Status of Coral Reefs in Malaysia, 2014

Reef Check Malaysia

Contents

Executive Summary

1. A total of 184 sites were surveyed in 2014 (2013: 196), 77 in Peninsular Malaysia and 107 in East Malaysia. The surveys are a continuation of a successful National Reef Check Survey Programme that has now run for eight years.

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 growing interest from the Government in further improving management of Malaysia's coral reefs. Surveys were carried out on a number of islands off Peninsular Malaysia's East and West coasts and in various parts of East Malaysia, both Sabah and Sarawak, covering both established Marine Protected Areas and non-protected areas,.

3. The results indicate that Malaysian reefs surveyed have a relatively high level of living coral, at 48.11% (2013: 48.33%). The 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 on better education and enforcement of existing laws to protect and conserve coral reefs, as well as the importance of involving local communities in decision making.

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. The Aichi Biodiversity Targets set national level targets for biodiversity conservation and **we recommend that the government invest in achieving Aichi Target 10** to reduce anthropogenic pressure on coral reefs and related ecosystems.

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 RM 50 billion per annum. Coral reefs are threatened by global warming, overfishing, pollution and sedimentation.

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 2014, the eight 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 will join 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 eighth annual Malaysia coral reef survey report and details the results of Reef Check surveys carried out during 2014. 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.org for more details).

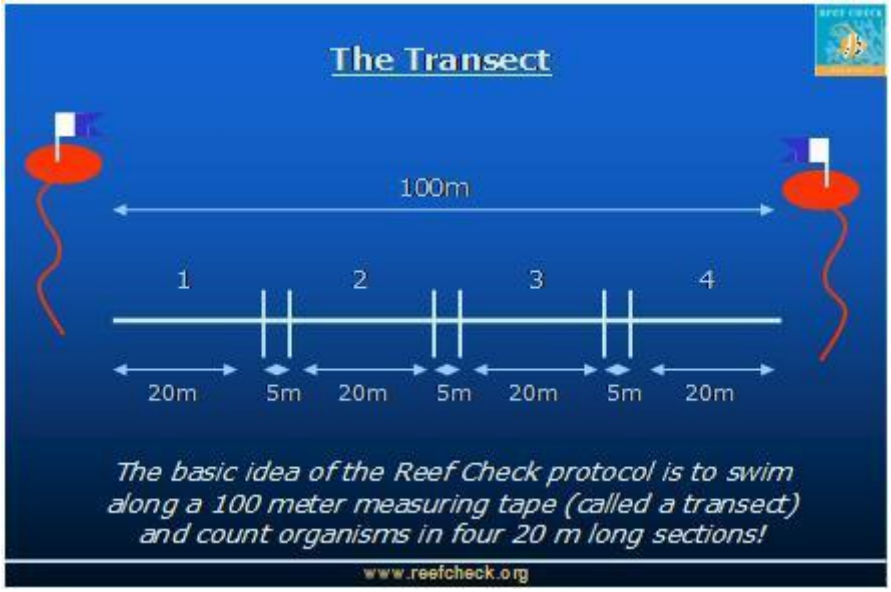
The Reef Check monitoring methodology allows scientists and managers to track changes to coral reefs over time. By surveying reefs on a regular basis, deleterious changes can be highlighted early, before they become problems. This gives managers the opportunity to intervene, carry out additional more 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 2014, a total of 184 sites were surveyed, 77 of which were in Peninsular Malaysia and the remaining 107 in 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 and Pangkor Laut). In East Malaysia, a large percentage of the surveys were conducted by a number of dive operators, notably in Lankayan and Mataking, and by Sabah Parks, in 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.

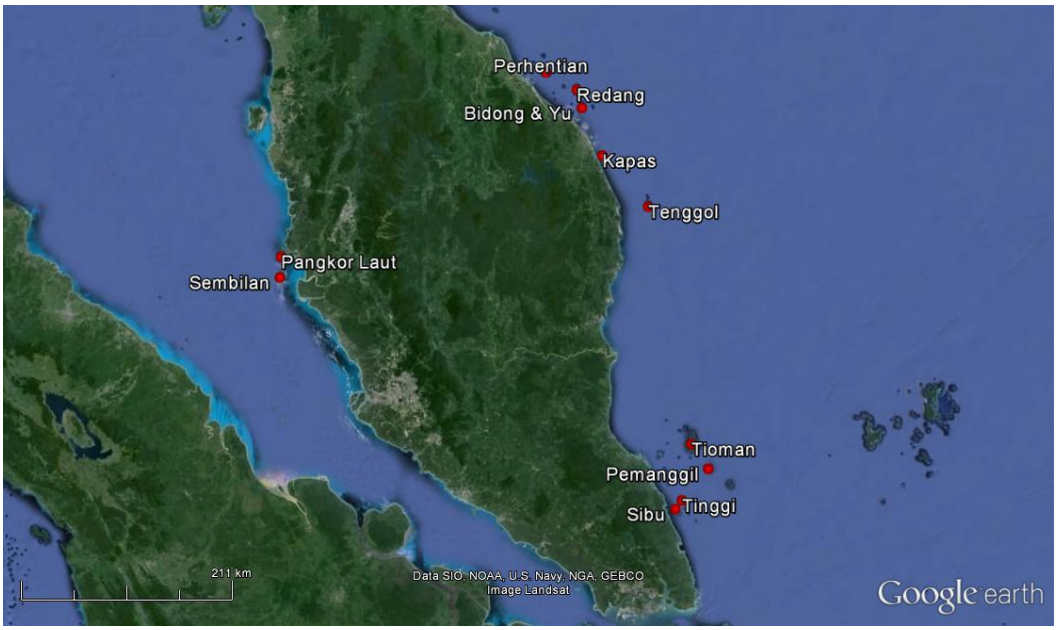
The list of sites surveyed is shown in appendix 1.

3. 2014 Survey Results and Analysis

This section details the results from surveys conducted in 2014, providing an overview of the condition of coral reefs in Malaysia as a whole, and a more detailed analysis of surveyed reef areas.

3.1 Status of Coral Reefs in Malaysia 2014

The results from all 184 surveys were compiled to provide an overview of the status of coral reefs around Malaysia. Sites surveyed off peninsular Malaysia are mostly developed 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: Surveyed islands in Peninsular Malaysia

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

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

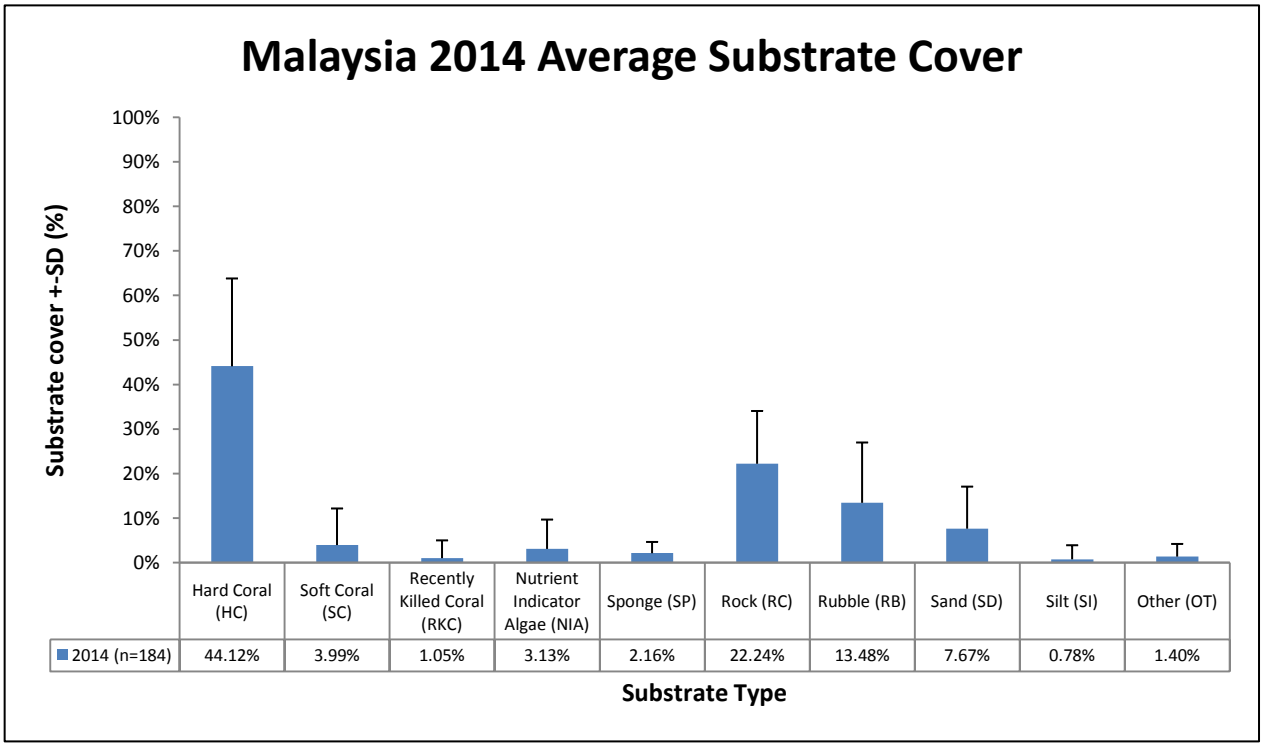
Percentage of live coral cover	Rating
0-25	Poor
26-50	Fair
51-75	Good
76-100	Excellent

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 48.11% (48.33% in 2013).

Recently Killed Coral 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 and Drupella snails) and other local stressors (e.g. sedimentation and disease). The low level of RKC (1.05%) in 2014 mirrored that of 2013 (1.53%).

Nutrient Indicator Algae 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 is a 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 increased slightly from 2013 (2.71%), but at 3.13%, it is still 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 sites where the proliferation of algae is becoming an issue that needs more attention, for example 44.38% at Roach Reef (Semporna), 35% at Yoshi Point 1 (Semporna) and 31.88% at Freshwater Bay (Tenggol).

Chart 1



Sponges are another normal component of coral reefs that, under the right conditions, can proliferate in the presence of high levels of nutrients. At 2.16%, the level of SP does not appear to be a threat.

Rock 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 2014 the average cover of RC on Malaysian reefs was 22.24%. 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.

Rubble 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 reefs with 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 13.48% in 2014, and this has not changed much over the last three years. 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 88.75% at Mataking House Reef (Mataking), 60% at South Rim (Tun Sakaran Marine Park) and 56.88% at Coral Garden Mataking (Mataking). These are sites where fish bombing was previously commonplace.

Sand 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 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 0.78%. 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 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 1.40% in 2014.

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 2014 surveys are shown below (Chart 2).

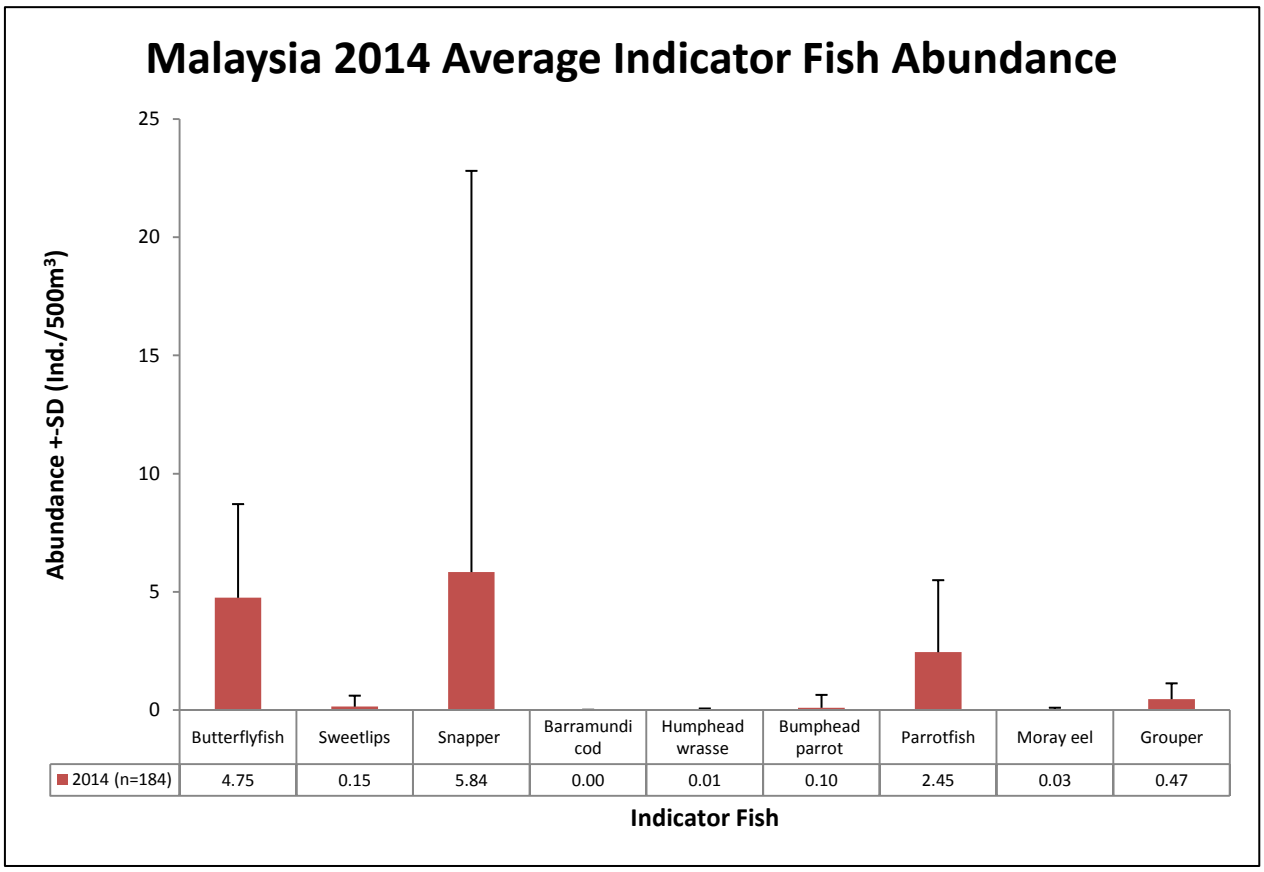
Barramundi cod, Humphead wrasse, Bumphead parrotfish, Groupers, Sweetlips, and Moray eels recorded an average abundance of less than 1 individual per 500m^3 survey transect. High value fish such as these, which are specially targeted for the international live food trade, recorded the lowest average 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 4.75 individuals per 500m^3 in 2014 and this mirrored the average abundance of 2013. 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 2014 was 2.45 individuals per 500m^3 and is similar to that of 2013.

Chart 2



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 2014 surveys is shown in Chart 3 below.

National abundance average 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, the overexploitation of invertebrates such as Tritons and Pencil urchins may have had a significant impact on their populations.

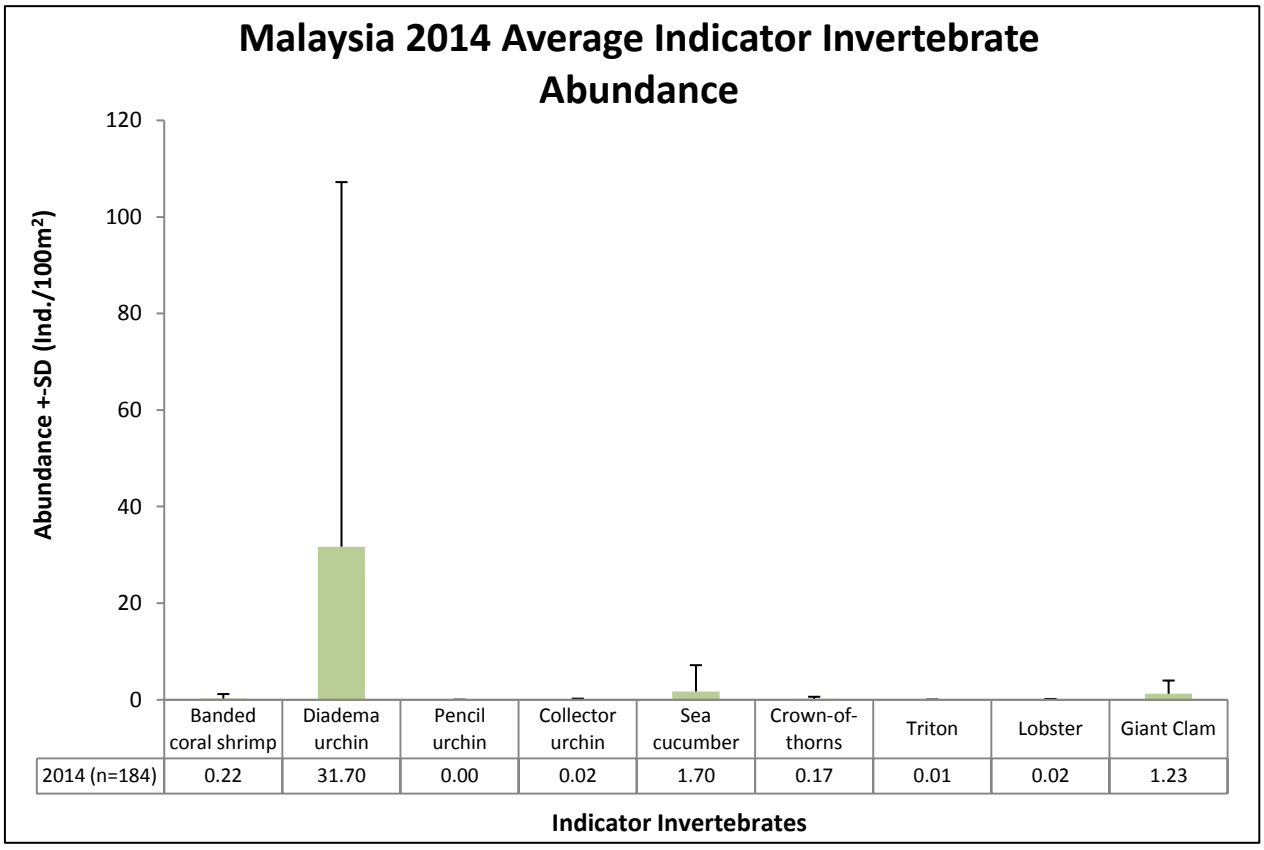
Similarly, several species targeted for the food trade are at or near zero (Lobster 0.02 individuals per 100m^2 survey transect; Collector Urchin – 0.02 individuals per 100m^2). Giant Clam recorded an average of 1.23 individuals per 100m^2. This includes both mature breeding adults as well as juveniles. 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 s well as maintaining a healthy population of herbivores fish can contribute to reducing 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, 0.17 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.

Chart 3



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

The sections below provide details of the health of coral reefs surveyed in three Eco-regions in Malaysia. 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 West coast Sabah and Sarawak, Eco-region 117)
- North Borneo (East coast of 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 table below.

Table 2: Site Coverage by Ecoregion

Islands/Areas	No. of sites	Protection Status	LCC (%)
Sunda Shelf			
Perhentian	10	Marine Park	53.62
Redang	12	Marine Park	58.13
Tioman	19	Marine Park	60.60
Kapas	4	Marine Park	56.88
Bidong/Yu	6	Marine Park	54.58
Tenggol	6	Marine Park	53.54
Pemanggil	4	Marine Park	54.06
Tinggi	4	Marine Park	61.88
Sibu	3	Marine Park	46.66
Miri	6	No protection	52.08
Kuching	1	No protection	55.00

Islands/Areas	No. of sites	Protection Status	LCC (%)
Malacca Strait			
Sembilan	8	No protection	33.91
Pangkor Laut	1	No protection	55.63
North Borneo			
Lankayan	15	SIMCA	46.20
Mataking/Pom Pom	11	No protection	27.04
Semporna	11	No protection	39.94
Mantanani	11	No protection	43.30
Usukan Cove	6	No protection	38.44
Tunku Abdul Rahman Park	13	Tunku Abdul Rahman Park	38.46
Tun Sakaran Marine Park	7	Tun Sakaran Marine Park	50.40
Lahad Datu	15	No protection	41.59
Sipadan	11	Sipadan Island Park	60.40
Total	**184**	**Average**	**48.11**

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, Mataking, Pom Pom, Usukan Cove), suggesting that protected areas are having some beneficial impacts on coral reefs in Malaysia.

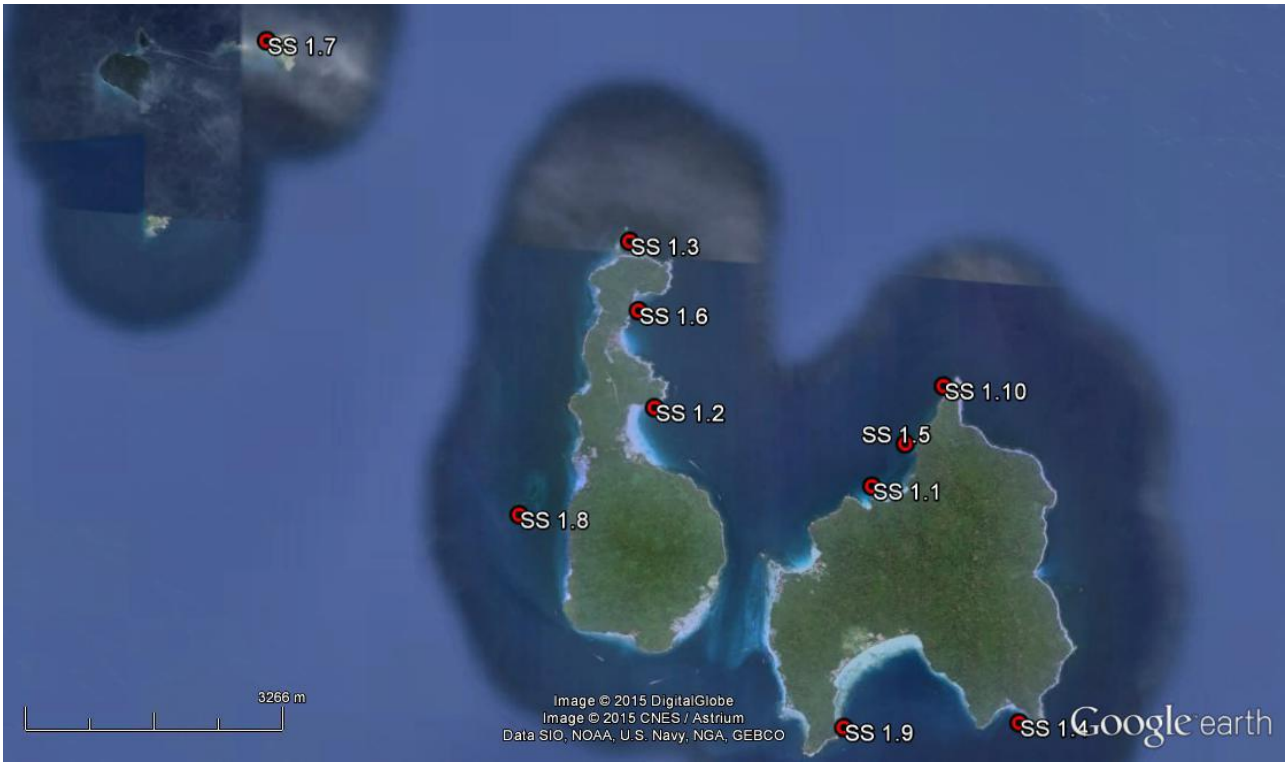
Sunda Shelf Region

3.2.1 Perhentian

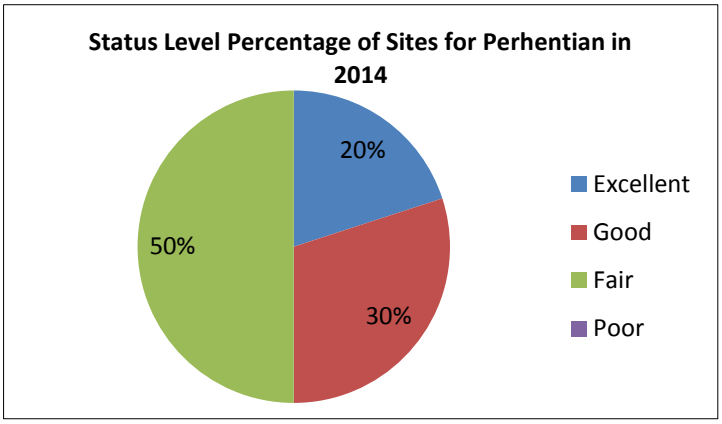
The Perhentian islands are located some 20km from Kuala Besut off the East coast of Terengganu, Malaysia. The islands have one village with a population of approximately 1,500, most of who work in tourism, the main industry on the islands. The islands are gazetted as a Marine Park (since 1994).

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, nor centralised 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.

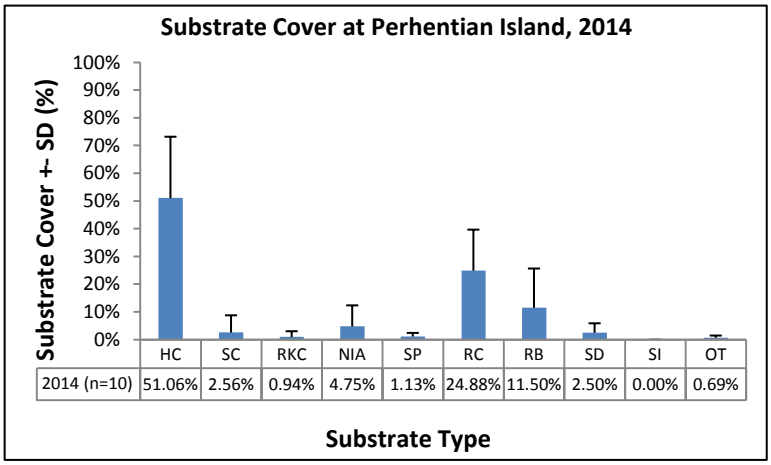


Map 3: Surveyed sites in Perhentian



A total of 10 coral reef sites were surveyed in Perhentian and 50% of the sites were in fair condition. Only 20% were in excellent condition, while 30% were in good condition. No reefs were in poor condition.

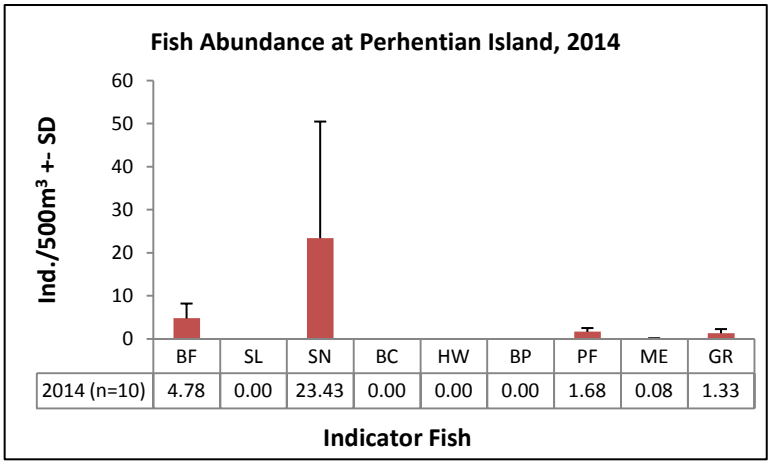
Substrate



Coral reefs around the Perhentian islands are considered to be in 'Good' condition, with 53.62% live coral cover, slightly below the average (56.38%) for reefs within the Sunda Shelf region.

The level of RB was the highest of all islands surveyed in Sunda Shelf region. The level was especially high at SS1.4 Tiga Ruang (45.63%) and SS1.2 Batu Nisan (26.25%). Although the average level of NIA is acceptable for Perhentian islands, the level was exceptionally high at SS1.3 Batu Tabir (23.75%) and SS1.10 Tanjung Besi (10%).

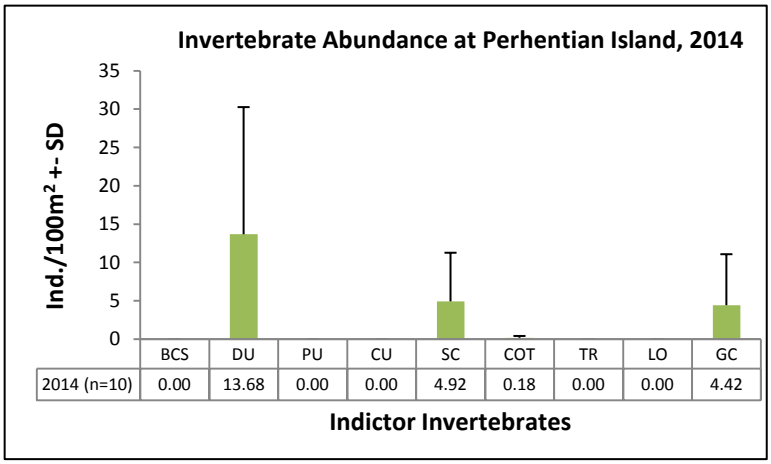
Fish



The most abundant fish were Snapper (second highest in Sunda Shelf region), followed by Butterflyfish.

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

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. The abundance of Giant Clam was the highest in Sunda Shelf region.

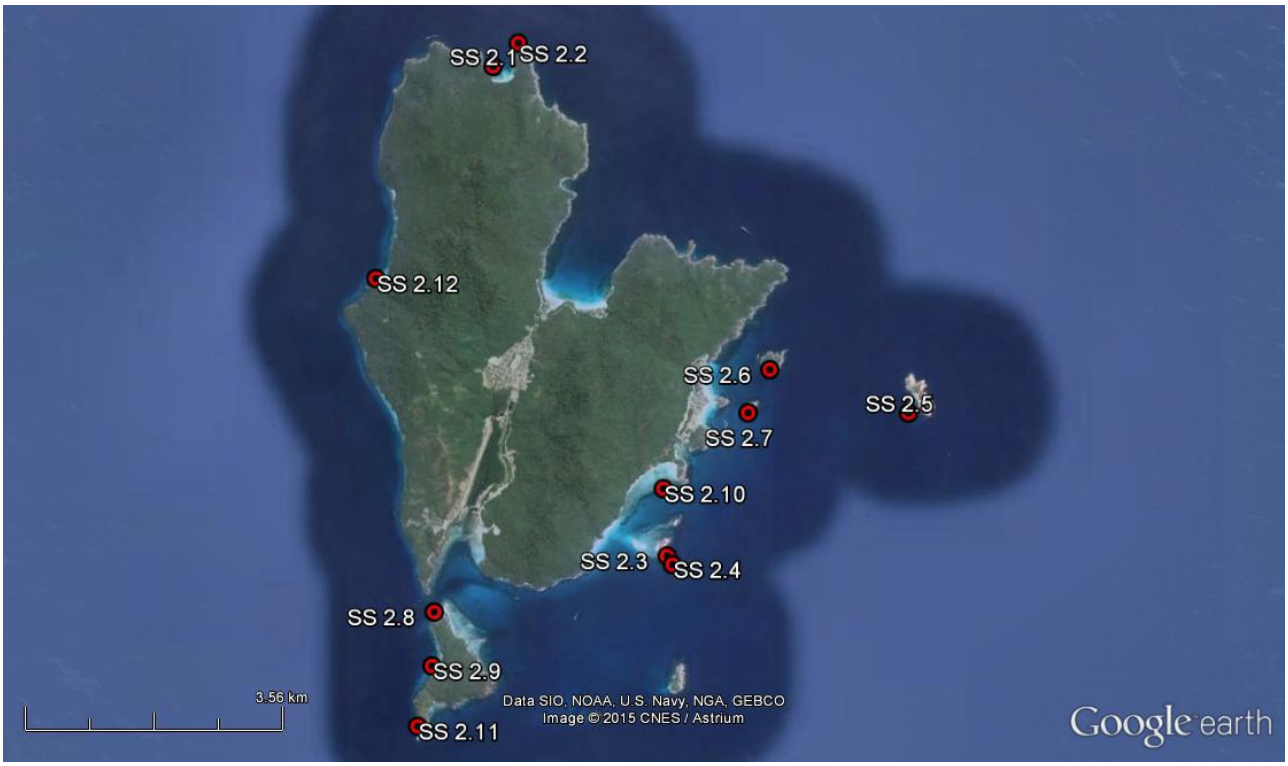
While rare animals were not sighted during the surveys, damage to the reefs was observed although the scale of the damage is low. Damage observed was mostly due to warm water bleaching at SS1.2 Batu Tabir and SS1.6 D' Lagoon.

3.2.2 Redang

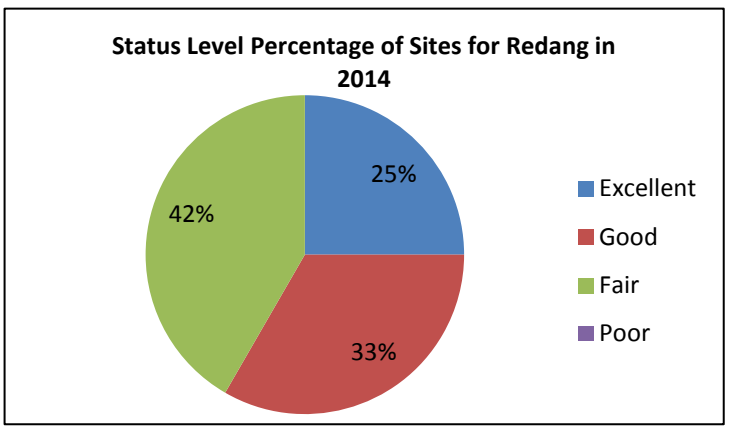
Redang Island is located some 25km from Merang, off the East coast of Terengganu, Malaysia. The island has a population of approximately 1,500, only a small proportion of who work in tourism, the main industry on the islands. The islands are gazetted as a Marine Park (since 1994).

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.

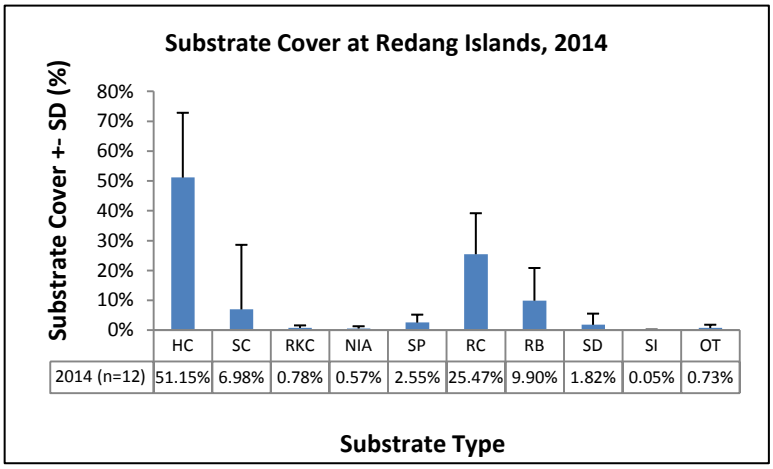


Map 4: Surveyed sites in Redang



A total of 12 coral reef sites were surveyed in Redang and 42% of the sites were in fair condition. Only 25% were in excellent condition, while 33% were in good condition. No reefs were in poor condition.

Substrate

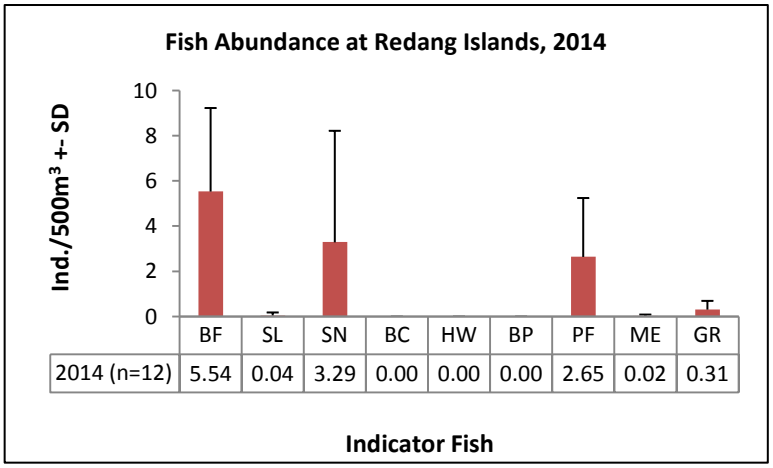


The reefs around Redang islands are considered to be in 'Good' condition, with live coral cover of 58.13% and slightly above the average (56.38%) for reefs within the Sunda Shelf region.

The level of RB has decreased compared to 2013 (11.35%), however it was still relatively high; especially at SS2.4 Kerengga Kecil (36.88%) and SS2.1 Chagar Hutang (21.88%).

Low level of NIA and SI indicates sewage pollution and sedimentation are not a problem for now.

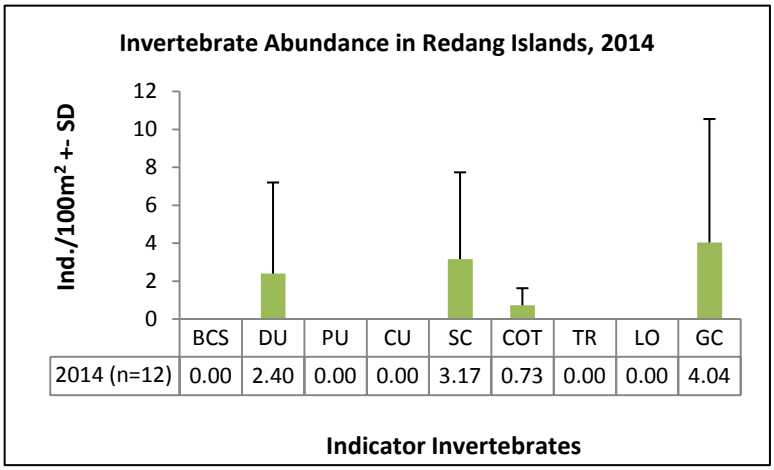
Fish



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

Similarly to Perhentian, high value fish such as Barramundi Cod, Humphead Wrasse and Bumphead Parrotfish were completely absent from surveys.

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, 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.

One blacktip reef shark and two hawksbill turtle were seen during the surveys. Damage due to warm water bleaching was observed at all sites except at SS2.9 Pasir Akar. Fish nets were also found on the reefs at SS2.3 Kerengga Besar and SS2.11 Terumbu Kili. Although the scale of the damage is considered low, it is evidence that illegal fishing is present inside the Marine Park.

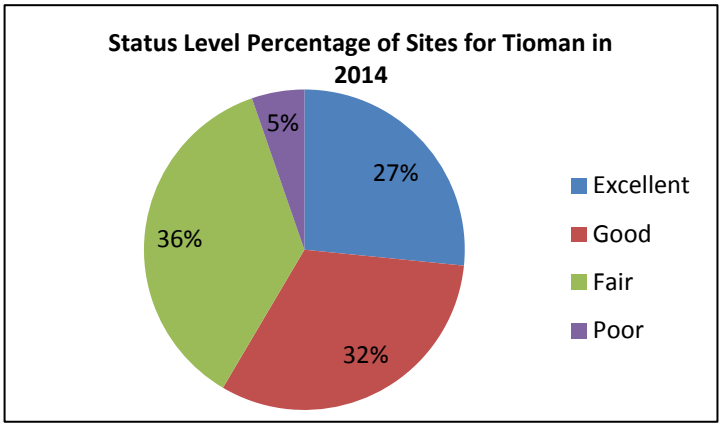
3.2.3 Tioman

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 tourism industry, 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.

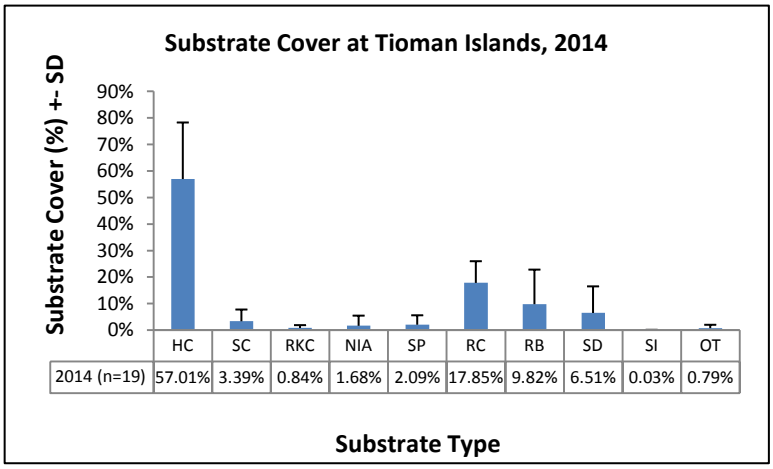
There is a small power generation station on the island, supplying electricity to all areas. The island has abundant fresh water, and a municipal incinerator was constructed some years ago. The island is served by an airport as well as boat services.

Map 5: Surveyed sites in Tioman



A total of 19 coral reef sites were surveyed in Tioman and 27% of the reefs were in excellent condition. 32% were in good condition, while 36% were in fair condition. 5% of the reefs were in poor condition.

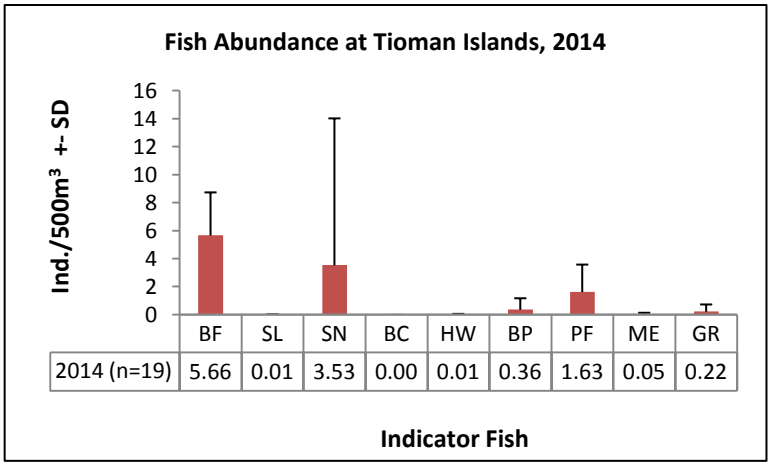
Substrate



The site is considered to be in 'Good' condition, with 60.40% live coral cover, above the average for reefs of the Sunda Shelf region (56.38%).

Level of RB was high and this reflects some recent disturbances in Tioman. Seven of the survey sites recorded more than 10% of RB and the level was exceptionally high at SS3.12 Labas, recording as much as 50.63%.

Fish

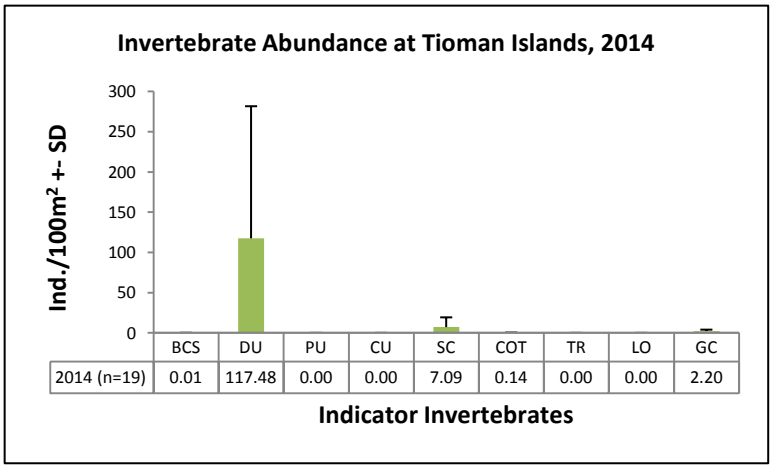


All indicator fish were observed except for Barramundi Cod.

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

Of all islands surveyed in Sunda Shelf region, Tioman is the only island that recorded both highly prized fish (Humphead Wrasse and Bumphead Parrotfish) during surveys.

Invertebrates



Several targeted species were absent, including Pencil Urchin, Collector Urchin, Triton and Lobster. The number of Diadema in Tioman was the highest of all islands surveyed in the Sunda Shelf region. The abundance is exceptionally high at SS3.4 Soyak South, recording as many as 663 ind./100m^2.

Annual COT cleanup around the island, organised by DMPM had managed to keep COT numbers within the natural range.

Damage on the reefs due to warm water bleaching was observed during surveys, at SS3.12 Labas, SS3.2 Renggis North and SS3.5 Soyak North. A few of the sites were impacted by drupella predation and only a few sites recorded boat anchor damage, discarded fish nets, and trash. Turtles (hawksbill) were observed at many sites in Tioman. Sea snake and shark's egg were also seen on the reefs during surveys.

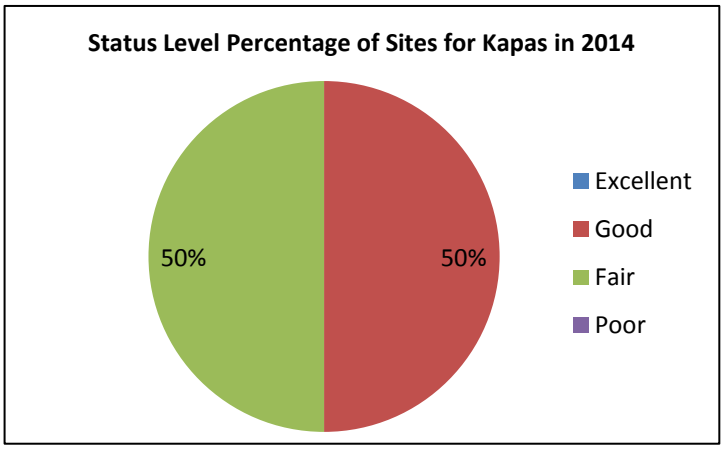
3.2.4 Kapas

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.

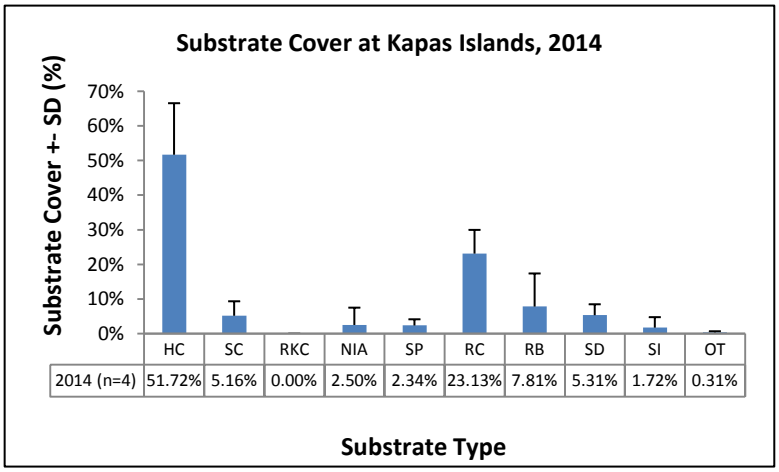
Reefs are mainly fringing off-shore reefs, with some submerged reefs.

Map 6: Surveyed sites in Kapas



A total of 4 coral reef sites were surveyed in Kapas. 50% of the sites were in good condition, while 50% were in fair condition.

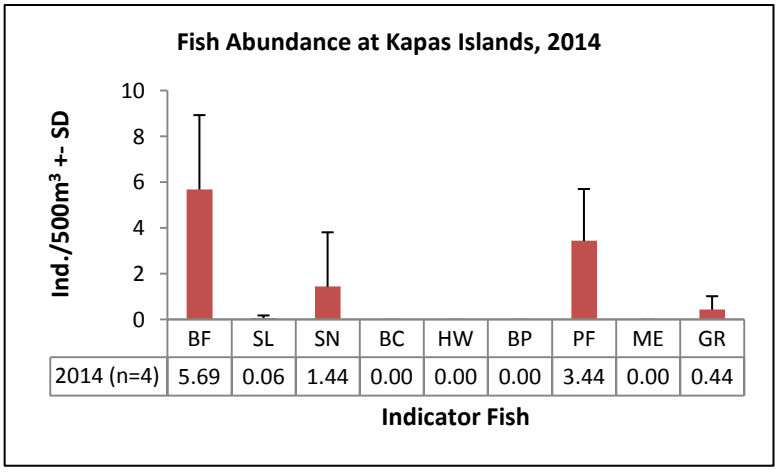
Substrate



Coral reefs around Kapas islands are considered to be in 'Good' condition, with 56.88% live coral cover, just above the average (56.38%) for all islands surveyed in the Sunda Shelf region.

The level of SI has increased from 0.13% in 2013 to 1.72% in 2014. Due to the close proximity of these islands to the mainland, the most likely source of this increased SI level is the rivers and other terrestrial runoffs from Marang.

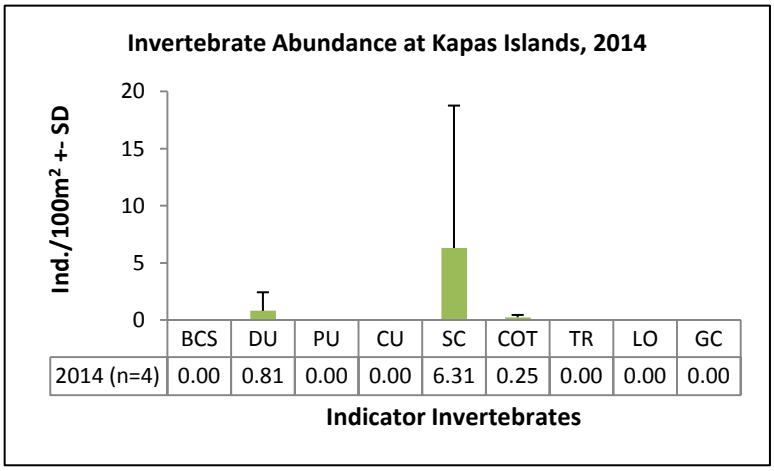
Fish



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

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

Invertebrates



Only three targeted species were present, including Diadema Urchin, Sea Cucumber and Crown-of-thorns.

Abundance of Sea Cucumber was the highest, followed by Diadema Urchin and COT.

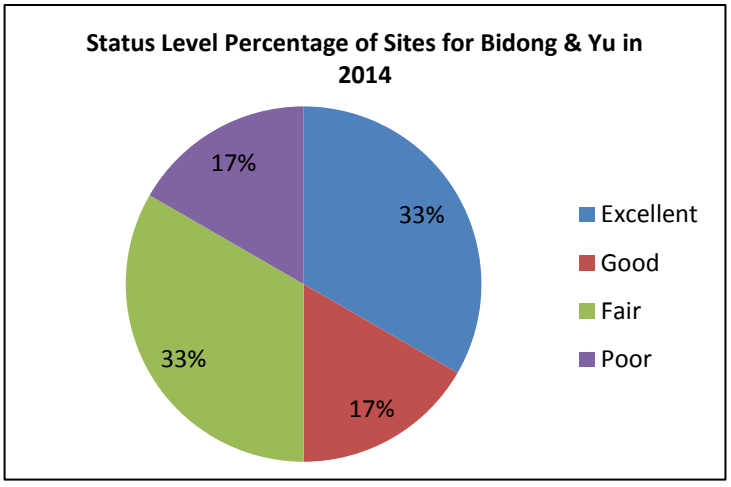
Damage due to warm water bleaching was observed at all sites. Fish net was also found at one of the survey sites.

3.2.5 Bidong/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.

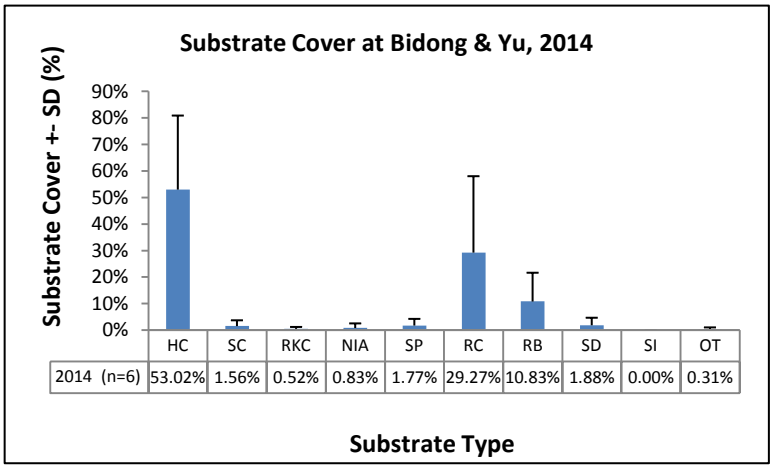
Bidong has mainly been a research base for University Malaysia Terengganu but has recently grown in popularity as a diving destination. Bidong has some sandy beaches and fringing reefs while Pulau Yu Besar and Kecil are mainly small rocky islands, with boulder slopes dropping to 25-30m, with some coral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

Map 7: Surveyed sites in Bidong & Yu



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

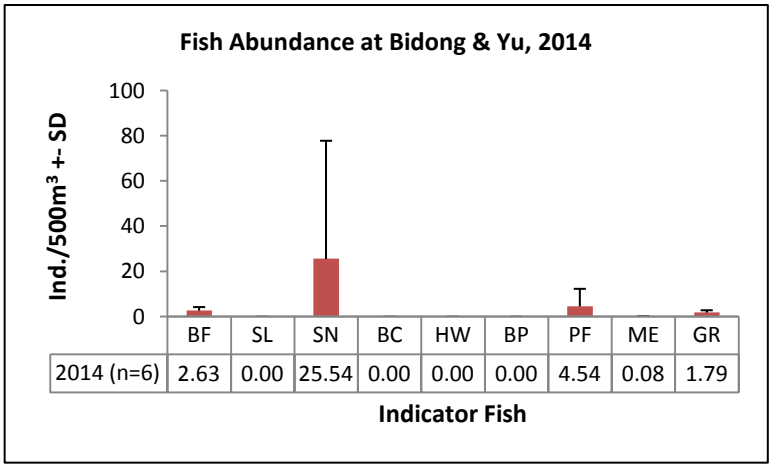
Substrate



Coral reefs around Bidong & Yu islands are considered to be in 'Good' condition, with 54.58% live coral cover, slightly below the average (56.38%) for reefs in Sunda Shelf region.

Although the level of NIA has decreased significantly compared to 2013 (7.29%), it stills need to be monitored closely. The high level of RC (highest in the Sunda Shelf region) reflects the rocky nature of much of the coastline of the islands, particularly Yu islands.

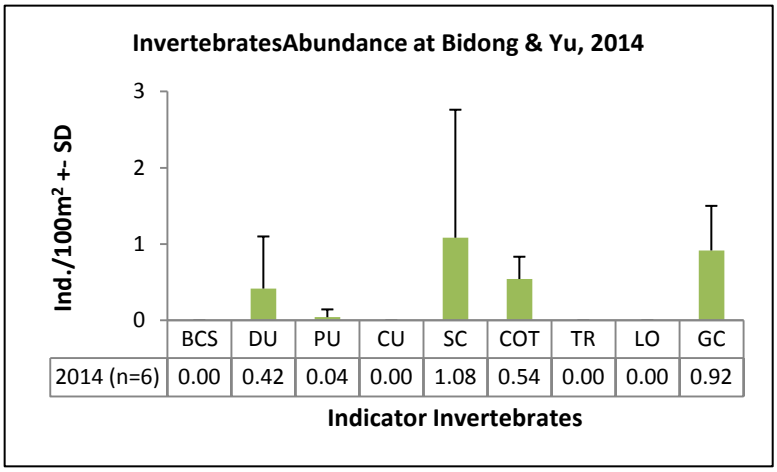
Fish



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

Abundance of Snapper has increased compared to 4.29 ind./500m^3 in 2013 and was the highest of all islands surveyed in Sunda Shelf region. Other fish indicators were all present in low number, including Butterflyfish, Moray Eel and Grouper.

Invertebrates



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

Abundance of most other indicators was low, including Diadema, Sea Cucumber, and Giant Clam. The abundance of COT found during surveys was above acceptable limits (0.2-0.3 ind./100m^2). Their population must be closely monitored. Nutrient runoff into the sea must be managed to avoid COT blooms in the future.

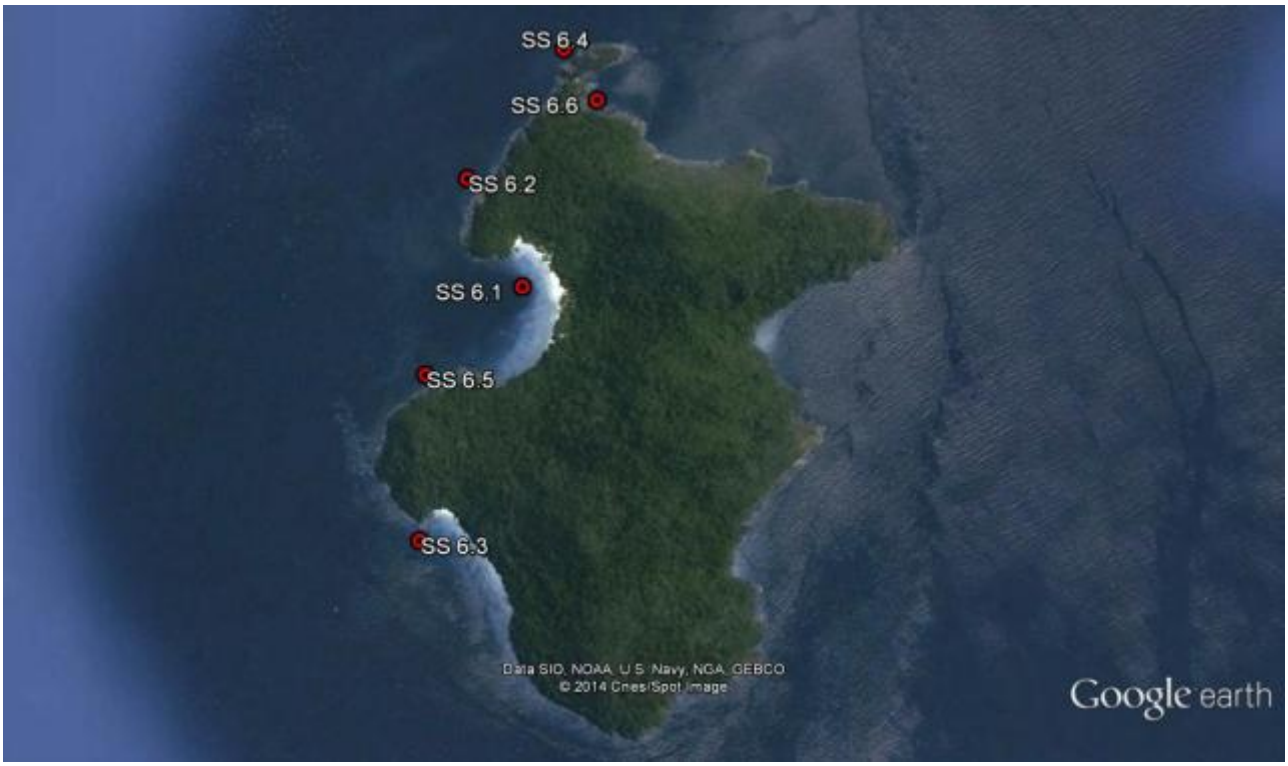
Natural damage to the reefs was observed during the surveys, such as warm water bleaching and predation by drupella. All sites except SS5.2 Pasir Tenggara were affected by bleaching. Fish nets and trash were also recorded at one of the survey sites.

3.2.6 Tenggol

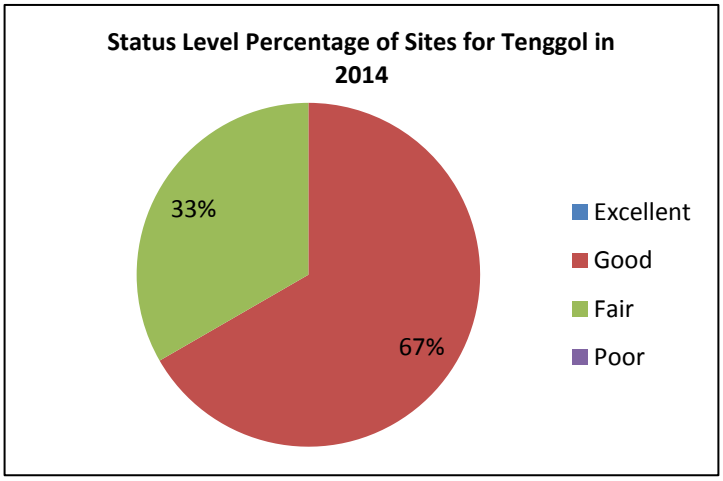
Tenggol Island is located approximately 30km from Dungun, off the East coast of Terengganu, Malaysia. This small island has no local population. The island is gazetted as a Marine Park (since 1994).

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.

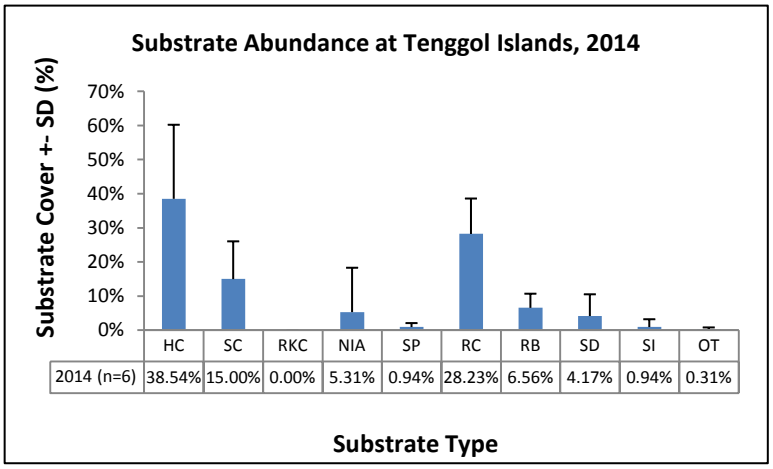


Map 8: Surveyed sites in Tenggol



A total of 6 coral reef sites were surveyed in Tenggol. 67% of the sites were in good condition, while 33% were in fair condition.

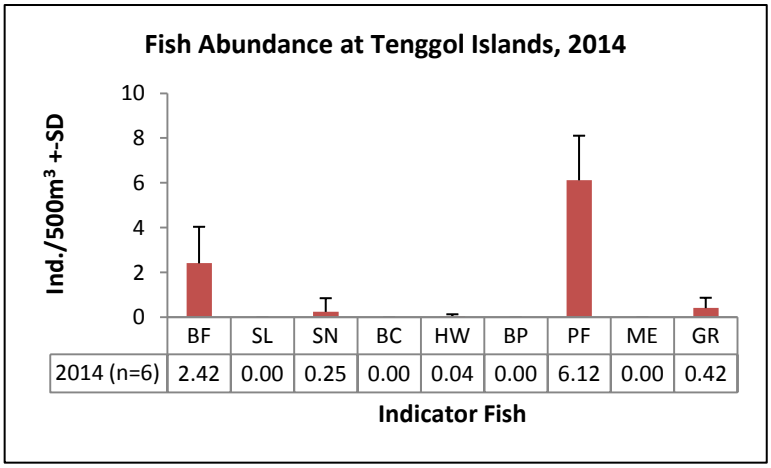
Substrate



The reefs in Tenggol were considered to be in 'Good' condition, with 53.54% live coral cover, slightly below the average (56.38%) for reefs of the Sunda Shelf region.

The level of NIA has decreased slightly from 6.35% in 2013 to 5.31% in 2014; all of which were recorded from SS6.1 Freshwater Bay (31.88%), where three resorts are located. This may indicates a source of sewage pollution and needs to be monitored closely.

Fish



Four indicator species were completely absent from surveys (Sweetlip, Barramundi Cod, Bumphead Parrotfish and Moray Eel)

Abundance of Parrotfish was the highest (highest in the Sunda Shelf region too), followed by Butterflyfish. Other indicators such as Snapper and Grouper were present in low number. Humphead Wrase was recorded at SS6.4 Rajawali Reef, although in low number.

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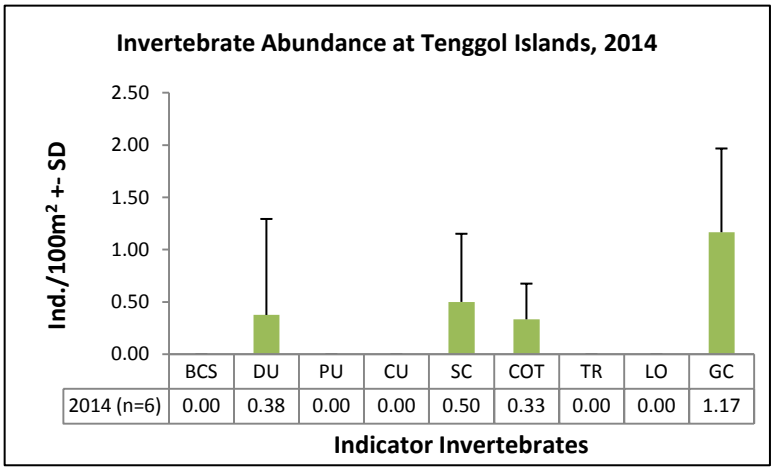
Invertebrates



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

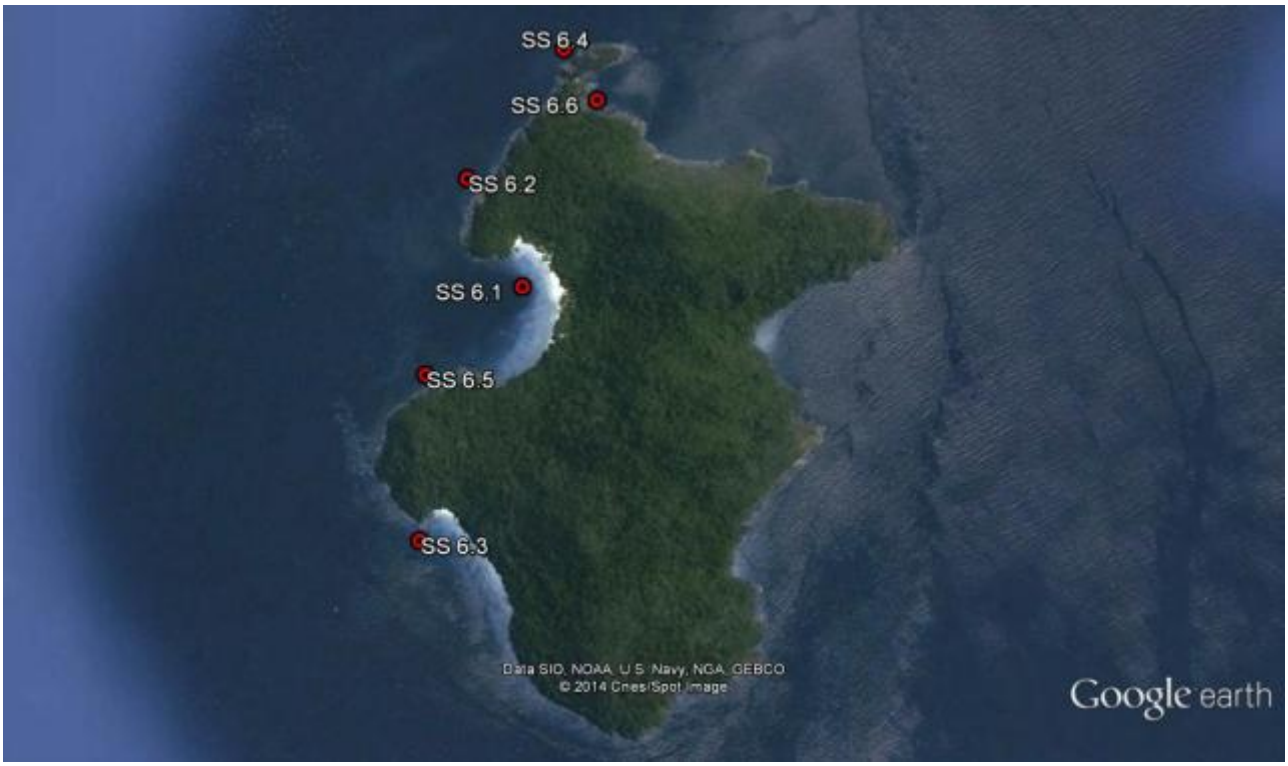
Abundance other indicator species was low, including Diadema, Sea Cucumber and Giant Clam. The abundance of COT increased from 0.29 ind./100m^2 in 2013 to 0.33 ind./100m^2 in 2014, slightly above the range which a healthy reef can supports (0.2-0.3 ind./100m^2). COT population must be closely monitored and measures must be taken to avoid COT blooms in the future.

Few natural and human disturbances to the reefs were observed during the surveys. Damage due to warm water bleaching was recorded at 3 out of 6 sites surveyed. Fish nets and trash were also found on the reefs at some sites. Evidence of coral harvesting were also observed in Tenggol, at SS6.5 Turtle Point. Although the scale of the damage is considered low, it is evidence that illegal activities are present inside the Marine Park.

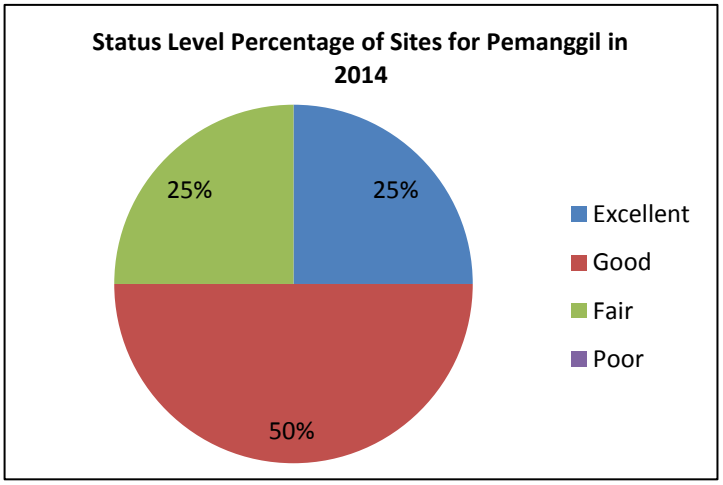
3.2.7 Pemanggil

Pemanggil Island is approximately 45km 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 for fishermen.

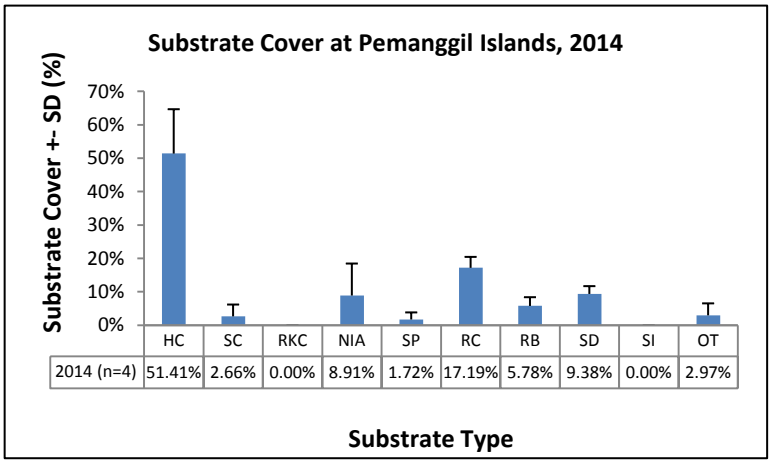


Map 9: Surveyed sites in Pemanggil



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

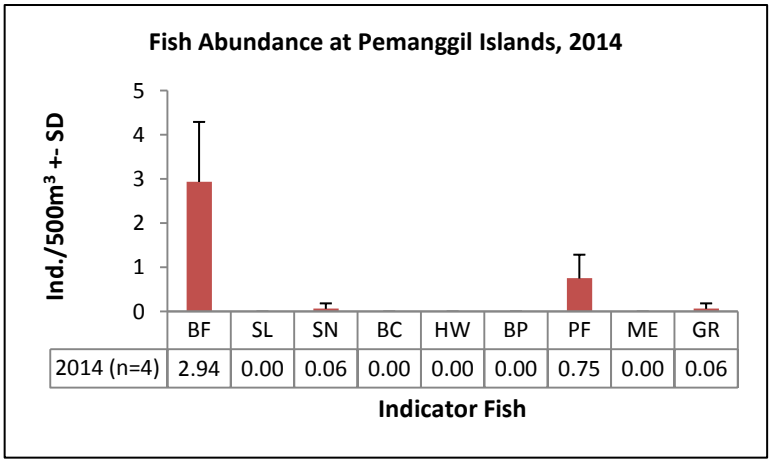
Substrate



The reefs in Pemanggil are considered to be in 'Good' condition, with 54.06% live coral cover, slightly below the average (56.38%) for reefs of the Sunda Shelf region.

Level of NIA has increased greatly from 4.31% in 2013 to 8.91% in 2014, and was the highest of all islands surveyed in Sunda Shelf region. This may indicates nutrient pollution and needs to be monitored closely.

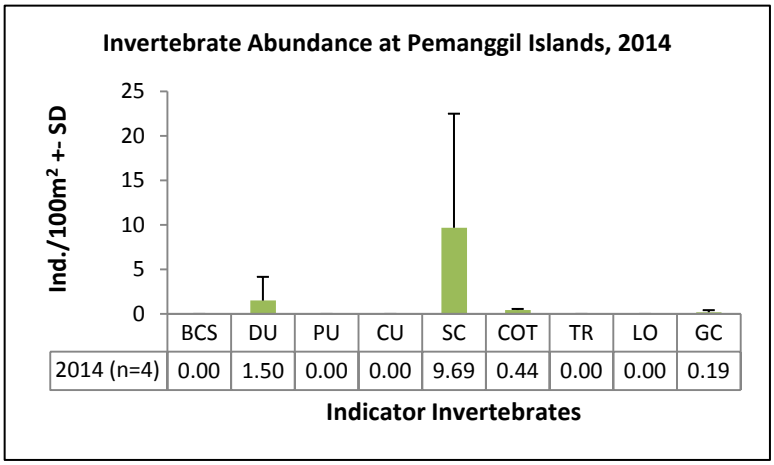
Fish



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

Abundance of all indicators is low, including Butterflyfish. Snapper, Parrotfish and Grouper recorded less than 1 ind./500m^3. Fishing around the island is widespread as there is no presence of Marine Park officers on the island.

Invertebrates



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

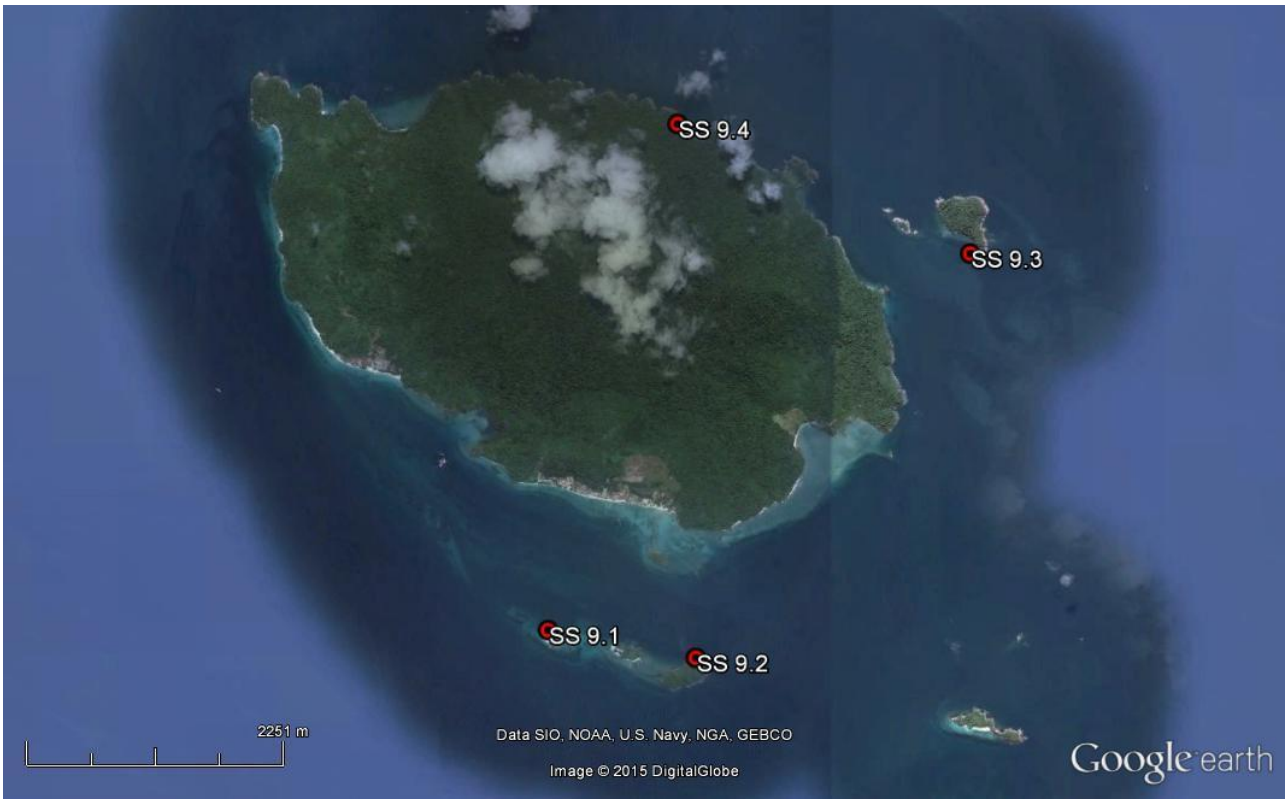
Sea Cucumber recorded the highest number (and the highest in the Sunda Shelf region), followed by Diadema Urchin. The abundance of COT has dropped slightly from 2013 (0.58 to 0.44 ind./100m^2), however the abundance is still slightly above what a healthy reef can sustain (0.2-0.3 ind./100m^2).

Coral damage by anchor and boat were observed.

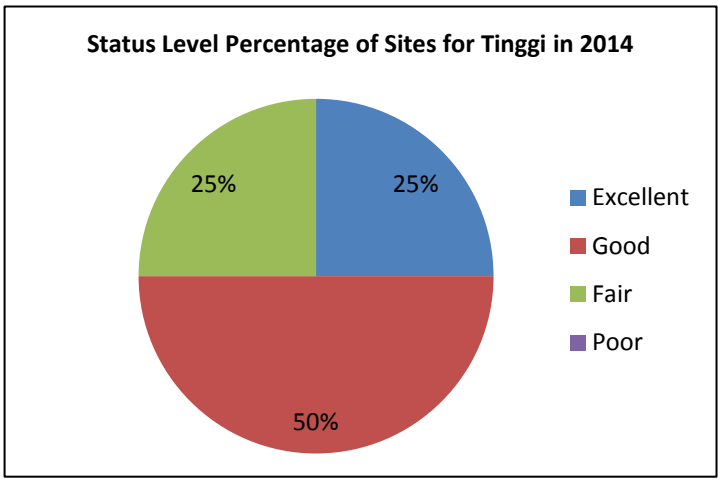
3.2.8 Tinggi

Tinggi Island 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 tourists as other islands off the East coast, but the tourism industry here is growing. There is no dive operator on Tinggi Island.

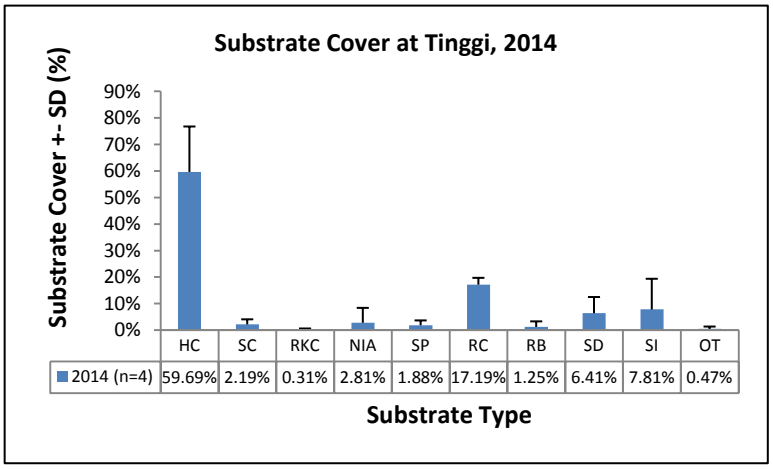


Map 10: Surveyed sites in Tinggi



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

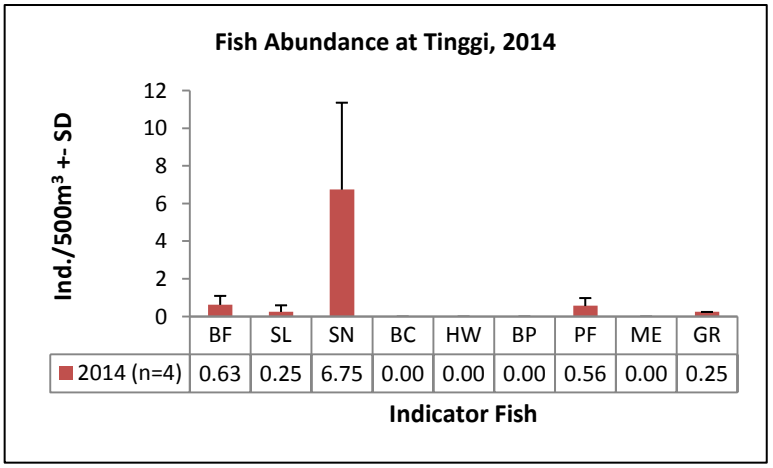
Substrate



Coral reefs around Tinggi Island were in 'Good' condition, with 61.88% live coral cover, above the average (56.38%) for reefs in the Sunda Shelf region.

Tinggi has the second highest level of SI, slightly below SI level in Sibu, of all islands surveyed in Sunda Shelf. This probably reflects 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.

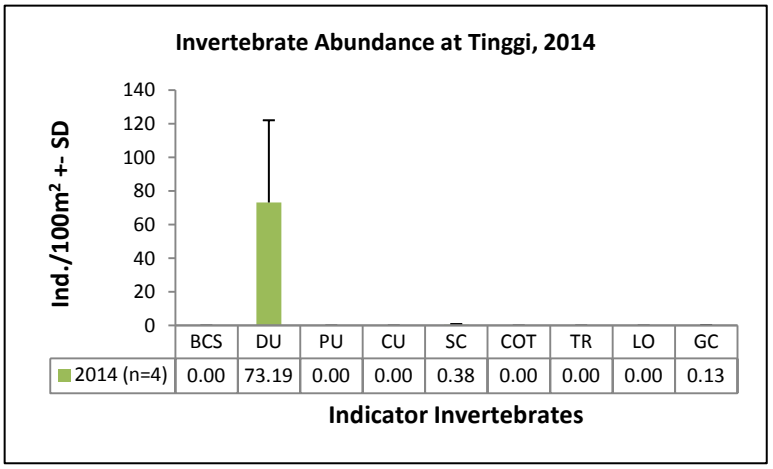
Fish



Same as last year, four indicator species were absent from surveys (Barramundi Cod, Humphead Wrasse, Bumphead Parrot and Moray Eel).

Snapper is the most abundant targeted fish. Abundance of other indicators is very low, including Butterflyfish, Sweetlip, Parrotfish, and Grouper, less than 1 ind./500m^3.

Invertebrates



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

Abundance of Diadema Urchin was high. The abundance of Sea Cucumber and Giant Clam was very low, less than 0.5 ind./100m^2.

No natural or human impacts and rare animals were recorded during surveys.

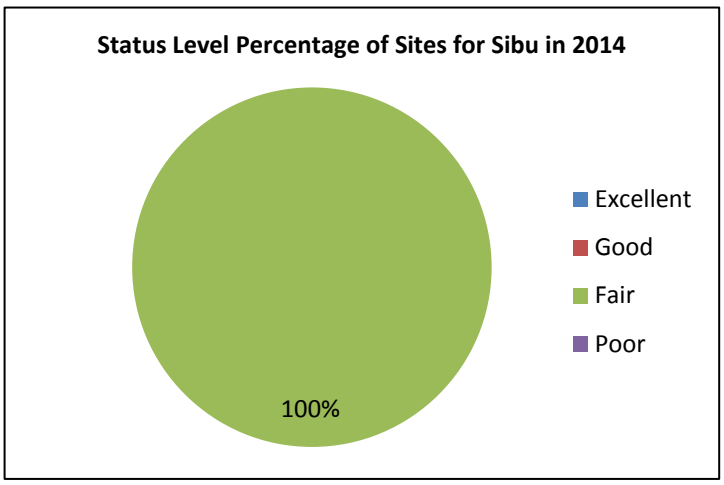
3.2.9 Sibu

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. There are only two dive operators on Sibu Island.

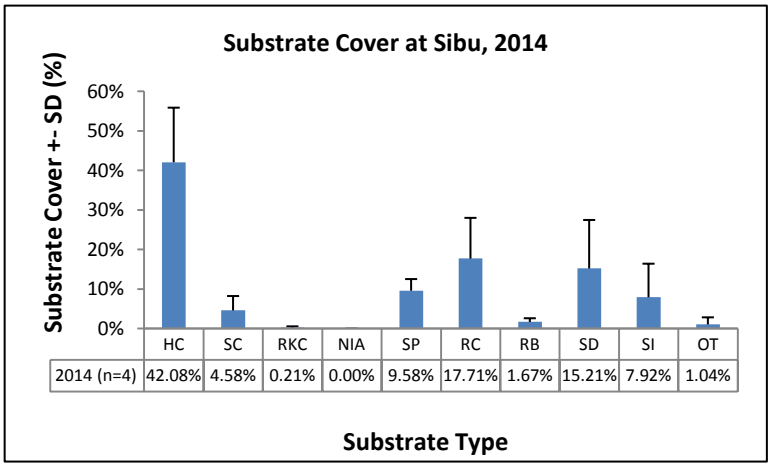
The islands are sparsely populated with few villages and a number of small resorts, typically used as a weekend or short vacation destination from Singapore.

Map 11: Surveyed sites in Sibu



A total of 4 coral reef sites were surveyed in Tinggi and 100% of the sites were in fair condition.

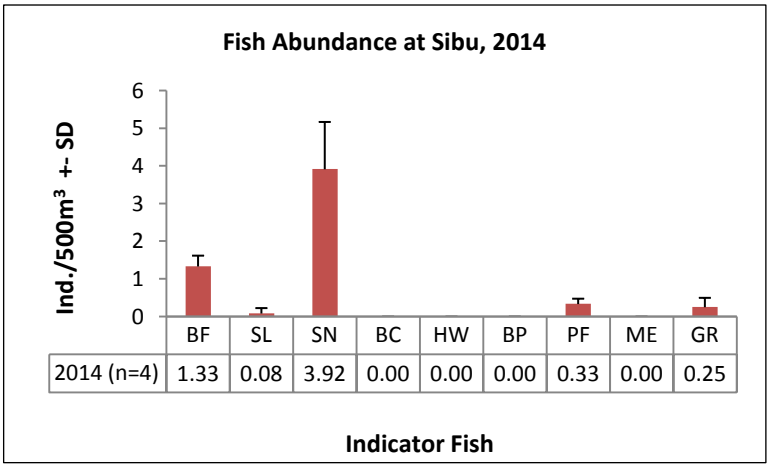
Substrate



Coral reefs around Sibu Island were in 'Fair' condition, with 46.66% live coral cover, below the average (56.38%) for reefs in the Sunda Shelf region.

The level of SI at Sibu Island is the highest of all islands surveyed in Sunda Shelf. This probably reflects 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.

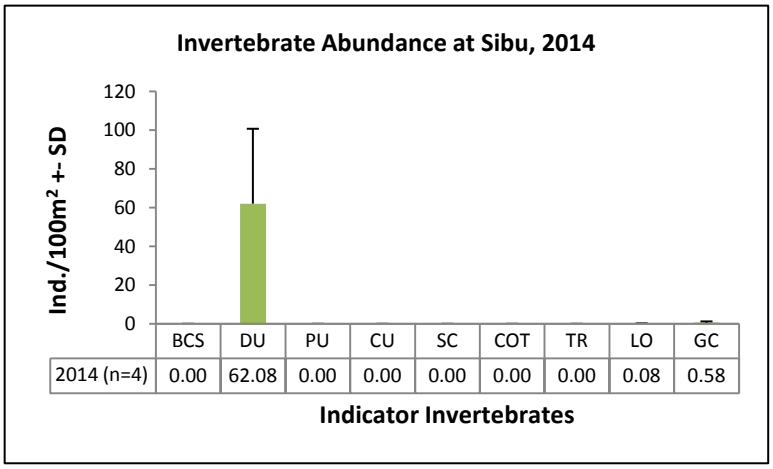
Fish



Same as last year, four indicator species were absent from surveys (Barramundi Cod, Humphead Wrasse, Bumphead Parrot and Moray Eel).

Snapper is the most abundant targeted fish. Abundance of other indicators is very low, including Butterrflyfish, Sweetlip, Parrotfish, and Grouper.

Invertebrates



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

Abundance of Diadema Urchin was high. The abundance of the remaining indicators (Lobster and Giant Clam) was very low, less than 1 ind./100m^2.

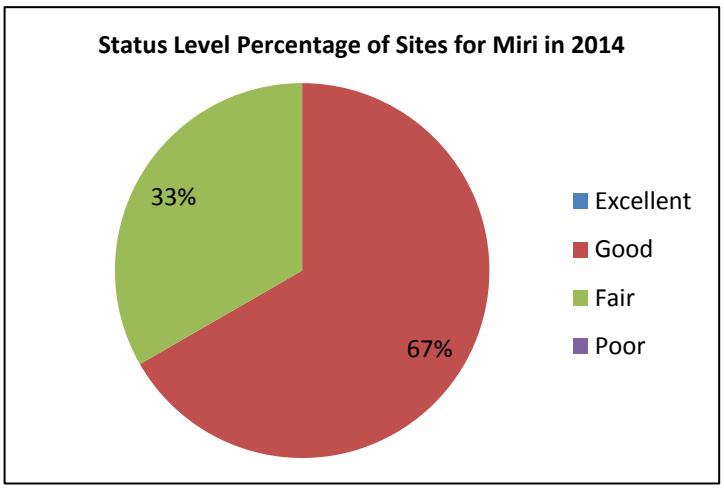
Hardly any natural or human impacts were observed during the surveys. Only one site was impacted by fish net. A sea snake was recorded at SS9.2 Malang Acha.

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.

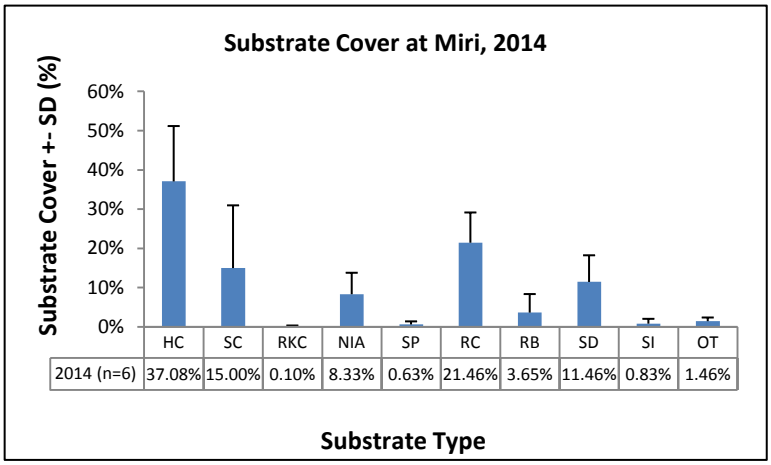
Miri has extensive submerged off-shore reefs, generally flat in profile, in depths ranging from 7 to 30m. In many areas, the presence of oil production facilities creates effective Marine Protected Areas, as boats are not allowed in the area due to security concerns.

Map 12: Surveyed sites in Miri



A total of 6 coral reef sites were surveyed in Miri. 67% of the sites were in good condition, while the remaining 33% were in fair condition.

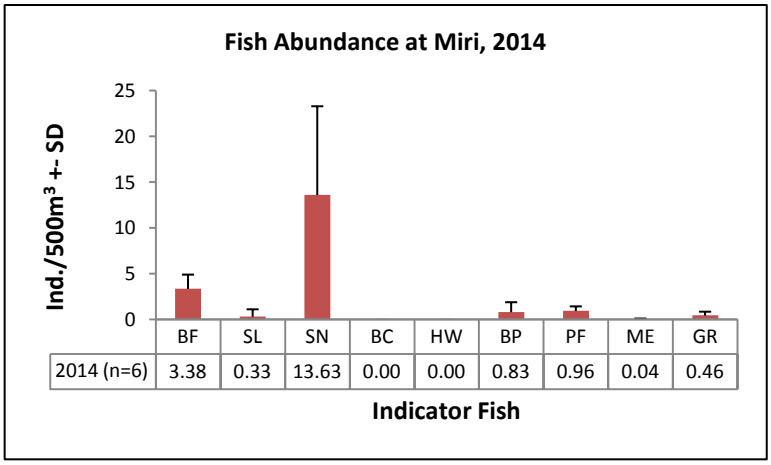
Substrate



Reefs in Miri are in 'Good' condition with 52.08% of live coral cover, below the average (56.38%) for Sunda Shelf region.

The level of NIA has increased significantly from 1.25% in 2013 to 8.33% in 2014. RB cover has also increased from last year, from 0.75% in 2013 to 3.65% in 2014. These increase need to be monitored closely especially for NIA level.

Fish

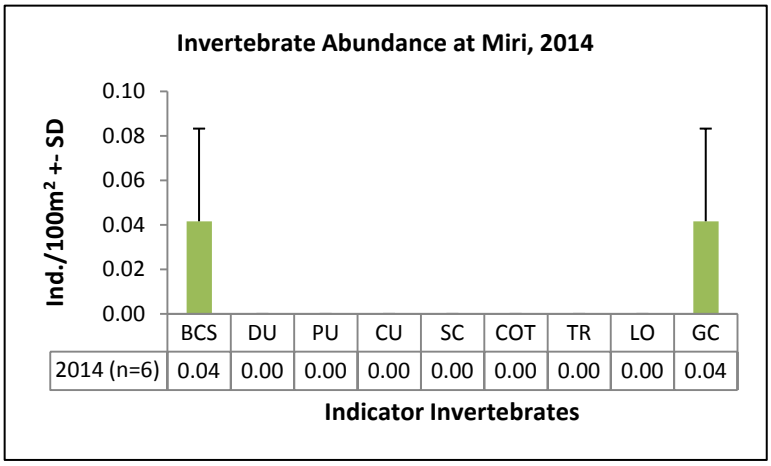


Only two indicator species were absent from surveys (Bumphead Parrotfish and Humphead Wrasse).

Same as last year, Snapper was the most abundant indicator fish recorded although the number has dwindled by half.

Abundance of other indicators was generally low.

Invertebrates



As last year, most of the indicator invertebrates were absent during surveys.

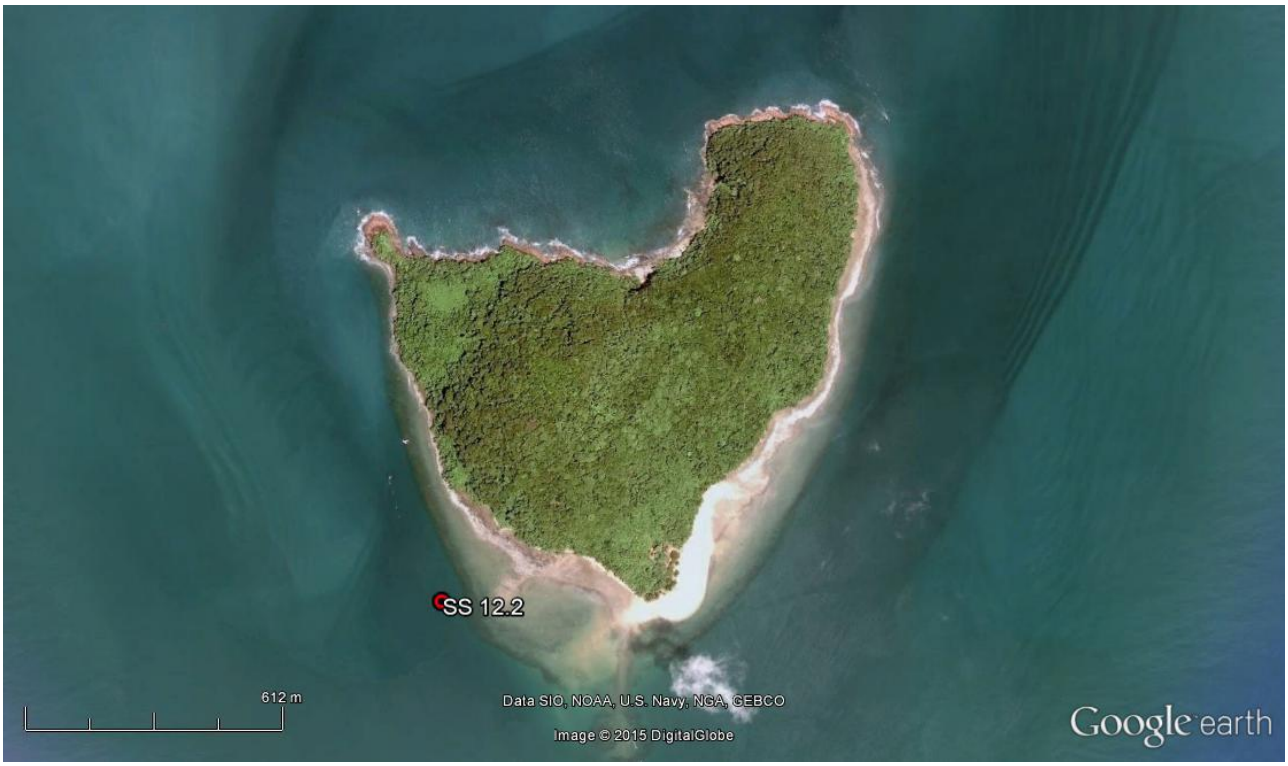
Only Banded Coral Shrimp and Giant Clam were recorded and their abundance was very low.

Discarded fish nets were the main impacts seen on reefs during surveys, observed at 4 out of 6 sites surveyed. Trash was also seen at 2 sites. The reefs monitored were not inside protected areas and thus fishing activities were common. Damage due to warm water bleaching was also observed. On a positive note, turtles were observed at 3 out of 6 sites surveyed.

3.2.11 Kuching

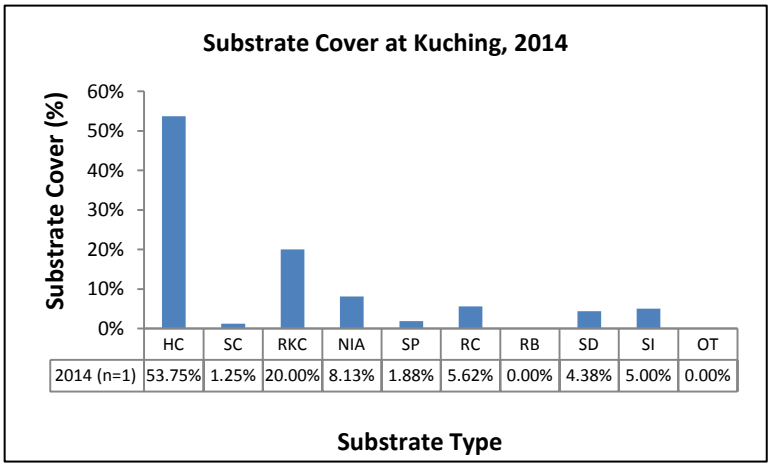
Kuching is located at the southern end of Sarawak and is the capital of the state. This developed city is also the most highly populated area in Sarawak.

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



Map 13: Surveyed sites in Kuching

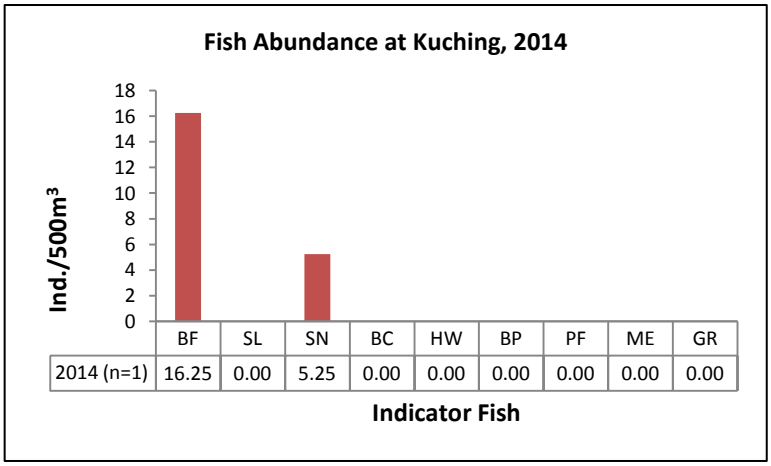
Substrate



Coral reefs around Kuching are considered to be in 'Good' condition, with 55% live coral cover, lower than the average (56.38%) for reefs of the Sunda Shelf region.

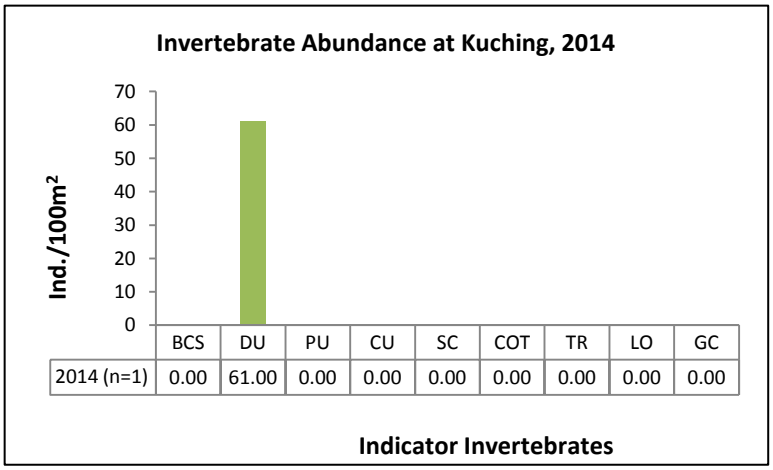
Level of RKC was very high at 20%, indicating recent disturbances in the area. NIA level was also high at 8.13%

Fish



Only two indicator fish were observed during the surveys (Butterflyfish and Snapper). Abundance of Butterflyfish was high at 16.25 individuals/500m^3.

Invertebrates



Only Diadema Urchin was recorded during the surveys and the abundance was high at 61 individuals/100m^2.

Boat anchor and trash were found on the reef. Damage due to warm water bleaching was also observed.

Straits of Malacca

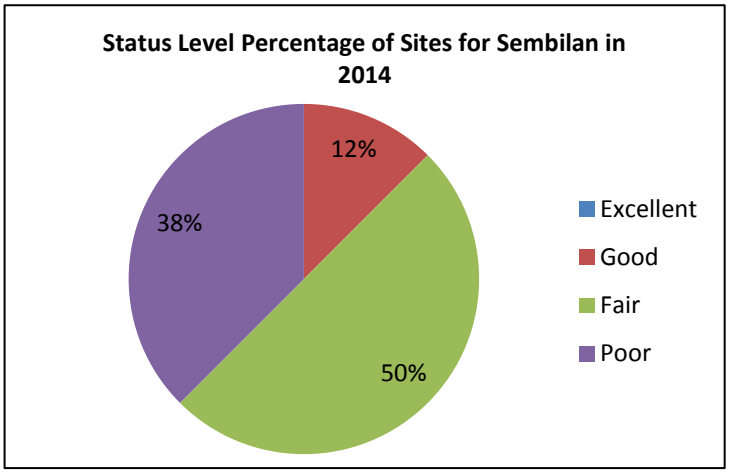
3.2.12 Sembilan Islands

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) and 15km south of Pulau Pangkor 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.

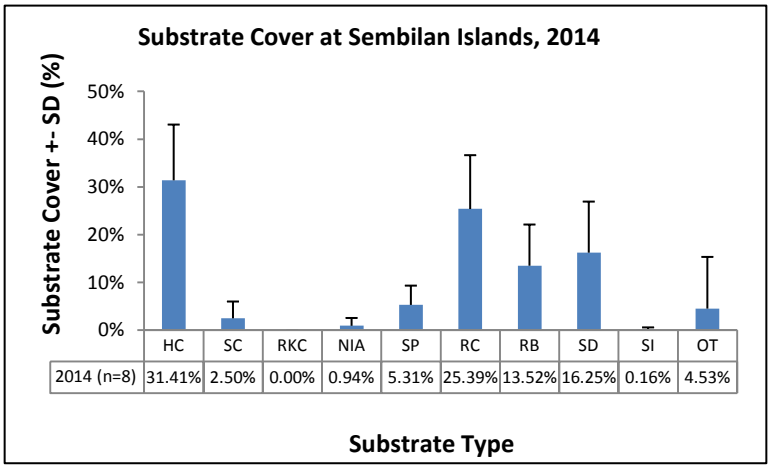
Pangkor Laut Island is an island off the coast of Perak, reached by ferry either from the old jetty or from Marina Island jetty both located in Lumut. It is promoted as a low-key tourist destination by the Malaysian government, but fishing, seafood and other fishing-related products remain major industries.

Map 14: Surveyed sites in Sembilan



A total of 8 coral reef sites were surveyed in Sembilan islands and only 12% of the reefs were in good condition. 50% of the sites were in fair condition, while the remaining 38% were in poor condition. No reefs were in excellent condition.

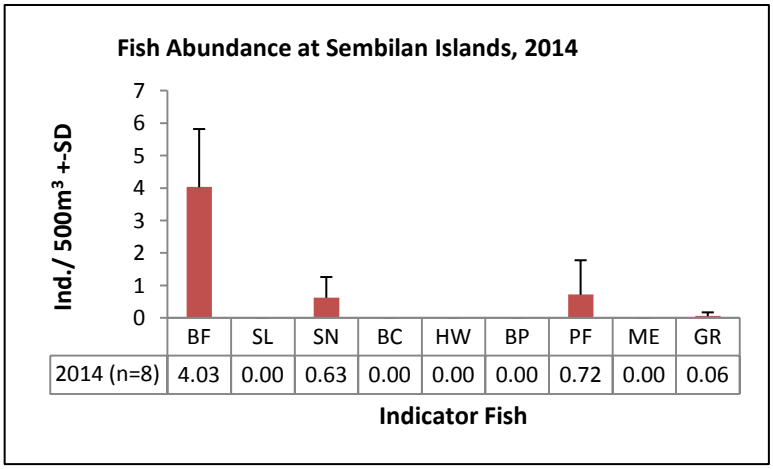
Substrate



Coral reefs around Sembilan islands are considered to be in 'Fair' condition, with 33.91% live coral cover.

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. 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.

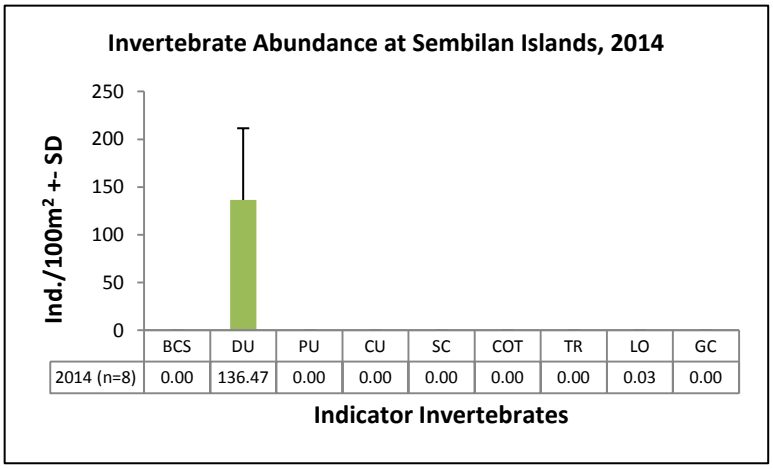
Fish



Only four indicator species were present during surveys (Butterflyfish, Snapper, Parrotfish and Grouper).

Abundance of Butterflyfish was the highest. Other indicator species were present in very low number, less than 1 ind./500m^3. On a positive note, many juvenile groupers were observed, 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 Urchin and Lobster.

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

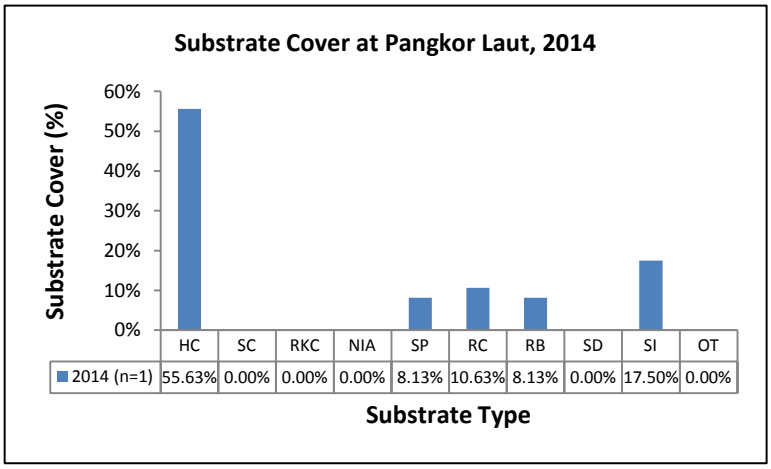
Trash, discarded fishing lines and nets were common on the reefs. Many of the reefs were also impacted by anchor and boat damage. Two seahorses were recorded during surveys.

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 15: Surveyed sites in Pangkor Laut

Substrate

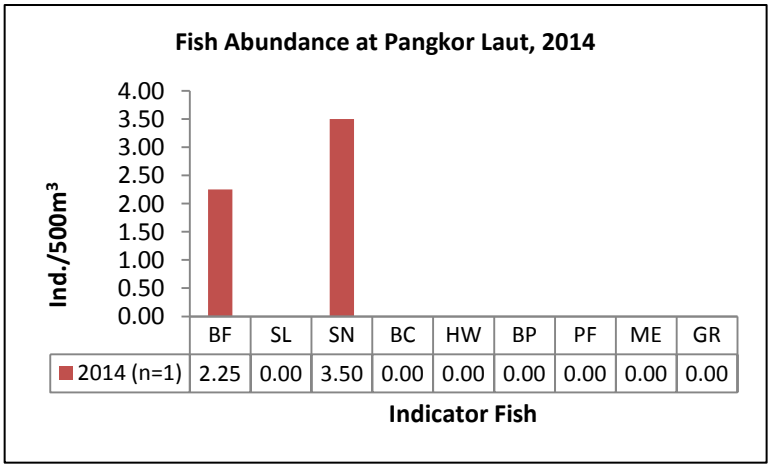


Coral reefs around Pangkor Laut are considered to be in 'Good' condition, with 55.63% live coral cover.

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.

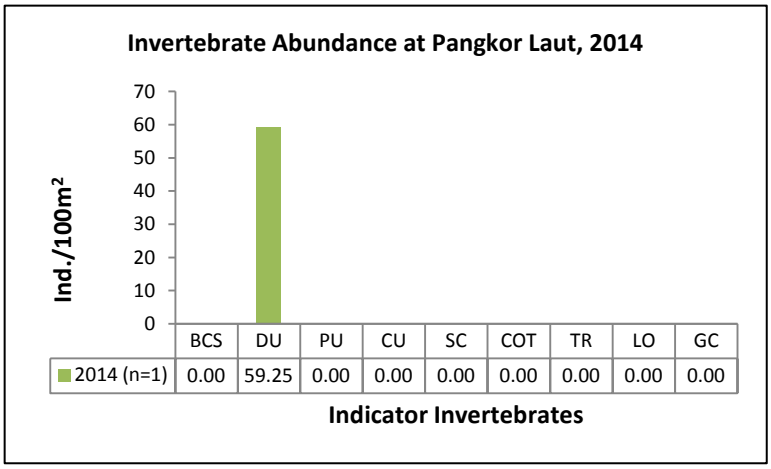
The level of RB was also high, indicating high level of recent disturbances in the area.

Fish



Only two indicator species were present during surveys, Butterflyfish and Snapper and their abundance was low.

Invertebrates



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

Damage by anchor and boat were observed on the reef.

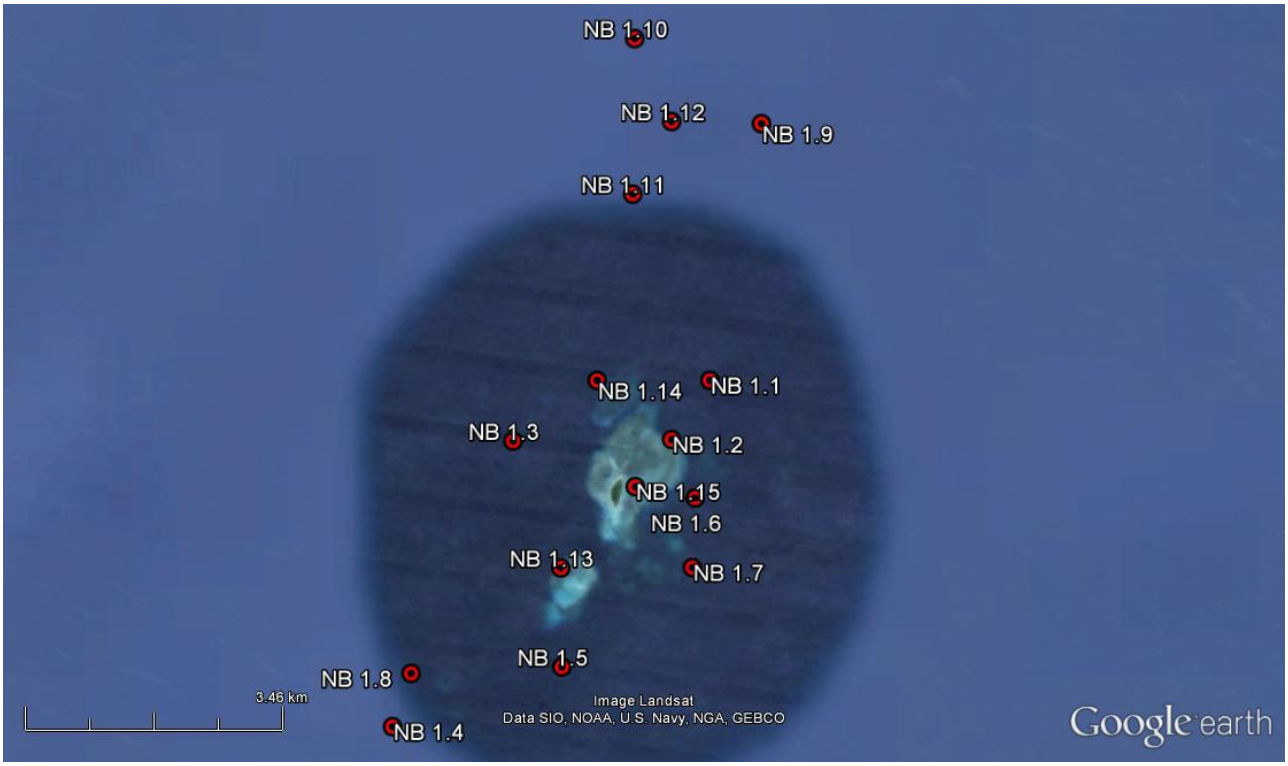
North Borneo

3.2.14 Lankayan

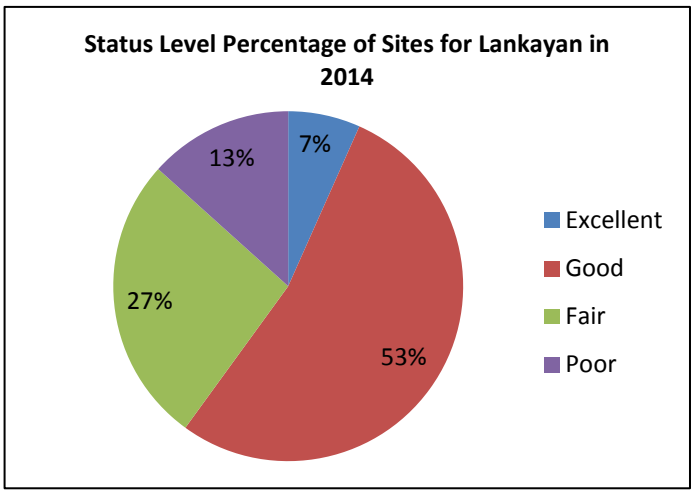
Lankayan is a small island in the Sulu Sea, a 1.5 hour boat ride north of Sandakan. A resort island, Lankayan is part of the Sugud Islands Marine Conservation Area (SIMCA), a large, privately managed MPA off the East coast of Sabah.

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 fishers from 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.

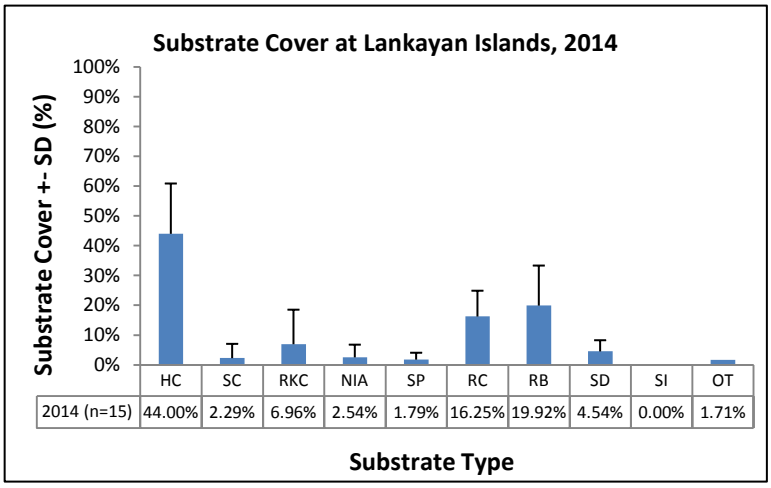


Map 16: Surveyed sites in Lankayan



A total of 15 coral reef sites were surveyed in Lankayan islands and only 7% of the reefs were in excellent condition. 53% of the reefs were in good condition and 27% were in fair condition. The remaining 13% of the reefs were in poor condition.

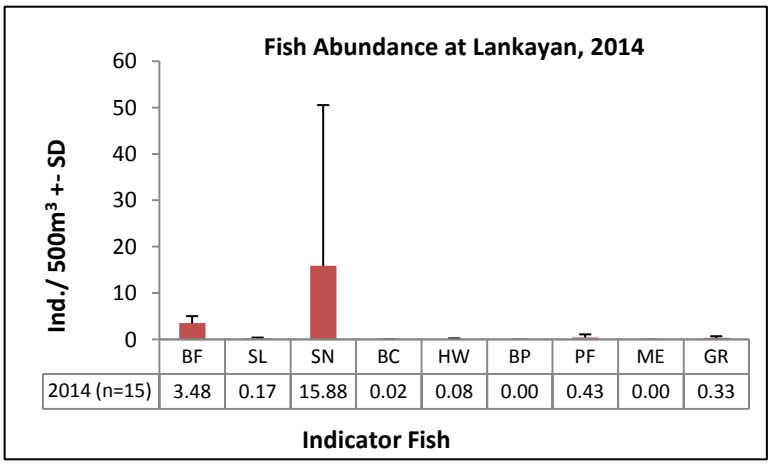
Substrate



The reefs in Lankayan islands are considered to be in 'Fair' condition, with 46.20% live coral cover, above the average (43.29%) for reefs within the North Borneo region.

RB level has increased from 16.5% in 2013 to 19.92% in 2014. RKC level has also increased from 1.54% in 2013 to 6.96% in 2014 and was the highest of all islands surveyed in North Borneo region. The increase suggests a high level of fish bombing activities in Lankayan. This need to be stopped before it destroys the whole of Lankayan's reef.

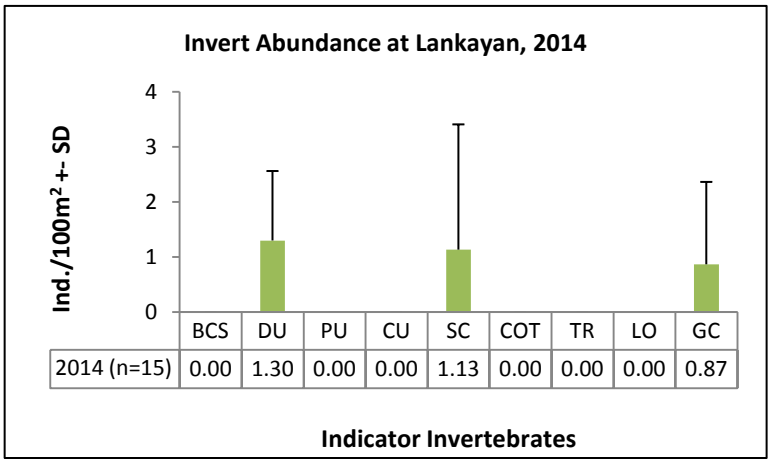
Fish



All indicator fish except for Bumphead Parrotfish and Moray Eel were seen during surveys.

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

Invertebrates



Only three indicator invertebrates were present during surveys, Diadema Urchin, Sea Cucumber and Giant Clam and their abundance was low.

Damage due to warm water bleaching was observed at all sites except at NB1.4 Goby Rock, NB1.5 Jaw Fish Lair and NB1.7 Lycia Garden. Some of the reefs were also impacted by trash. A turtle was observed at NB1.6 Ken's Rock.

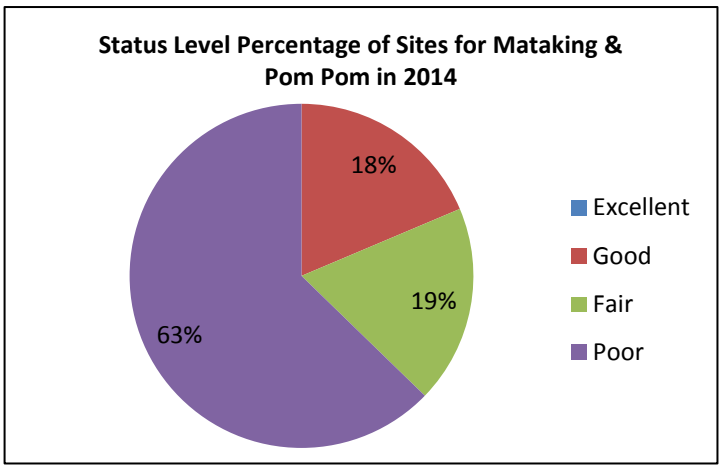
3.2.15 Mataking/Pom Pom

The two islands of Mataking and Pom Pom, which are 8km apart, are approximately 35km East from the major town of Semporna in the South of Sabah. Both islands are a well known tourist spot and have two resorts each. Diving and snorkelling are the main activities on both islands, and they access the same coral reef dive sites.

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.

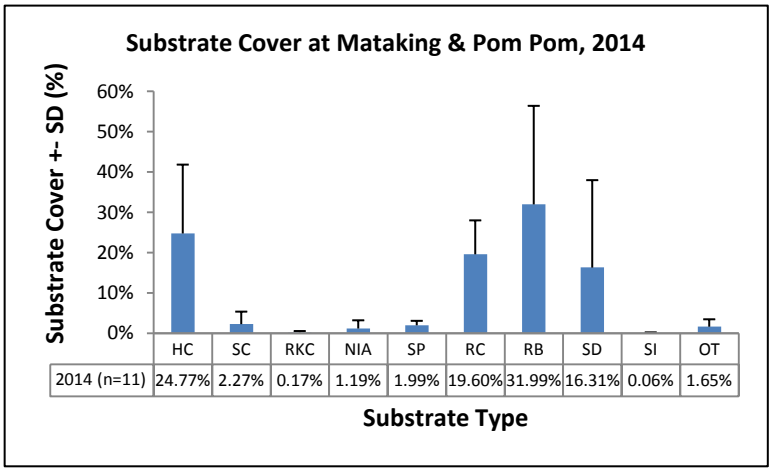
Both islands have fringing reefs, and coral extends down to almost 30m. Coral reefs around this, and surrounding, islands have been extensively damaged by fish bombing in the past, and fish bombing continues in some areas nearby.

Map 17: Surveyed sites in Mataking and Pom Pom



A total of 11 coral reef sites were surveyed in Mataking and Pom Pom islands. More than 60% of the reefs were in poor condition. 19% were in fair condition and only 18% were in good condition. No reefs were in excellent condition.

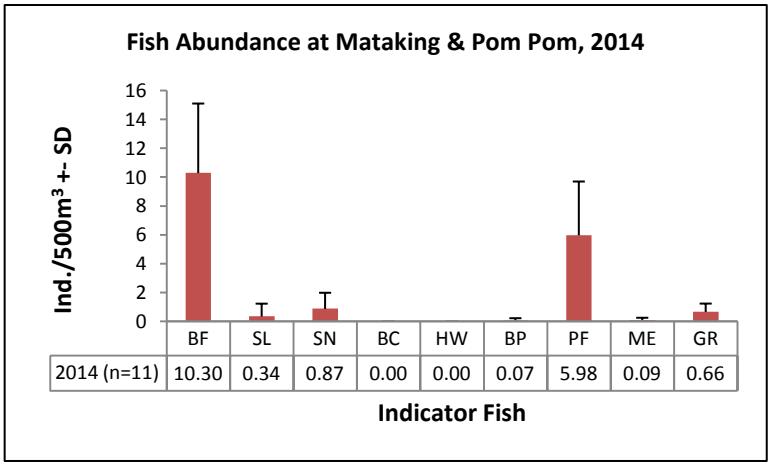
Substrate



The reefs around the island were considered to be in 'Fair' condition, with 27.04% live coral cover, below the average (43.29%) in the North Borneo region.

The reef in Mataking general had very high amount of RB (the highest in North Borneo region), with an average of 31.99%, rising to as high as 56.88% on one site (NB2.2 Coral Garden Mataking). The level of RB in Pom Pom recorded as high as 88.75%. This is due to extensive fish bombing over a long period of time, which is still going on currently.

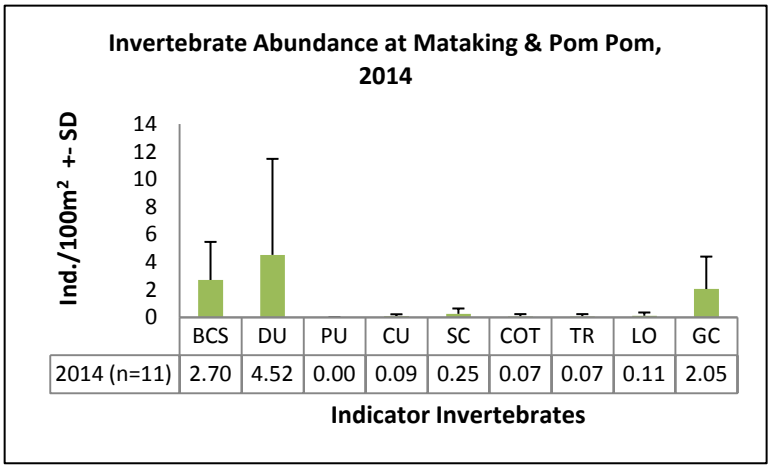
Fish



Only two indicator fish were absent during the surveys (Barramundi Cod and Humphead Wrasse). The abundance of Butterflyfish was the highest (second highest in North Borneo region), followed by Parrotfish.

Other indicator fish were present in low number.

Invertebrates



Only one indicator was absent from all surveys (Pencil Urchin).

The abundance of Diadema was the highest, followed by Banded Coral Shrimp. Population of other indicator invertebrates was low.

Both natural (warm water bleaching) and human (dynamite fishing, fishing nets and trash) impacts were seen on reefs during surveys. Mataking and Pom Pom recorded the highest number of turtle sighting during surveys. Turtle was observed at all survey sites except for NB2.7 Boheyan and NB2.2 Coral Garden. Eagle Ray was also seen at one of the sites.

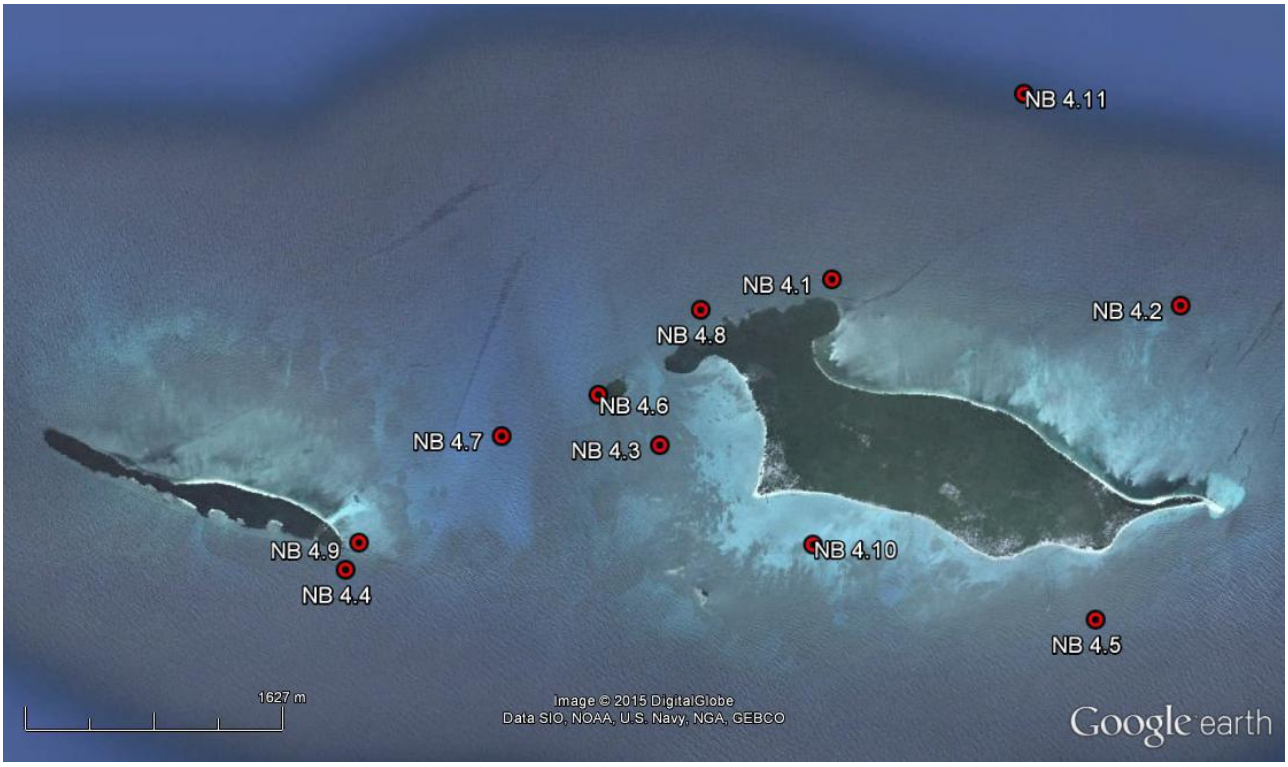
3.2.16 Mantanani

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

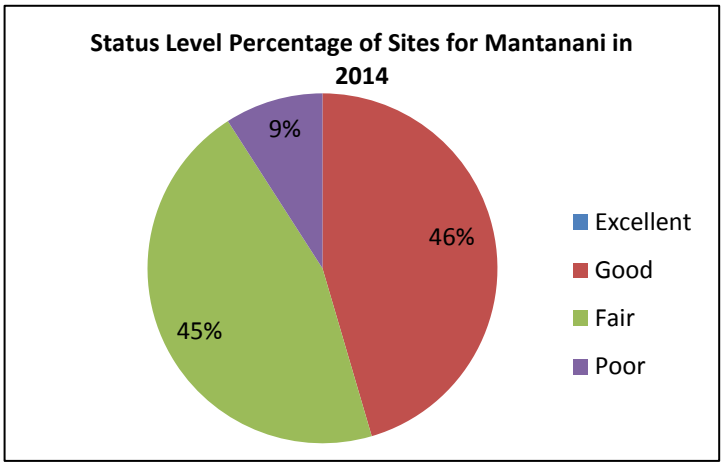
Mantanani is mainly populated by Bajau Ubian, with a small population of about 1,000 in two villages. The three main economic activities are fishing, drying salted fish and collecting shellfish.

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.

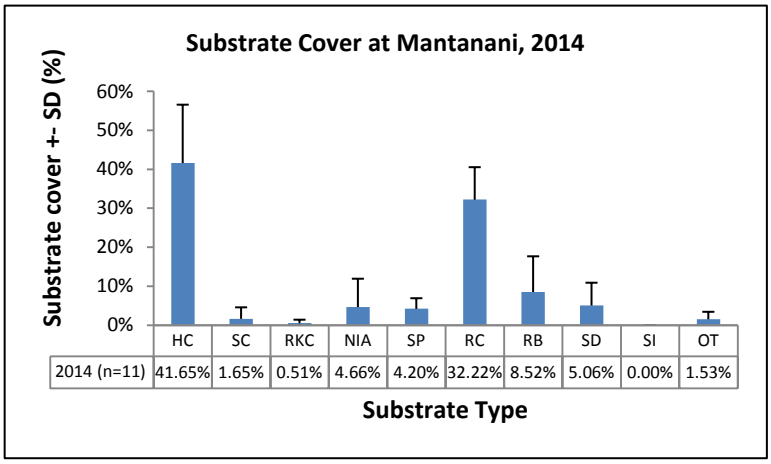


Map 18: Surveyed sites in Mantanani



A total of 11 coral reef sites were surveyed in Mantanani islands and 46% of the reefs were in good condition. 45% were in fair condition and the remaining 9% of the reefs were in poor condition. No reefs were in excellent condition.

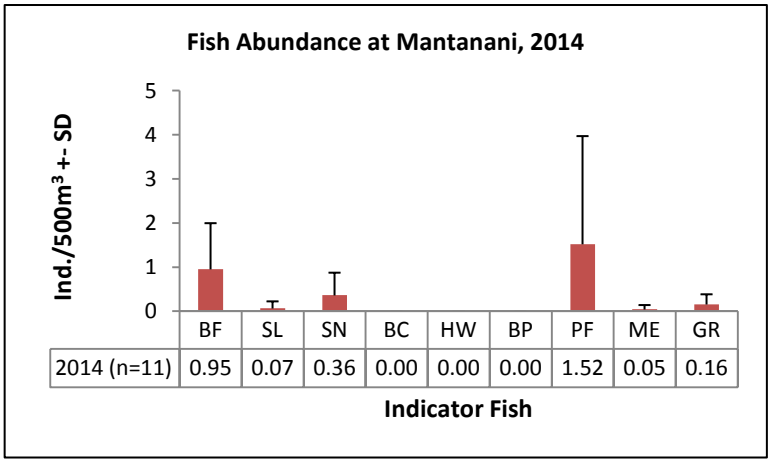
Substrate



Coral reefs around Mantanani islands are considered to be in 'Fair' condition, with 43.30% live coral cover, very similar to the average (43.29%) for reefs in the North Borneo region.

The level of RC has increased from 18.65% in 2013 to 32.22% in 2014, a significant proportion of which is dead coral and was recorded as RB in 2013. RB level has decreased from 23.94% in 2013 to 8.52% in 2014, much of which are reclassified as RC during 2014 surveys.

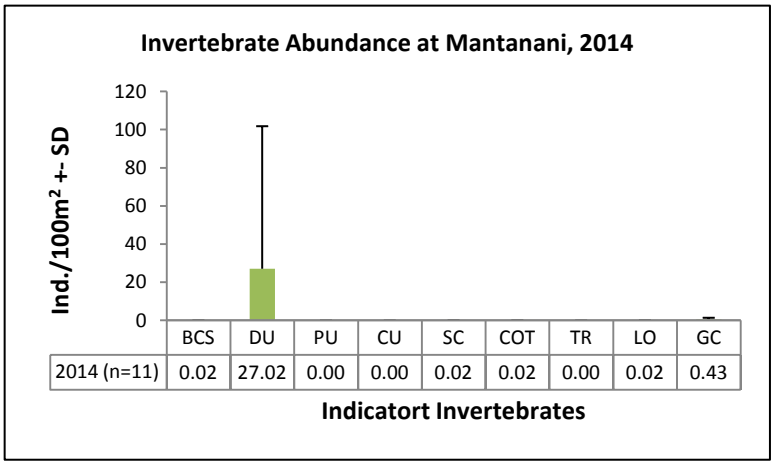
Fish



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

Other indicators were present in very low number. All indicators recorded less than 1 ind./500m^3 except for Parrotfish. These islands are not gazetted as a Marine Protected Area and are impacted by fishing pressure and destructive fishing method (fish bombing).

Invertebrates



Three indicator species were absent, including Pencil and Collector Urchin, and Triton.

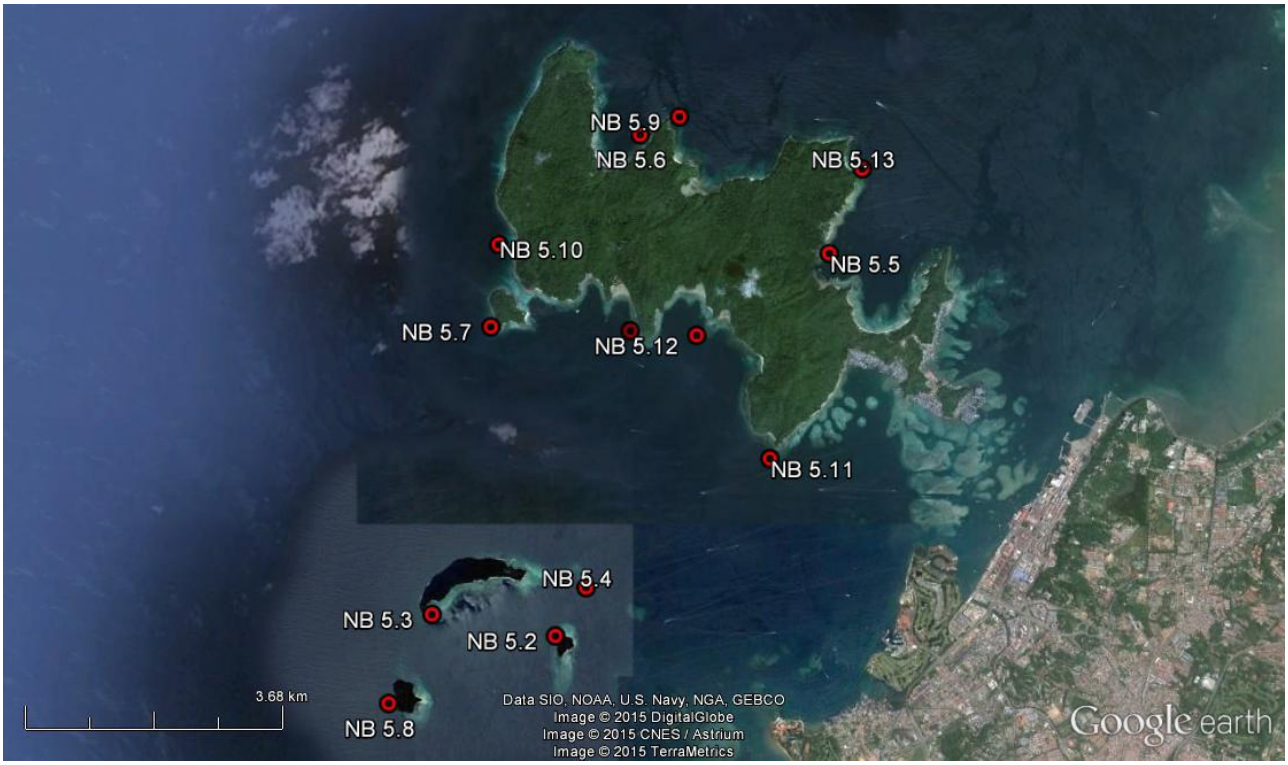
Abundance of Diadema Urchin was high. Other indicator species were present in very low number (Banded Coral Shrimp, Sea Cucumber, Crown-of-thorns, Lobster and Giant Clam).

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. One turtle was also recorded at NB5.4 Italian Place during surveys.

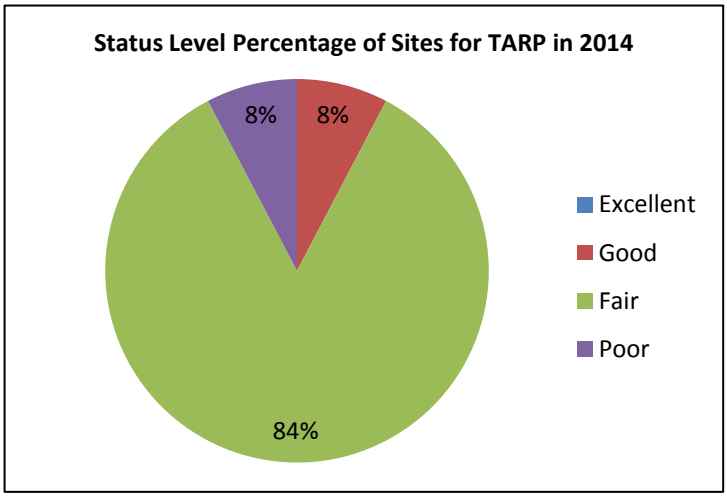
3.2.17 Tunku Abdul Rahman Park, Kota Kinabalu

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 is relatively untouched, remote and undeveloped. The islands receive large numbers of day tourists from Kota Kinabalu.

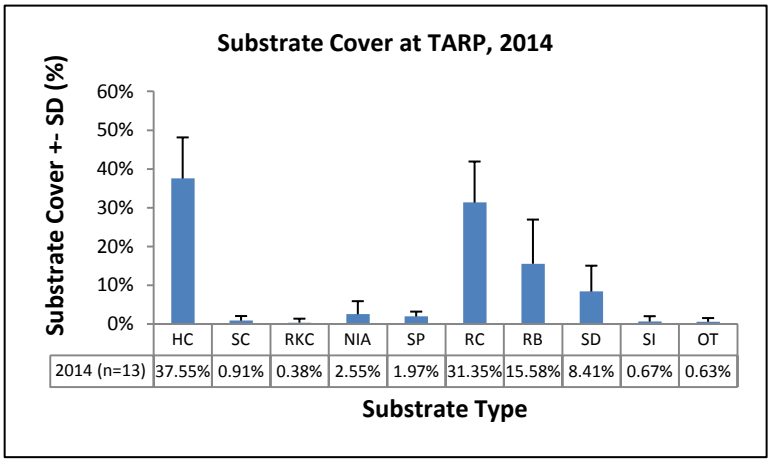


Map 19: Surveyed sites in TARP, Kota Kinabalu



A total of 13 coral reef sites were surveyed in TARP and 84% of the reefs were in fair condition. 8% were in good condition and the remaining 8% of the reefs were in poor condition. No reefs were in excellent condition.

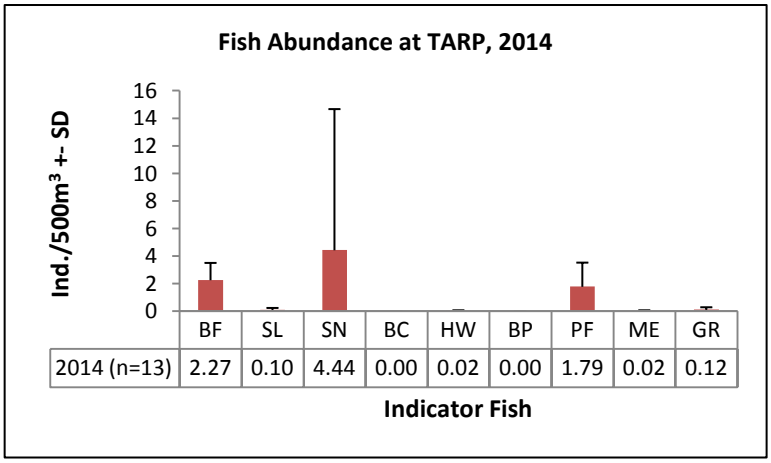
Substrate



Coral reefs around the islands are considered to be in 'Fair' condition with 38.46% live coral cover, below the average (43.29%) for reefs within the North Borneo region.

The high level of RB (15.58%) was similar to that of 2013, indicating recent disturbances to the reefs, and recorded as high as 42.50% at one site. This is a cause for concern and needs to be monitored closely.

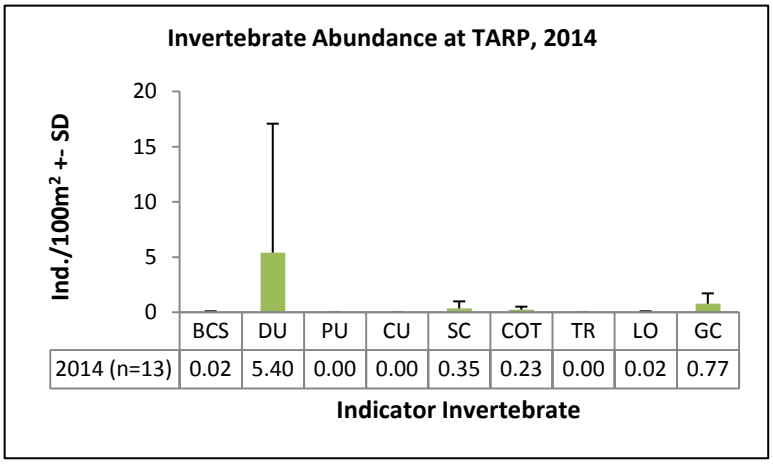
Fish



Only two indicator species were completely absent from surveys (Barramundi Cod and Bumphead Parrotfish).

Snapper was the most abundant indicator fish, followed by Butterflyfish and Parrotfish. Abundance of all other indicators were low (Sweetlip, Humphead Wrasse, Moray Eel and Grouper).

Invertebrates



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

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

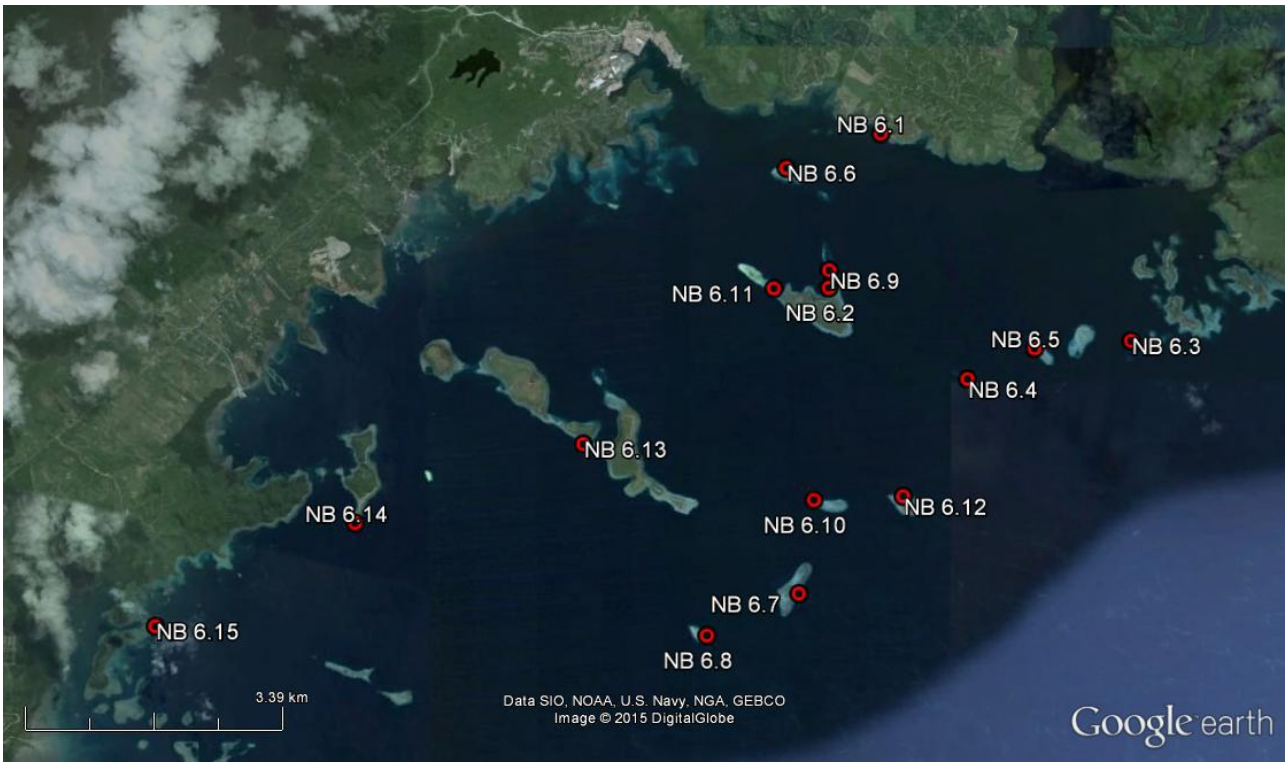
Trash, discarded fishing nets and line were observed during surveys. Shark and turtle were also recorded during the surveys.

3.2.18 Lahad Datu

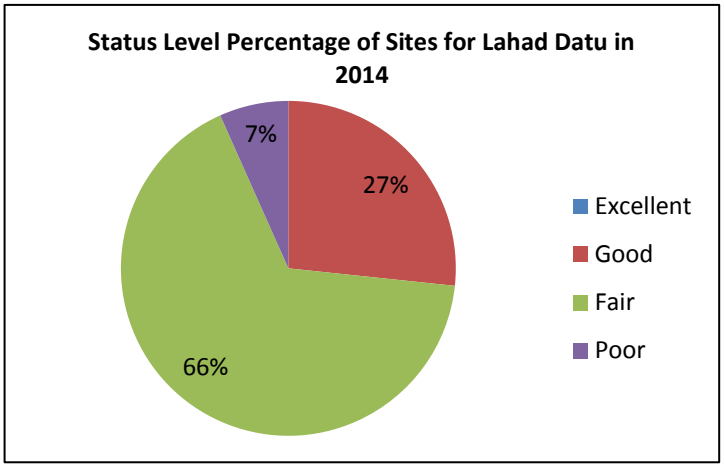
Lahad Datu is a town located in the east of Sabah, Malaysia, on the island of Borneo. It occupies the peninsula on the north side of Darvel Bay – the largest semi-enclosed bay on the east coast of Borneo islands. Administratively, it falls within the Tawau Division and is estimated to have a population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

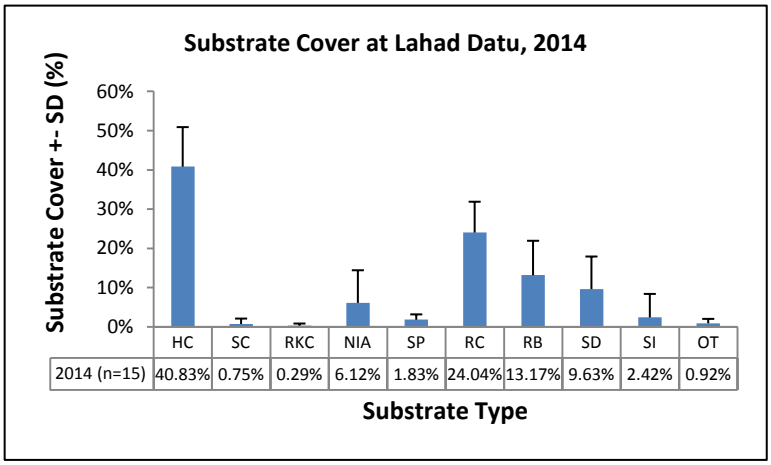


Map 20: Surveyed sites in Lahad Datu



A total of 15 coral reef sites were surveyed in Lahad Datu and 66% of the reefs were in fair condition. Only 27% of the reefs were in good condition and the remaining 7% were in poor condition No reefs were in excellent condition.

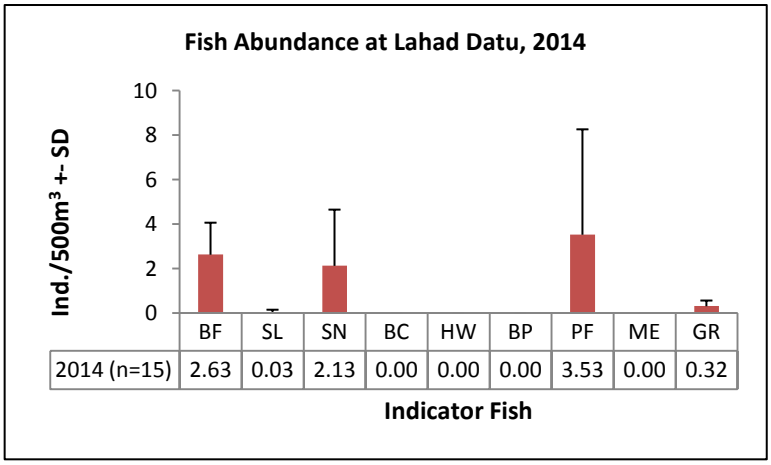
Substrate



Reefs in Lahad Datu are considered to be in 'Fair' condition with live coral cover of 41.58%, below the average (43.29%) for reefs in the North Borneo region.

RB level was high with half of the survey sites recorded more than 10% and one site recorded more than 30%. This is due to destructive fishing method occurring around that area.

Fish

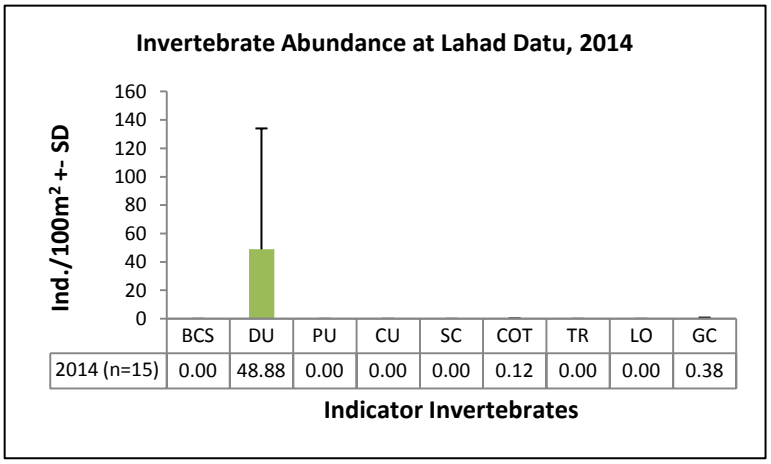


Four indicator fish were absent during surveys (Barramundi Cod, Humphead Wrasse, Bumphead Parrotfish and Moray Eel).

Parrotfish recorded the highest number, followed by Butterflyfish and Snapper. Sweetlip and Grouper were present in very low number.

Many juveniles Grouper were observed, indicating a possible recovery in population abundance, however fishing is common in this area and none of the reefs are protected by law.

Invertebrates



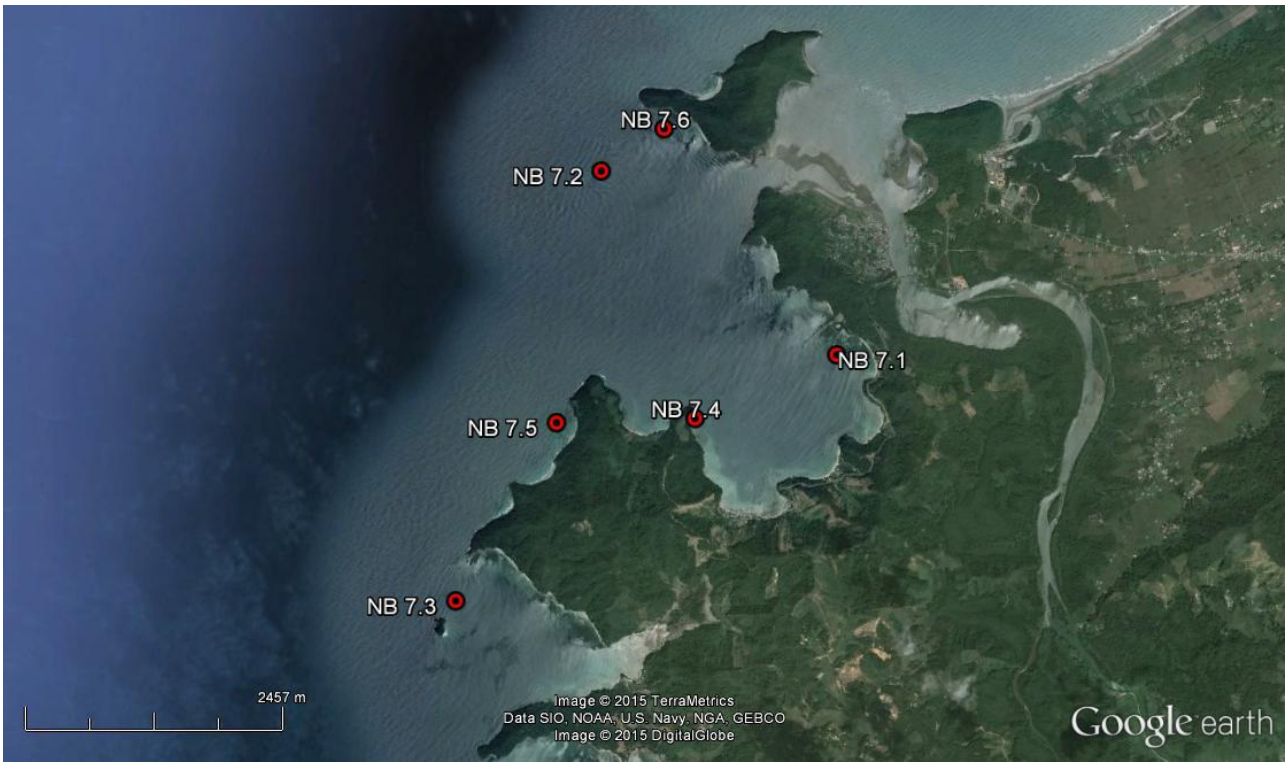
Only three indicator invertebrates were present during surveys, Diadema Urchin, Crown-of-thorns and Giant Clam. The abundance of Diadema Urchin was high (second highest in the North Borneo region) while the abundance of Crown-of-thorns and Giant Clam was low.

On a positive note, Collector Urchin was seen just outside the survey area.

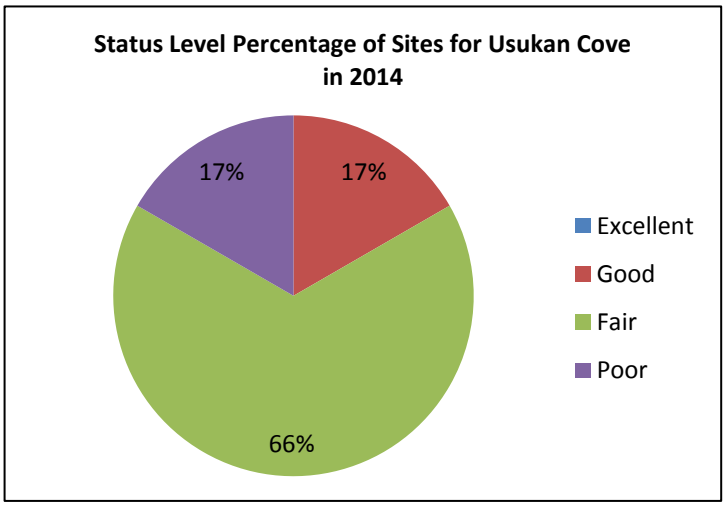
Extensive human impacts were seen on most of the reefs. Signs of boat anchor damage, dynamite fishing, discarded fishing nets and trash were visible during surveys. Two of the sites, NB7.2 House Reef and NB7.4 Lam's Point, were also impacted by mild bleaching.

3.2.19 Usukan Cove

Usukan Cove is located on the North West coast of Sabah approximately half way between Kota Kinabalu and Kudat.

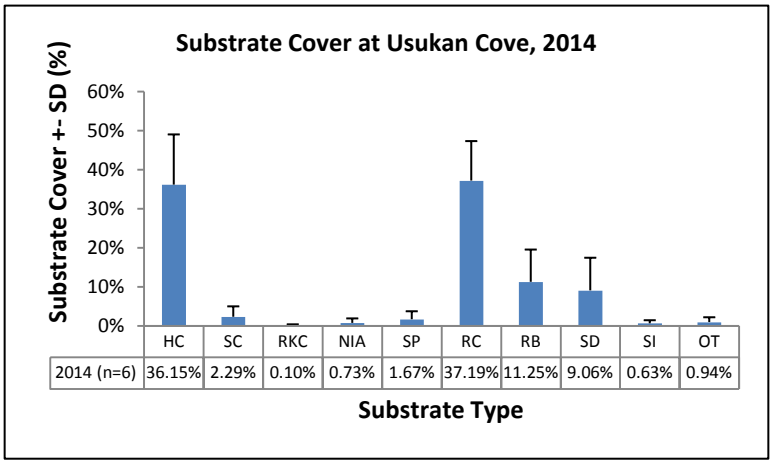


Map 21: Surveyed sites in Kota Usukan Cove



A total of 6 coral reef sites were surveyed in Usukan Cove and 66% of the reefs were in fair condition. 17% were in fair condition while the remaining 17% were in poor condition. No reefs were in excellent condition.

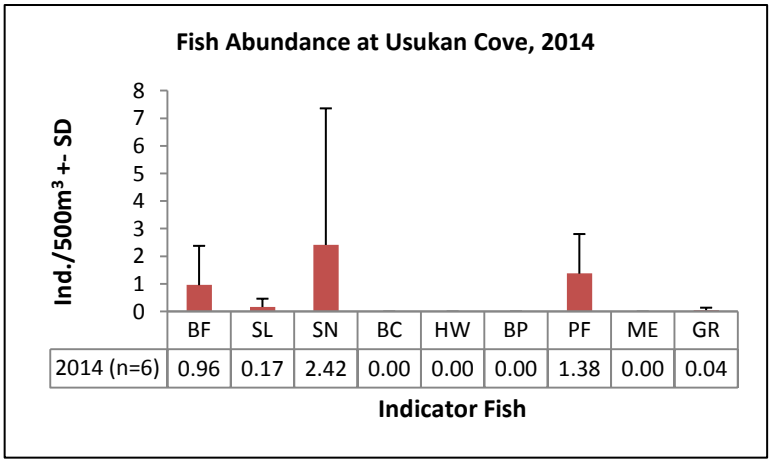
Substrate



Reefs in Usukan Cove are considered to be in 'Fair' condition with 38.44% live coral cover, below the average (43.29%) for North Borneo region. Large area of the reefs consists mainly of dead coral (RC and RB). Fish bombing was common in this area and this is likely to have caused the damage.

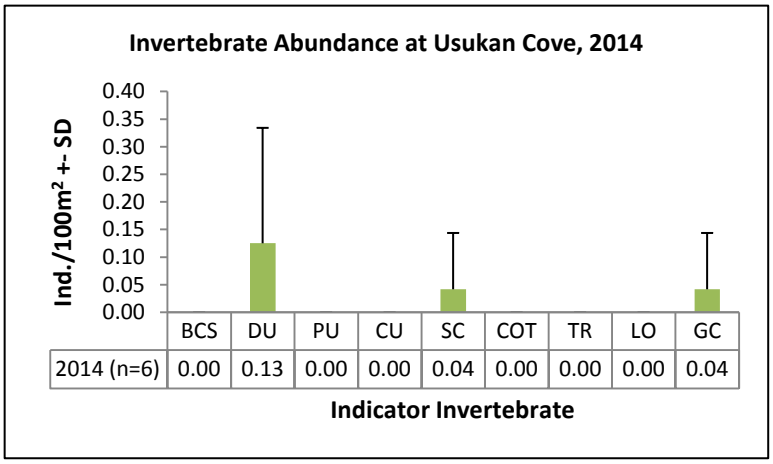
Low level of SI, SP and NIA indicates the water is suitable for coral to grow and large area of rock provides suitable substrate for coral recruitment. If the threat of fish bombing is removed, coral may be able to re-colonise this area.

Fish



Four indicator fish were absent from surveys (Barramundi Cod, Humphead Wrasse, Bumphead Parrotfish and Moray Eel). Other indicator fish were present in very low abundance, less than 1 ind./500m^3 except for Parrotfish.

Invertebrates



Only three indicator invertebrates were observed during surveys (Diadema, Urchin, Sea Cucumber and Giant Clam) and their abundance was very low.

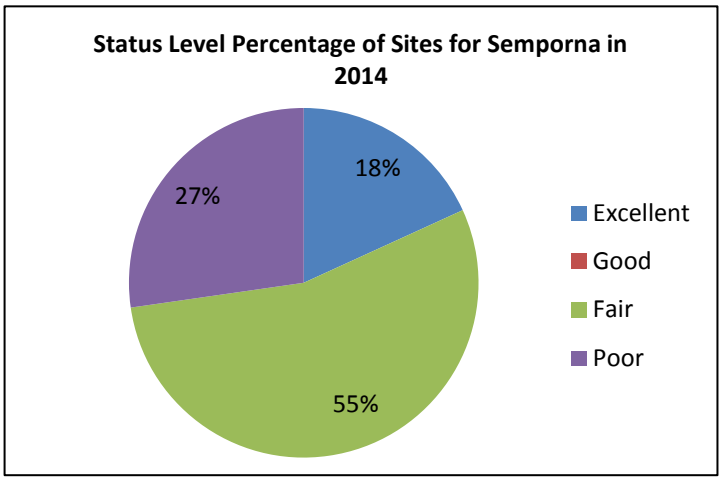
Extensive human and natural impacts were seen on the reefs with signs of boat anchor damage, trash, discarded fishing nets and lines, dynamite fishing and warm water bleaching.

3.2.20 Semporna

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.

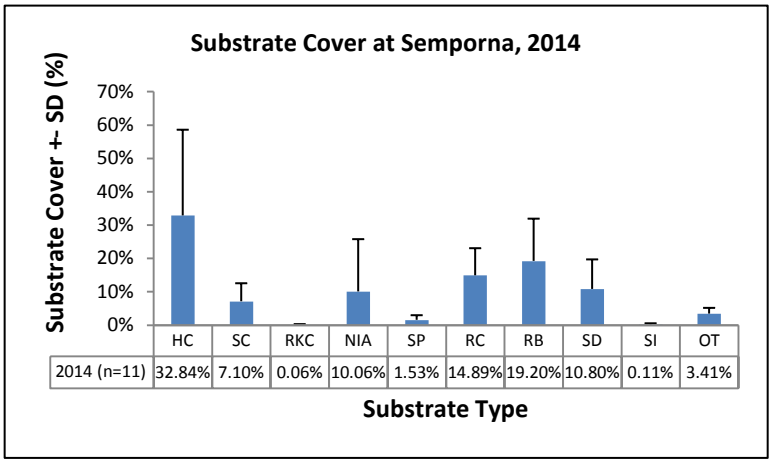
Tourism is also an important element of the economy. Semporna is a popular base for tourists visiting Sipadan, Mabul and other islands nearby.

Map 22: Surveyed sites in Semporna



A total of 11 coral reef sites were surveyed in Semporna and only 18% of the reefs were in excellent condition. 55% were in fair condition and the remaining 27% were in poor condition. No reefs were in good condition.

Substrate

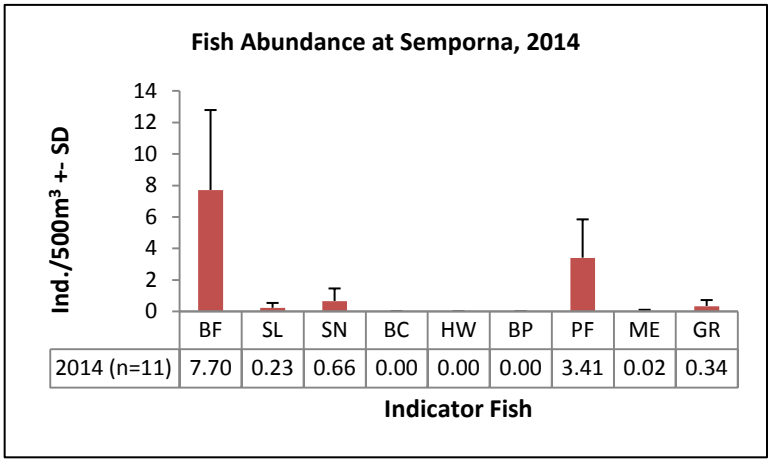


Reefs in Semporna were considered to be in 'Fair' condition with 39.94% live coral cover and were below the average (43.29%) for North Borneo Region.

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

The high level of NIA, the highest of all islands surveyed in the North Borneo region, indicates that the waters around Semporna are rich in nutrients.

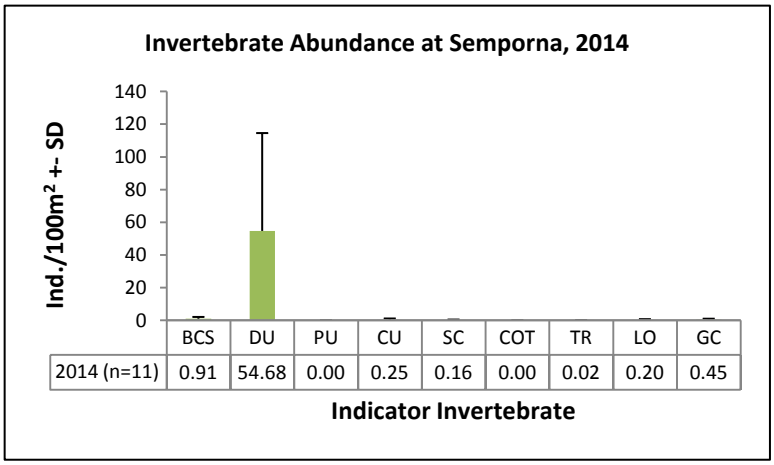
Fish



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

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

Invertebrate



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

Abundance of Diadema Urchin was high and was the highest of all surveyed in North Borneo region (this reflects the level of NIA mentioned above). The abundance of other indicators were very low, less than 1 ind./100m^2.

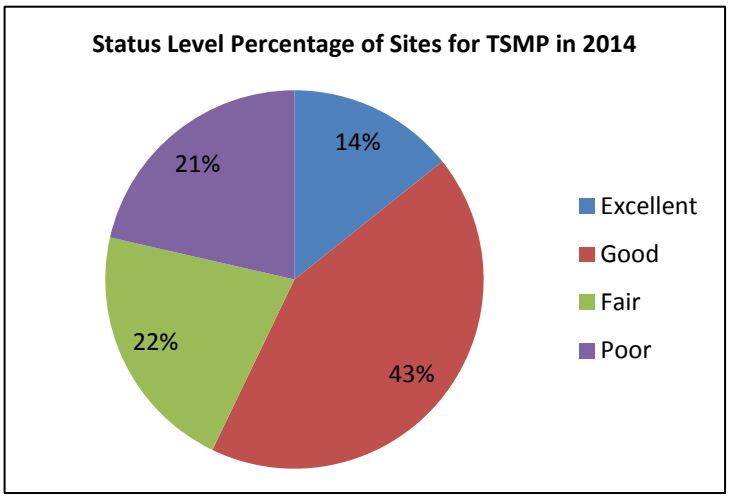
Extensive damage by dynamite fishing was observed during surveys. Signs of coral damage due to trash, discarded fishing gear and warm water bleaching were also seen. A turtle was also recorded during surveys.

3.2.21 Tun 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.

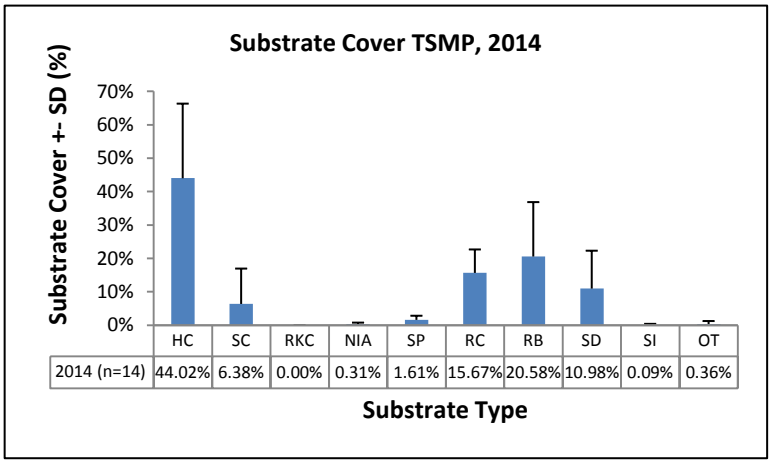
In 2004, the park became the seventh gazetted area under Sabah Parks with a total area of 100.8 km². There are approximately 2,000 people living within the park.

Map 23: Surveyed sites in Tun Sakaran Marine Park, Semporna



A total of 14 coral reef sites were surveyed in TSMP and only 14% of the reefs were in excellent condition. 43% were in good condition and 22% were in fair condition. The remaining 21% of the reefs were in poor condition.

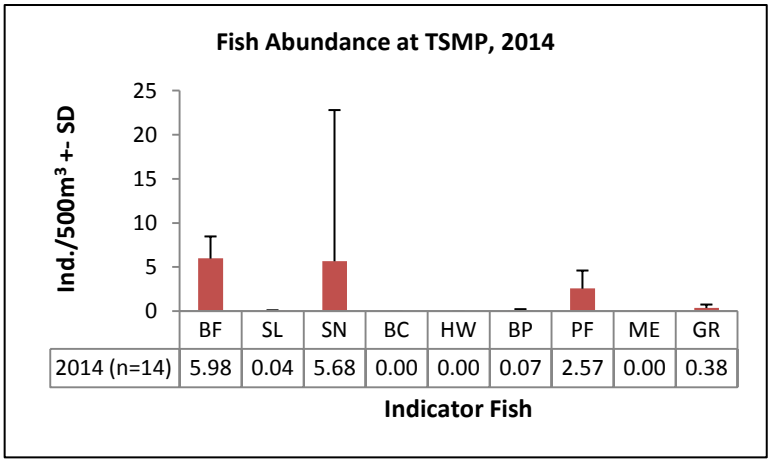
Substrate



Coral reefs within the TSMP were considered to be in 'Good' condition with 50.40% live coral cover, above the average (43.29%) for reefs within the North Borneo region.

High amount of RC was recorded and this indicates that there is suitable substrate for coral recruits to settle and grow. High amount of RB was also recorded and this may be due to illegal fish bombing activities that are known to occur.

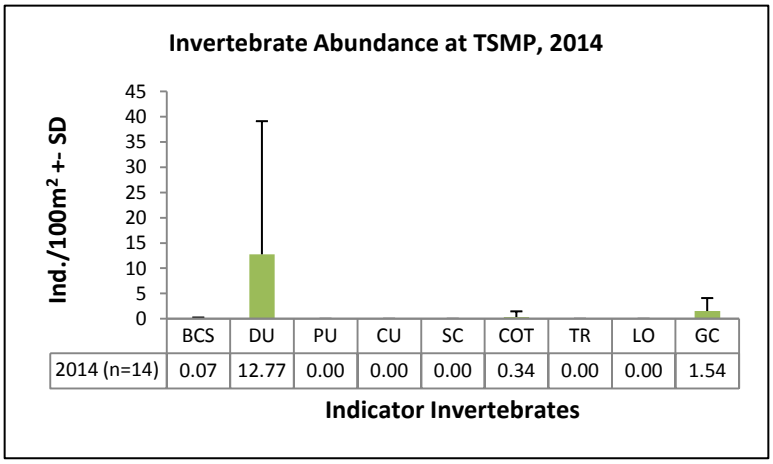
Fish



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

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

Invertebrates



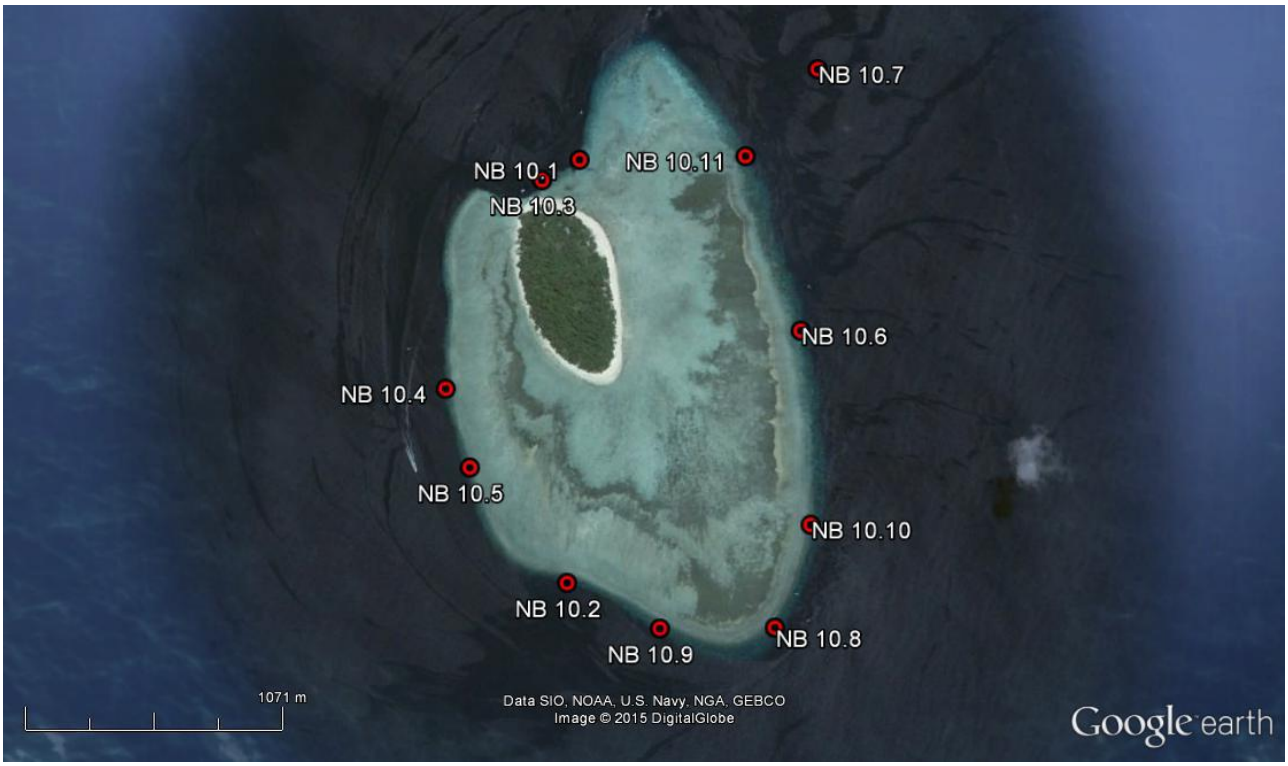
Diadema Urchin was the most abundant indicator invertebrate. Other indicators were recorded in low abundance.

Sign of dynamite fishing as well as warm water bleaching were seen on the reefs during surveys. Shark, turtle and a school of barracuda were observed during the surveys.

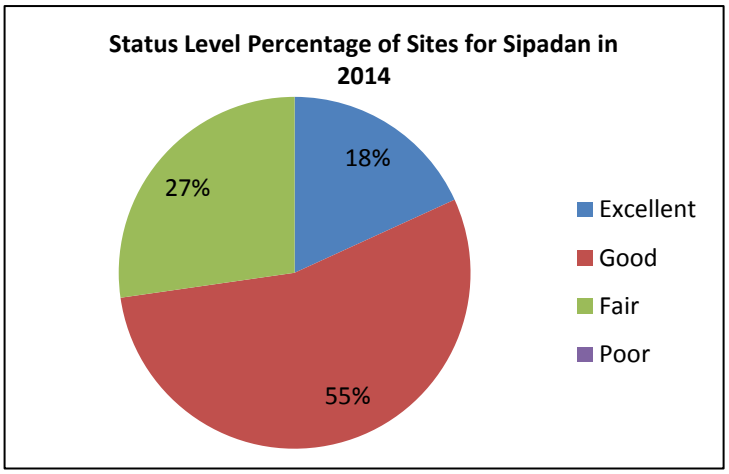
3.2.22 Sipadan

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 cone that 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

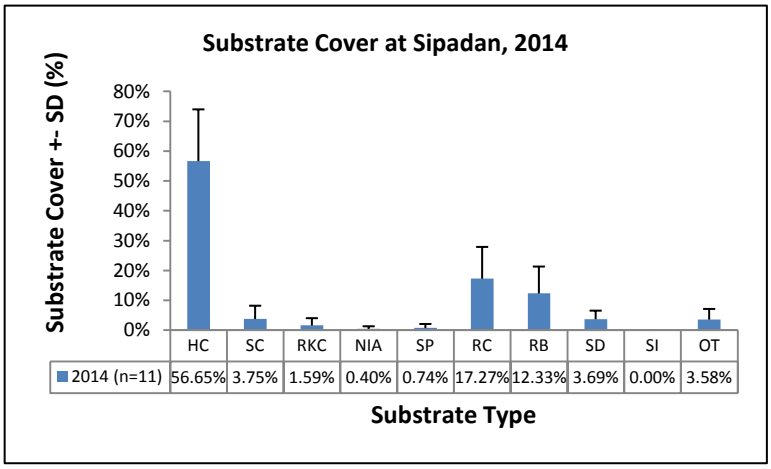


Map 24: Surveyed sites in Sipadan



A total of 11 coral reef sites were surveyed in Sipadan and 18% of the reefs were in excellent condition. 55% were in good condition and the remaining 27% were in fair condition. No reefs were in poor condition.

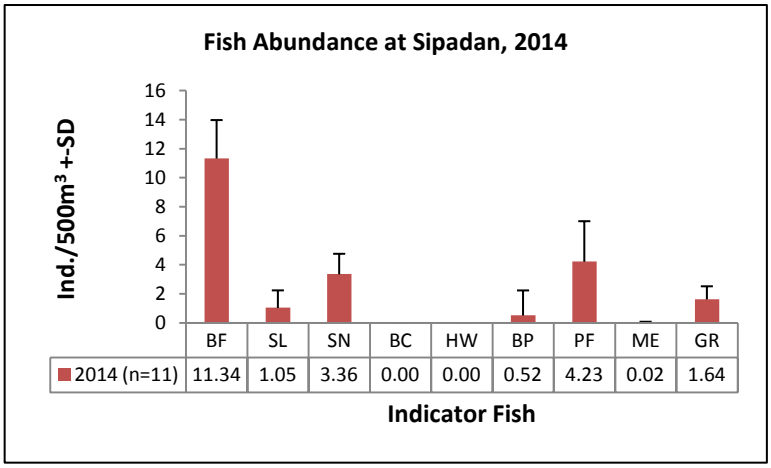
Substrate



Coral reefs within the Sipadan were considered to be in 'Good' condition with 60.40% live coral cover and above the average (43.29%) of reefs within the North Borneo region.

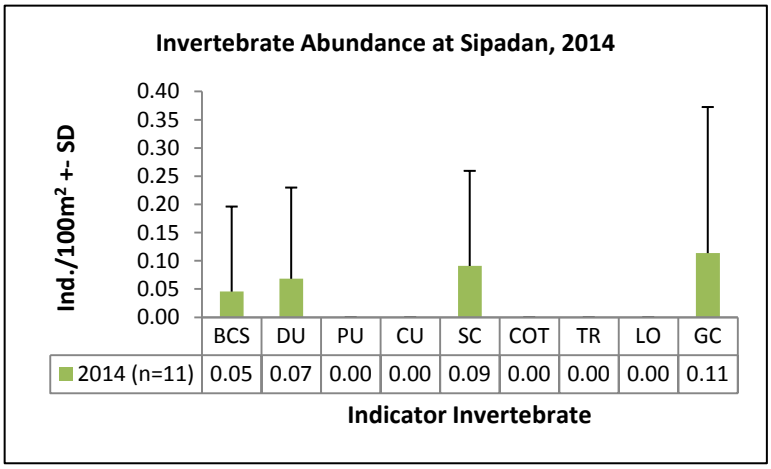
Reasonable amount of RC was recorded and this indicates that there is suitable substrate for coral recruits to settle and grow. High amounts of RB were also recorded and this may be due to the high number of tourists visiting the island. This is a cause for concern and needs to be monitored closely.

Fish



Butterflyfish was the most abundant indicator recorded during surveys (the highest of all islands surveyed in North Borneo region), followed by Parrotfish and Snapper. Sweetlip, Bumphead Parrotfish, Moray Eel and Grouper were present in low number.

Invertebrate



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

Sharks and turtles were recorded during surveys.

3.3 Six Years Comparison – Perhentian, Redang, Tioman and Tenggol

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. The sections below provide details of the health of selected coral reefs in Perhentian, Redang, Tioman and Tenggol over 6 years, from 2009 to 2014. Only sites that were surveyed every year over the 6 years period are included in this section: 10 in Perhentian, 8 in Redang, 10 in Tioman and 5 in Tenggol:

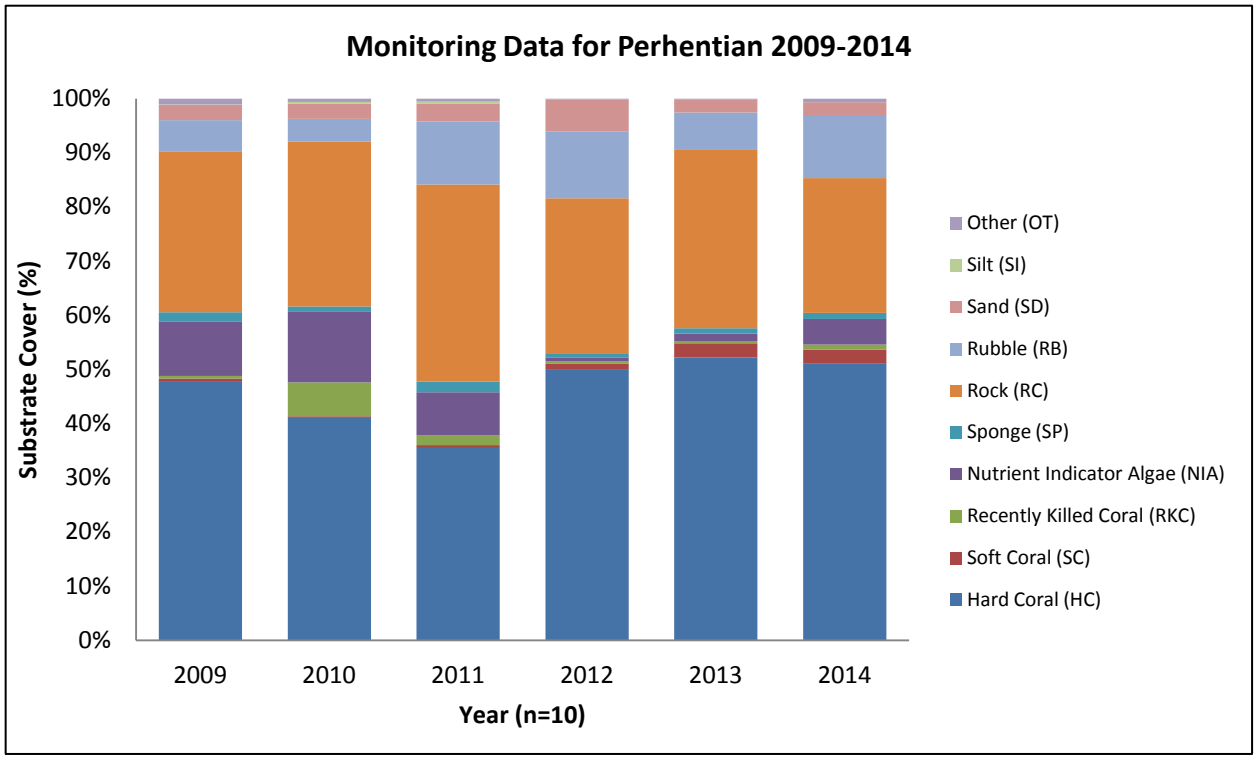
Perhentian Batu Nisan, D' Lagoon, Sea Bell, Tanjung Besi, Batu Layar, Sharkpoint, Batu Tabir, Tukas Laut, Tiga Ruang and Pulau Rawa

Redang Chagar Hutang East, Pulau Lima Southern Tip, P. Paku Kecil, P. Pinang, P. Paku Besar, Redang Kalong House Reef, P. Kerengga Besar and P. Kerengga Kecil

Tioman Teluk Kador, Batu Malang, Pirate Reefs, Renggis North, Soyak, Soyak South, Sepoi, Chebeh, Tomok and Labas

Tenggol Turtle Point, Gua Rajawali, Teluk Rajawali, Rajawali Reef, Freshwater Bay

3.3.1 Perhentian



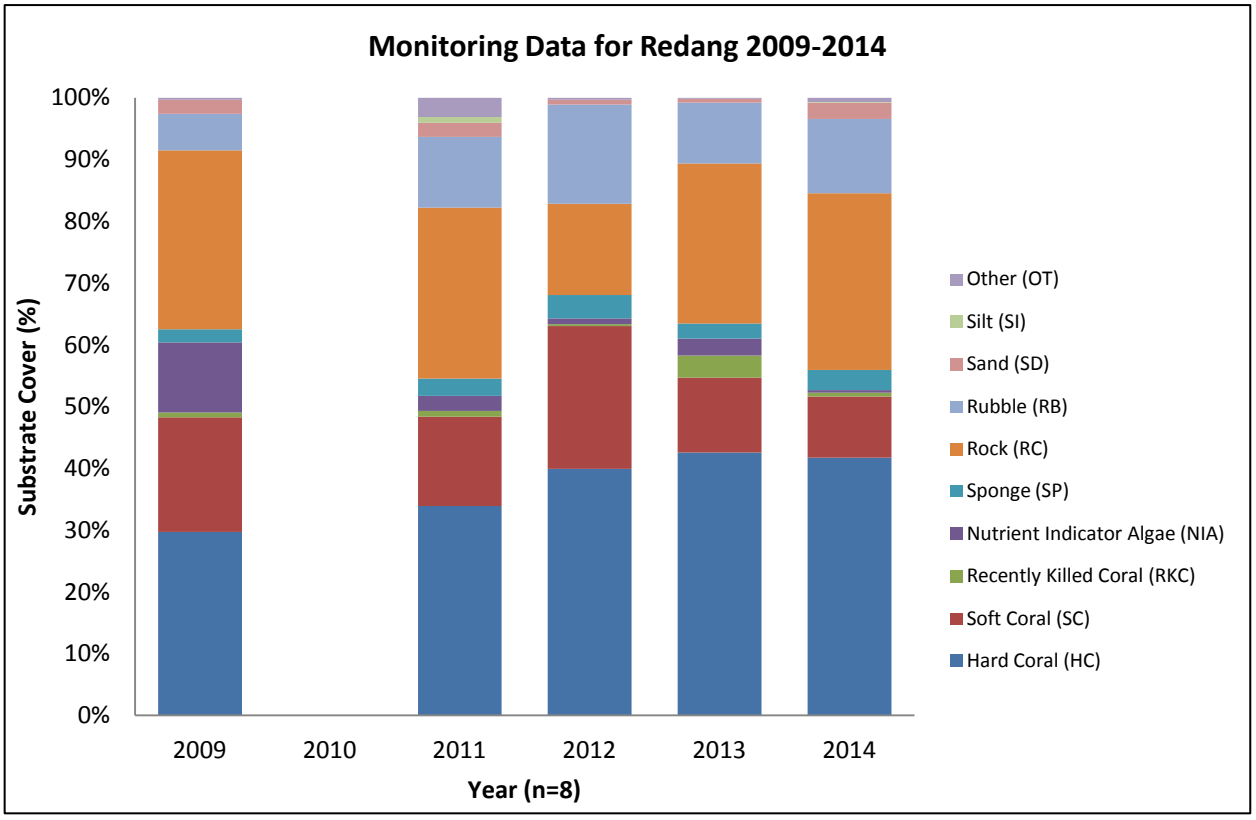
The data from the surveys conducted on Perhentian over the last six years show that there have been quite significant variations in reef health over that period of time. A 26% decrease in HC cover over the first three years from 47.88% (2009) to 35.38% (2011) is probably reflecting the impact of the major bleaching event experienced in 2010. This is mirrored by concomitant changes in RKC and RC over the period. The data are consistent with HC killed by the 2010 bleaching event being reclassified first as RKC (large increase from 2009 to 2010 and declining in 2011) and then RC (highest level in 2011).

The 2012 surveys then show a substantial recovery, with HC cover increasing to 49.94%. In 2014, HC cover has increased to 51.06%. Live Coral Cover (LCC = HC + SC) has been consistently recorded above 50% since the 2012 surveys, a rating of "good" according to the Coral Reef Health Criteria. These data are probably reflecting that the reefs are resilient, being able to recover from the destructive effect of bleaching.

The inconsistent factor is the level of NIA detected during surveys. From 2009 to 2011 the level of NIA remained in the range 7 to 14%, followed by a substantial decrease in 2012 to 0.75% and increased again in 2013 and 2014 to 4.75% in 2014. 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 Redang

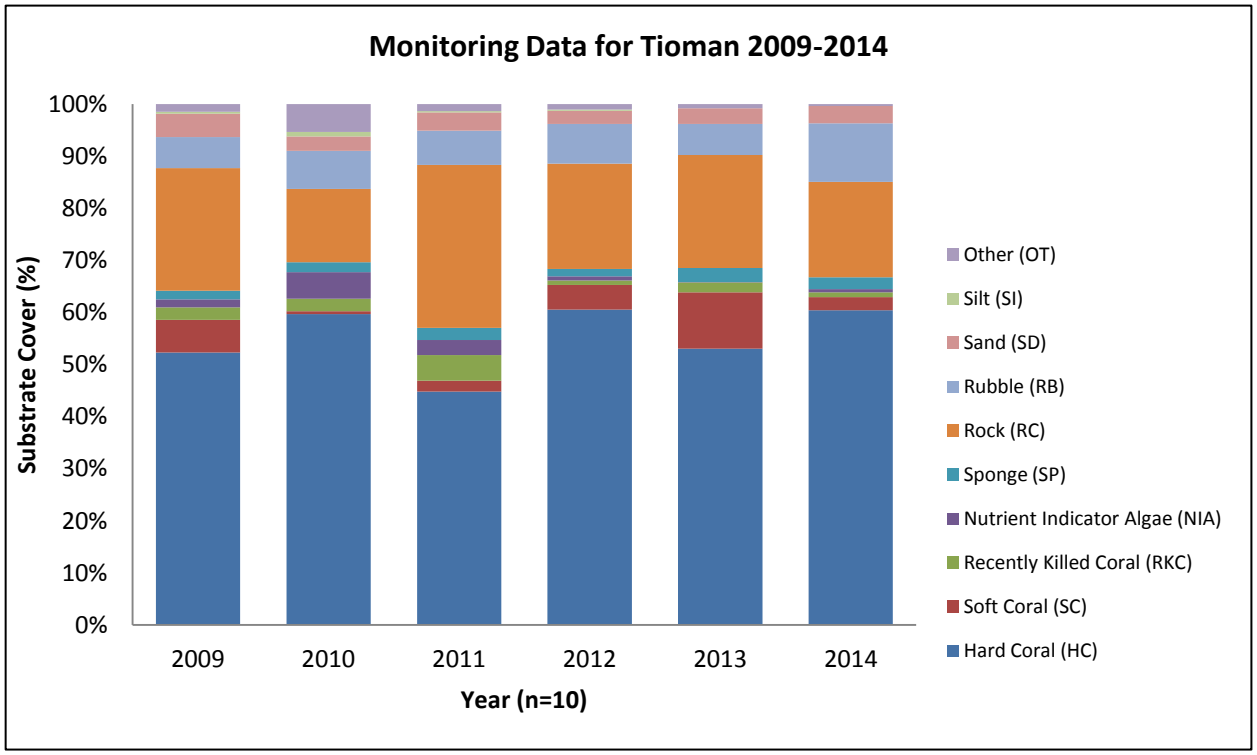


The data from surveys conducted on Redang since 2009 follow a similar to Perhentian. Despite the lack of data for 2010, we can still see that there has been a slight increase in HC cover over the years, with the exception of a very slight decrease in 2014. The overall condition of coral reefs around Redang Island has been good over the years, with average LCC at or above 50%.

The level of RB has remained high in the range 9 to 17% in the last 4 years, from 2011 to 2014. The sites of most concern are Chagar Hutang East, Pulau Lima Southern Tip, Pulau Pinang and Pulau Kerengga Kecil where over 10% RB was recorded during the 2014 survey. This situation needs to be monitored to ensure no continuing recent damage as it could have a negative impact on the corals over a long term period.

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

3.3.3 Tioman



The data from the surveys conducted on Tioman over the last 6 years show that there have been some variations over that period of time. Generally, the condition of the coral reefs surveyed around Tioman Island has been consistently good over the years, with LCC cover above 50% with the exception of 46.79% in 2011. In the past 3 years, from 2012 to 2014, LCC has been consistently recorded to be above 60%.

There was a considerable decrease in HC cover from 59.70% in 2010 to 44.71% in 2011. The decrease of HC was likely due to the 2010 mass bleaching event. In 2012, HC increased considerably to 60.52% and maintained at 60.41% in 2014, probably showing the reefs are resilient, being able to recover from the destructive effect of bleaching.

The level of RB has remained in the range of 5 to 8% over the survey period. However the average level has increased substantially in 2014 to 11.22% from 5.91% in 2013. The sites of most concern are Teluk Kador and Labas. At Teluk Kador, RB level increased from 1.88% in 2013 to 14.38% in 2014 while at Labas, RB level increased from 9.38% in 2013 to 50.63% in 2014. 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.

3.3.4 Tenggol

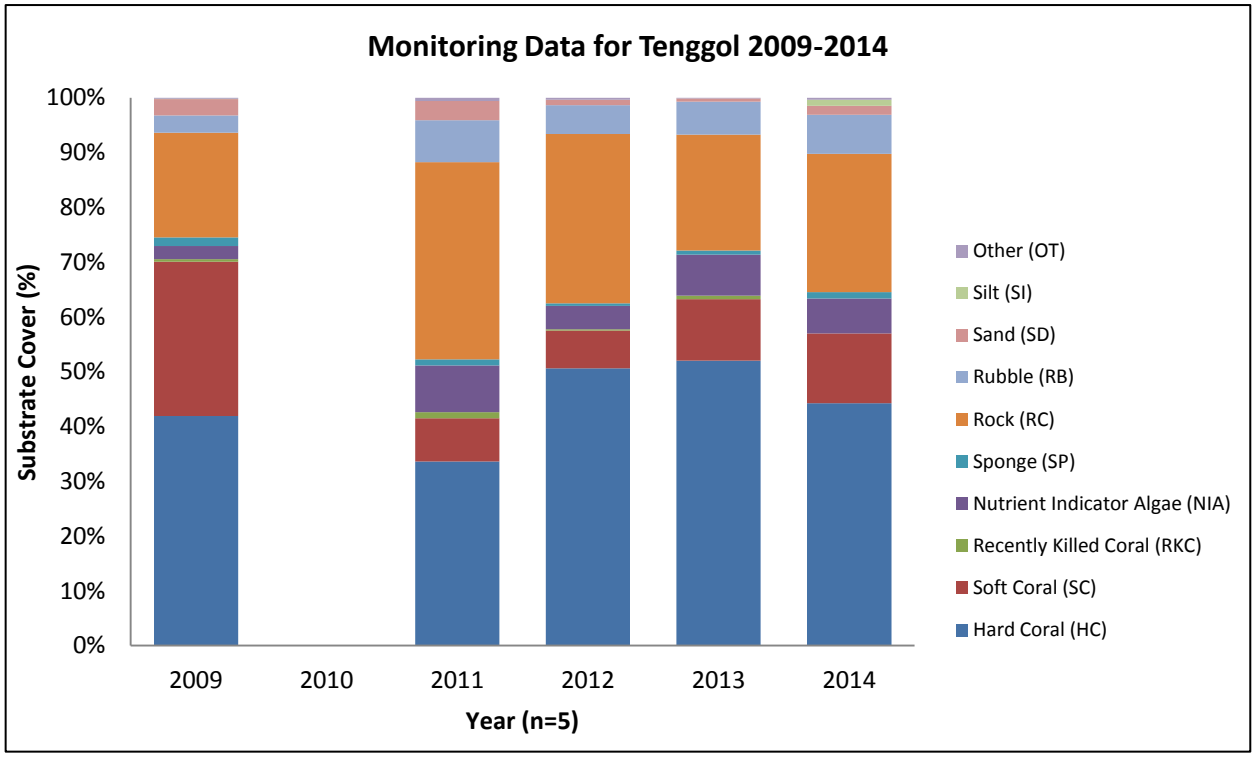
The data from surveys conducted on Tenggol since 2009 show a similar pattern to other locations – recovery in LCC since the 2010 bleaching event. The overall condition of coral reefs around Tenggol Island since then has been good, with average LCC above 50%.

In the last two years there appears to have been a shift from HC to SC. In some reefs we have observed such changes as being due to zoanthid soft corals colonizing 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. Further investigations might be useful to determine the cause of this shift.

There is a need to look into the increase of RB level over the years, from 3.13% in 2009 to 7.63% in 2011 remaining at that level to 2014 (7.13%). This concern goes to NIA level as well, which has increased from 2.38% in 2009 to 8.50% in 2011 and has only dropped slightly to 6.38% in 2014. The site of most concern is Freshwater Bay which recorded 11.25% of NIA in 2009 and in 2011, the level has increased significantly to

38.13% and has maintained at 31.88% in 2014. 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.



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 48.11%. 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 10% 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	4.75	20.75	Pandanan, Mataking	Banded Coral Shrimp	0.22	9	Pom Pom
Sweetlips	0.15	4	Barracuda Point, Sipadan	Diadema	31.70	663	Soyak South, Tioman
Snapper	5.84	132	Yu Besar, Yu	Pencil Urchin	0	0.25	Tengkorak, Bidong
Barramundi Cod	0	0.25	Pegaso, Lankayan	Collector Urchin	0.02	2.75	Denawan, Semporna
Hump Head Wrasse	0.01	0.5	Goby Rock & Lycia Garden, Lankayan	Sea Cucumber	1.70	45.50	Soyak South, Tioman
Bump Head Parrotfish	0.10	5.75	Barracuda Poin, Sipadan	Crown of Thorns	0.17	4.25	Kapikan Reef, TSMP
Parrotfish	2.45	20	Mid Reef, Lahad Datu	Triton	0.01	0.5	Timba-Timba, Mataking
Moray Eel	0.03	0.5	Pandanan Bay, Mataking	Lobster	0.02	1.5	Yoshi Point 1, Semporna
Grouper	0.47	3.5	Hanging Garden, Sipadan	Giant Clam	1.23	22.75	Mataking House Reef

4.1.4 Historical data are available for some reef locations in Peninsular Malaysia since 2009. For these areas, the data 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

Threats facing reefs in Malaysia can be divided into local and global impacts:

- 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 coral reef managers can do about the global threats and coral reef management strategies should focus on addressing the local threats. A number of recommendations are made below.

4.2.1 Monitoring & Awareness

Several steps should be taken to make information on coral reefs and reef health available to all stakeholders.

- 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.

4.2.2 Local Threats, Local Management

Many threats to coral reefs arise within existing Marine Parks in Malaysia, due to tourism development and local community activities. Addressing these threats needs action at the local level.

During the tenth meeting of the Conference of the Parties (COP) to the Convention on Biodiversity (CBD), held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan, a revised and updated Strategic Plan for Biodiversity was adopted, which included the Aichi Biodiversity Targets for the 2011-2020 period. As a signatory of the Convention on Biological Diversity (CBD), Malaysia is bound by the Aichi Targets. Several of the Aichi Targets relate to conserving marine biodiversity, including Target 10 which 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.**

The target recognises that:

> Urgently reducing anthropogenic pressures on those ecosystems affected by climate change or ocean acidification will give them greater opportunities to adapt. Where multiple drivers are combining to weaken ecosystems, aggressive action to reduce those pressures most amenable to rapid intervention should be prioritized. Many of these drivers can be addressed more easily than climate change or ocean acidification.

Working together with Department of Marine Parks Malaysia, RCM is in the process of developing Action Plans to address local impacts in Malaysia's Marine Parks. 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 review current management strategies and plans for existing Marine Parks 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 Marine Parks.

4.2.3 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.

4.2.4 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.

4.3 Conclusion

The 2014 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.

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KPMG	**KPMG in Malaysia:** since 2007 has been donating funds to support a Corporate Reef Check team and education programmes in two schools in KL.
Sime Darby Foundation	**Sime Darby Foundation:** supporting the five year Cintai Tioman programme to build reef and community resilience and empower the local community to play a greater role in managing the Marine Park.
HSBC Amanah Takaful	**HSBC Amanah Takaful:** supporting school education programme and school waste recycling programme as part of the Cintai Tioman programme
MURPHY	**Murphy Oil Corporation:** supporting reef rehabilitation 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.
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 in Tioman
F&N	**F & N:** funding recycling and awareness campaign in Redang.
PAM PERTUBUHAN AKITEK MALAYSIA MALAYSIAN INSTITUTE OF ARCHITECTS	**PAM:** Pertubuhan Akitek Malaysia is funding reef rehabilitation programmes in Tioman and Pangkor
	Shell Malaysia: supporting community programme in Sabah
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We work through a small network of dive centres who continue to support our work. These include:

Reef Check Certified Facilities:

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

Other dive operators:

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

NGOs:

- WWF
- MNS Miri Branch

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Appendix 1: Survey Sites (2014)

Sunda Shelf

No.	Site Name	Island	Coordinate
SS 1.1	Batu Layar	Perhentian	5 54 43.69 N 102 45 00.28 E
SS 1.2	Batu Nisan	Perhentian	5 55.265 N 102 43.508 E
SS 1.3	Batu Tabir	Perhentian	5 56 24.33 N 102 43 20.11 E
SS 1.4	Tukas Laut	Perhentian	5 53 06.45 N 102 46 01.13 E
SS 1.5	Tiga Ruang	Perhentian	5 55.019 N 102 45.233 E
SS 1.6	D' Lagoon	Perhentian	5 55.929 N 102 43.396 E
SS 1.7	P. Rawa	Perhentian	5 57.777 N 102 40.833 E
SS 1.8	Sea Bell	Perhentian	5 54.532 N 102 42.574 E
SS 1.9	Shark Point	Perhentian	5 53.075 N 102 44.812 E
SS 1.10	Tanjung Basi	Perhentian	5 55.414 N 102 45.498 E
SS 2.1	Chagar Hutang	Redang	5 48 53.5 N 103 00 25.8 E
SS 2.2	Chagar Hutang East	Redang	5 49 3.58 N 103 00 37.30 E
SS 2.3	P. Kerengga Besar	Redang	5 45 14.03 N 103 01 44.07 E
SS 2.4	P. Kerengga Kecil	Redang	5 45 10.14 N 103 01 46.55 E
SS 2.5	P. Lima Southern Tip	Redang	5 46 18.1 N 103 03 32.8 E
SS 2.6	P. Paku Besar	Redang	5 46 37.43 N 103 02 30.33 E
SS 2.7	P. Paku Kecil	Redang	5 46 18.1 N 103 02' 20.5 E
SS 2.8	P. Pinang Marine Park Centre	Redang	5 44 48.92 N 102 59 59.35 E
SS 2.9	Pasir Akar	Redang	5 44 24.71 N 102 59 58.37 E
SS 2.10	Redang Kalong HR	Redang	5 45 44.14 N 103 01 42.43 E
SS 2.11	Terumbu Kili	Redang	5 43 57.76 N 102 59 51.88 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 38.97 N 104 6 45.20 E
SS 3.4	Soyak South	Tioman	2 52.480 N 104 08.810 E
SS 3.5	Soyak North	Tioman	2 52 33.59 N 104 08 53.03 E
SS 3.6	Batu Malang	Tioman	2 54.139 N 104 06.148 E
SS 3.7	Tekek HR	Tioman	2 48 57.6 N 104 09 03.74 E
SS 3.8	Chebeh	Tioman	2 55 56.76 N 104 05 48.87 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 32.61 N 104 7 22.89 E
SS 3.12	Labas	Tioman	2 53 19.09 N 104 3 55.19 E
SS 3.13	Abect HR	Tioman	2 49.087 N 104 09.237 E
SS 3.14	Jahat East	Tioman	2 40.127 N 104 10.518 E
SS 3.15	Munjor South	Tioman	2 44.521 N 104 13.064 E
SS 3.16	Nyak	Tioman	2 46.759 N 104 12.756 E
SS 3.17	Pasir Penut	Tioman	2 45.594 N 104 13.313 E
SS 3.18	Melina	Tioman	2 44.410 N 104 7.898 E

SS 3.20	Renggis South	Tioman	2 48.569 N 104 08.119 E
SS 4.1	Coral Garden 1	Kapas	5 13 59 N 103 15 38 E
SS 4.2	Coral Garden 3	Kapas	5 13 56 N 103 15 37 E
SS 4.3	Silent Reef	Kapas	5 13 37 N 103 16 9 E
SS 4.4	Teluk Jawa	Kapas	5 12 32 N 103 16 6 E
SS 5.1	Heritage Row	Bidong/Yu	5 36.900 N 103 03.400 E
SS 5.2	Pasir Tenggara	Bidong/Yu	5 36.614 N 103 03.813 E
SS 5.3	P. Karah	Bidong/Yu	5 35.934 N 103 03.851 E
SS 5.4	P. Tengkorak	Bidong/Yu	5 39.500 N 103 04.200 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 48.456 N 103 40.706 E
SS 6.2	Gua Rajawali	Tenggol	4 49 13.19 N 103 40 58.63 E
SS 6.3	Pasir Tenggara	Tenggol	4 48.03 N 103 40.56 E
SS 6.4	Rajawali Reef	Tenggol	4 49 17.61 N 103 41 25.35 E
SS 6.5	Turtle Point	Tenggol	4 48 21.31 N 103 40 29.25 E
SS 6.6	Teluk Rajawali	Tenggol	4 49.2 N 103 41.05 E
SS 7.1	Bumphead Bay	Pemanggil	2 34 53.4 N 104 20 7.15 E
SS 7.2	Lobster Bay	Pemanggil	2 34 45.74 N 104 18 56.32 E
SS 7.5	Pemanggil Village South	Pemanggil	2 34.761 N 104 18.945 E
SS 7.6	Tridacna Bay	Pemanggil	2 35.800 N 104 19.635 E
SS 9.1	P. Mentinggi	Tinggi	2 16.405 N 104 6.940 E
SS 9.2	P. Nanga	Tinggi	2 16.274 N 104 7.640 E
SS 9.3	P. Ibol	Tinggi	2 18.183 N 104 8.935 E
SS 9.4	P. Tanjung Gua Subang	Tinggi	2 18.792 N 104 7.552 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 11.1	Siwa 4A	Miri	4 16 23 N 113 48 53 E
SS 11.2	Siwa Penyu	Miri	4 16 35 N 113 49 3 E
SS 11.3	Anemone Centre	Miri	4 17 33 N 113 49 33 E
SS 11.4	Anemone North	Miri	4 17 37 N 113 49 34 E
SS 11.5	Eve's Garden	Miri	4 20 35 N 113 53 54 E
SS 11.6	Sunday Reef	Miri	4 17 13 N 113 49 10 E
SS 12.2	Satang Besar West	Kuching	n/a

Malacca Strait

No.	Site Name	Island	Coordinate
MS 1.1	Pasir Tengkorak P. Lalang	Sembilan	4.0027 N 100.5467 E
MS 1.2	Site 1 P.Saga	Sembilan	4.0122 N 100.5449 E
MS 1.4	Site 2 P. Rumbia	Sembilan	4.0224 N 100.5479 E
MS 1.5	Zoanthid Garden P. Rumbia	Sembilan	4.0321 N 100.5500 E
MS 1.6	P. Buluh	Sembilan	3.9945 N 100.5357 E
MS 1.7	Anemone Garden P. Saji	Sembilan	4.0065 N 100.5348 E

MS 1.8	Frogfish P. Nipis	Sembilan	4.0575 N 100.5397 E
MS 1.9	Rock Garden	Sembilan	4.0114 N 100.5351 E
MS 2.1	Pangkor Laut	Pangkor	4.1899 N 100.5483 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 29.14 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 30.47 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 HR	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 35.96 N 118 56.454 E
NB 2.7	Timba Timba	Mataking	4 32.96 N 118 55.75 E
NB 2.8	Mataking	Mataking	4 34.797 N 118 56.782 E
NB 2.9	Pandanan	Mataking	4 34.75N 118 55.222 E
NB 2.10	Boheyan	Mataking	4 28.405 N 118 56.762 E
NB 3.2	Pom Pom	Pom Pom	4 35.528 N 118 51.678 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 42.73 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 20.84 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 20.84 E
NB 4.11	Kolam	Mantanani	6 43.93 N 116 21.567 E
NB 5.1	Base Camp	TARP, Kota Kinabalu	6 0 25 N 116 1 20 E

NB 5.2	Mamutik	TARP, Kota Kinabalu	5 58 4.04 N 116 0 45.38 E
NB 5.3	Manukan West	TARP, Kota Kinabalu	5 58 13.97 N 115 59 48 E
NB 5.4	Mid Reef	TARP, Kota Kinabalu	5 58 26.60 N 116 0 59.49 E
NB 5.5	Teluk Melohom	TARP, Kota Kinabalu	6 10.66 N 116 2 52.54 E
NB 5.6	Police Beach	TARP, Kota Kinabalu	6 1 55.49 N 116 01 24.93 E
NB 5.7	Sapi	TARP, Kota Kinabalu	6 0 29 N 116 0 13 E
NB 5.8	Sulug	TARP, Kota Kinabalu	5 57 32.84 N 115 59 27.86 E
NB 5.9	Meranggis Reef	TARP, Kota Kinabalu	6 2 4 N 116 1 43 E
NB 5.10	Ribbon Reef	TARP, Kota Kinabalu	6 1 5 N 116 0 19 E
NB 5.11	Tanjung Wokong	TARP, Kota Kinabalu	5 59 26 N 116 2 25 E
NB 5.12	Teluk Kuari	TARP, Kota Kinabalu	6 0 23 N 116 1 51 E
NB 5.13	Teluk Tavajun	TARP, Kota Kinabalu	6 1 40 N 116 3 8 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 15.47 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 54.74 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 54.51 N 118 10.644 E
NB 7.1	Usukan Cove Lodge Reef	Usukan Cove	6 22 27.31 N 116 20 35.17 E
NB 7.2	Uban-Uban	Usukan Cove	6 23 24.06 N 116 19 22.02 E
NB 7.3	Pandan-Pandan	Usukan Cove	6 21 11.35 N 116 18 36.84 E
NB 7.4	Poduko	Usukan Cove	6 22 7.68 N 116 19 51.15 E
NB 7.5	Lok Liak	Usukan Cove	6 22 6.37 N 116 19 8.18 E
NB 7.6	Keramat	Usukan Cove	6 23 37.08 N 116 19 41.58 E
NB 8.14	Yoshi Point 2	Semporna	4 14.193 N 118 33.190 E
NB 8.15	Batik	Semporna	4 43.242 N 118 27.984 E
NB 8.16	Baturua	Semporna	4 31.263 N 118 48.287 E
NB 8.17	Bum Bum	Semporna	4 26.684 N 118 45.309 E
NB 8.18	Denawan	Semporna	4 18.025 N 118 50.44 E
NB 8.19	Larapan	Semporna	4 33.515 N 118 36.9 E
NB 8.20	Macromania Baturua	Semporna	4 32.722 N 118 49.547 E
NB 8.21	Pasalat	Semporna	4 30.851 N 118 43.58 E
NB 8.22	Roach Reef	Semporna	4 10.573 118 18.44 E
NB 8.23	Si Amil	Semporna	4 18.965 N 118 52.508 E

NB 8.24	Yoshi Point 1	Semporna	4 15.307 N 118 32.028 E
NB 9.1	Dead End Channel	TSMP, Semporna	4 34 24.5 N 118 45 30.4 E
NB 9.2	Kapikan Reef	TSMP, Semporna	4 37 41.9 N 118 50 06.7 E
NB 9.3	Mantabuan	TSMP, Semporna	4 37 56 N 118 47 47.9 E
NB 9.4	Ribbon Reef	TSMP, Semporna	4 36 08.1 N 118 46 05.4 E
NB 9.5	South Rim	TSMP, Semporna	4 34 04.7 N 118 45 29.9 E
NB 9.6	Sibuan	TSMP, Semporna	4 39 9.26 N 118 39 53.04 E
NB 9.7	Tanjung Kenangan	TSMP, Semporna	4 35.127 N 118 47.155 E
NB 10.1	Barracuda Point	Sipadan	4 7 7.8 N 118 37 44.7 E
NB 10.2	Coral Garden	Sipadan	4 6 20.5 N 118 37 43.3 E
NB 10.3	Drop Off	Sipadan	4 7 5.5 N 118 37 40.5 E
NB 10.4	Hanging Garden	Sipadan	4 6 42.2 N 118 37 29.7 E
NB 10.5	Lobster Lair	Sipadan	4 6 33.4 N 118 37 32.4 E
NB 10.6	Mid Reef	Sipadan	4 6 48.7 N 118 38 9.5 E
NB 10.7	North Point	Sipadan	4 7 17.93 N 118 38 11.38 E
NB 10.8	South Point	Sipadan	4 6 15.5 N 118 38 6.6 E
NB 10.9	Staghorn Crest	Sipadan	4 6 15.4 N 118 37 53.7 E
NB 10.10	Turtle Patch	Sipadan	4 6 27 N 118 38 10.6 E
NB 10.11	White Tip	Sipadan	4 7 8.2 N 118 38 3.3 E