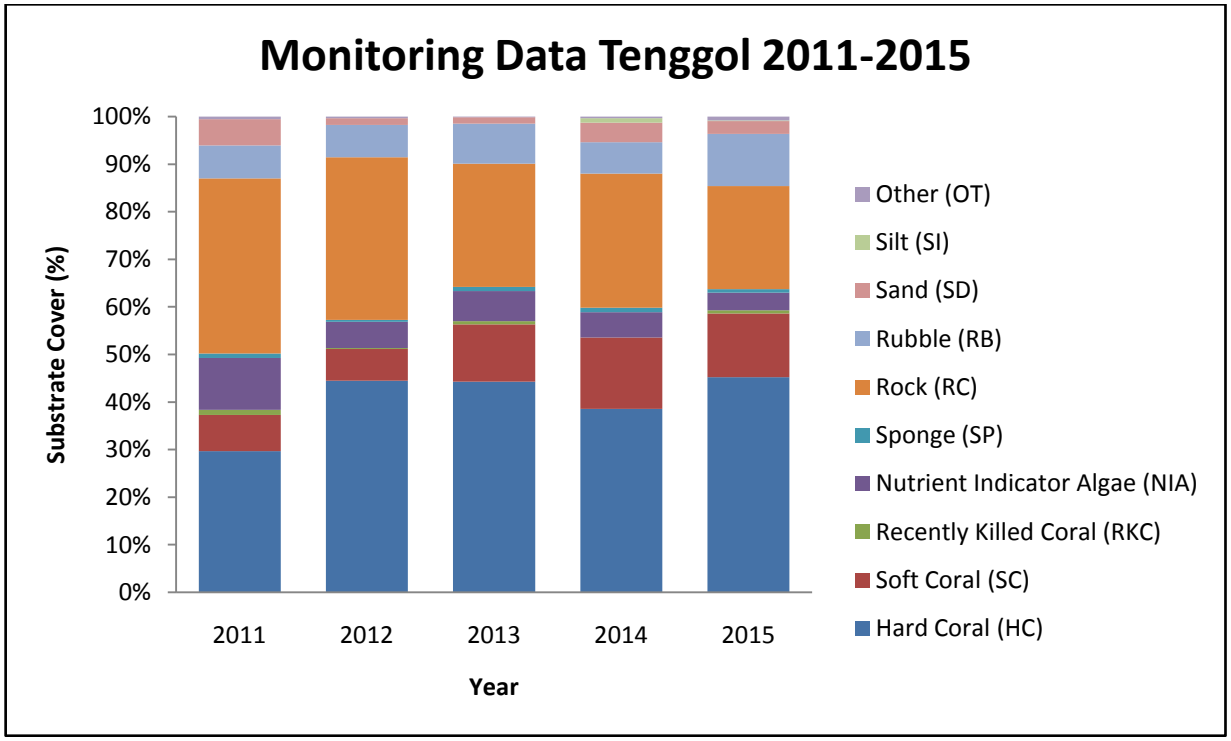
The data from surveys conducted on Tioman over the last five years show that there has been some variationin LCC over that period of time. Generally, the condition of the coral reefs surveyed around the island has been consistently good over the years, with LCC cover above 50% with the exception of 46.79% in 2011 – again reflecting the mortality caused by the 2010 bleaching. In subsequent years, LCC has been consistently been above 60%.



The level of RB remained in the range of 5 to 8% over the first three years of the survey period. However the average level has increased substantially in 2014 and 2015 to 11.22% and 12.63% respectively from 5.91% in 2013. The site of most concern is Labas with RB level increased from 9.38% in 2013 to 50.63% in 2014 and subsequently to 71.88% in 2015. This situation needs to be monitored closely to ensure no continuing damage as it could have a negative impact on the corals over a long term period.

3.3.2.4 Tenggol

The data from surveys conducted on Tenggol since 2011 show a similar pattern to other locations – recovery in LCC since the 2010 bleaching event. The overall condition of coral reefs around Tenggol Island since then has been good, with average LCC above 50%.



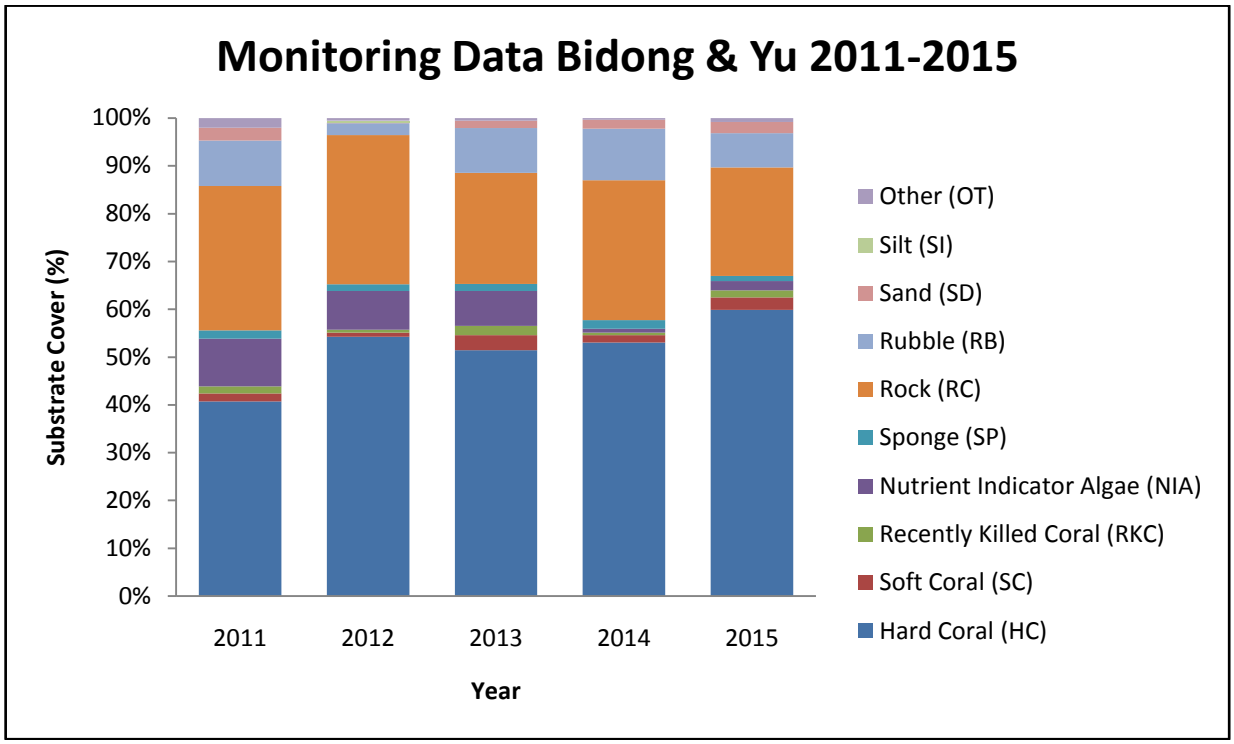
In the last 2-3 years there appears to have been a shift from RC to SC. In some reefs we have observed such changes as being due to zoanthid soft corals colonizing long dead branching hard corals, so that while the “headline” LCC appears healthy the reef is actually undergoing a significant shift to a potentially less stable state – soft coral does not contribute to reef extension. The colonisation of zoanthid on long dead branching hard corals reducesavailable space for hard coral recruits (new hard corals) to attach themselves and grow, thus potentially impeding reef recovery and extension. However, some recent publications suggest that SC “cleans and prepares” dead coral for new HC recruits, leading to reef recovery. This needs to be reviewed after future surveys.

A further concern is the relatively high level of RB over the years, increasing to 7.63% in 2011 and remaining around that level until 2014 after which it increased further. This concern also reflects the level of NIA, which increased to 8.50% in 2011. Although it dropped to 4.50% by 2015, the level is still relatively high. The site of most concern is Freshwater Bay which recorded 38.13% NIA in 2011, reducing to 22.50% by 2015. This high level of NIA is probably indicative of raised levels of nutrient in the waters, most likely due to untreated sewage released by the resorts as this site is located just in front of a stretch of beach where four resorts are located.

It is possible that these three factors are linked. Bleaching in 2010 may have weakened the reefs, causing physical damage (high RB) and a subsequent change from HC to SC, as well as increased amounts of NIA. The reefs in the area may not be highly resilient, and may be susceptible to damage by growing tourism to the island.

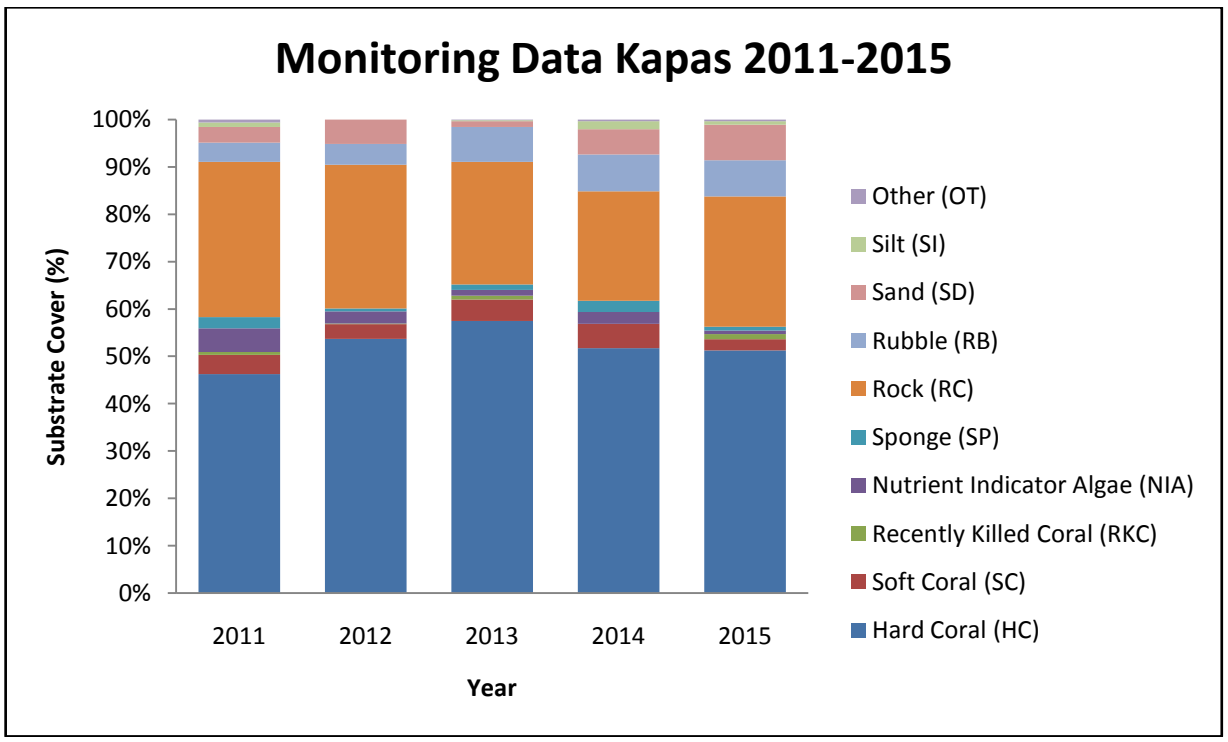
3.3.2.5 Bidong &Yu

The sites around the two islands show a similar trend in LCC to other East coast sites, increasing from 2011-2012 after recovering from the 2010 bleaching event. Further recovery is apparent through to 2015.



However, the data show some inconsistencies over the five year period, with varying levels of RC, RB and NIA. These trends should be monitored to identify the cause and ensure reefs remain healthy.

3.3.2.6 Kapas

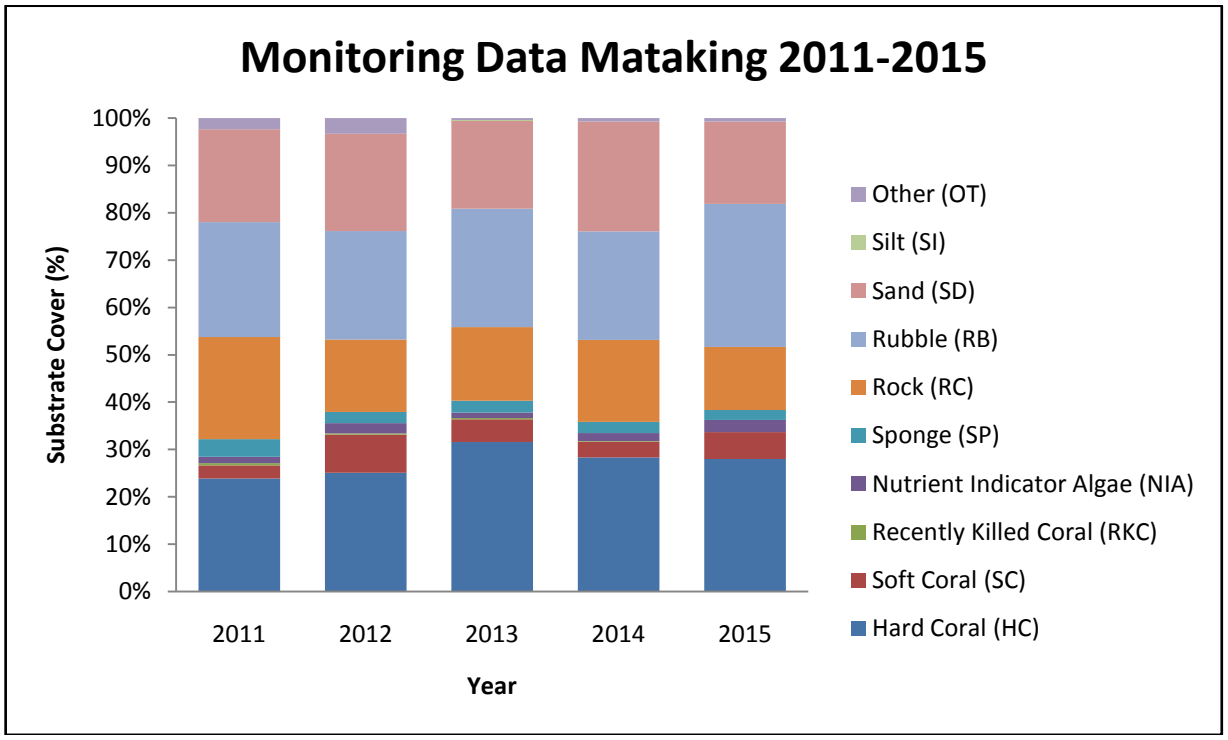


The data on coral reef health in Kapas show a similar pattern to other areas, with a recovery since the bleaching of 2010. However, although LCC is generally above 50% (except for 2011), following a peak of LCC in 2013 there has been an apparent decline in health through to 2015.

The only other significant changes over the period are an increase in RB (to 7.66% in 2015) and an increase in SD to a similar level. This perhaps indicates raised level of human impacts on Kapas (e.g. RB eroding into SD). The cause of these changes needs to be determined so that preventive measure can be taken to ensure no continuing damage to the reefs around the island.

3.3.2.7 Mataking

The data from surveys conducted on Mataking since 2011 show little significant change, with the overall condition of reefs around the Island remaining fair, with average LCC above 25%.



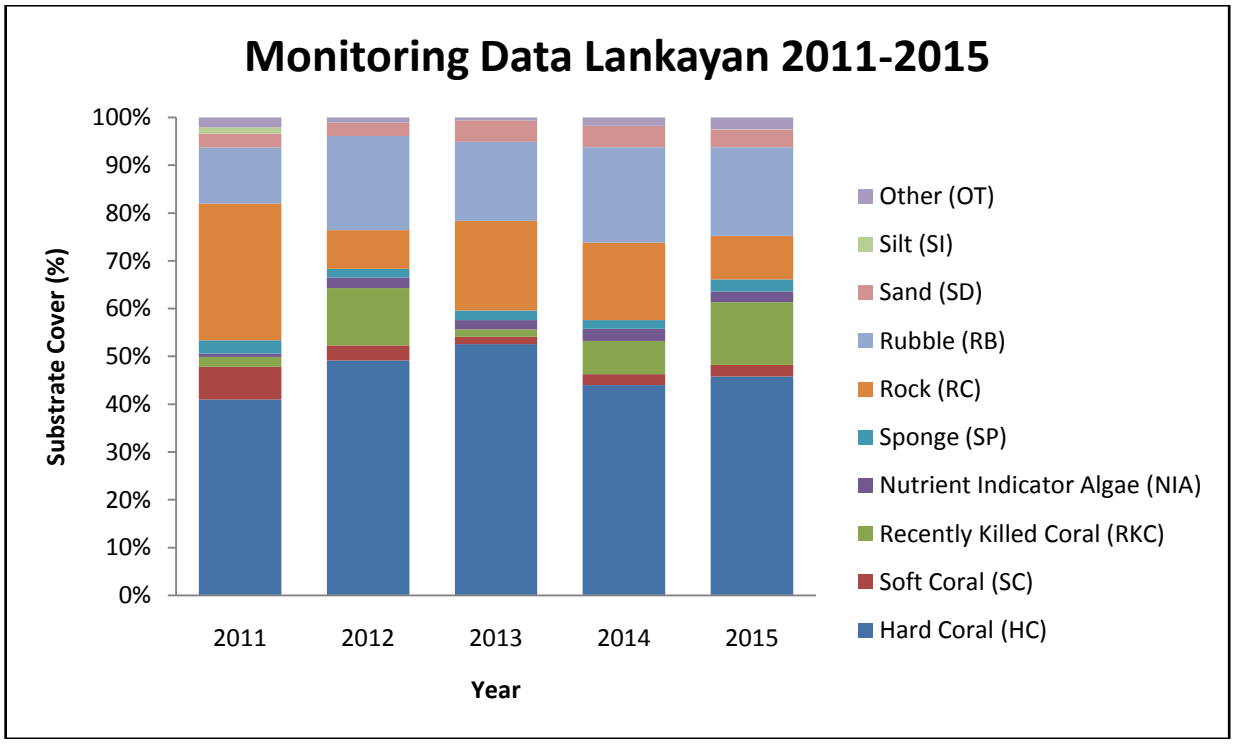
The level of RB has remained very high in the range 22 to 31% in the last 5 years, from 2011 to 2015. Although some of the variability results from lack of permanent transect markers, most of this is a result of known historical and on-going fish bombing in the area. The sites of most concern are Coral Garden Mataking, Pandanan Bay and Sweetlips Rock where RB level recorded during the 2015 survey ranges from 33 to 66%.

It is unlikely that reefs in the area will have the chance to regenerate unless the problem of fish bombing is addressed. This is a common problem in Sabah, and is seen elsewhere in our results. Urgent action is required by the relevant authorities.

3.3.2.8 Lankayan

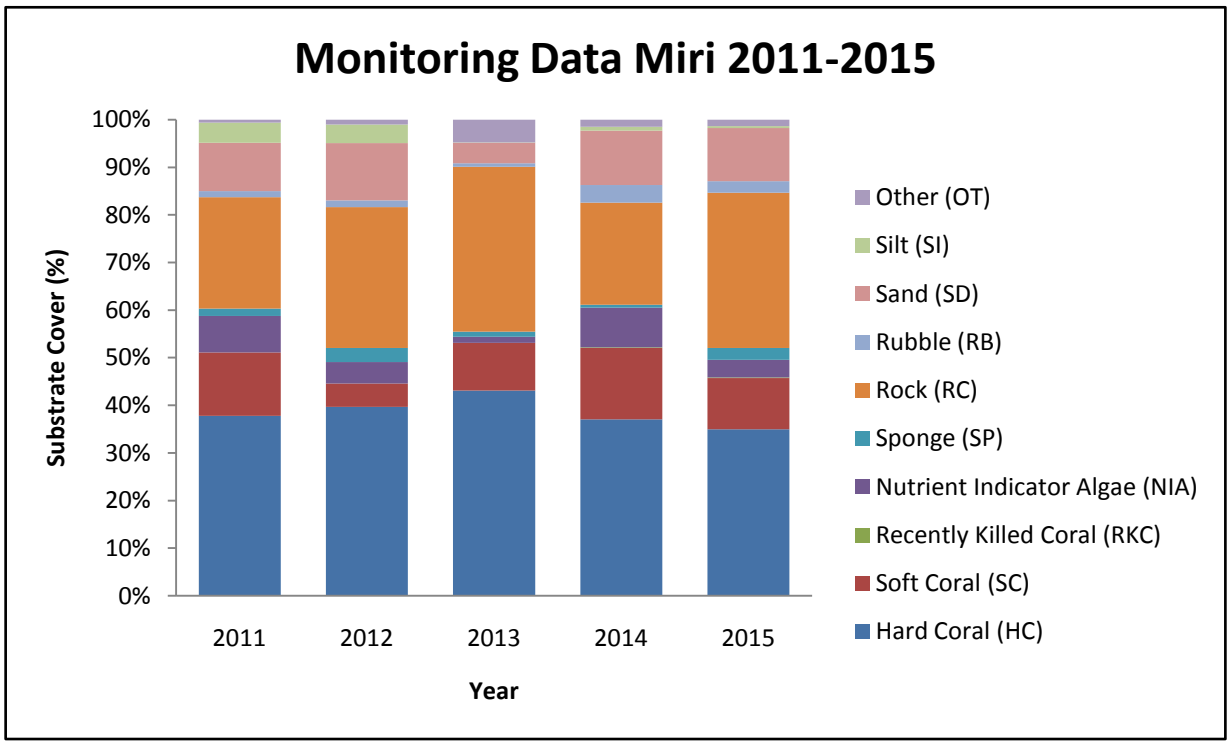
There is wide variation in data from Lankayan. HC increased significantly from 2011 to 2013, but then reduced to 2014. At the same time, RB and RKC both increase, perhaps indicative of the widespread fish bombing in the area.

Overall, reefs around Lankayan are healthier than other areas of Sabah (higher LCC), probably due to the presence of the SIMCA protected area. However, even though the area has effective protection it is still showing signs of the damage that results from fish bombing. There is an urgent need to address this issue, as in other areas.



3.3.2.9 Miri

Surveys conducted in Miri show that the health of reefs varies between fair and good. It is thought that some of the variability in data is a result of not having fixed transects: all the reefs surveyed off Miri are submerged and in open ocean locations, in which it is difficult to establish fixed transects. Although GPS coordinates are used to identify reef areas, locating specific start points can be challenging, hence the variation in data.



Most sites are some distance off shore, and few areas suffer significantly from the impacts of siltation/sedimentation (with the obvious exception of those close to the shore). The main impact to reefs in Miri appears to be over-fishing, with fish populations consistently low. Controlling fishing will have the impact

of allowing fish populations (particularly herbivores) to recover, preventing the increase in NIA seen in two of the five years of surveys.

New reef areas are being opened up for leisure diving and there is a need to increase the number of sites surveyed in Miri to ensure a consistent picture of reef health can be developed.

4. Summary and Recommendations

4.1 Summary

4.1.1 On average, reefs in Malaysia are in fair to good condition, as measured by widely used coral reef health criteria. Average Live Coral Cover (LCC) for Malaysia is 45.95%. However, it should be noted that the average masks a wide range of variation in reef health, from reefs with over 85% live coral cover (LCC) to reefs with below 5% LCC.

4.1.2 Using LCC as a measure, coral reefs in Peninsular Malaysia can be said to be in "better condition" than reefs in East Malaysia. In contrast, diversity and abundance of most fish and invertebrate indicators are higher in East Malaysia.

4.1.3 Average populations of both fish and invertebrate indicators are universally low. Assuming the maximum abundance of any given indicator is an estimate of the potential abundance for any reef, the average abundance of all indicators is several magnitudes lower than the potential (see table below).

Table 3: Average and Maximum abundance of Indicator Species

Fish				**Invertebrates**			
Indicator	Abundance			Indicator	Abundance		
	Avg.	Max.	Max. Site		Avg.	Max.	Max. Site
Butterflyfish	4.06	32.5	Satang Besar West, Kuching	Banded Coral Shrimp	0.11	6	Eel Garden, Mabul
Sweetlips	0.19	5	Lutjanus, Pulau Tiga	Diadema	29.73	478.75	Riza Garden, Mantanani
Snapper	3.85	96.75	Tanjung Basi, Perhentian	Pencil Urchin	0.01	0.5	Denawan 1 , Semporna
Barramundi Cod	0	0	n/a	Collector Urchin	0.01	0.75	South Rim, TSMP
Humphead Wrasse	0.02	1.25	Lobster Lair, Sipadan	Sea Cucumber	1.46	47.5	Soyak South, Tioman
Bumphead Parrotfish	0.15	20	Cleaning Station, Kapalai	Crown of Thorns	0.21	4.5	Pulau Tengkorak, Bidong
Parrotfish	2.36	17	Base Camp, TARP	Triton	0	0.25	Friedrich Heaven 1, Yoshi Point 2, Alert Patches 2, Barracuda Point
Moray Eel	0.07	1.75	Kapalai House Reef, Kapalai	Lobster	0.03	1	Pulau Bakungan 1, Pulau Penyu
Grouper	0.65	5.25	Maliangin Besar 1 & Maliangin Kecil 2A, Maliangin	Giant Clam	0.94	23	D' Lagoon, Perhentian

4.1.4 Analysis of data from surveys conducted since 2011 show few significant changes over time. The data highlight the differences between reefs in different areas, and support the need for local management as conditions vary in each reef area.

4.1.5 Key threats facing coral reefs in Peninsular Malaysia are development and tourism related, with most impacts arising from land-based pollution, sewage pollution, land use change or direct impacts (boats, anchors, users).

4.1.6 Coral reefs in East Malaysia face different threats. In Sabah and Sarawak, threats appear to be population related, with impacts arising from resource use (over-fishing and destructive fishing) and lack of management (few MPAs, limited enforcement and patrolling of extensive coastline).

4.2 Recommendations

Scientists are increasingly recognising that threats to coral reefs can be divided into two broad categories:

- Local threats are those that arise within coral reef areas due to human intervention and activity. They include pollution, sedimentation, over-fishing and direct impacts by reef users
- Global threats arise outside coral reef areas. They are associated with climate change and include coral bleaching and ocean acidification.

There is little that coral reef managers can do about the global threats and coral reef management strategies should focus on addressing the local threats. Identifying local threats, community involvement, funding, building resilience and governance all need to be addressed if local management is to be effective.

4.2.1 Local Threats, Local Management

Many threats to coral reefs arise at the local (island) level, often due to tourism development and local community activities. Such threats are often location specific. Addressing these threats therefore needs action at the local level. This is reflected in the Aichi Biodiversity Targets, of which Target10 states that:

> **By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.**

Reducing anthropogenic pressures on coral reefs will give them greater opportunities to adapt. Working together with Department of Marine Parks Malaysia, RCM has identified a list of 27 local impacts to coral reefs, and has developed Action Plans to reduce these impacts.

It is strongly recommended that the Department allocates sufficient resources to assist the successful dissemination and implementation of those Action Plans. In particular, State Governments, which are responsible for development, should be included in the consultation process as a key decision maker.

Furthermore, it is recommended that DMPM and other management agencies (Sabah Parks, Sarawak Forestry Corporation) review current management strategies and plans for existing protected areas to identify opportunities to strengthen local management and involve local communities in decision making. This will lead to local “buy-in” to management plans, and “ownership” of change initiatives. Two on-going RCM initiatives in Tioman include:

- Capacity building to enable local community members to conduct conservation programmes under contract to DMPM (e.g. mooring buoy management programme, crown of thorns monitoring & management programme)
- Activating the Community Consultative Committee to give local communities a stronger voice in Marine Park management and enhance opportunities to effectively participate in management initiatives and programmes.

If successful, these programmes could easily be replicated in other managed areas.

4.2.2Identifying and Protecting Resilient Coral Reefs

Closely linked to the need to reduce local impacts is the need to build resilience in coral reefs. Resilience is the ability of a system to cope with or adapt to change. The resilience of coral reefs is the biological ability of coral reefs to recover from natural disturbances such as storms and bleaching episodes.

Some reef areas are known to be more resilient than others, and are better able to overcome these external influences. They are therefore essential in seeding damaged areas and contributing to the recovery of those areas.

It is recommended that management agencies conduct broader reef resilience studies to identify resilient areas of reefs and to develop specific management strategies to protect those areas.

4.2.3Stakeholder Involvement: Monitoring andAwareness

Research shows that stakeholder involvement is important in successful coral reef conservation. It is important to make information on coral reefs and reef health available to all stakeholders, and to raise awareness of the need to protect reefs.

- Increase the scale and scope of the existing reef monitoring programme by:
    - Increasing the number of sites covered by the programme in both Peninsular and East Malaysia, and include sites outside existing Marine Protected Areas
    - Encouraging more dive operators to participate in monitoring programmes and train staff as EcoDivers
    - Establish permanent transects for surveys and disseminate details widely among dive operators and government agencies.

- Improve the availability of timely and relevant information to all reef users, including:
    - Install better signage (where relevant) to ensure that visitors realize that ALL waters surrounding the islands form part of the Marine Park, rather than only the area immediately adjacent to the marine park centre; include signs of “do’s and don’ts” in coral reef areas
    - Make available handouts to be given to each visitor to coral reef areas (e.g. “do’s and don’ts” and how and where to report any offense observed).

- Implement more education and awareness campaigns and talks for visitors and operators alike in coral reef areas:
    - Encourage resorts to apply Responsible Tourism guidelines to their operations and improve management practices
    - Establish a rating system for resorts operating in coral reef areas, to provide information to customers on the degree to which operators care for the environment
    - Encourage dive operators to join reef management programmes such as Green Fins and improve education to customers
    - Encourage wise usage of fresh water (storing rainwater from roofs, recycling water for watering plants etc.)
    - Install recycling bins and improve collection of rubbish in all areas.

4.2.4 Expand Marine Protected Areas (MPAs)

Large areas of coral reefs around Malaysia remain unprotected. Protecting reefs in gazetted areas can contribute to increasing their resilience to both natural (e.g. storms, disease) and man-made (e.g. dynamite fishing, pollution, sedimentation) impacts.

Target 11 of the Aichi Targets states that:

> **By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.**

Currently only approximately 1.4% of Malaysia’s territorial waters are in protected areas. There therefore is an urgent need to increase the amount of coral reef within gazetted protected areas, and to put in place the necessary resources to ensure effective enforcement.

In particular, consideration should be given to allowing resorts and communities to have the authority to establish MPAs, which they can manage on a local level. RCM has been involved in discussions with local communities in two areas which we recommend should be gazetted as MPAs:

- Mantanani Island, Sabah: some 45 minutes from Kota Belud, north of Kota Kinabalu, the three islands of the Mantanani Islands group are home to a population of some 1,000 people. Rapid tourism growth in the last five years is adding to local pressures on coral reefs around the islands (including bomb fishing and over-fishing). It is recommended that the local community be involved in discussions to establish an MPA around the islands

- Sembilan Islands, Perak: one of the last remaining significant coral reef areas on Malaysia's West coast, the nine islands of the Sembilan archipelago currently have no protected status. Coastal development and pollution from both terrestrial and marine sources, as well as unregulated fishing, threaten the reefs around the islands. It is recommended that local communities (Pangkor, Manjung) and the fishing industry be invited to participate in developing a suitable protected areas scheme around the islands that both protects existing livelihoods and affords coral reefs there a degree of protection.

4.2.5 Networking MPAs

Scientists increasingly recognise the benefits of incorporating individual MPAs into networks. Networks can be more representative of marine habitats and therefore are more resilient to major environmental changes.

Malaysia currently has a number of individual Marine Parks off the East coast of Peninsular Malaysia that are all treated separately. It is recommended that DMPM consider creating larger managed areas, with zones for multiple users (as is the case with the Great Barrier Reef), by networking existing Marine Parks together with related ecosystems (seagrass beds, mangroves) and fisheries management areas. Such a managed area could be created off the East coast of Peninsular Malaysia, incorporating the entire coastal area, and with no-take zones for conservation (existing Marine Parks), fisheries protected areas (e.g. submerged reefs off the East coast) and fisheries areas. Establishing such a managed area would have numerous benefits, including:

- Coordinating management of related marine ecosystems (coral reefs, seagrass beds, mangroves)
- Leveraging financial resources from tourist islands to protect submerged, non-tourist reefs
- Protecting food security
- Assisting in the introduction of EAFM
- Contributing to Aichi Target 11, requiring 10% of coastal waters to be incorporated into managed areas.

Such an initiative would require extensive consultation with local communities, fishing communities and state planning departments, as well as other stakeholders.

4.2.6Funding Conservation: Private-Public Partnerships

The private sector is taking a greater role in managing protected areas. Private sector operators often have a greater incentive to manage and conserve an area, for example because it enhances their business, or provides greater economic security for local communities. The benefit to government of private sector management is that government no longer has to fund conservation; the operator takes responsibility for raising funds for management and conservation.

Malaysia already has one example of a private-public partnership in reef conservation – the Sugud Island Marine Conservation Area (SIMCA). It is recommended that the model be adapted and used in other areas to increase private sector involvement in management of marine areas. It is essential that local communities be fully consulted and involved in any management agreements and discussion of management plans, as they are most likely to be affected by, and beneficiaries of, such agreements. Their buy-in is essential for success.

4.3 Conclusion

The 2015 review of the health of coral reefs around Malaysia indicates that reefs are generally in "fair" or "good" condition, though it is acknowledged that these averages mask variations in different reef areas.

Coral reefs are an important biological and economic resource in Malaysia, providing food and jobs for thousands of people. Reefs must be conserved for the benefit of future generations.

While the current status of Malaysia's reefs appears relatively stable, there is no room for complacency. All stakeholders, particularly management agencies (DMPM in Peninsular Malaysia and Sabah Parks/Sarawak Forestry Corporation in East Malaysia) and State governments must take action to reduce local threats in order to ensure reefs are strong and resilient, and able to withstand major disruptions from global threats in the future.

Acknowledgements

We are grateful to the following sponsors for their support during 2015:

Sime Darby YAYASAN	**Yayasan Sime Darby:**supporting a five year programme on Tioman island to build reef resilience and social resilience.
CIMB FOUNDATION	**CIMB Foundation:**funding a clean-up campaign and plastic recycling system on Mantanani Island, Sabah.
VALE	**Vale Malaysia:** providing support to local communities in Perak through alternative livelihoods and investments in social assets.
KPMG	**KPMG in Malaysia:** donates funds to support a Corporate Reef Check team and education programmes in two schools in KL.
MURPHY	**Murphy Oil Corporation:** supporting reef rehabilitation and community awareness efforts in Mantanani island, Sabah.
YTL SINCE 1955	**YTL:** Supporting efforts by RCM to improve coral reefs around Malaysia, including through its Pangkor Laut Resort which supports surveys at the Sembilan islands.
KHAZANAH NASIONAL	**The Khazanah Grants Programme** aims to guide all its Civil Society Partner Organisations towards achieving sustainable funding, operational excellence and organisational development.
SGP The GEF Small Grants Programme	**SGP:** funding a programme of work in Sabah to raise awareness of the negative impacts of fish bombing, including education and public awareness campaigns.
LA MER	**La Mer:** donates funds to support a Reef Check survey programme in Lahad Datu, Sabah.
KOSÉ	**Kose:** supporting reef rehabilitation programmes.
Russell Bedford	**Russell Bedford LC & Company:** provides *pro bono* company secretarial services for RCM.
JABATAN TAMAN LAUT MALAYSIA	**Department of Marine Park Malaysia:** donates funds and assists Reef Check surveys on Marine Park islands, as well as supports Reef Check reef rehabilitations and island-based school programmes.
THE BOARD OF TRUSTEES OF THE SABAH PARKS	**Sabah Parks:** assists Reef Check surveys on Sabah Park islands.

Reef Check Malaysia cannot work in isolation. We continue to maintain a close working relationship with the **Department of Marine Park Malaysia**, Ministry of Natural Resources and Environment, and **Sabah Parks**. In addition, we work with scientists at several universities and our **Scientific Advisory Council** (current members are Affendi Yang Amri and Jillian Ooi at UM, and Gopinath Nagaraj at FanLi Consulting) to ensure our work is scientifically robust. Finally our **Board of Trustees** (Ning Baizura, Lim Jit Cheng, Kevin Hiew, Ruth Yeoh and Gordon Reid) provides advice on governance and fund raising. We are grateful to them for their guidance and expertise.

We work through a small network of dive centres and NGOs, who continue to support our work. These include:

Reef Check Certified Facilities:

- Bubbles Dive Centre, Perhentian
- Redang Kalong, Redang
- Scuba Explorers, Tenggol
- Tioman Dive Centre, Tioman
- Borneo Divers, KK
- Reef Guardian, Lankayan, Sandakan
- Mataking Reef & Dive Resort.
- Usukan Cove Lodge Dive Centre, KK
- Scuba Junkie, Semporna

Other dive operators:

- Aqua Sport Divers, Kapas
- Kapalai Resort
- Scooba Tank and Mari Mari Dive Lodge, Mantanani.
- B&J Diving Centre, Tioman
- Darvel Bay Diving, Lahad Datu
- Red Monkey Divers, Miri
- Pelangi Resort, Redang

NGOs:

- MNS Miri Branch
- Blue Temple Conservation
- Juara Turtle Project
- WWF Malaysia
- Banggi Youth Club

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Appendix 1: Survey Sites (2015)

Sunda Shelf

No.	Site Name	Island	Coordinate
SS 1.1	Batu Layar	Perhentian	5 54.722 N 102 44.693 E
SS 1.2	Batu Nisan	Perhentian	5 55.259 N 102 43.536 E
SS 1.3	Batu Tabir	Perhentian	5 56.345 N 102 43.321 E
SS 1.4	Tukas Laut	Perhentian	5 53.162 N 102 46.216 E
SS 1.5	Tiga Ruang	Perhentian	5 54.867 N 102 45.244 E
SS 1.6	D' Lagoon	Perhentian	5 55.927 N 102 43.395 E
SS 1.7	P. Rawa	Perhentian	5 57.777 N 102 40.833 E
SS 1.8	Sea Bell	Perhentian	5 54.636 N 102 42.589 E
SS 1.9	Shark Point	Perhentian	5 53.044 N 102 44.821 E
SS 1.10	Tanjung Basi	Perhentian	5 55.387 N 102 45.518 E
SS 2.1	Teluk Mat Delah	Redang	5 47.970 N 103 01.017 E
SS 2.2	Chagar Hutang East	Redang	5 49.038 N 103 00.597 E
SS 2.3	P. Kerengga Besar	Redang	5 45.261 N 103 01.737 E
SS 2.4	P. Kerengga Kecil	Redang	5 45.519 N 103 01.751 E
SS 2.5	P. Lima Southern Tip	Redang	5 46.397 N 103 03.553 E
SS 2.6	P. Paku Besar	Redang	5 46.777 N 103 02.557 E
SS 2.7	P. Paku Kecil	Redang	5 46.305 N 103 02.338 E
SS 2.8	P. Pinang Marine Park Centre	Redang	5 44.814 N 102 59.987 E
SS 2.9	Pasir Akar	Redang	5 44.398 N 102 59.955 E
SS 2.10	Redang Kalong HR	Redang	5 45.660 N 103 01.584 E
SS 2.11	Terumbu Kili	Redang	5 43.928 N 102 59.825 E
SS 2.12	Mak Simpan	Redang	5 47.302 N 102 59.556 E
SS 3.1	Pirates Reef	Tioman	2 49.428 N 104 09.445 E
SS 3.2	Renggis North	Tioman	2 48.594 N 104 08.183 E
SS 3.3	Fan Canyon	Tioman	2 54.650 N 104 06.753 E
SS 3.4	Soyak South	Tioman	2 52.480 N 104 08.810 E
SS 3.5	Soyak North	Tioman	2 52.560 N 104 08.884 E
SS 3.6	Batu Malang	Tioman	2 54.139 N 104 06.148 E
SS 3.7	Tekek House Reef	Tioman	2 48.960 N 104 09.062 E
SS 3.8	Chebeh	Tioman	2 55.946 N 104 05.814 E
SS 3.9	Sepoi	Tioman	2 53.883 N 104 03.100 E
SS 3.10	Teluk Kador	Tioman	2 54.891 N 104 06.507 E
SS 3.11	Tumuk	Tioman	2 47.581 N 104 07.335 E
SS 3.12	Labas	Tioman	2 53.318 N 104 03.920 E
SS 3.13	Teluk Dalam	Tioman	2 52.456 N 104 11.254 E
SS 3.14	Jahat East	Tioman	2 40.127 N 104 10.518 E
SS 3.15	Munjor South	Tioman	2 44.492 N 104 13.068 E
SS 3.16	Nayak	Tioman	2 46.758 N 104 12.760 E
SS 3.17	Saing	Tioman	2 45.502 N 104 11.950 E
SS 3.18	Batu Nipah	Tioman	2 43.928 N 104 08.125 E
SS 4.1	Coral Garden 1	Kapas	5 14.113 N 103 15.678 E

SS 4.2	Coral Garden 3	Kapas	5 14.149 N 103 15.782 E
SS 4.3	Silent Reef	Kapas	5 13.785 N 103 16.079 E
SS 4.4	Teluk Jawa	Kapas	5 12.526 N 103 16.165 E
SS 4.5	Jellyfish City	Kapas	5 13.468 N 103 15.658 E
SS 5.1	Heritage Row	Bidong/Yu	5 36.922 N 103 03.412 E
SS 5.2	Pasir Tenggara	Bidong/Yu	5 36.607 N 103 03.780 E
SS 5.3	P. Karah	Bidong/Yu	5 35.935 N 103 03.851 E
SS 5.4	P. Tengkorak	Bidong/Yu	5 39.967 N 103 04.277 E
SS 5.5	P. Yu Besar	Bidong/Yu	5 38.615 N 103 09.063 E
SS 5.6	P. Yu Kecil	Bidong/Yu	5 37.533 N 103 09.570 E
SS 6.1	Freshwater Bay	Tenggol	4 48.546 N 103 40.669 E
SS 6.2	Gua Rajawali	Tenggol	4 48.768 N 103 40.556 E
SS 6.3	Pasir Tenggara	Tenggol	4 48.021 N 103 40.456 E
SS 6.4	Rajawali Reef	Tenggol	4 49.037 N 103 40.755 E
SS 6.5	Turtle Point	Tenggol	4 48.364 N 103 40.468 E
SS 6.6	Teluk Rajawali	Tenggol	4 48.931 N 103 40.824 E
SS 7.1	Bumphead Bay	Pemanggil	2 35.066 N 104 20.180 E
SS 7.2	Lobster Bay	Pemanggil	2 34.237 N 104 19.306 E
SS 7.3	Pemanggil Village South	Pemanggil	2 34.761 N 104 18.945 E
SS 7.4	Tridacna Bay	Pemanggil	2 35.790 N 104 19.588 E
SS 9.1	P. Mentinggi	Tinggi	2 16.405 N 104 06.940 E
SS 9.2	P. Nanga	Tinggi	2 16.274 N 104 07.640 E
SS 9.3	P. Ibol	Tinggi	2 18.183 N 104 08.935 E
SS 9.4	P. Tanjung Gua Subang	Tinggi	2 18.792 N 104 07.552 E
SS 10.1	Buntut Meriam	Sibu	2 13.860 N 104 03.130 E
SS 10.2	Malang Acha	Sibu	2 11.040 N 104 06.409 E
SS 10.3	Beach 3	Sibu	2 11.268 N 104 05.888 E
SS 10.4	Sibu Hujung	Sibu	2 10.374 N 104 06.721 E
SS 10.5	Sibu Kukus	Sibu	2 10.696 N 104 06.553 E
SS 10.6	The Coconut	Sibu	2 13.567 N 104 03.184 E
SS 11.1	Siwa 4A	Miri	4 16.383 N 113 48.883 E
SS 11.2	Siwa Penyu	Miri	4 16.583 N 113 49.050 E
SS 11.3	Anemone Centre	Miri	4 17.550 N 113 49.550 E
SS 11.4	Anemone North	Miri	4 17.616 N 113 49.566 E
SS 11.5	Eve's Garden	Miri	4 20.583 N 113 53.900 E
SS 11.6	Sunday Reef	Miri	4 17.217 N 113 49.167 E
SS 12.2	Satang Besar West	Kuching	1 47.202 N 110 09.475E
SS 12.3	Satang Besar East	Kuching	1 46.983 N 110 10.041 E

Malacca Strait

No.	Site Name	Island	Coordinate
MS 1.1	Pasir Tengkorak P. Lalang	Sembilan	4 00.162 N 100 32.802 E
MS 1.2	Site 1 P.Saga	Sembilan	4 00.732 N 100 32.694 E
MS 1.3	Site 2 P. Lalang	Sembilan	4 00.099 N 100 32.945 E
MS 1.4	Site 2 P. Rumbia	Sembilan	4 01.344 N 100 32.874 E

MS 1.5	Zoanthid Garden P. Rumbia	Sembilan	4 01.926 N 100 33.000 E
MS 1.6	P. Buluh	Sembilan	3 59.650 N 100 32.048 E
MS 1.7	Anemone Garden P. Saji	Sembilan	4 00.390N 100 32.088 E
MS 1.8	Frogfish P. Nipis	Sembilan	4 03.450 N 100 32.382 E
MS 1.9	Rock Garden	Sembilan	4 00.684 N 100 32.106 E
MS 2.1	Pangkor Laut	Pangkor	4 11.393 N 100 32.899 E
MS 3.1	Coral Garden	Payar	6 03.371 N 100 02.157 E
MS 3.2	Singapore Bay	Payar	6 03.639 N 100 02.472 E
MS 3.3	Langkawi Coral	Payar	6 03.951 N 100 02.606 E

North Borneo

No.	Site Name	Island	Coordinate
NB 1.1	Bimbo Rock	Lankayan	6 31.240 N 117 55.763 E
NB 1.2	Edwin Rock	Lankayan	6 30.806 N 117 55.499 E
NB 1.3	Froggie Fort	Lankayan	6 30.806 N 117 54.337 E
NB 1.4	Goby Rock	Lankayan	6 28.745 N 117 53.448 E
NB 1.5	Jawfish	Lankayan	6 29.182 N 117 54.670 E
NB 1.6	Ken's Rock	Lankayan	6 30.393 N 117 55.651 E
NB 1.7	Lycia Garden	Lankayan	6 29.895 N 117 55.634 E
NB 1.8	Mel's Rock	Lankayan	6 29.140 N 117 53.584 E
NB 1.9	Moray Reef	Lankayan	6 33.125 N 117 56.141 E
NB 1.10	Pegaso	Lankayan	6 33.726 N 117 55.210 E
NB 1.11	Reef 38	Lankayan	6 32.619 N 117 55.201 E
NB 1.12	Reef 77	Lankayan	6 33.124 N 117 55.482 E
NB 1.13	Sandbar S	Lankayan	6 29.900 N 117 54.681 E
NB 1.14	Veron	Lankayan	6 31.259 N 117 54.944 E
NB 1.15	Zorro	Lankayan	6 30.470 N 117 55.218 E
NB 2.1	Cahaya Way	Mataking	4 30.252 N 118 56.504 E
NB 2.2	Coral Garden	Mataking	4 34.212 N 118 57.415 E
NB 2.3	Mataking House Reef	Mataking	4 34.758 N 118 56.415 E
NB 2.4	Pandanan Bay	Mataking	4 34.907 N 118 54.795 E
NB 2.5	Stingray City	Mataking	4 33.359 N 118 55.627 E
NB 2.6	Sweetlips Rock	Mataking	4 35.960 N 118 56.454 E
NB 3.2	Uban-Uban	Usukan Cove	6 23.442 N 116 19.342 E
NB 3.3	Pandan-Pandan	Usukan Cove	6 21.265 N 116 18.666 E
NB 3.4	Poduko	Usukan Cove	6 22.322 N 116 19.438 E
NB 3.5	Lok Liak	Usukan Cove	6 22.126 N 116 19.101 E
NB 3.6	Keramat	Usukan Cove	6 23.635 N 116 19.637 E
NB 4.1	Sahara	Mantanani	6 43.295 N 116 20.905 E
NB 4.2	Abalone	Mantanani	6 43.207 N 116 22.105 E
NB 4.3	Police Gate	Mantanani	6 42.730 N 116 20.313 E
NB 4.4	Italian Place	Mantanani	6 42.308 N 116 19.232 E
NB 4.5	Riza Garden	Mantanani	6 42.136 N 116 21.812 E
NB 4.6	Linggisan	Mantanani	6 42.832 N 116 20.084 E
NB 4.7	Stingray Point	Mantanani	6 42.764 N 116 19.771 E

NB 4.8	Indian Brothers	Mantanani	6 43.191 N 116 20.454 E
NB 4.9	Mari Mari House Reef	Mantanani	6 42.396 N 116 19.275 E
NB 4.10	Coral Reef	Mantanani	6 42.389 N 116 20.840 E
NB 4.11	Kolam	Mantanani	6 43.930 N 116 21.567 E
NB 5.1	Base Camp	TARP, Kota Kinabalu	6 00.491 N 116 01.322 E
NB 5.2	Mamutik	TARP, Kota Kinabalu	5 58.067 N 116 00.756 E
NB 5.3	Manukan West	TARP, Kota Kinabalu	5 58.246 N 115 59.659 E
NB 5.4	Mid Reef	TARP, Kota Kinabalu	5 58.433N 116 00.750 E
NB 5.5	Teluk Melohom	TARP, Kota Kinabalu	6 01.011N 116 02.876E
NB 5.6	Police Beach	TARP, Kota Kinabalu	6 02.483 N 116 01.183 E
NB 5.7	Sapi	TARP, Kota Kinabalu	6 00.479 N 116 00.190 E
NB 5.8	Sulug	TARP, Kota Kinabalu	5 57.547 N 115 59.464 E
NB 5.9	Meranggis Reef	TARP, Kota Kinabalu	6 02.067 N 116 01.717 E
NB 5.10	Ribbon Reef	TARP, Kota Kinabalu	6 01.551 N 116 00.272 E
NB 5.11	Tanjung Wokong	TARP, Kota Kinabalu	5 59.433 N 116 02.417 E
NB 5.12	Teluk Kuari	TARP, Kota Kinabalu	6 00.501 N 116 01.880 E
NB 5.13	Teluk Tavajun	TARP, Kota Kinabalu	6 01.667 N 116 03.133 E
NB 6.1	House Reef	Lahad Datu	4 58.027 N 118 15.841 E
NB 6.2	Cabbage Reef	Lahad Datu	4 56.927 N 118 15.470 E
NB 6.3	Paradise	Lahad Datu	4 56.548 N 118 17.637 E
NB 6.4	Lam's Point	Lahad Datu	4 56.275 N 118 16.464 E
NB 6.5	Nemo Garden	Lahad Datu	4 56.494 N 118 16.945 E
NB 6.6	Fish Eyes	Lahad Datu	4 57.782 N 118 15.165 E
NB 6.7	Mid Reef	Lahad Datu	4 54.740 N 118 15.256 E
NB 6.8	Small Reef	Lahad Datu	4 54.444N 118 14.595 E
NB 6.9	Adam's Point	Lahad Datu	4 57.052 N 118 15.473 E
NB 6.10	Ira's Reef	Lahad Datu	4 55.412 N 118 15.363 E
NB 6.11	Light House	Lahad Datu	4 56.922 N 118 15.076 E
NB 6.12	Pulau Burung	Lahad Datu	4 55.439 N 118 16.003 E
NB 6.13	Pulau Laila	Lahad Datu	4 55.811 N 118 13.711 E
NB 6.14	Pulau Tabun	Lahad Datu	4 55.246 N 118 12.076 E
NB 6.15	Tumunong Hallo	Lahad Datu	4 54.510 N 118 10.644 E
NB 7.1	Kapalai Rock	Kapalai	4 12.615 N 118 40.797 E
NB 7.2	Great Wall	Kapalai	4 13.767 N 118 40.800 E
NB 7.3	Little Okinawa	Kapalai	4 12.850 N 118 40.533 E
NB 7.4	Cleaning Station	Kapalai	4 13.517 N 118 41.283 E
NB 7.5	Kapalai House Reef	Kapalai	4 13.577 N 118 41.098 E
NB 8.1	Alert Patches 2	Semporna	4 09.139 N 118 15.451 E
NB 8.2	Alert Patches 3	Semporna	4 09.808 N 118 16.511 E
NB 8.3	Mid Rock	Semporna	4 10.683 N 118 18.467 E
NB 8.4	Cust Reef	Semporna	4 17.226 N 118 43.520 E
NB8.5	Darby Bank	Semporna	4 06.751 N 118 13.504 E
NB 8.6	Erzherhog Reef	Semporna	4 14.363 N 118 26.011 E
NB 8.7	Friedrich Heaven 1	Semporna	4 14.363 N 118 26.011 E

NB 8.8	Hand Rock	Semporna	4 08.455 N 118 10.792 E
NB 8.9	Yoshi Point 1	Semporna	4 15.307 N 118 32.028 E
NB 8.10	Yoshi Point 2	Semporna	4 14.193 N 118 33.190 E
NB 8.11	Second Beach Si Amil	Semporna	4 18.800 N 118 52.583 E
NB 8.12	Third Beach Si Amil	Semporna	4 18.949 N 118 52.501 E
NB 8.13	Denawan 1	Semporna	4 18.017 N 118 50.433 E
NB 9.1	Eel Garden	Mabul	4 13.883 N 118 38.017 E
NB 9.2	Ribbon Valley	Mabul	4 14.046 N 118 38.255 E
NB 9.3	Stingray City	Mabul	4 14.222 N 118 37.641 E
NB 9.4	Panglima	Mabul	4 14.922 N 118 37.529 E
NB 9.5	Paradise	Mabul	4 14.989 N 118 37.830 E
NB 10.1	Lutjanus	Pulau Tiga	5 43.213 N 115 38.688 E
NB 10.2	Larai-Larai	Pulau Tiga	5 43.017 N 115 38.097 E
NB 10.3	Tanjung Putri	Pulau Tiga	5 42.517 N 115 39.195 E
NB 10.4	Tagi Beach	Pulau Tiga	5 42.768 N 115 40.347 E
NB 10.5	Senanggol	Pulau Tiga	5 42.482 N 115 41.958 E
NB 10.6	Mid Reef	Pulau Tiga	5 42.302 N 115 37.705 E
NB 11.2	Kapikan Reef	TSMP, Semporna	4 37.698 N 118 50.112 E
NB 11.3	Mantabuan	TSMP, Semporna	4 37.933 N 118 47.798 E
NB 11.4	Ribbon Reef	TSMP, Semporna	4 36.135 N 118 46.090 E
NB 11.5	South Rim	TSMP, Semporna	4 34.078 N 118 45.498 E
NB 11.6	Sibuan	TSMP, Semporna	4 39.154 N 118 39.884 E
NB 11.7	Tanjung Kenangan	TSMP, Semporna	4 35.127 N 118 47.155 E
NB 12.1	Barracuda Point	Sipadan	4 07.130 N 118 37.745 E
NB 12.2	Coral Garden	Sipadan	4 06.342 N 118 37.722 E
NB 12.3	Drop Off	Sipadan	4 07.092 N 118 37.675 E
NB 12.4	Hanging Garden	Sipadan	4 06.703 N 118 37.495 E
NB 12.5	Lobster Lair	Sipadan	4 06.557 N 118 37.540 E
NB 12.6	Mid Reef	Sipadan	4 06.812 N 118 38.158 E
NB 12.8	South Point	Sipadan	4 06.258 N 118 38.110 E
NB 12.9	Staghorn Crest	Sipadan	4 06.257 N 118 37.895 E
NB 12.10	Turtle Patch	Sipadan	4 06.450 N 118 38.177 E
NB 12.11	White Tip	Sipadan	4 07.137 N 118 38.055 E
NB 12.12	West Ridge North	Sipadan	4 06.910 N 118 37.487 E
NB 13.1	Mid Reef	Pulau Penyu	6 10.402 N 118 04.287 E
NB 13.2	Pulau Bakungan 1	Pulau Penyu	6 10.192 N 118 06.538 E
NB 13.3	Pulau Bakungan 2	Pulau Penyu	6 09.805 N 118 06.483 E
NB 13.4	Pulau Gulisan	Pulau Penyu	6 09.268 N 118 03.512 E
NB 13.5	Selingan	Pulau Penyu	6 10.813 N 118 03.803 E
NB 14.1	Balambangan 1	Balambangan	7 11.165 N 116 51.860 E
NB 14.2	Balambangan 2	Balambangan	7 11.365 N 116 52.184 E
NB 14.3	Balambangan 3	Balambangan	7 12.205 N 116 50.591 E
NB 15.1	Maliangin Kecil 1	Maliangin	7 04.829 N 117 00.807 E
NB 15.2	Maliangin Kecil 2A	Maliangin	7 04.706 N 117 01.772 E

NB 15.3	Maliangin Kecil 3	Maliangin	7 04.430 N 117 01.318 E
NB 15.4	Maliangin Kecil 5	Maliangin	7 04.570 N 117 00.889 E
NB 15.5	Maliangin Besar 1	Maliangin	7 05.679 N 117 01.401 E
NB 15.6	Maliangin Besar 2	Maliangin	7 06.028 N 117 01.771 E
NB 15.7	Maliangin Besar 3A	Maliangin	7 05.432 N 117 03.310 E
NB 15.8	Maliangin Besar 5	Maliangin	n/a
NB 15.9	Maliangin Besar 6	Maliangin	n/a
NB 15.10	Maliangin Besar 7	Maliangin	7 05.012 N 117 02.312 E
NB 16.1	Berungus Pitas 1	Berungus	6 57.347 N 117 00.343 E
NB 16.2	Berungus Pitas 2	Berungus	6 56.863 N 117 00.632 E
NB 16.3	Berungus Pitas 3	Berungus	6 57.940 N 117 01.139 E
NB 16.4	Berungus Pitas 4	Berungus	6 56.398 N 117 00.934 E