



STATUS OF CORAL REEFS IN MALAYSIA 2021

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Reef Check
MALAYSIA





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Division of Fisheries Conservation and Protection
Department of Fisheries Malaysia
Ministry of Agriculture and Food Industry
Wisma Tani, Aras 3,
Blok Menara 4G2, Presint 4
62628 Putrajaya

Tel: 03-8870 4005 Fax: 03-8881 1086

www.dof.gov.my

CONTENT

1	EXECUTIVE SUMMARY	4
2	INTRODUCTION	5
3	REEF CHECK	6
	Background	6
	Survey Sites	6
	Methodology	7
4	SURVEY RESULTS & ANALYSIS	9
	Malaysia	9
	Eco-regions in Malaysia	13
	Sunda Shelf	14
	Malacca Strait	50
	North Borneo	59
5	REEF CHECK DATA OVER THE YEARS	98
	Sunda Shelf	98
	Malacca Strait	101
	North Borneo	104
	Local Changes in Reef Health	107
6	SUMMARY & RECOMMENDATIONS	129
	Summary	129
	Recommendations	129
7	CONCLUSION	131
	ACKNOWLEDGEMENTS	132
	REFERENCES	135
	APPENDIX 1: SURVEY SITES	136

EXECUTIVE SUMMARY

1. This report presents data from coral reef surveys conducted in Malaysia during 2021 using the Reef Check survey protocol. Reef Check is a coral reef monitoring methodology used to assess the health of coral reefs in over 95 countries and territories worldwide, and in Malaysia since 2001. Surveys were carried out by trained volunteers – members of the public, dive operators and government officials from Department of Fisheries Malaysia and Sabah Parks. The participation of the latter is evidence of the continuing commitment of the Government in further improving management of Malaysia's coral reefs.
2. A total of 206 sites were surveyed in 2021 (2020: 201): 86 in Sunda Shelf eco-region; 11 in Malacca Strait eco-region; and 109 in North Borneo eco-region. The surveys are a continuation of a successful National Reef Check Survey Programme that has now run for fifteen years. Survey sites, mainly islands, include both established Marine Protected Areas (MPAs) and non-protected areas.
3. The results indicate that, on average, the coral reefs surveyed have a “fair” level of living coral, at 44.26%. This is a slight increase on 2020 (41.32%) and reverses a declining trend that started in 2015. It is possible that this improvement is at least partly due to the huge reduction in tourist visitors to coral reefs over the last two years. Further monitoring is required to confirm this observation which, if supported by data, might suggest that site closures be considered as a management measure for the future.
4. Abundance of most indicator fish and invertebrates remains low. Historical over-harvesting and low natural populations might be the reason for this, but many of the sites surveyed, particularly in Peninsular Malaysia, are in marine protected areas, where protection might be expected to encourage populations to grow. Indicators of disturbance and pollution have increased in many reef areas. These result from human activities and there is a need to address these local impacts to protect reefs from development and tourism.
5. The report recommends taking action to improve management of marine resources by addressing local impacts and introducing participatory management. This gives local stakeholders a stronger voice in decisions that affect their livelihoods, and numerous studies exist to suggest that this can lead to improved conservation outcomes.
6. Particular emphasis is given to building resilience – both ecological and economic. Resilient reefs are more likely to withstand or bounce back from the growing threats of climate change. Resilient communities have diversified economies and do not rely entirely on coral reefs for their livelihoods. This reduces human pressures on reefs, particularly from tourism.
7. The government is asked to consider introducing a more sustainable tourism model, moving away from the “mass” tourism model of the last 20-30 years. There is an opportunity to establish a more environmentally friendly tourism industry while “building back better” in the aftermath of the covid pandemic. Tourism trends suggest tourists are looking for a different experience – more authentic, less crowded. Developing high value, low volume destinations will allow local communities to maintain the livelihoods while dramatically reducing pressure on ecosystems.

While the improvement in Live Coral Cover, one of the key coral reef health indicators, is to be welcomed, we urge the government to intensify efforts to protect coral reefs. Reefs provide food and jobs for many people in Malaysia, and are an important tourism product. Simple steps such as reducing fishing, eliminating physical impacts from tourism and other human activities and improving sewage treatment, can be achieved easily and locally, and can contribute significantly to improving the health of coral reefs.

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.

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 world has lost 19% of the original area of coral reefs, 15% are seriously threatened with loss in the next 10-20 years and 20% under threat of loss in the next 20-40 years (Status of Coral Reefs of the World, 2008).
- Over 60% of the world's reefs are under immediate and direct threat from one or more local sources (Reefs at Risk Revisited, 2011).

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
- Destructive fishing
- Coastal development
- Pollution
- Physical impacts

In Malaysia, the Department of Fisheries Malaysia, Sabah Parks and Sarawak Forestry Corporation are tasked with managing these local threats to their protected reef areas. Meanwhile, Reef Check Malaysia (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 2021, the fifteenth year of surveys.



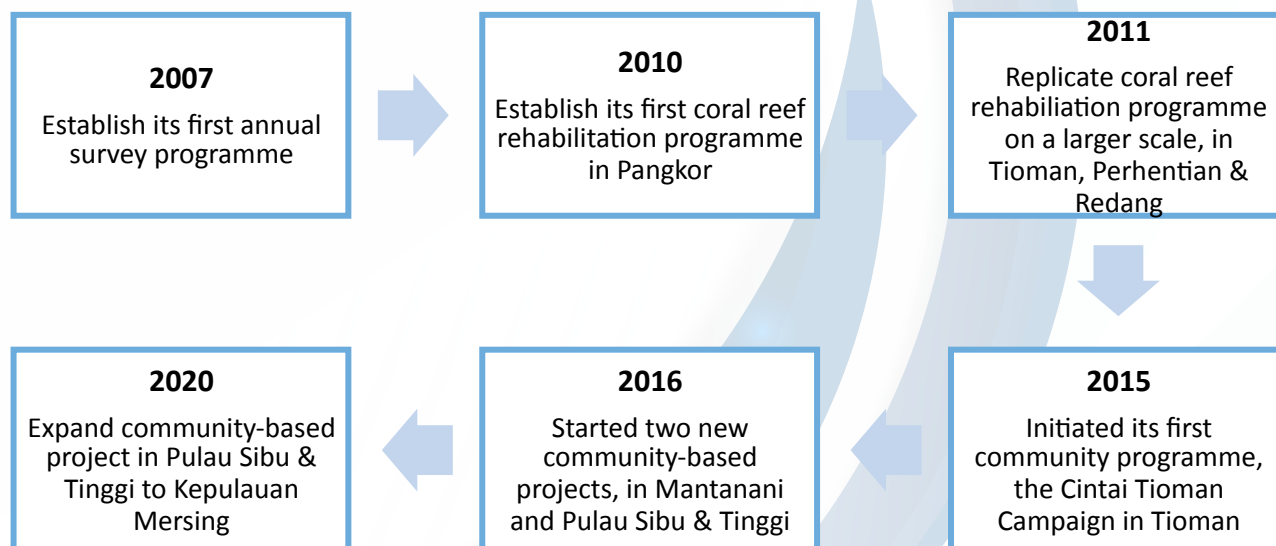
Due to the COVID-19 pandemic, we were unable to conduct surveys at the following permanent sites: Pangkor Laut, Pulau Sembilan, Miri and Labuan.

REEF CHECK

Background

Reef Check Malaysia (RCM) is part of the world wide Reef Check network. Established in 1997 in the USA, Reef Check now has Coordinators in over 95 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.

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 fourteen years, RCM has trained over 1000 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.



This report is the fifteenth annual Malaysia coral reef survey report and details the results of Reef Check surveys carried out during 2021. 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.

Survey Sites

A total of 206 sites were surveyed, 86 of which were in Sunda Shelf region, 11 in Malacca Strait region and 109 in North Borneo region. As far as possible, the same sites are visited each year to provide consistent data over time. In Sunda Shelf and Malacca Strait regions, a large percentage of the surveys were conducted by RCM together with Marine Parks Malaysia and RCM's volunteers. In North Borneo region, a large percentage of the surveys were conducted by RCM together with Sabah Parks and a number of dive operators, notably Lankayan, Mabul, Matakang and Kapalai. This is one of the success stories of getting local stakeholders to be involved in monitoring and management of their own local reefs. The list of sites surveyed is shown in appendix 1.

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.

A 100 m transect line is deployed and along it four 20 m transects are surveyed, each separated by 5 m, which provides four replicates per transect (8 per complete survey) for statistical analysis (see figure below).

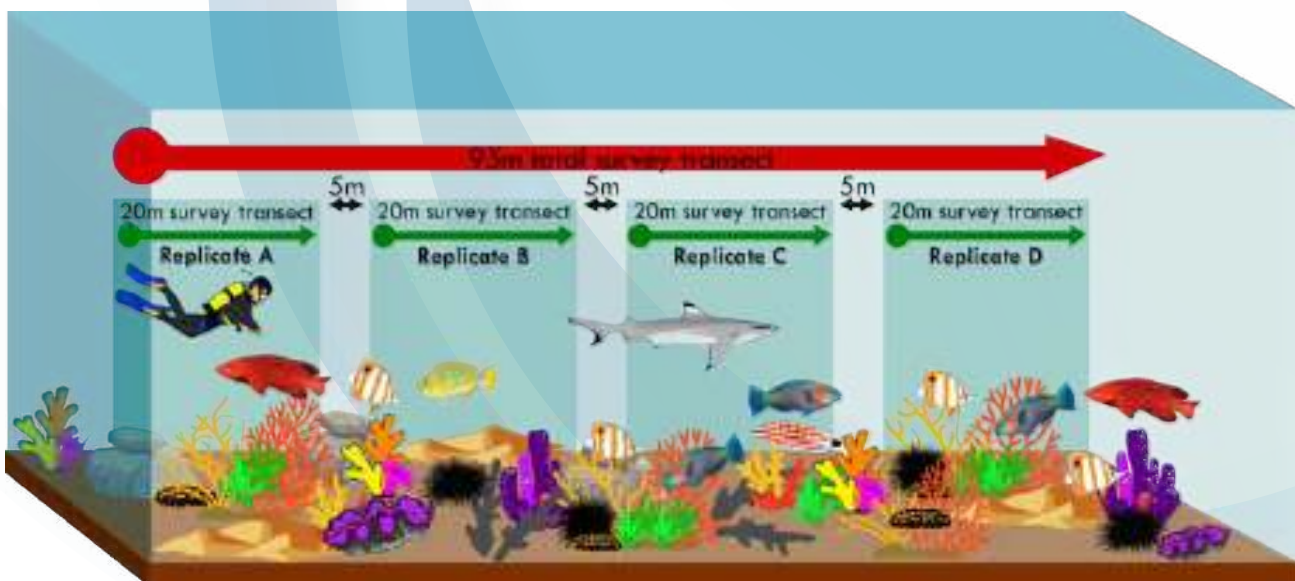


Figure showing the transect – the basic idea of the Reef Check protocol is to swim along a 100m measuring tape (transect) and count organisms in four 20m long transect.

Four types of data are collected:



Fish

Divers count the indicator fish along the four 20m long x 5m wide x 5m high corridors by swimming slowly.

Reef Check indicator fish species were chosen on the basis of targeted demand for:

- Aquarium trade: Butterflyfish (BF)
- Food fish: Sweetlips (SL), Snapper (SN), Barramundi Cod (BC), Parrotfish (PF), Moray Eel (ME), Grouper (GR)
- Live-food fish trade: Humphead Wrasse (HW), Bumphead Parrotfish (BP)



Invertebrate

Divers count the indicator invertebrates along the four 20m x 5m belts.

The invertebrate indicators are targeted for different reasons:

- Collected for Curio trade: Banded Coral Shrimp (BCS), Pencil Urchin (PU), Triton Shell (TR)
- Collected for Food: Collector Urchin (CU), Sea Cucumber (SC), Lobster (LO), Giant Clam (GC)
- Ecological Imbalance/Predator Outbreaks: *Diadema* Urchin (DU), Crown of Thorns (COT)



Substrate

Using Point Intercept method, substrate category is noted at every 0.5m.

The categories are: hard coral (HC), soft coral (SC), sponge (SP), nutrient indicator algae (NIA), recently killed coral (RKC), coral rubble (RB), rock (RC), sand (SD), silt (SI) and other (OT). These are divided into categories that reflect their impact on reef health:

Live Coral Cover: HC + SC

Other: OT

Available Substrate: RC

Sand: SD

Disturbance Indicators: RKC + RB + SI

Pollution Indicators: NIA + SP



Impact

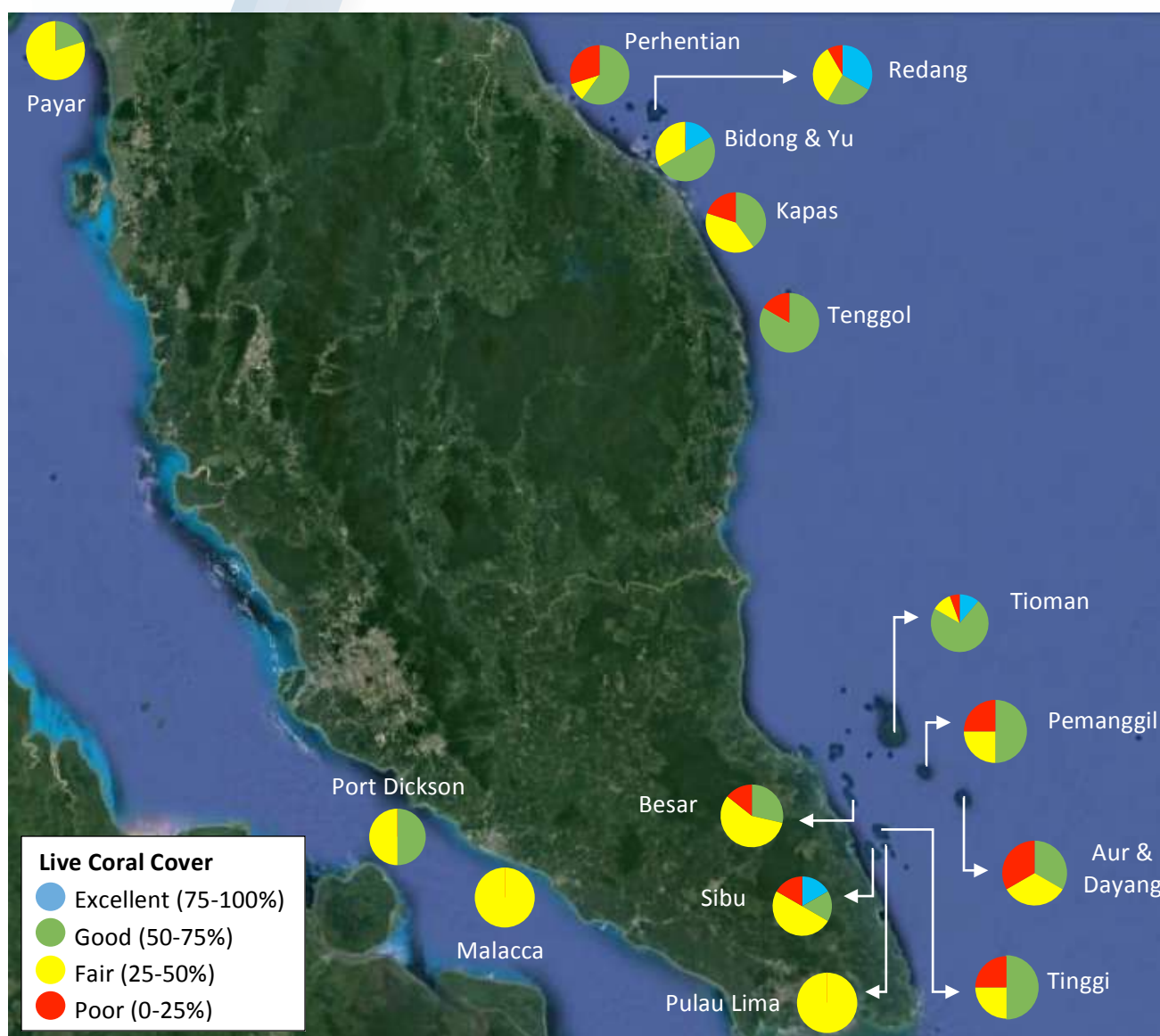
Assess the damage to coral from bleaching, anchoring, destructive fishing, corallivores (such as *Drupella* snail or Crown-of-Thorns starfish), and trash.

SURVEY RESULTS & ANALYSIS

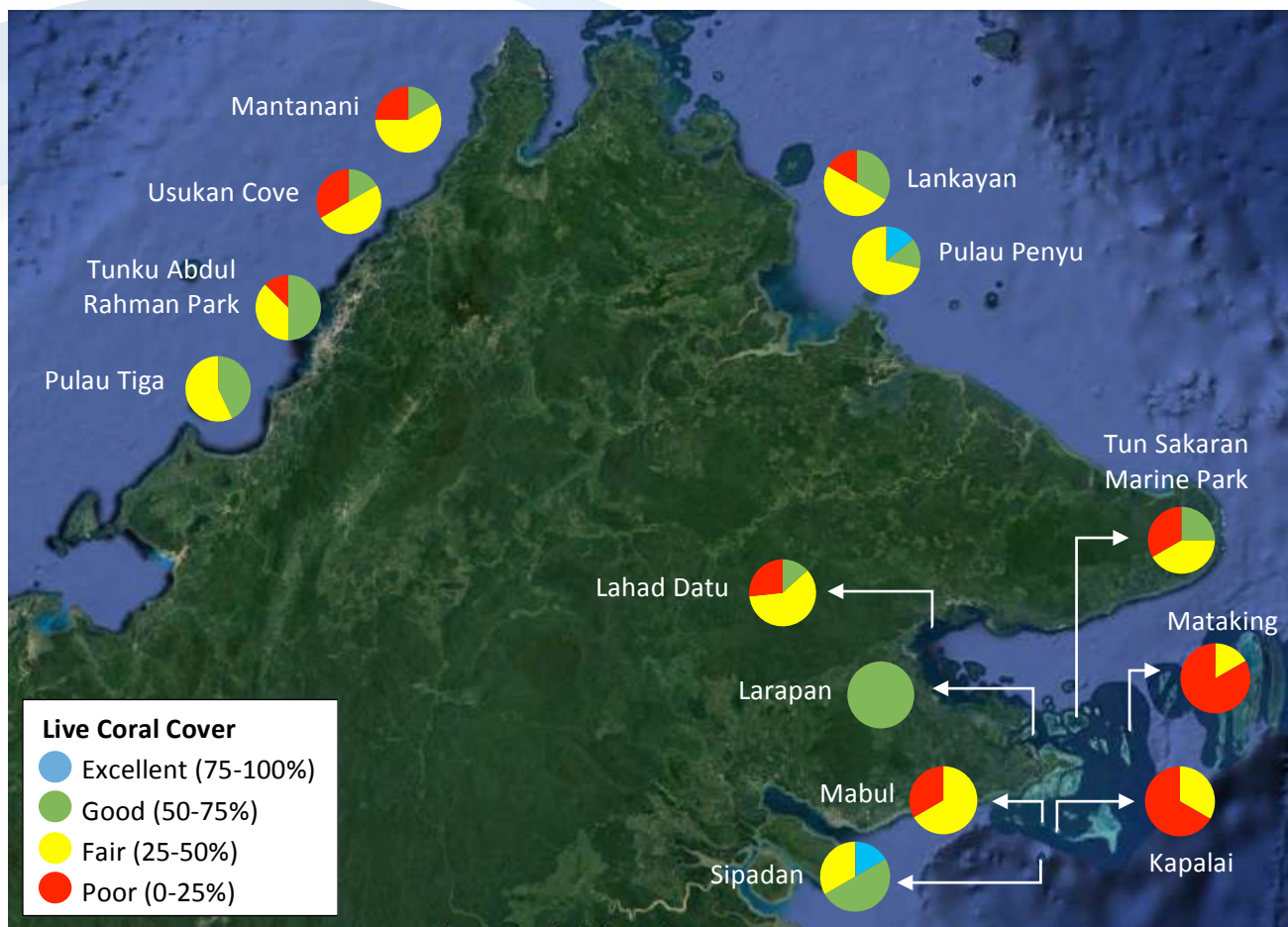
This section presents the results from surveys conducted in 2021, providing an overview of the condition of coral reefs in Malaysia as a whole, and a detailed analysis of the health of reefs in areas surveyed.

Malaysia

The results from all 206 surveys were compiled to provide an overview of the status of coral reefs around Malaysia. Sites surveyed off Peninsular Malaysia are mostly islands which are important tourist destinations while the islands and reefs off Sabah are less frequently visited but face other problems such as destructive fishing practices.



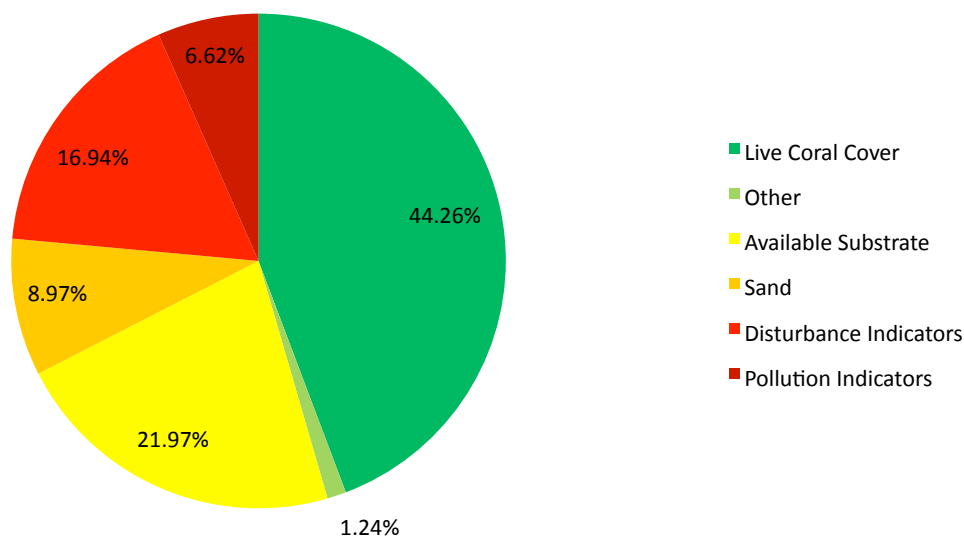
Map showing the reef health composition of each survey location in Peninsular Malaysia based on Live Coral Cover.



Map showing the reef health composition of each survey location in Sabah based on Live Coral Cover.

Coral Cover and Health

Substrate Composition in Malaysia



- Malaysian reefs are on average in 'Fair' condition.
- Mean hard coral (reef builder) cover is 40.13%.
- Available substrate for coral recruits to attach is very high.
- Indicators for disturbance are high.

INDICATORS FOR DISTURBANCE

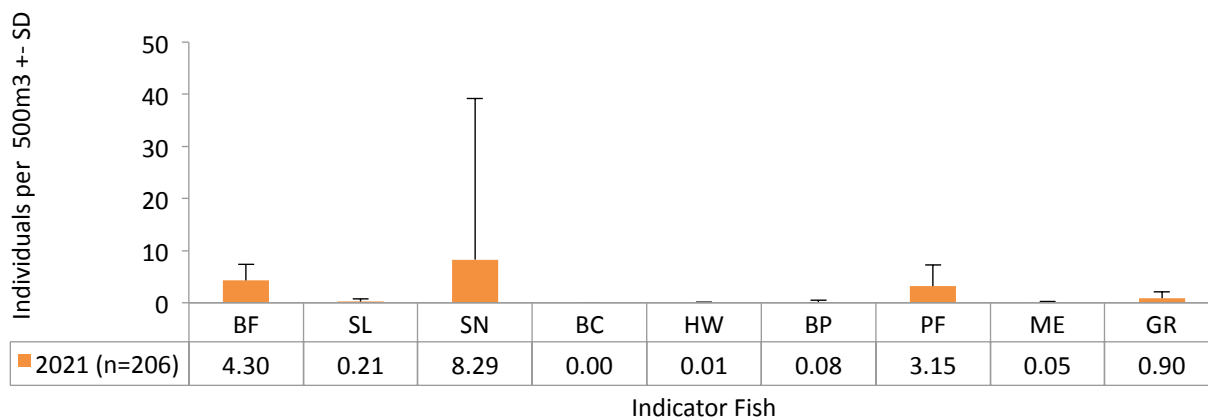
- Mainly in North Borneo region.
- Over 30% of Pulau Tiga reefs consist of indicators for disturbance.
- 20-30% of Mabul, Mantanani, Matakang, Sipadan, Tunku Abdul Rahman Park and Tun Sakaran Marine Park reefs consist of indicators for disturbance.

INDICATORS FOR POLLUTION

- Mainly in Sunda Shelf region.
- Over 30% of Port Dickson reefs consist of indicators for pollution.
- 20-30% of Aur & Dayang and Pulau Tinggi reefs consist of indicators for pollution.

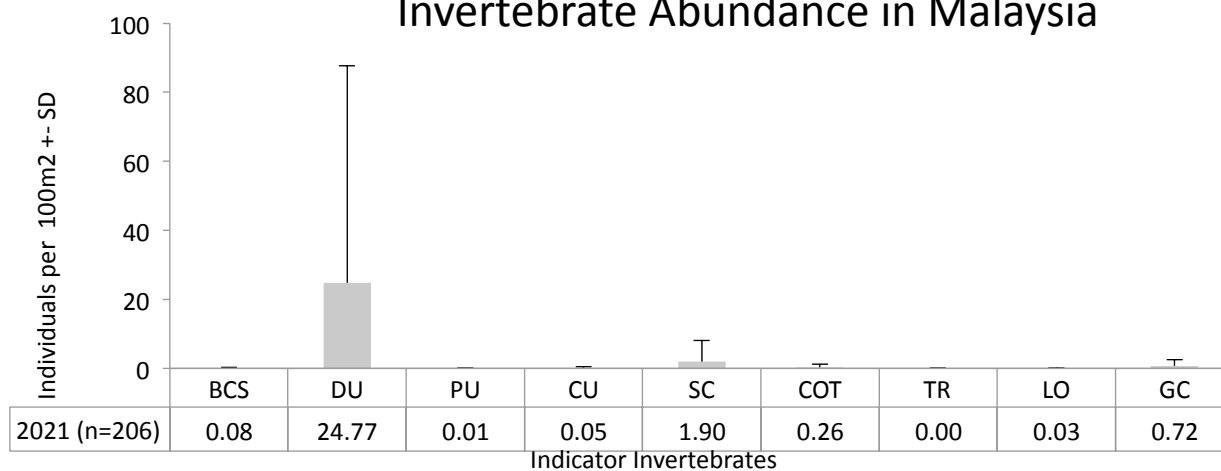
Fish and Invertebrates

Fish Abundance in Malaysia



- Very low abundance of indicators targeted for live-food fish trade.
- Low abundance of fish targeted for food, except for snapper.
- This suggest that populations of fish targeted for food is heavily harvested.

Invertebrate Abundance in Malaysia



- Diadema urchin abundance is high.
- Very low abundance of indicators targeted for curio trade and food.
- Crown-of-thorns is not an issue in Malaysia.



CROWN-OF-THORNS

- Tioman, Tenggol, Aur and Dayang, Pemanggil and Tunku Abdul Rahman Park are facing crown-of-thorns issues.

Eco-regions in Malaysia

The data below provide an overview 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. The marine eco-regions relevant to Malaysia are based on the “Marine Eco-regions of the World” system (Spalding et al, 2007). They are:

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



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

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. The results highlight the different problems each island/area is facing. Islands/regions covered in each eco-region are shown in table below.

Site Coverage by Ecoregion

Eco-region	Islands/Areas	No. of sites	Protection Status	LCC (%)	Average (%)
Sunda Shelf	Tioman	18	Marine Park, Pahang	60.59	50.49
	Bidong & Yu	6	Marine Park, Terengganu (Yu only)	55.52	
	Kapas	5	Marine Park, Terengganu	43.38	
	Perhentian	10	Marine Park, Terengganu	43.25	
	Redang	12	Marine Park, Terengganu	55.83	
	Tenggol	6	Marine Park, Terengganu	57.81	
	Aur & Dayang	6	Marine Park, Johor	38.65	
	Pemanggil	4	Marine Park, Johor	43.91	
	Pulau Besar	7	Marine Park, Johor	39.82	
	Sibu	6	Marine Park, Johor	45.94	
	Tinggi	4	Marine Park, Johor	48.13	
	Pulau Lima	2	No protection	49.38	
Malacca Strait	Payar	5	Marine Park, Kedah	44.88	42.61
	Malacca	4	No protection	35.63	
	Port Dickson	2	No protection	50.94	
North Borneo	Kapalai	6	No protection	18.23	39.50
	Lahad Datu	15	No protection	32.67	
	Lankayan	6	SIMCA	39.17	
	Larapan	6	No protection	67.08	
	Mabul	6	No protection	27.81	
	Mantanani	12	No protection	37.81	
	Mataking	6	No protection	21.35	
	Pulau Penyu	9	Sabah Parks	46.70	
	Pulau Tiga	7	Sabah Parks	43.57	
	Sipadan	12	Sabah Parks	54.48	
	TARP	8	Sabah Parks	48.36	
	TSMP	12	Sabah Parks	36.04	
	Usukan Cove	5	No protection	35.83	

Sunda Shelf – 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 seven villages, with a total population of approximately 3,700 most of whom work in the tourism industry, the main industry on the island. 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 at one point it was eclipsed by other destinations (particularly Redang and Perhentian). However, in recent years, tourism on Tioman Island has picked up again and now there are over 100 resorts and 40 dive operators on the island.

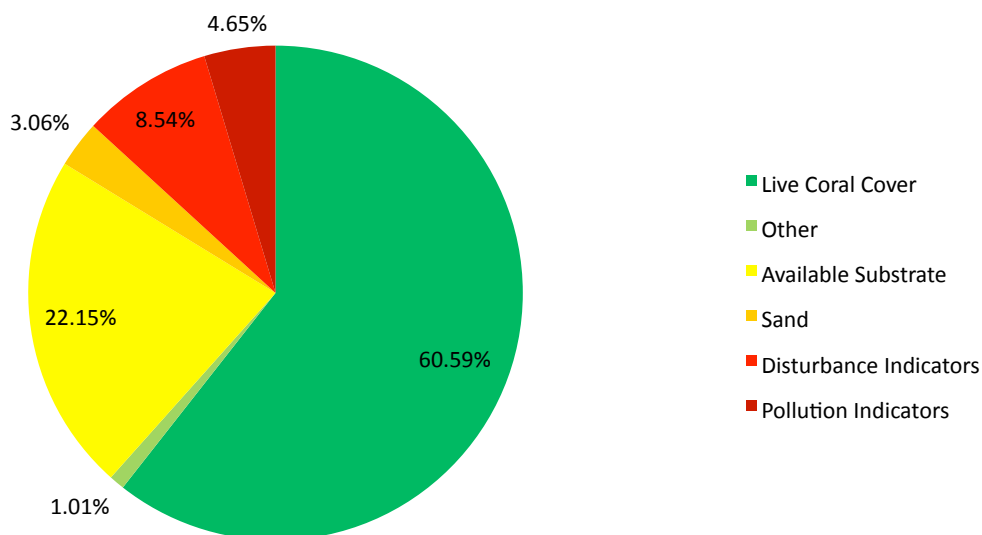
There is a small power generation station on the island, supplying electricity to all areas. Freshwater on the island depends mainly on several river systems coming from the hilly forested areas. A municipal incinerator was constructed some years ago. The island is served by ferry services.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Excellent' coral cover, 13 are in 'Good' condition, 2 show 'Fair' health and 1 is in 'Poor' state.

Coral Cover and Health

Substrate Composition at Tioman



- Tioman is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 57.12%.
- In 'Good' condition and above the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are slightly elevated.
- Rubble level is especially high at Labas, Batu Nipah and Pirate Reef.

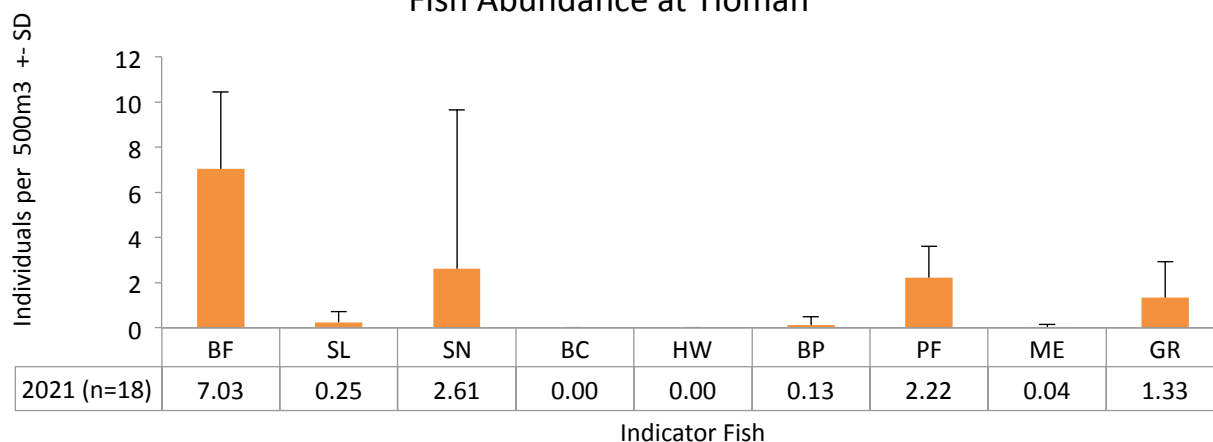
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at some sites.
- Discarded fishing nets at one site caused the mortality of one turtle.
- One site was impacted by bleaching.



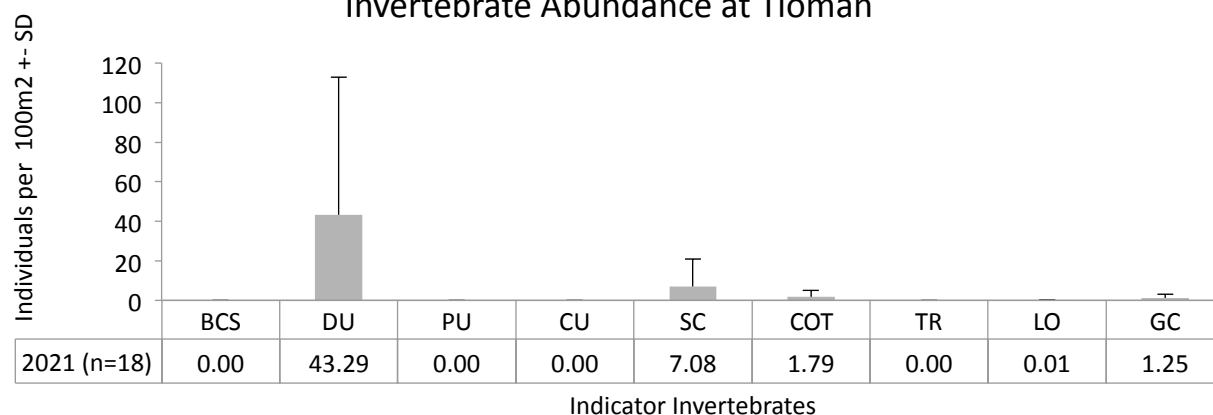
Fish and Invertebrate

Fish Abundance at Tioman



- Butterflyfish abundance is the highest.
- Bumphead parrotfish, fish targeted for live-food fish trade, is recorded.
- Fish targeted for food are low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Tioman



- Diadema urchin abundance is the highest.
- Invertebrates targeted for food are low in abundance, except for sea cucumber.
- Indicators for curio trade are absent.
- Crown-of-thorns is an issue in Tioman. A healthy coral reef can support a population of 0.2-0.3 individuals per 100m², Tioman recorded 1.79.

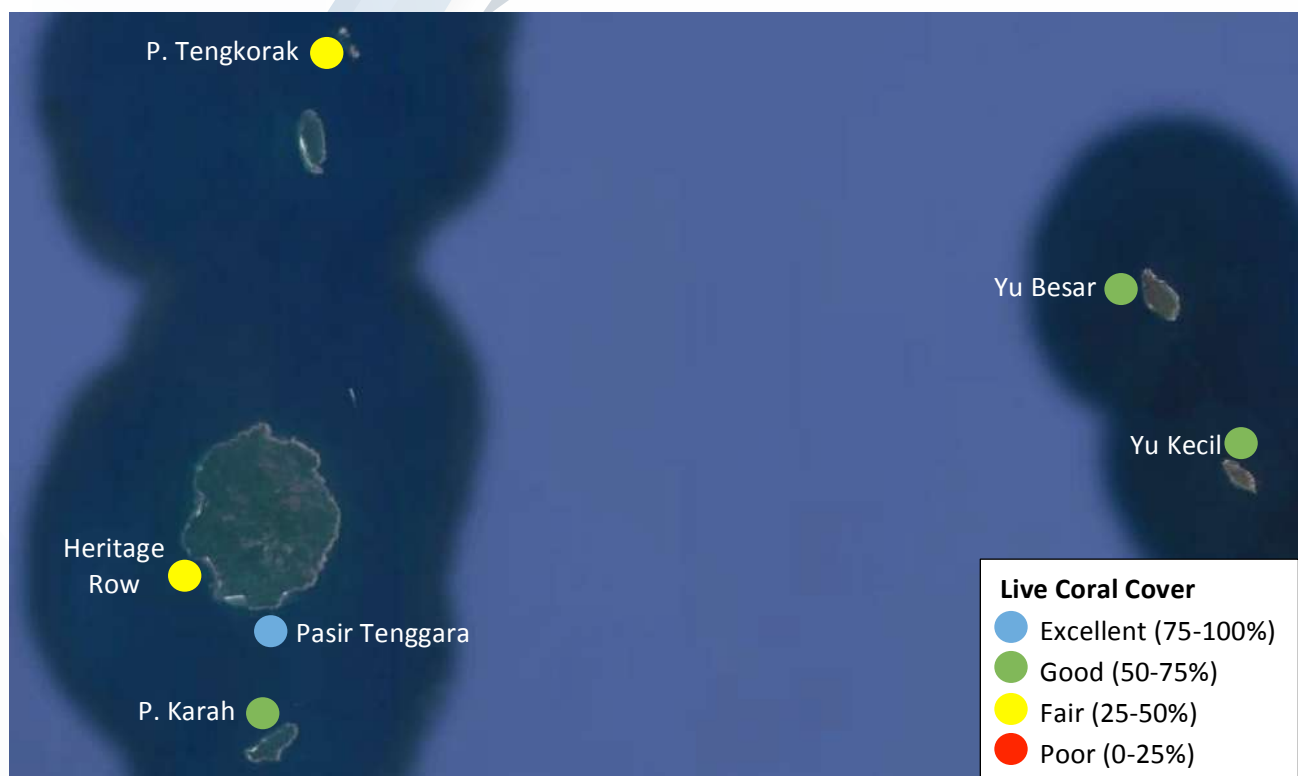
RARE ANIMALS

- Blacktip shark and turtle were recorded at many sites.

Sunda Shelf – 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. Yu islands are now gazetted as a Marine Park.

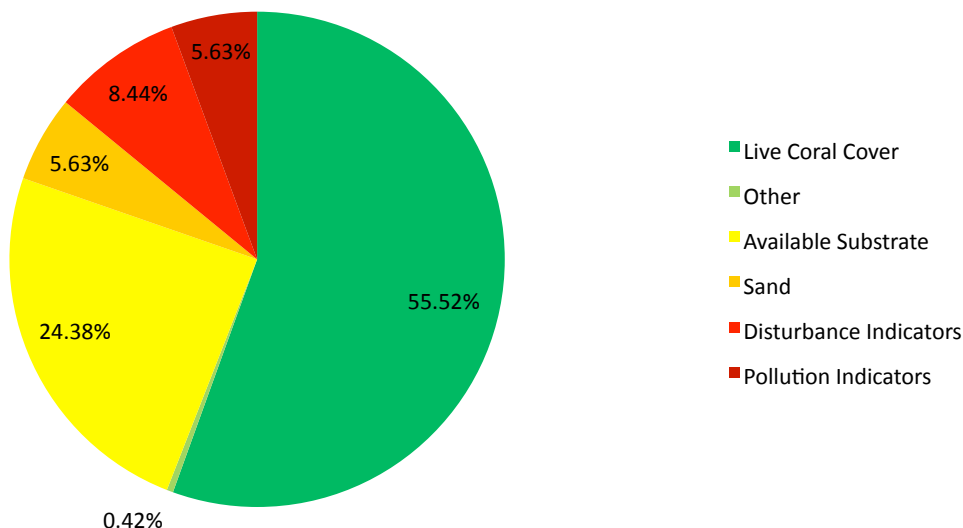
Bidong has mainly been used as a research base for University Malaysia Terengganu but has recently grown in popularity as a diving destination. Bidong has some sandy beaches and fringing reefs while Pulau Yu Besar and Kecil are mainly small rocky islands, with boulder slopes dropping to 25-30m, with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



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Excellent' coral cover, 3 are in 'Good' condition, and 2 show 'Fair' health.

Coral Cover and Health

Substrate Composition at Bidong & Yu



- Bidong and Yu are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 39.06%.
- In 'Good' condition and above the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are slightly high.
- Rubble level is especially high at Heritage Row and Pulau Tengkorak.
- Although Pasir Tenggara has 'Excellent' coral cover, the high percentage of live coral cover is mainly attributed by soft coral (zoanthid), which recorded 88.13%. Hard coral cover is only 3.75%. Zoanthid appears to colonise the whole reef. While the category appears "healthy", the reef is actually undergoing a significant shift to a potentially less stable state.

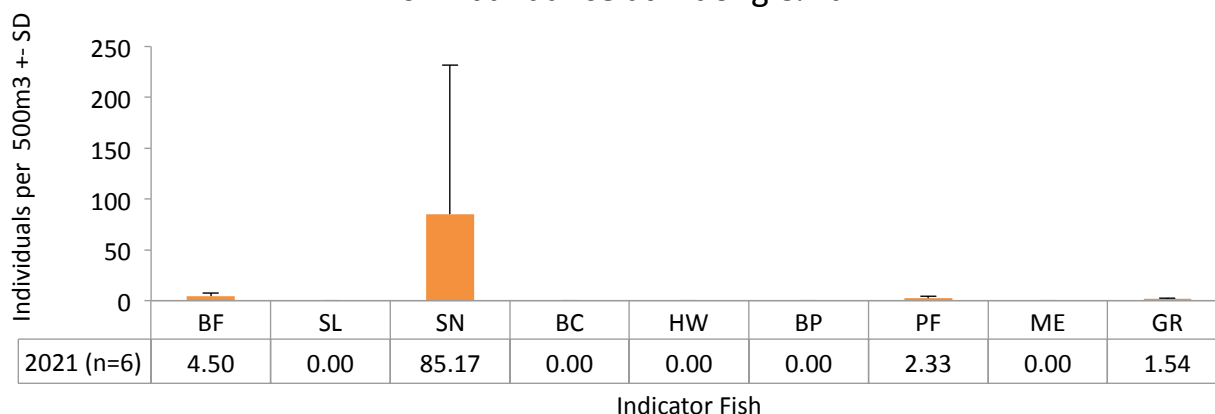
CORAL IMPACTS

- Discarded fishing nets were recorded at some sites.
- Two sites were impacted by warm water bleaching.
- Damages due to COT, boat anchor, discarded fishing nets and fish trap were recorded outside of survey transects.



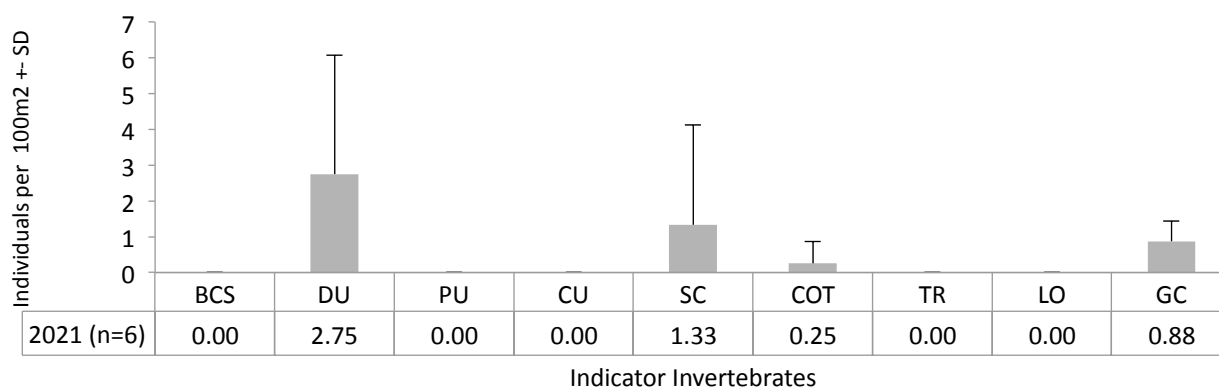
Fish and Invertebrate

Fish Abundance at Bidong & Yu



- Snapper abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Bidong & Yu



- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.
- Crown-of-thorns is not an issue in Bidong & Yu.

Sunda Shelf – Kapas

Kapas is a small island located just 6km from Marang, off the East coast of Terengganu, Malaysia. There is no resident local population but several resorts provide accommodation for tourists. The island is gazetted as a Marine Park (since 1994).

The island is not a major tourism destination due to its small size, but does have an established tourist market, with less than ten resorts and one dive operator. Diving and snorkelling are the main tourist activities. There is no centralised electricity supply, resorts operate their own generators for power. Groundwater supplies are limited and there is no centralised sewage treatment, each resort having its own sewage treatment facilities.

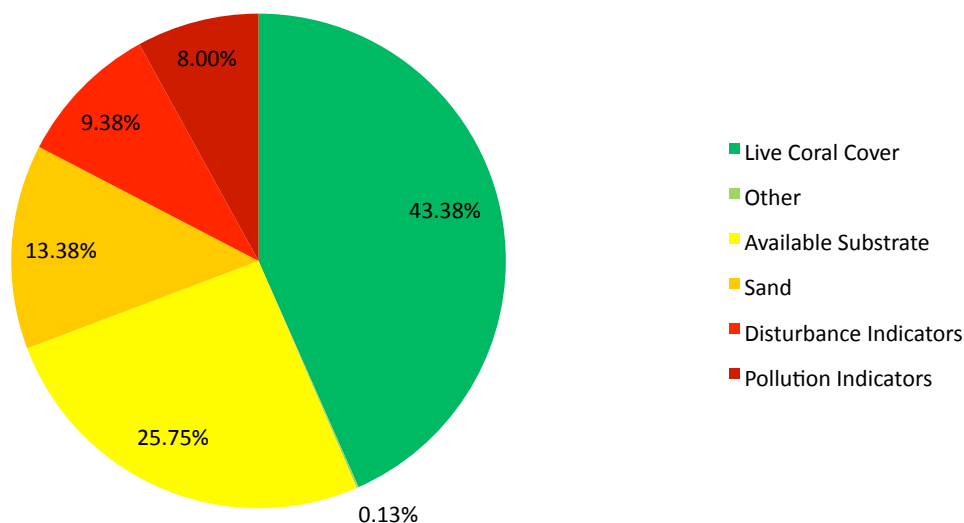
Reefs are mainly fringing off-shore reefs, with some submerged reefs.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Good' coral cover, 2 are in 'Fair' condition, and 1 shows 'Poor' health.

Coral Cover and Health

Substrate Composition at Kapas



- Kapas is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 42.13%.
- In 'Fair' condition and below the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high.
- Disturbance indicators are slightly high.
- Rubble level is very high at Coral Garden 1 which recorded 36.88%.
- Pollution indicators are slightly high.
- Nutrient indicator algae level is especially high at Silent Reef and Coral Garden 3.

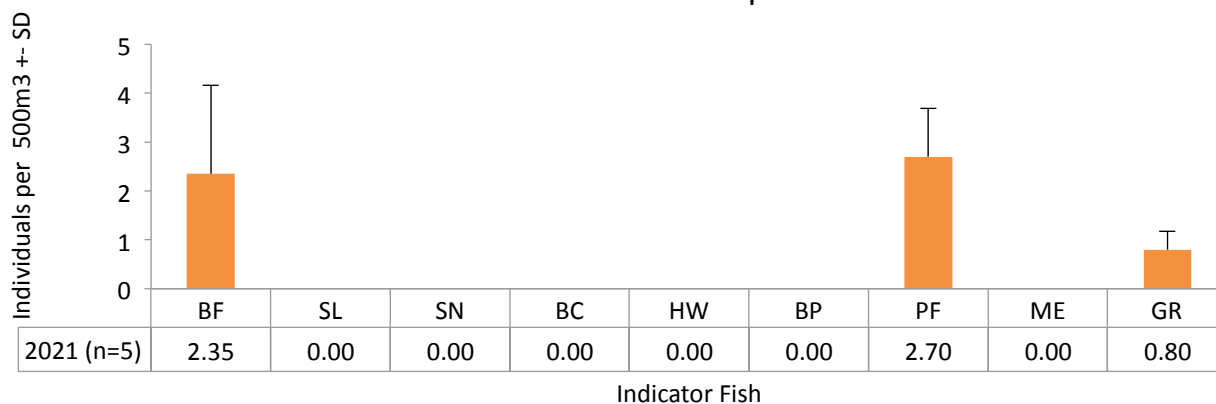
CORAL IMPACTS

- Discarded fishing nets and trash were recorded at some sites.



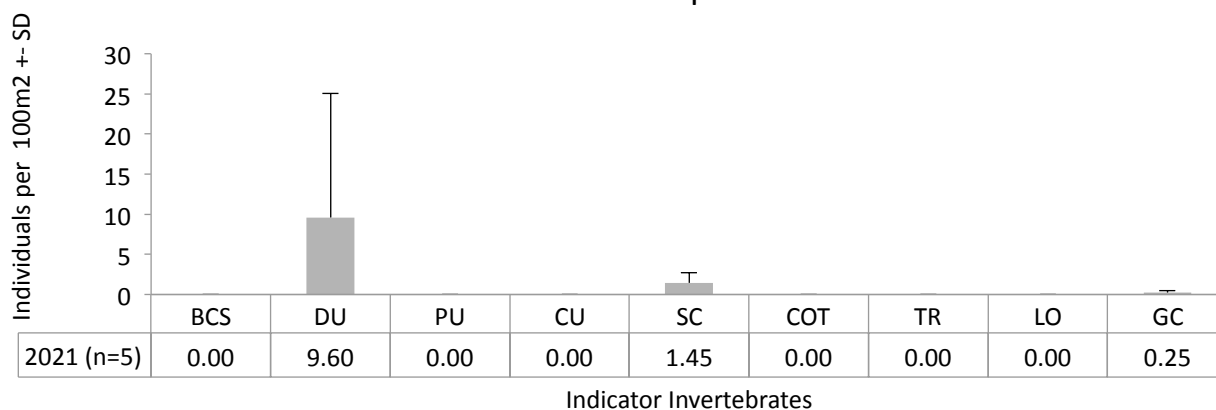
Fish and Invertebrate

Fish Abundance at Kapas



- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are low in abundance.
- This suggest that fish targeted for food are heavily harvested.

Invertebrate Abundance at Kapas



- Diadema urchin abundance is the highest.
- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.

RARE ANIMALS

- Eagle ray was recorded.



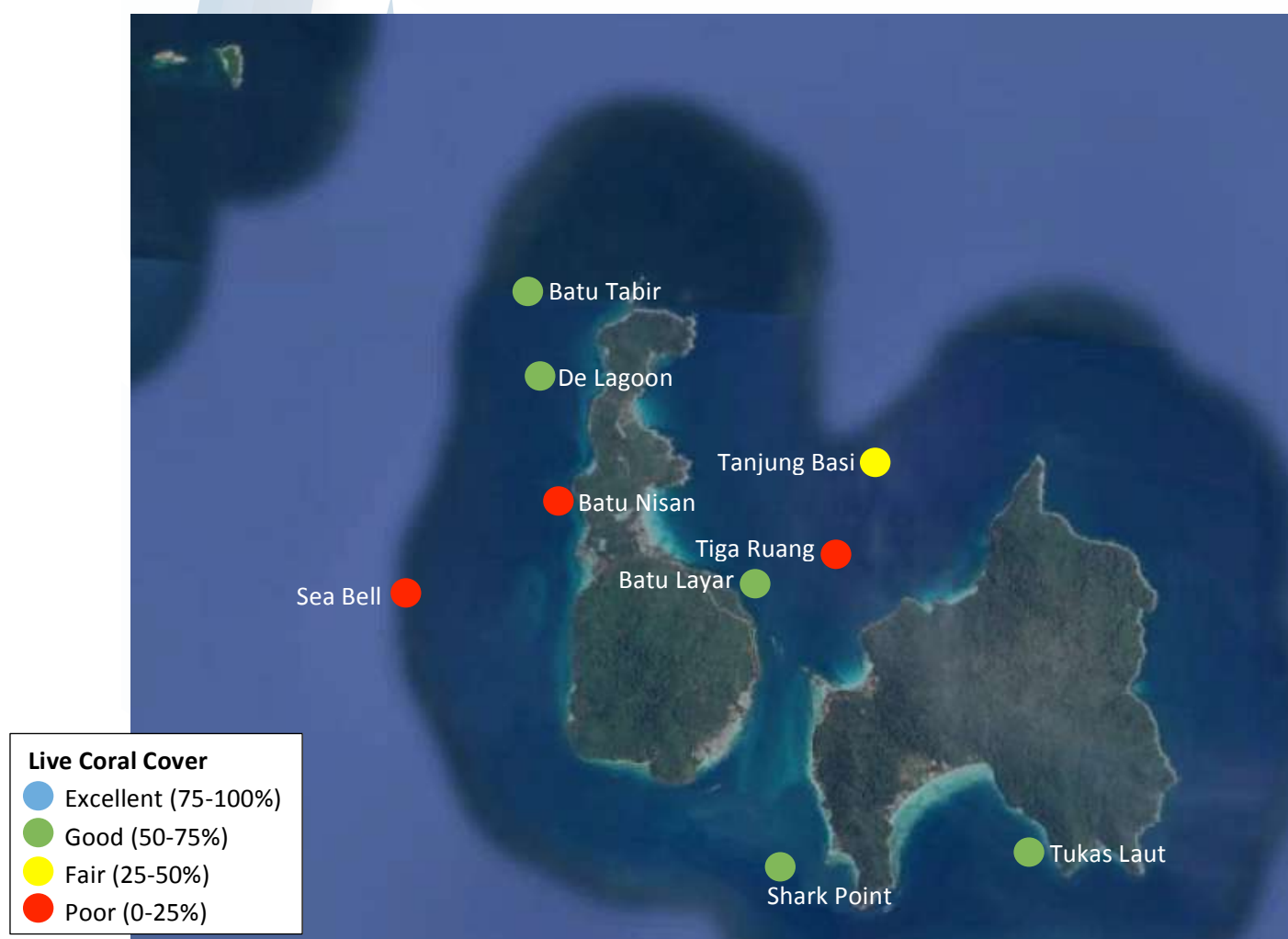
Sunda Shelf – Perhentian

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 2,300, most of whom 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 over 40 resorts, mainly small, family run chalets with a growing number of large resorts to cater for a changing tourist market. There are now over 20 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.

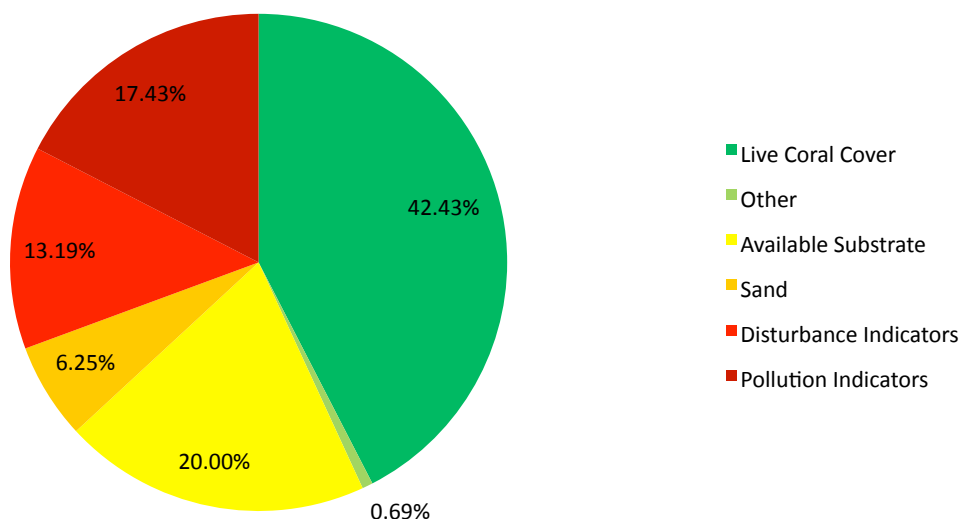
mainly fringing off-shore reefs, with some submerged reefs.



Map showing the health categories of each survey site based on Live Coral Cover: 5 sites have 'Good' coral cover, 1 is in 'Fair' condition, and 4 show 'Poor' health.

Coral Cover and Health

Substrate Composition at Perhentian



- Perhentian is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 38.44%.
- In 'Fair' condition and below the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are high.
- The level of recently killed coral is extremely high at Batu Nisan which recorded 65.63%. The level is also high at Tanjung Besi which recorded 9.38%.
- Rubble level is especially high at Pulau Rawa.
- Pollution indicators are high.
- Nutrient indicator algae level is very high at many sites.
- 85% of Seabell reefs consist of nutrient indicator algae (formerly a healthy reef with high LCC).
- Sponge level is especially high at Tiga Ruang.

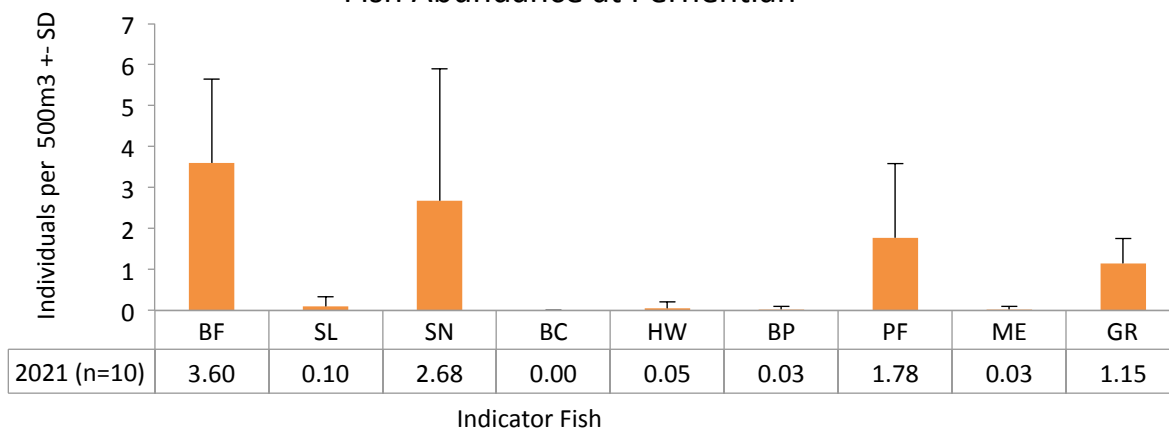
CORAL IMPACTS

- The extremely high level of recently killed coral at Batu Nisan was due to warm water bleaching.
- The high level of recently killed coral at Tanjung Besi was due to storm damage.



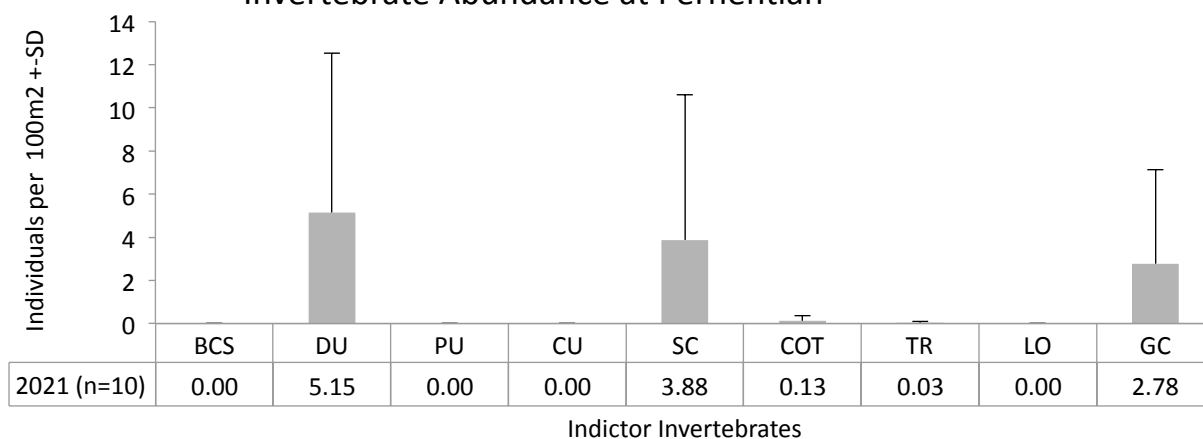
Fish and Invertebrate

Fish Abundance at Perhentian



- Indicators targeted for live-food fish trade are recorded although in low abundance.
- Fish targeted for food are low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Perhentian



- Invertebrates targeted for food are low in abundance.
- Triton, indicator for curio trade, is recorded.
- Crown-of-thorns is not an issue in Perhentian.

RARE ANIMALS

- Shark was recorded.

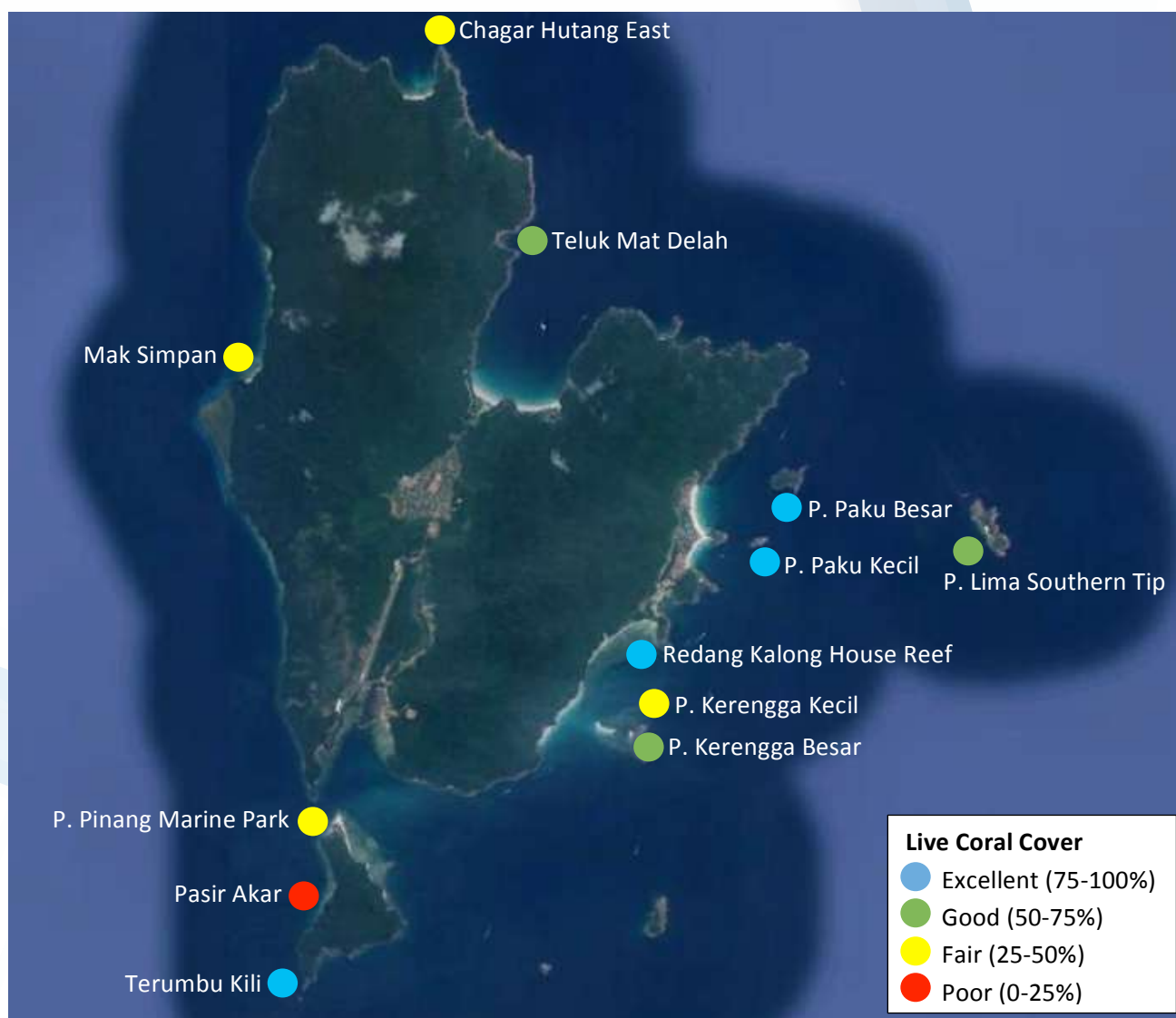


Sunda Shelf – Redang

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 whom 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 centralised electricity supply, resorts operate their own generators for power. Water is supplied by pipeline from the mainland and each resort has its own sewage treatment facilities. The island is served by an airport (flights to KL and Singapore) as well as boat services from the mainland.

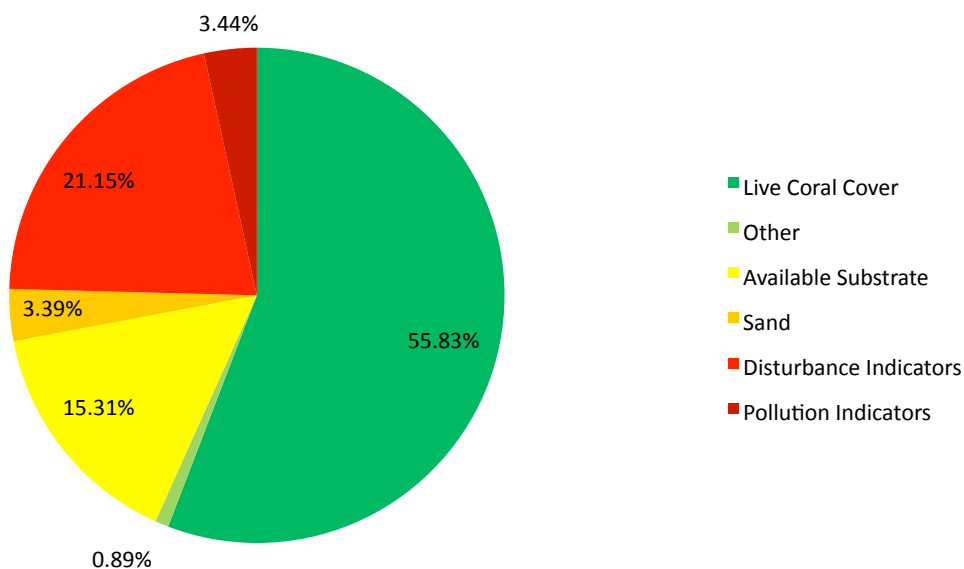
Both fringing off-shore reefs and submerged reefs can be found in the area.



Map showing the health categories of each survey site based on Live Coral Cover: 4 sites have 'Excellent' coral cover, 3 are in 'Good' condition, 4 show 'Fair' health and 1 is in 'Poor' state.

Coral Cover and Health

Substrate Composition at Redang



- Redang is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 53.65%.
- In 'Good' condition and above the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are very high. This is considered to be a result of the impact of a major storm in 2020 which caused extensive damage to some shallow sites.
- Rubble level is especially high at Pasir Akar, Pulau Pinang Marine Park, Teluk Mat Delah and Mak Simpan.
- The level of recently killed coral is extremely high at Pulau Kerengga Kecil, which recorded 61.25%. The level is also high at Pulau Kerengga Besar and Pulau Paku Besar.

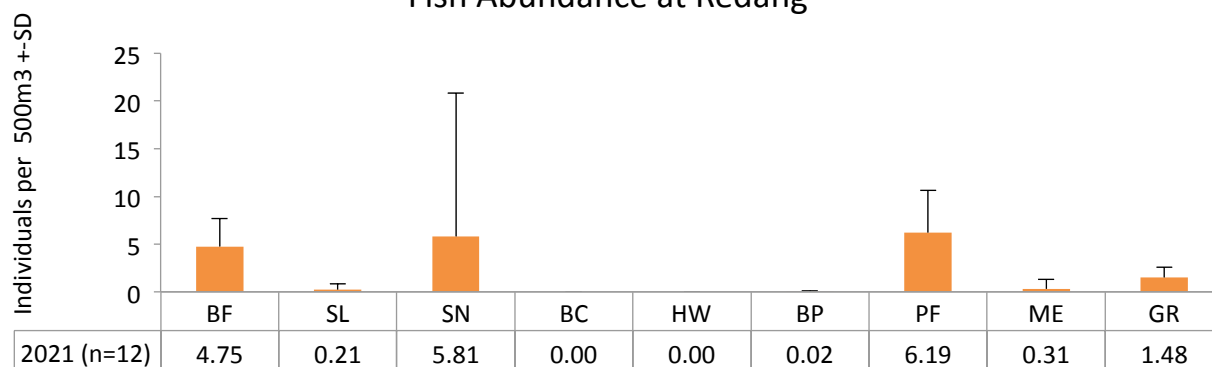
CORAL IMPACTS

- Trash was recorded at a few sites.
- A few reefs were impacted by storm damage and warm water bleaching.
- The extremely high level of recently killed coral at Pulau Kerengga Kecil was due to storm damage.



Fish and Invertebrate

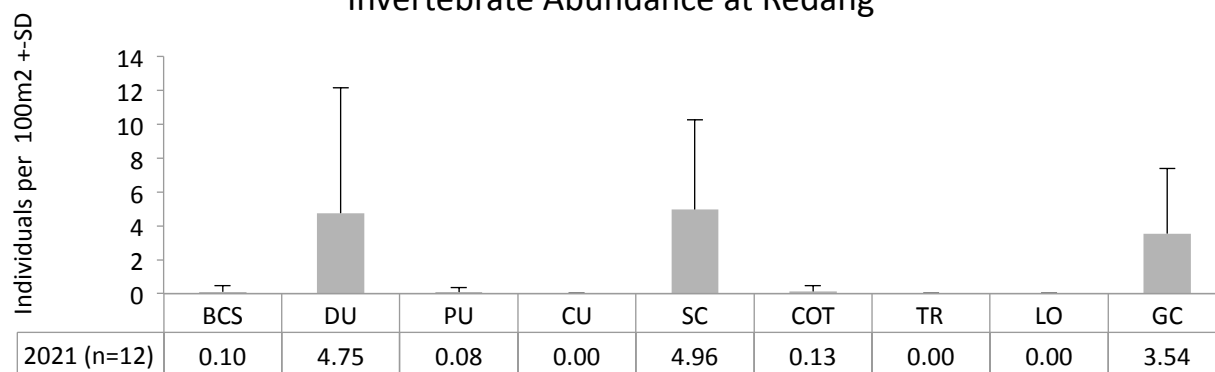
Fish Abundance at Redang



Indicator Fish

- Parrotfish abundance is the highest.
- Bumphead parrotfish, fish targeted for live-food fish trade, is recorded.

Invertebrate Abundance at Redang



Indicator Invertebrates

- Banded coral shrimp, indicator for curio trade, is recorded.
- Crown-of-thorns is not an issue in Redang.

RARE ANIMALS

- Turtles were recorded at many sites.



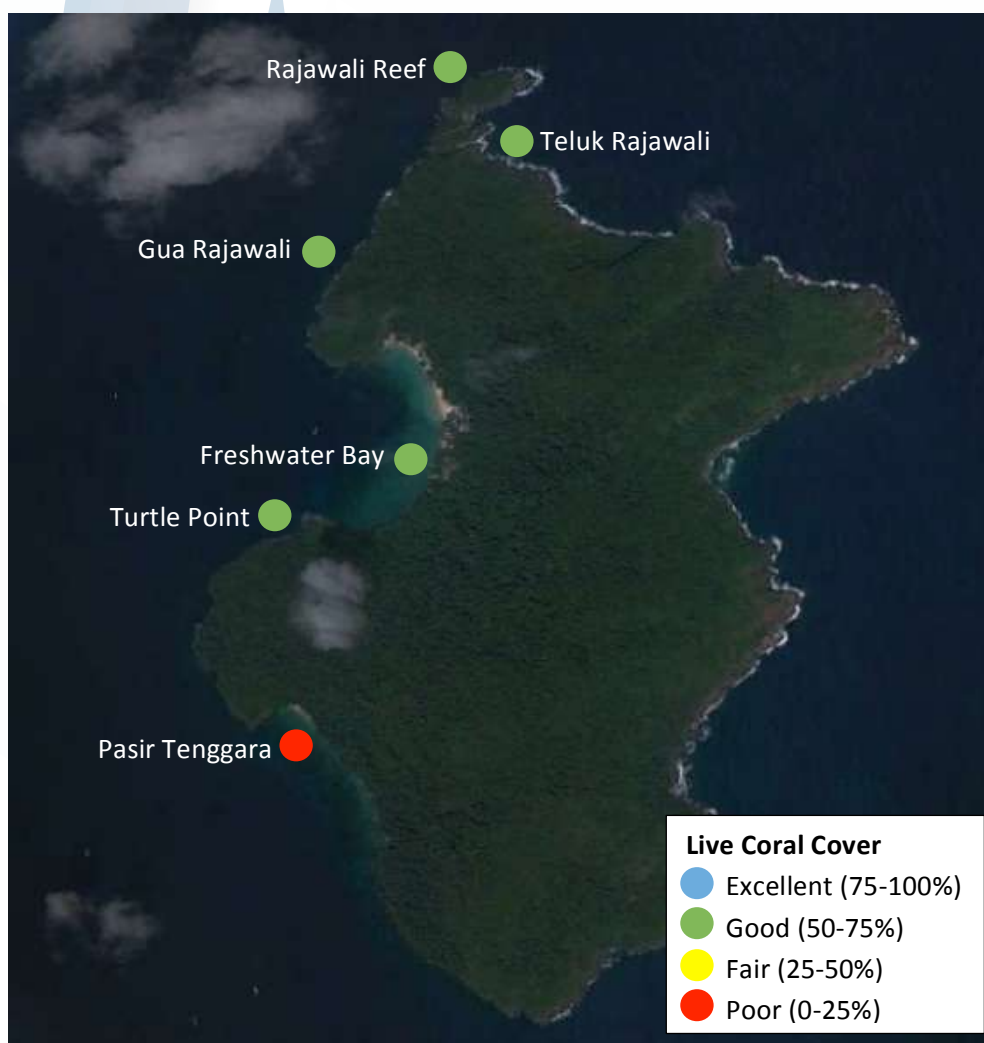
Sunda Shelf – Tenggol

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 centralised electricity supply, resorts operate their own generators for power. Groundwater supplies are limited and there is no centralised sewage treatment, each resort having its own sewage treatment facility.

Tenggol Island has gained in popularity over the last few years and many dive and snorkel operators have started to operate from Dungun, the nearest town on the mainland, offering day trip packages to divers and snorkelers alike.

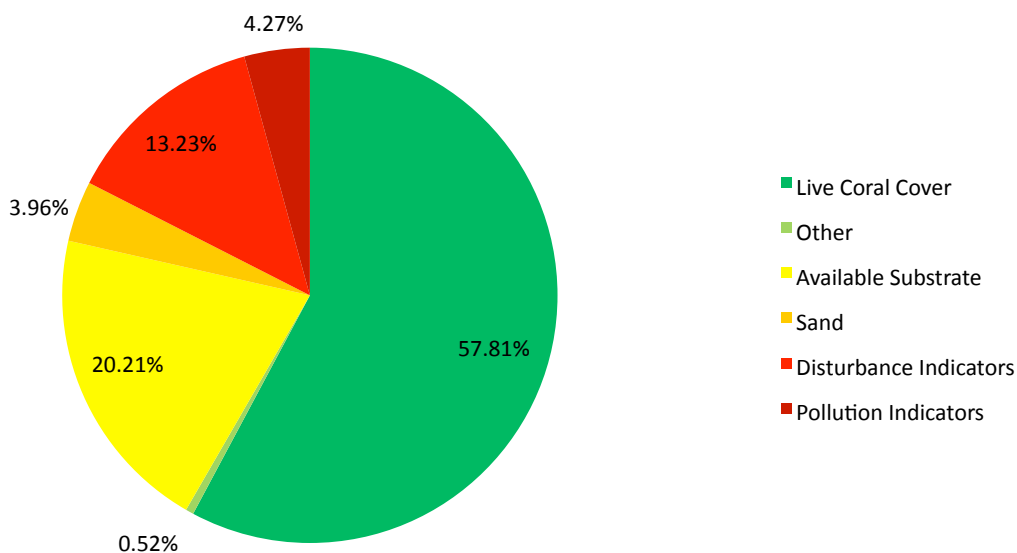
Much of the island's coastline is rocky, besides a couple of sandy beaches. The reefs are mainly fringing reefs and rocky reefs.



Map showing the health categories of each survey site based on Live Coral Cover: 5 sites have 'Good' coral cover and 1 is in 'Poor' condition.

Coral Cover and Health

Substrate Composition at Tenggol



- Tenggol is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 46.35%.
- In 'Good' condition and above the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are high.
- Rubble level is especially high at Pasir Tenggara.
- Pollution indicators are not high for Tenggol in general but the level of nutrient indicator algae is especially high at Freshwater Bay.

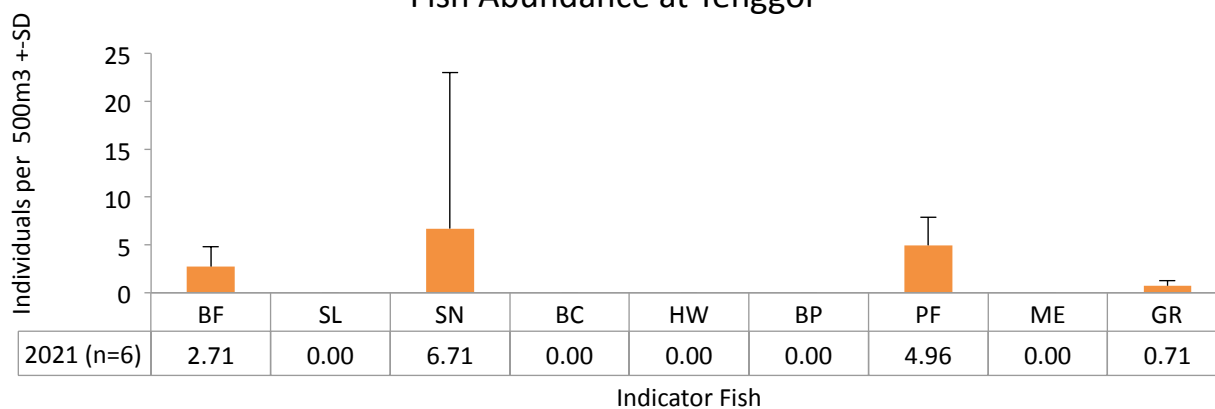
CORAL IMPACTS

- Discarded fishing nets and trash were recorded.
- One site was impacted by warm water bleaching.
- Coral damage due to fish bites was recorded at one site.



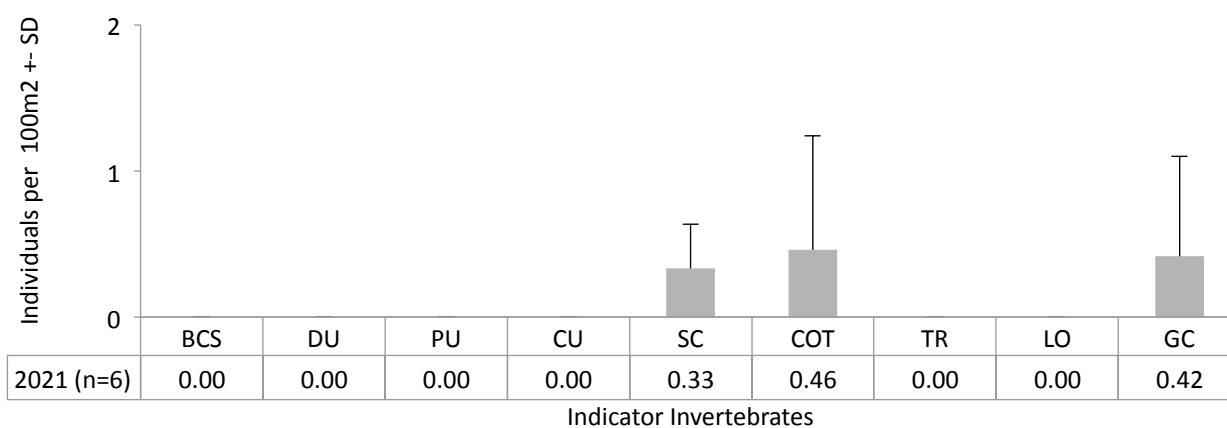
Fish and Invertebrate

Fish Abundance at Tenggol



- Snapper abundance is the highest.
- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are low in abundance, except for snapper and parrotfish.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Tenggol



- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.
- Crown-of-thorns is an issue in Tenggol.
- A healthy coral reef can support a population of 0.2-0.3 individuals per 100m², Tenggol recorded 0.46.

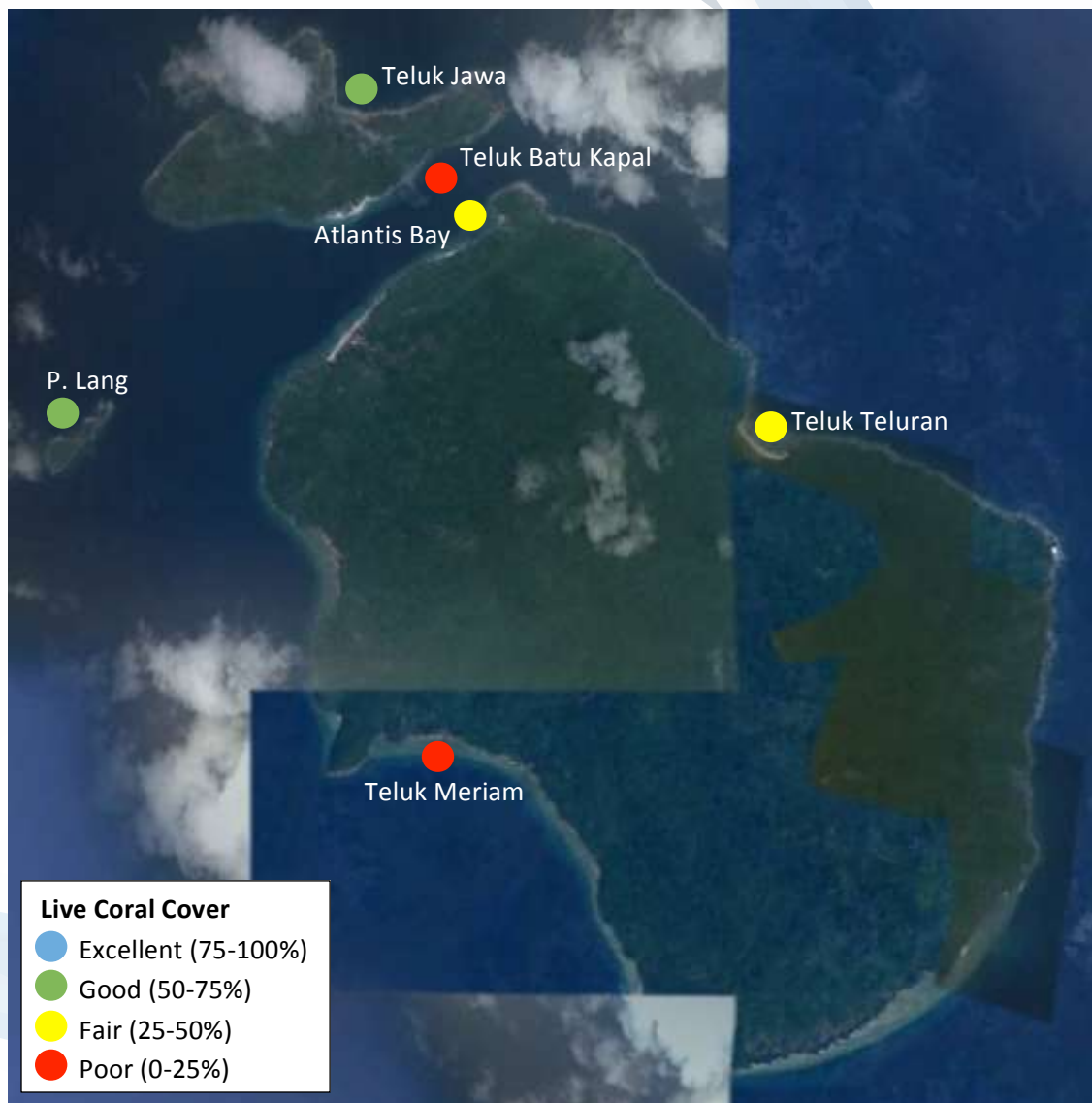
RARE ANIMALS

- Juvenile green turtle was recorded.

Sunda Shelf – Aur & Dayang

Pulau Aur and Pulau Dayang are adjacent islands in Mersing District, Johor. They lie about 76km east of Mersing off the East coast of Peninsular Malaysia and were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

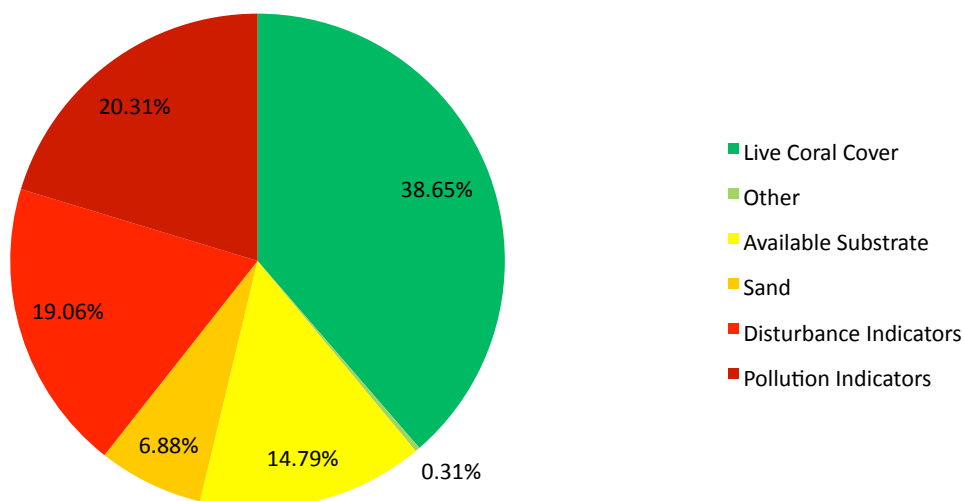
Their corals, lagoons and offshore pools make these islands a tourist attraction. The islands are sparsely populated with few villages and have for many years been a frequent stopover point for fishermen. Pulau Aur and Pulau Dayang used to be a popular diving destination among tourists from Singapore.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Good' coral cover, 2 are in 'Fair' condition, and 2 show 'Poor' health.

Coral Cover and Health

Substrate Composition at Aur & Dayang



- Aur and Dayang is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 35.83%.
- In 'Fair' condition and below the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- Rubble level is very high at all sites, except Teluk Teluran which recorded zero rubble.
- Pollution indicators are very high.
- Nutrient indicator algae level is very high at all sites.

CORAL IMPACTS

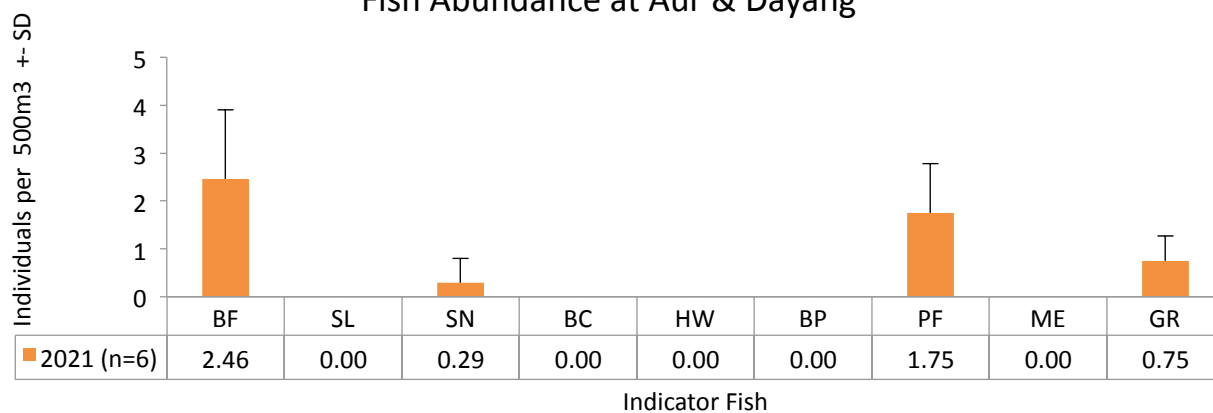
- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.
- One site was impacted by warm water bleaching.

Fish and



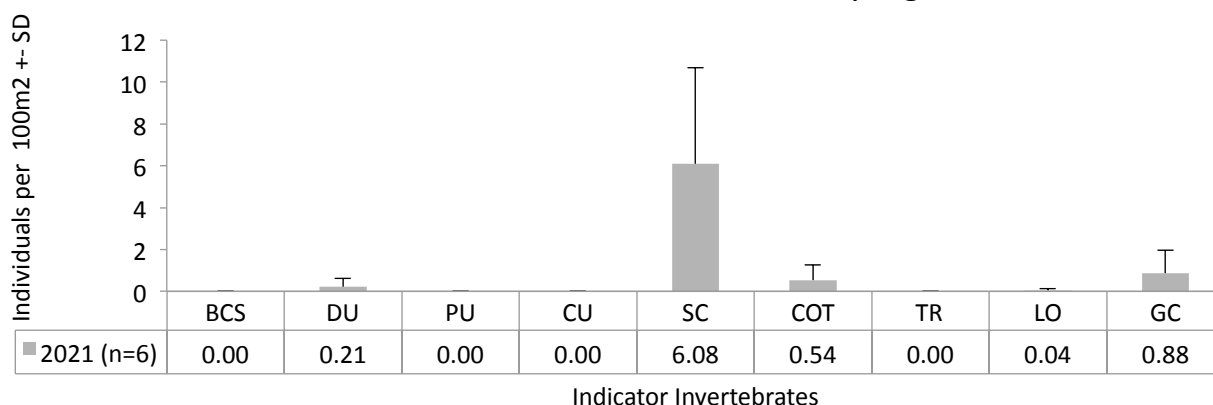
Invertebrate

Fish Abundance at Aur & Dayang



- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Aur & Dayang



- Sea cucumber abundance is the highest.
- Invertebrates targeted for food are very low in abundance, except for sea cucumber.
- Indicators for curio trade are absent.
- Crown-of-thorns is an issue in Aur and Dayang.
- A healthy coral reef can support a population of 0.2-0.3 individuals per 100m², Aur and Dayang recorded 0.54.

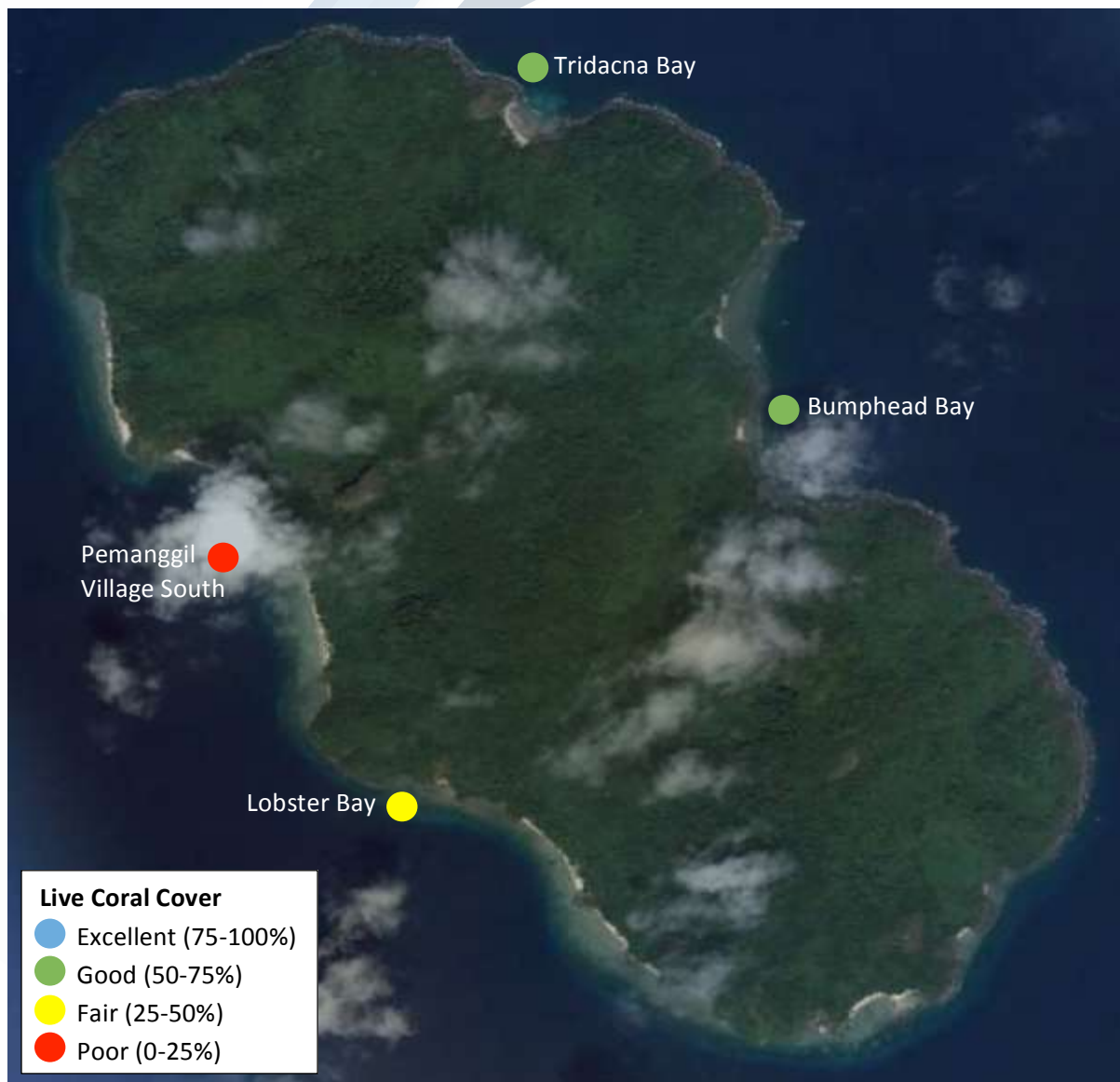
RARE ANIMALS

- Blacktip sharks were recorded.

Sunda Shelf – 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).

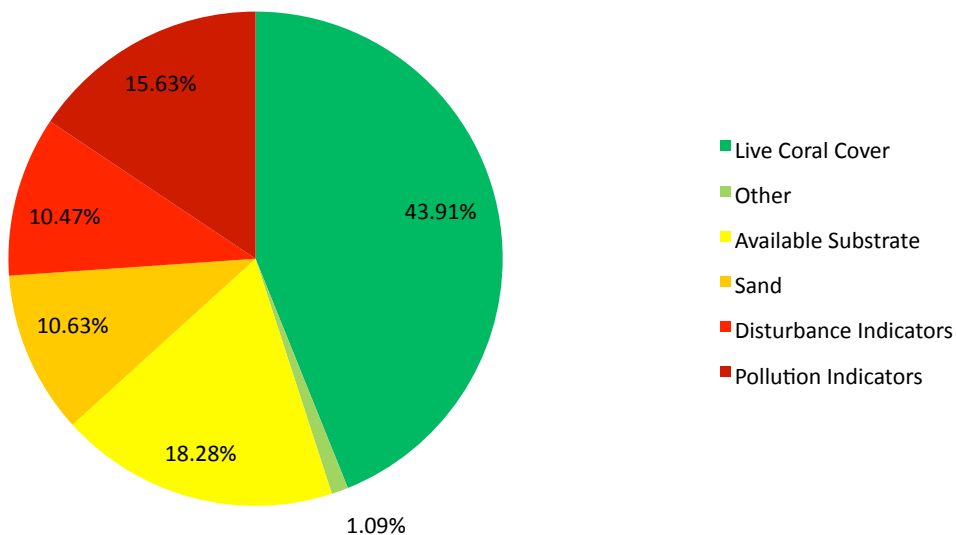
The island is sparsely populated and has for many years been a frequent stopover point for fishermen.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Good' coral cover, 1 is in 'Fair' condition, and 1 shows 'Poor' health.

Coral Cover and Health

Substrate Composition at Pemanggil



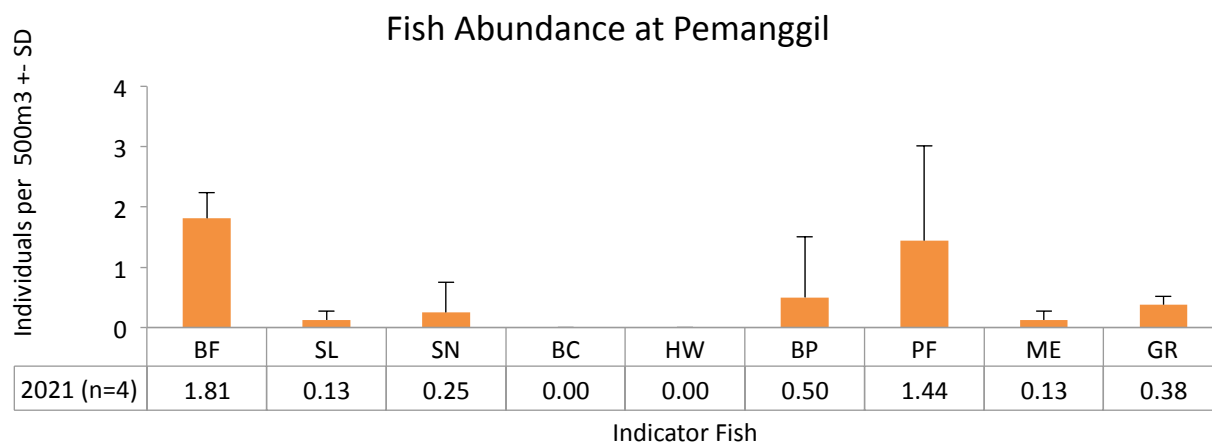
- Pemanggil is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 42.34%.
- In 'Fair' condition and below the Sunda Shelf region average (50.94%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- Rubble level is especially high at Pemanggil Village South.
- Pollution indicators are high.
- Nutrient indicator algae level is high at all sites.

CORAL IMPACTS

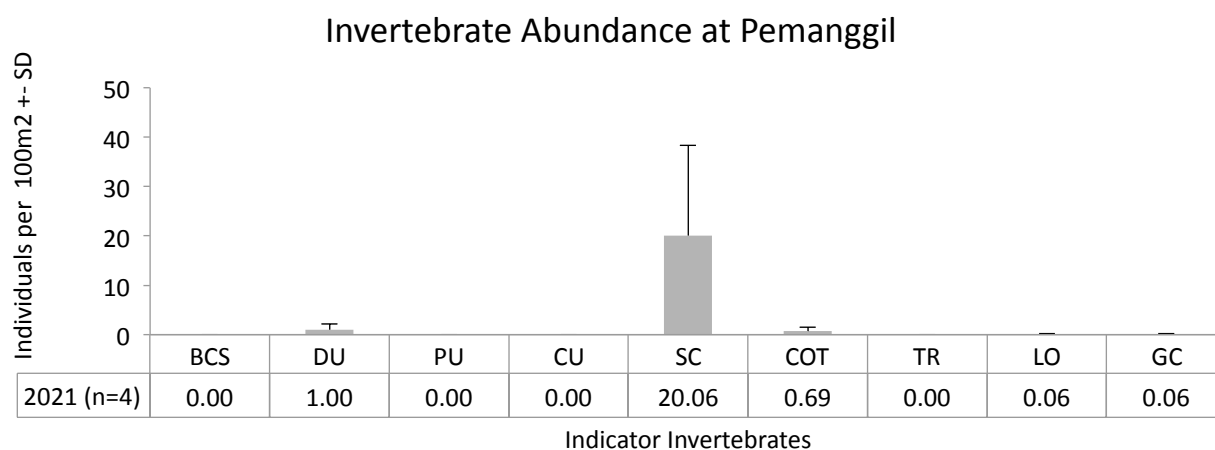
- Boat anchor damage and trash were recorded.
- One site was impacted by warm water bleaching.



Fish and Invertebrate



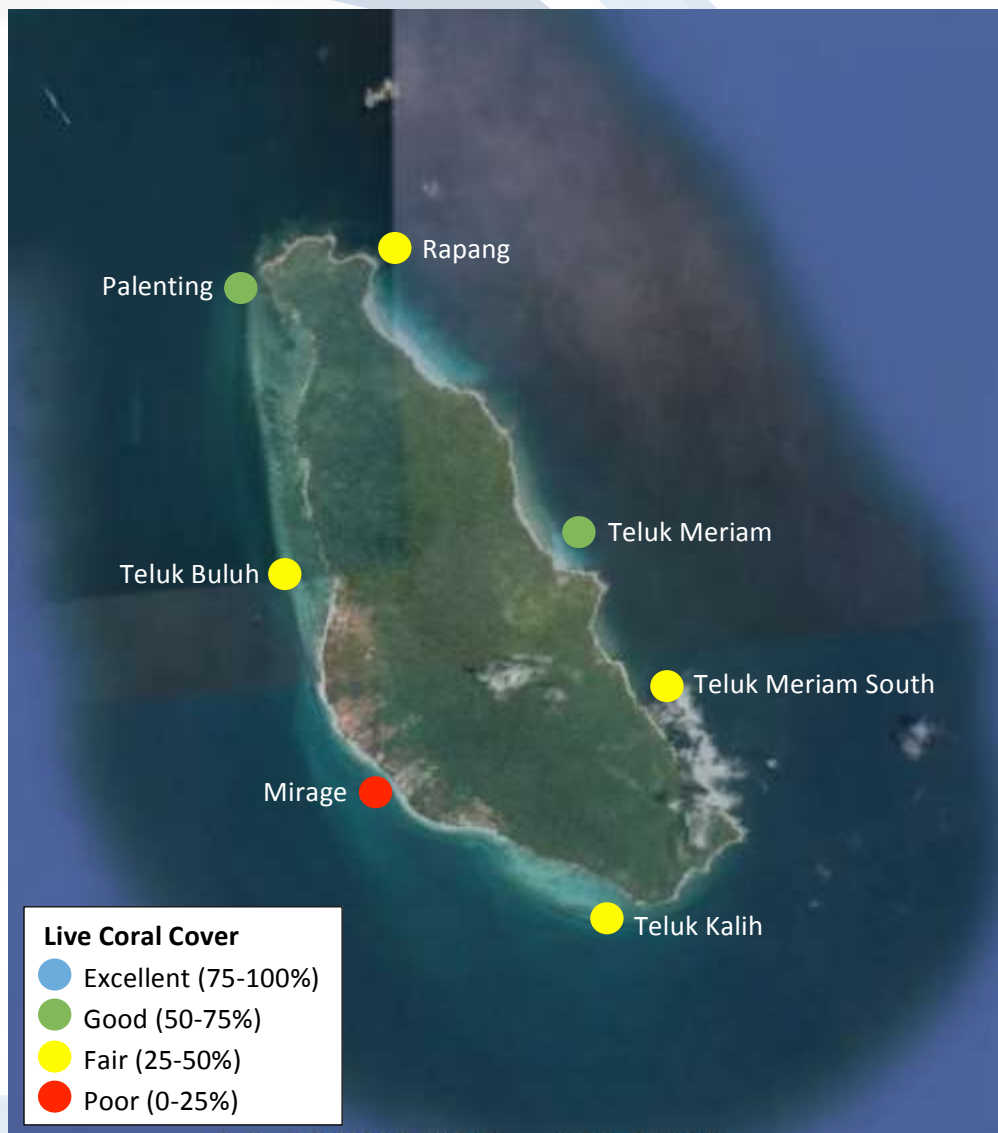
- Bumphead parrotfish, fish targeted for live-food fish trade, is recorded.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.



- Sea cucumber abundance is high.
- Invertebrates targeted for curio trade are absent.
- Indicators targeted for food are very low in abundance, except for sea cucumber.
- Crown-of-thorns is an issue in Pemanggil.
- A healthy coral reef can support a population of 0.2-0.3 individuals per 100m², Pemanggil recorded 0.69.

Sunda Shelf – Pulau Besar

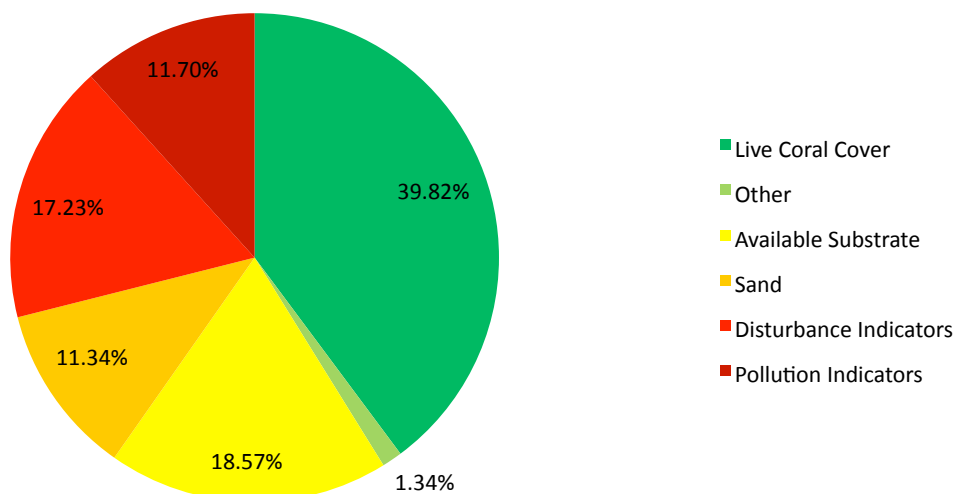
Pulau Besar is an island in Mersing District, Johor. The island is surrounded by Pulau Rawa, Pulau Sibul and Pulau Tinggi. The waters surrounding the island group were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Good' coral cover, 4 are in 'Fair' condition, and 1 shows 'Poor' health.

Coral Cover and Health

Substrate Composition at Pulau Besar



- Pulau Besar is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 38.30%.
- In 'Fair' condition and below the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- Silt level is especially high at Mirage which recorded 51.25%. The level is high at all sites, except for Teluk Kalih which recorded 1.25%.
- Pollution indicators are high.
- Nutrient indicator algae level is especially high at Teluk Meriam South, Teluk Kalih and Mirage.

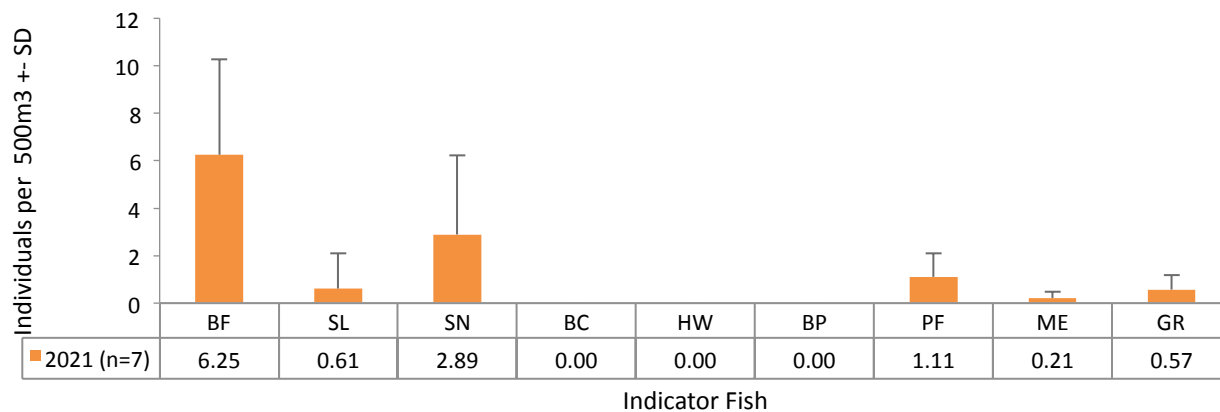
CORAL IMPACTS

- Boat anchor damage and trash were recorded at some sites.
- Discarded fishing nets were recorded at many sites.
- All reefs, except for one, were impacted by warm water bleaching.
- Drupella predation was recorded.



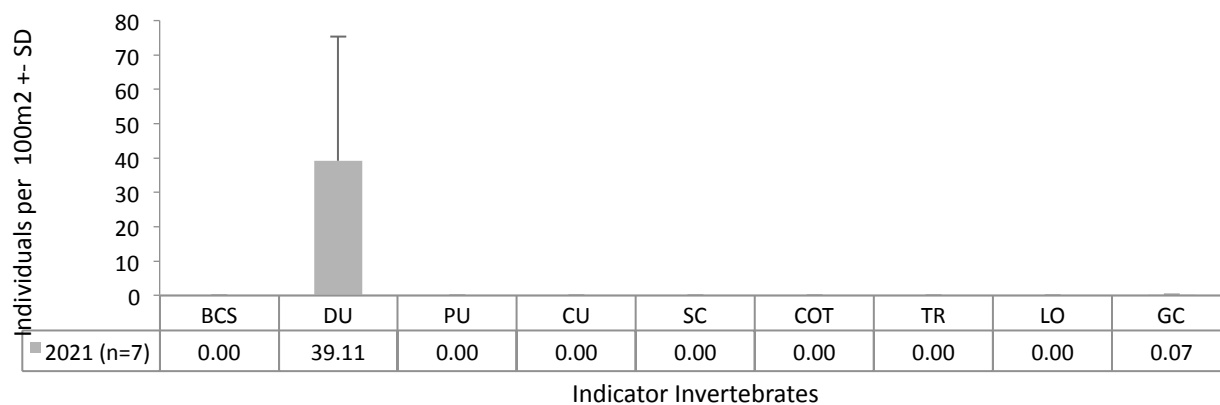
Fish and Invertebrate

Fish Abundance at Pulau Besar



- Butterflyfish abundance is the highest.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Pulau Besar



- Diadema urchin abundance is high.
- Invertebrates targeted for food are absent except for giant clam which is very low in abundance.
- Indicators for curio trade are absent.

RARE ANIMALS

- Turtle was recorded.



Sunda Shelf – Sibul

The Sibul archipelago, known locally by the name of the largest island, Sibul, is located less than 10km off the East coast of mainland Peninsular Malaysia. The waters surrounding the island group were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

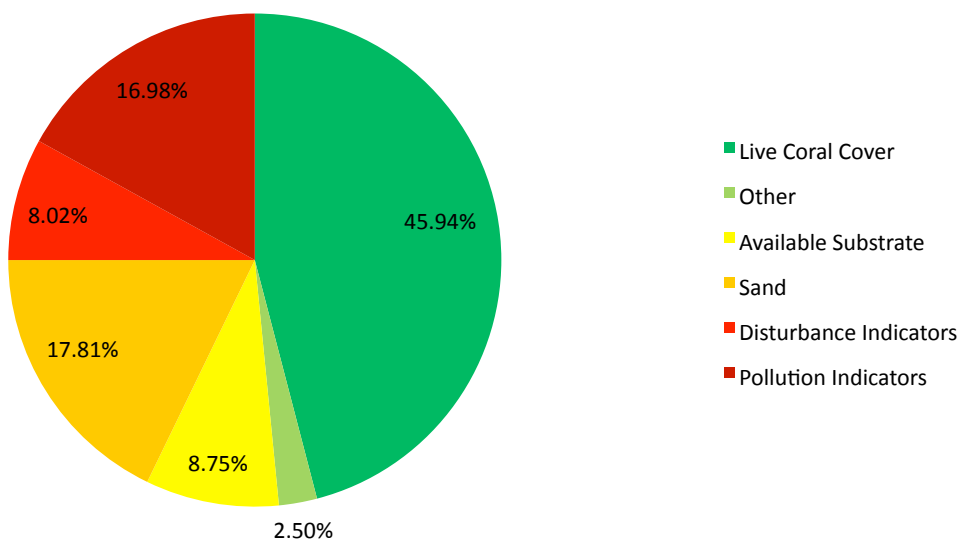
Sibul island is not as popular among tourists as other islands off the East coast, but the tourism industry here is growing. The island is sparsely populated with few villages and a number of small resorts.



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Excellent' coral cover, 1 is in 'Good' condition, 3 show 'Fair' health and 1 is in 'Poor' state.

Coral Cover and Health

Substrate Composition at Sibul



- Sibul is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 44.38%.
- In 'Fair' condition and below the Sunda Shelf region average (50.49%).
- Sand level is high.
- Disturbance indicators are slightly high.
- Silt level is high at many sites.
- Pollution indicators are high.
- Nutrient indicator algae and sponge level are high at many sites.

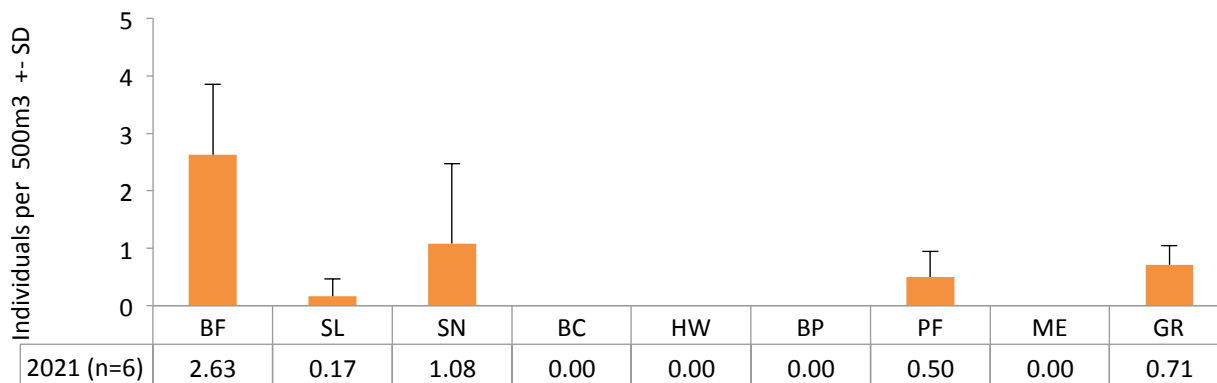
CORAL IMPACTS

- Discarded fishing net and trash were recorded.
- Most reefs were impacted by warm water bleaching.



Fish and Invertebrate

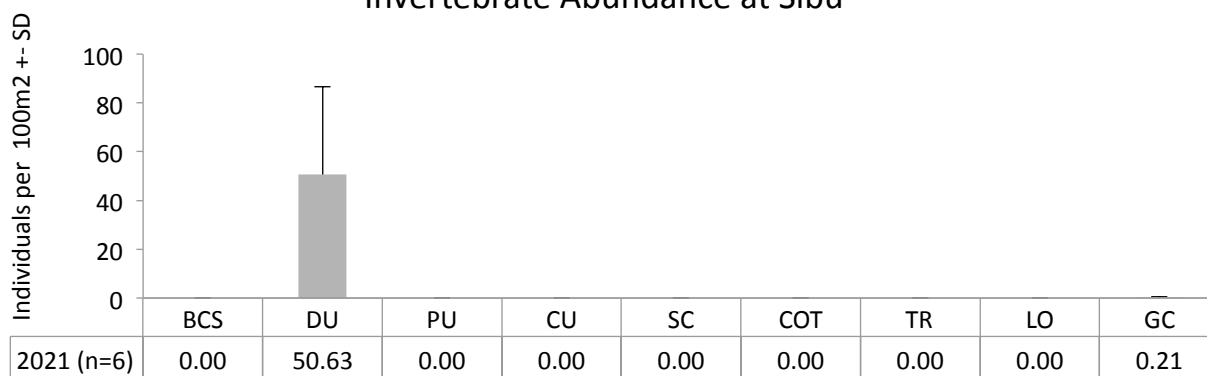
Fish Abundance at Sibü



Indicator Fish

- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Sibü



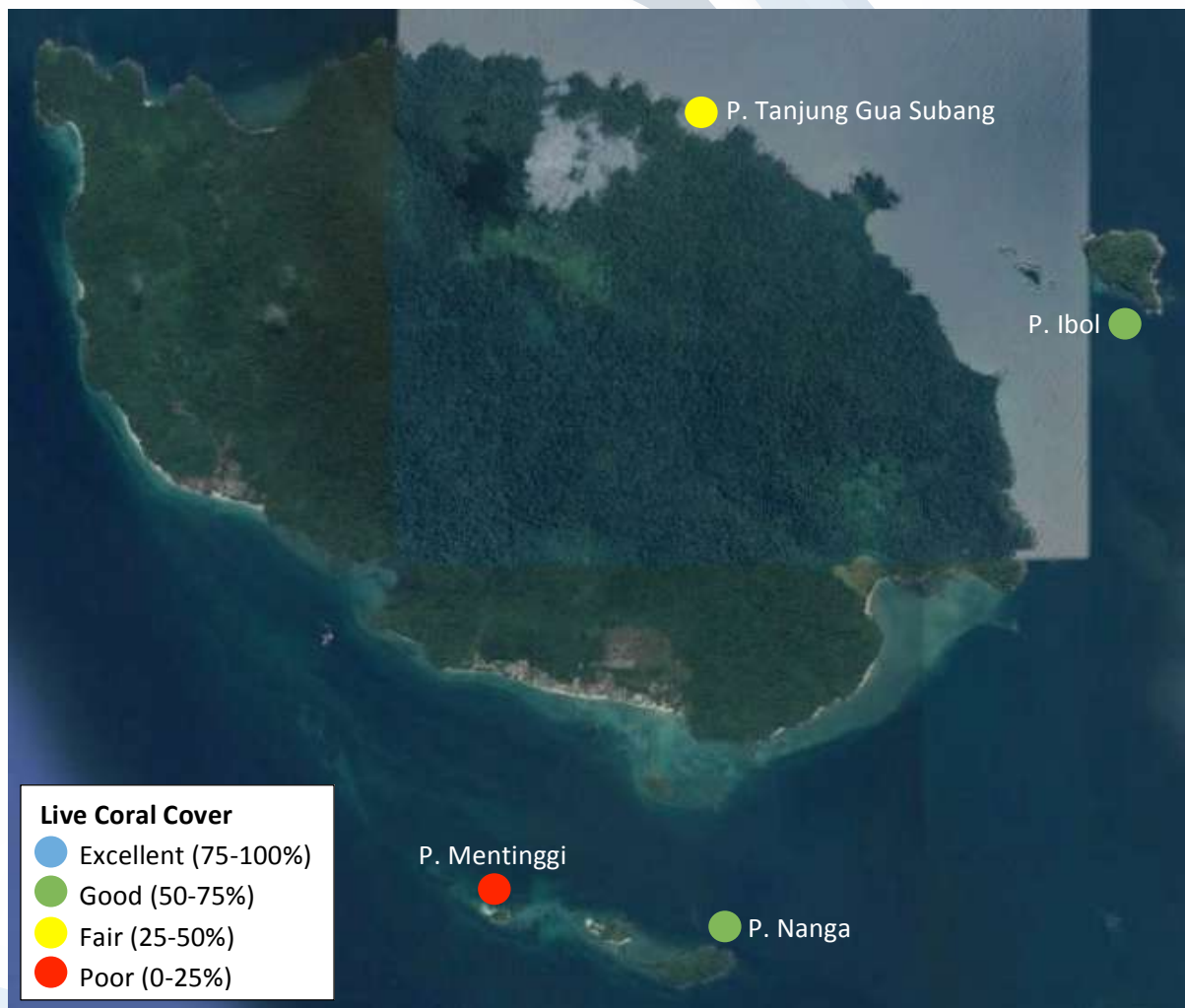
Indicator Invertebrates

- Diadema urchin abundance is high.
- Invertebrates targeted for food are absent except for giant clam which is very low in abundance.
- Indicators for curio trade are absent.

Sunda Shelf – 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 a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

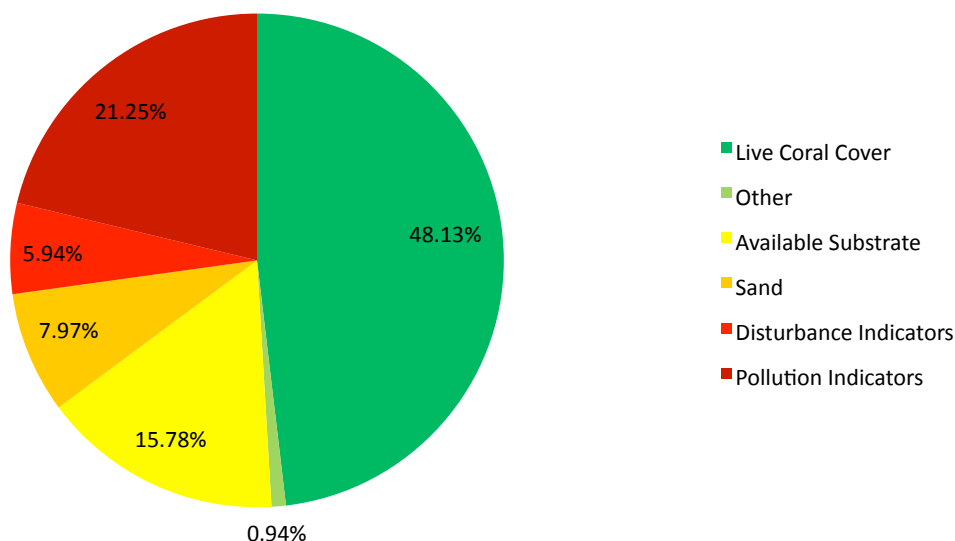
The island is not as popular among tourists as other islands off the East coast, but the tourism industry here is growing. There are two dive operators on Tinggi Island.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Good' coral cover, 1 is in 'Good' condition, and 1 shows 'Fair' health.

Coral Cover and Health

Substrate Composition at Tinggi



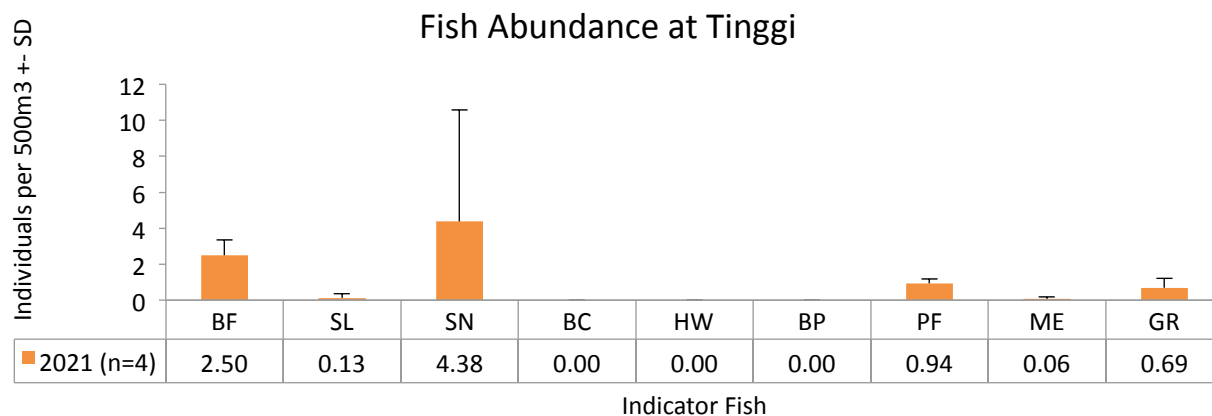
- Tinggi is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 39.53%.
- In 'Fair' condition and below the Sunda Shelf region average (50.49%).
- Available substrate for coral recruits to attach is high.
- Pollution indicators are very high.
- Nutrient indicator algae level is high at all sites, especially at Pulau Mentinggi.
- Sponge level is especially high at Pulau Mentinggi.

CORAL IMPACTS

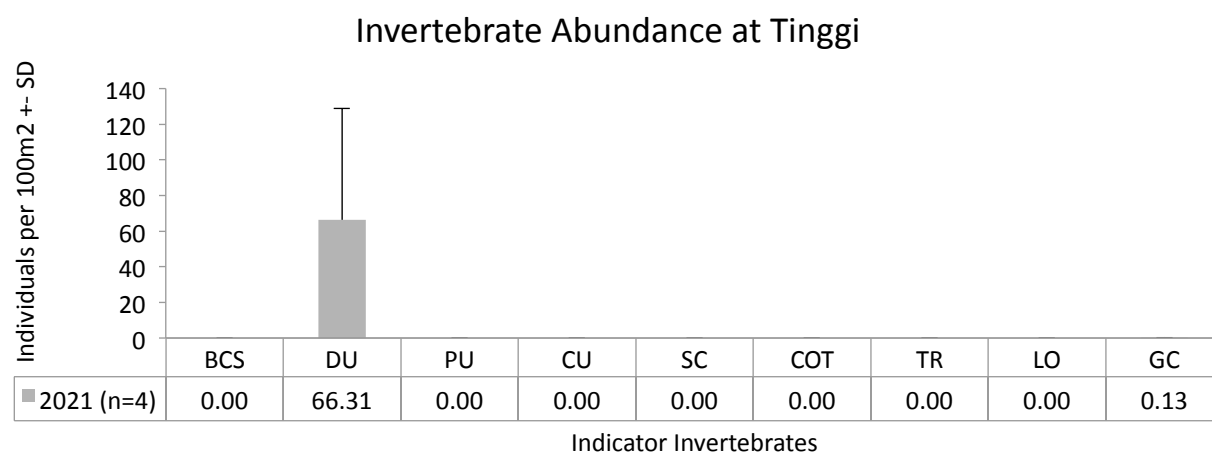
- Boat anchor damage was recorded.
- Discarded fishing net and trash were recorded at many sites.



Fish and Invertebrate



- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance, except for snapper
- This suggests that fish targeted for food are heavily harvested.



- Diadema urchin abundance is high.
- Invertebrates targeted for food are absent except for giant clam which is very low in abundance.
- Absent of indicators for curio trade.

Sunda Shelf – Pulau Lima

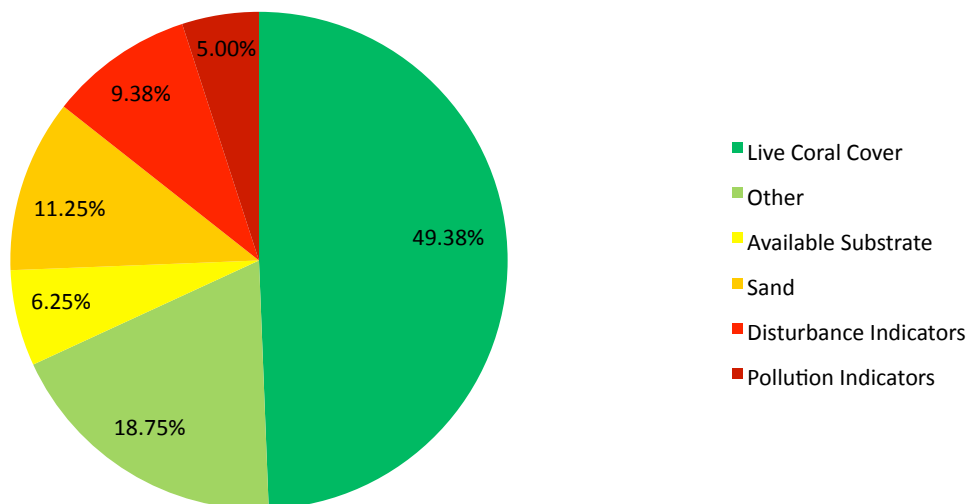
Pulau Lima is an island in Mersing District, Johor. The island is surrounded by Pulau Sibul and Pulau Tinggi and frequented by snorkelers and divers from the nearby Pulau Sibul and Pulau Tinggi. The island is not populated. The natural ecosystem hosts diverse marine life, has high aesthetic value and is a national heritage.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Fair' coral cover.

Coral Cover and Health

Substrate Composition at Pulau Lima



- Pulau Lima is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 48.75%.
- In 'Fair' condition and below the Sunda Shelf region average (50.49%).
- The level of Other is high, mainly attributed by anemone.
- Sand level is high.
- Disturbance indicators are slightly high.

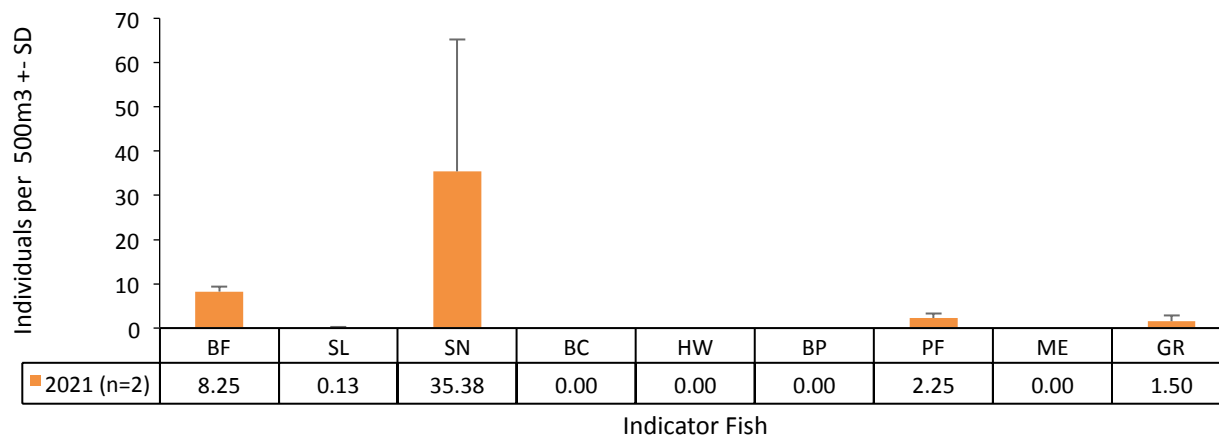
CORAL IMPACTS

- Boat anchor damage, fish trap and trash were recorded.
- All reefs were impacted by warm water bleaching.
- Drupella predation was recorded.



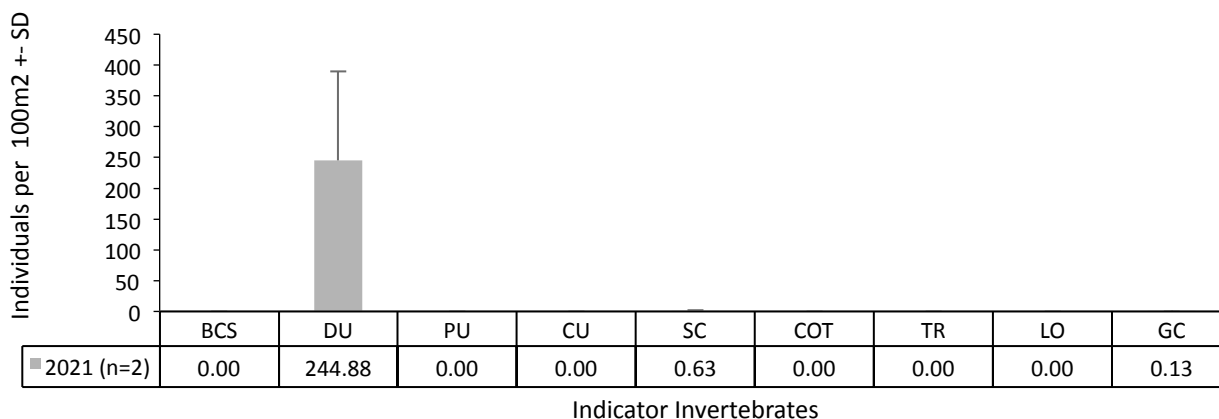
Fish and Invertebrate

Fish Abundance at Pulau Lima



- Snapper abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Pulau Lima



- Diadema urchin abundance is high.
- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.

RARE ANIMALS

- Nurse shark was recorded.

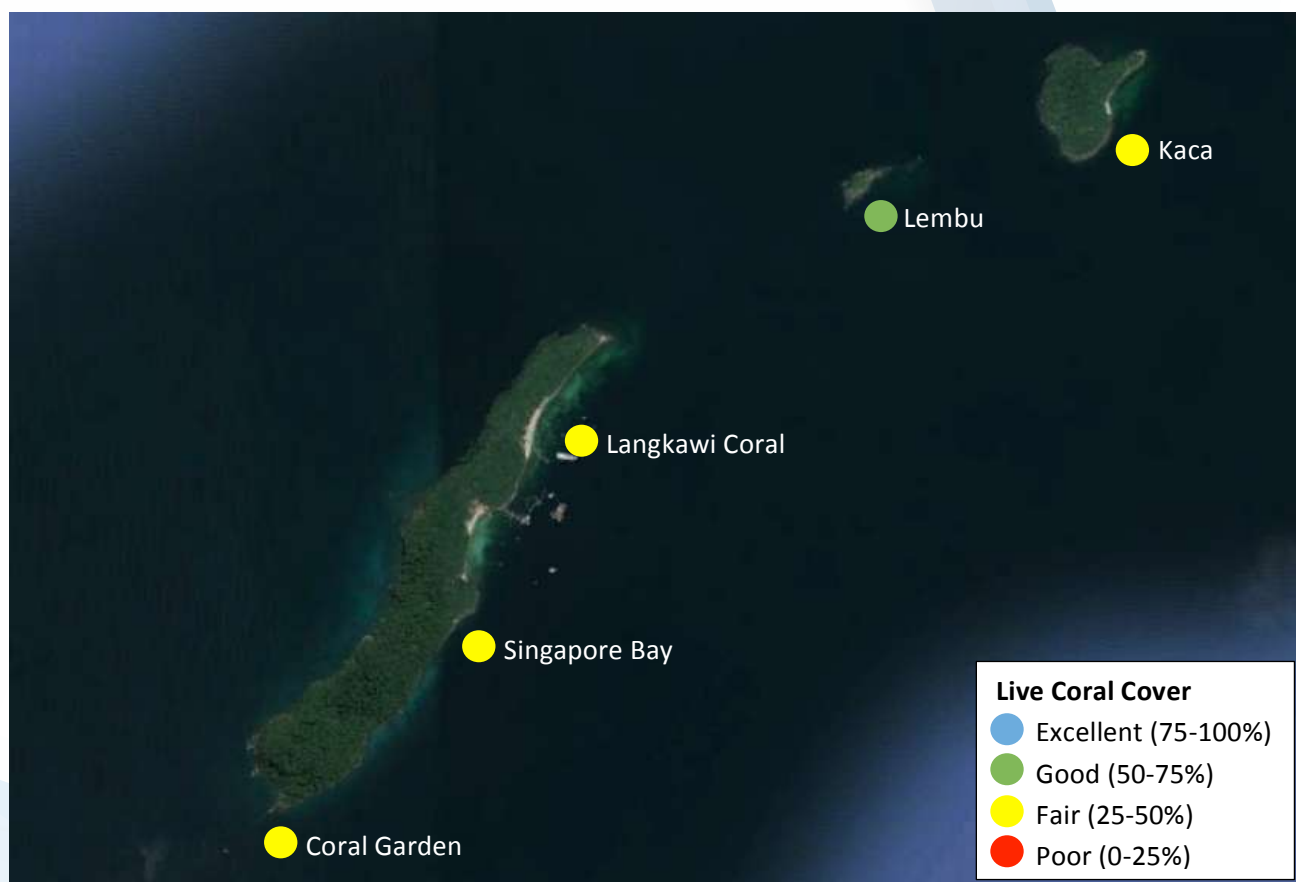


Malacca Strait – Payar

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

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

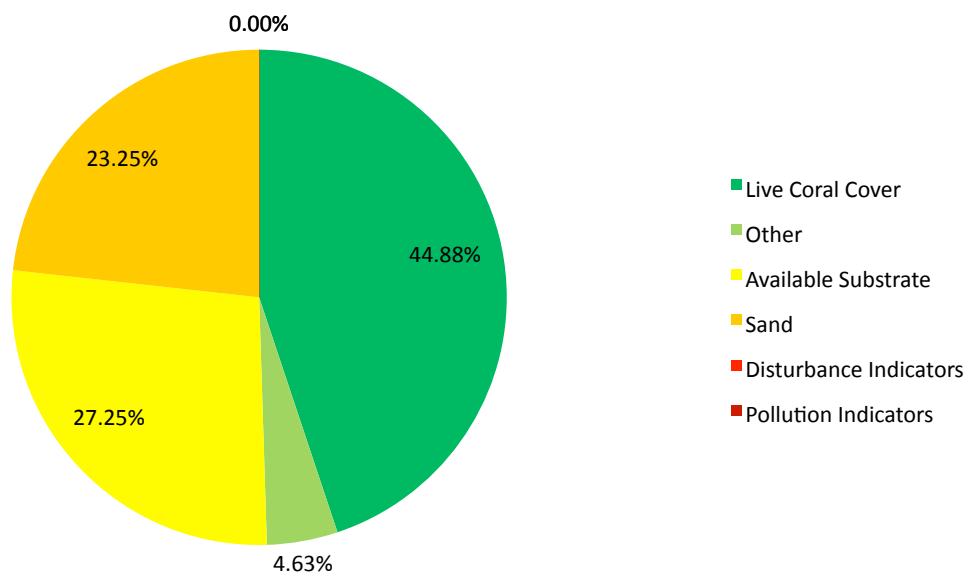
The island is uninhabited and the only operating structures on the island are the Marine Park centre with facilities for day trip visitors such as gazebos, picnic tables and restroom facilities at selected areas. There is also an old abandoned resort. A floating platform moored just off Payar serves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



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Excellent' coral cover, 1 is in 'Good' condition, 1 shows 'Fair' health and 1 is in 'Poor' state.

Coral Cover and Health

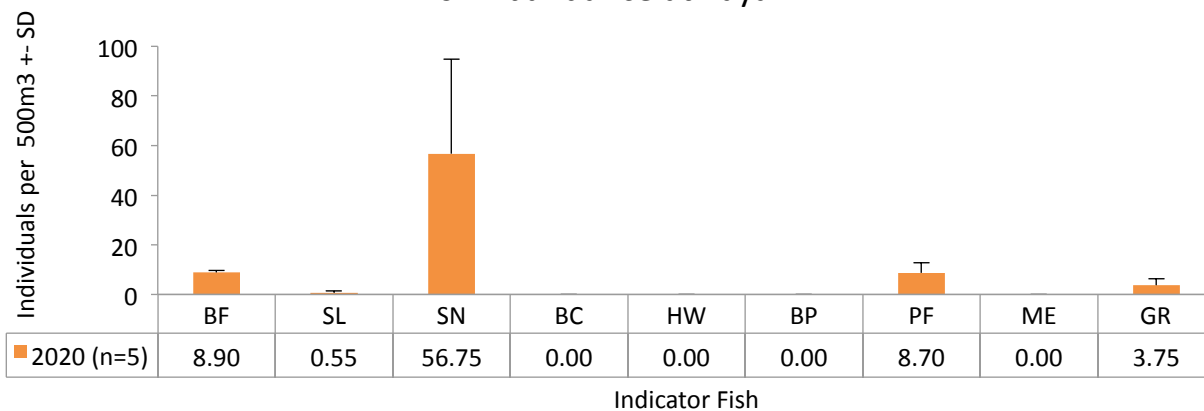
Substrate Composition at Payar



- Payar is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 44.88%.
- In 'Fair' condition and above the Malacca Strait region average (42.61%).
- Available substrate for coral recruits to attach is very high.
- Sand level is very high.
- Absent of disturbance and pollution indicators.

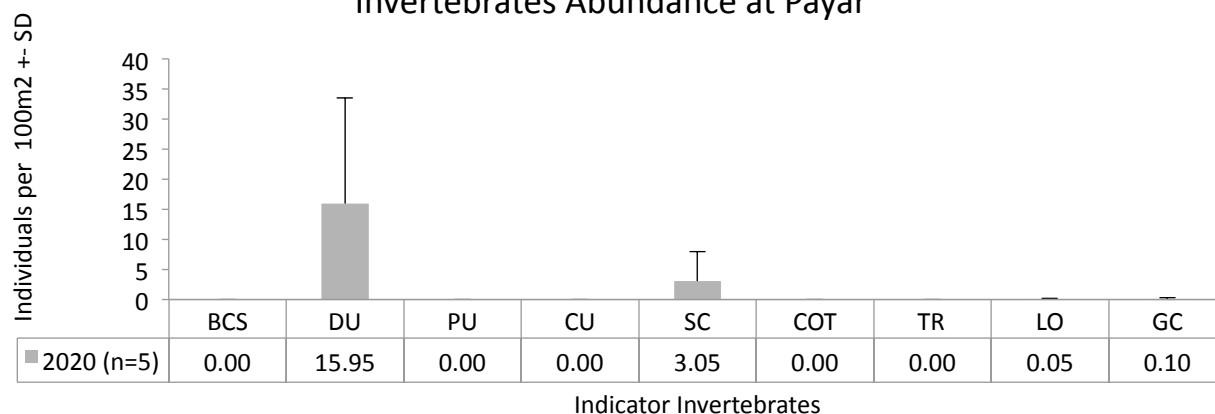
Fish and Invertebrate

Fish Abundance at Payar



- Snapper abundance is high.
- Absent of indicators targeted for live-food fish trade.

Invertebrates Abundance at Payar



- Invertebrates targeted for food are very low in abundance, except for sea cucumber.
- Indicators for curio trade are absent.

RARE ANIMALS

- Blacktip reef sharks were recorded.



Malacca Strait – Malacca

There are a number of islands off the state of Malacca. Pulau Besar is the largest island. It is popular for its ancient graves, tombs and mausoleums which are scattered around the island. The island has a number of other attractions such as old wells, uniquely shaped rocks, village of elves, elves' palace, cave and museum.

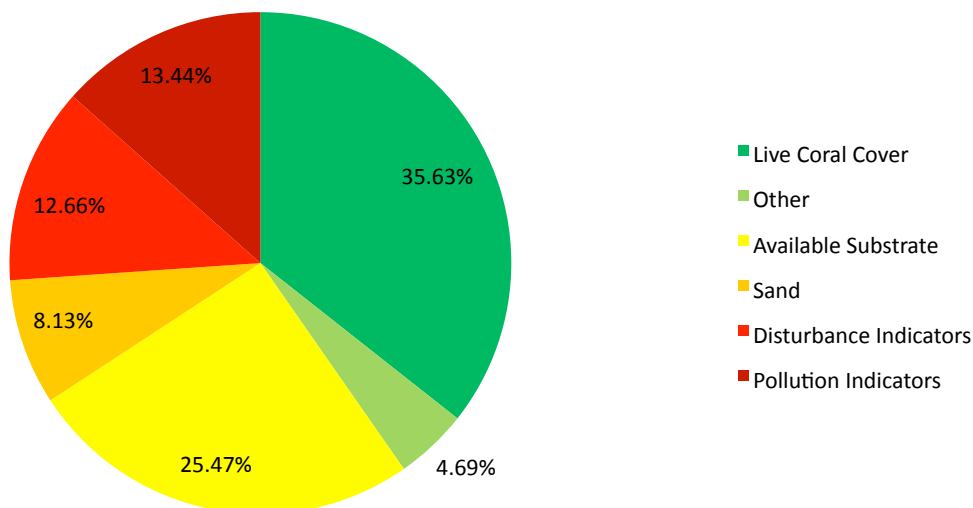
Pulau Undan is located furthest away from the mainland. The name is said to have come from a seabird that used to be abundant on the island and its surrounding, as there were many food sources including fish and snails. The island is not populated but there is a lighthouse to ensure the safety of ships passing through Malacca Strait. Boat trip from mainland to the island takes approximately 35 minutes.



Map showing the health categories of each survey site based on Live Coral Cover: 4 sites have 'Fair' coral cover.

Coral Cover and Health

Substrate Composition at Malacca



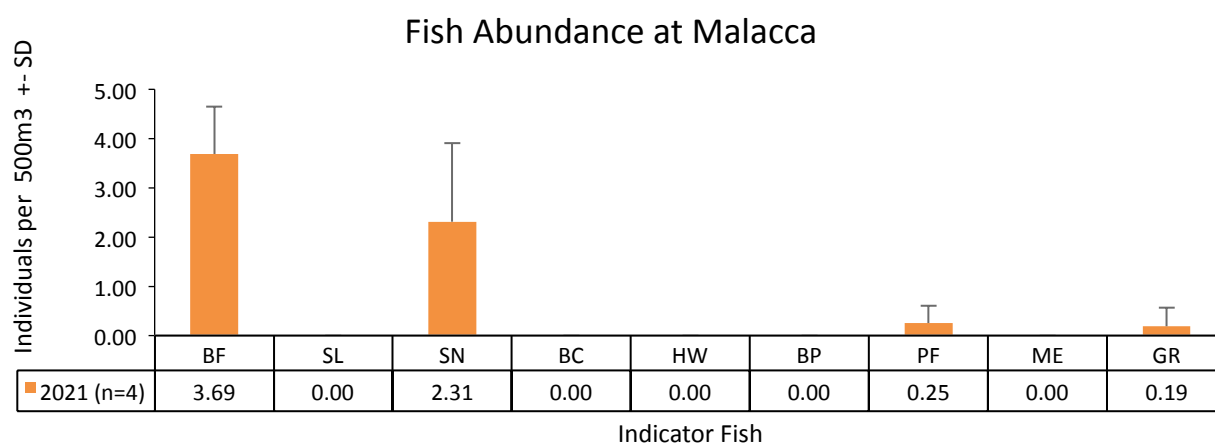
- Malacca is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 34.22%.
- In 'Fair' condition and below the Malacca Strait region average (42.61%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high.
- Disturbance indicators are high.
- Silt level is especially high at Pulau Lalang and Pulau Undan 1.
- Pollution indicators are high.
- Nutrient indicator algae level is especially high at Pantai Labuan and Pulau Lalang.

CORAL IMPACTS

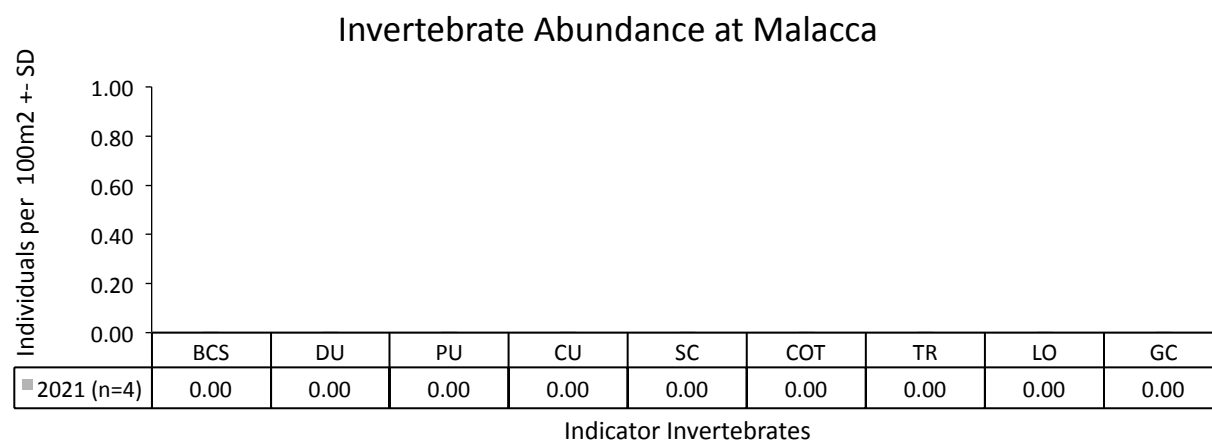
- Trash was recorded.



Fish and Invertebrate



- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.



- Absent of indicator invertebrates.

Malacca Strait – Port Dickson

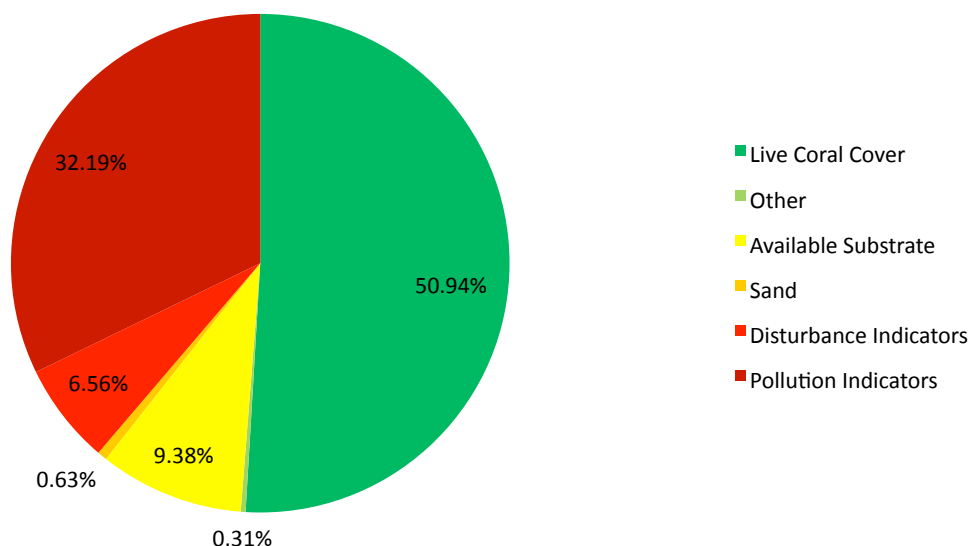
Port Dickson is a coastal town in Port Dickson district, Negeri Sembilan. Historically, the small town used to produce charcoal and tin ore. Over the years, Port Dickson evolved into a busy trading centre and has two oil and gas refineries, as well as home to many army camps. The beach of Port Dickson is a popular holiday destination for local visitors. In the 1990s, Port Dickson is boomed with hotels and resorts. Port Dickson provides sports and activities such as go-karts, paint ball target shooting, archery and ATV riding.



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Good' coral cover and 1 is in 'Fair' condition.

Coral Cover and Health

Substrate Composition at Port Dickson



- Port Dickson is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 37.19%.
- In 'Good' condition and above the Malacca Strait region average (42.61%).
- Pollution indicators are extremely high.
- Nutrient indicator algae level is especially high at Tanjung Tuan which recorded 40.63%. The level is also very high at Kem Askar.

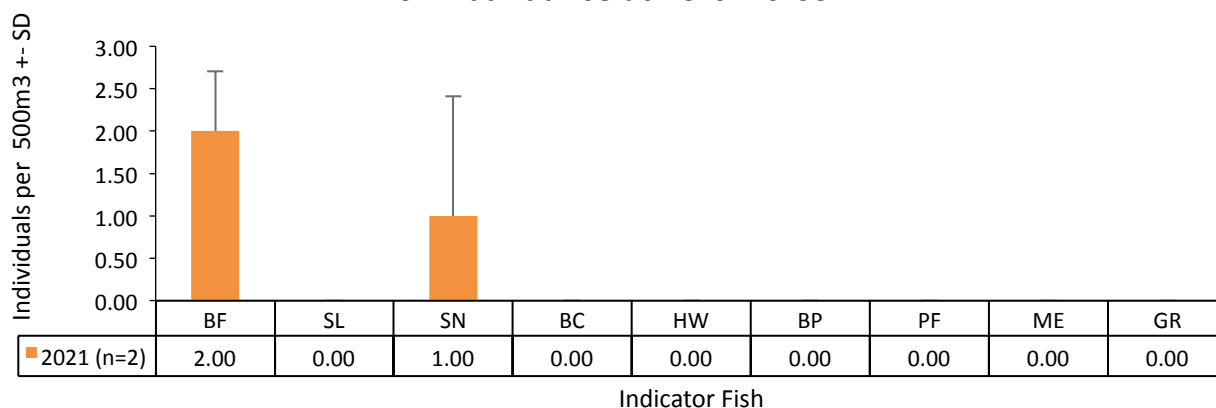
CORAL IMPACTS

- Discarded fishing net was recorded.



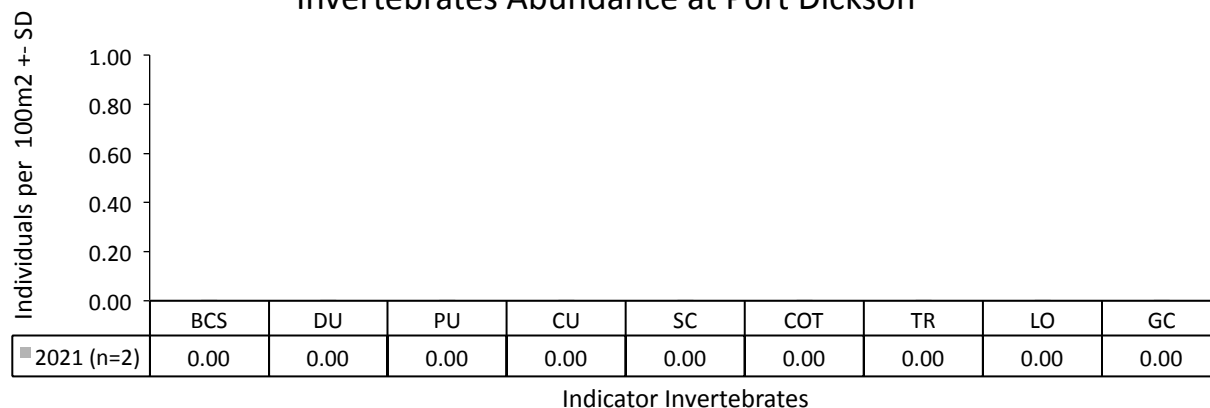
Fish and Invertebrate

Fish Abundance at Port Dickson



- Absent of indicators targeted for live-food fish trade.
- Absent of fish targeted for food, except for snapper and the abundance is low.
- This suggests that fish targeted for food are heavily harvested.

Invertebrates Abundance at Port Dickson

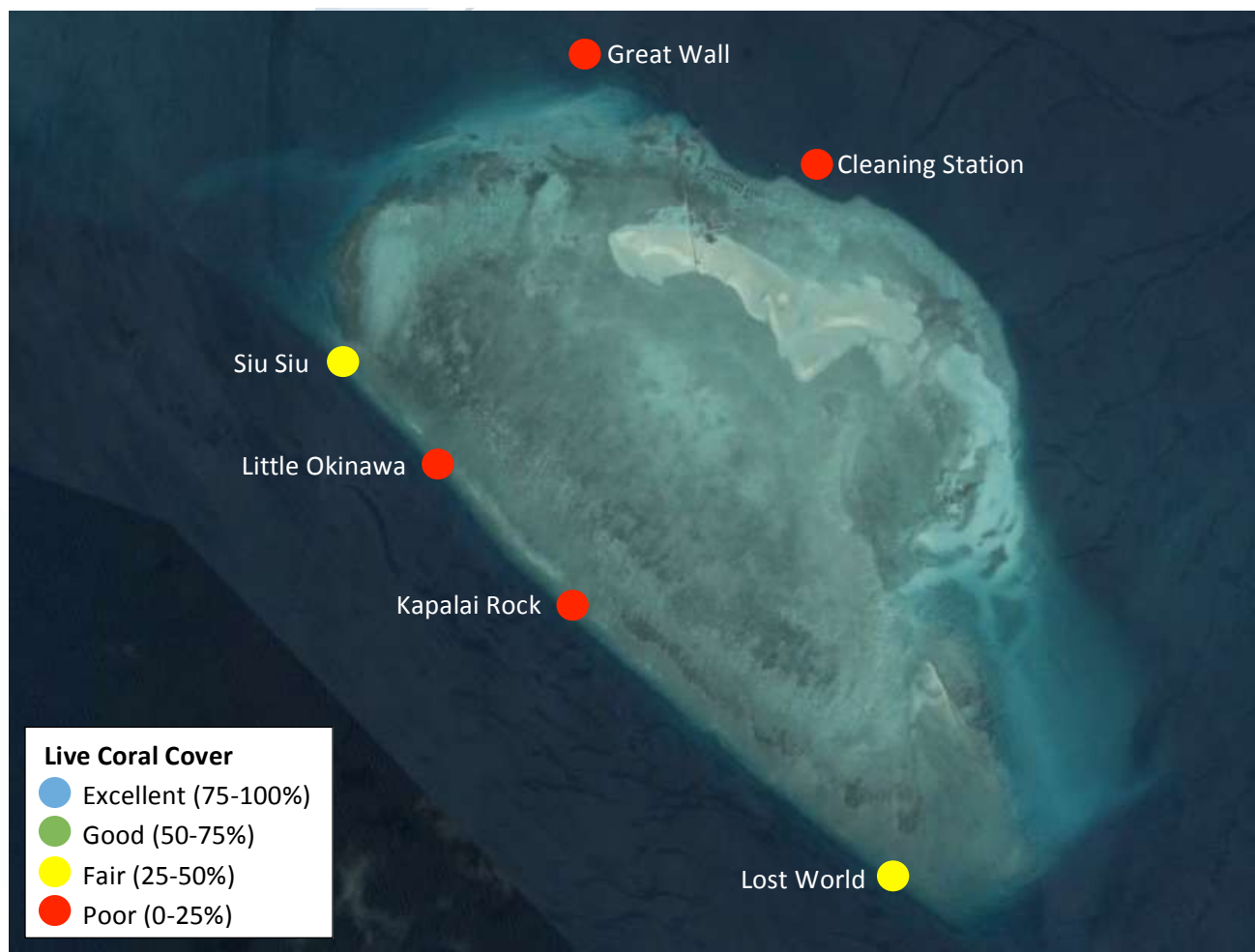


- Absent of indicator invertebrates.

North Borneo – Kapalai

Kapalai Island is located near Semporna, Sabah and is 15 kilometres from Sipadan Island. Though it is called an island, it is actually a sandbar situated on Ligitan Reef. Kapalai used to be a real island with vegetation but erosion over the last few hundred years has reduced the island to sea level. All of the buildings are on stilts resting on the reef.

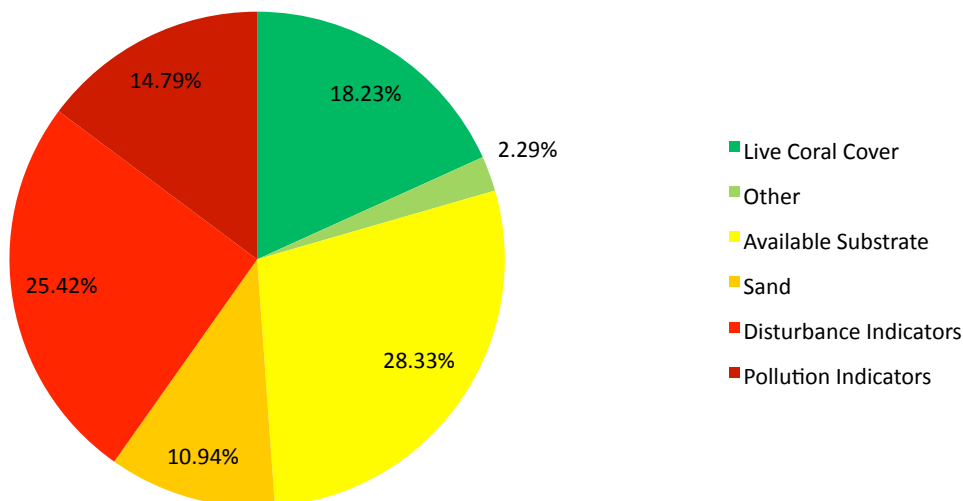
Kapalai is mostly known for its scuba diving. There is only one private resort on the island while the rest of the island is uninhabited.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Fair' coral cover and 4 are in 'Poor' condition.

Coral Cover and Health

Substrate Composition at Kapalai



- Kapalai is dominated by available substrate for coral recruits to attach.
- Kapalai mean hard coral, reef builder, cover is 14.79%.
- In 'Poor' condition and below the North Borneo region average (39.50%).
- Disturbance indicators are very high.
- Rubble level is high at all sites.
- Silt level is especially high at Great Wall which recorded 36.25%. The level is also high at Cleaning Station.
- Pollution indicators are high.
- Nutrient indicator algae level is especially high at Great Wall, Little Okinawa and Lost World.
- All the above are considered signs of unhealthy reefs. While available substrate for coral recruits to attach is very high, high level of disturbance and pollution indicators may deter corals growth if they are not deal with.

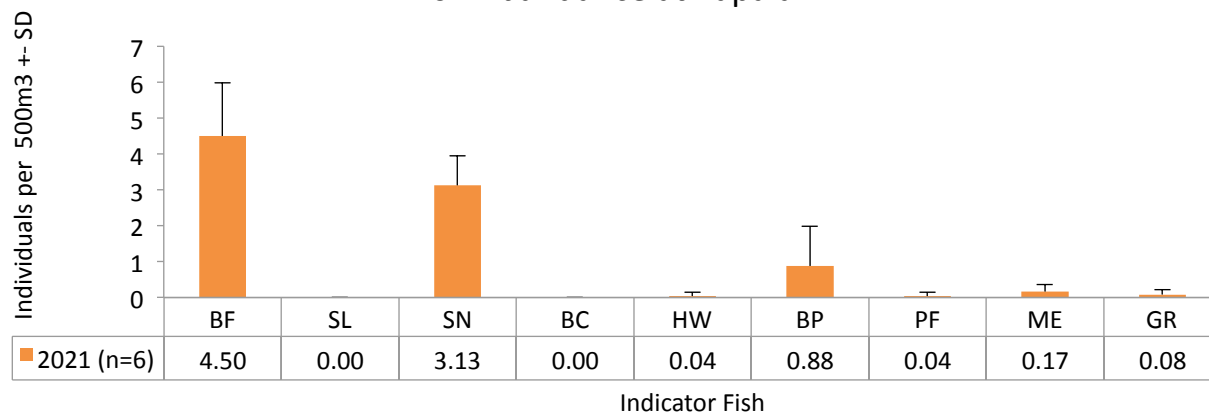
CORAL IMPACTS

- Boat anchor damage, discarded fishing net and trash were recorded at many sites.
- Coral damage due to fish bombing was recorded. At one site, one unexploded fish bomb was found.



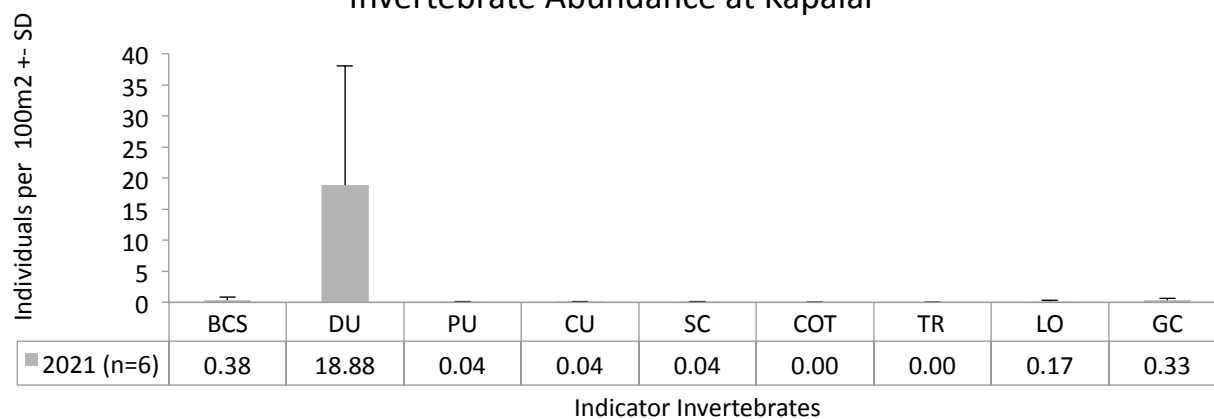
Fish and Invertebrate

Fish Abundance at Kapalai



- Humphead wrasse and bumphead parrotfish, indicators targeted for live-food fish trade, are recorded.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Kapalai



- Diadema urchin abundance is high.
- Banded coral shrimp and pencil urchin, indicators for curio trade, are recorded.
- Invertebrates targeted for food is very low in abundance.

RARE ANIMALS

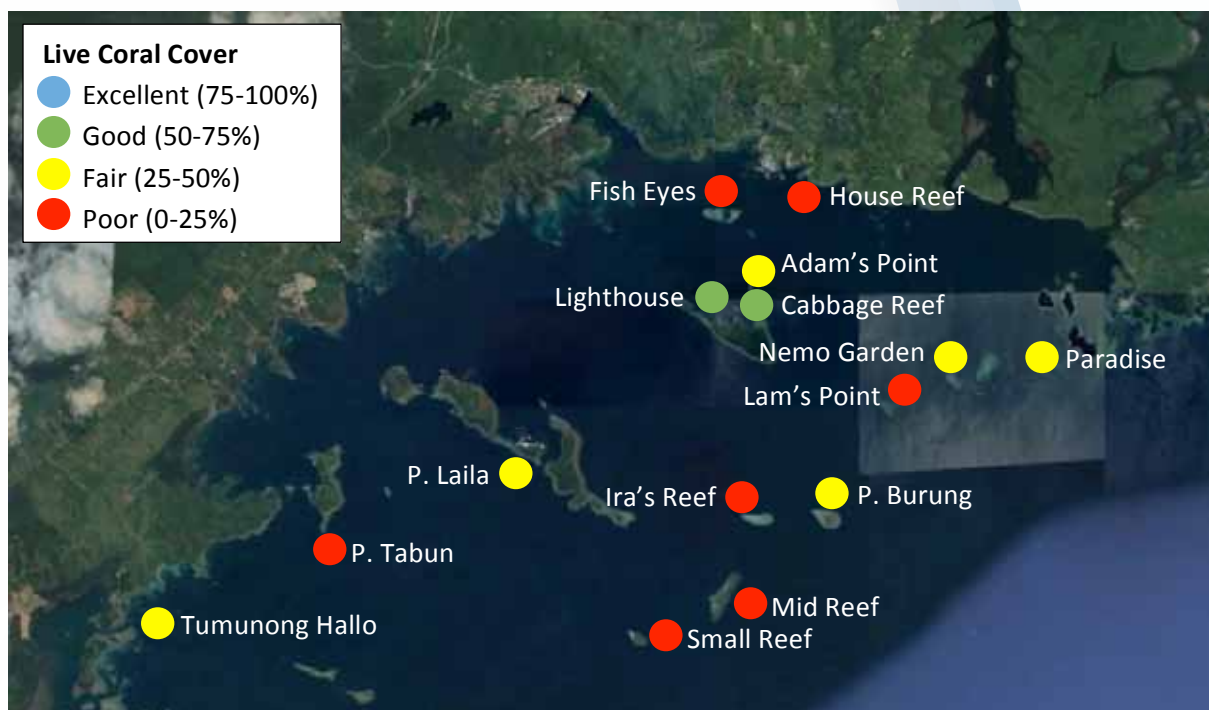
- Eagle ray and turtle were recorded.

North Borneo – 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

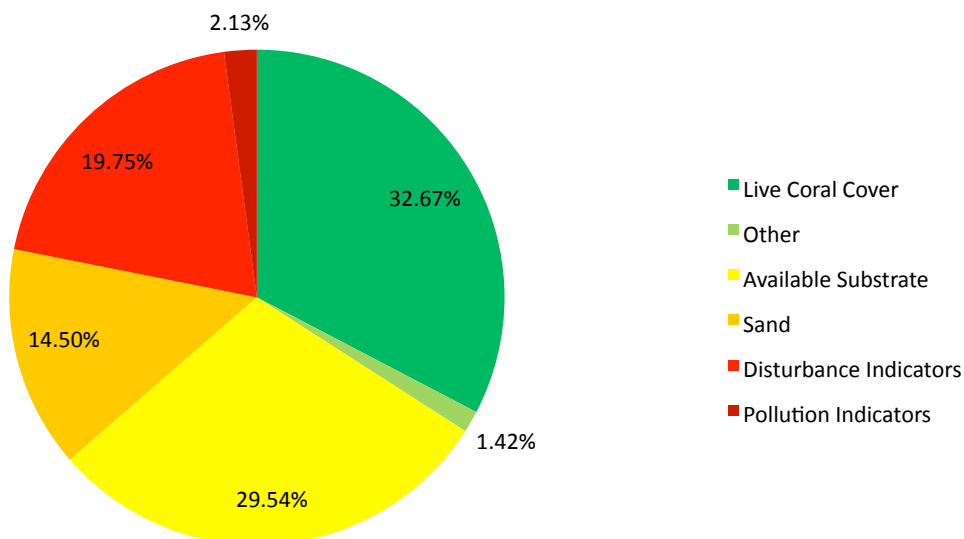


Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Good' coral cover, 6 are in 'Fair' condition, and 7 show 'Poor' health.

and submerged reefs.

Coral Cover and Health

Substrate Composition at Lahad Datu



- Lahad Datu is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 31.29%.
- In 'Fair' condition and below the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high.
- Disturbance indicators are very high.
- Rubble level is especially high at Ira's Reef, Fish Eyes and Small Reef.
- Silt level is especially high at Tumunong Hallo (63.13%).

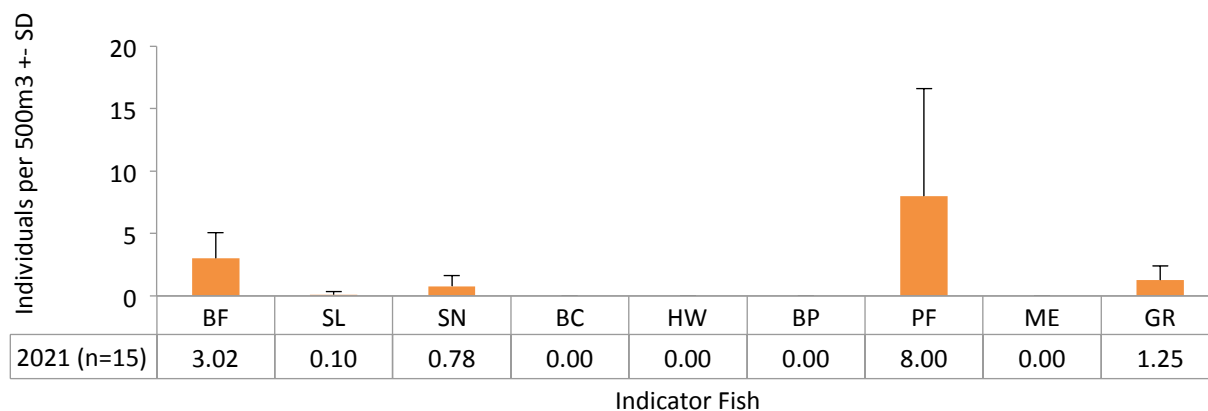
CORAL IMPACTS

- Discarded fishing net, fish traps, and trash were recorded at many sites.
- Fishing activities were observed during surveys.
- Some sites were impacted by warm water bleaching and drupella predation.



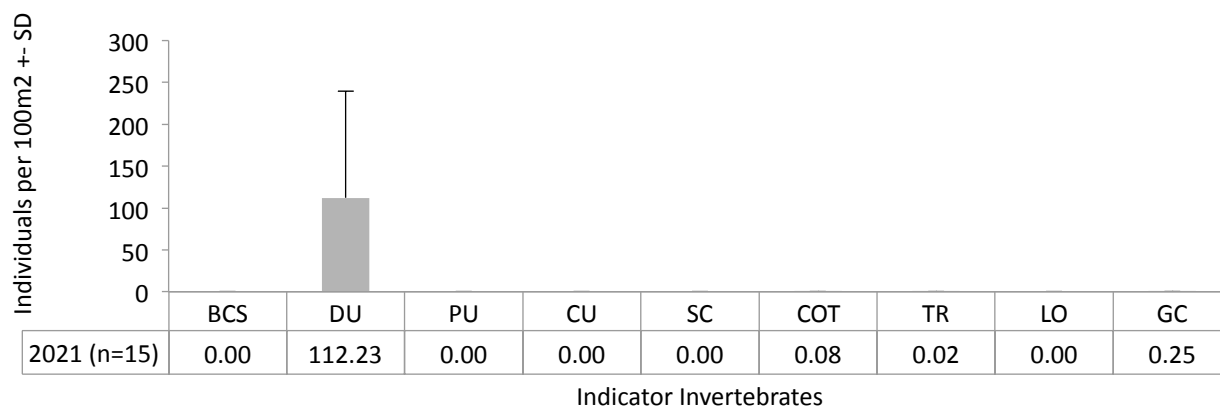
Fish and Invertebrate

Fish Abundance at Lahad Datu



- Parrotfish abundance is high.
- Fish targeted for food are very low in abundance, except for parrotfish.
- Absent of indicators targeted for live-food fish trade.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Lahad Datu



- Diadema urchin abundance is high.
- Triton, indicator for curio trade, is recorded.
- Invertebrates targeted for food is very low in abundance.
- Crown-of-thorns is not an issue in Lahad Datu.

RARE ANIMALS

- Turtles were recorded.

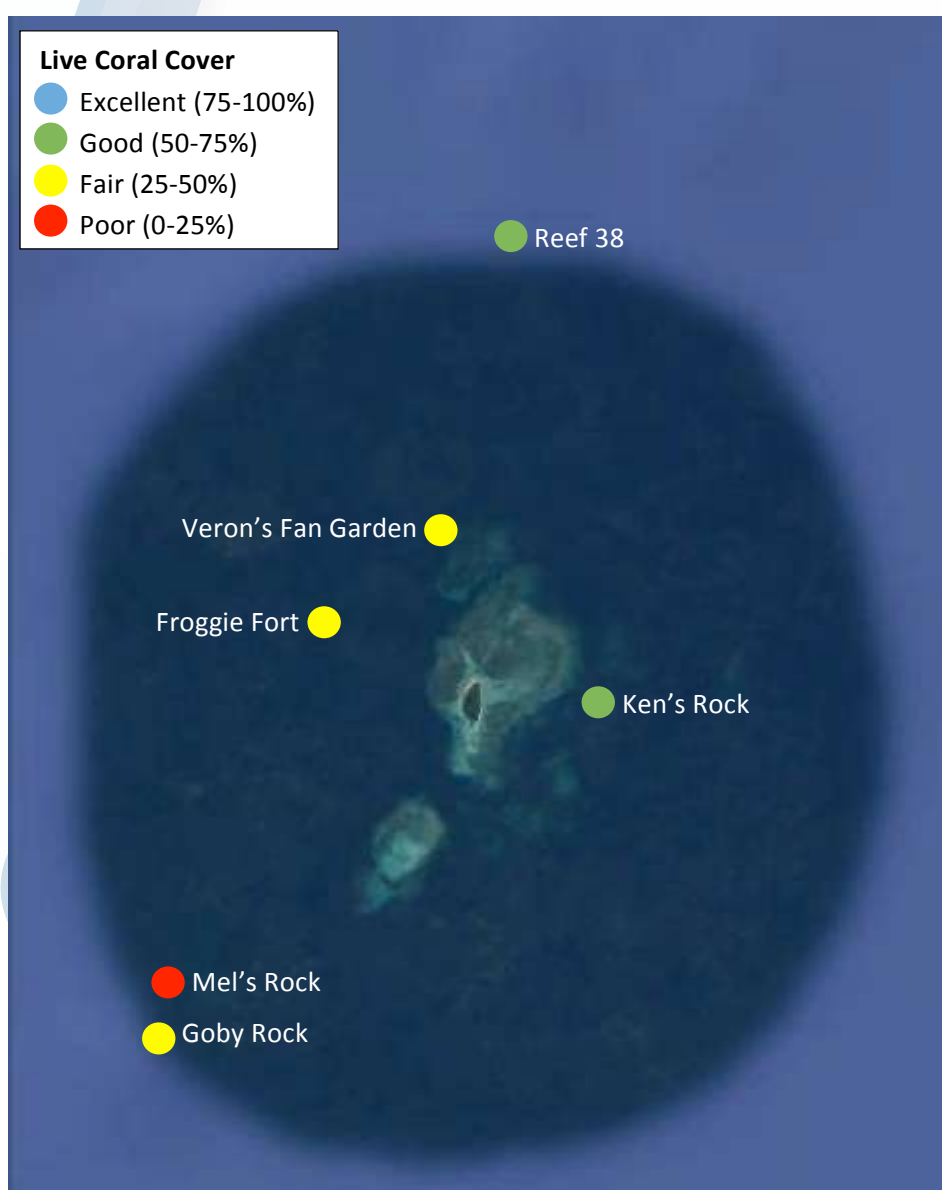


North Borneo – Lankayan

Lankayan is a small island in the Sulu Sea, a 1.5hour 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.

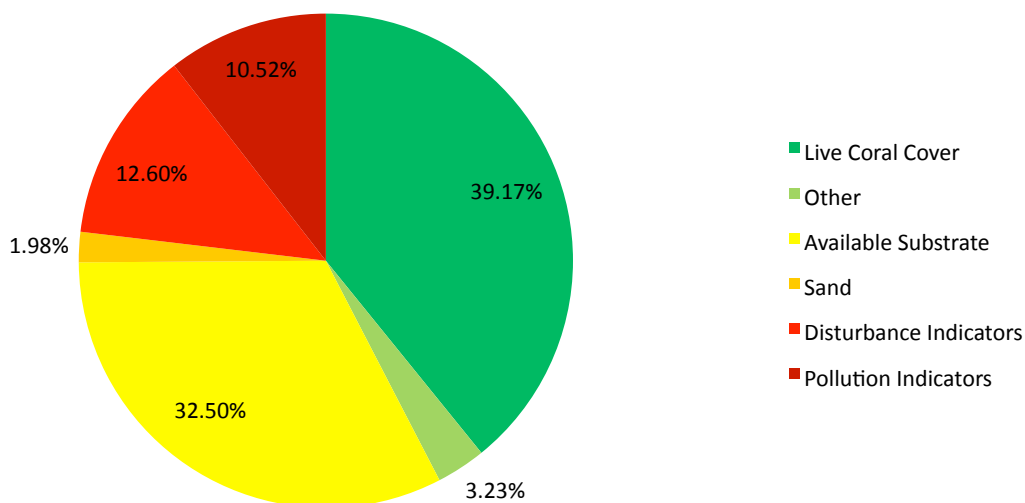
Before the creation of SIMCA, blast fishing was a constant problem, and turtle eggs were poached on a regular basis. Lankayan Island is the only developed island within SIMCA. The 0.05 km² island is the site of the Lankayan Island Dive Resort (LIDR), which is the only structure on the otherwise uninhabited island.



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Good' coral cover, 3 are in 'Fair' condition and 1 shows 'Poor' health.

Coral Cover and Health

Substrate Composition at Lankayan



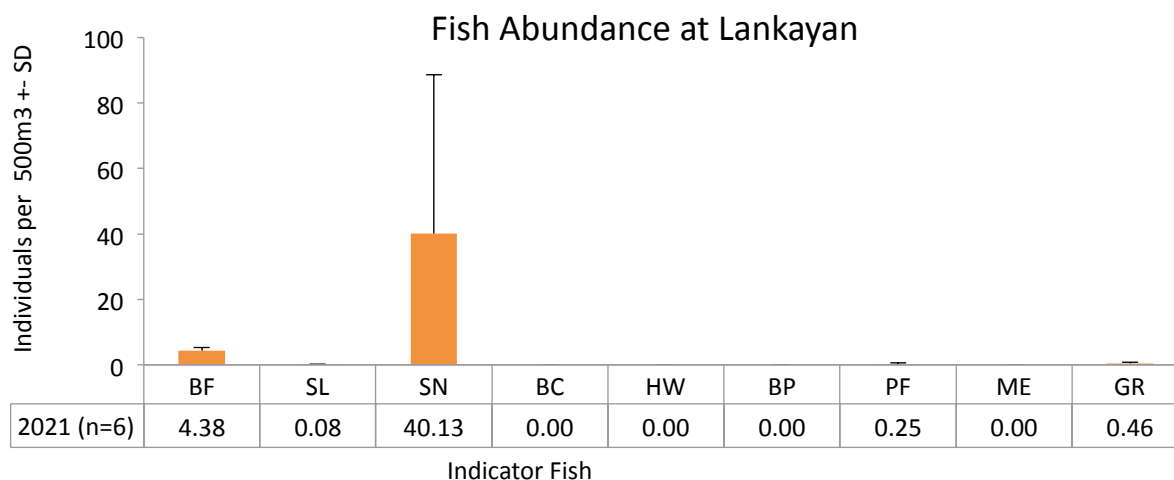
- Lankayan is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 36.98%.
- In 'Fair' condition and below the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are high.
- Rubble level is high at all sites, except for Reef 38.
- Pollution indicators are high.
- Nutrient indicator algae level is especially high at Mel's Rock and Veron's Fan Garden.
- Sponge level is especially high at Froggie Fort and Goby Rock.

CORAL IMPACTS

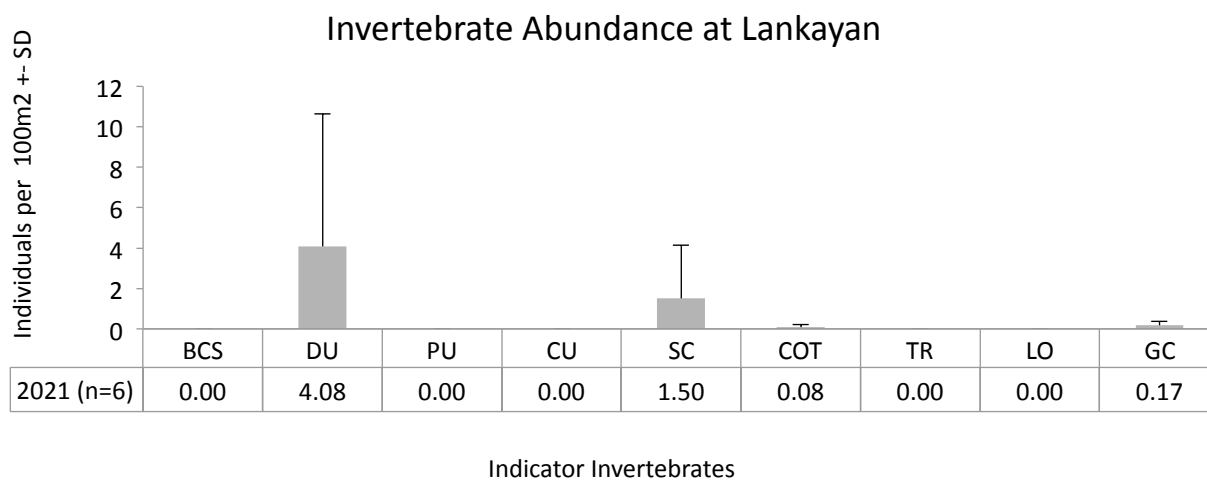
- All sites were impacted by warm water bleaching.



Fish and Invertebrate



- Snapper abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.



- Indicators for curio trade are absent.
- Very low abundance of invertebrates targeted for food.

RARE ANIMALS

- Shark was recorded.

North Borneo – Larapan

Larapan Island is located in the Sulu Sea off the south-eastern coast of Sabah. The island has two villages with a small population of just over 1200 people and basic infrastructures such as primary school, kindergarten, mosque, community hall, and solar and saltwater desalination systems. There are no proper sewage and municipal waste management systems.

The island is a fishing village and a hotspot for fish bombing. Gleaning activities are popular amongst the locals. It is not a popular diving or snorkelling site. In terms of natural resources, the island has rich marine biodiversity, especially its coral reefs.

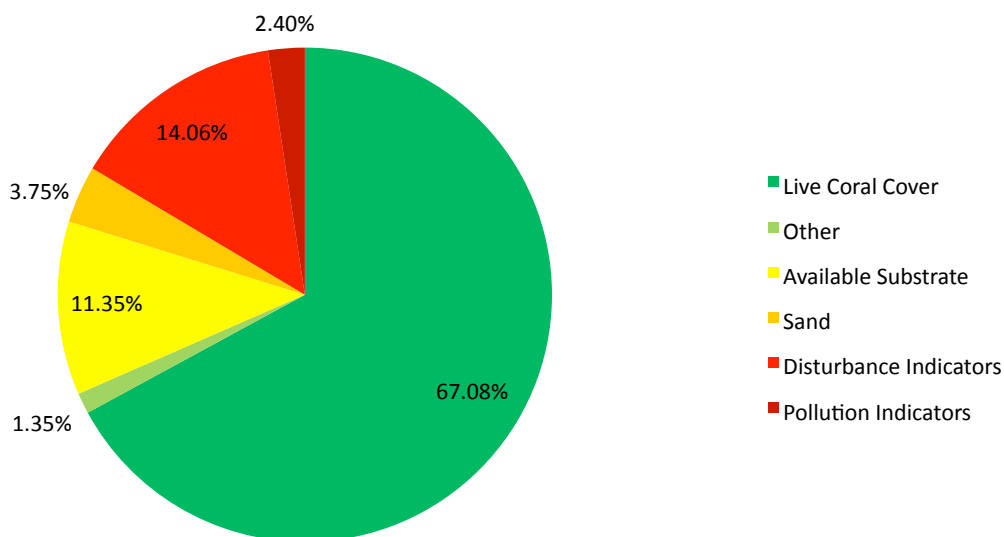
Recently, a small group of people from the community has taken it upon themselves to patrol the areas to prevent encroachments and destructive fishing activities. They also conduct surveys to monitor the reefs.



Map showing the health categories of each survey site based on Live Coral Cover: 6 sites have 'Good' coral cover.

Coral Cover and Health

Substrate Composition at Larapan



- Larapan is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 64.17%.
- In 'Good' condition and above the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- Rubble level is high at all sites, except for Point 1 which recorded 0.63%.

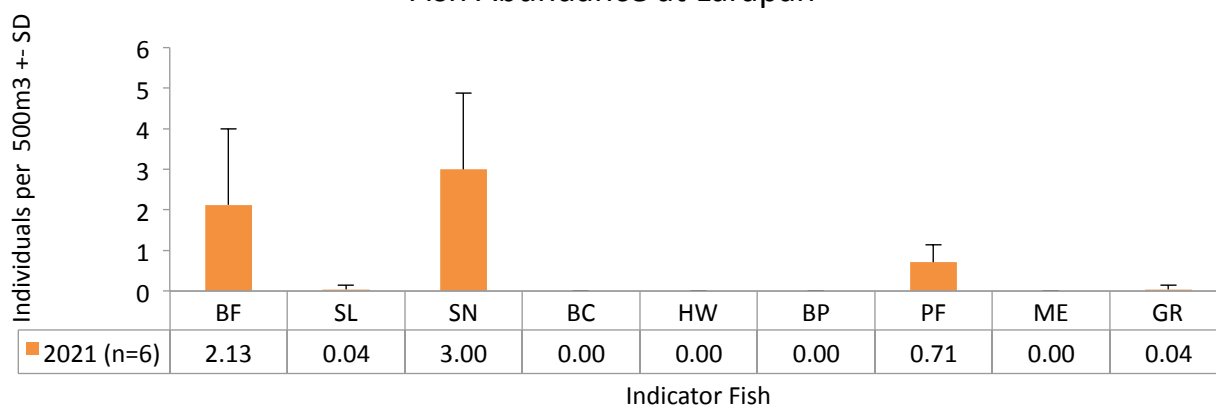
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.
- Coral damage due to fish bombing was recorded at some sites.



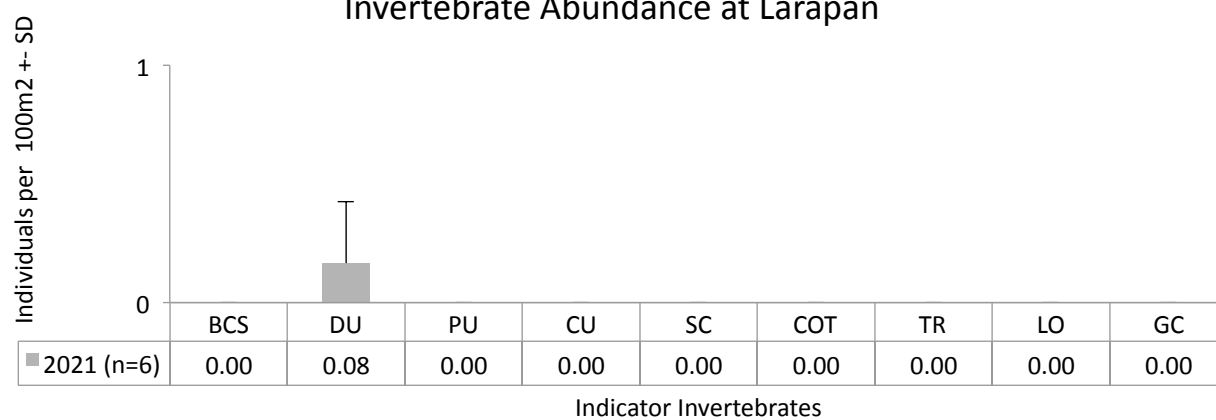
Fish and Invertebrate

Fish Abundance at Larapan



- Absent of fish targeted for live-food fish trade.
- Fish targeted for food were very low in abundance, except for snapper.
- This suggest that fish targeted for food are heavily harvested.

Invertebrate Abundance at Larapan

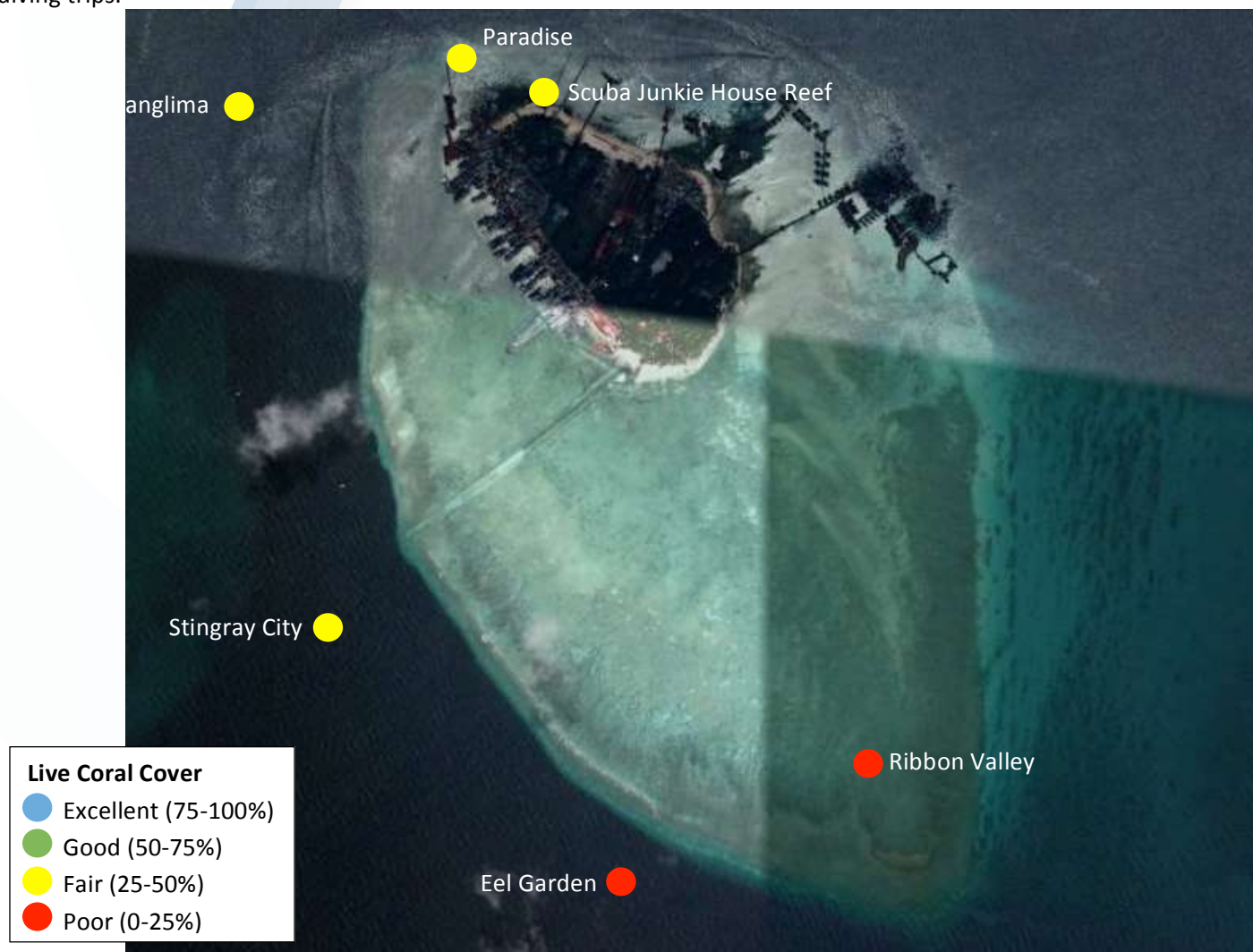


- Only diadema urchin is recorded and the abundance is very low.

North Borneo – Mabul

Mabul is a small island off the south-eastern coast of Sabah. The island has been a fishing village since the 1970s. In the 1990s, it first became popular to divers due to its proximity to Sipadan Island, 15km away. This 20-hectare piece of land surfaces 2–3 m above sea level, consists mostly of flat ground and the aerial view is oval-shaped. Surrounding it are sandy beaches, perched on the northwest corner of a larger 2 km² reef. The reef is on the edge of the continental shelf and the seabed surrounding the reef slopes out to 25 to 30 m deep.

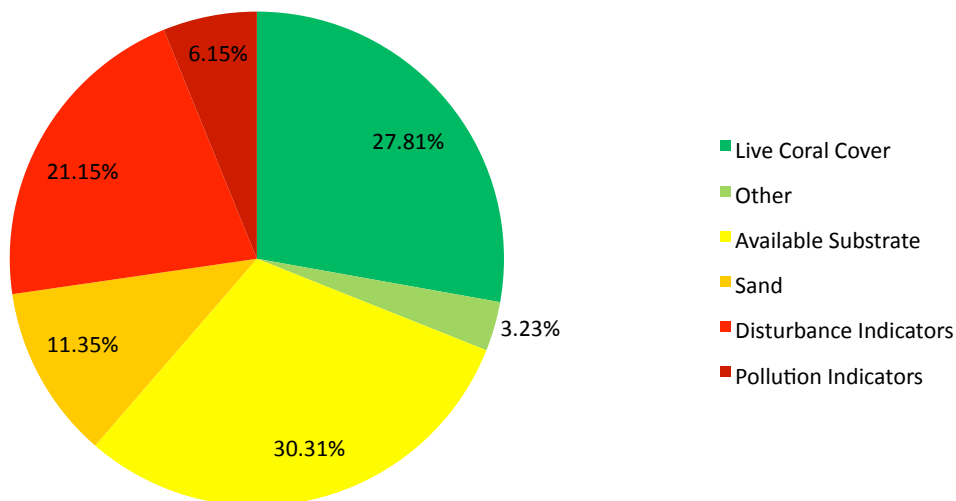
There are several dive resorts operating on Mabul Island, which provide accommodation for scuba divers – most are located on the island or on stilts over the water, while one is on a converted oil platform about 500 meters from the beach. There are also several home stay and backpacker accommodations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



Map showing the health categories of each survey site based on Live Coral Cover: 4 sites have 'Fair' coral cover and 2 are in 'Poor' condition.

Coral Cover and Health

Substrate Composition at Mabul



- Mabul is dominated by available substrate for coral recruits to attach.
- Mabul mean hard coral (reef builder) cover is 20.63%.
- In 'Fair' condition and below the North Borneo region average (39.50%).
- Sand level is high.
- Disturbance indicators are very high.
- Rubble level is high at many sites.
- Silt level is especially high at Scuba Junkie House Reef.
- All the above are considered signs of unhealthy reefs. While available substrate for coral recruits to attach is very high, high level of disturbance indicators may deter coral growth if they are not dealt with.

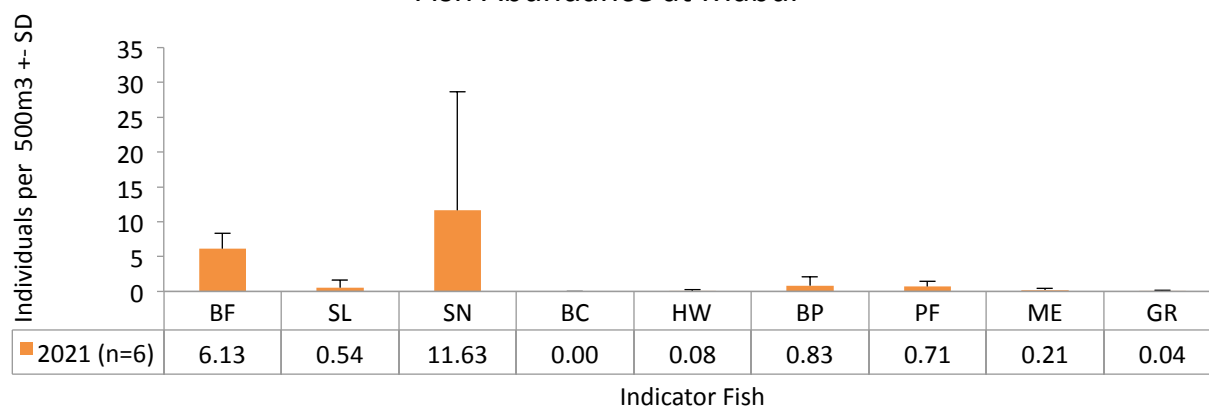
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.
- Two sites were impacted by warm water bleaching.



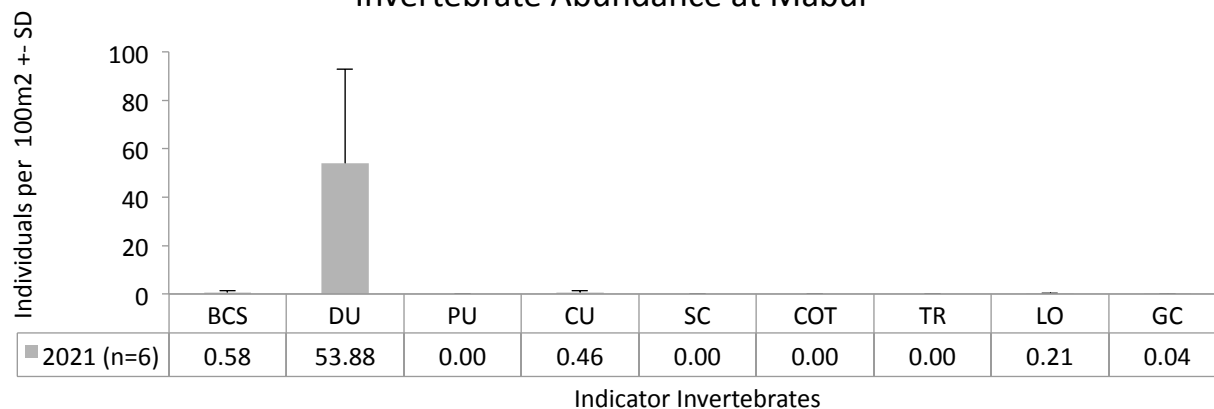
Fish and Invertebrate

Fish Abundance at Mabul



- Humphead wrasse and bumphead parrotfish, indicators targeted for live-food fish trade, are recorded.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Mabul



- Diadema urchin abundance is high.
- Banded coral shrimp, indicator for curio trade, is recorded.
- Invertebrates targeted for food is very low in abundance.

RARE ANIMALS

- Turtles were recorded at many sites. Shark was recorded.



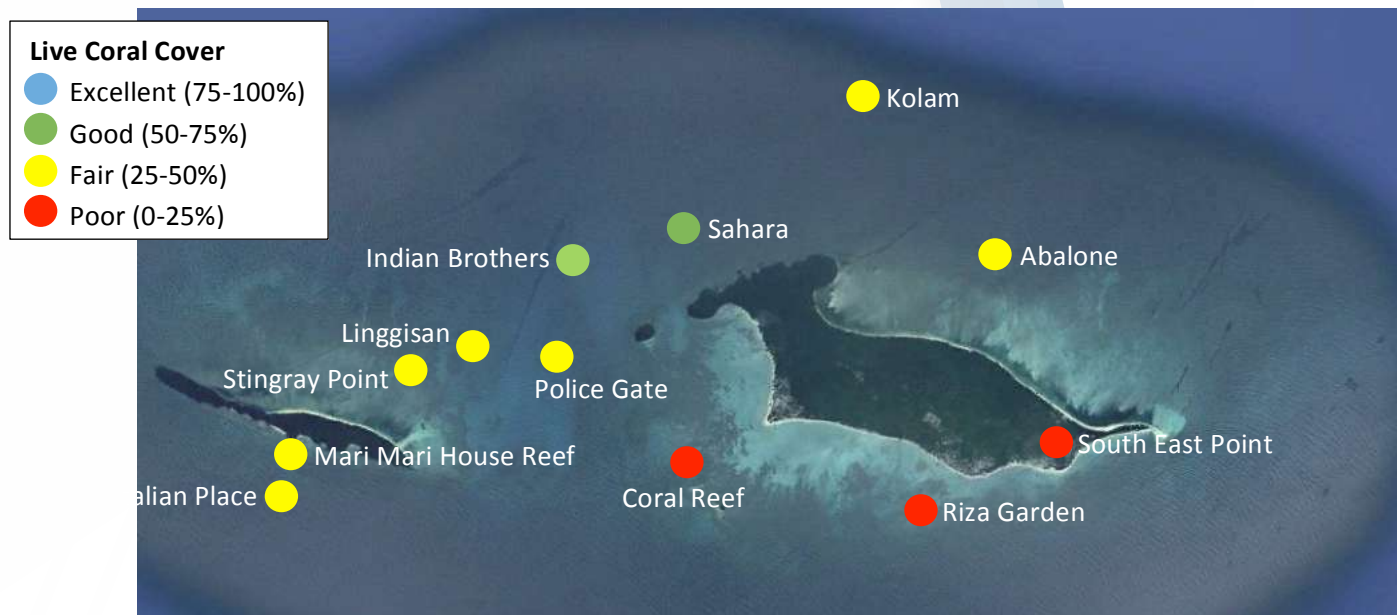
North Borneo – Mantanani

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

Mantanani is mainly populated by Bajau Ubian, with a small population of about 1,000 in two villages. The two main economic activities are fisheries and tourism.

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

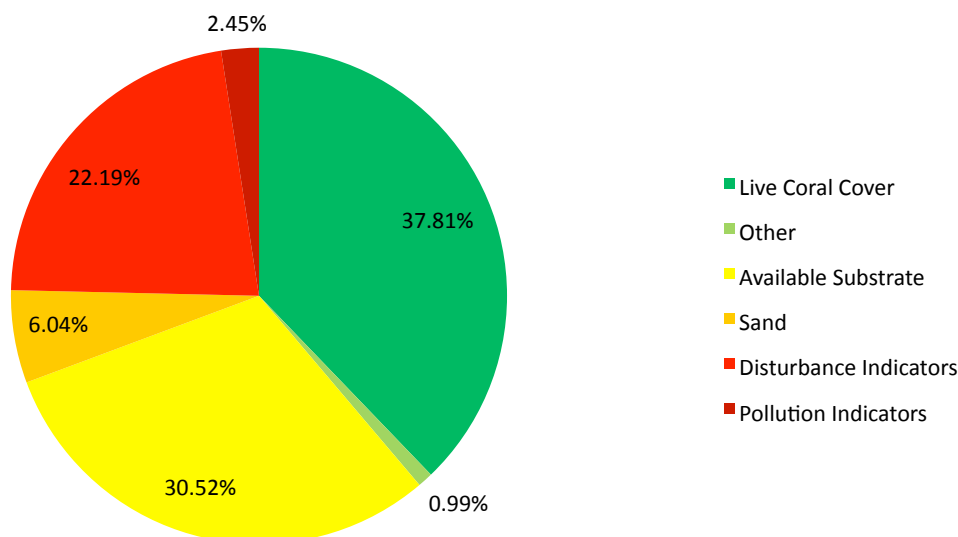
Fish bombing is a major problem in the area. This destructive fishing method has damaged large areas of reef around the islands. Blast detector data showed that a total of 2832 blasts were recorded from June 2014 until February 2020. The blasts were recorded within 5km radius of Mantanani.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Good' coral cover, 7 are in 'Fair' condition, and 3 show 'Poor' health.

Coral Cover and Health

Substrate Composition at Mantanani



- Mantanani is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 36.56%.
- In 'Fair' condition and below the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are very high.
- Rubble level is high at most sites. The level is especially high at Coral Reef (53.75%), South East Point (46.25%) and Riza Garden (42.50%).
- Fish bombing is common in Mantanani; this may explain the high level of rubble.

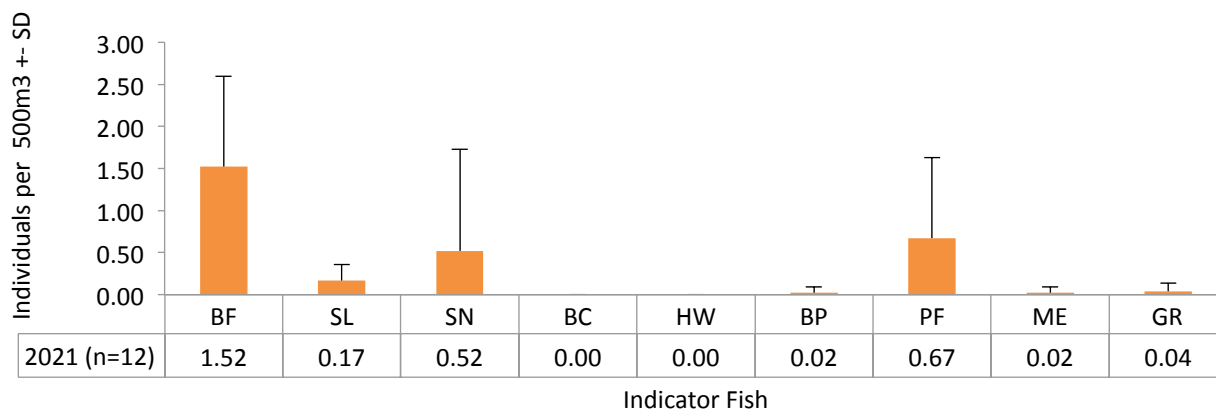
CORAL IMPACTS

- Boat anchor damage, discarded fishing net and trash were recorded at some sites.
- Coral damage due to fish bombing, moving drift wood, Drupella predation and Terpios sponge infection were recorded.
- Many sites were impacted by warm water bleaching.



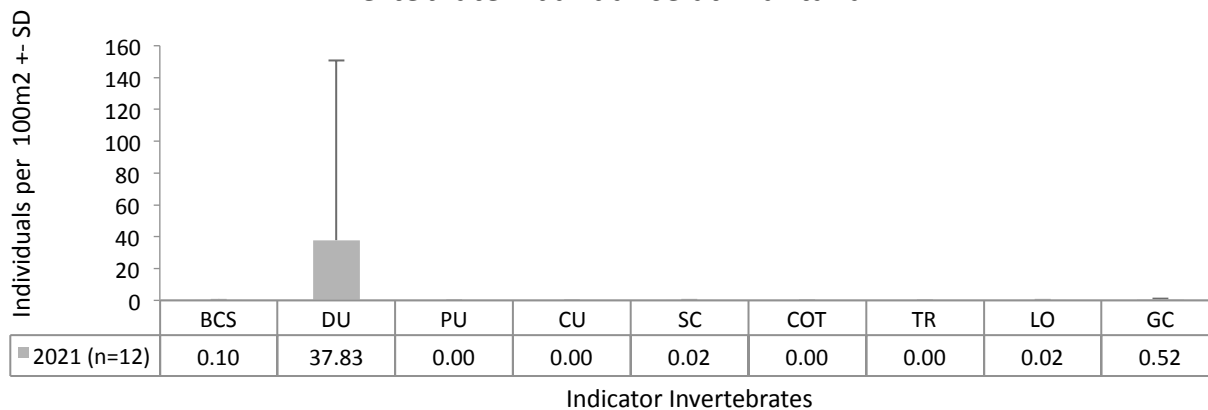
Fish and Invertebrate

Fish Abundance at Mantanani



- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Mantanani



- Diadema urchin abundance is high.
- Banded coral shrimp, indicator for curio trade, is recorded.
- Invertebrates targeted for food is very low in abundance.

RARE ANIMALS

- Turtle was recorded.

North Borneo – Mataking

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

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

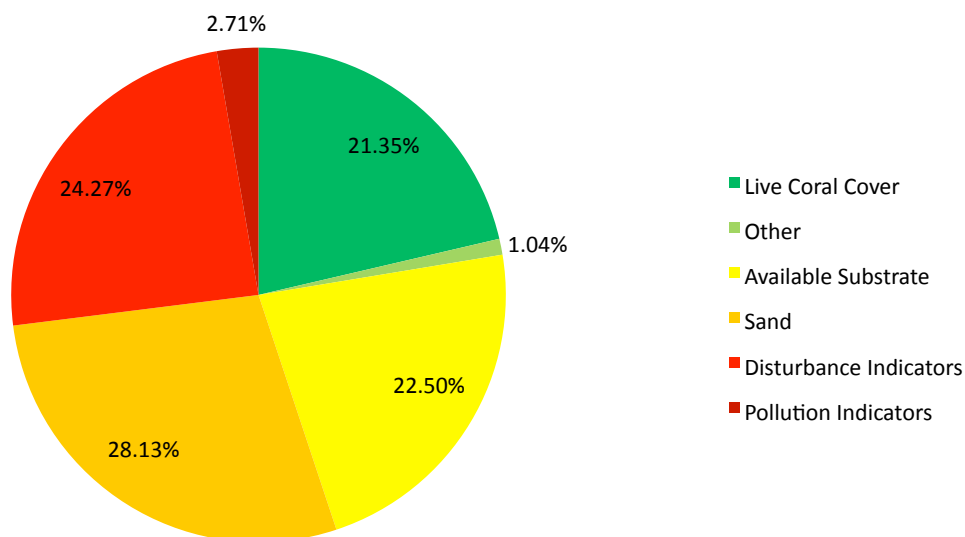
The island has fringing reefs, and coral extends down to almost 30m. Coral reefs around this, and surrounding islands have been extensively damaged by fish bombing in the past, and fish bombing continues in some areas nearby.



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Fair' coral cover and 5 are in 'Poor' condition.

Coral Cover and Health

Substrate Composition at Matakings



- Matakings is dominated by sand.
- Matakings mean hard coral (reef builder) cover is 19.58%.
- In 'Poor' condition and below the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are very high.
- Rubble level is high at all sites.
- Silt level is high at Matakings House Reef.
- All the above are considered signs of unhealthy reefs. While available substrate for coral recruits to attach is very high, high level of disturbance indicators may deter coral growth if they are not deal with.

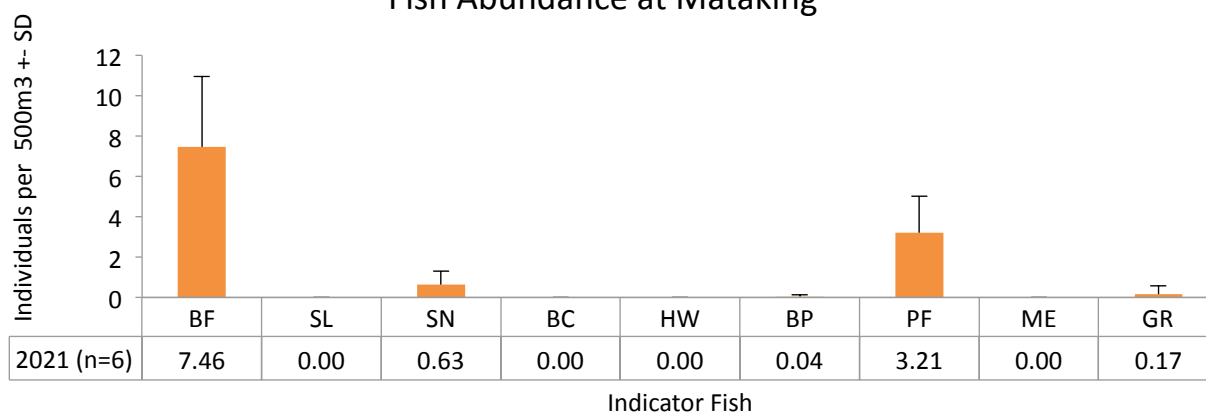
CORAL IMPACTS

- Discarded fishing net and trash were recorded.
- Some sites were impacted by warm water bleaching.



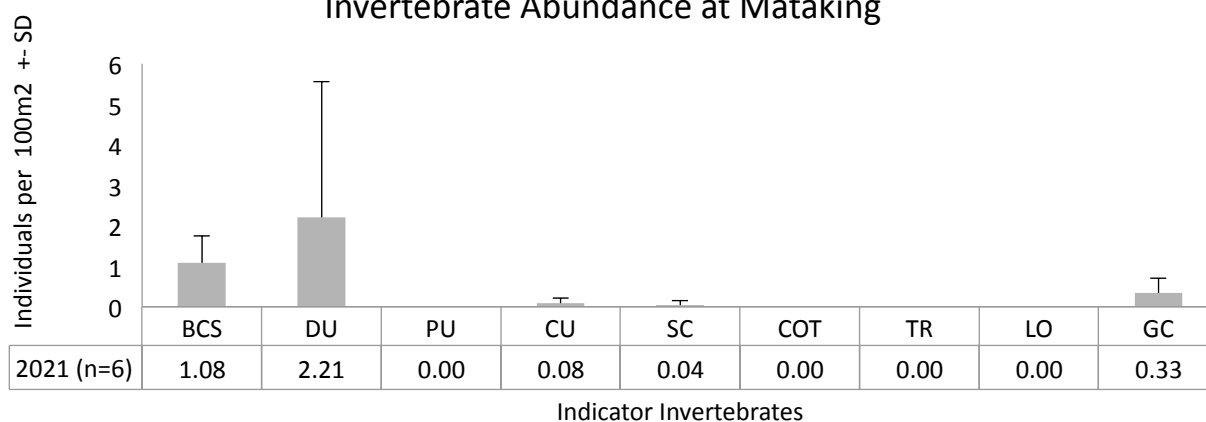
Fish and Invertebrate

Fish Abundance at Matakang



- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Matakang



- Banded coral shrimp, indicator for curio trade, is recorded.
- Invertebrates targeted for food is very low in abundance.

RARE ANIMALS

- Eagle ray and turtle were recorded.



North Borneo – Pulau Penyu

Pulau Penyu lies in the Sulu Sea some 40km north of Sandakan, Sabah. It comprises of three islands; Pulau Selingan, Pulau Bakungan Kecil and Pulau Gulisan. The park gained its popularity from the green and hawksbill turtles which lay their eggs on the beaches of the islands. All the three islands are protected within marine parks on both sides of the Malaysian and Philippine borders. The park covers an area of 17.4km² and administered by Sabah Parks.

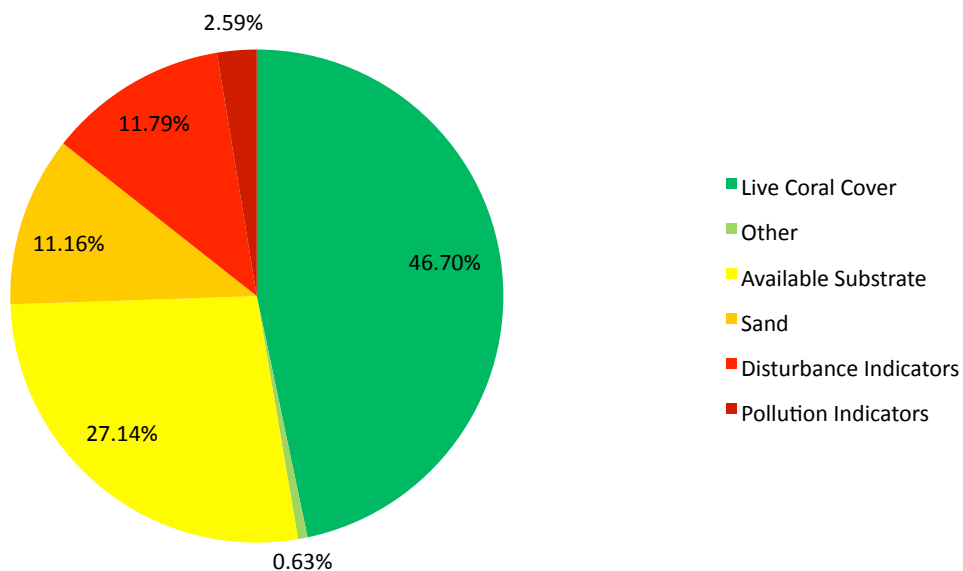
Only on Selingan are there chalets for overnight visitors, and those who wish to see the turtles laying egg must stay overnight. However, park rules and regulations are strictly enforced and visitors are not allowed on the beach from sunset to sunrise so as not to disturb the turtles. A ranger will call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



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Excellent' coral cover, 1 is in 'Good' condition, 5 show 'Fair' health and 1 is in 'Poor' state.

Coral Cover and Health

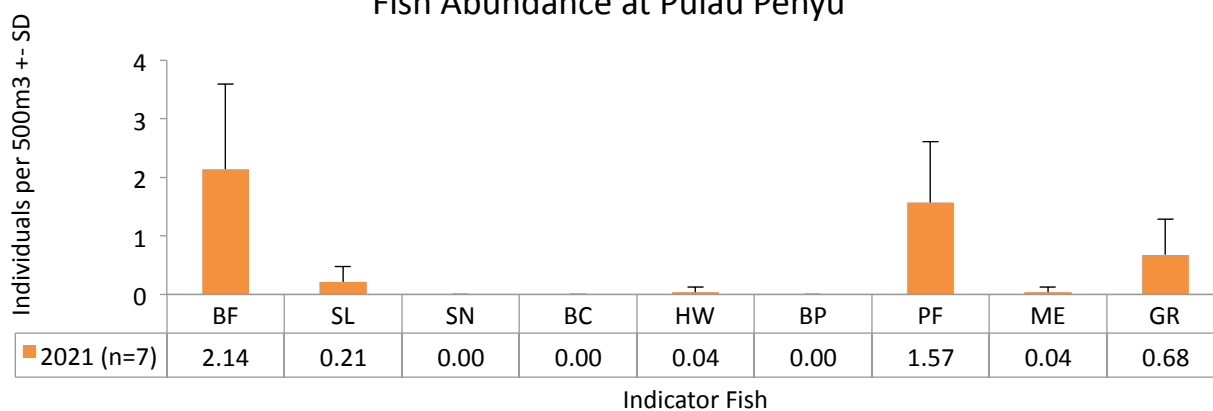
Substrate Composition at Pulau Penyu



- Pulau Penyu is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 43.93%.
- In 'Fair' condition and above the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high.
- Disturbance indicators are high.
- Rubble level is high at all sites except for Selingan.

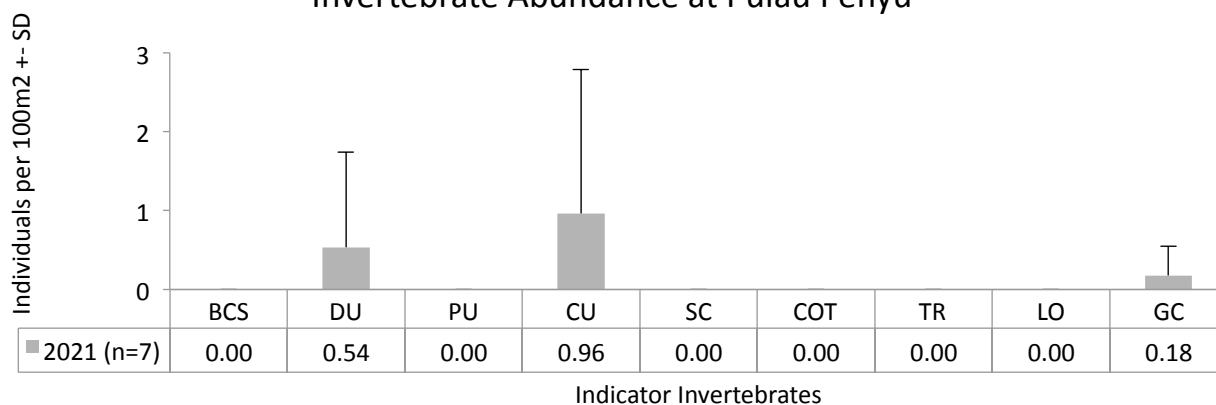
Fish and Invertebrate

Fish Abundance at Pulau Penyu



- Humphead wrasse, indicator targeted for live-food fish trade, is recorded.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Pulau Penyu



- Indicators for curio trade are absent.
- Invertebrates targeted for food is very low in abundance.

RARE ANIMALS

- Turtles were recorded.



North Borneo – Pulau Tiga

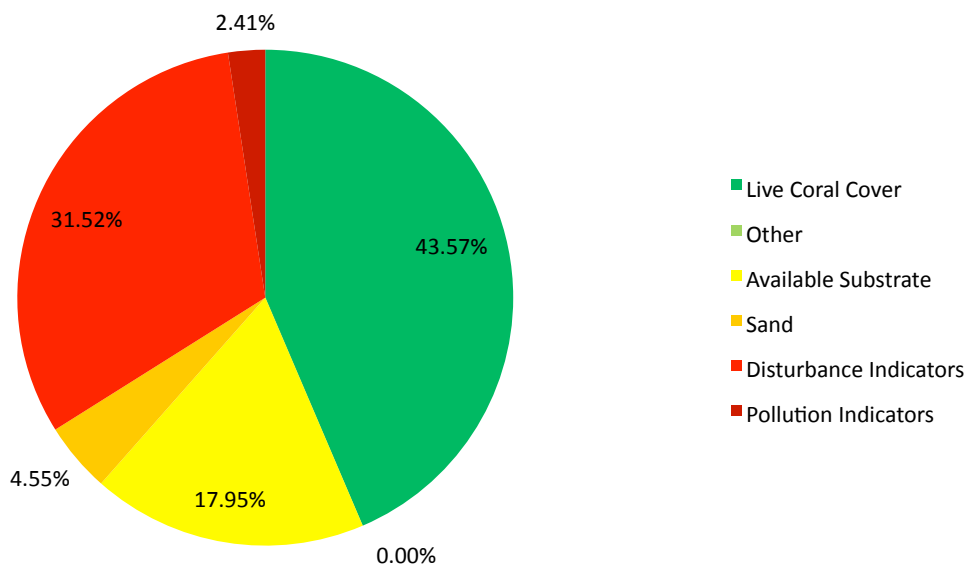
Pulau Tiga is one of a group of small uninhabited islands in Kimanis Bay off the western coast of Sabah. The islands were formed on 21 September 1897, when an earthquake on Mindanao caused a volcanic eruption near Borneo. The island is 607 hectares in size and has a couple of active mud volcanoes at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



Map showing the health categories of each survey site based on Live Coral Cover: 3 sites have 'Good' coral cover and 4 are in 'Fair' condition.

Coral Cover and Health

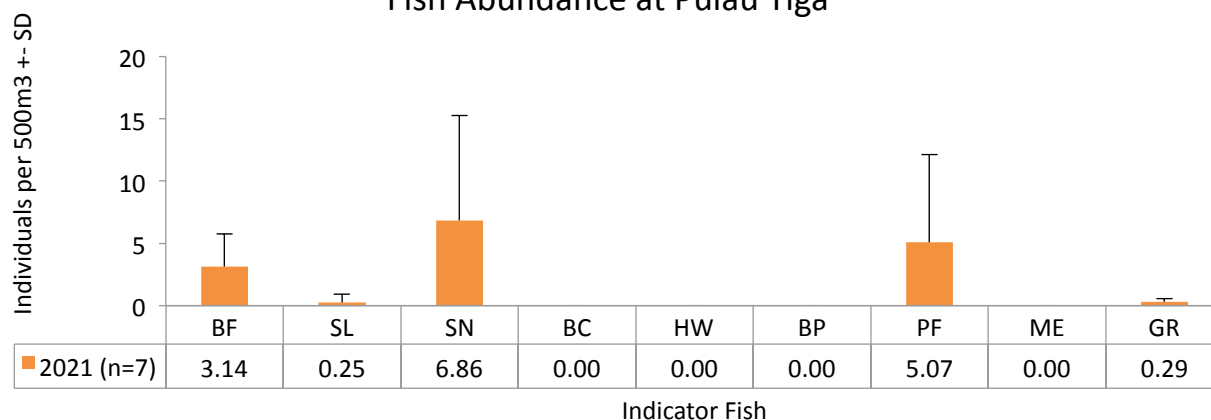
Substrate Composition at Pulau Tiga



- Pulau Tiga is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 41.16%.
- In 'Fair' condition and above the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are very high.
- Rubble level is high at all sites, except for Mid Reef which recorded 4.38%.
- 60% of Senanggol reefs consist of rubble, Larai-Larai 51.88% and Tagi Beach 45%.

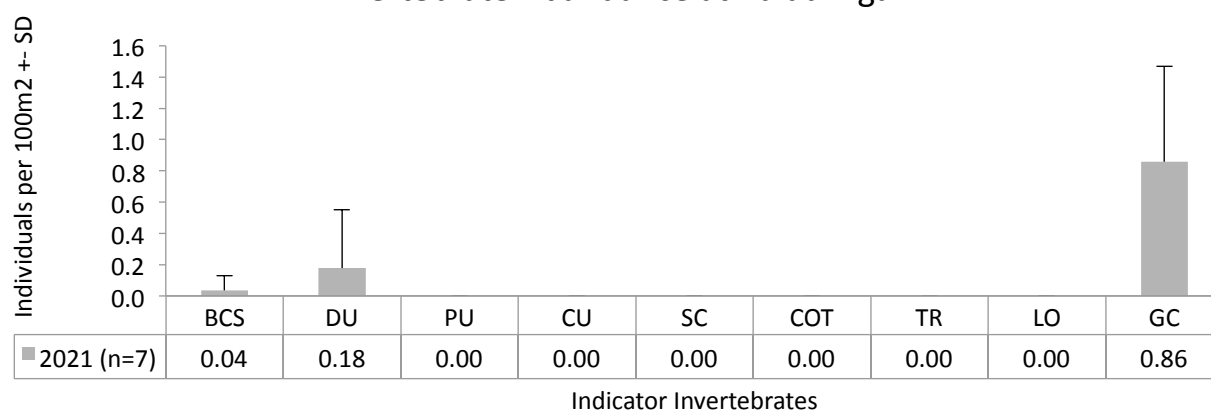
Fish and Invertebrate

Fish Abundance at Pulau Tiga



- Snapper abundance is the highest, followed by parrotfish
- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance, except for snapper and parrotfish.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Pulau Tiga

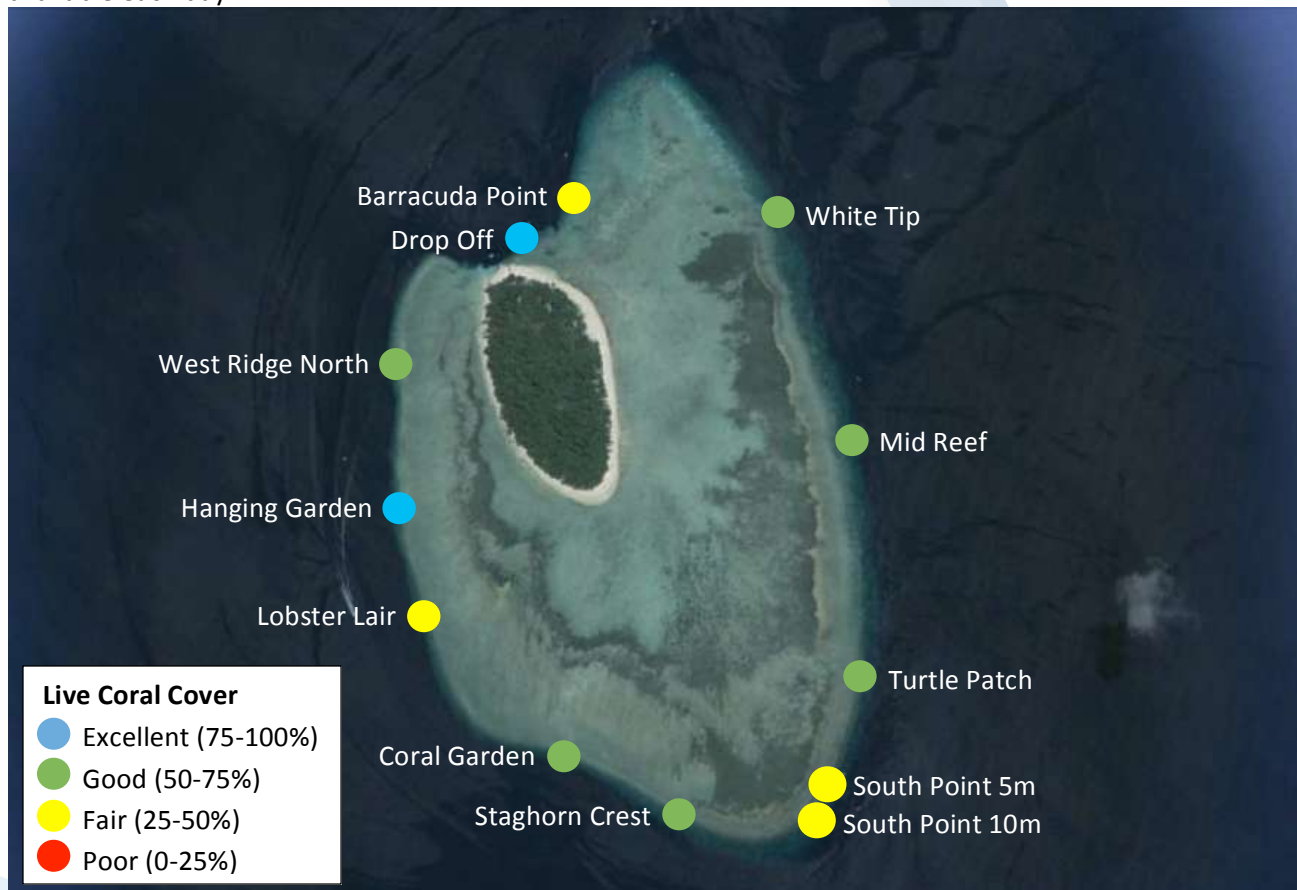


- Banded coral shrimp, indicator for curio trade, is recorded.
- Very low abundance of invertebrates targeted for food.

North Borneo – Sipadan

Sipadan is the only oceanic island in Malaysia, rising 600 metres from the seabed and rated by many dive journals as one of the top destinations for diving in the world. Sipadan is located in the Celebes Sea off the east coast of Sabah. It was formed by living corals growing on top of an extinct volcanic cone that took thousands of years to develop.

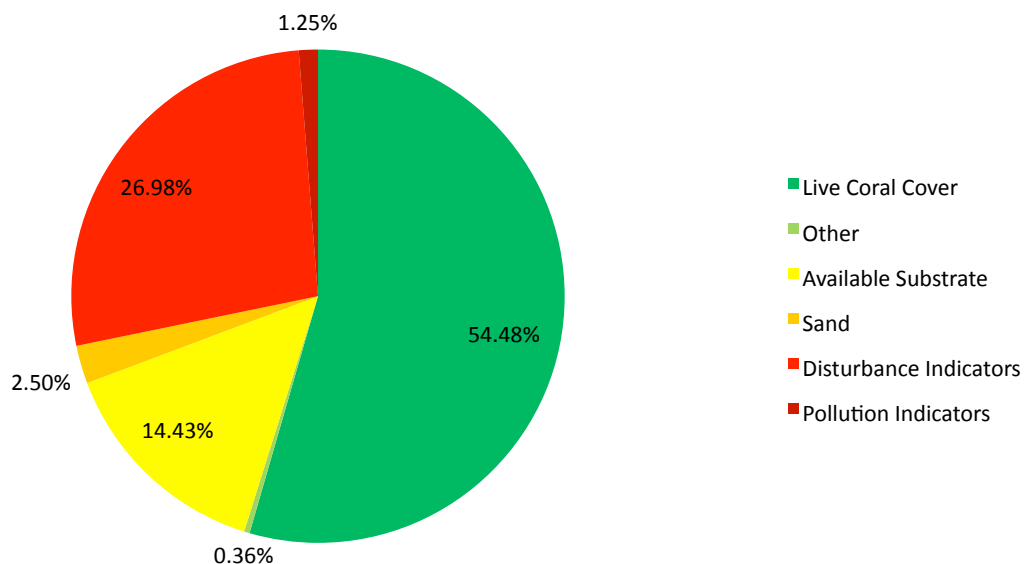
Sipadan is located at the heart of the Indo-Pacific basin, the centre of one of the richest marine habitats in the world. More than 3,000 species of fish and hundreds of coral species have been classified in this ecosystem. Visiting Sipadan requires a permit issued by Sabah Parks. Since 2019, there are 178 permits available each day.



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Excellent' coral cover, 6 are in 'Good' condition, and 4 show 'Fair' health.

Coral Cover and Health

Substrate Composition at Sipadan



- Sipadan is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 45.21%.
- In 'Good' condition and above the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are very high.
- Rubble level is high at all sites, except for Drop Off and West Ridge North which recorded 2.50% and 5.63% respectively. The level is especially high at South Point, Lobster Lair and Turtle Patch.

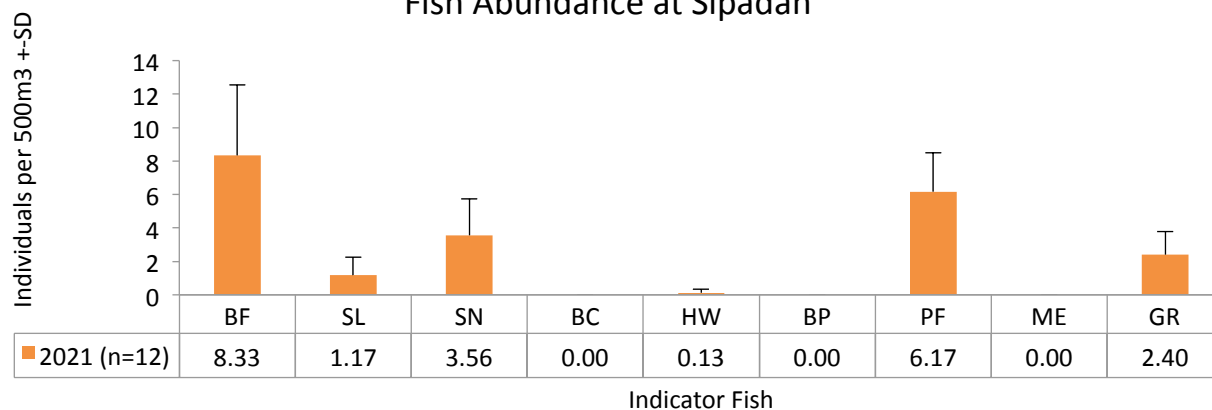
CORAL IMPACTS

- Discarded fishing nets and trash were recorded.



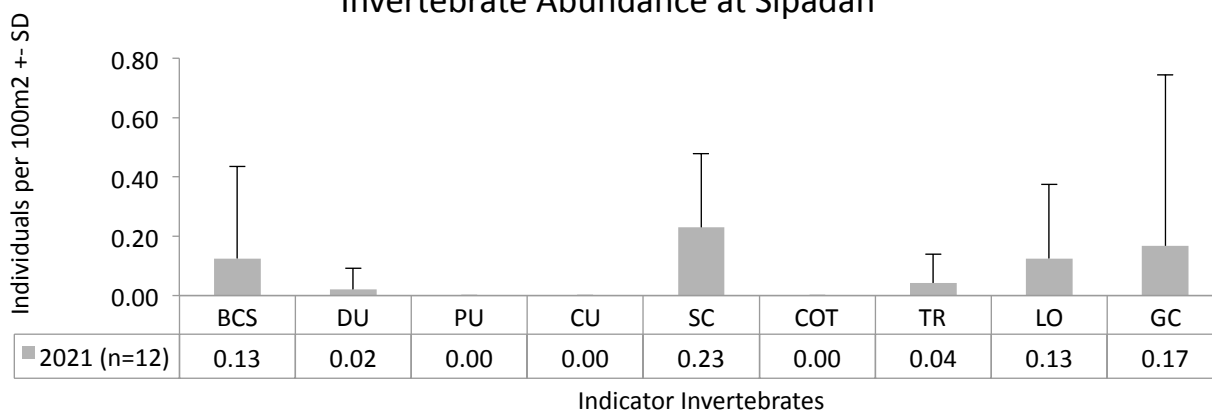
Fish and Invertebrate

Fish Abundance at Sipadan



- Humphead wrasse, indicator targeted for live-food fish trade, is recorded.
- Butterfly fish, indicator for aquarium trade, abundance is high.
- Fish targeted for food are low in abundance, except for parrotfish.

Invertebrate Abundance at Sipadan



- Banded coral shrimp and triton, indicators for curio trade, are recorded.
- Very low abundance of invertebrates targeted for food.

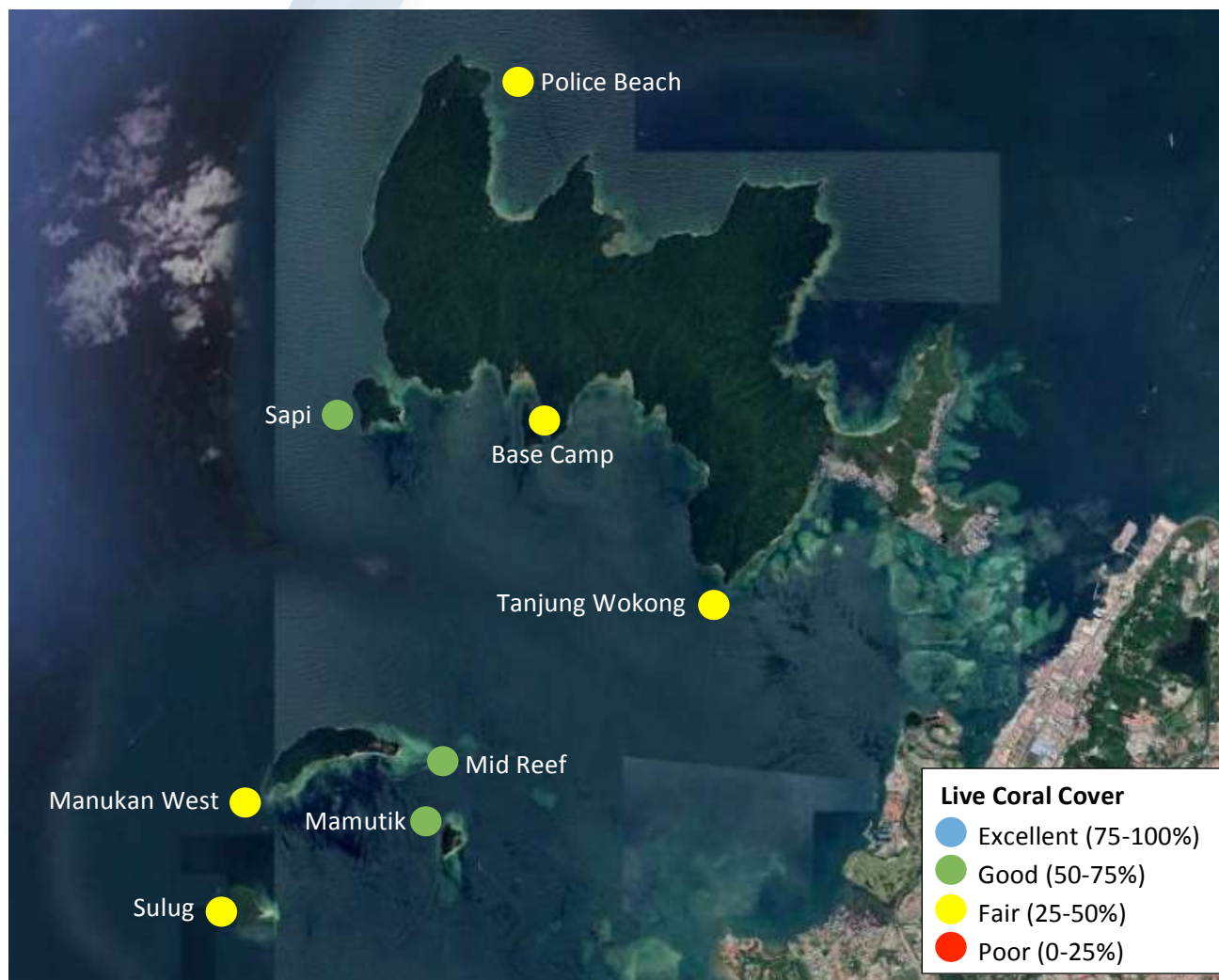
RARE ANIMALS

- Turtles were recorded at many sites. Manta ray and sharks were recorded.

North Borneo – Tunku Abdul Rahman Park

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.

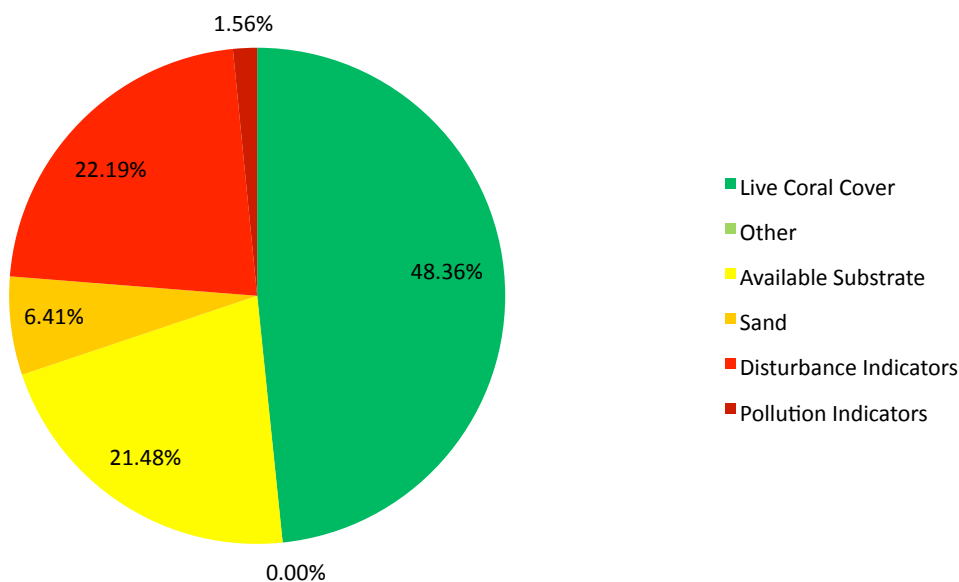
All five islands have tourist facilities such as chalets/rest house, jetty, picnic shelters, barbecue pits, tables, changing rooms and toilets, except for Pulau Sulug which is relatively untouched, remote and undeveloped. The islands receive large numbers of day tourists from Kota Kinabalu.



Map showing the health categories of each survey site based on Live Coral Cover: 3 sites have 'Good' coral cover and 5 are in 'Fair' condition.

Coral Cover and Health

Substrate Composition at Tunku Abdul Rahman Park



- Tunku Abdul Rahman Park is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 46.72%.
- In 'Fair' condition and above the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are very high.
- Rubble level is very high at all sites, except Base Camp. The level is especially high at Mamutik.

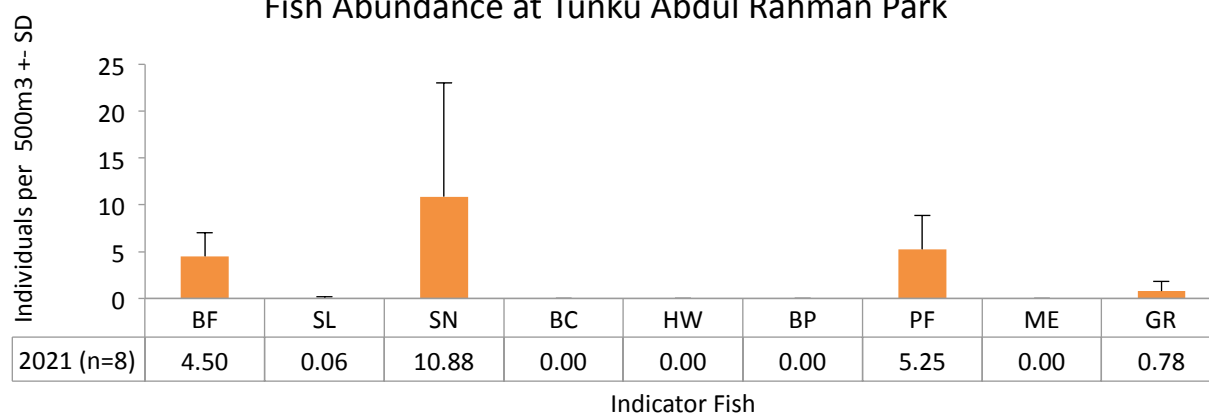
CORAL IMPACTS

- Discarded fishing nets and trash were recorded.



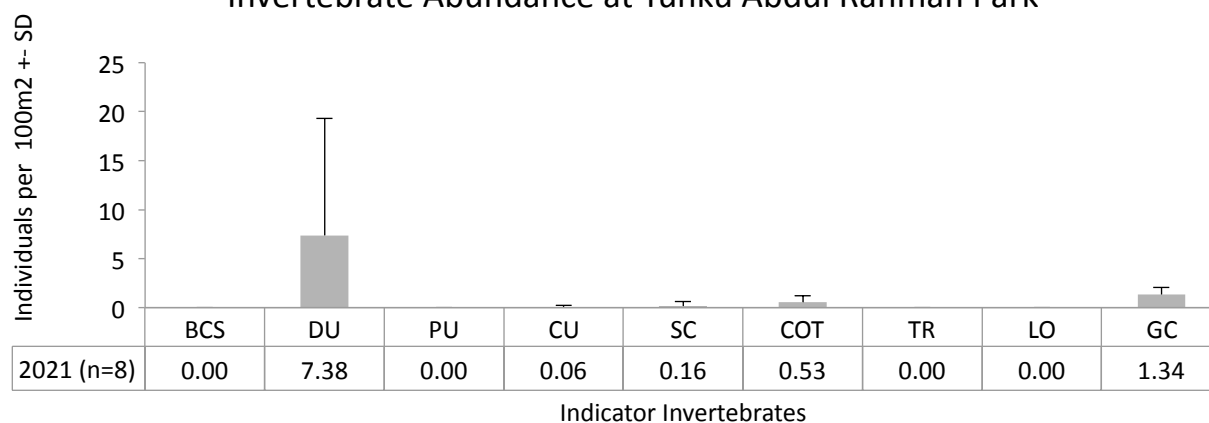
Fish and Invertebrate

Fish Abundance at Tunku Abdul Rahman Park



- Snapper abundance is the highest.
- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are low in abundance, except for snapper and parrotfish.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Tunku Abdul Rahman Park



- Diadema urchin abundance is the highest.
- Indicators for curio trade are absent.
- Very low abundance of invertebrates targeted for food.
- Crown-of-thorns is an issue in Tunku Abdul Rahman Park.
- A healthy coral reef can support a population of 0.2-0.3 individuals per 100m², Tunku Abdul Rahman Park recorded 0.53.

North Borneo – Tun Sakaran Marine Park

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.

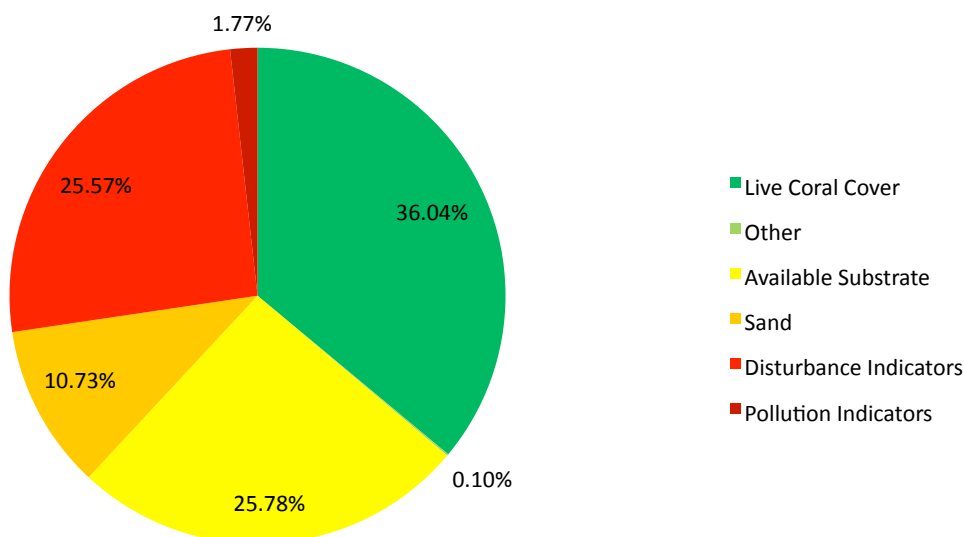
In 2004, the park became the seventh gazetted area under Sabah Parks with a total area of 100.8 km². There are approximately 2,000 people living within the park.



Map showing the health categories of each survey site based on Live Coral Cover: 3 sites have 'Good' coral cover, 5 are in 'Fair' condition, and 4 show 'Poor' health.

Coral Cover and Health

Substrate Composition at Tun Sakaran Marine Park



- Tun Sakaran Marine Park is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 26.30%.
- In 'Fair' condition and below the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high.
- Disturbance indicators are very high.
- Rubble level is high at all sites, except for Ribbon Reef (5 & 10m) and Kapikan Reef (5m). The level is especially high at South Rim (5 & 10m) and Sibuan (5 & 10m).

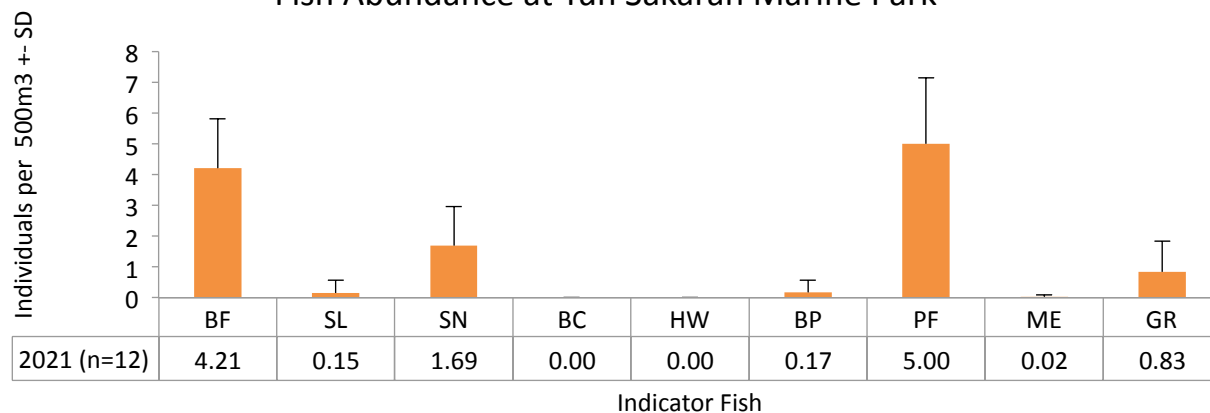
CORAL IMPACTS

- Discarded fishing nets and trash were recorded.
- Many sites were impacted by warm water bleaching, storm damage and sedimentation.



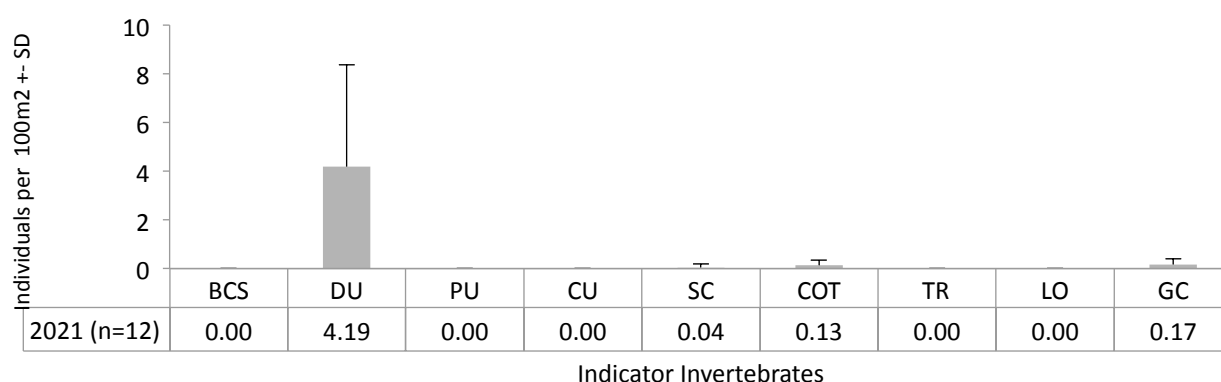
Fish and Invertebrate

Fish Abundance at Tun Sakaran Marine Park



- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Fish targeted for food are low in abundance, except for parrotfish.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Tun Sakaran Marine Park



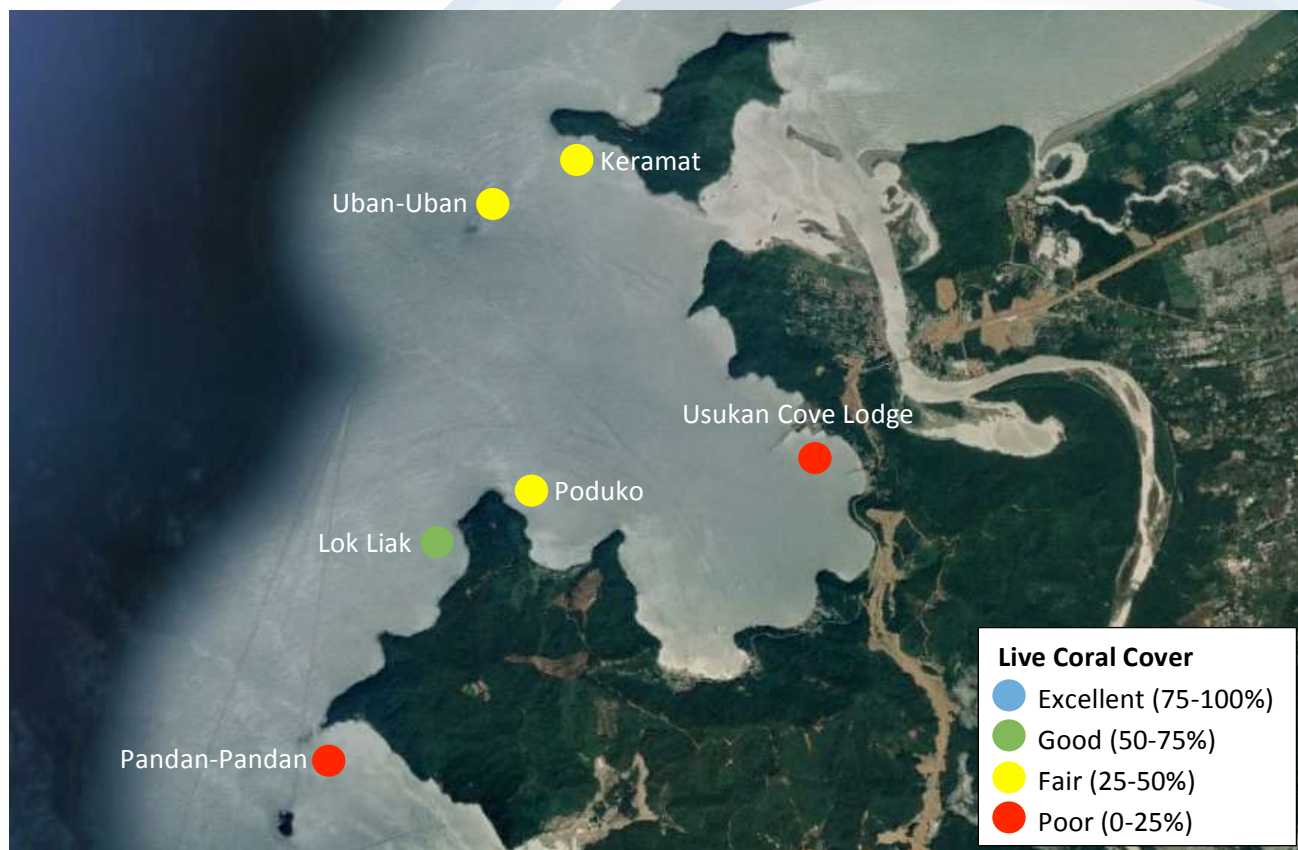
- Absent of indicators for curio trade.
- Very low abundance of invertebrates targeted for food.
- Crown-of-thorns is not an issue in Tun Sakaran Marine Park.

RARE ANIMALS

- Turtles were recorded.

North Borneo – Usukan Cove

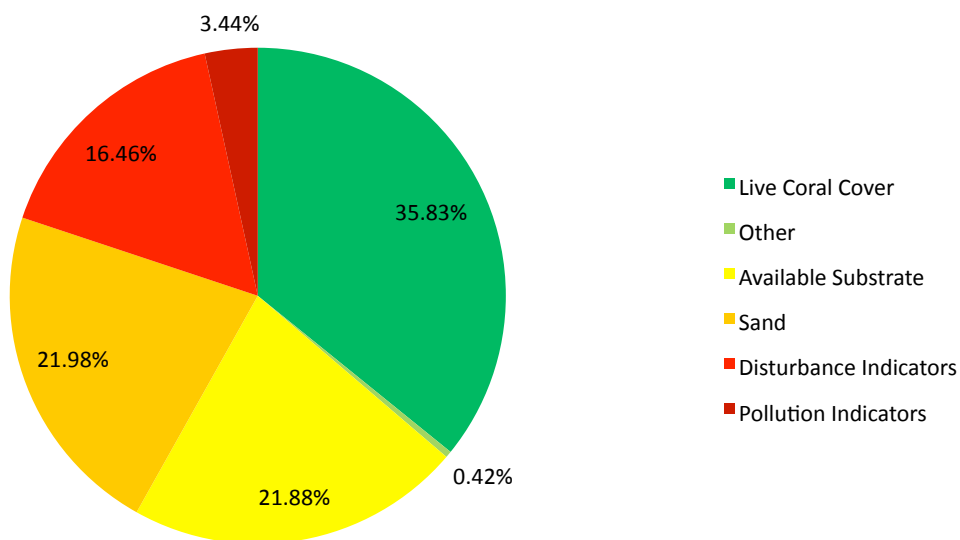
Usukan Cove is located on the North West coast of Sabah approximately half way between Kota Kinabalu and Kudat, in a district called Kota Belud, just beside Kampung Kuala Abai where the jetty to Mantanani Island is situated. Diving and snorkelling as well as fishing are the main activities offered in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



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Good' coral cover, 3 are in 'Fair' condition, and 2 show 'Poor' health.

Coral Cover and Health

Substrate Composition at Usukan Cove



- Usukan Cove is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 34.48%.
- In 'Fair' condition and below the North Borneo region average (39.50%).
- Available substrate for coral recruits to attach is very high.
- Sand level is very high. The level is especially high at Pandan-Pandan and Usukan Cove Lodge, both recorded over 45%.
- Disturbance indicators are high.
- Rubble level is high at all sites.

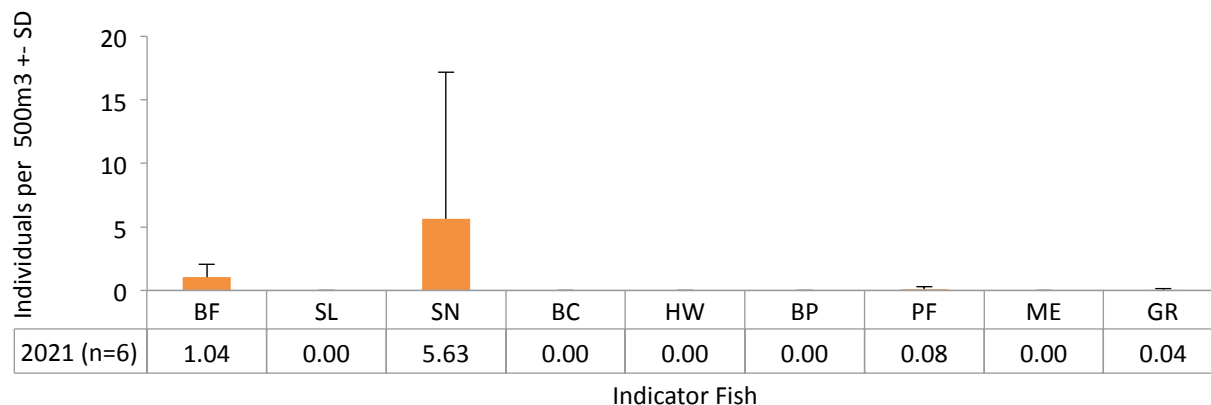
CORAL IMPACTS

- Many sites were impacted by warm water bleaching.
- Coral damages due to storm, sedimentation and construction works were



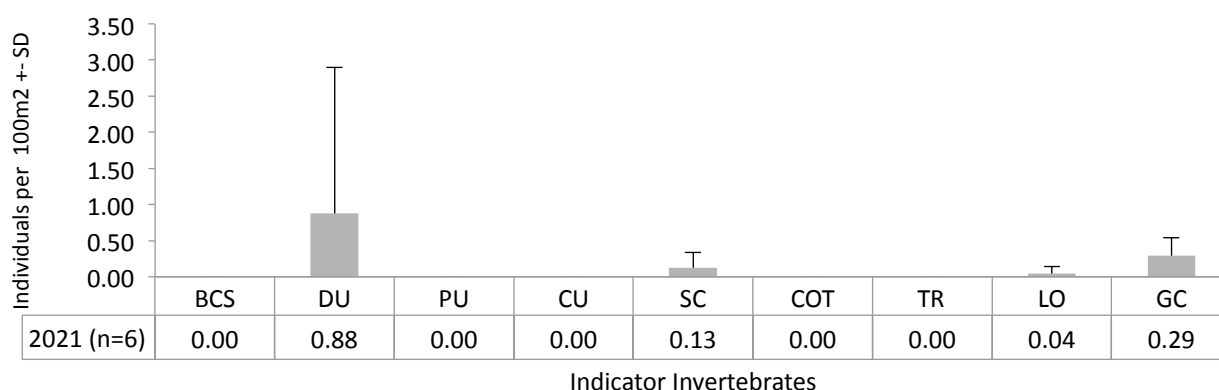
Fish and Invertebrate

Fish Abundance at Usukan Cove



- Absent of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.

Invertebrate Abundance at Usukan Cove



- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.

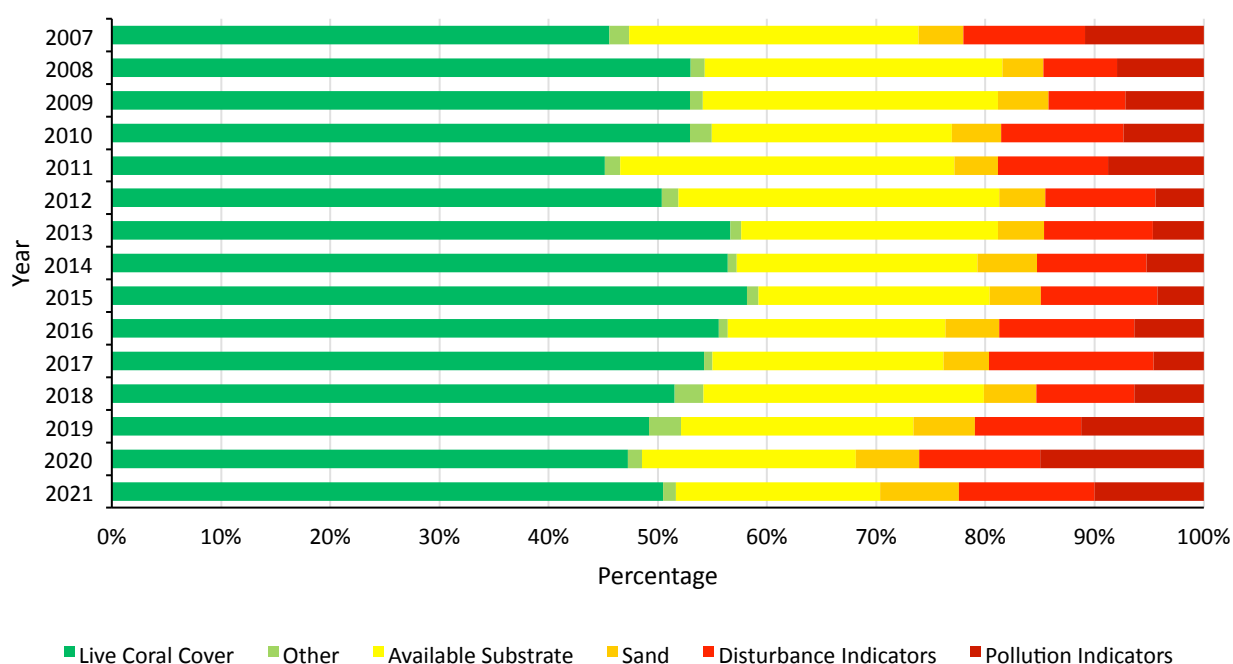
REEF CHECK DATA OVER THE YEARS

Reef Check data are primarily used for monitoring coral reef health and comparisons of data over time can highlight significant changes and indicate problems and emerging issues. This section reviews data collected over the last fifteen years to assess changes to Malaysia's reefs over the period, separated into three eco-regions: Sunda Shelf, Malacca Strait and North Borneo.

Sunda Shelf

Coral Cover and Health

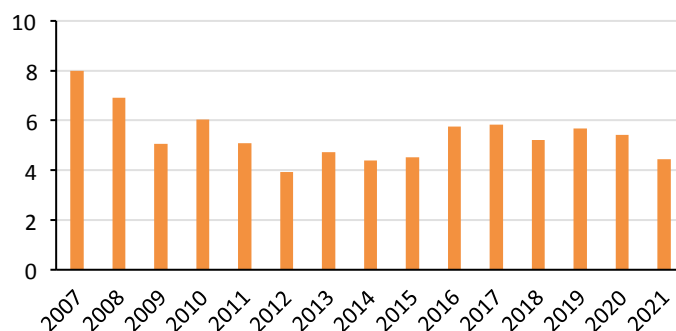
Reef Health in Sunda Shelf



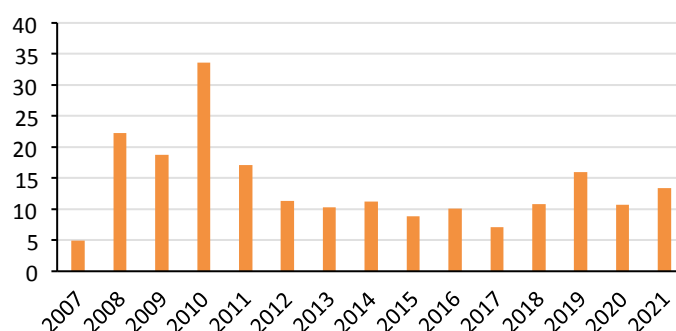
- From 2015 to 2020, the reefs in Sunda Shelf have deteriorated, as reflected by the decrease in live coral cover.
- In 2021, the reefs show improvement. The improvement is mainly attributed to recovery of reefs in Terengganu following damage caused by storm Pabuk in 2019 (particularly reefs at Bidong & Yu, Perhentian, Redang and Tenggol).
- Available substrate for coral recruits to attach to is high, indicating possible chance of further reef recovery if human impacts and crown-of-thorns population (see invertebrates) are dealt with.

Fish

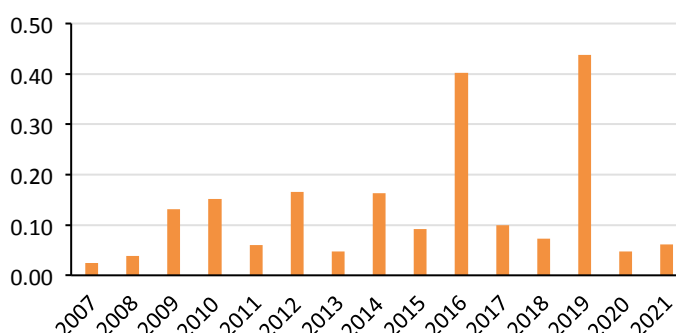
Fish Targeted for Aquarium Trade



Fish Targeted for Food



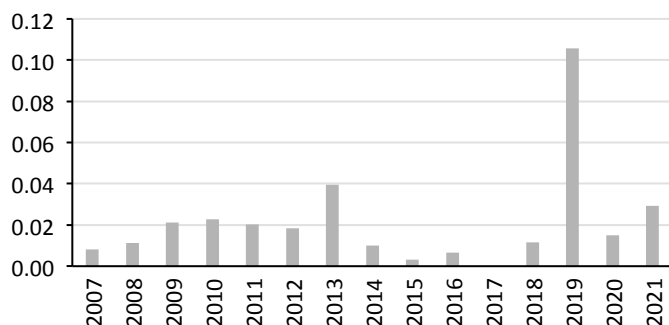
Fish Targeted for Live-food Fish Trade



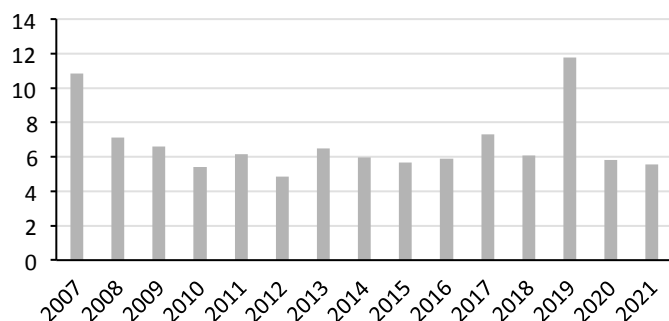
- The abundance of fish targeted for aquarium trade is more or less the same over the years.
- The abundance of fish targeted for food does not change much. The high abundance from 2008 to 2011 was contributed by snappers.
- Very low abundance of fish targeted for live-food fish trade, with spikes in 2016 and 2019 which were attributed to non-resident bumphead parrotfish communities.

Invertebrate

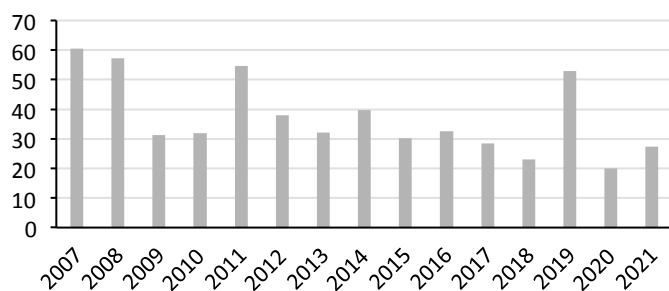
Invertebrates Targeted for Curio Trade



Invertebrates Targeted for Food

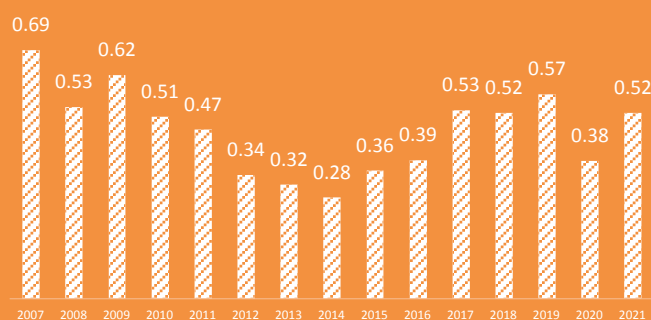


Ecological imbalance/predator outbreak Indicators



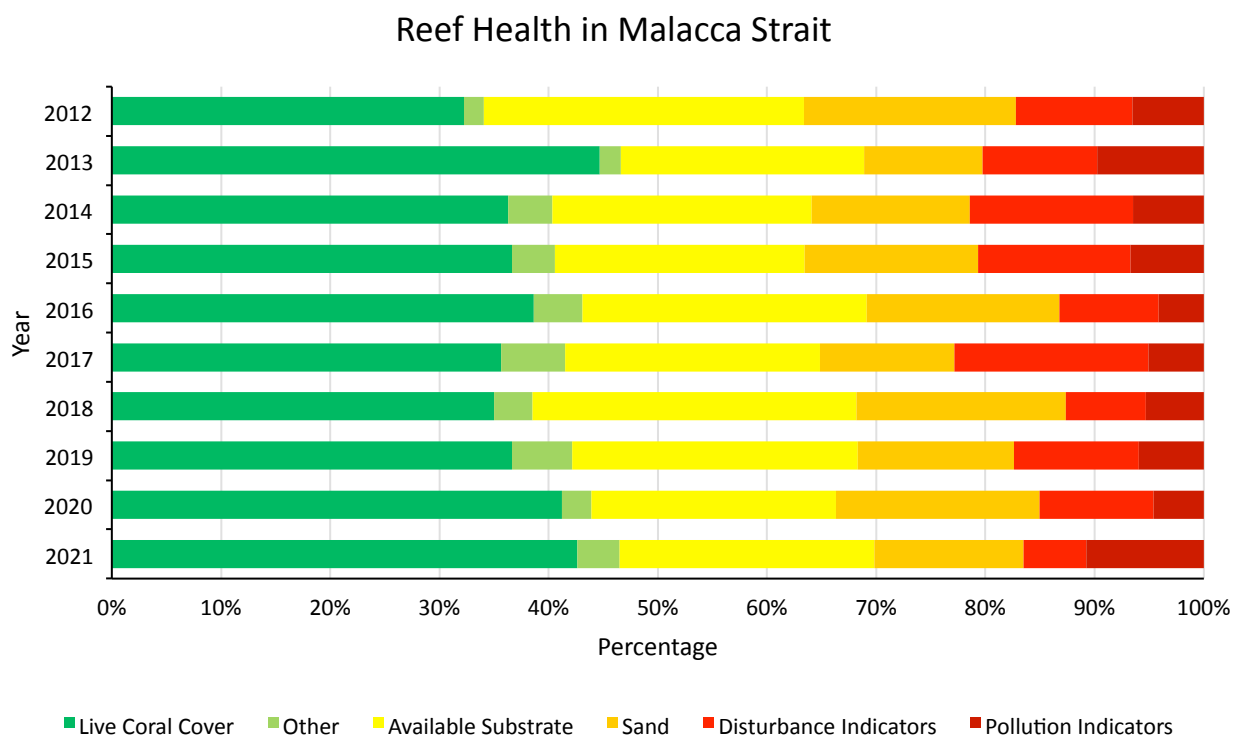
- Very low abundance of invertebrates targeted for curio trade.
- Indicators targeted for food have maintained more or less the same over the years.
- Indicators for ecological imbalance/predator outbreaks have been inconsistent over the years.
- High number of crown-of-thorns and the abundance is above what a healthy reef can support (0.2-0.3 individual per 100m²).

CROWN-OF-THORNS IN SUNDA SHELF



Malacca Strait

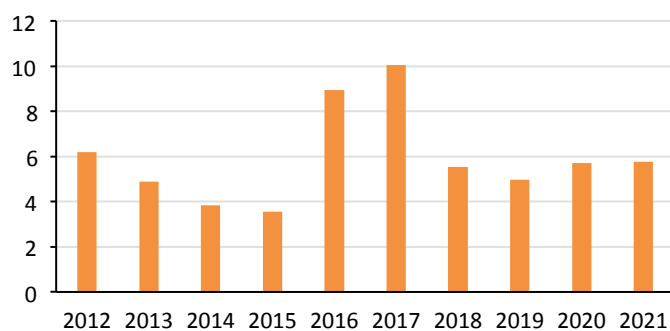
Coral Cover and Health



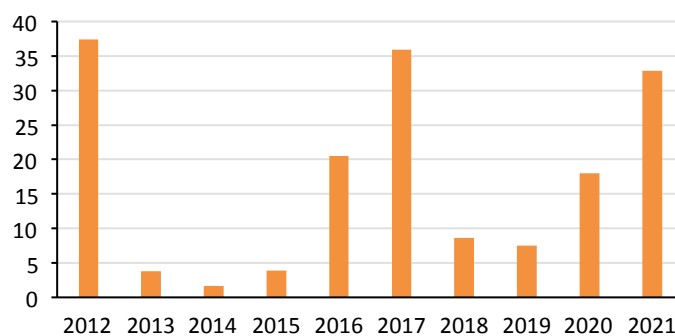
- The reefs in Malacca Strait have maintained more or less the same from 2012 to 2018.
- From 2018 onwards, the reefs show improvement, as reflected by the increase in live coral cover.
- Disturbance indicators have decreased in the last 3 years.
- Reduced disturbance indicators allow the reefs in Malacca Strait to improve.

Fish

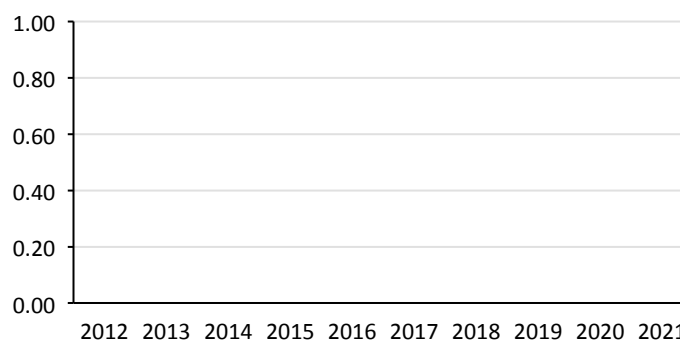
Fish Targeted for Aquarium Trade



Fish Targeted for Food



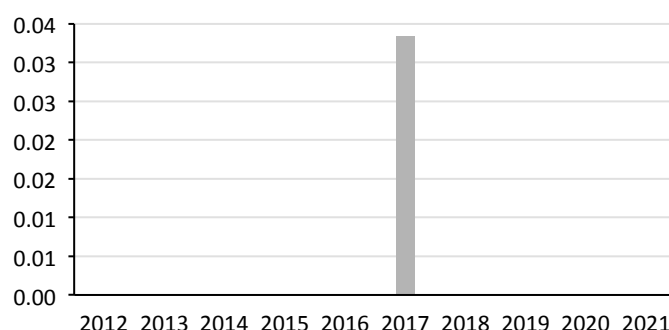
Fish Targeted for Live-food Fish Trade



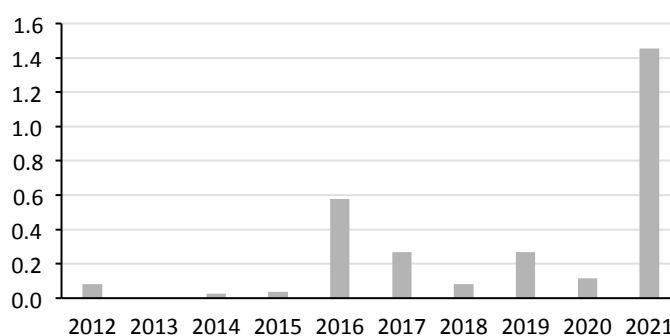
- Fish targeted for life-food fish trade is never observed and recorded.
- The abundance of fish targeted for aquarium trade is more or less the same over the years.
- Fish targeted for food is mainly attributed by snappers.
- The abundance of fish targeted for food is inconsistent over the years.

Invertebrate

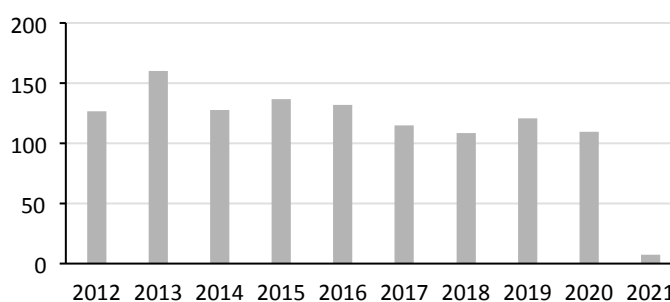
Invertebrates Targeted for Curio Trade



Invertebrates Targeted for Food



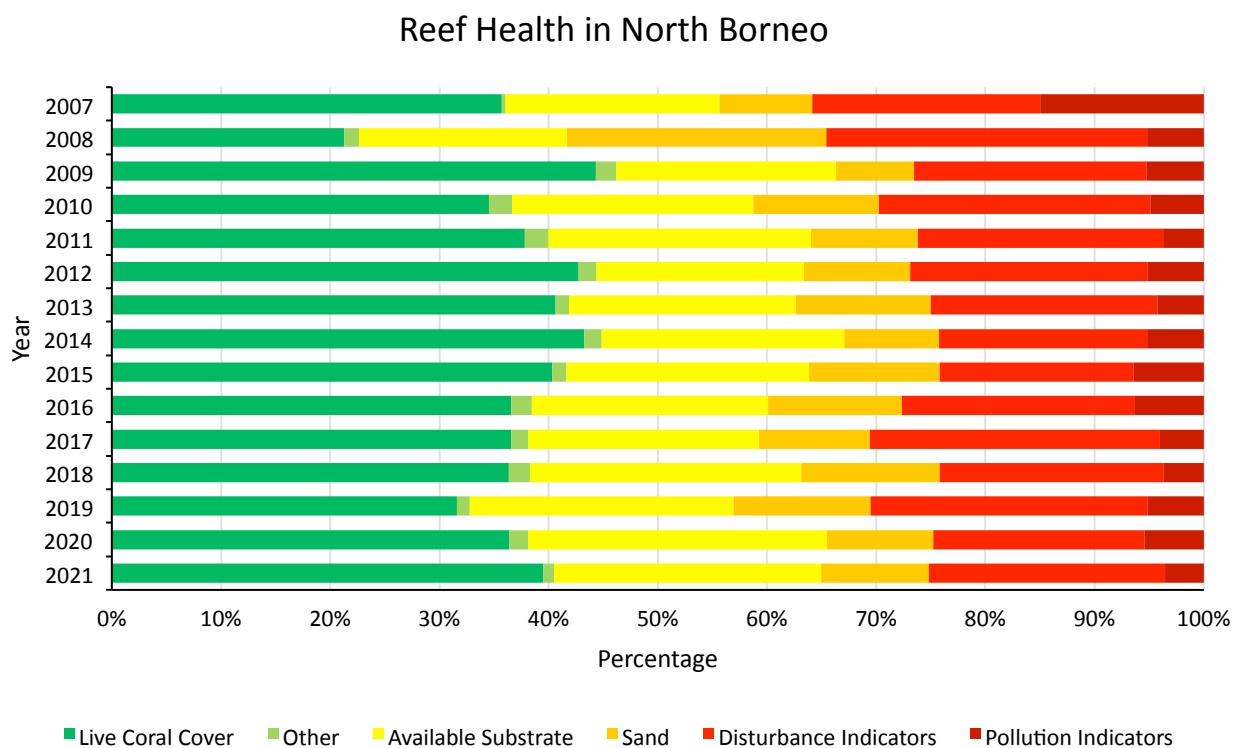
Ecological imbalance/predator outbreak Indicators



- Invertebrates targeted for curio trade is only observed and recorded once, in 2017.
- Very low abundance of invertebrates targeted for food. The spike in 2021 is considered to reflect the addition of Malacca and Port Dickson that year, rather than an actual increase in the abundance of invertebrates targeted for food.
- Ecological imbalance/predator outbreak indicators are attributed solely by diadema urchin and the abundance is more or less the same over the years. The reduction in 2021 is considered to reflect the elimination of Pulau Sembilan and Pangkor Laut that year, rather than an actual decrease in the abundance of ecological imbalance/predator outbreak indicators.

North Borneo

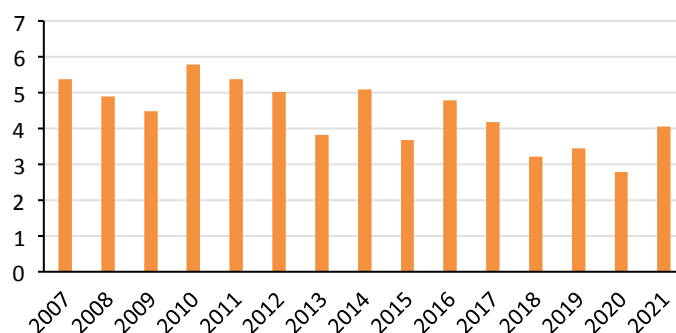
Coral Cover and Health



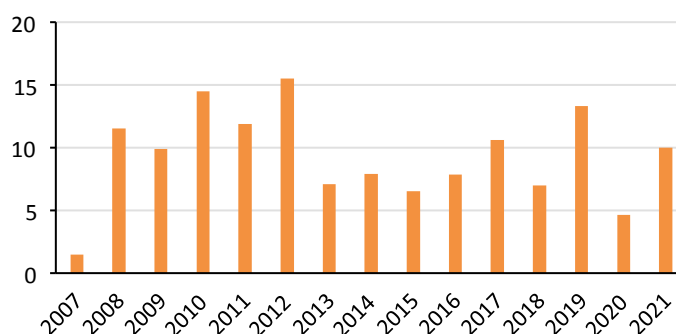
- The reefs in North Borneo have maintained more or less the same over the years.
- In 2021, the reefs show some improvement.
- All substrate categories do not show much changes.

Fish

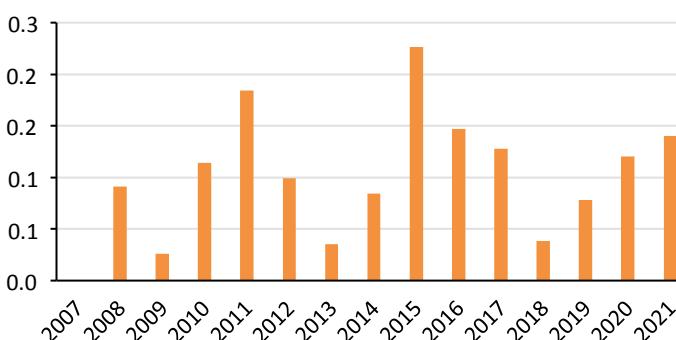
Fish Targeted for Aquarium Trade



Fish Targeted for Food



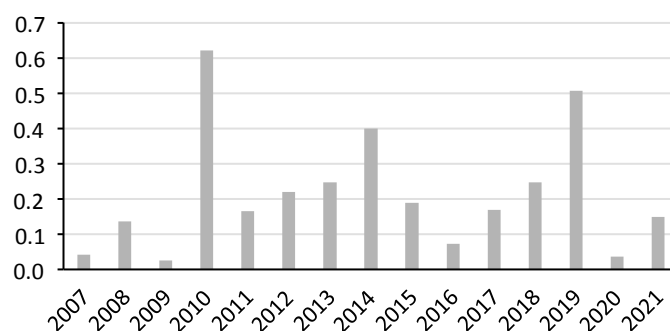
Fish Targeted for Live-food Fish Trade



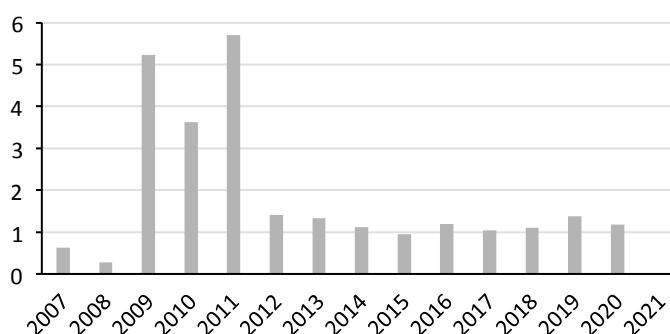
- The abundance of fish targeted for aquarium trade, food and live-food fish trade is inconsistent over the years.

Invertebrate

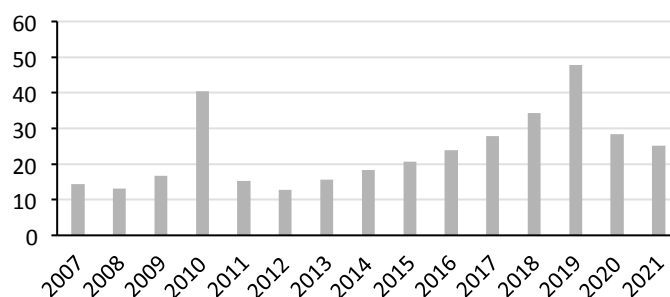
Invertebrates Targeted for Curio Trade



Invertebrates Targeted for Food



Ecological imbalance/predator outbreak
Indicators



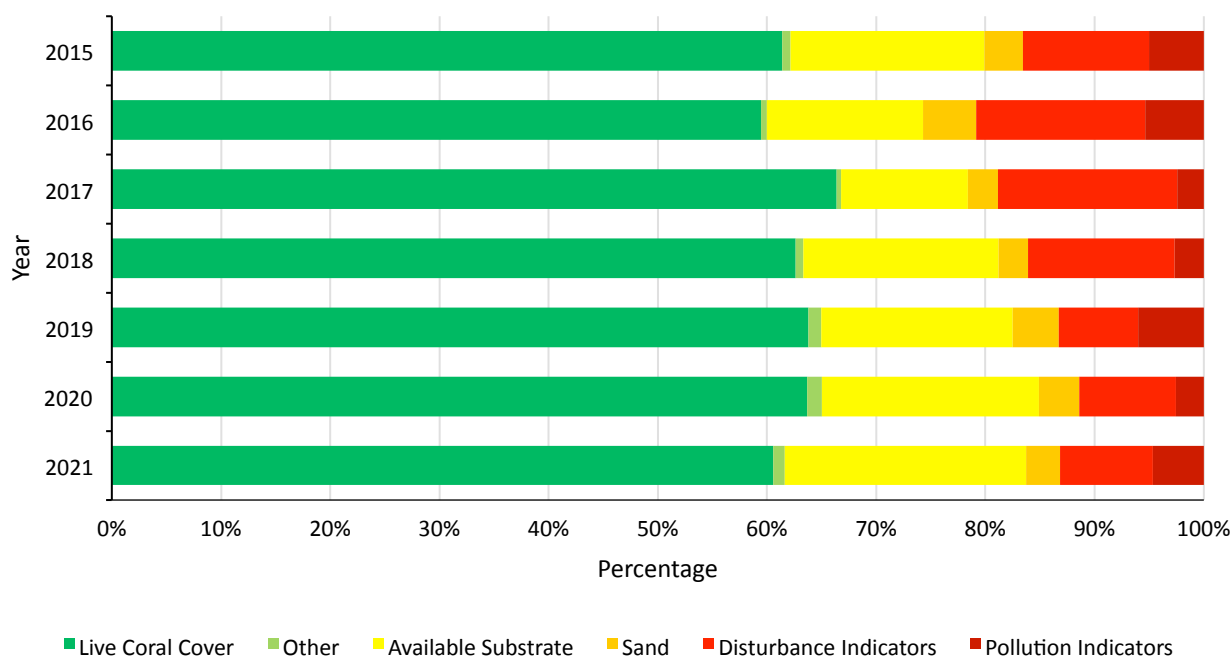
- The abundance of invertebrates targeted for curio trade is inconsistent over the years.
- Very low abundance of invertebrates targeted for food.
- The abundance of indicators for ecological imbalance/predator outbreak has decrease over the last 3 years.

Local Changes in Reef Health

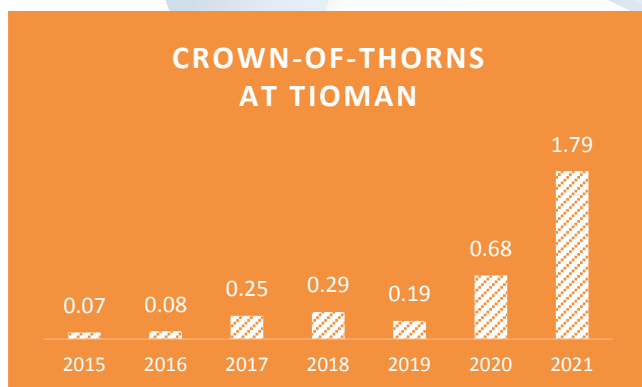
This section provides details of the health of coral reefs around Malaysia over the last 7 years, from 2015 to 2021. Only islands/areas with permanent sites that were surveyed every year over the period are included in this section.

Sunda Shelf – Tioman

Reef Health at Tioman

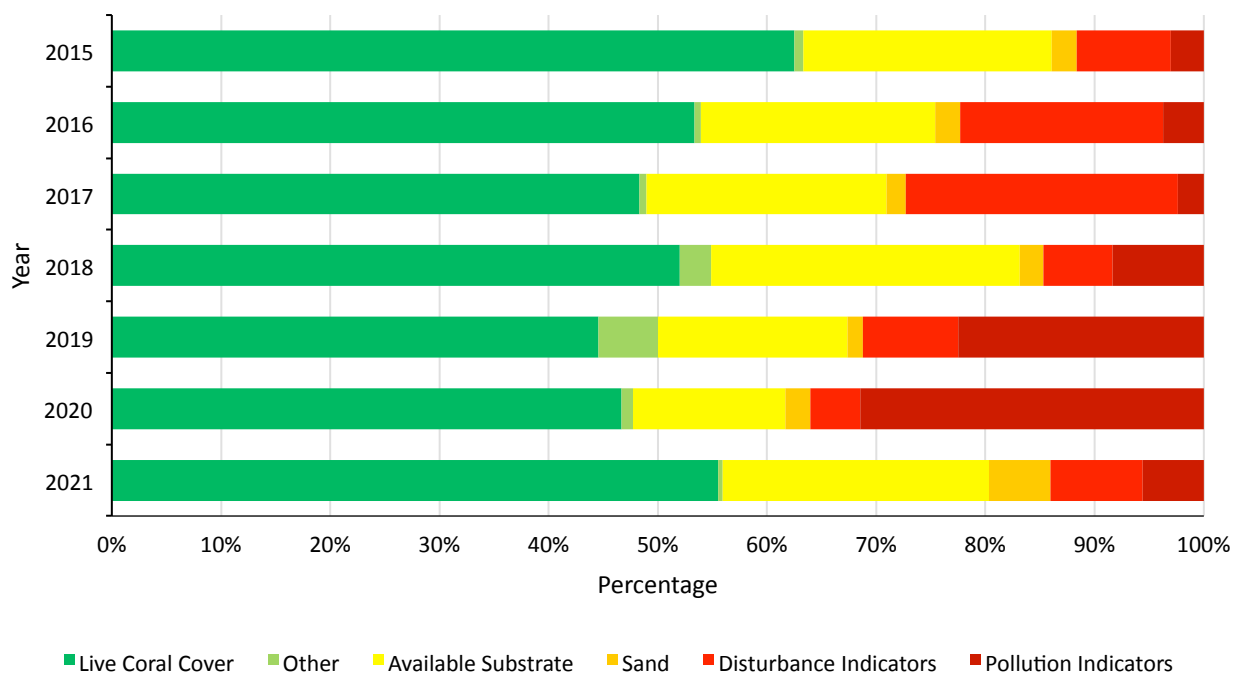


- Tioman reefs have maintained in 'good' condition.
- Live coral cover shows slight decrease in 2021.
- Disturbance indicators have decreased but the level is still slightly high.
- Pollution indicators show variation over the years.
- Over the last 2 years, crown-of-thorns population shows an upward trend. In 2021, the population has increased significantly, above what a healthy reef can support (0.2-0.3 individual per 100m²). This is a cause for concern and existing efforts by reef managers to control the population need to be heightened.



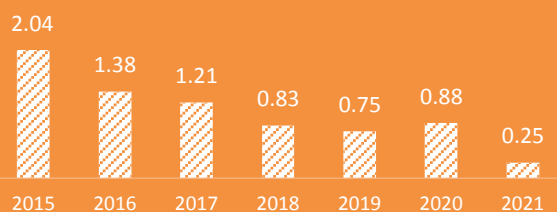
Sunda Shelf – Bidong & Yu

Reef Health at Bidong & Yu



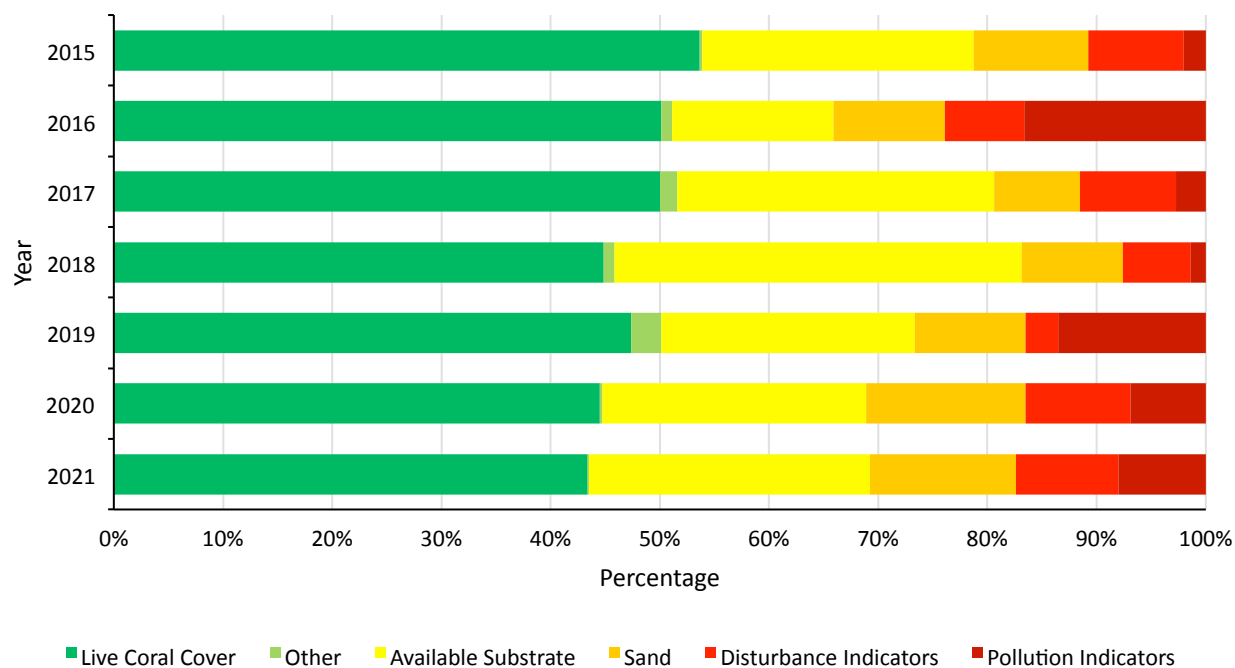
- From 2015 to 2017, live coral cover shows a declining trend due to increasing disturbance indicators.
- The decrease in live coral cover in 2019 is probably due to Tropical Storm Pabuk which struck Bidong and Yu in January that year, causing major physical damage to shallow reefs.
- The sharp increase in pollution indicators in 2019 and 2020 is likely due to Tropical Storm Pabuk. Storms bring high rainfall and watershed runoff which increase external nutrient loads. It also causes sediment resuspension contributing to increase internal nutrient loads. The level has reduced significantly in 2021.
- Disturbance indicators have decreased since 2018 and the level has remained stable ever since.
- The abundance of crown-of-thorns has decreased over the years and the population is now within what a healthy reef can sustain (0.2-0.3 individual per 100m²).
- Reduced and acceptable population of crown-of-thorns coupled with reduced disturbance and pollution indicators allow Bidong and Yu reefs to recover from Tropical Storm Pabuk damage. This is reflected by the increase in live coral cover over the last 3 years.

CROWN-OF-THORNS AT BIDONG & YU



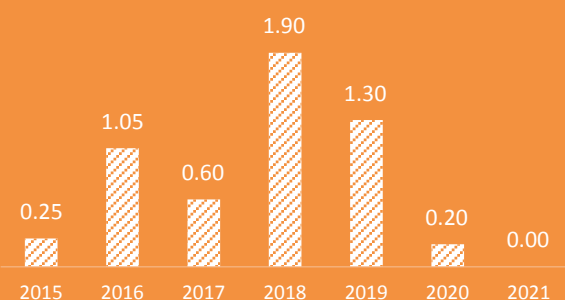
Sunda Shelf – Kapas

Reef Health at Kapas



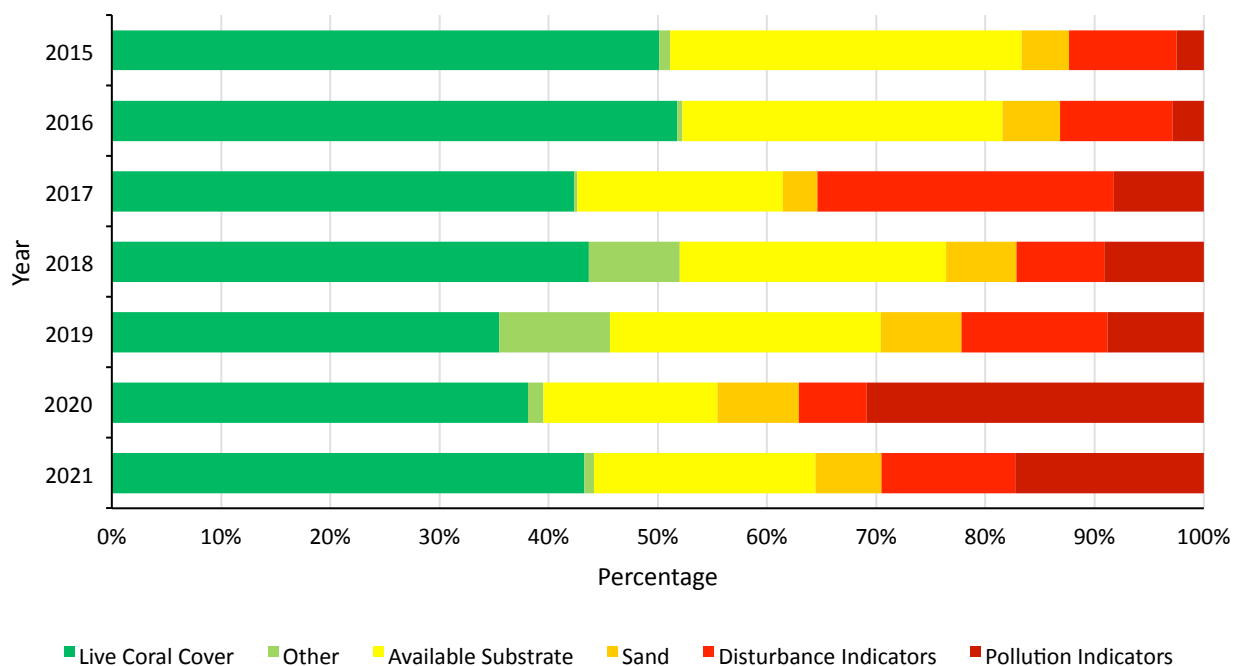
- Kapas reefs have deteriorated from 'good' to 'fair' condition, as reflected by the decrease in live coral cover.
- The decrease in live coral cover is likely due increasing pollution indicators.
- The abundance of crown-of-thorns has decreased over the years and the population is now within what a healthy reef can sustain (0.2-0.3 individual per 100m²).
- Disturbance indicators have not change much over the years but the level is slightly high.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery if human impacts are in check.

CROWN-OF-THORNS AT KAPAS

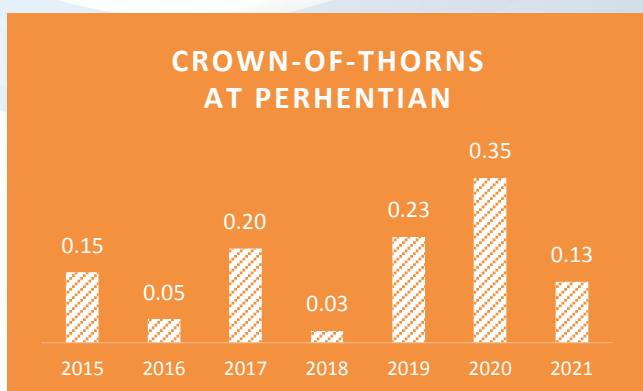


Sunda Shelf – Perhentian

Reef Health at Perhentian

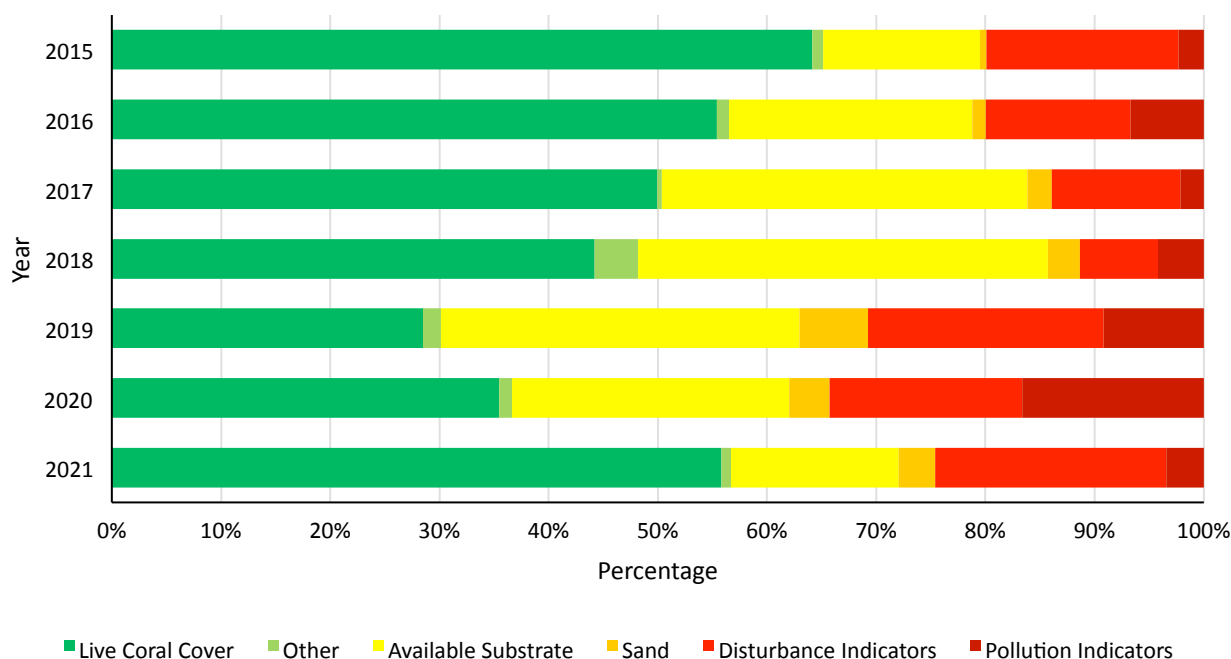


- The decrease in live coral cover in 2017 is likely due to physical damage caused by human activities. The decrease in 2019 is probably due to Tropical Storm Pabuk which struck Perhentian in January that year, causing major physical damage to shallow reefs. Both are reflected by the increase in disturbance indicators.
- Starting in 2020, the reefs show signs of recovery, as reflected by the increase in live coral cover.
- Pollution indicators have increased significantly in 2020. This could be the cause of increase in crown-of-thorns abundance that year. In 2021, pollution indicators have decreased, so did crown-of-thorns abundance.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery from 'fair' to 'good' condition if human impacts are in check.

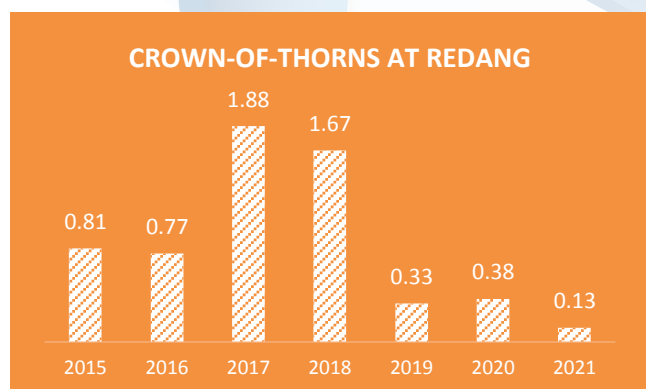


Sunda Shelf – Redang

Reef Health at Redang

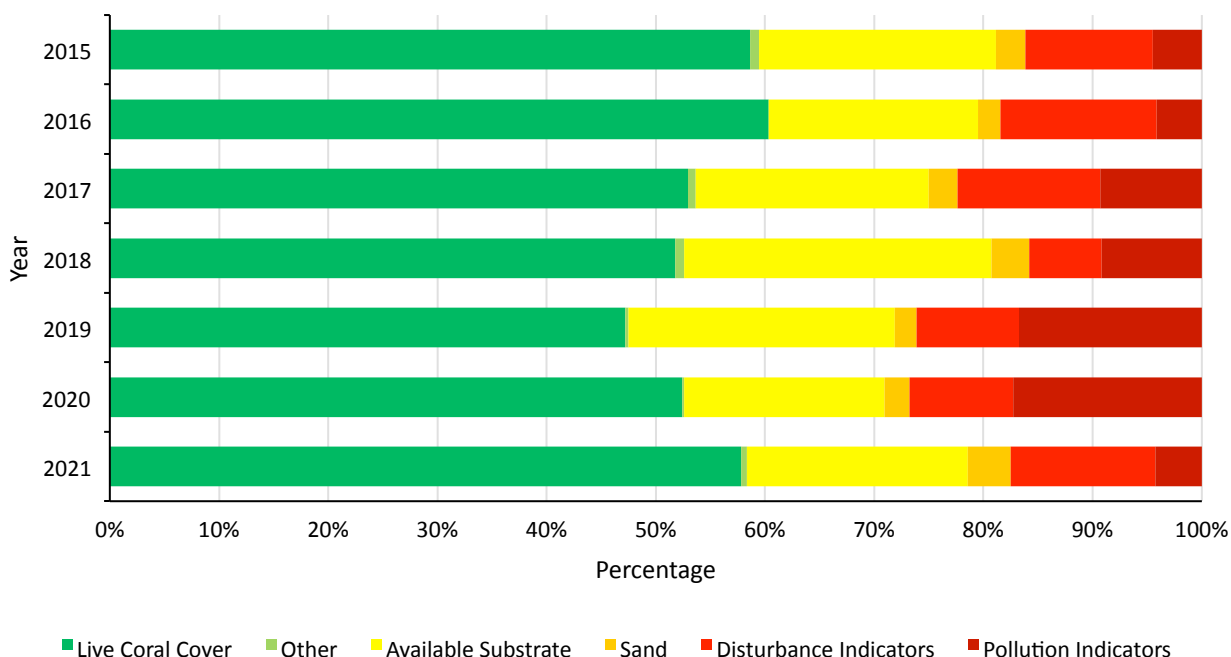


- The decrease in live coral cover from 2016 to 2018 is likely due to very high abundance of crown-of-thorns, which is above what a healthy reef can sustain (0.2-0.3 individual per 100m²).
- The sharp decrease in live coral cover in 2019 is probably due to Tropical Storm Pabuk which struck Redang in January that year, causing major physical damage to shallow reefs, as reflected by the sharp increase in disturbance indicators.
- The storm also caused an increase in pollution indicators. Storm brings high rainfall and water-shed runoff which increase external nutrient loads. It also causes sediment resuspension contributing to increase internal nutrient loads. The level has reduced in 2021.
- In 2019, the abundance of crown-of-thorns decreased significantly. The population has remained low ever since and is now within what a healthy reef can sustain.
- Reduced abundance of crown-of-thorns coupled with reduced pollution indicators allow Redang reefs to recover from Tropical Storm Pabuk damage. This is reflected by the increase in live coral cover over the last 3 years.



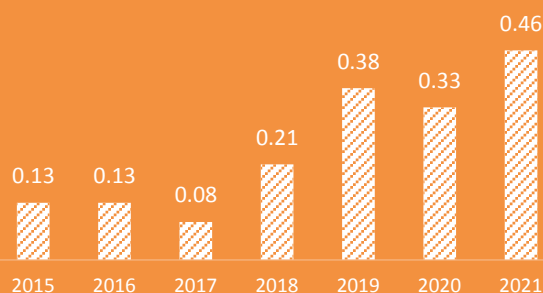
Sunda Shelf – Tenggol

Reef Health at Tenggol



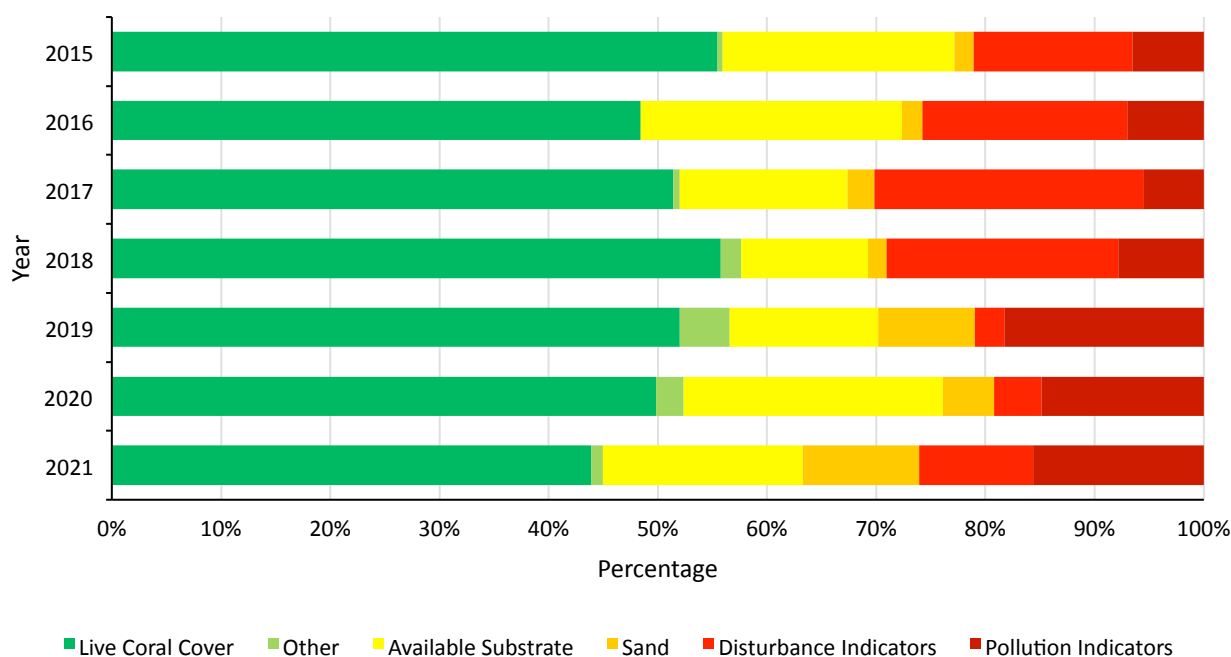
- The decrease in live coral cover in 2017 is likely due to pollution, as reflected by the increase in pollution indicators. The decrease in 2018 is likely due to an increase in crown-of-thorns abundance.
- The sharp decrease in 2019 is probably due to Tropical Storm Pabuk which struck Tenggol in January that year, causing major physical damage to shallow reefs, as reflected by the increase in disturbance indicators.
- The storm also caused a significant increase in pollution indicators. Storm brings high rainfall and watershed runoff which increase external nutrient loads. It also causes sediment resuspension contributing to increase internal nutrient loads. The level has reduced significantly in 2021.
- In 2019, the abundance of crown-of-thorns has increased to above what a healthy reef can sustain (0.2-0.3 individual per 100m²). This is a cause for concern and efforts need to be taken by reef managers to control the population.
- Reduced pollution indicators allow Tenggol reefs to recover from Tropical Storm Pabuk damage. This is reflected by the increase in live coral cover over the last 3 years.

CROWN-OF-THORNS AT TENGGOL

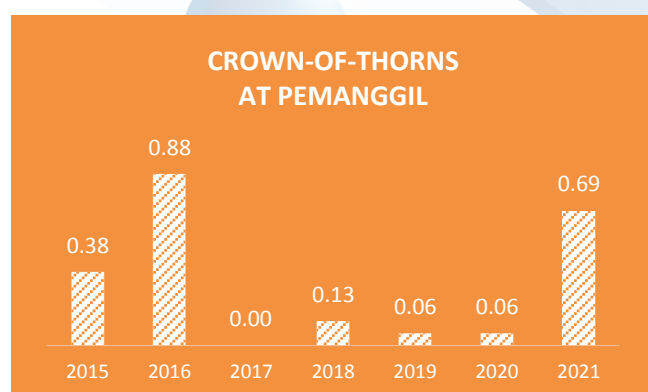


Sunda Shelf – Pemanggil

Reef Health at Pemanggil

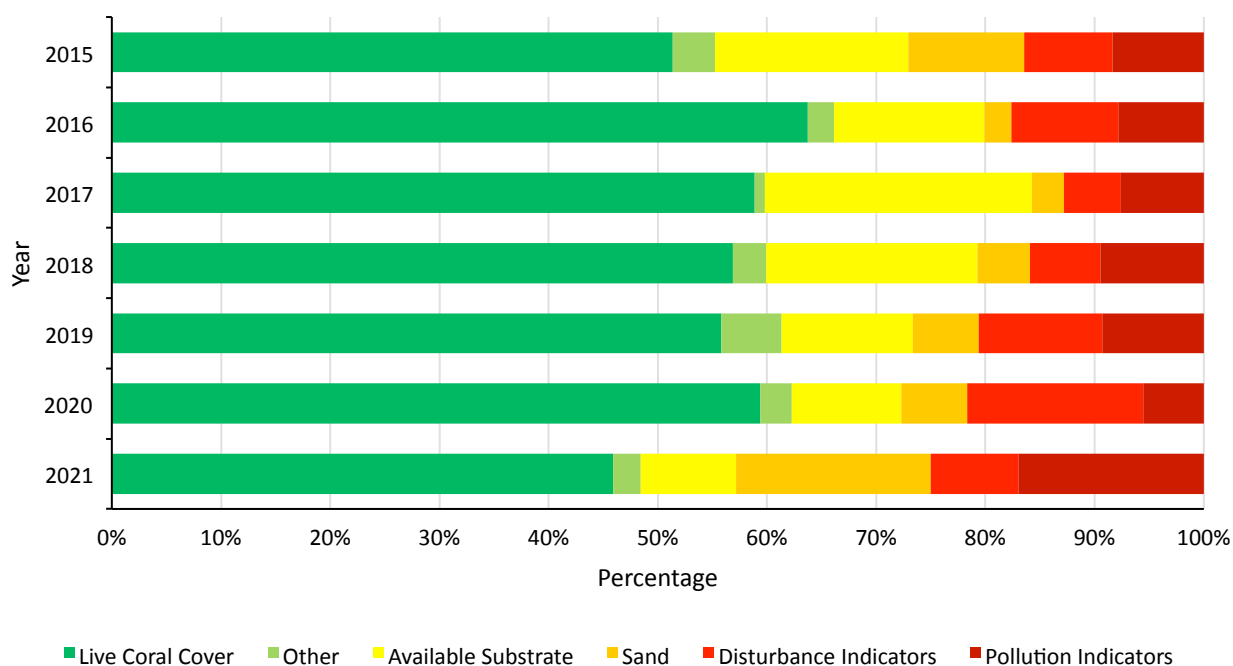


- Pemanggil reefs have deteriorated from 'good' to 'fair' condition, as reflected by the decrease in live coral cover.
- The decrease in live coral cover in 2016 is likely due to a significant increase in crown-of-thorns abundance. From 2017 to 2020, the abundance of crown-of-thorns has decreased, however the abundance has increased significantly in 2021, to above what a healthy reef can sustain (0.2-0.3 individual per 100m²). This is a cause for concern and efforts need to be taken by reef managers to control the population.
- The decrease in live coral cover from 2018 to 2021 is probably due to raised level of nutrient in the waters around the island, as reflected by the increase in pollution indicators.
- Disturbance indicators show an upward trend over the last 3 years.
- Available substrate for coral recruits to attach is high, possible chance of reef recovery if human impacts are dealt with.



Sunda Shelf – Sibü

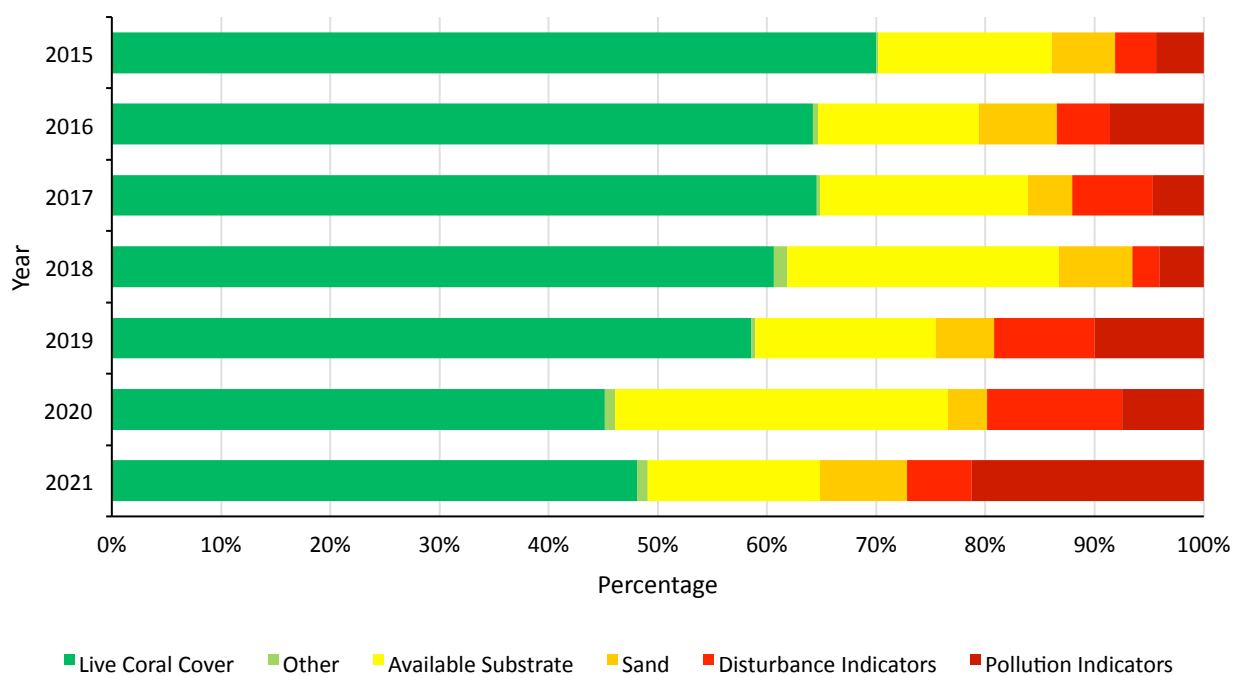
Reef Health at Sibü



- Sibü reefs have maintained in 'good' condition over the years. However, in 2021, the reefs have deteriorated from 'good' to 'fair' condition, as reflected by the decrease in live coral cover. The decrease is probably due to raised level of nutrient in the waters around the island, as reflected by the increase in pollution indicators.
- Disturbance indicators have increased. This is not only reflected by the increase in disturbance indicators from 2017 to 2020, but also by the increase in sand level. Increasing amount of sand can be an indication of disturbance as dead coral breaks off and are eroded into fine particles (sand) by wave action.
- Available substrate for coral recruits to attach is still high, possible chance of reef recovery if human impacts are deal with.

Sunda Shelf – Tinggi

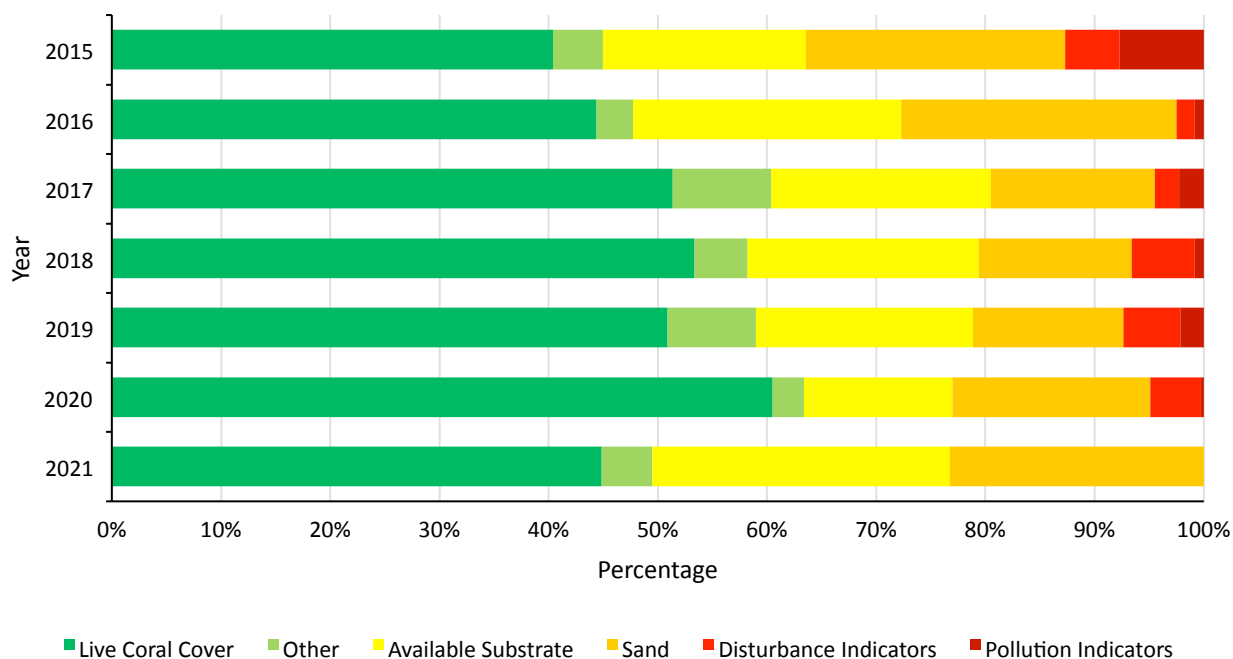
Reef Health at Tinggi



- Tinggi reefs have deteriorated from 'good' to 'fair' condition, as reflected by the decrease in live coral cover.
- The decrease is likely due to physical damage caused by human activities, as reflected by the increase in disturbance indicators, and raised level of nutrient in the waters around the island, as reflected by the increase in pollution indicators.
- Available substrate for coral recruits to attach is high, possible chance of reef recovery if human impacts are dealt with.

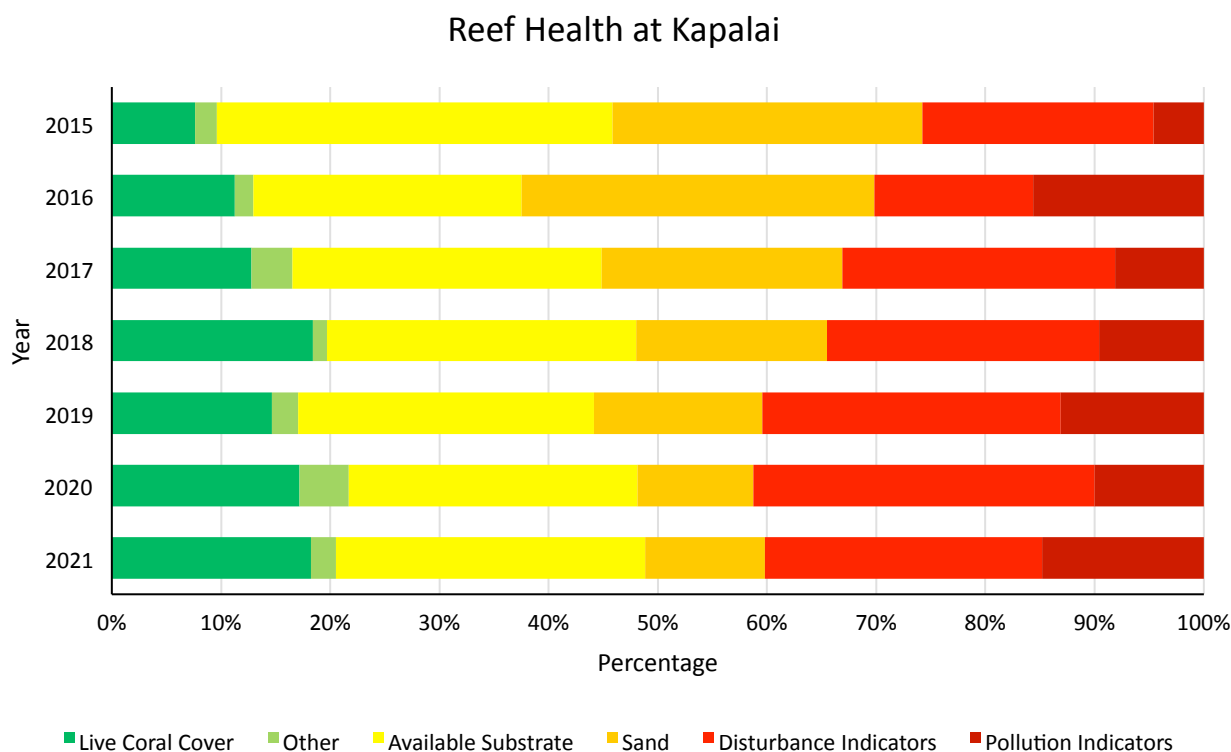
Malacca Strait – Payar

Reef Health at Payar



- Payar reefs have improved from 'fair' to 'good' condition, as reflected by the increase in live coral cover.
- The increase in live coral cover is likely due to decrease level of nutrient in the waters around the islands, as reflected by the decrease in pollution indicators.
- In 2021, the reefs have deteriorated. The cause of the decrease is unknown.

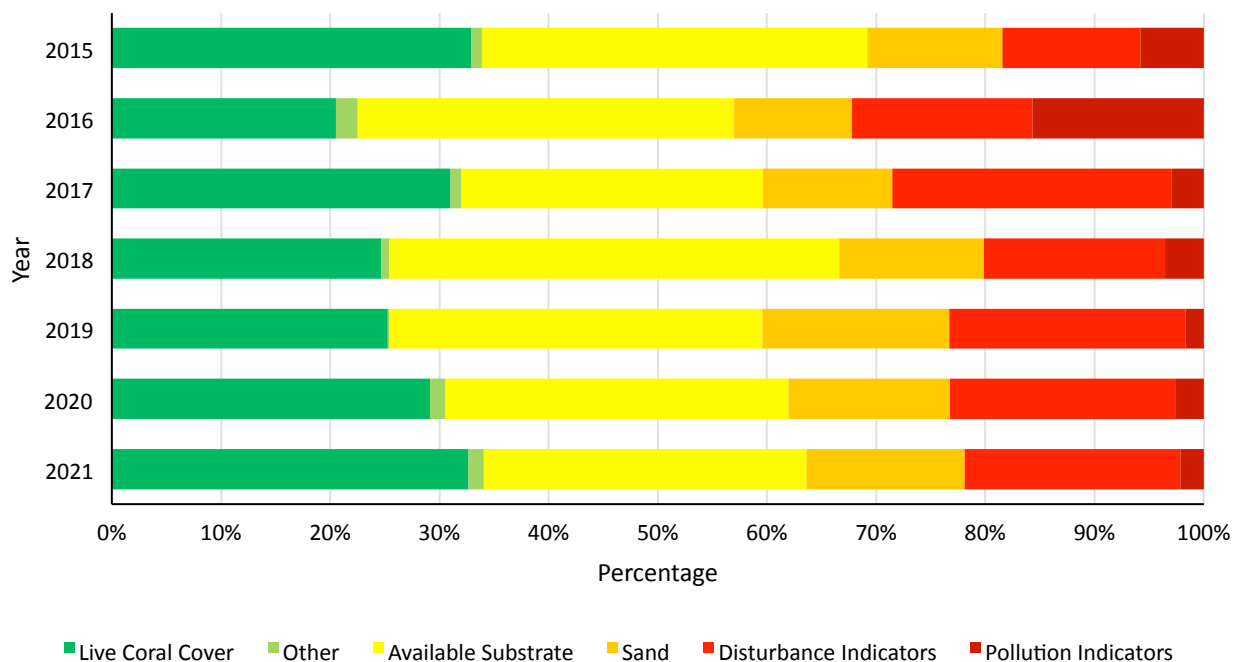
North Borneo – Kapalai



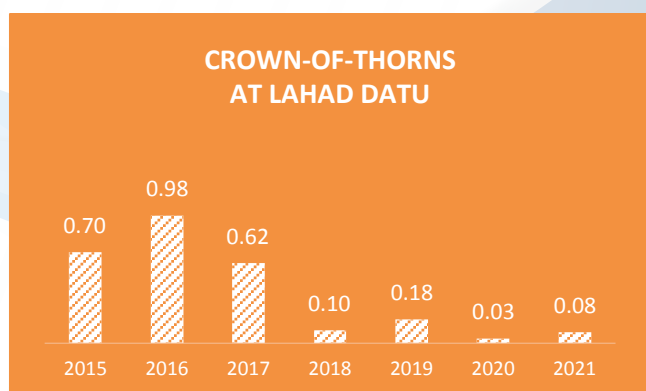
- Kapalai reefs have improved over the years, as reflected by the increase in live coral cover.
- Disturbance indicators have not change much over the years but the level is very high.
- Pollution indicators show an upward trend.
- Sand level has decreased over the years. Decreasing amount of sand can be an indication of decreasing disturbance.
- Reduced disturbance allows Kapalai reefs to improve.
- Available substrate for coral recruits to attach is very high, possible chance of continuous improvement of reefs health if human impacts are deal with.

North Borneo – Lahad Datu

Reef Health at Lahad Datu

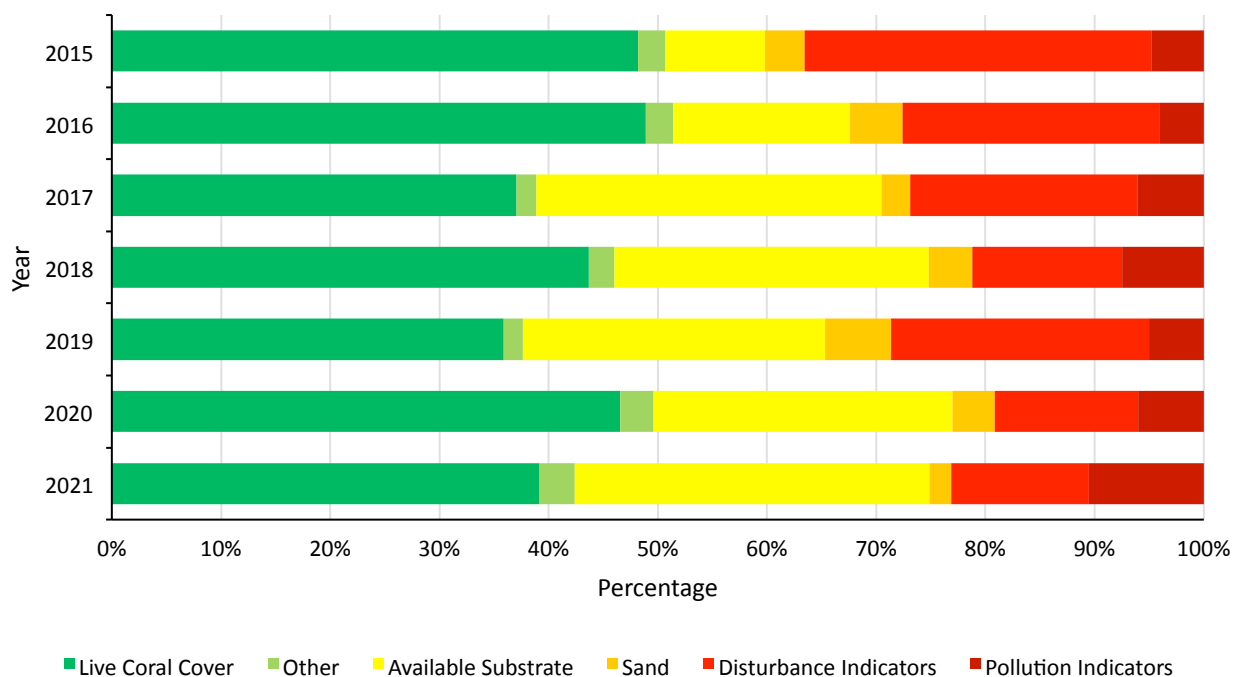


- Lahad Datu reefs have improved over the years, as reflected by the increase in live coral cover.
- From 2015 to 2017, the abundance of crown-of-thorns was above what a healthy reef can sustain (0.2-0.3 individual per 100m²). Since 2018, the abundance has decreased and maintained within the healthy range.
- Disturbance indicators show a downward trend over the last 3 years.
- Reduced abundance of crown-of-thorns coupled with reduced disturbance indicators allow Lahad Datu reefs to improve.



North Borneo – Lankayan

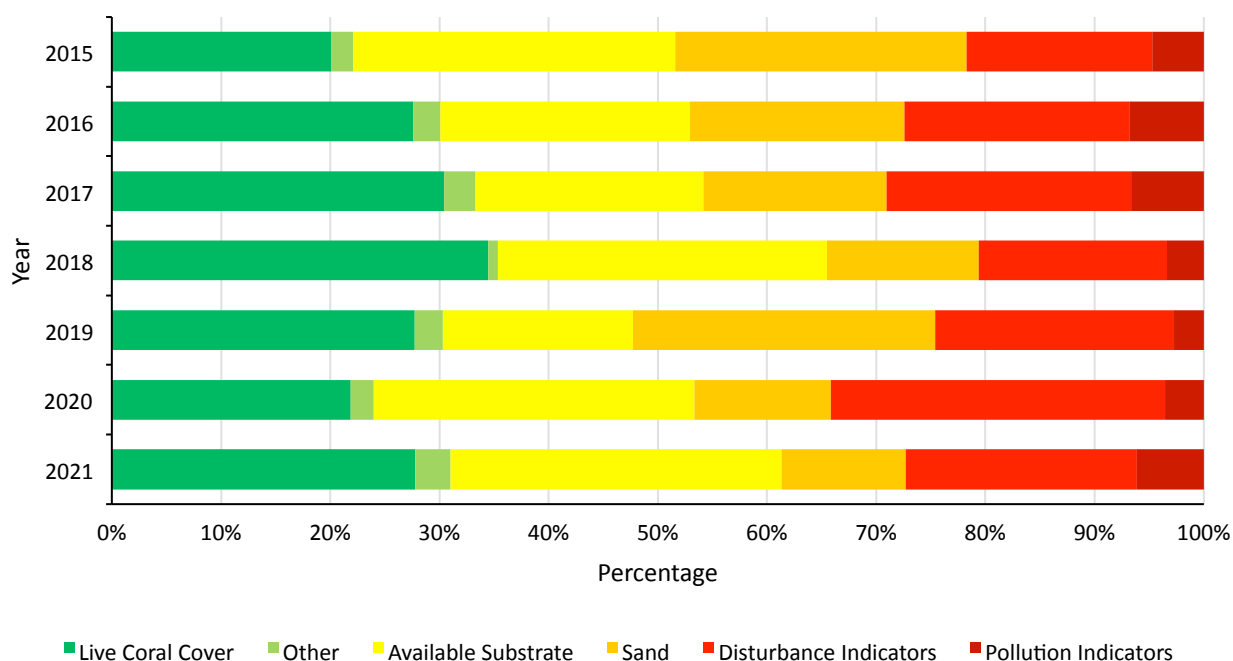
Reef Health at Lankayan



- The health of Lankayan reefs shows variation over the years.
- The decrease in live coral cover in 2021 is considered to reflect the elimination of nine sites that year (due to Covid-19 pandemic which hampered survey efforts), rather than an actual decrease in live coral cover.
- Disturbance indicators have decreased.
- Pollution indicators show an upward trend.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery if human impacts are dealt with.

North Borneo – Mabul

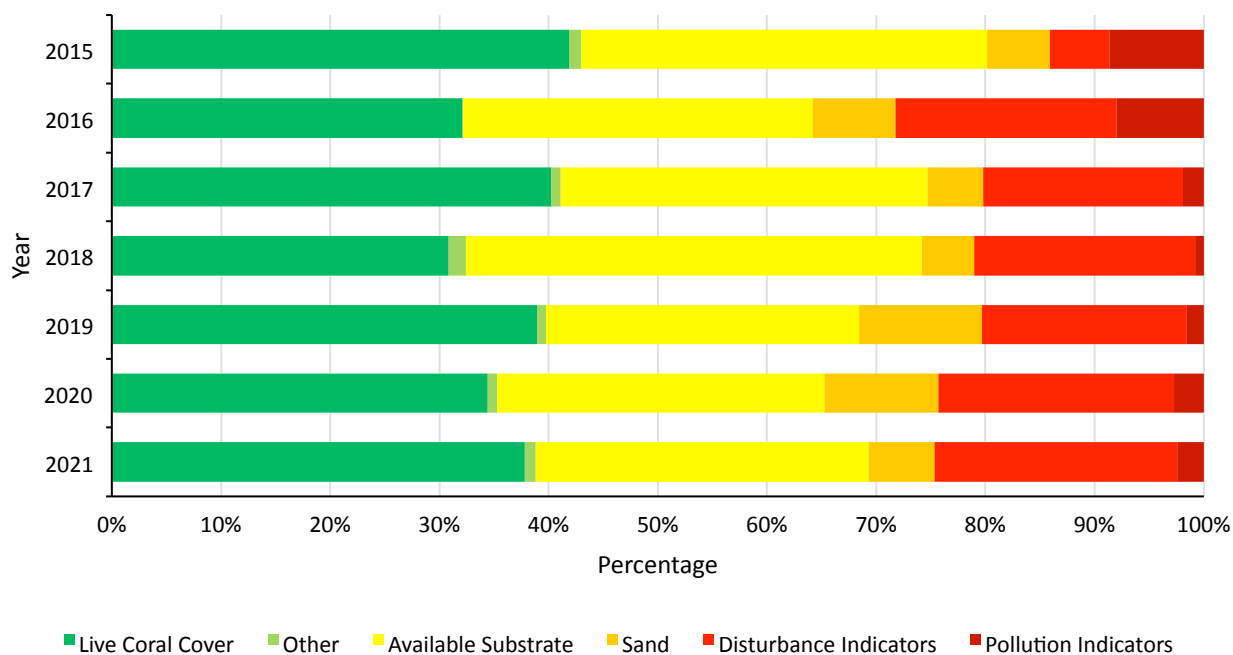
Reef Health at Mabul



- From 2015 to 2018, the health of Mabul reefs showed improvement, as reflected by the increase in live coral cover. Sand level decreased during that period. Decreasing amount of sand can be an indication of decreasing disturbance. Reduced disturbance allows the reefs to improve.
- From 2018 onwards, Mabul reefs have deteriorated, as reflected by the decrease in live coral cover. The decrease is likely due to physical damage caused by human activities and/or storm, as reflected by the increase in disturbance indicators.
- The decrease in 2020 is also due to elimination of 3 sites that year as a result of Covid-19 pandemic which hampered survey efforts.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery if human impacts are dealt with.

North Borneo – Mantanani

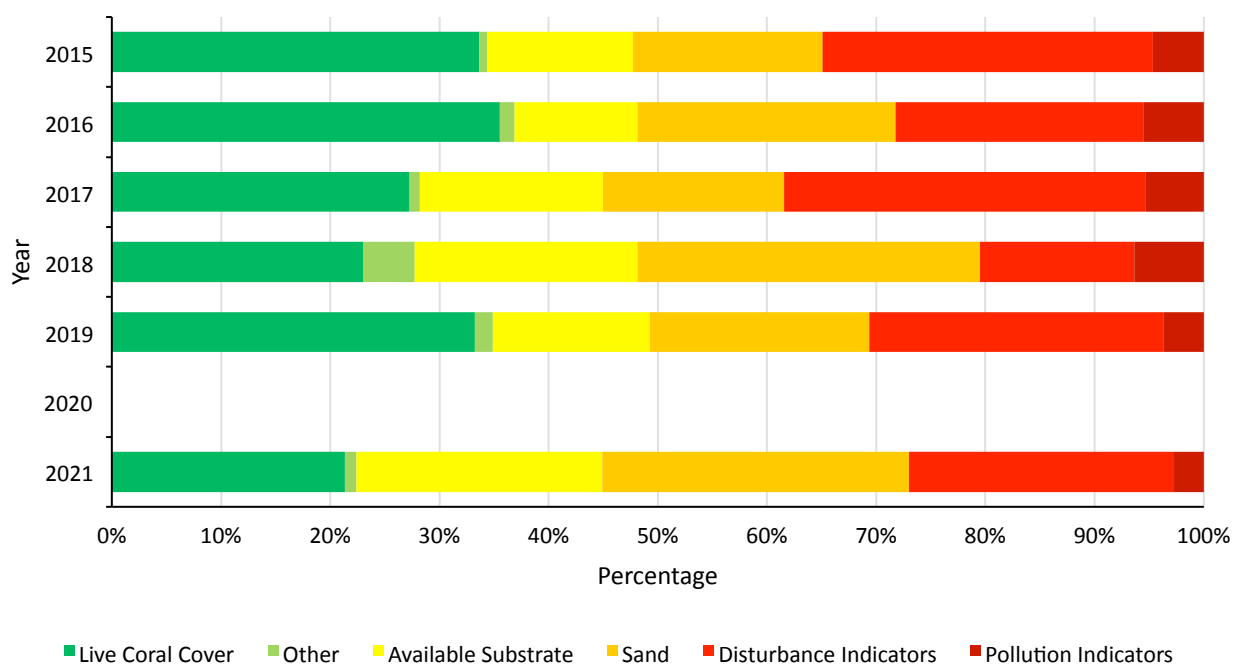
Reef Health at Mantanani



- The health of Mantanani reefs shows variation over the years. Overall, the reefs have deteriorated slightly, as reflected by the decrease in live coral cover.
- The decrease is likely due to physical damage caused by human activities and/or storm, as reflected by the increase in disturbance indicators and sand level. Increasing amount of sand can be an indication of disturbance as dead coral breaks off and is eroded into fine particles (sand) by wave action.
- Pollution indicators have decreased however they are showing an upward trend in the last 4 years.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery if human impacts are dealt with.

North Borneo – Matakong

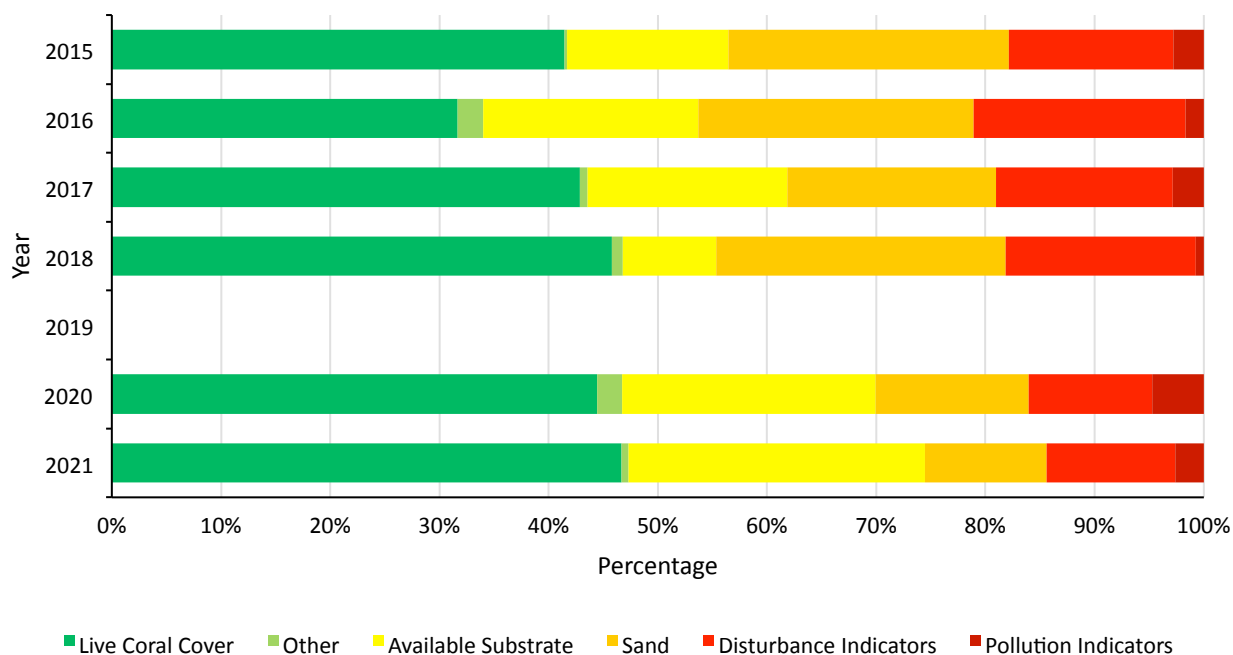
Reef Health at Matakong



- The health of Matakong reefs shows variation over the years. Overall, the reefs have deteriorated, as reflected by the decrease in live coral cover.
- The decrease is likely due to physical damage caused by human activities and/or storm, as reflected by the increase in sand level. Increasing amount of sand can be an indication of disturbance as dead coral breaks off and is eroded into fine particles (sand) by wave action.
- Disturbance indicators are high.
- Pollution indicators have decreased.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery if human impacts are dealt with.

North Borneo – Pulau Penyu

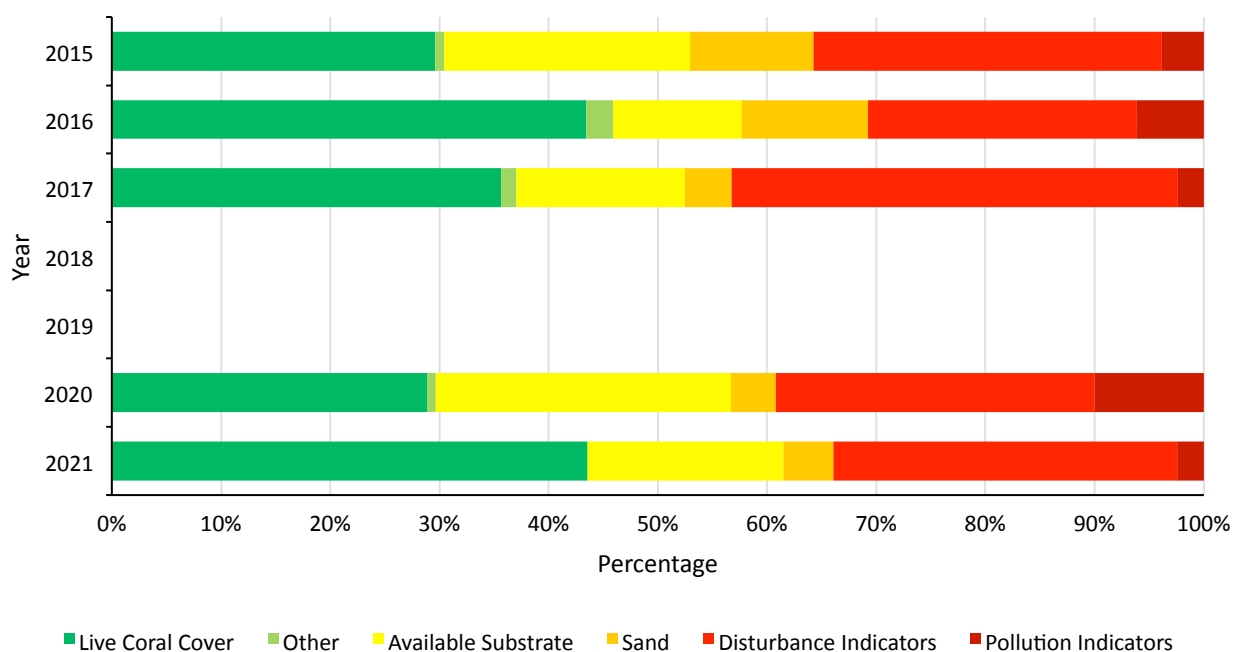
Reef Health at Pulau Penyu



- Pulau Penyu reefs have maintained in 'fair' condition.
- Disturbance indicators have decreased.
- Sand level has decreased over the years. Decreasing amount of sand can be an indication of decreasing disturbance.

North Borneo – Pulau Tiga

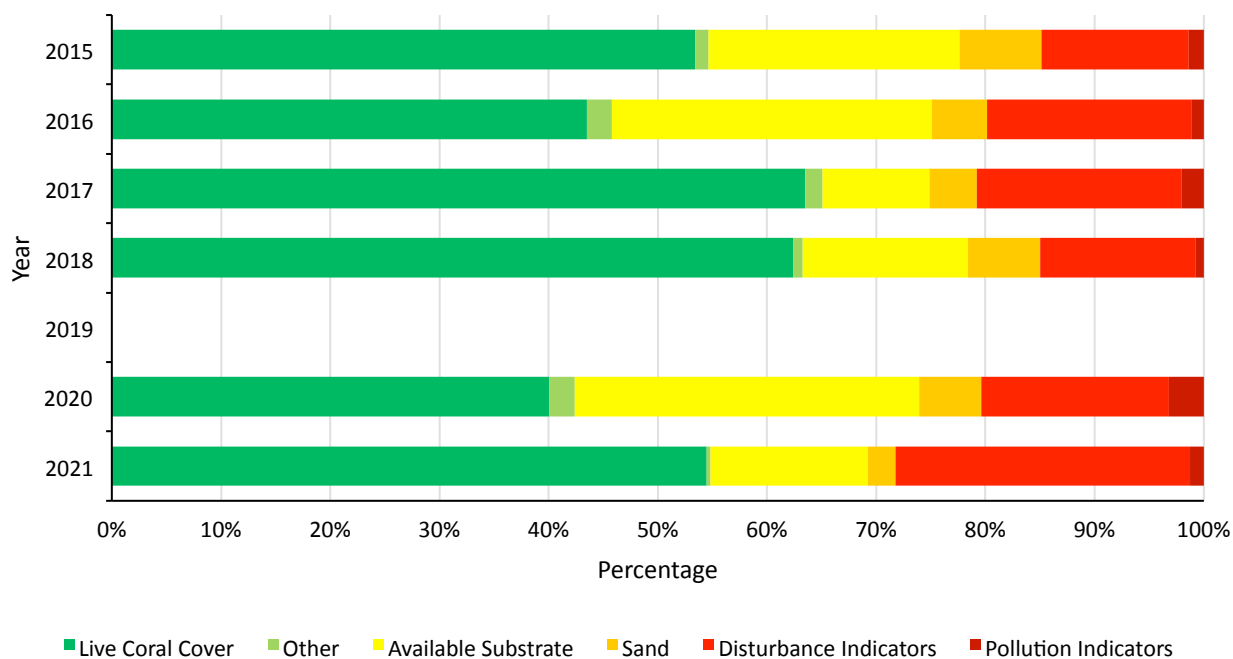
Reef Health at Pulau Tiga



- The health of Pulau Tiga reefs shows variation over the years.
- Disturbance indicators remain very high.

North Borneo – Sipadan

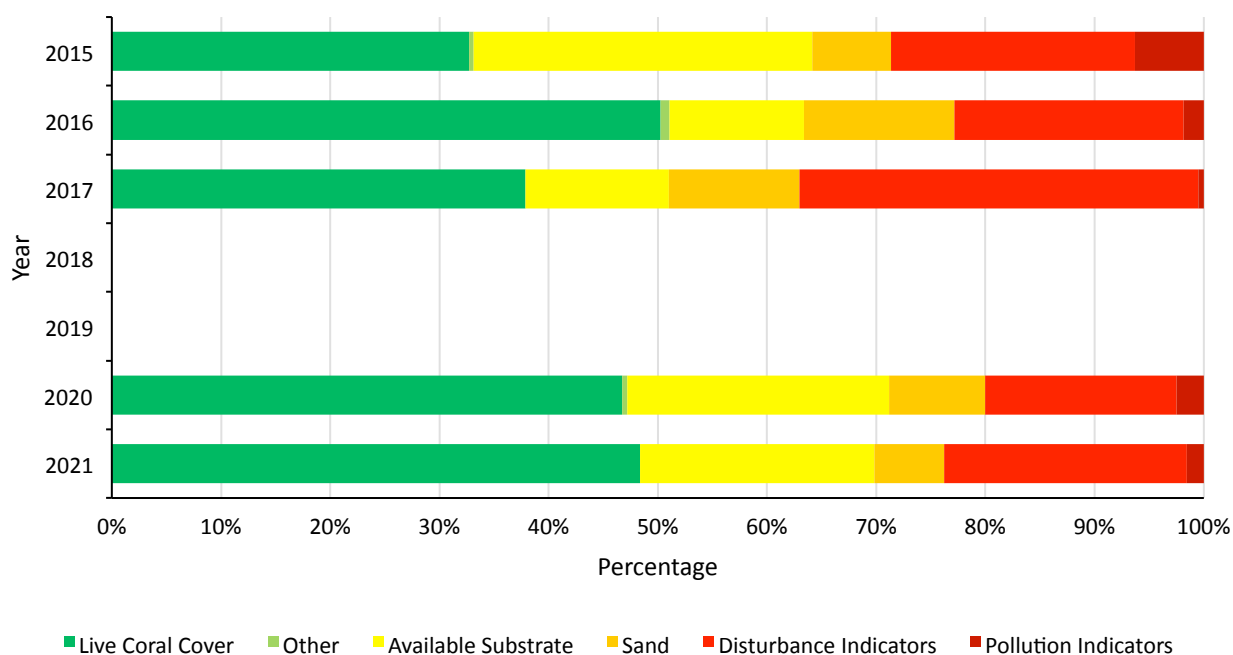
Reef Health at Sipadan



- The health of Sipadan reefs shows variation over the years.
- The spike in live coral cover in 2017 is considered to reflect the elimination of 4 sites that year, rather than an actual increase in live coral cover.
- Disturbance indicators show an upward trend.
- Pollution indicators remain low.

North Borneo – Tunku Abdul Rahman Park

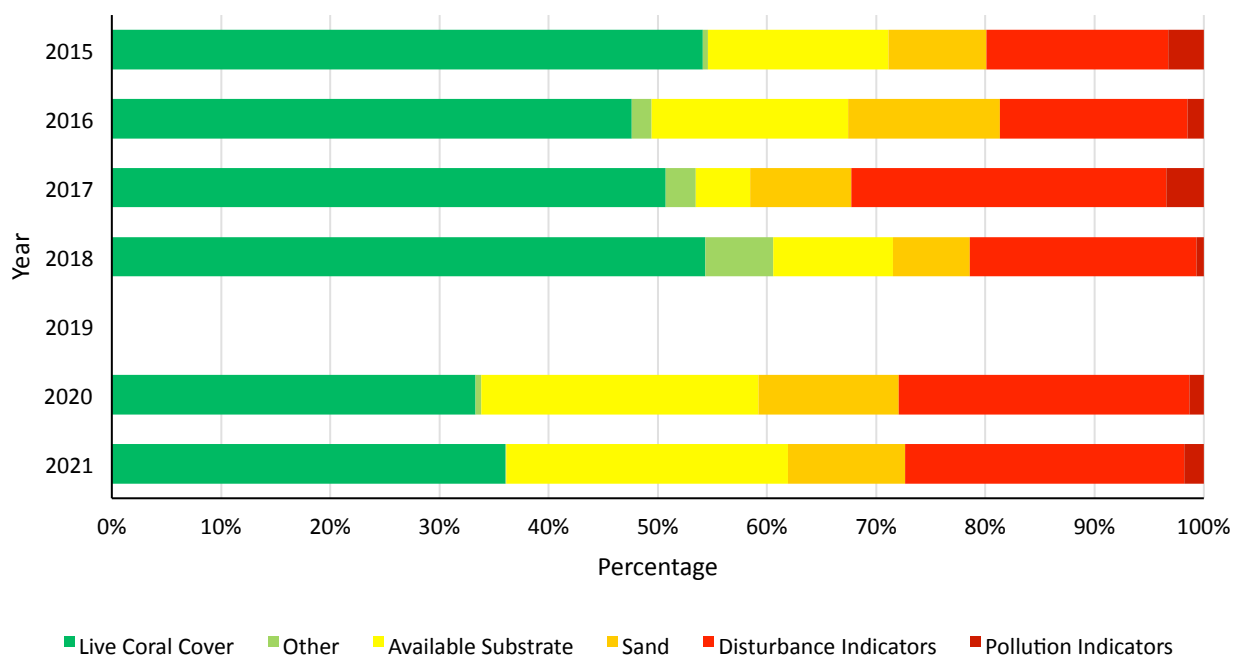
Reef Health at Tunku Abdul Rahman Park



- Tunku Abdul Rahman Park reefs have improved over the years, as reflected by the increase in live coral cover.
- Sand level has decreased over the years. Decreasing amount of sand can be an indication of decreasing disturbance.
- Pollution indicators has decreased.
- Reduced disturbance and pollution indicators allows Tunku Abdul Rahman Park reefs to improve.
- Available substrate for coral recruits to attach is very high, possible chance of continuous improvement of reefs health if human impacts are deal with.

North Borneo – Tun Sakaran Marine Park

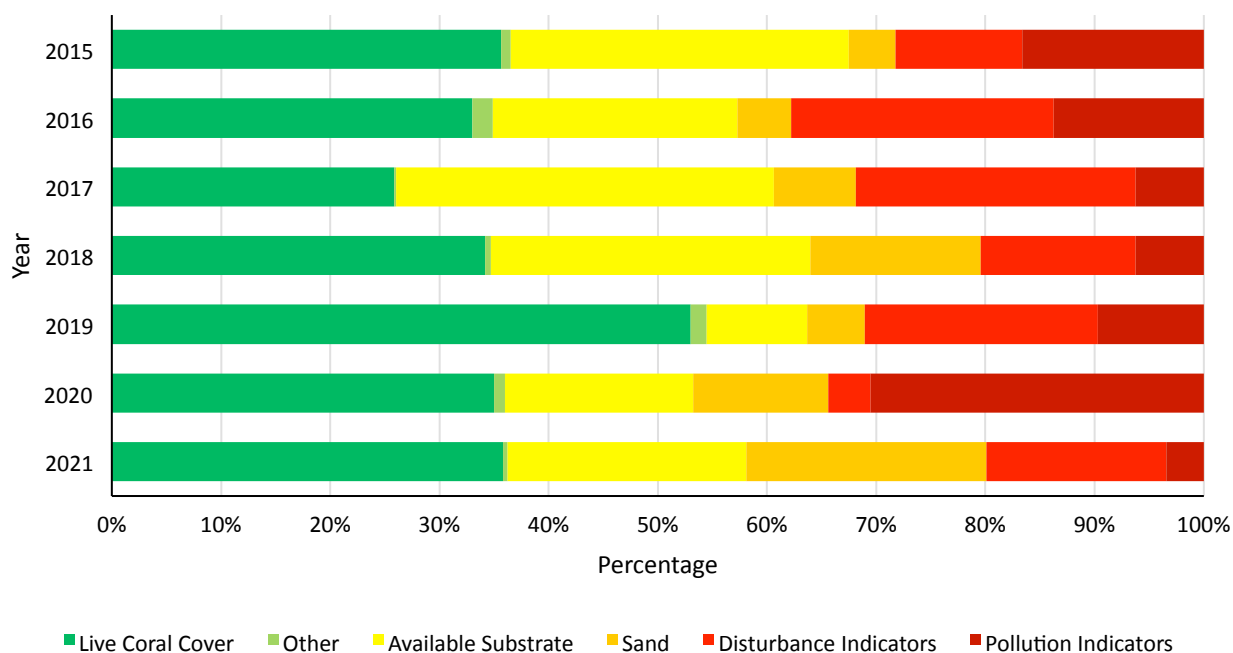
Reef Health at Tun Sakaran Marine Park



- Tun Sakaran Marine Park reefs have deteriorated from 'good' to 'fair' condition, as reflected by the decrease in live coral cover.
- The decrease in live coral cover is likely due to physical damage caused by human activities and/or storm, as reflected by the increase in disturbance indicators and sand level. Increasing amount of sand can be an indication of disturbance as dead coral breaks off and is eroded into fine particles (sand) by wave action.
- In 2021, the reefs show some recovery.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery if human impacts are deal with.

North Borneo – Usukan Cove

Reef Health at Usukan Cove



- Usukan Cove reefs have maintained in 'fair' condition.
- The decrease in live coral cover in 2017 is considered to reflect the elimination of 3 sites that year, rather than an actual decrease in live coral cover.
- The cause of the spike in live coral cover in 2019 is not known.
- Disturbance and pollution indicators show variation over the years.
- Sand level has increased. Increasing amount of sand can be an indication of disturbance as dead coral breaks off and is eroded into fine particles (sand) by wave action.

SUMMARY & RECOMMENDATIONS

Summary

The decline in a key coral reef health indicator, Live Coral Cover, that has been noticeable since 2015 has been reversed in 2021, with a slight increase in average Live Coral Cover for Malaysia.

Balanced against this, abundance of both fish and invertebrate indicators remains generally low suggesting either historical or on-going fishing pressure.

Numerous indicators of disturbance (e.g. Nutrient Indicator Algae, Recently Killed Coral, Crown of Thorns starfish) highlight on-going concerns about the trajectory of reef health. Both local impacts (such as sewage pollution) and global impacts (such as ocean warming) are visible in survey data.

While the slight improvement in LCC is to be welcomed, survey data suggest similar problems to those highlighted in previous survey reports: coral reef health is declining, fish and invertebrate populations are low, human impacts continue to increase, and climate change impacts are increasing.

Recommendations

2021 marks the second year of the COVID-19 pandemic that has affected economies around the world. Of particular relevance to coral reef health in Malaysia, 2021 also marks the second year in which tourist numbers have been dramatically lower than they have been in recent years due to international travel restrictions and local Movement Control Orders. Given that tourism impacts (physical damage, sewage and waste pollution) have been identified as a significant impact on coral reefs in Malaysia in previous years, the reduction in tourist numbers might be expected to have an impact on reef health. In fact, the data support this – to some degree:

- In all three ecoregions (Sunda Shelf, Malacca Strait and North Borneo) Live Coral Cover, a key indicator of coral reef health, has increased. This reverses a trend going back to 2015.
- Variations in pollution and disturbance indicators are less consistent but combined show a slight reduction. This perhaps suggests that overall, reefs have been less impacted by anthropogenic factors over the last 1-2 years.

These factors point to one possible reef conservation strategy: site closures. If LCC has increased after just 2 years of reduced tourism activity, it seems that short-term (1-2 years) temporary site closures could help reefs to recover, and should be one of the strategies considered by reef managers. Further testing and analysis is required to confirm this.

However, as noted repeatedly in this and previous annual reports, the averages mask a wide range. This reinforces the view that Reef Check data are most useful when used to assess individual sites or islands. Just one example serves to demonstrate this. Tioman, which has been consistently among the healthiest reef areas since the annual survey programme began in 2007, bucks the general trend for 2021. Live Coral Cover shows a reduction in 2021 – albeit still in the “good” classification; but this is the opposite of the general trend highlighted above.

One possible cause of this is that Tioman reported high Crown of Thorns (COT) abundance in 2021. It is generally accepted that a healthy coral reef can support a population of 0.2-0.3 individuals per 100m², Tioman recorded 1.79. High COT numbers in turn reflect poor water quality and this suggests a specific remedy for Tioman – improve sewage treatment.

With these broad trends in mind, we recommend the following actions to protect Malaysia's coral reefs.

Location-based action plans

Review survey data and develop action plans to address the specific threats identified in each reef area. Many of the impacts will be the same in different reef areas (e.g. physical impacts by tourists in Peninsular Malaysia East coast sites). But it is likely that a different mix of responses will be required to address specific challenges in different reef areas.

These action plans should be incorporated in to Management Plans and management agency programmes.

Resilience

Implement programmes to build reef resilience in all reef areas. The three pillars of resilience are:

- Water quality
- Herbivory
- Physical impacts.

Each of these should be addressed on a location-by-location basis to ensure optimum conditions for building reef resilience.

These three resilience characteristics should be included into the location-based action plans to ensure that short term impacts are being dealt with at the same time as building long-term reef resilience.

Local stakeholder participation

There is abundant evidence to support the case for local stakeholder participation in management. Simply put, stakeholders who are involved in decision making are engaged and more likely to cooperate with management needs, regulations and conservation activities.

Our own experience on Tioman island supports this: the Tioman Marine Conservation Group now has representation in all seven villages on the island; members regularly participate in a range of conservation activities including ghost net removal, reef restoration, COT removal and mooring buoy maintenance. All these activities contribute to building resilience. And more importantly, the members feel engaged in reef conservation.

We strongly recommend strengthening the existing Reef Care programme in Peninsular Malaysia to empower local stakeholder participation in management and conservation actions. In particular, an improved institutional structure is required that formalises community role in management and provides for improved communication between all stakeholders (e.g. a Reef Care committee whose members represent management agencies, local communities and tourism operators). We also recommend replicating a similar approach in East Malaysia.

CONCLUSION

After another year of movement restrictions and low tourism activity, there are some indications that reef health can recover if the impacts and disturbances resulting from high tourist numbers are reduced, or eliminated. Live Coral Cover has improved for the first time since 2015.

This reinforces previous suggestions that we need to review our approach to tourism, and to reef conservation. A recent study by Tourism Malaysia highlighted several trends indicating that tourism preferences are changing – moving away from mass tourism to more tailored experiences, with safety and hygiene high on the list of priorities. This reflects trends in the international market.

Mass tourism affects ecosystems *and* communities. The industry is changing; management needs to change to reflect this, to ensure reefs are as pristine as possible, to provide opportunities for local stakeholders to participate, and to build resilience against the future impacts of climate change.

As we stated in last year's report: all stakeholders need to get together and discuss these challenges and derive solutions that benefit us all. We all rely on coral reefs, and the ecosystem services they provide; we all have a role in protecting them.

ACKNOWLEDGEMENTS

Once again this year, the COVID-19 pandemic hit us hard, with interstate travel and SCUBA diving activities banned for much of the year. Despite this, we have been able to conduct the annual survey programme, with only a small number of sites missed.



We are very grateful to Department of Fisheries for stepping in and taking the responsibility to carry out Reef Check surveys around Peninsular Malaysia. If not for them, there would be a lot of missing data for Peninsular Malaysia.



We are also grateful to Sabah Parks for their continuous efforts in carrying out Reef Check surveys at Sabah Parks islands.

Reef Check Malaysia cannot work in isolation and we continue to maintain a close working relationship with the Marine Parks section of the Department of Fisheries and Sabah Parks, both of whom make significant contributions to this annual survey programme by conducting surveys at some of the sites, as well as assisting in reef rehabilitation programmes and school education projects.

We are grateful to the following sponsors for supporting the 2021 survey programme and conservation efforts:



In addition, we work with our:

Board of Trustees who provides advice on governance and fund raising

- Lim Jit Cheng
- Kevin Hiew
- Ruth Yeoh
- Datuk Hiswani Harun

Scientific Advisory Council to ensure our work is scientifically robust

- Affendi Yang Amri (UM)
- Jillian Ooi, (UM)
- Gopinath Nagaraj (FanLi Consulting)

We are grateful to them for their guidance and expertise.

Particular thanks go to:



They conduct surveys, fully or partially sponsor surveys, and/or provide facilities for and promote Reef Check EcoDiver programme.

Finally, thanks to the many EcoDivers who give up their time to help us with surveys. Our small team could not possibly manage all those surveys ourselves, and we really appreciate your efforts. To you, and the many other volunteers who have helped in our work, we are grateful.

- | | |
|---|------------------------------|
| • Ghazali bin Abu Bakar | • Izzat Hakimi bin A'arizu |
| • Kamarul Zaman bin Awang | • Jurin Makapuh |
| • Mohamad Fatihi bin Abdullah | • Mohd Nur Aiman bin Suhaimi |
| • Tengku Husin Tengku Kadir | • Mohd Syarin bin Moktar |
| • Idris bin Muda | • Tanya Leibrick |
| • Muhammad Rafiq Hakimi bin Mohd Noor | • Yusri bin Mohamed Noor |
| • Zaki bin Yahya | • Zaharin bin Baharuddin |
| • Mohammad Fidtri bin Mamat | • Farhana Azmi |
| • Mohammad Khairi bin Mohamad Zukri | • Jeethvendra |
| • Huzaifah bin Jaafar | • Tommy Cheo Seng Kong |
| • Ton Abdullah | • Mohd Khairol |
| • Sharuhuzilla bin Ngah | • Mohd Fairul Hafiz Bin Saik |
| • Magenthiran | • Mad Rinta Parintamin |
| • Izarenah Md Repin | • Rojaniah Jawalani |
| • Rasidah bt Razali | • Mariam Syarmilah Musa |
| • Mohd Hazim bin Mohd Zamri | • Rizman Bin Zulkifli |
| • Muhd Hazwan Rasyid B. Mohd Sabri | • Muhammad Yusri Bin Misari |
| • Suhaimi Bin Ishak | • Mohd Nara bin Hj Ahmad |
| • Muhammad Ammar Syukran Bin Mohd Kamaludin | • Jalil Mapait |
| • Jennifer Pippin | • Moksidi Pistino |
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| • Amier Hamzah bin Abdul Rahim | • Juneidy Bahai |
| • Abu Abdul Rashid bin Ali | • Claudius Jalani |
| • Asyraf bin Md Shah | • Joe Michael |
| | • Davies Spiji |



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- Mohd Fadzlee bin Salih
- Jamadi Hassan

- Roslee Abd Karim
- Hairol Riman
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- Silver Sapok
- Kamin Baluat

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APPENDIX 1 : SURVEY SITES

Sunda Shelf

Site Name	Island	Coordinate
Pirates Reef	Tioman	2 49.428 N 104 09.445 E
Renggis	Tioman	2 48.594 N 104 08.161 E
Fan Canyon	Tioman	2 54.650 N 104 06.753 E
Soyak South	Tioman	2 52.480 N 104 08.810 E
Soyak North	Tioman	2 52.558 N 104 08.828 E
Batu Malang	Tioman	2 54.139 N 104 06.148 E
Tekek House Reef	Tioman	2 48.960 N 104 09.062 E
Chebeh	Tioman	2 55.946 N 104 05.814 E
Sepoi	Tioman	2 53.883 N 104 03.100 E
Teluk Kador	Tioman	2 54.891 N 104 06.507 E
Tumuk	Tioman	2 47.581 N 104 07.335 E
Labas	Tioman	2 53.318 N 104 03.920 E
Teluk Dalam	Tioman	2 52.456 N 104 11.254 E
Jahat East	Tioman	2 40.127 N 104 10.518 E
Munjor South	Tioman	2 44.492 N 104 13.068 E
Nayak	Tioman	2 46.758 N 104 12.760 E
Saing	Tioman	2 45.502 N 104 11.950 E
Batu Nipah	Tioman	2 43.928 N 104 08.125 E
Heritage Row	Bidong/Yu	5 36.922 N 103 03.412 E
Pasir Tenggara	Bidong/Yu	5 36.607 N 103 03.780 E
P. Karah	Bidong/Yu	5 35.935 N 103 03.851 E
P. Tengkorak	Bidong/Yu	5 39.967 N 103 04.277 E
P. Yu Besar	Bidong/Yu	5 38.615 N 103 09.063 E
P. Yu Kecil	Bidong/Yu	5 37.533 N 103 09.570 E
Coral Garden 1	Kapas	5 14.113 N 103 15.678 E
Coral Garden 3	Kapas	5 14.149 N 103 15.782 E
Silent Reef	Kapas	5 13.785 N 103 16.079 E
Teluk Jawa	Kapas	5 12.526 N 103 16.165 E
Jellyfish City	Kapas	5 13.468 N 103 15.658 E
Batu Layar	Perhentian	5 54.722 N 102 44.693 E
Batu Nisan	Perhentian	5 55.259 N 102 43.536 E
Batu Tabir	Perhentian	5 56.345 N 102 43.321 E
Tukas Laut	Perhentian	5 53.162 N 102 46.216 E
Tiga Ruang	Perhentian	5 54.867 N 102 45.244 E
D' Lagoon	Perhentian	5 55.927 N 102 43.395 E
P. Rawa	Perhentian	5 57.777 N 102 40.833 E
Sea Bell	Perhentian	5 54.636 N 102 42.589 E
Shark Point	Perhentian	5 53.044 N 102 44.821 E
Tanjung Basi	Perhentian	5 55.387 N 102 45.518 E
Teluk Mat Delah	Redang	5 47.970 N 103 01.017 E
Chagar Hutang East	Redang	5 49.038 N 103 00.597 E
P. Kerengga Besar	Redang	5 45.261 N 103 01.737 E

P. Kerengga Kecil	Redang	5 45.519 N 103 01.751 E
P. Lima Southern Tip	Redang	5 46.397 N 103 03.553 E
P. Paku Besar	Redang	5 46.777 N 103 02.557 E
P. Paku Kecil	Redang	5 46.305 N 103 02.338 E
P. Pinang Marine Park Centre	Redang	5 44.814 N 102 59.987 E
Pasir Akar	Redang	5 44.398 N 102 59.955 E
Redang Kalong HR	Redang	5 45.660 N 103 01.584 E
Terumbu Kili	Redang	5 43.928 N 102 59.825 E
Mak Simpan	Redang	5 47.302 N 102 59.556 E
Freshwater Bay	Tenggol	4 48.546 N 103 40.669 E
Gua Rajawali	Tenggol	4 48.768 N 103 40.556 E
Pasir Tenggara	Tenggol	4 48.021 N 103 40.456 E
Rajawali Reef	Tenggol	4 49.037 N 103 40.755 E
Turtle Point	Tenggol	4 48.364 N 103 40.468 E
Teluk Rajawali	Tenggol	4 48.931 N 103 40.824 E
Atlantis Bay	Aur/Dayang	2 28.271 N 104 30.633 E
Pulau Lang	Aur/Dayang	2 27.594 N 104 29.358 E
Teluk Meriam	Aur/Dayang	2 26.509 N 104 30.571 E
Teluk Teluran	Aur/Dayang	2 27.617 N 104 31.587 E
Teluk Batu Kapal	Aur/Dayang	2 28.368 N 104 30.481 E
Teluk Jawa	Aur/Dayang	2 28.651 N 104 30.271 E
Bumphead Bay	Pemanggil	2 35.066 N 104 20.180 E
Lobster Bay	Pemanggil	2 34.237 N 104 19.306 E
Pemanggil Village South	Pemanggil	2 34.761 N 104 18.945 E
Tridacna Bay	Pemanggil	2 35.790 N 104 19.588 E
Palenting	Pulau Besar	2 27.408 N 103 58.298 E
Rapang	Pulau Besar	2 27.503 N 203 58.758 E
Teluk Buluh	Pulau Besar	2 26.543 N 103 58.385 E
Teluk Kalih	Pulau Besar	2 25.398 N 103 59.410 E
Teluk Meriam	Pulau Besar	2 26.672 N 103 59.309 E
Teluk Meriam South	Pulau Besar	2 26.127 N 103 59.610 E
Mirage	Pulau Besar	2 25.823 N 103 58.718 E
Buntut Meriam	Sibu	2 13.860 N 104 03.130 E
Malang Acha	Sibu	2 11.040 N 104 06.409 E
Beach 3	Sibu	2 11.268 N 104 05.888 E
Sibu Hujung	Sibu	2 10.374 N 104 06.721 E
Sibu Kukus	Sibu	2 10.696 N 104 06.553 E
The Coconut	Sibu	2 13.567 N 104 03.184 E
P. Mentinggi	Tinggi	2 16.405 N 104 06.940 E
P. Nanga	Tinggi	2 16.274 N 104 07.640 E
P. Ibol	Tinggi	2 18.183 N 104 08.935 E
P. Tanjung Gua Subang	Tinggi	2 18.792 N 104 07.552 E
P. Lima	Pulau Lima	2 13.099 N 104 08.990 E
Tokong Sanggul	Pulau Lima	2 13.377 N 104 08.082 E



Malacca Strait

Site Name	Island	Coordinate
Coral Garden	Payar	6 03.371 N 100 02.157 E
Singapore Bay	Payar	6 03.639 N 100 02.472 E
Langkawi Coral	Payar	6 03.951 N 100 02.606 E
Kaca	Payar	6 04.389 N 100 03.444 E
Lembu	Payar	6 04.293 N 100 03.067 E
Pantai Labuan	Malacca	2 06.546 N 102 19.357 E
Pulau Lalang	Malacca	2 07.259 N 102 18.974 E
Pulau Undan 1	Malacca	2 02.944 N 102 20.021 E
Undan Jetty	Malacca	2 02.869 N 102 20.119 E
Kem Askar	Port Dickson	2 25.619 N 101 51.331 E
Tanjung Tuan	Port Dickson	2 24.841 N 101 51.041 E

North Borneo

Site Name	Island	Coordinate
Kapalai Rock	Kapalai	4 12.615 N 118 40.797 E
Great Wall	Kapalai	4 13.767 N 118 40.800 E
Little Okinawa	Kapalai	4 12.850 N 118 40.533 E
Cleaning Station	Kapalai	4 13.517 N 118 41.283 E
Lost World	Kapalai	4 12.093 N 118 41.392 E
Siu Siu Point	Kapalai	4 13.087 N 118 40.313 E
House Reef	Lahad Datu	4 58.027 N 118 15.841 E
Cabbage Reef	Lahad Datu	4 56.927 N 118 15.470 E
Paradise	Lahad Datu	4 56.548 N 118 17.637 E
Lam's Point	Lahad Datu	4 56.275 N 118 16.464 E
Nemo Garden	Lahad Datu	4 56.494 N 118 16.945 E
Fish Eyes	Lahad Datu	4 57.782 N 118 15.165 E
Mid Reef	Lahad Datu	4 54.740 N 118 15.256 E
Small Reef	Lahad Datu	4 54.444 N 118 14.595 E
Adam's Point	Lahad Datu	4 57.052 N 118 15.473 E
Ira's Reef	Lahad Datu	4 55.412 N 118 15.363 E
Light House	Lahad Datu	4 56.922 N 118 15.076 E
P. Burung	Lahad Datu	4 55.439 N 118 16.003 E
P. Laila	Lahad Datu	4 55.811 N 118 13.711 E
P. Tabun	Lahad Datu	4 55.246 N 118 12.076 E
Tumunong Hallo	Lahad Datu	4 54.510 N 118 10.644 E
Froggie Fort	Lankayan	6 30.806 N 117 54.337 E
Goby Rock	Lankayan	6 28.745 N 117 53.448 E
Ken's Rock	Lankayan	6 30.393 N 117 55.651 E
Mel's Rock	Lankayan	6 29.140 N 117 53.584 E
Reef 38	Lankayan	6 32.619 N 117 55.201 E
Veron	Lankayan	6 31.259 N 117 54.944 E
Kampung Point	Larapan	4 33.319 N 118 35.396 E
Point 1	Larapan	4 33.614 N 118 36.910 E
Point 2	Larapan	4 33.586 N 118 36.910 E
Point 3	Larapan	4 33.878 N 118 35.592 E
SMEE 1	Larapan	4 34.453 N 118 36.254 E

SMEE 2	Larapan	4 32.947 N 118 35.949 E
Eel Garden	Mabul	4 13.883 N 118 38.017 E
Ribbon Valley	Mabul	4 14.046 N 118 38.255 E
Stingray City	Mabul	4 14.222 N 118 37.641 E
Panglima	Mabul	4 14.922 N 118 37.529 E
Paradise	Mabul	4 14.989 N 118 37.830 E
Scuba Junkie House Reef	Mabul	4 14.938 N 118 37.925 E
Sahara	Mantanani	6 43.295 N 116 20.905 E
Abalone	Mantanani	6 43.207 N 116 22.105 E
Police Gate	Mantanani	6 42.730 N 116 20.313 E
Italian Place	Mantanani	6 42.308 N 116 19.232 E
Riza Garden	Mantanani	6 42.136 N 116 21.812 E
Linggisan	Mantanani	6 42.832 N 116 20.084 E
Stingray Point	Mantanani	6 42.764 N 116 19.771 E
Indian Brothers	Mantanani	6 43.191 N 116 20.454 E
Mari Mari House Reef	Mantanani	6 42.396 N 116 19.275 E
Coral Reef	Mantanani	6 42.389 N 116 20.840 E
Kolam	Mantanani	6 43.930 N 116 21.567 E
South East Point	Mantanani	6 42.454 N 116 22.329 E
Cahaya Way	Mataking	4 30.252 N 118 56.504 E
Coral Garden	Mataking	4 34.212 N 118 57.415 E
Mataking House Reef	Mataking	4 34.758 N 118 56.415 E
Pandanan Bay	Mataking	4 34.907 N 118 54.795 E
Stingray City	Mataking	4 33.359 N 118 55.627 E
Sweetlips Rock	Mataking	4 35.960 N 118 56.454 E
Pulau Bakungan 1	Pulau Penyu	6 10.192 N 118 06.538 E
Pulau Bakungan 2	Pulau Penyu	6 09.805 N 118 06.483 E
Pulau Gulisan	Pulau Penyu	6 09.268 N 118 03.512 E
Selingan	Pulau Penyu	6 10.813 N 118 03.803 E
Lutjanus	Pulau Tiga	5 43.213 N 115 38.688 E
Larai-Larai	Pulau Tiga	5 43.017 N 115 38.097 E
Tanjung Putri	Pulau Tiga	5 42.517 N 115 39.195 E
Tagi Beach	Pulau Tiga	5 42.768 N 115 40.347 E
Senanggol	Pulau Tiga	5 42.482 N 115 41.958 E
Mid Reef	Pulau Tiga	5 42.302 N 115 37.705 E
Larai-Larai Midreef	Pulau Tiga	5 43.779 N 115 36.477 E
Barracuda Point	Sipadan	4 07.130 N 118 37.745 E
Coral Garden	Sipadan	4 06.342 N 118 37.722 E
Drop Off	Sipadan	4 07.092 N 118 37.675 E
Hanging Garden	Sipadan	4 06.703 N 118 37.495 E
Lobster Lair	Sipadan	4 06.557 N 118 37.540 E
Mid Reef	Sipadan	4 06.812 N 118 38.158 E
South Point	Sipadan	4 06.258 N 118 38.110 E
Staghorn Crest	Sipadan	4 06.257 N 118 37.895 E
Turtle Patch	Sipadan	4 06.450 N 118 38.177 E
White Tip	Sipadan	4 07.137 N 118 38.055 E
West Ridge North	Sipadan	4 06.910 N 118 37.487 E
Base Camp	Tunku Abdul Rahman Park	6 00.491 N 116 01.322 E
Mamutik	Tunku Abdul Rahman Park	5 58.067 N 116 00.756 E



Manukan West	Tunku Abdul Rahman Park	5 58.246 N 115 59.659 E
Mid Reef	Tunku Abdul Rahman Park	5 58.433 N 116 00.750 E
Police Beach	Tunku Abdul Rahman Park	6 02.483 N 116 01.183 E
Sapi	Tunku Abdul Rahman Park	6 00.479 N 116 00.190 E
Sulug	Tunku Abdul Rahman Park	5 57.547 N 115 59.464 E
Tanjung Wokong	Tunku Abdul Rahman Park	5 59.433 N 116 02.417 E
Kapikan Reef	Tun Sakaran Marine Park	4 37.698 N 118 50.112 E
Mantabuan	Tun Sakaran Marine Park	4 37.933 N 118 47.798 E
Ribbon Reef	Tun Sakaran Marine Park	4 36.135 N 118 46.090 E
South Rim	Tun Sakaran Marine Park	4 34.078 N 118 45.498 E
Sibuan	Tun Sakaran Marine Park	4 39.154 N 118 39.884 E
Tanjung Kenangan	Tun Sakaran Marine Park	4 35.127 N 118 47.155 E
Uban-Uban	Usukan Cove	6 23.442 N 116 19.342 E
Pandan-Pandan	Usukan Cove	6 21.265 N 116 18.666 E
Poduko	Usukan Cove	6 22.322 N 116 19.438 E
Lok Liak	Usukan Cove	6 22.126 N 116 19.101 E
Keramat	Usukan Cove	6 23.635 N 116 19.637 E
Usukan Cove Lodge	Usukan Cove	6 22.455 N 116 20.586 E



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