Reef Check
MALAYSIA

Jabatan Perikanan Malaysia

THE BOARD OF TRUSTEES OF THE SABAH PARKS

Status of Coral Reefs in Malaysia 2022

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Executive Summary

1. This report presents data from coral reef surveys conducted in Malaysia during 2022 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 323 sites were surveyed in 2022 (2021: 206): 159 in Sunda Shelf eco-region; 23 in Malacca Strait eco-region; and 141 in North Borneo eco-region. The surveys are a continuation of a successful National Reef Check Survey Programme that has now run for 16 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 47.83%. This is a slight increase on 2022 (2021: 44.26%) and continues a trend noted in last year's surveys, reversing a decline that started in 2015. It is likely that this improvement is at least partly due to the huge reduction in tourist visitors to coral reefs during the Covid pandemic. Further monitoring is required to confirm this observation which, if supported by data, might suggest that temporary 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 coastal communities in Malaysia and are an important tourism product. Simple steps such as reducing unsustainable 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 resilience and 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.

1. Introduction

Coral reefs are an important ecological and economic resource in many countries around the world, providing a range of valuable ecosystem services to millions of people. Coral reefs provide jobs, food and coastal protection, among other benefits, to over 100 million people in South East Asia. They are the most diverse marine ecosystems on earth. Despite being recognised for their economic and aesthetic value, coral reefs are being damaged by a variety of both local and global threats.

- The 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 because 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

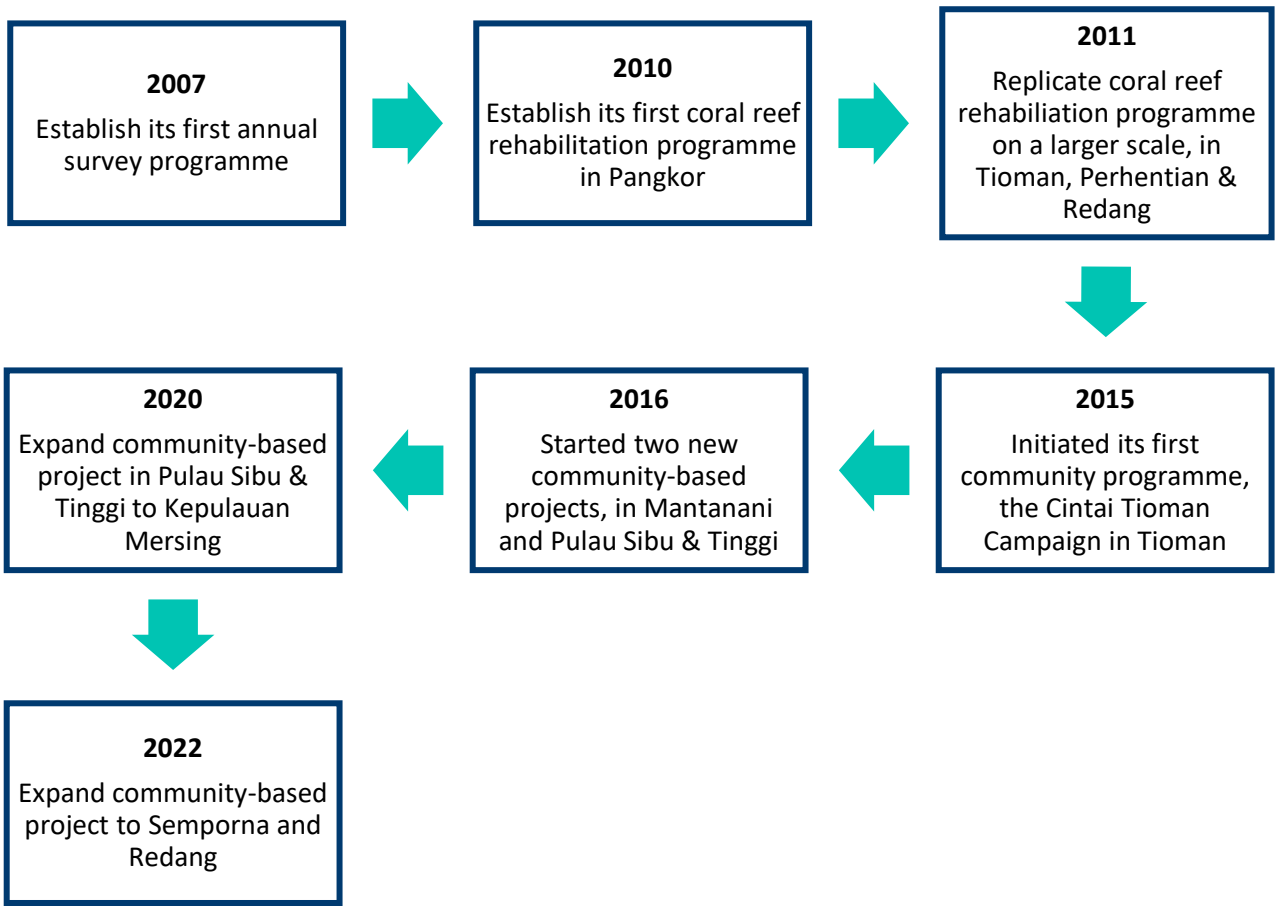
In Malaysia, the Department of Fisheries Malaysia (DoFM), Sabah Parks and Sarawak Forestry are tasked with managing these local threats to their protected reef areas. Meanwhile, Reef Check Malaysia (RCM) works with various stakeholders to conserve coral reefs. Since it was registered in 2007, RCM has established an annual, national coral reef monitoring programme. This report presents the results of coral reef surveys conducted in Malaysia during 2022, the 16th year of surveys.

2. 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 16 years, RCM has trained over 1000 divers to conduct reef surveys at over 200 permanent monitoring sites on coral reefs off the coast of Peninsular Malaysia and at sites around East Malaysia. RCM is also active in education and awareness programmes.



This report is the 16th annual Malaysia coral reef survey report and details the results of Reef Check surveys carried out during 2022. 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 323 sites were surveyed, 159 of which were in Sunda Shelf region, 23 in Malacca Strait region and 141 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 Department of Fisheries Malaysia (DoFM) and RCM's volunteers. In North Borneo region, a large percentage of the surveys were conducted by RCM together with Sabah Parks, RCM's volunteers and a few dive operators. 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 100m transect line is deployed and along it four 20m transects are surveyed, each separated by 5m, which provides 4 replicates per transect (8 per complete survey) for statistical analysis (see figure below).

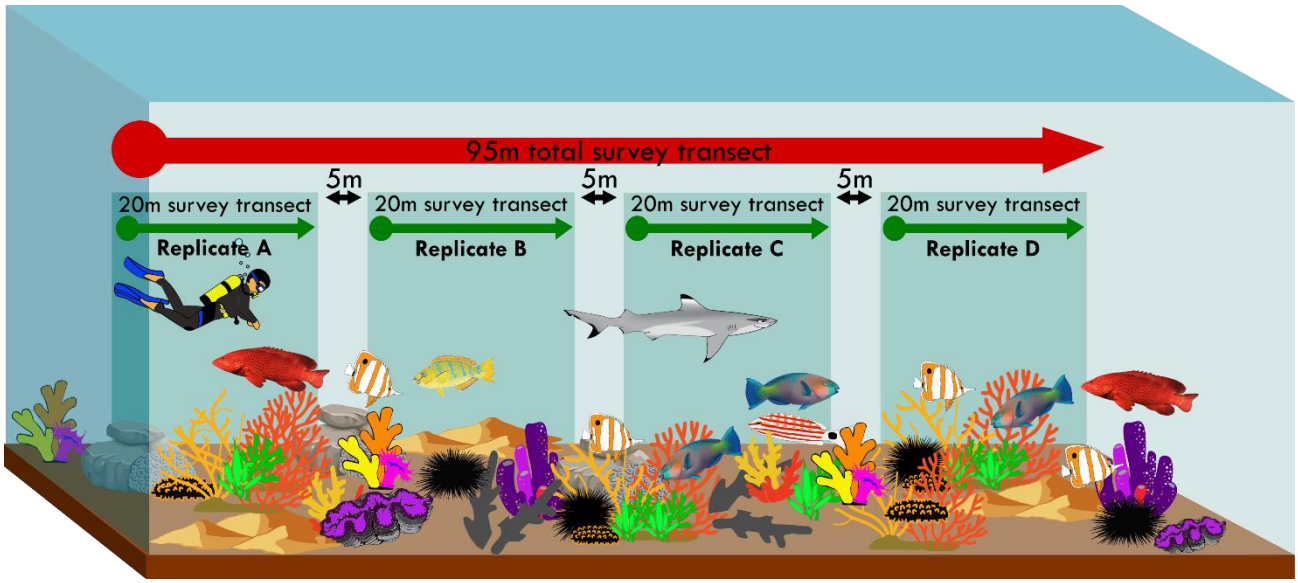


Figure showing the transect – the basic idea of the Reef Check protocol is to swim along a 100m measuring tape (transect) and count organisms in four 20m long transect.

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

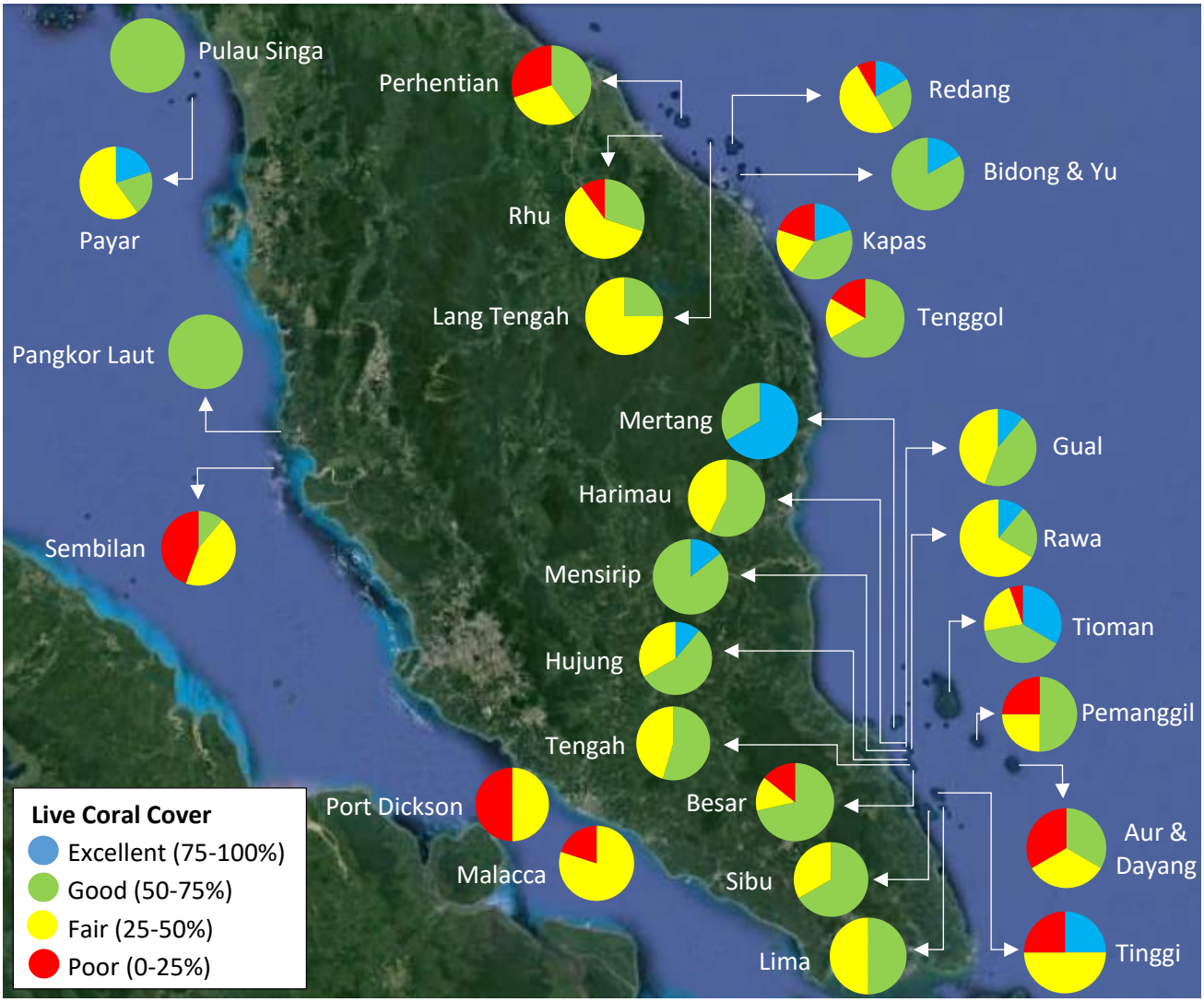
Assess the damage to coral from bleaching, anchoring, destructive fishing, corallivores (such as *Drupella* snail or Crown-of-Thorns starfish), and trash.

3. Survey Results & Analysis

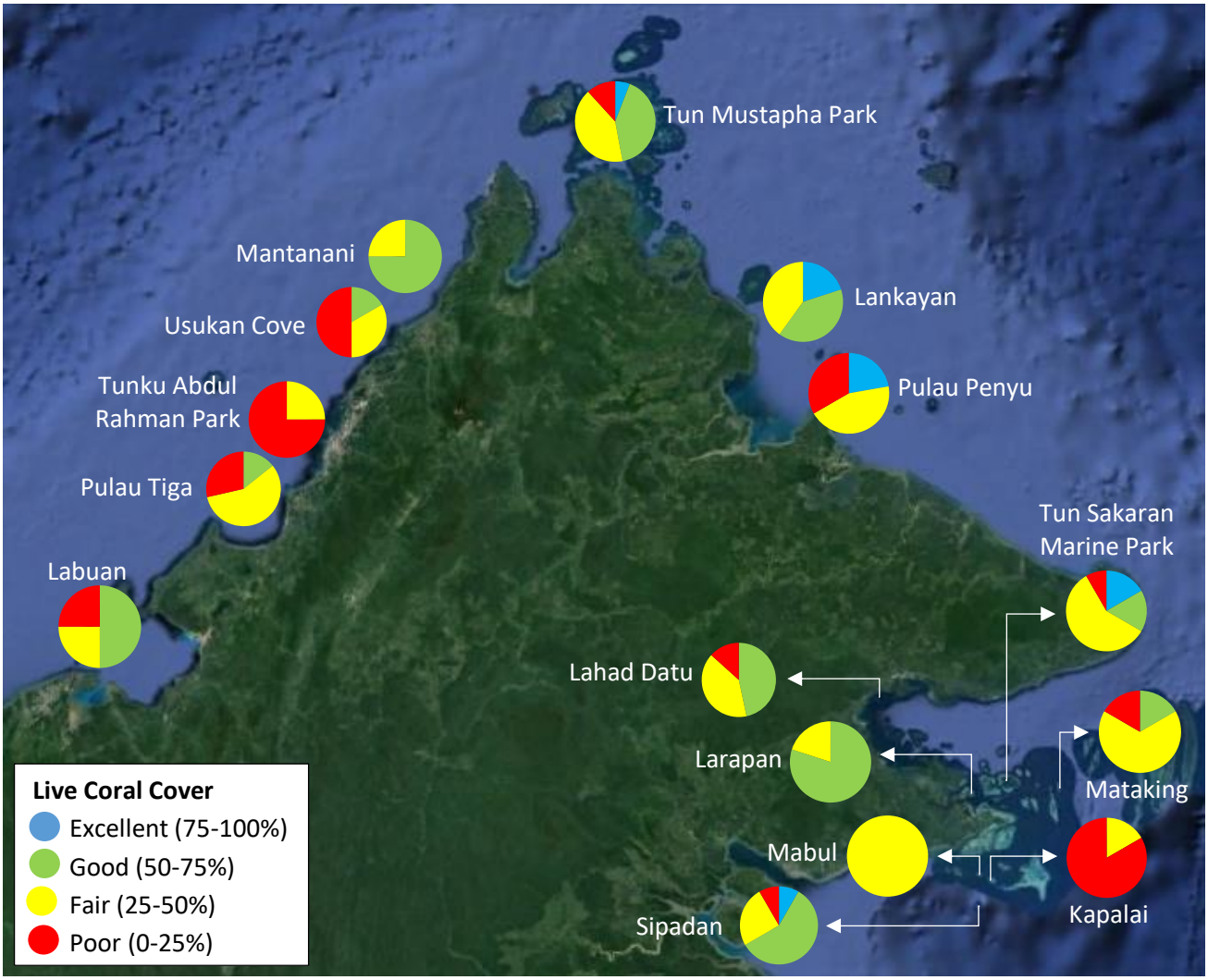
This section presents the results from surveys conducted in 2022, providing an overview of the condition of coral reefs in Malaysia as a whole, and a detailed analysis of the health of reefs in areas surveyed.

Malaysia

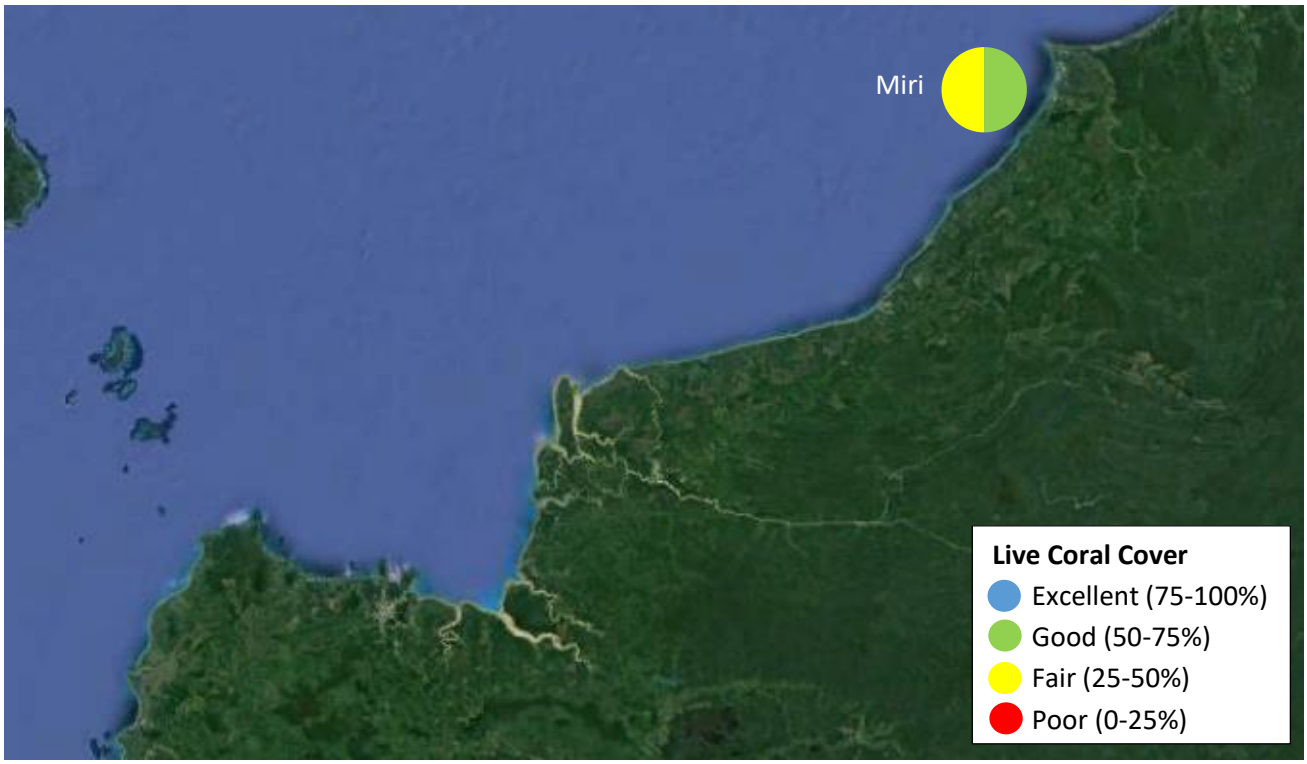
The results from all 323 surveys were compiled to provide an overview of the status of coral reefs around Malaysia. Sites surveyed off Peninsular Malaysia are mostly islands which are important tourist destinations while the islands and reefs off Sabah are less frequently visited but face other problems such as destructive fishing practices.



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

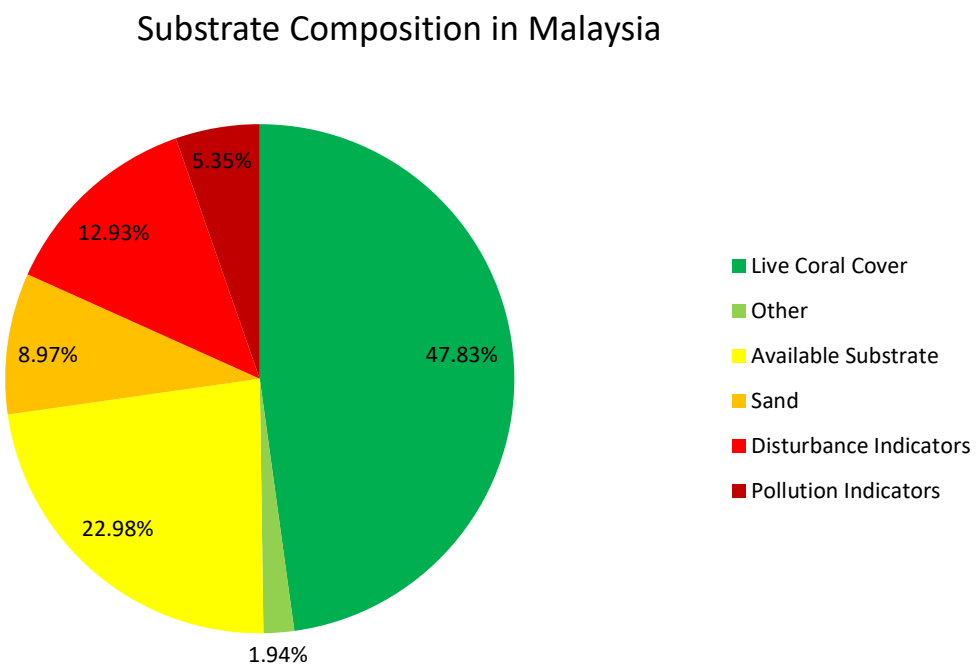


Map showing the reef health composition of each survey location in Sabah based on Live Coral Cover.



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

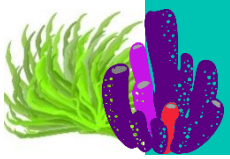
Coral Cover and Health



- On average, Malaysian reefs are in 'Fair' condition.
- Mean hard coral (reef builder) cover is 44.26%.
- Available substrate for coral recruits to attach is very high.
- Indicators for disturbance are high.

INDICATORS FOR DISTURBANCE

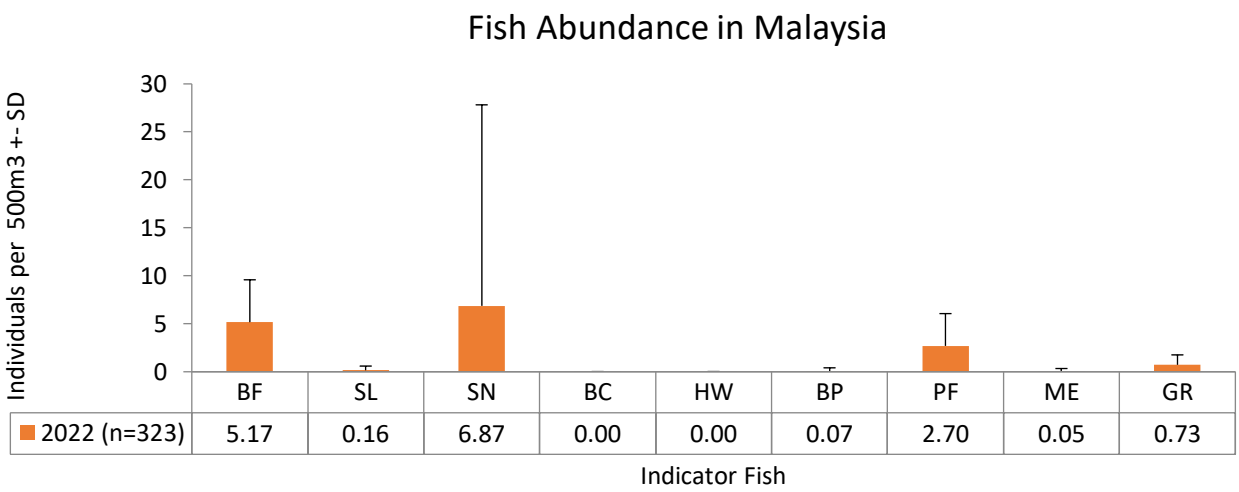
- In all three regions.
- Over 30% of Malacca and Tunku Abdul Rahman Park reefs consist of indicators for disturbance.
- 20-30% of Pangkor Laut, Redang, Labuan and Usukan Cove reefs consist of indicators for disturbance.



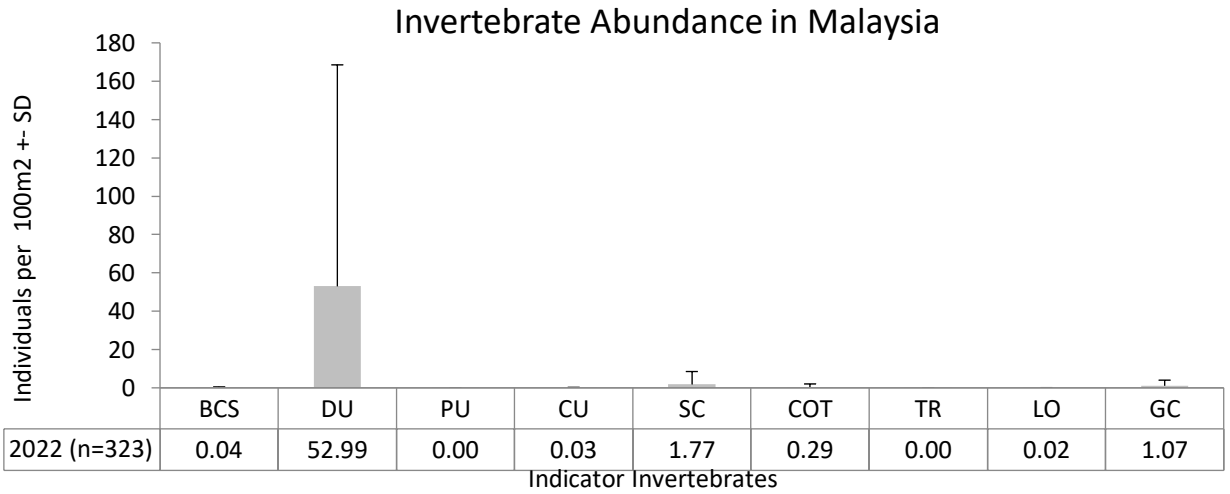
INDICATORS FOR POLLUTION

- Mainly in Malacca Strait and Sunda Shelf regions.
- Over 20% of Pulau Singa and Port Dickson reefs consist of indicators for pollution.

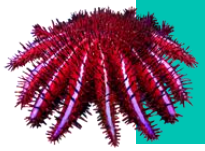
Fish and Invertebrates



- 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 are heavily harvested.



- Diadema urchin abundance is high.
- Very low abundance of indicators targeted for curio trade and food.
- On average, crown-of-thorns are not an issue in Malaysia but they are a problem in some individual locations.



CROWN-OF-THORNS

- Tioman, Bidong and Yu, Tenggol, Aur and Dayang, Pemanggil, Lahad Datu and Pulau Penyu 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)

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.

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

Site Coverage by Ecoregion

Eco-region	State	Islands/Areas	No. of sites	Protection Status	LCC (%)	Average (%)
Sunda Shelf	Pahang	Tioman	18	Marine Park	63.37	53.34
	Terengganu	Bidong & Yu	6	Marine Park (Yu only)	63.54	
	Terengganu	Kapas	5	Marine Park	47.63	
	Terengganu	Lang Tengah	4	Marine Park	46.09	
	Terengganu	Perhentian	12	Marine Park	41.31	
	Terengganu	Redang	12	Marine Park	48.28	
	Terengganu	Rhu	10	No protection	43.44	
	Terengganu	Tenggol	6	Marine Park	51.46	
	Johor	Aur & Dayang	6	Marine Park	39.17	
	Johor	Besar	7	Marine Park	48.39	
	Johor	Gual	9	Marine Park	56.94	
	Johor	Harimau	7	Marine Park	52.59	
	Johor	Hujung	9	Marine Park	53.19	
	Johor	Lima	2	No protection	51.88	
	Johor	Mensirip	7	Marine Park	69.20	
	Johor	Mertang	3	No protection	76.04	
	Johor	Pemanggil	4	Marine Park	48.91	
	Johor	Rawa	9	Marine Park	62.36	
	Johor	Sibu	6	Marine Park	53.85	
	Johor	Tengah	11	Marine Park	53.41	
	Johor	Tinggi	4	Marine Park	48.28	
	Sarawak	Miri	4	MSCRNP	48.59	

Eco-region	State	Islands/Areas	No. of sites	Protection Status	LCC (%)	Average (%)
Malacca Strait	Kedah	Payar	5	Marine Park	57.13	37.47
	Kedah	Pulau Singa	1	Sea Cucumber PA	67.50	
	Perak	Pangkor Laut	1	No protection	61.25	
	Perak	Sembilan	9	No protection	29.31	
	Malacca	Malacca	5	No protection	30.13	
	Ng. Sembilan	Port Dickson	2	No protection	16.56	
North Borneo	Sabah	Kapalai	6	No protection	24.27	43.31
	Sabah	Labuan	4	Marine Park	42.19	
	Sabah	Lahad Datu	15	No protection	43.00	
	Sabah	Lankayan	15	SIMCA	54.92	
	Sabah	Larapan	5	No protection	55.63	
	Sabah	Mabul	6	No protection	33.23	
	Sabah	Mantanani	12	No protection	51.93	
	Sabah	Mataking	6	No protection	36.04	
	Sabah	Pulau Penyu	9	Sabah Parks	42.92	
	Sabah	Pulau Tiga	7	Sabah Parks	33.39	
	Sabah	Sipadan	12	Sabah Parks	50.57	
	Sabah	TARP	8	Sabah Parks	20.08	
	Sabah	TMP	18	Sabah Parks	45.59	
	Sabah	TSMP	12	Sabah Parks	51.56	
	Sabah	Usukan Cove	6	No protection	29.90	

Sunda Shelf – Tioman

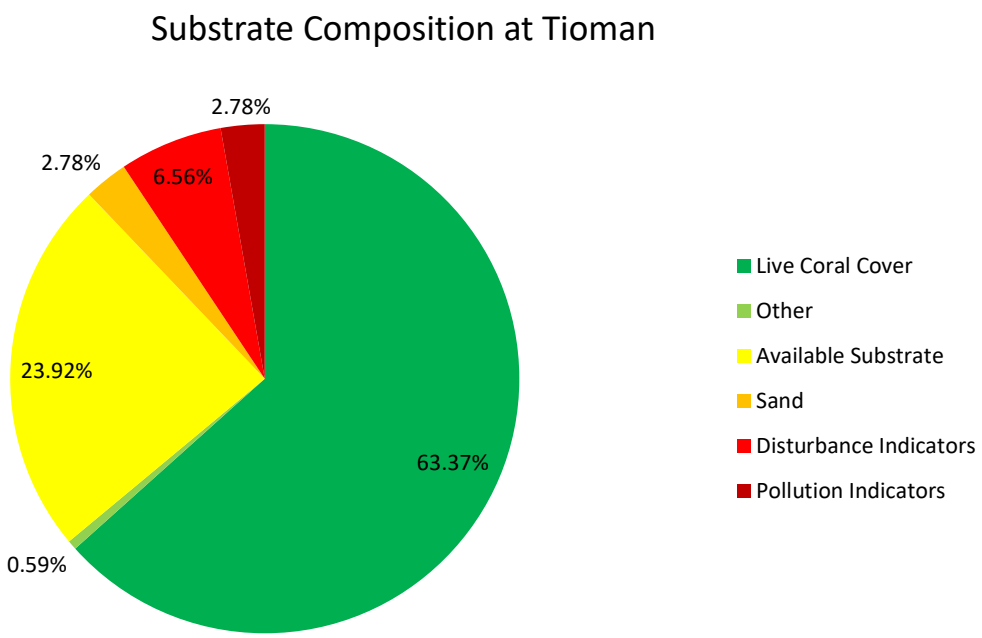
Tioman Island is located some 50km from Mersing, off the East coast of Pahang. It is the largest island off the East coast of Peninsular Malaysia. The island has seven villages, with a total population of approximately 3,700 most of whom work in the tourism industry, the main industry on the island. The island has been gazetted as a Marine Park since 1994. Reefs are mainly fringing offshore 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 an airport as well as ferry services from the mainland.

Map showing the health categories of each survey site based on Live Coral Cover: 6 sites have 'Excellent' coral cover, 7 are in 'Good' condition, 4 show 'Fair' health and 1 is in ‘Poor’ state.

Coral Cover and Health

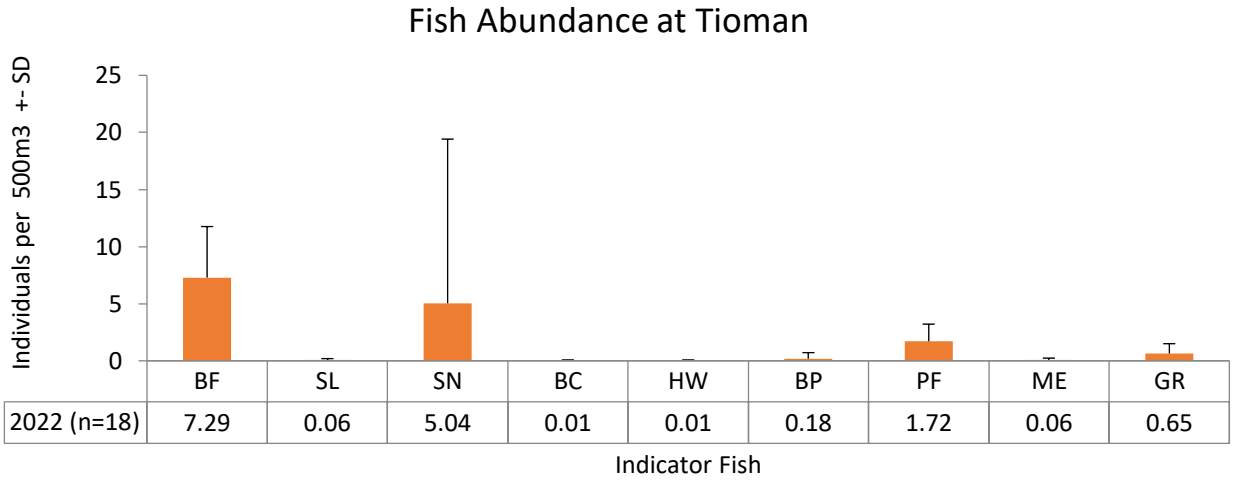


- Tioman reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 60.21%.
- In 'Good' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.

CORAL IMPACTS

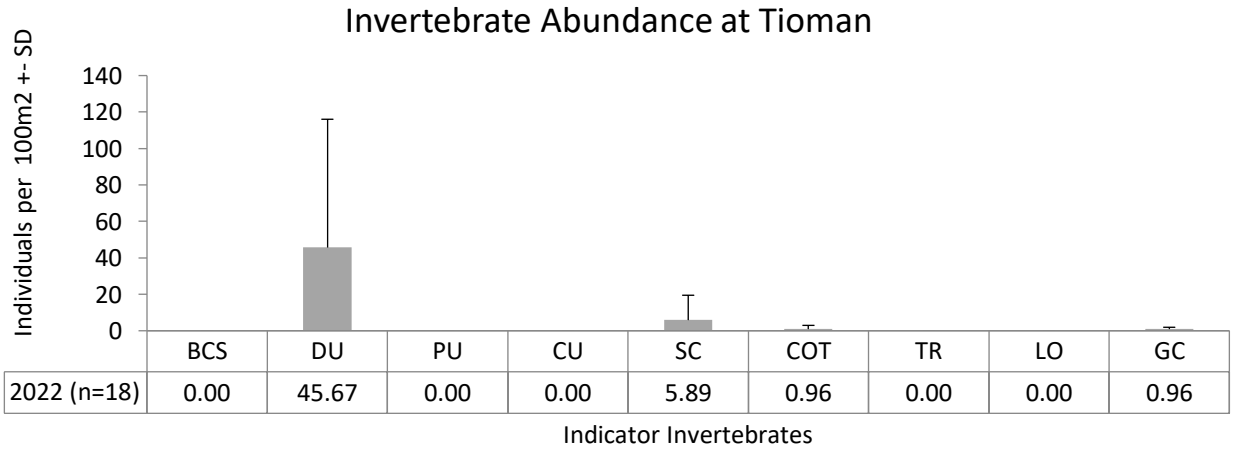
- Boat anchor damage, discarded fishing nets and trash were recorded at some sites.
- Some sites were impacted by crown-of-thorns and drupella predation.

Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=18)	7.29	0.06	5.04	0.01	0.01	0.18	1.72	0.06	0.65

- All indicator fish were recorded.
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Humphead wrasse and bumphead parrotfish, fish targeted for live-food fish trade, were recorded.
- Fish targeted for food are low in abundance, except for snapper.

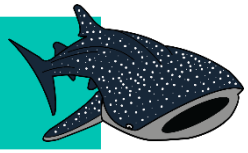


	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=18)	0.00	45.67	0.00	0.00	5.89	0.96	0.00	0.00	0.96

- 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 are issue in Tioman. A healthy coral reef can support a population of 0.2-0.3 individuals per 100m^2, Tioman recorded 0.96.

RARE ANIMALS

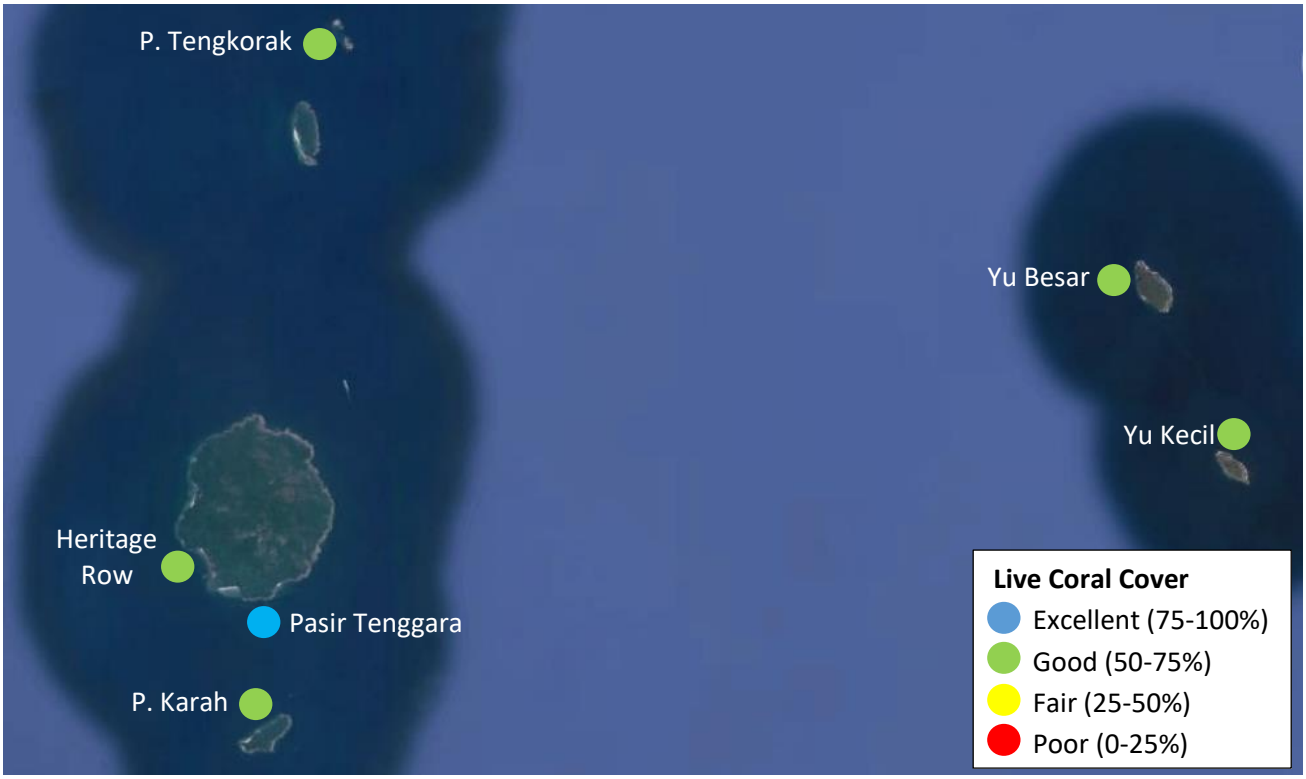
- Blacktip reef shark and turtle were recorded at many sites.



Sunda Shelf – Bidong & Yu

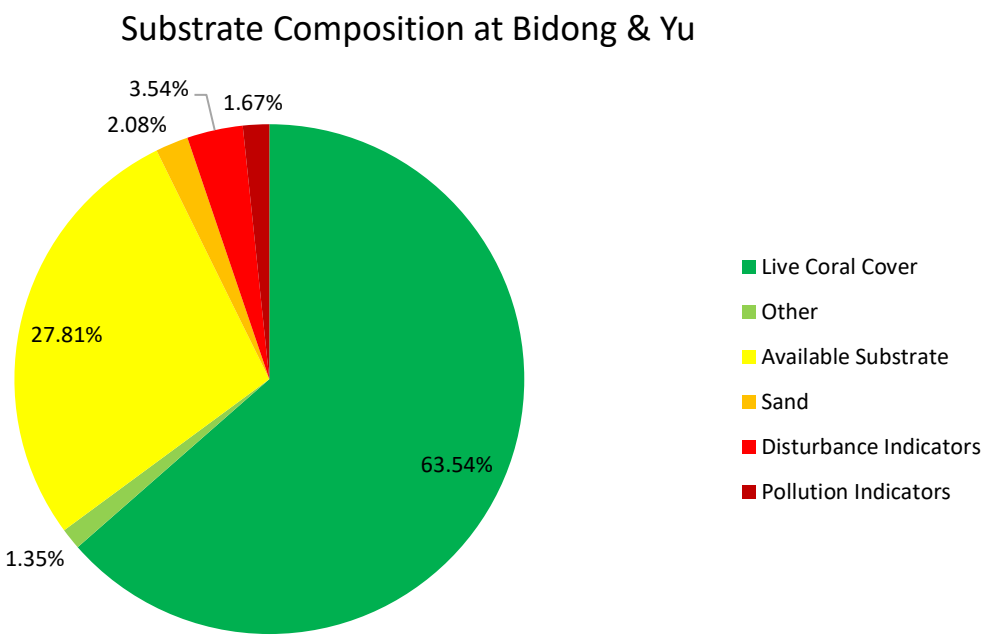
The Bidong and Yu archipelago comprises several small islands, located 15-25km from Marang, off the East coast of Terengganu, Malaysia. The islands are unpopulated, though from 1978 to 1991 Bidong was a centre for Vietnamese refugees. Yu islands are gazetted as a Marine Park under the Fisheries Act 1985.

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 and 5 are in 'Good' condition.

Coral Cover and Health

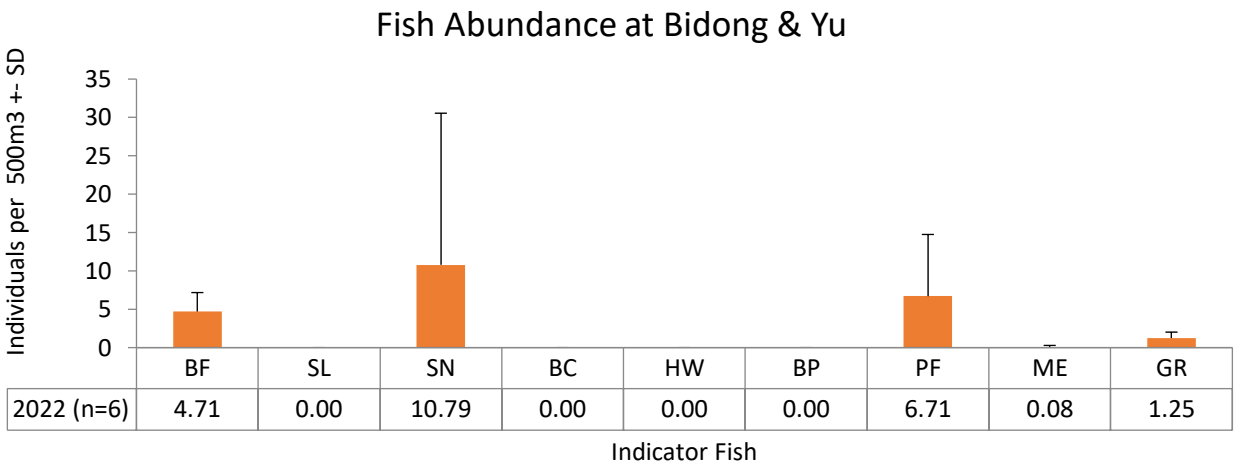


- Bidong and Yu reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 48.65%.
- In 'Good' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Although Pasir Tenggara has 'Excellent' coral cover, the high percentage of live coral cover is mainly attributed by soft coral (zoanthid), which recorded 77.50%. Hard coral cover is only 2.50%. 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

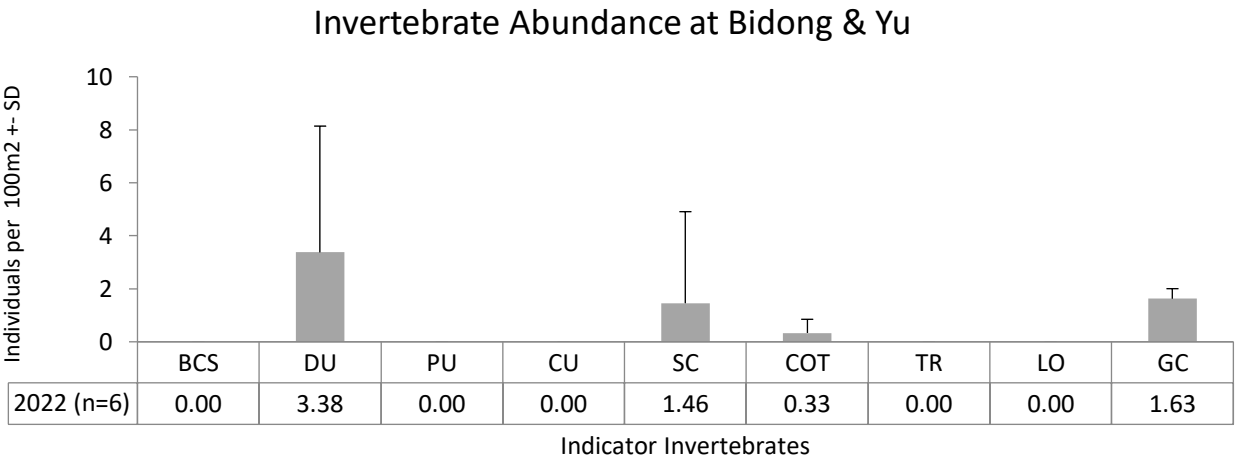
- Boat anchor damage, discarded fishing nets and trash were recorded.
- One site was impacted by warm water bleaching.

Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=6)	4.71	0.00	10.79	0.00	0.00	0.00	6.71	0.08	1.25

- Butterflyfish, indicator for aquarium trade, is recorded.
- Snapper abundance is the highest.
- Fish targeted for food are very low in abundance, except for snapper and parrotfish.
- Indicators targeted for live-food fish trade are absent.
- This suggests that fish targeted for food are heavily harvested.



	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=6)	0.00	3.38	0.00	0.00	1.46	0.33	0.00	0.00	1.63

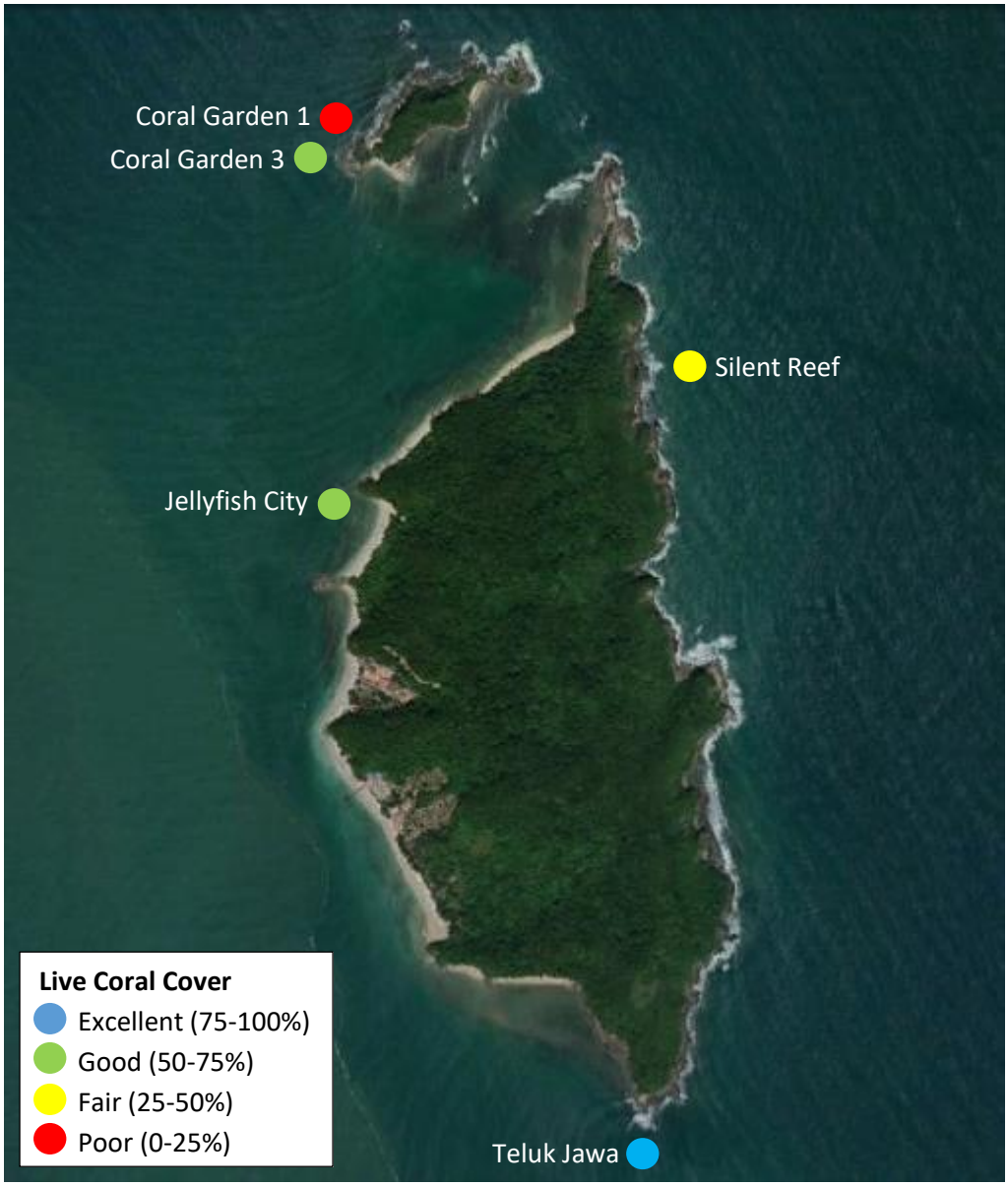
- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.
- Crown-of-thorns are a slight concern in Bidong & Yu. A healthy coral reef can support a population of 0.2-0.3 individuals per $100m^2$, Bidong & Yu recorded 0.33.

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 under the Fisheries Act 1985 (Amended 1993).

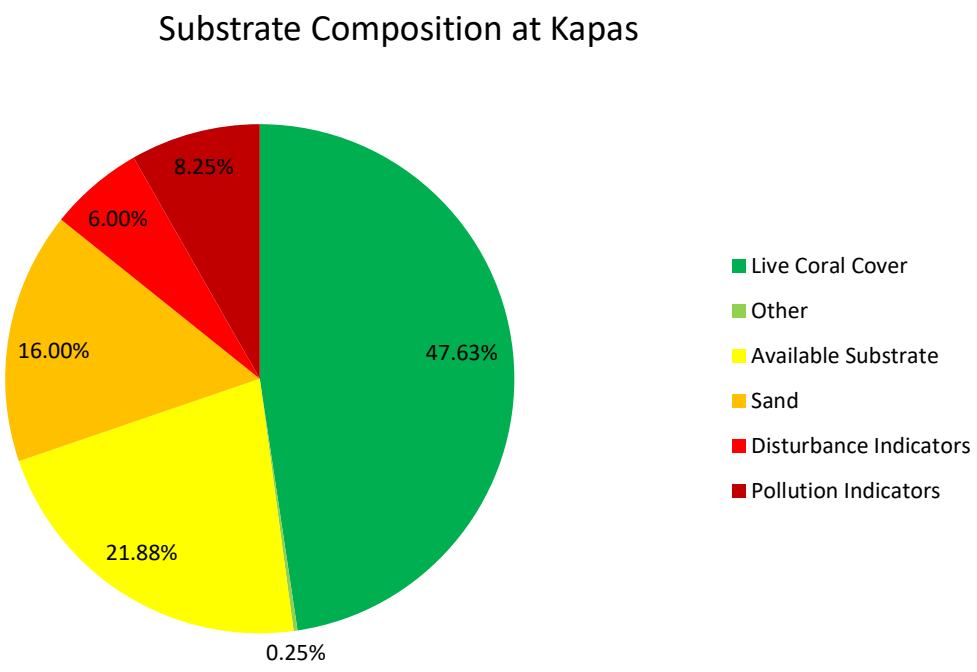
The island is not a major tourism destination due to its small size, but does have an established tourist market, with less than ten resorts and one dive operator. Diving and snorkelling are the main tourist activities. There is no centralised electricity supply, resorts operate their own generators 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 offshore reefs, with some submerged reefs.



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

Coral Cover and Health

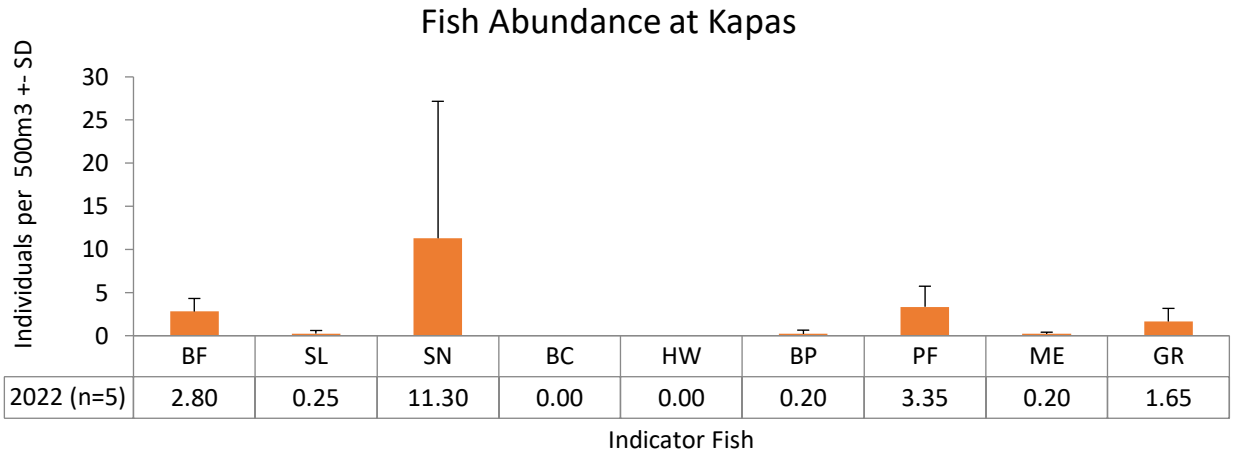


- Kapas reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 44.38%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is especially high at Jellyfish City which recorded 32.50%.
- Disturbance indicators are not high in Kapas in general but the level of rubble is especially high at Coral Garden 1 which recorded 23.75%.
- Pollution indicators are slightly elevated.
- Nutrient indicator algae level is especially high at Silent Reef which recorded 20.63%.

CORAL IMPACTS

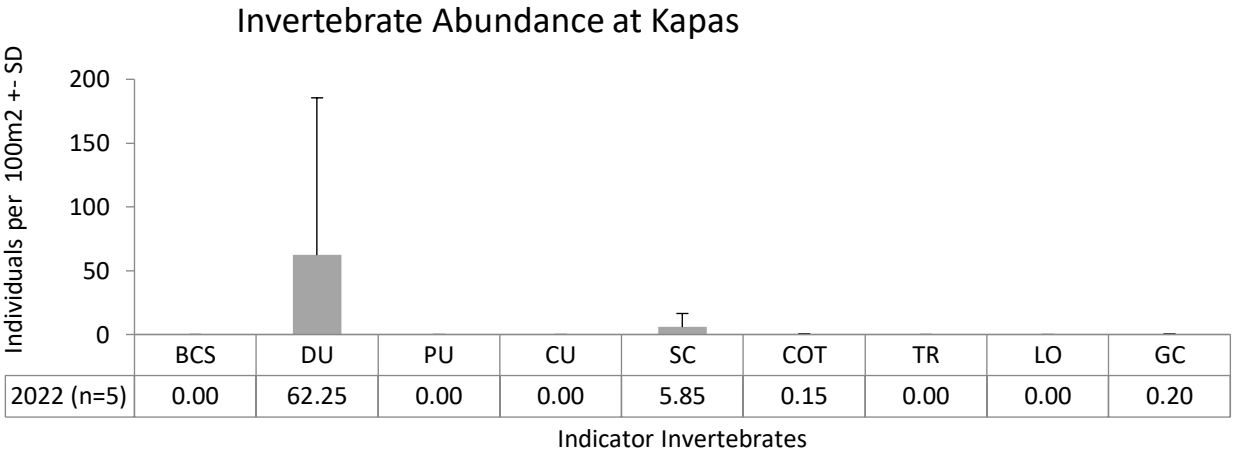
- Trash and impact due to warm water bleaching were recorded at many sites.

Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=5)	2.80	0.25	11.30	0.00	0.00	0.20	3.35	0.20	1.65

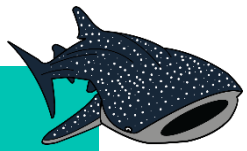
- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- All fish targeted for food, except barramundi cod, are recorded. The abundance is low except for snapper.



	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=5)	0.00	62.25	0.00	0.00	5.85	0.15	0.00	0.00	0.20

- Diadema urchin 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 are not an issue in Kapas.

RARE ANIMALS



- Porcupine ray was recorded.

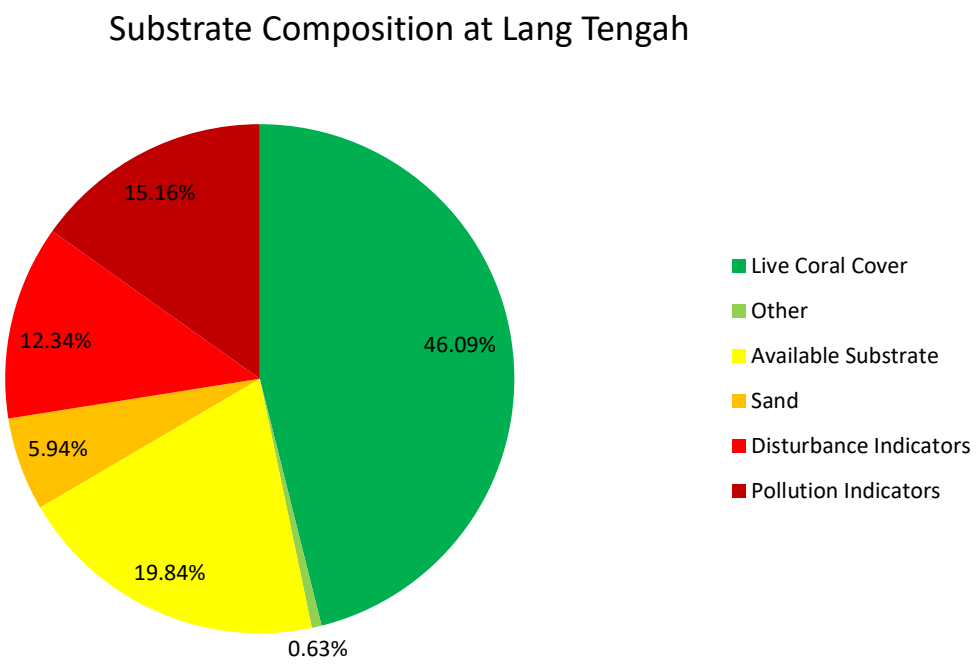
Sunda Shelf – Lang Tengah

Lang Tengah is located about 40km northeast of Kuala Terengganu on the east coast of peninsular Malaysia. It was gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993). It is connected to the mainland by ferries to Merang. Lang Tengah appeals to holiday goers who are looking for a quiet tropical island getaway. Lang Tengah is much quieter, with less development, compared to nearby islands. There are 3 resorts and 1 camp site located on the island.

Coral reefs on Lang Tengah are teeming with fish life and occasional sharks and rays. The island has nesting green turtle from April to October. Occasionally, hawksbill turtle will also nest on Lang Tengah. The island is also covered with primary forest and has a wide variety of flora and fauna.

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

Coral Cover and Health

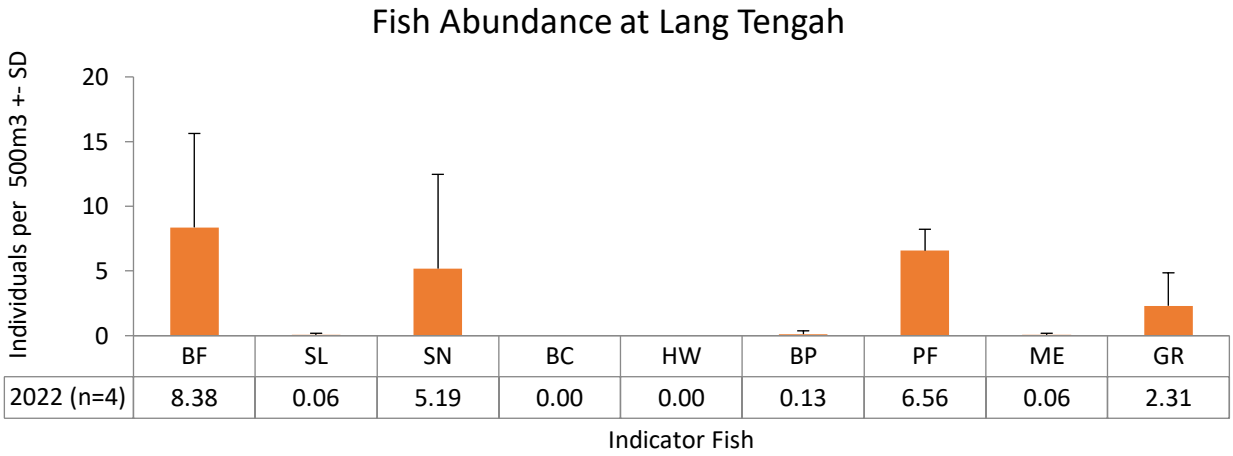


- Lang Tengah reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 42.19%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- Rubble level is very high at Tanjung Telunjuk and Summer Bay House Reef.
- Pollution indicators are high.
- Nutrient indicator algae level is high at all sites. It is especially high at Batu Bulan which recorded 23.75%.

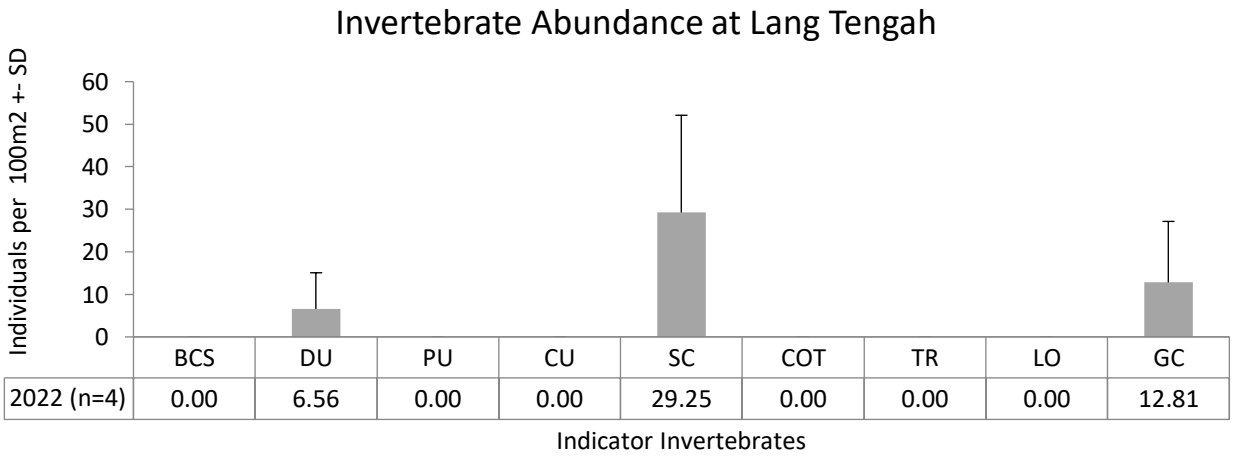
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at some sites.
- Impact due to warm water bleaching were recorded at all sites.
- Drupella and crown-of-thorns predations and white band disease were recorded.

Fish and Invertebrate

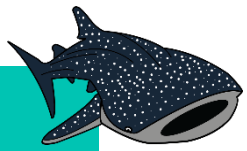


- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Butterflyfish, indicator for aquarium trade, abundance is high.
- All fish targeted for food, except barramundi cod, are recorded.



- Sea cucumber and giant clam, invertebrates targeted for food, are high in abundance.
- Indicators for curio trade are absent.

RARE ANIMALS



- Shark was recorded.

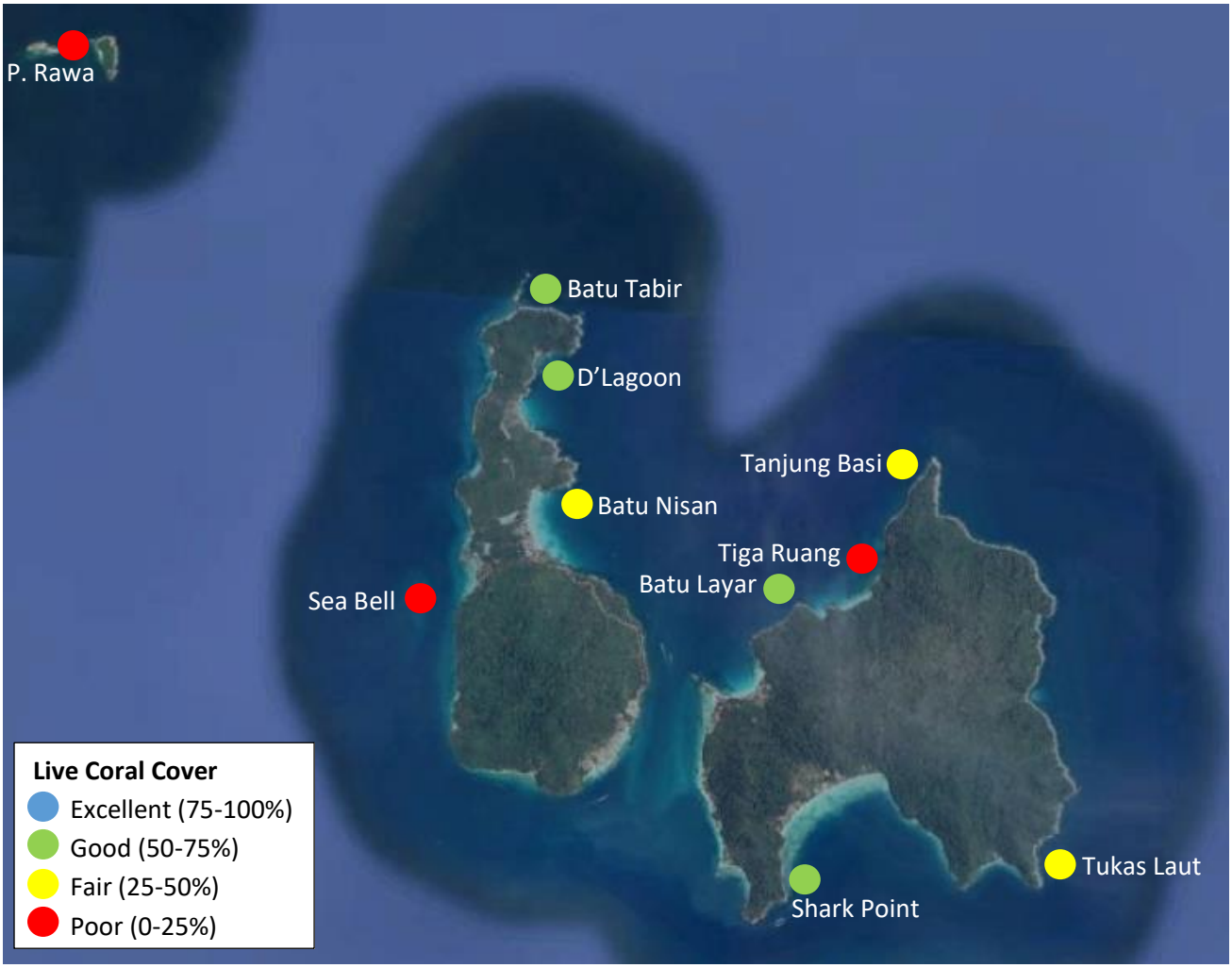
Sunda Shelf – Perhentian

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.

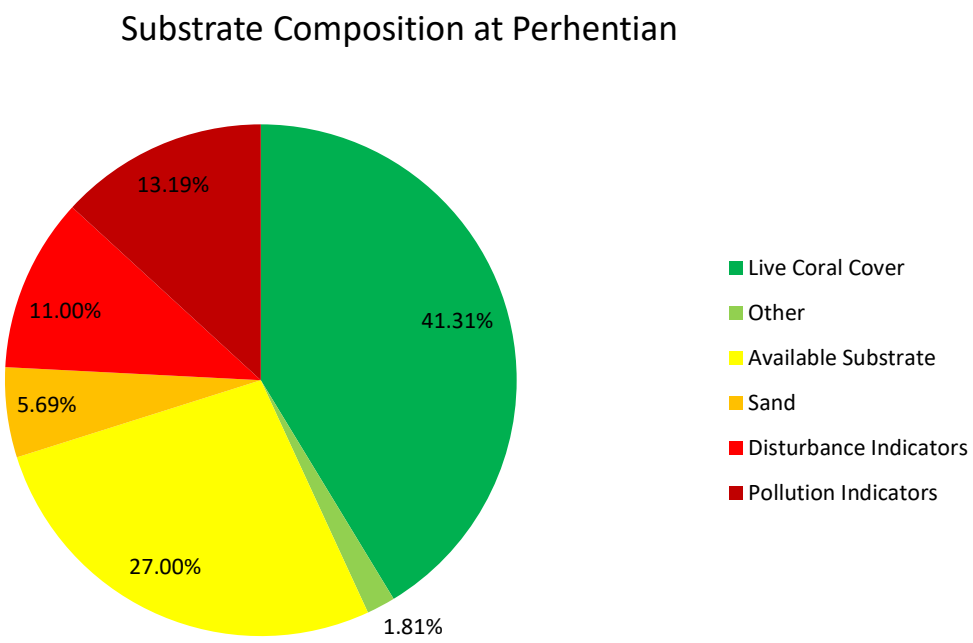
Growth in tourism has been rapid on the islands, and resort development continues. There is no grid-supplied electricity, nor centralised sewage treatment; groundwater supplies are limited in Perhentian and fresh water is supplied from the mainland.

Reefs are mainly fringing offshore reefs, with some submerged reefs.



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

Coral Cover and Health

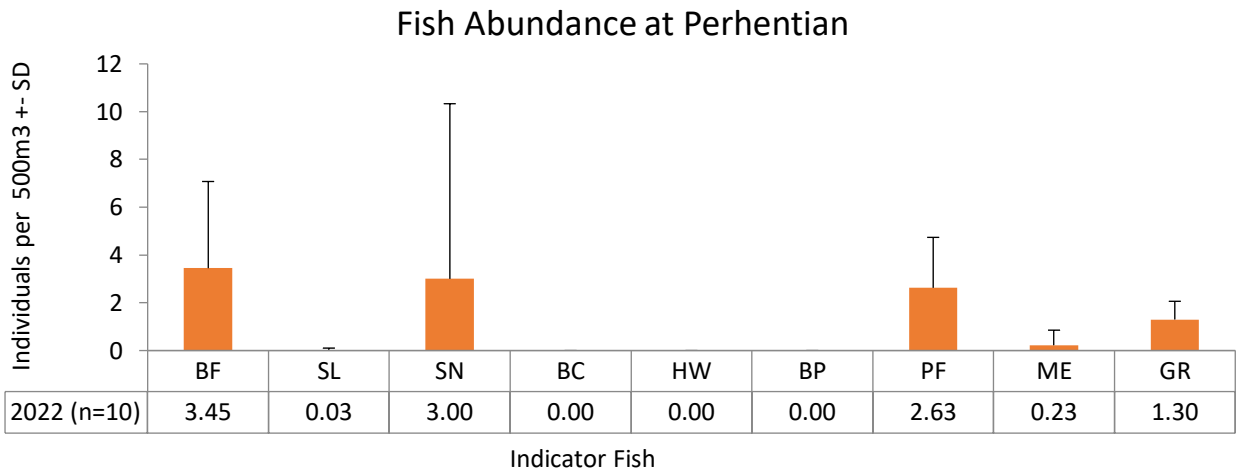


- Perhentian reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 40.13%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are high.
- Rubble level is especially high at Batu Nisan (39.38%), Tiga Ruang (36.25%) and Pulau Rawa (20%).
- Pollution indicators are high.
- 78.13% of Sea Bell consists of nutrient indicator algae.

CORAL IMPACTS

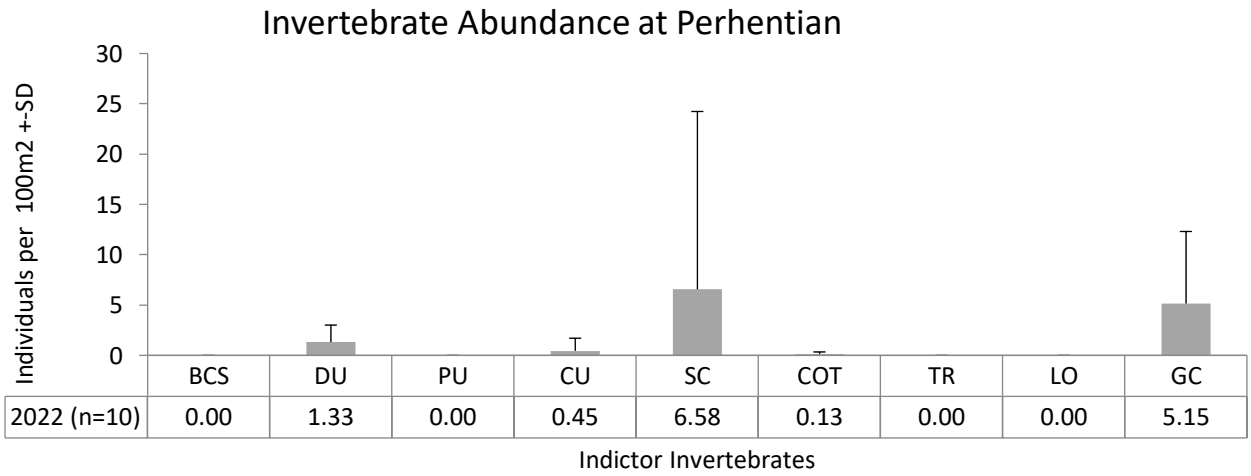
- Discarded fishing nets and trash were recorded

Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=10)	3.45	0.03	3.00	0.00	0.00	0.00	2.63	0.23	1.30

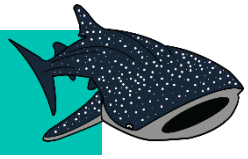
- Butterflyfish, indicator for aquarium trade, is recorded.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are low in abundance.
- This suggests that fish targeted for food is heavily harvested.



	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=10)	0.00	1.33	0.00	0.45	6.58	0.13	0.00	0.00	5.15

- The abundance of sea cucumber and giant clam, indicators targeted for food, is high.
- Invertebrates targeted for food are low in abundance, except for sea cucumber and giant clam.
- Indicators for curio trade are absent.
- Crown-of-thorns are not an issue in Perhentian.

RARE ANIMALS

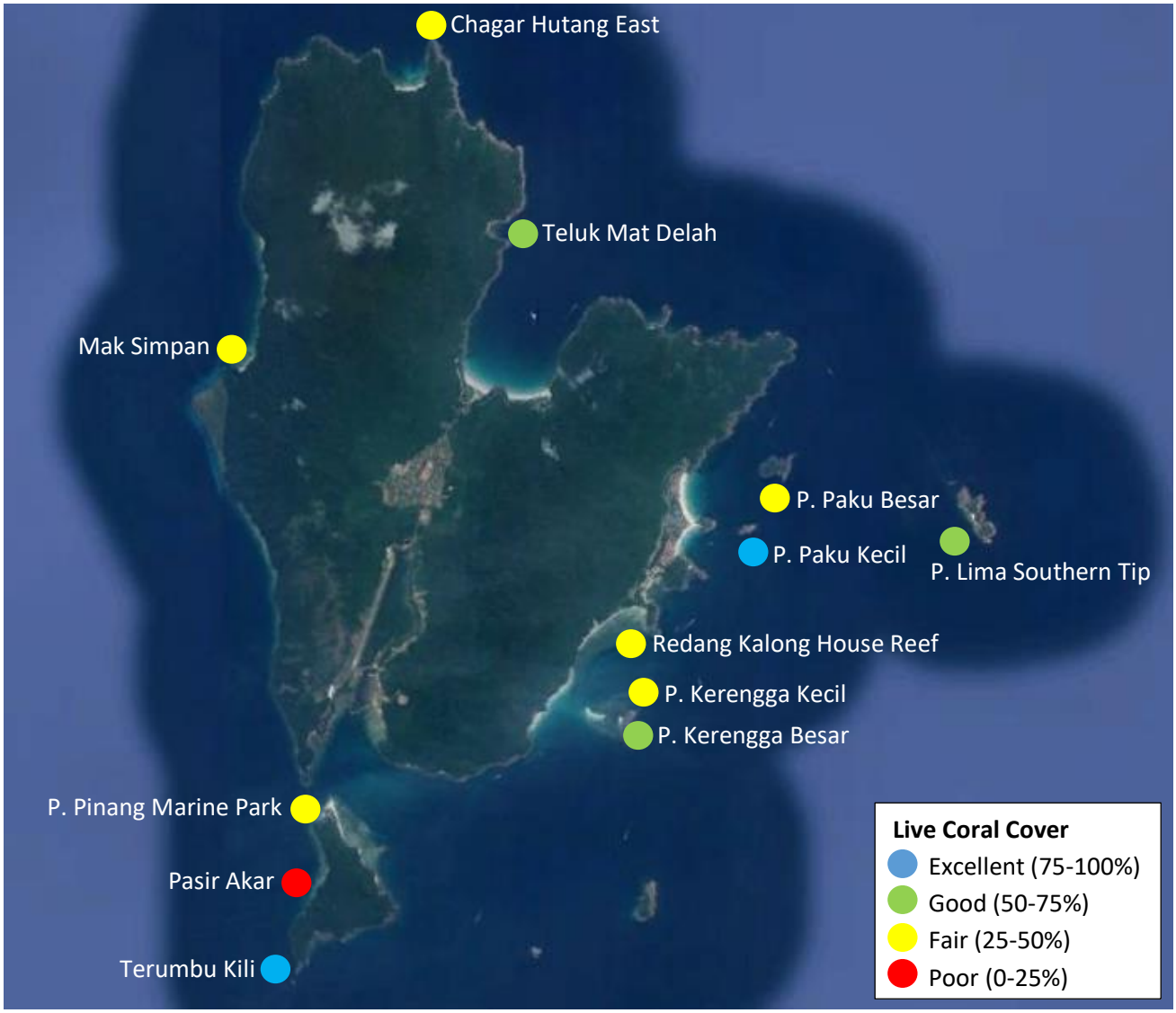


- Shark and turtle were recorded.

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 under the Fisheries Act 1985 (Amended 1993).

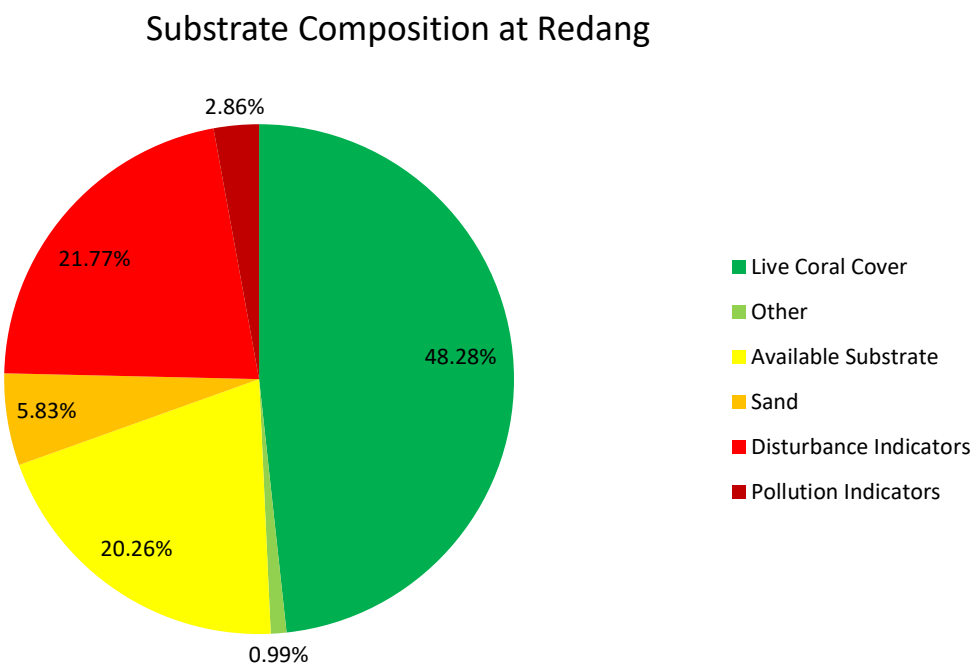
The island is a popular resort destination, with a more upmarket image than nearby Perhentian. Diving and snorkelling are the main tourist activities. There are 10 medium-large size resorts, mainly on Pasir Panjang. Most resorts have an in-house dive operator. There is no centralised electricity supply,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



Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Excellent' coral cover, 3 are in 'Good' condition, 6 show 'Fair' health and 1 is in ‘Poor’ state.

Both fringing offshore reefs and submerged reefs can be found in the area.

Coral Cover and Health

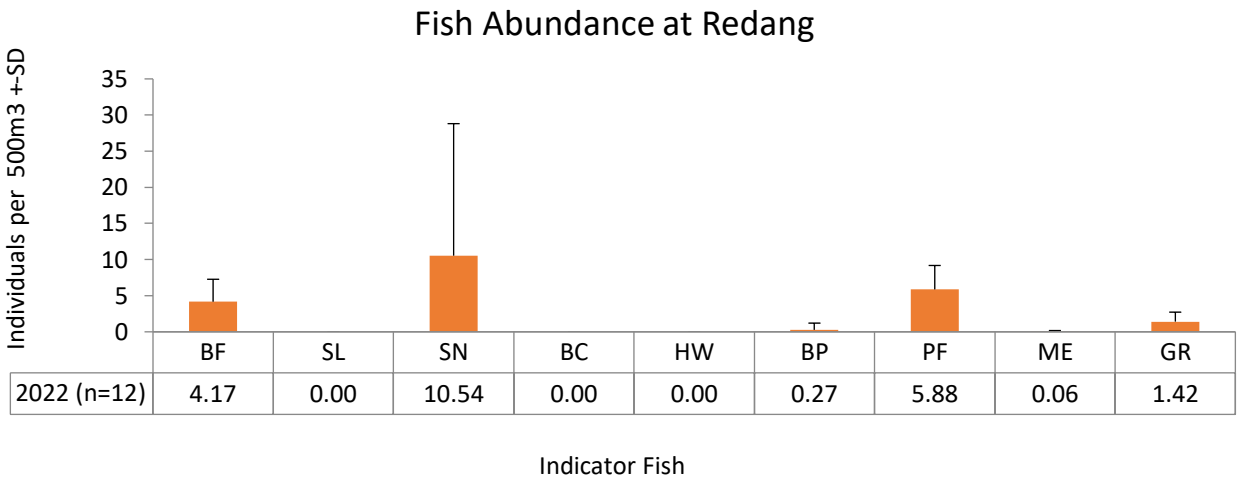


- Redang reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 45.94%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are very high.
- 61.25% of Pulau Kerengga Kecil consists of recently killed coral.
- Rubble level is especially high at Pulau Pinang Marine Park (58.13%), Pasir Akar (39.38%), Redang Kalong House Reef (28.13%) and Pulau Paku Besar (23.75%).

CORAL IMPACTS

- Discarded fishing nets were recorded.
- Trash was recorded at many sites.

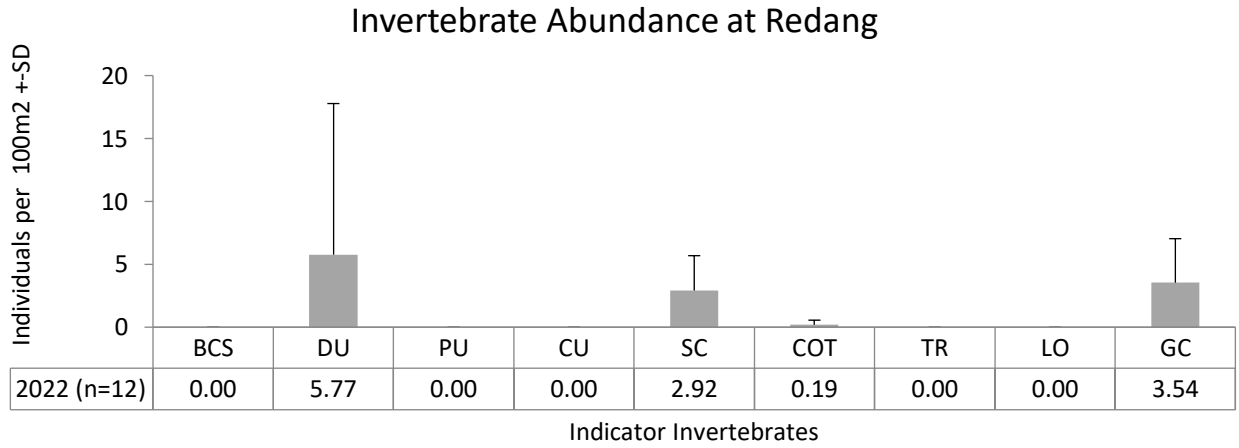
Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=12)	4.17	0.00	10.54	0.00	0.00	0.27	5.88	0.06	1.42

Indicator Fish

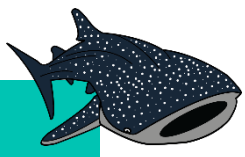
- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Butterflyfish, indicator for aquarium trade, is recorded.
- The abundance of snapper and parrotfish is high.
- Fish targeted for food are low in abundance, except for snapper and parrotfish.



	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=12)	0.00	5.77	0.00	0.00	2.92	0.19	0.00	0.00	3.54

Indicator Invertebrates

- Indicators for curio trade are absent.
- Invertebrates targeted for food are low in abundance, except for giant clam.
- Crown-of-thorns are not an issue in Redang.



RARE ANIMALS

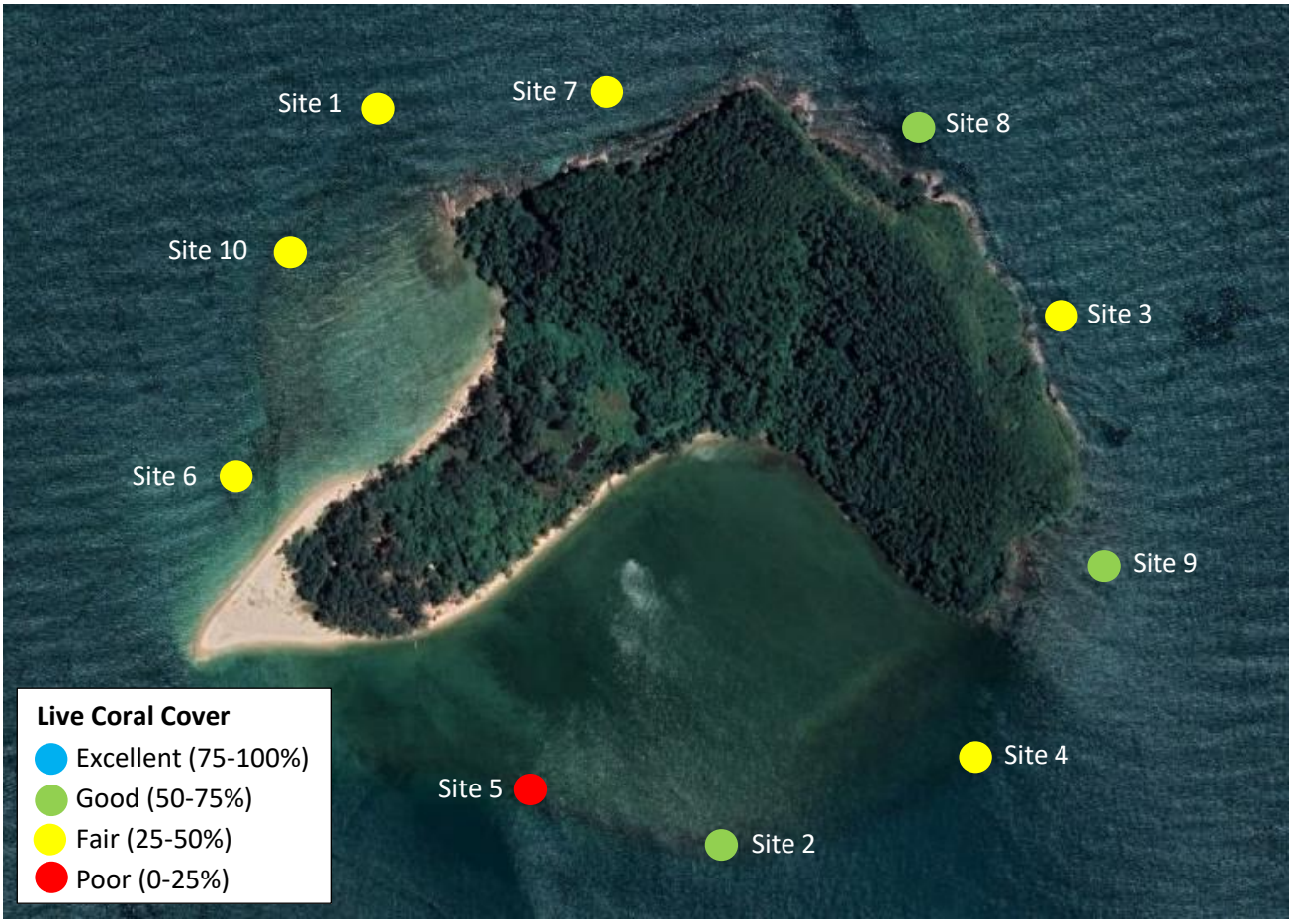
- Turtle was recorded.

Sunda Shelf – Pulau Rhu

Pulau Rhu is a small, heavily wooded island located approximately 6km south of Kuala Besut, and just 3km off the East coast of Terengganu, Malaysia. Measuring some 0.8 x 0.65km, the island is uninhabited.

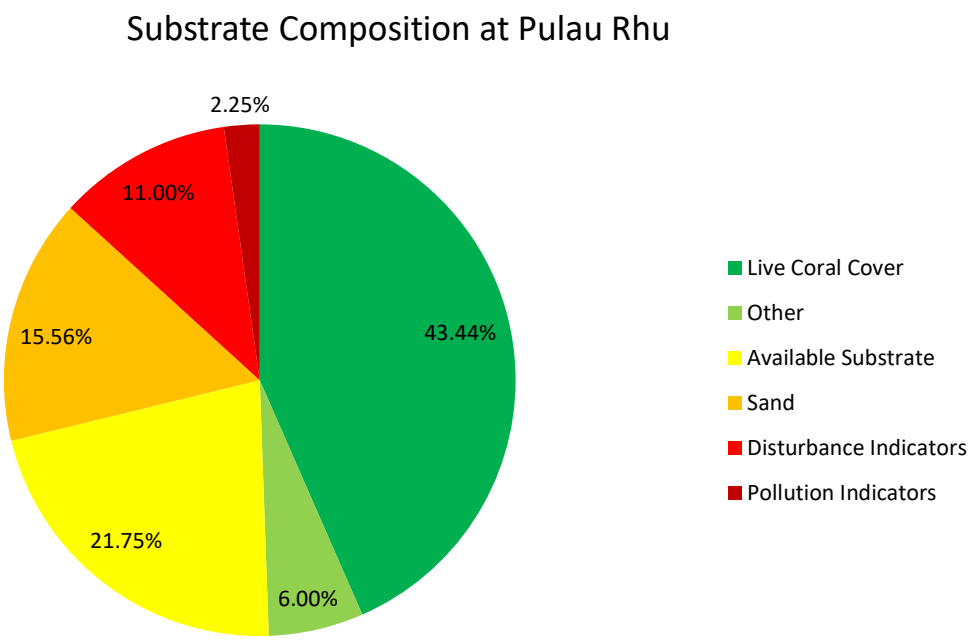
Pulau Rhu has fringing reefs and is a moderately popular tourism destination, due to its close proximity to the mainland and Kuala Besut. It is also an important habitat for endangered flying foxes, which roost on the island. While it is not as popular as the more distant Perhentian islands, it is visited by island-hopping trips, snorkelers, recreational anglers and water sports operators such as banana boats, operating from the mainland.

The island has no protected status and is a popular fishing ground for local small scale, artisanal fishermen who lay nets and fish traps close to the island. Though there is no resort on the island, there is a camp site with toilet and shower facilities. No data are available on either the number of fishermen regularly using the area and their catches, nor the number of tourists visiting the island.



Map showing the health categories of each survey site based on Live Coral Cover: 3 sites have 'Good' coral cover, 6 are in 'Fair' condition and 1 shows ‘Poor’ health.

Coral Cover and Health

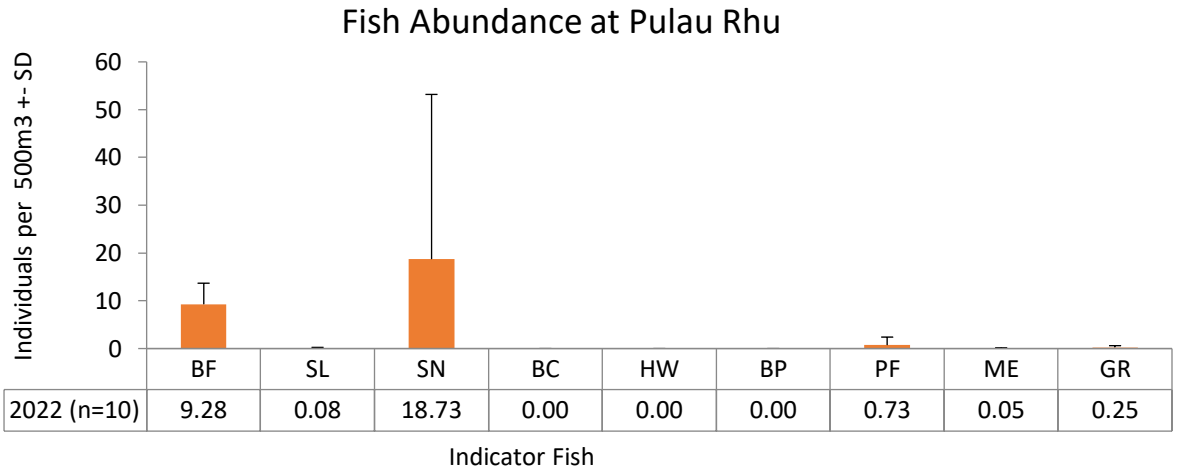


- Pulau Rhu reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 43.31%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is especially high at Site 5 and 6.
- Disturbance indicators are high.
- Rubble level is especially high at Site 1, 5 and 10.
- Silt level is high at Site 7 and 8.

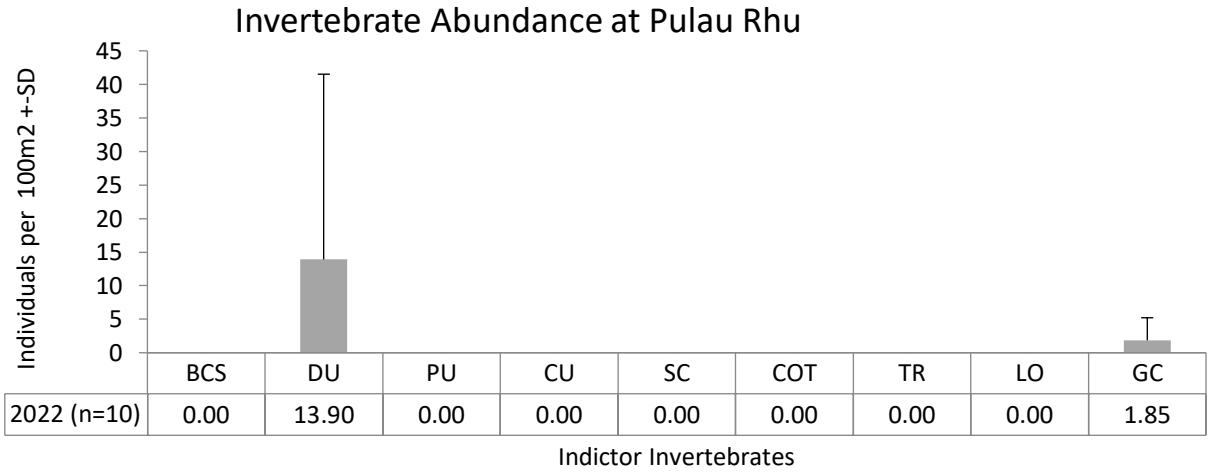
CORAL IMPACTS

- Discarded fishing nets and trash were recorded at many sites.
- All sites were impacted by warm water bleaching.
- Two sites were impacted by black band disease.

Fish and Invertebrate



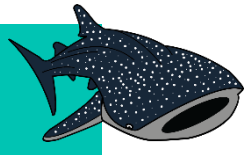
- Snapper abundance is the highest.
- Fish targeted for food are very low in abundance, except for snapper.
- Absence of indicators targeted for live-food fish trade.
- Butterflyfish, indicator for aquarium trade, abundance is high.
- This suggests that fish targeted for food are heavily harvested.



- Only diadema urchin and giant clam are recorded.
- Indicators for curio trade are absent.

RARE ANIMALS

- Turtle and sea snake were recorded.



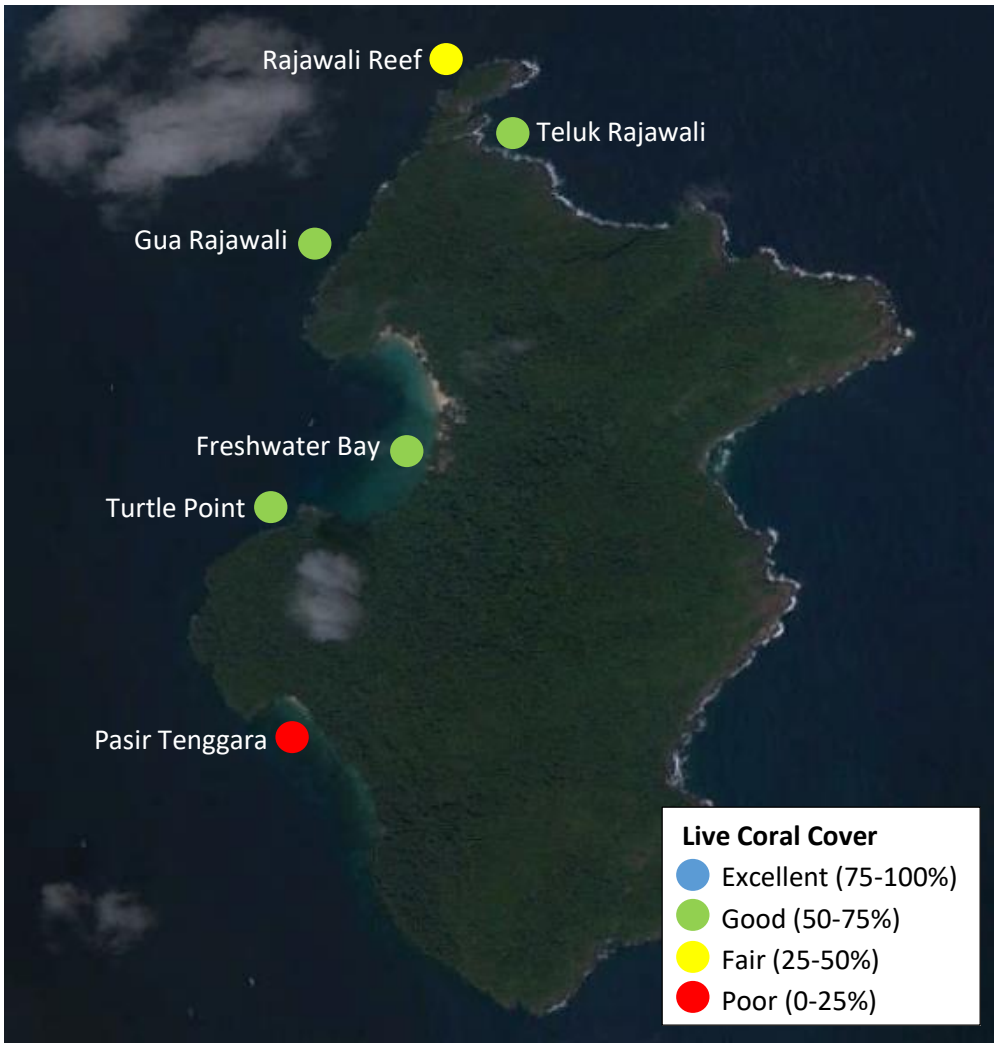
Sunda Shelf – Tenggol

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.

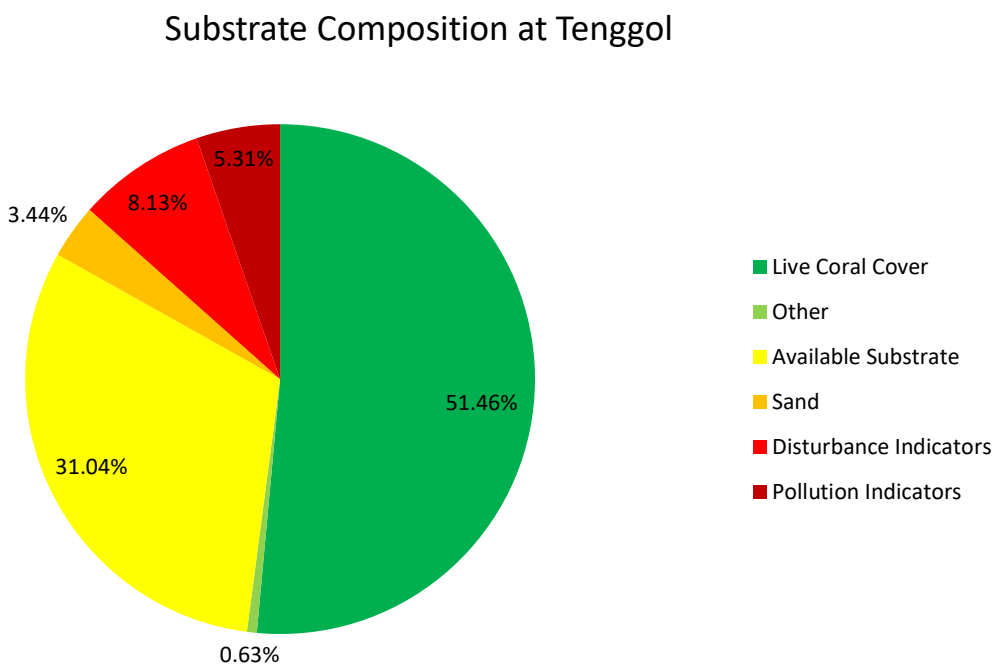
Tenggol Island has gained in popularity over the last few years and many dive and snorkel operators have started to operate from Dungun, the nearest town on the mainland, offering day trip packages to divers and snorkelers alike.

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: 4 sites have 'Good' coral cover, 1 is in 'Fair' condition and 1 shows 'Poor' health.

Coral Cover and Health

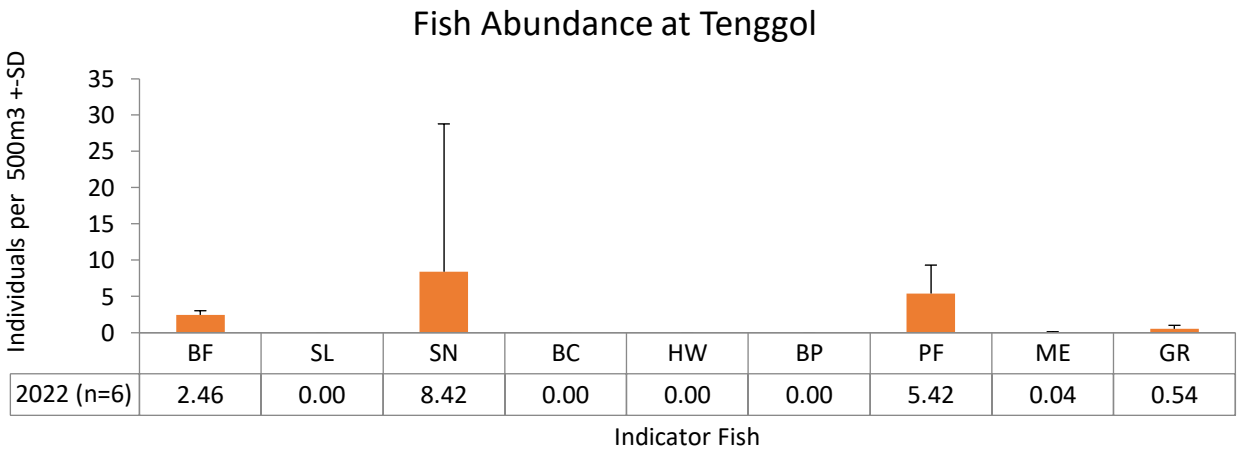


- Tenggol reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 40.21%.
- In 'Good' condition but below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are slightly high.
- Rubble level is especially high at Pasir Tenggara which recorded 32.50%.
- Pollution indicators are not high in Tenggol in general but the level of nutrient indicator algae is especially high at Freshwater Bay.

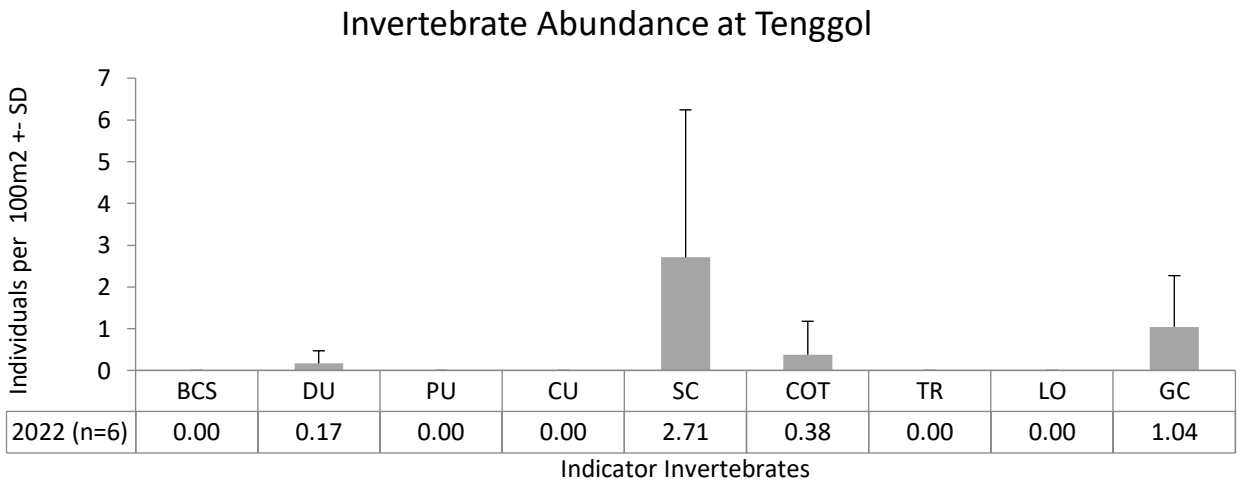
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.
- All sites were impacted by warm water bleaching.
- Crown-of-thorns predation was recorded at one site.

Fish and Invertebrate



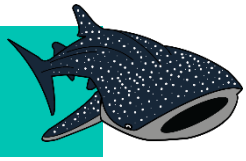
- Snapper abundance is the highest.
- Fish targeted for food are low in abundance, except for snapper and parrotfish.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Absence of indicators targeted for live-food fish trade.
- This suggests that fish targeted for food is heavily harvested.



- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.
- Crown-of-thorns are issue in Tenggol.
- A healthy coral reef can support a population of 0.2-0.3 individuals per 100m^2, Tenggol recorded 0.38.

RARE ANIMALS

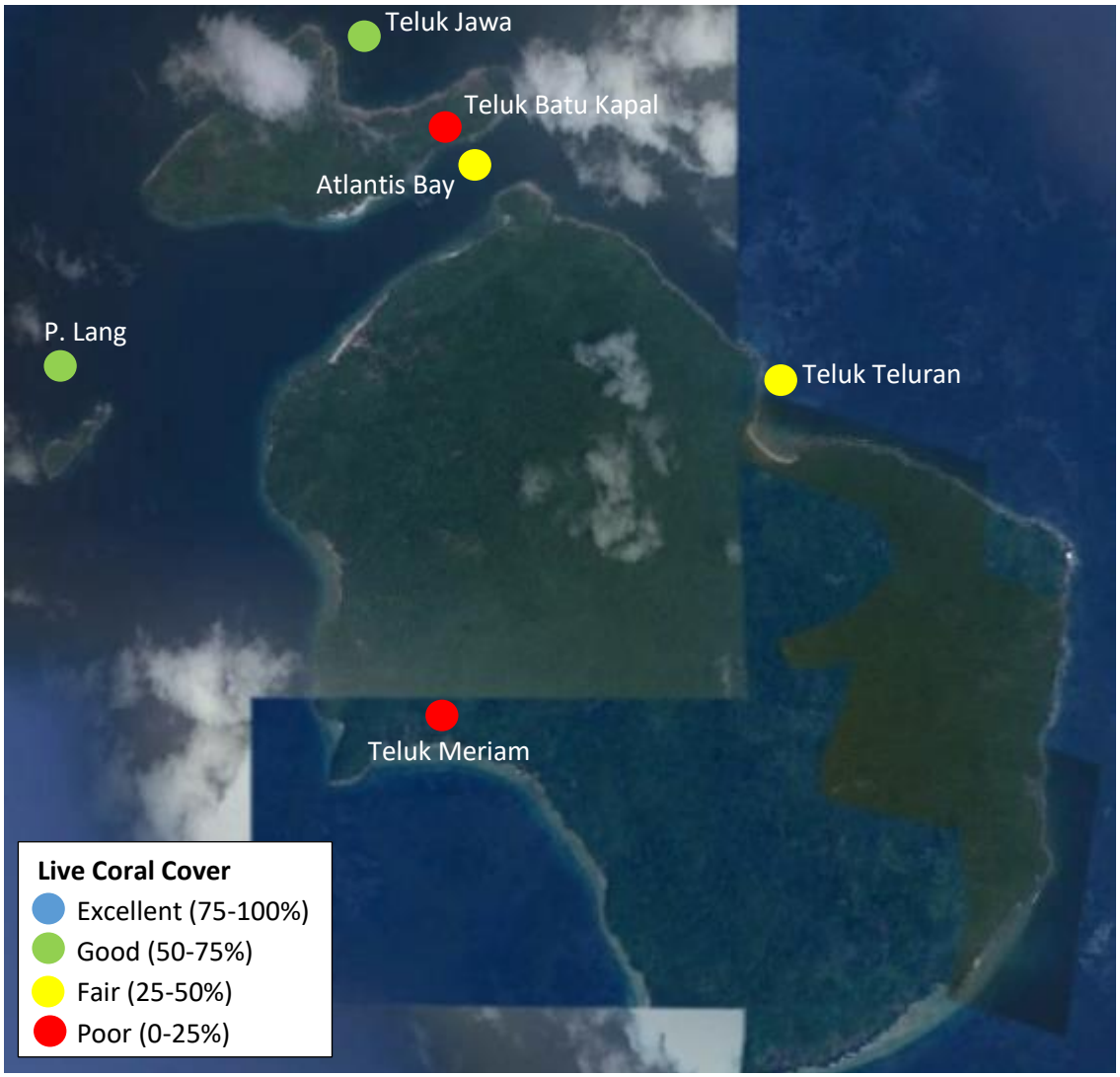
- Blacktip reef shark, hawksbill and green turtle were recorded.



Sunda Shelf – Aur & Dayang

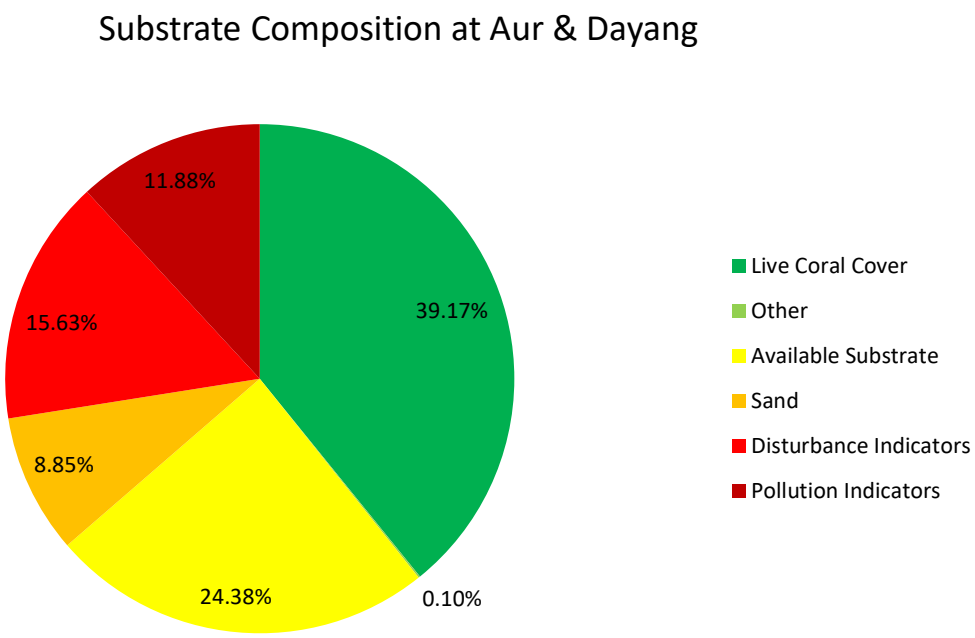
Pulau Aur and Pulau Dayang are adjacent islands in Mersing District, Johor. They lie about 76km east of Mersing off the East coast of Peninsular Malaysia and were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

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

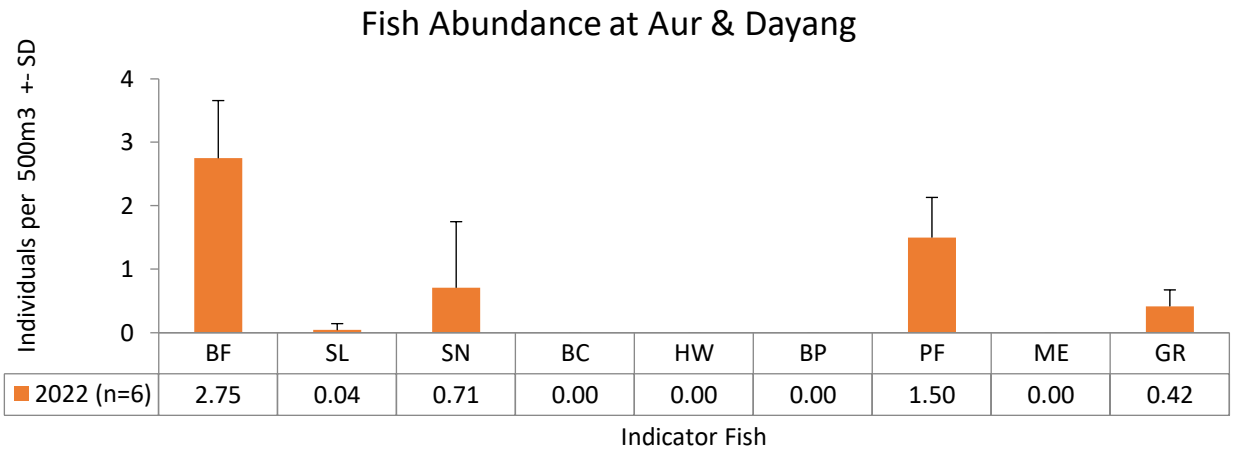


- Aur and Dayang reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 37.71%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is highest at Teluk Meriam which recorded 21.25%.
- Disturbance indicators are high.
- Rubble level is especially high at Atlantis Bay, Teluk Batu Kapal and Pulau Lang.
- Pollution indicators are high.
- Nutrient indicator algae level is especially high at Teluk Meriam, Teluk Teluran and Teluk Batu Kapal.

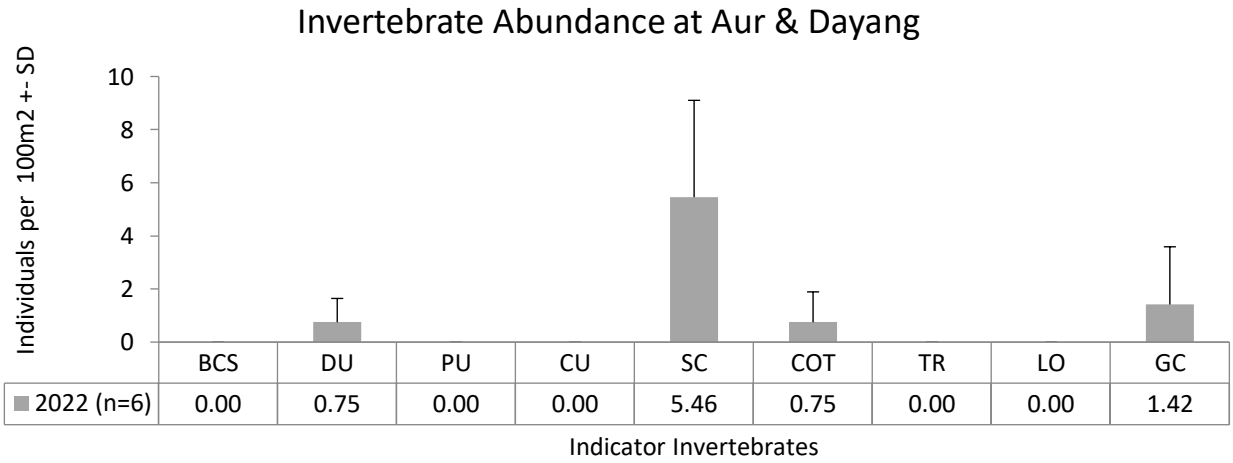
CORAL IMPACTS

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

Fish and Invertebrate



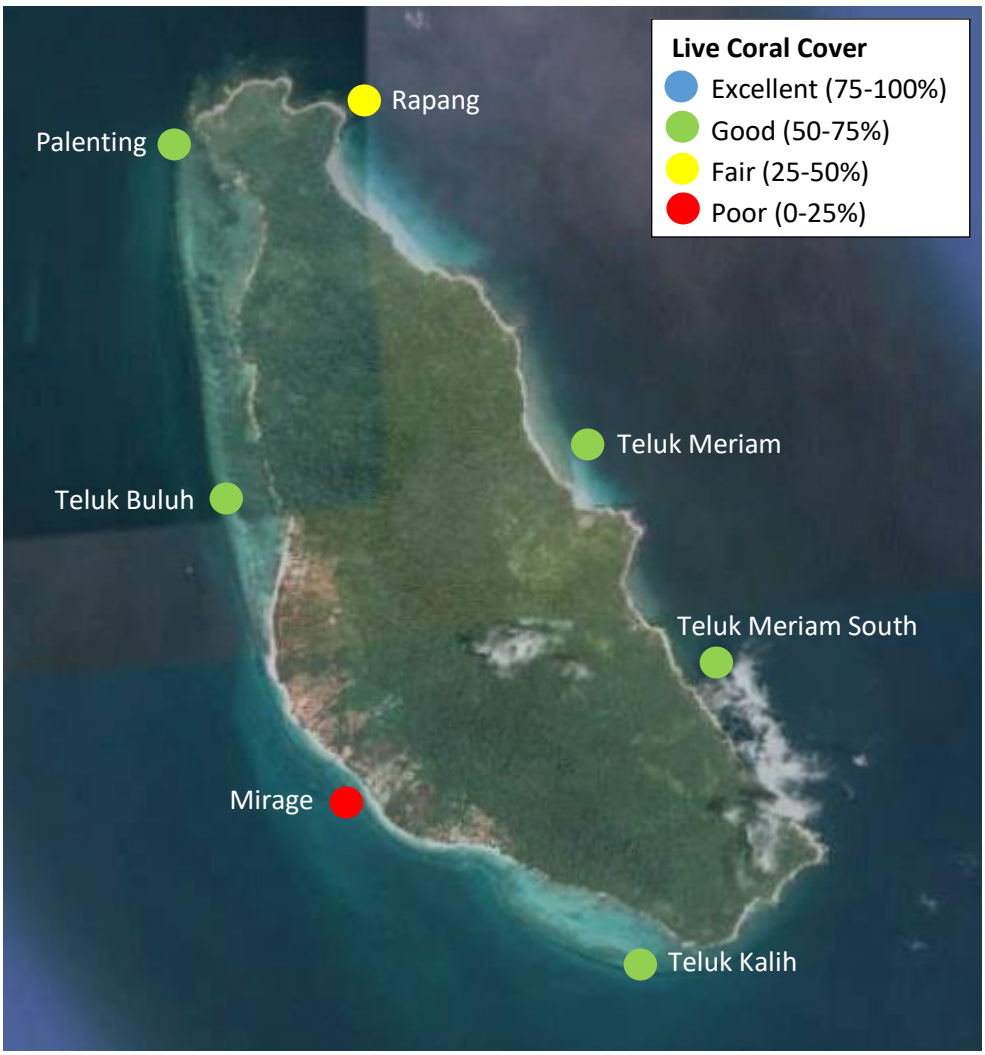
- Absent of indicators targeted for live-food fish trade.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food is heavily harvested.



- Invertebrates targeted for food are very low in abundance, except for sea cucumber.
- Indicators for curio trade are absent.
- Crown-of-thorns are issue in Aur and Dayang.
- A healthy coral reef can support a population of 0.2-0.3 individuals per $100m^2$, Aur and Dayang recorded 0.75.

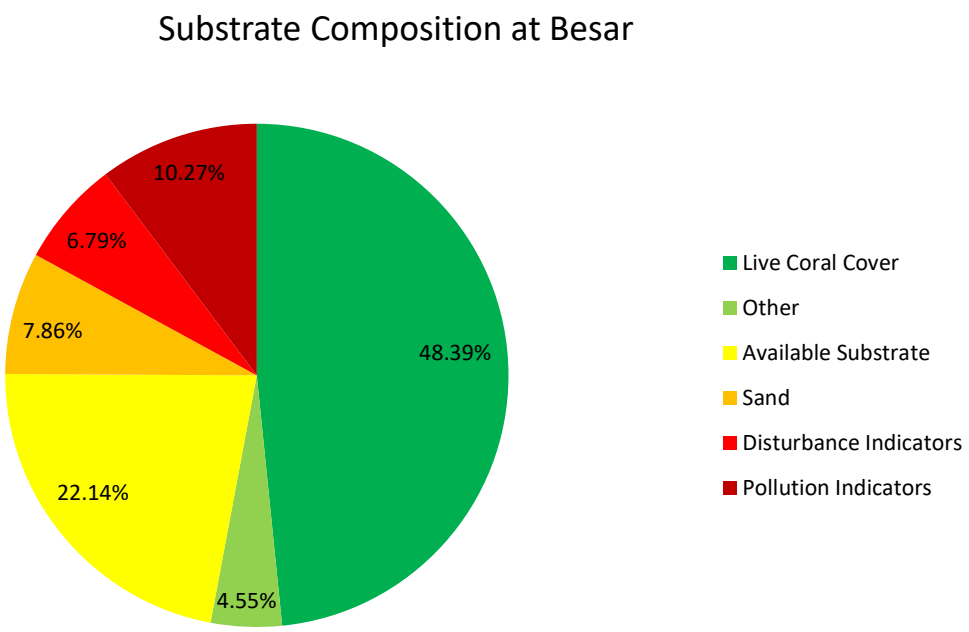
Sunda Shelf – Besar

Pulau Besar is an island in Mersing District, Johor. The island is surrounded by Pulau Rawa, Pulau Sibu 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: 5 sites have 'Good' coral cover, 1 is in 'Fair' condition, and 1 shows 'Poor' health.

Coral Cover and Health

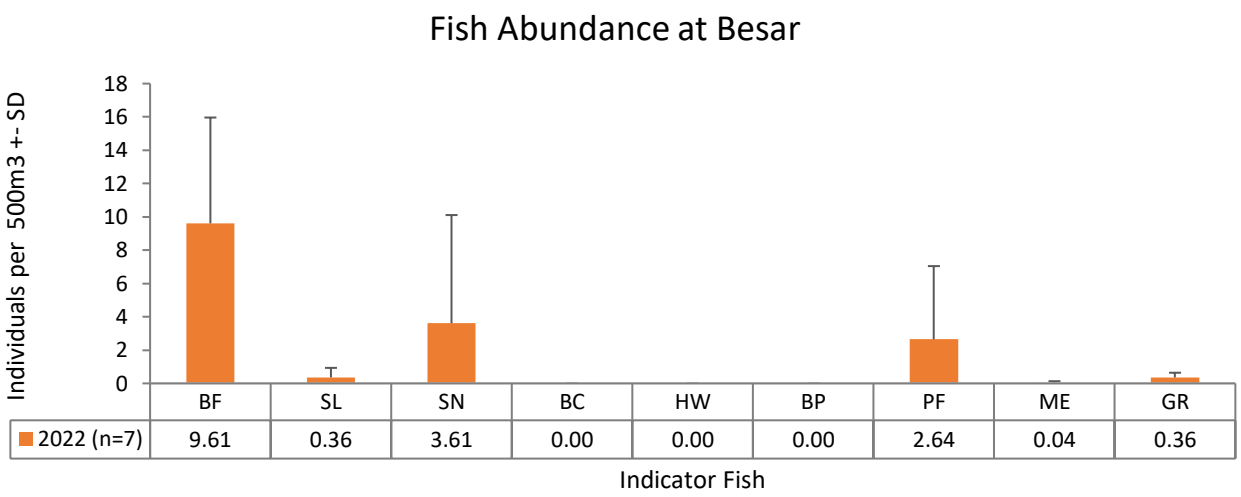


- Pulau Besar reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 47.41%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. It is especially high at Rapang and Mirage.
- Pollution indicators are high.
- The level of nutrient indicator algae is very high at Mirage which recorded 45%.

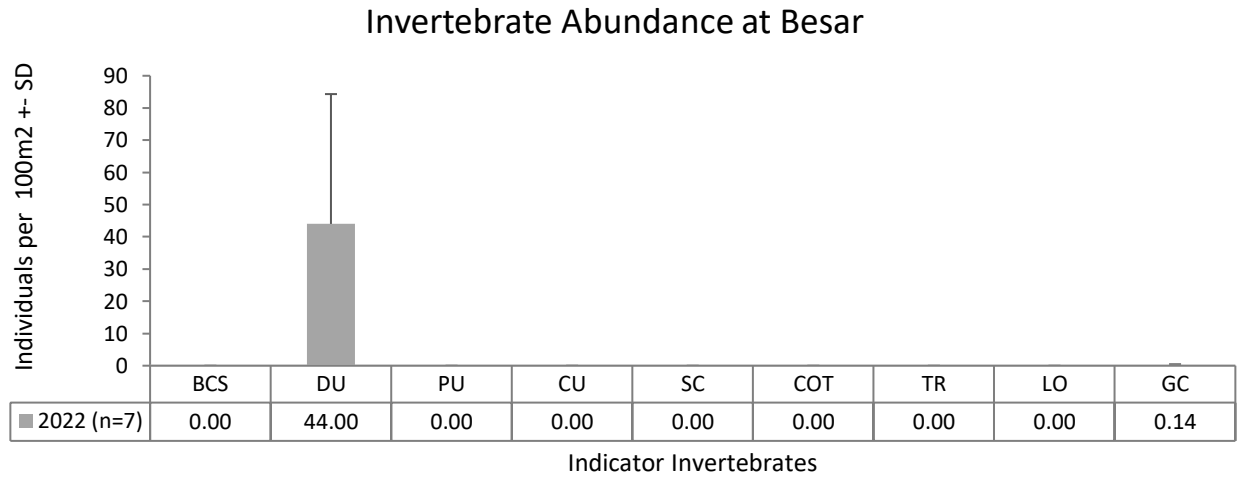
CORAL IMPACTS

- Boat anchor damage and trash were recorded at some sites.
- Discarded fishing nets were recorded at many sites. One turtle and one shark were found dead, stuck at the discarded fishing nets.
- All reefs were impacted by warm water bleaching.

Fish and Invertebrate



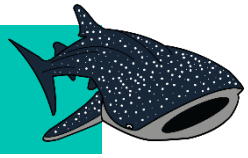
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are low in abundance.
- This suggests that fish targeted for food is heavily harvested.



- Only diadema urchin and giant clam are recorded.
- Diadema urchin abundance is high.
- Indicators for curio trade are absent.

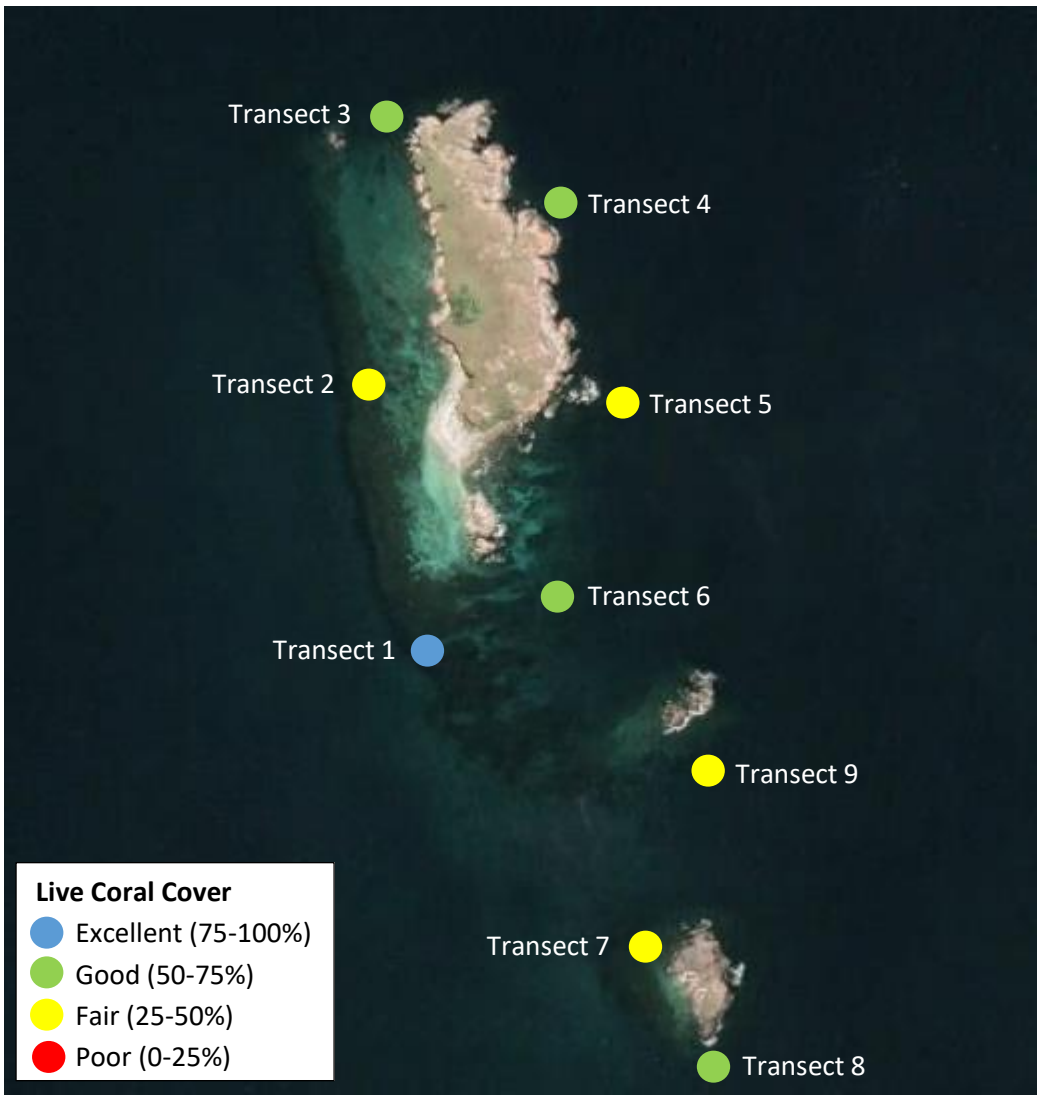
RARE ANIMALS

- Crocodile fish was recorded.



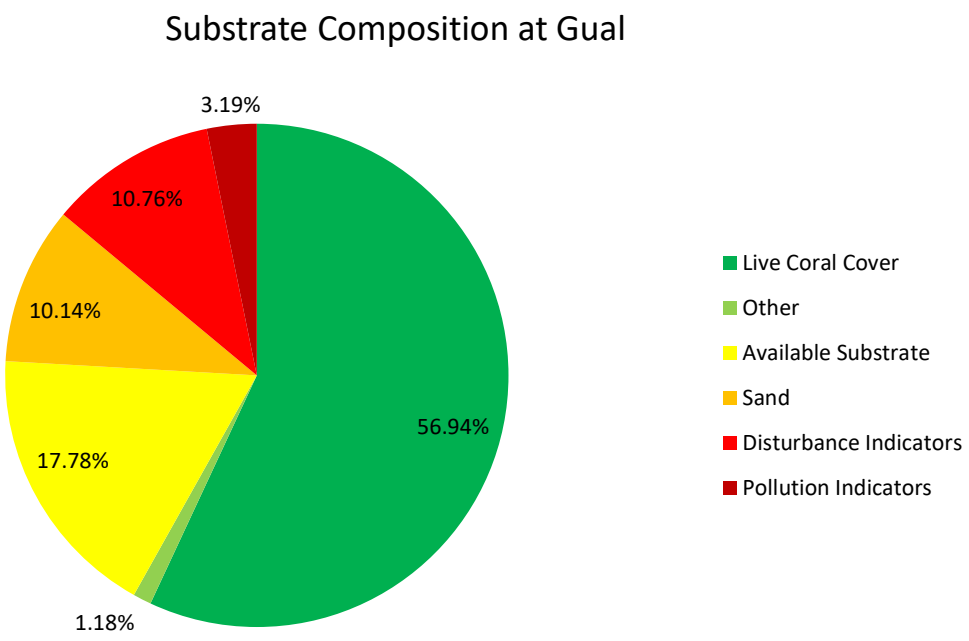
Sunda Shelf – Gual

Pulau Gual is an island in Mersing District, Johor. The island is not populated and surrounded by Pulau Harimau, Pulau Mensirip and Pulau Rawa. 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: 1 site has 'Excellent' coral cover, 4 are in 'Good' condition, and 4 show 'Fair' health.

Coral Cover and Health

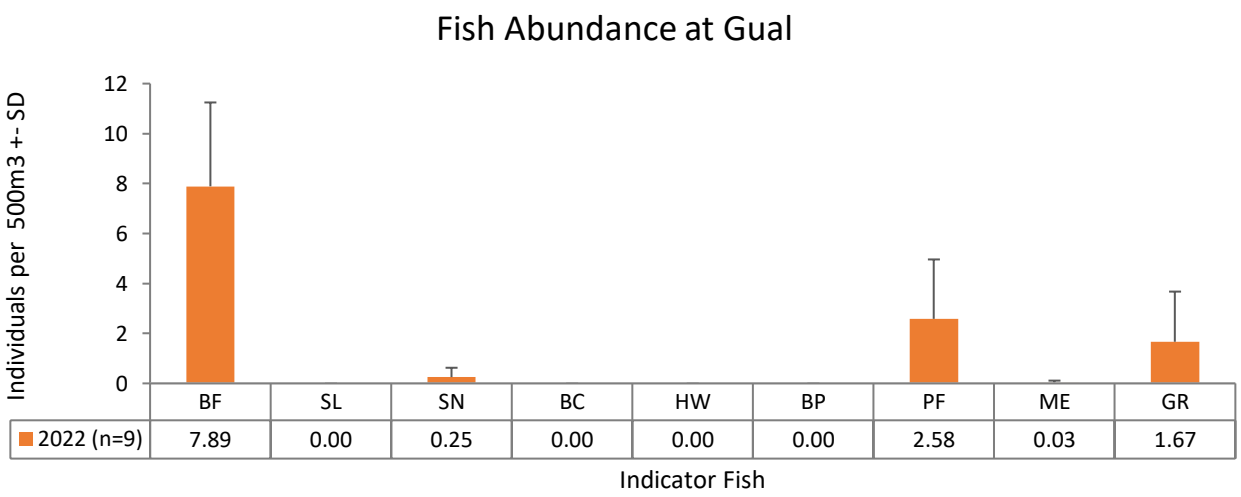


- Pulau Gual reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 55.56%.
- In 'Good' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.
- Sand level is high. It is especially high at Transect 9 which recorded 36.25%.
- Disturbance indicators are high.
- Rubble level is especially high at Transect 7 which recorded 37.50%.
- Silt level is high especially high at Transect 9.

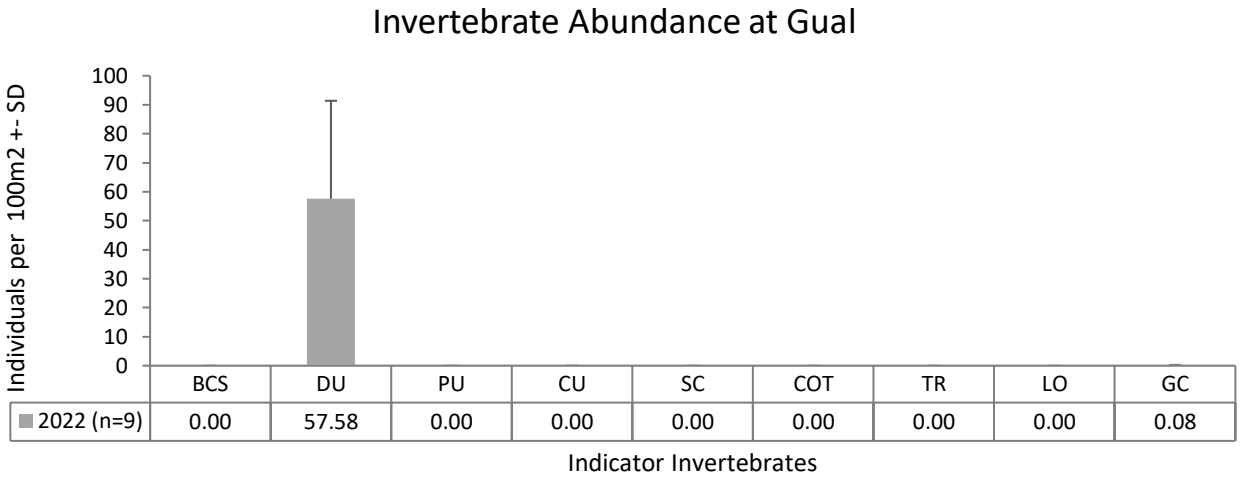
CORAL IMPACTS

- Boat anchor damage and discarded fishing nets were recorded at many sites.
- Many reefs were impacted by warm water bleaching.

Fish and Invertebrate



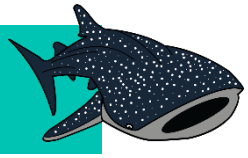
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are low in abundance.
- This suggests that fish targeted for food are heavily harvested.



- Only diadema urchin and giant clam are recorded.
- Diadema urchin abundance is high.
- Indicators for curio trade are absent.

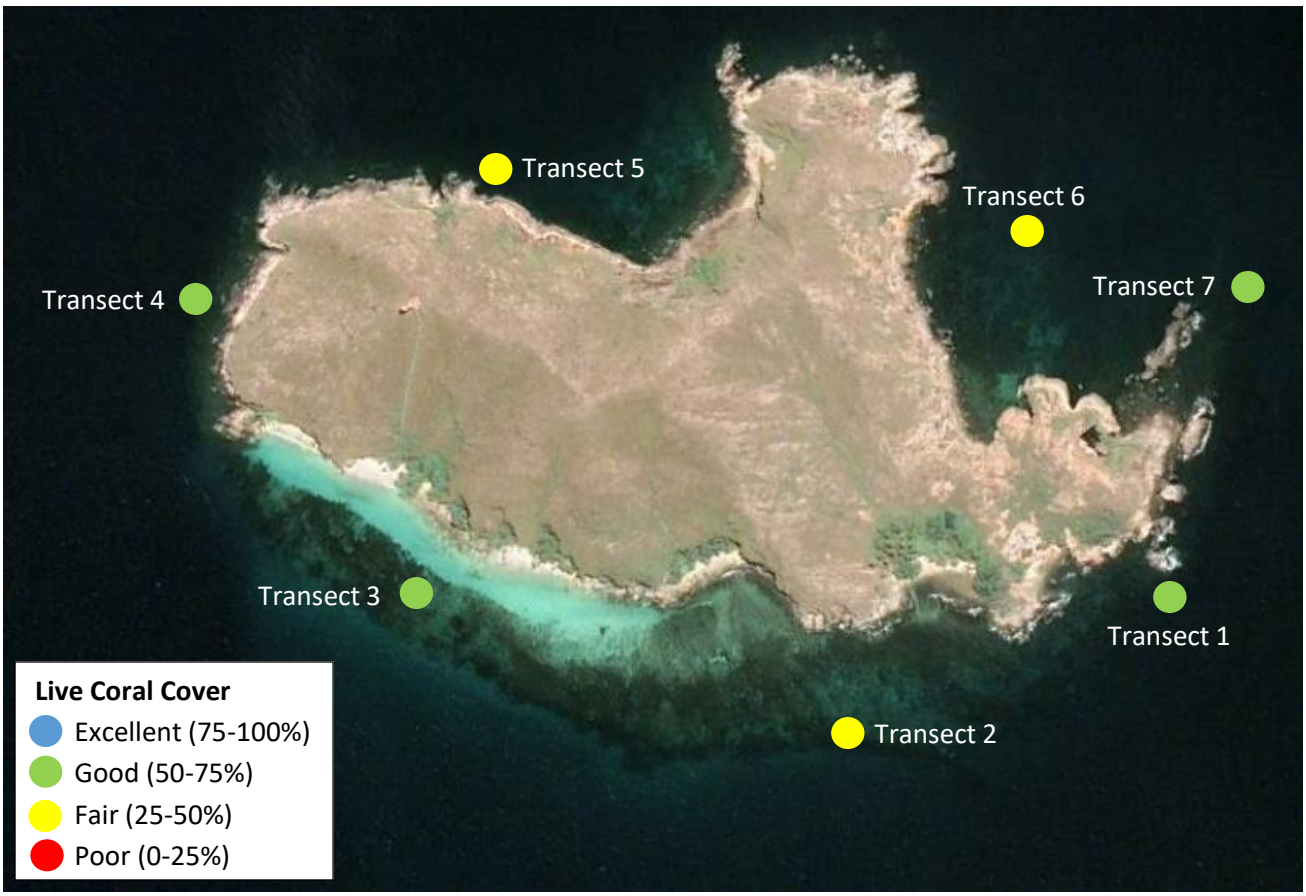
RARE ANIMALS

- Turtles were recorded.



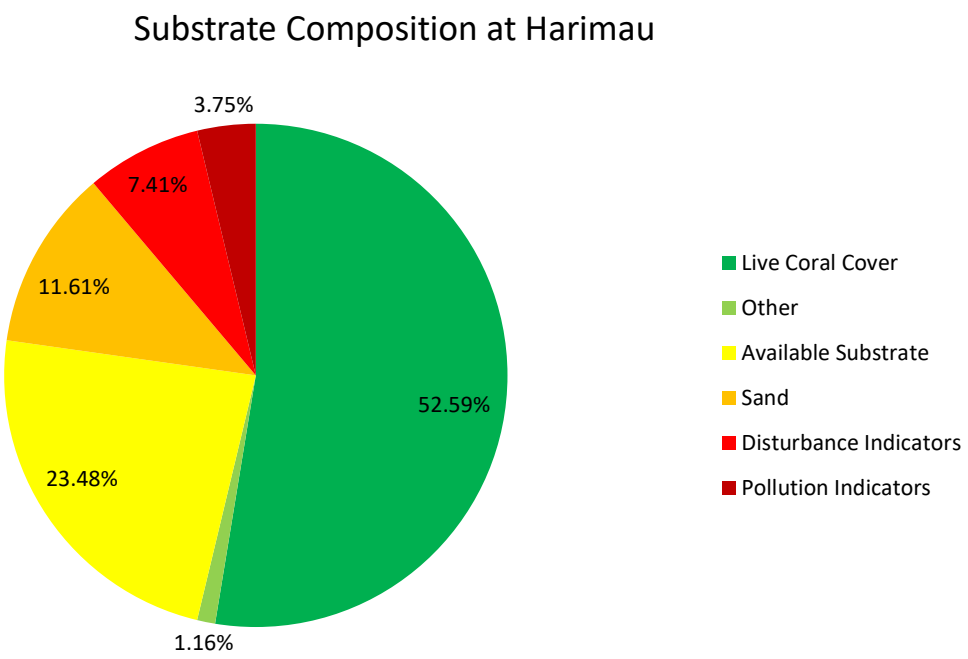
Sunda Shelf – Harimau

Pulau Harimau is an island in Mersing District, Johor. The island is not populated and surrounded by Pulau Mertang, Pulau Mensirip, Pulau Gual and Pulau Rawa. 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: 4 sites have 'Good' coral cover and 3 are in 'Fair' condition.

Coral Cover and Health

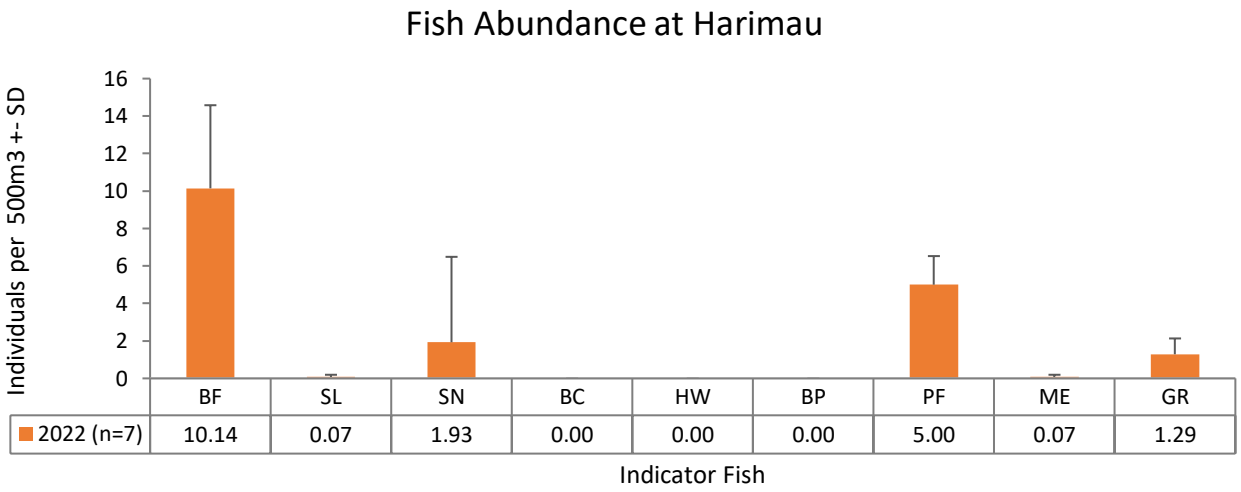


- Pulau Harimau reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 52.41%.
- In 'Good' condition but below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. It is especially high at Transect 6 which recorded 29.38%.
- Disturbance indicators are slightly high.
- Rubble level is especially high at Transect 5 and 6.

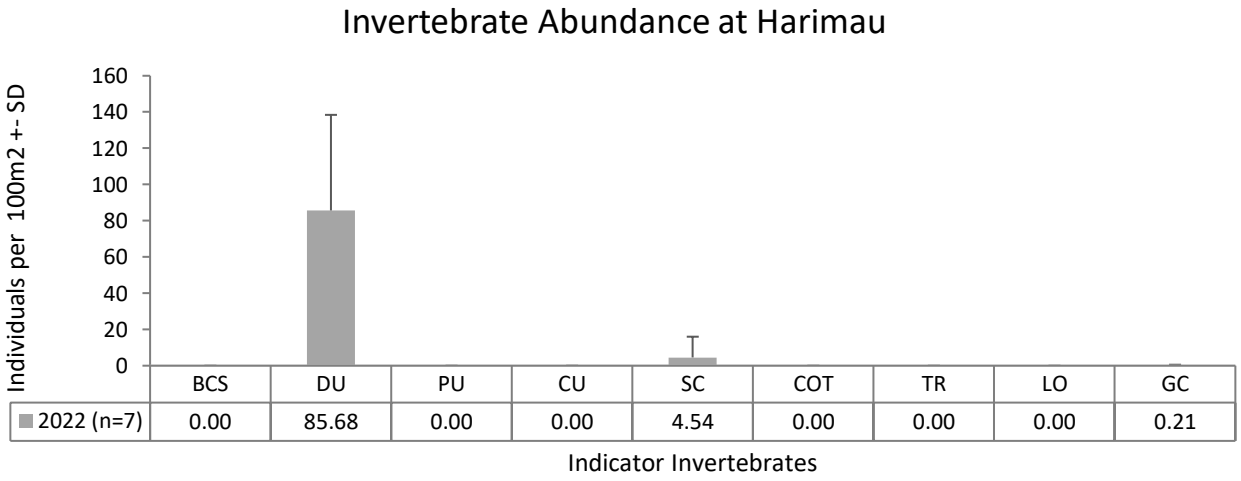
CORAL IMPACTS

- Boat anchor damage and trash were recorded at some sites.
- Discarded fishing nets were recorded at all sites.
- One reef was impacted by warm water bleaching.

Fish and Invertebrate



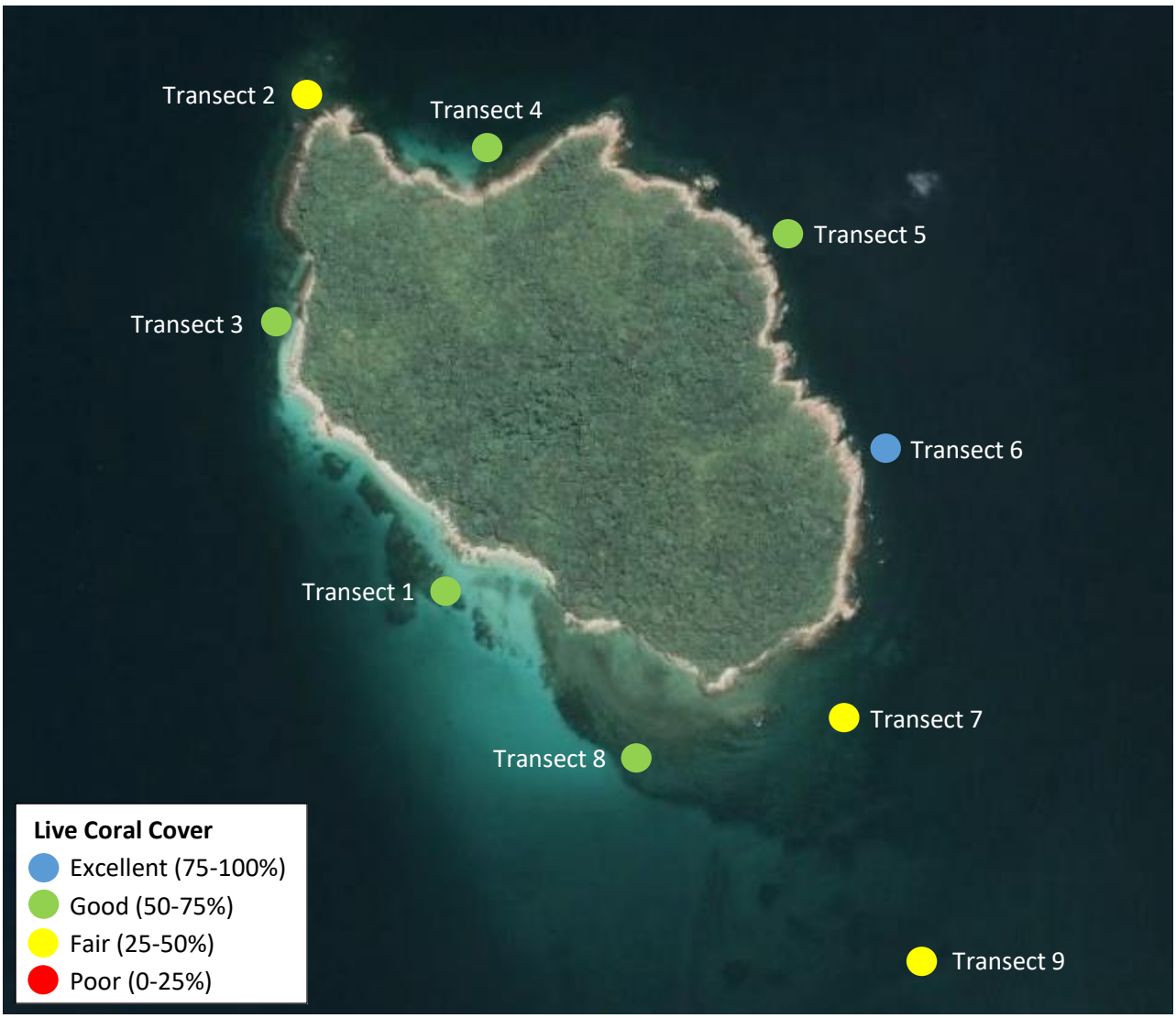
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are low in abundance, except for parrotfish.
- This suggests that fish targeted for food are heavily harvested.



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

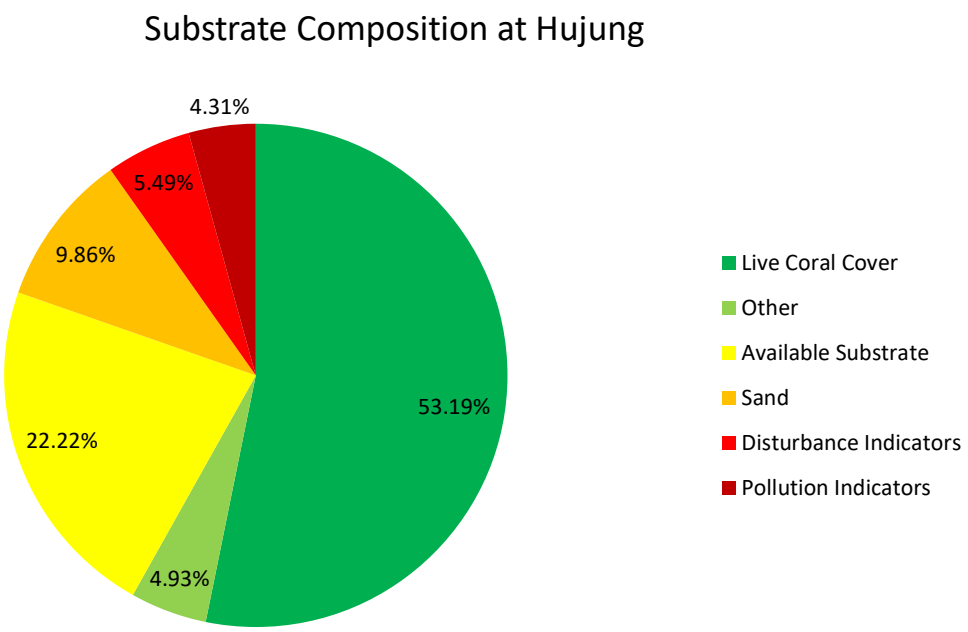
Sunda Shelf – Hujung

Pulau Hujung is an island in Mersing District, Johor. The island is not populated and surrounded by Pulau Rawa, Pulau Sibu 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: 1 site has 'Excellent' coral cover, 5 are in 'Good' condition, and 3 show 'Fair' health.

Coral Cover and Health

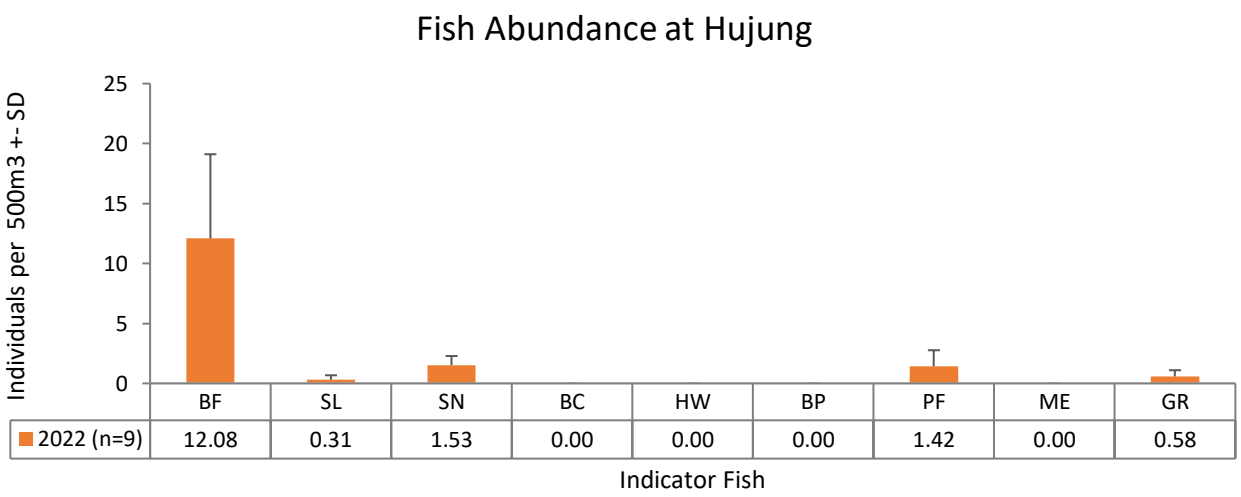


- Pulau Hujung reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 52.15%.
- In 'Good' condition but below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is high at many sites.

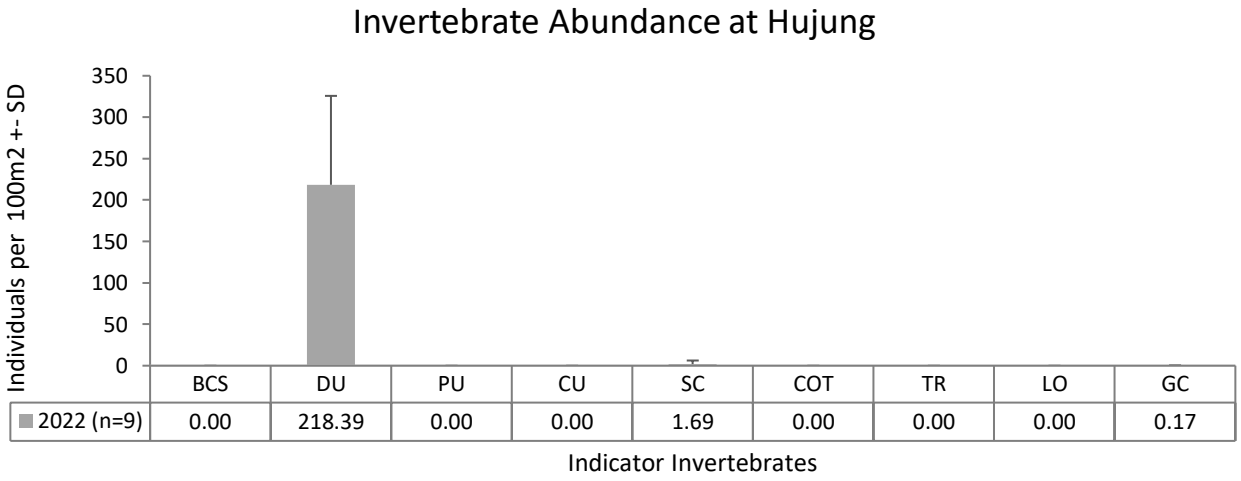
CORAL IMPACTS

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

Fish and Invertebrate



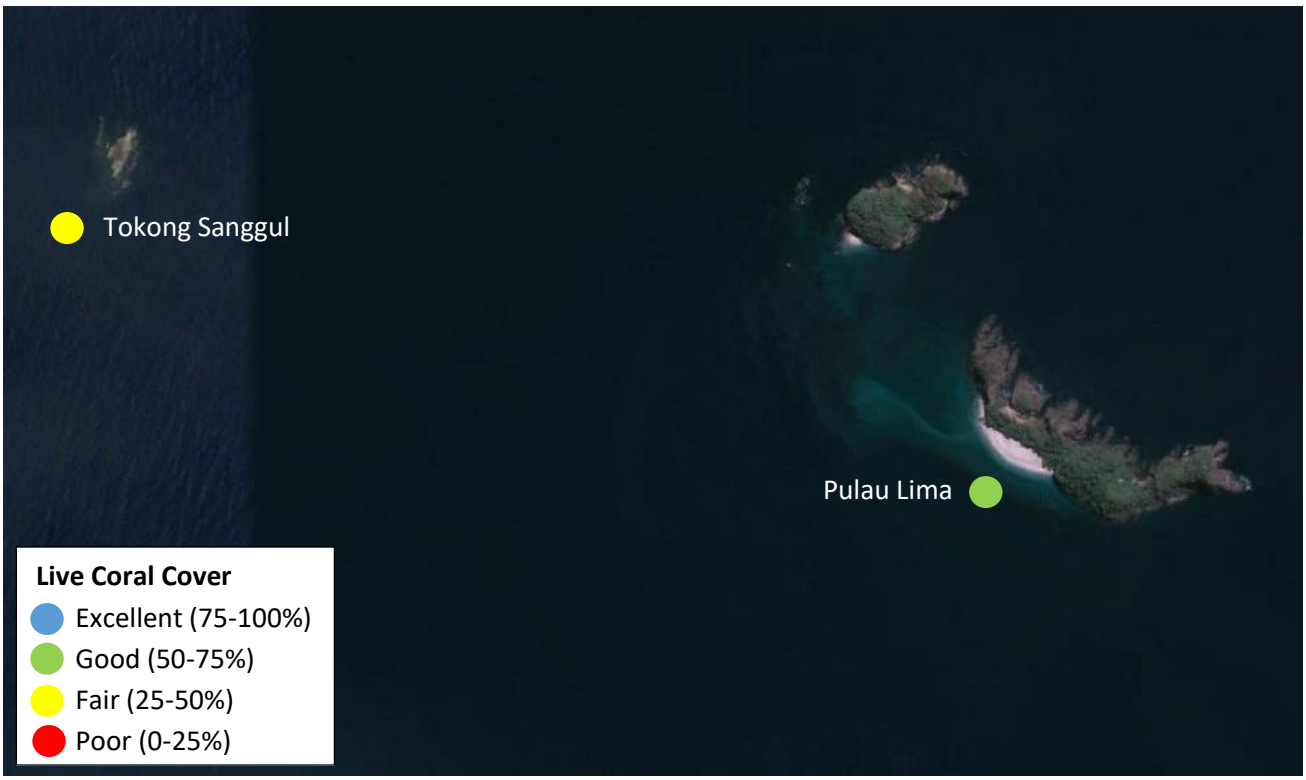
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.



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

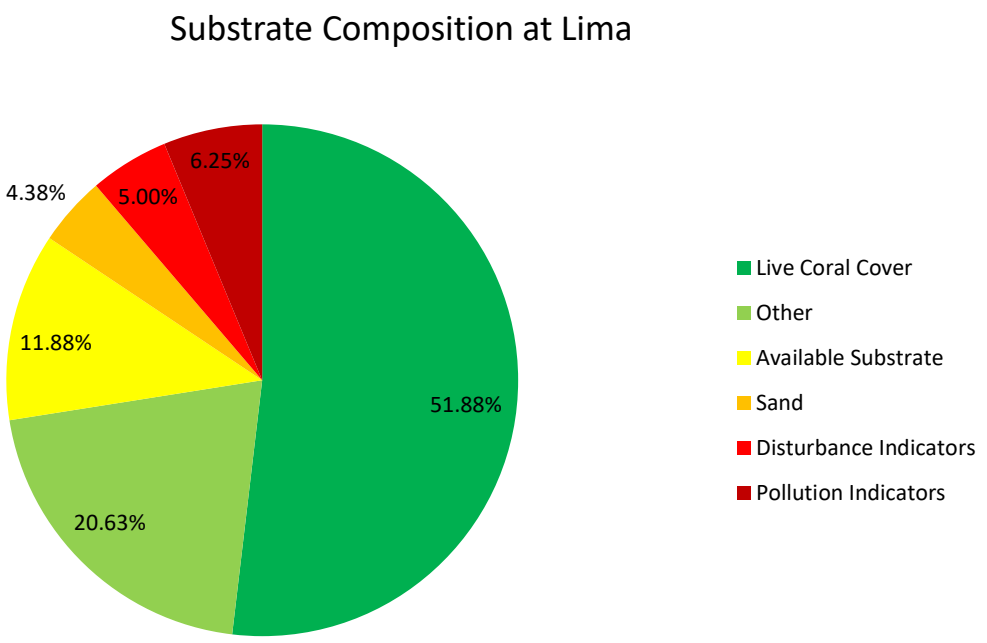
Sunda Shelf – Lima

Pulau Lima is an island in Mersing District, Johor. The island is surrounded by Pulau Sibu and Pulau Tinggi and frequented by snorkelers and divers from the nearby Pulau Sibu 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: 1 site has 'Good' coral cover and 1 is in 'Fair' condition.

Coral Cover and Health

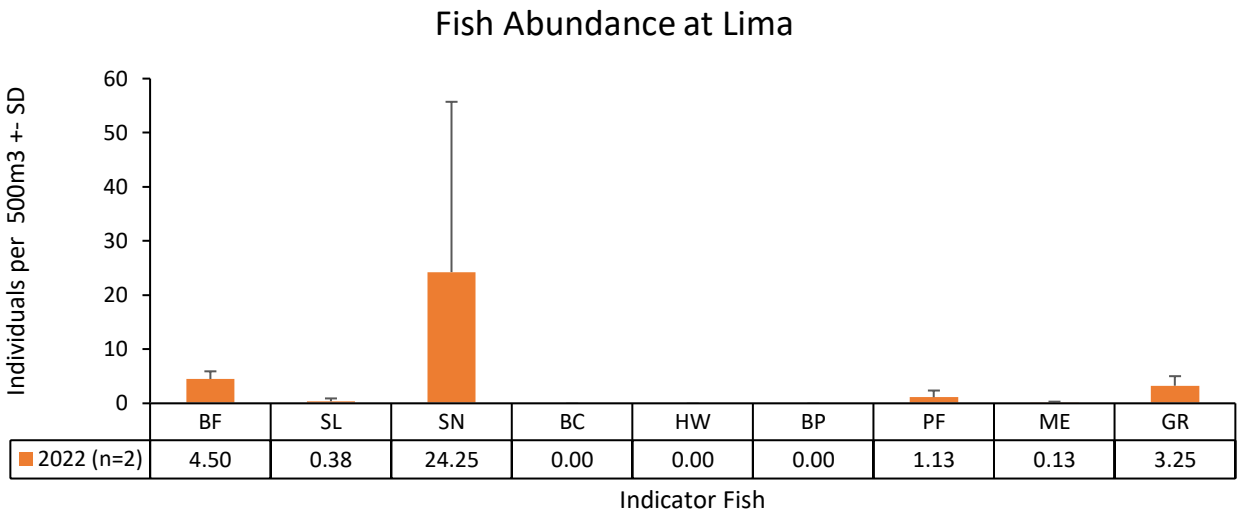


- Pulau Lima reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 50%.
- In 'Good' condition but below the Sunda Shelf region average (53.34%).
- The level of Other is high, mainly attributed by corallimorph.
- Available substrate for coral recruits to attach is high.
- Pollution indicators are not high in Pulau Lima in general but the level of sponge is especially high at Tokong Sanggul.

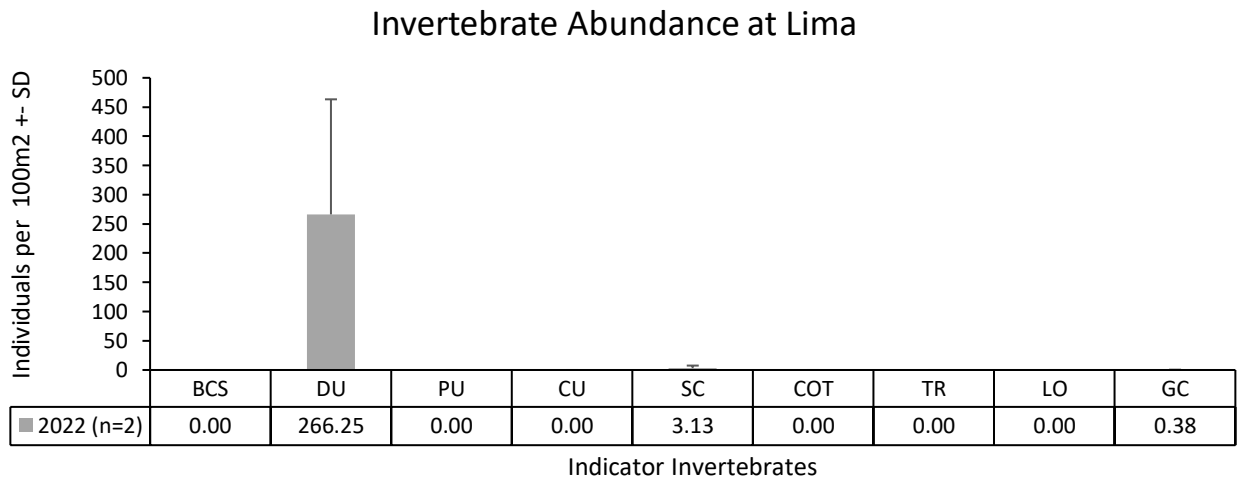
CORAL IMPACTS

- Discarded fishing nets were recorded.
- Paling of corals due to warm water were observed at all sites.

Fish and Invertebrate



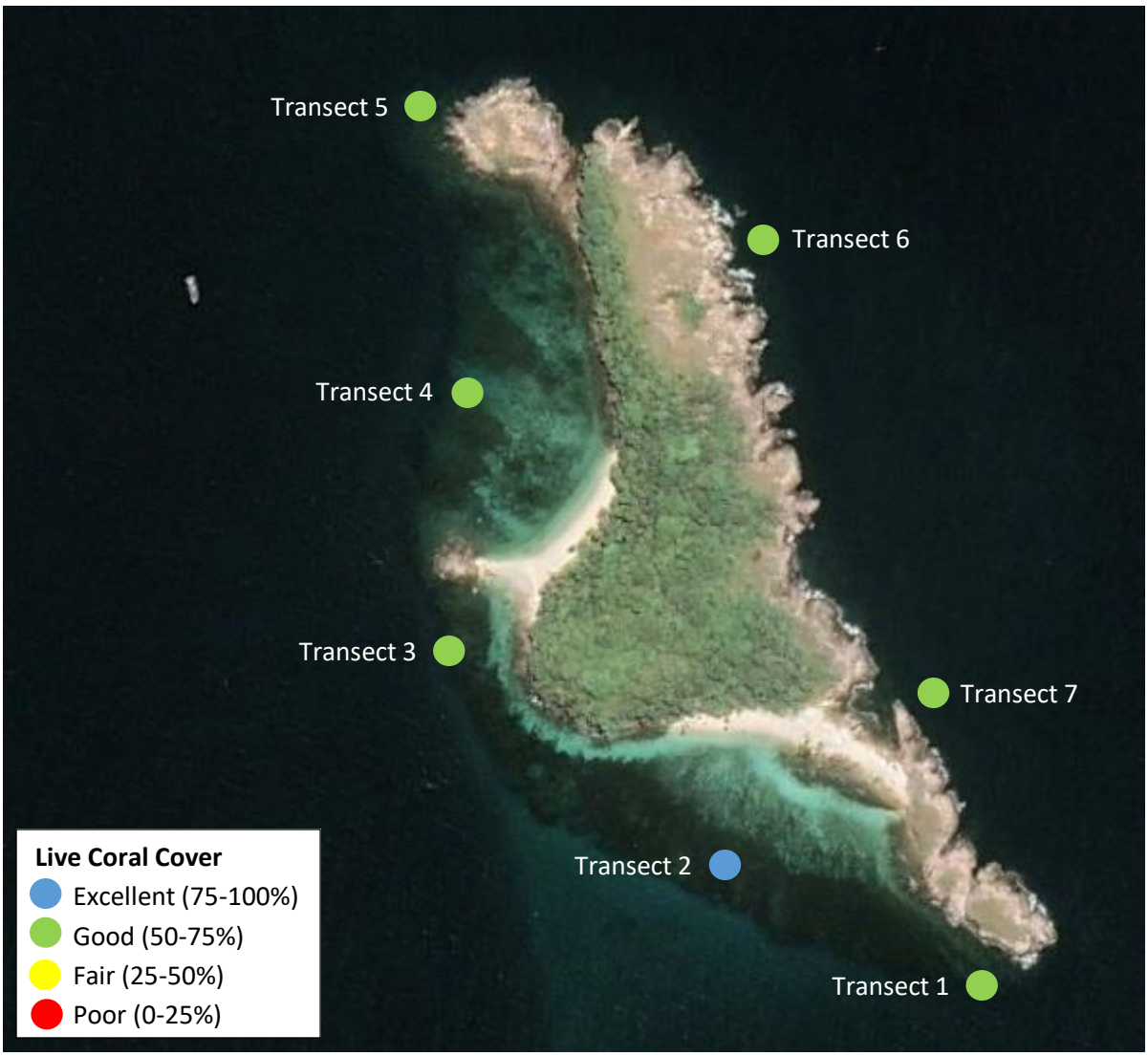
- Snapper abundance is high.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food is low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.



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

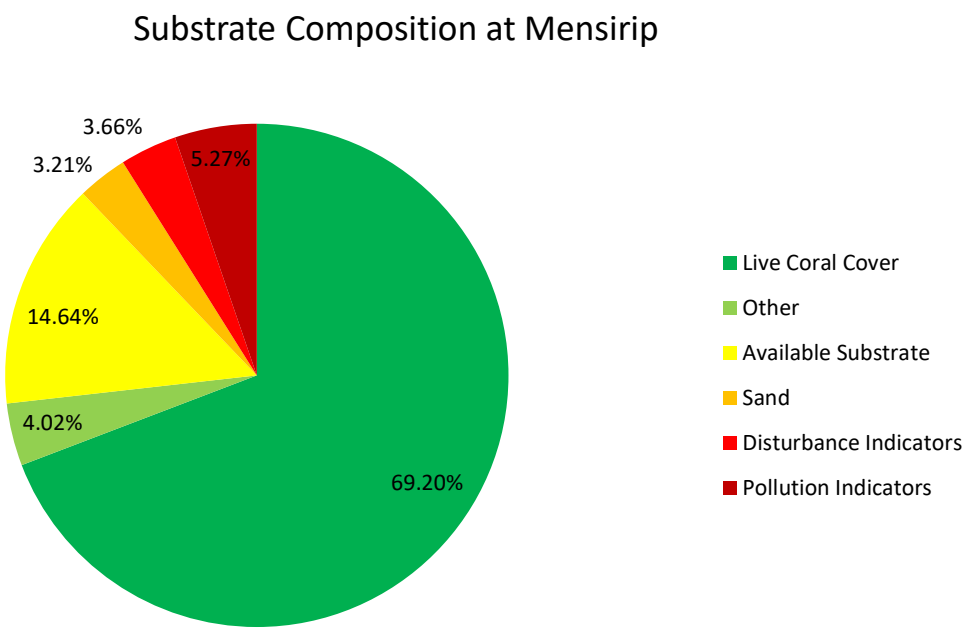
Sunda Shelf – Mensirip

Pulau Mensirip is an island in Mersing District, Johor. The island is not populated and surrounded by Pulau Harimau, Pulau Gual and Pulau Rawa. 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: 1 site has 'Excellent' coral cover and 6 are in 'Fair' condition.

Coral Cover and Health

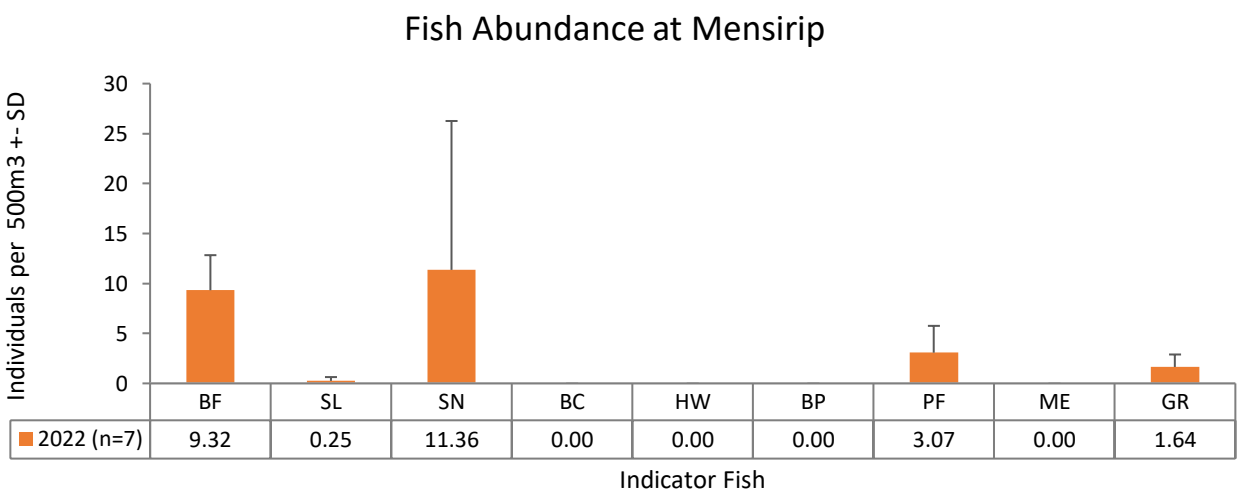


- Pulau Mensirip reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 53.30%.
- In 'Good' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.

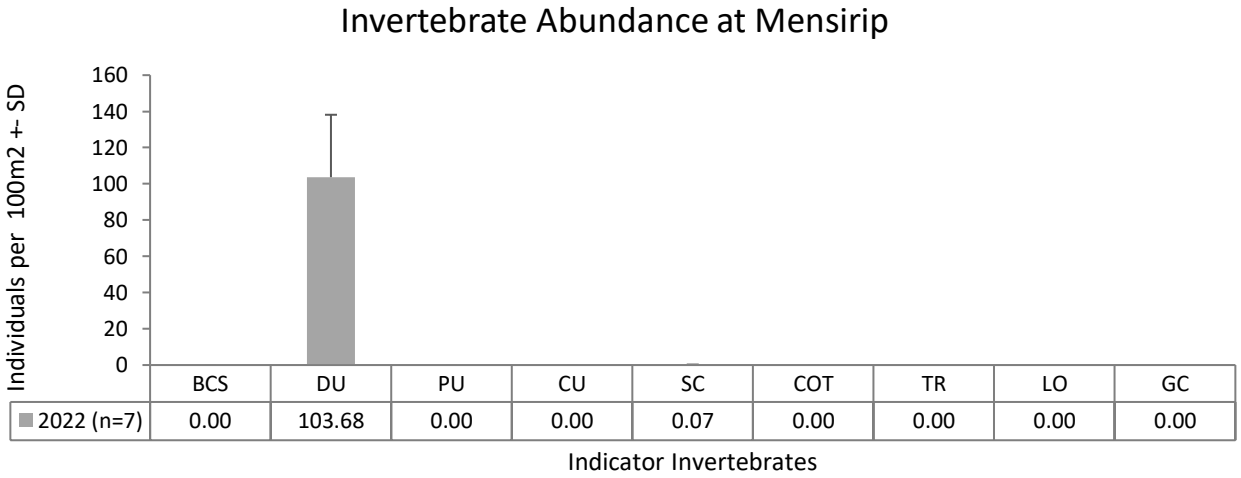
CORAL IMPACTS

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

Fish and Invertebrate



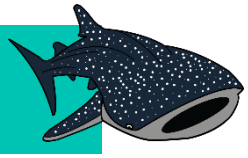
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Indicators targeted for live-food fish trade are absent.
- Snapper, fish targeted for food, abundance is high.
- Fish targeted for food is low in abundance, except for snapper and parrotfish.
- This suggests that fish targeted for food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



- Only diadema urchin and sea cucumber are recorded.
- Diadema urchin abundance is high.
- Indicators for curio trade are absent.

RARE ANIMALS

- Turtles were recorded.

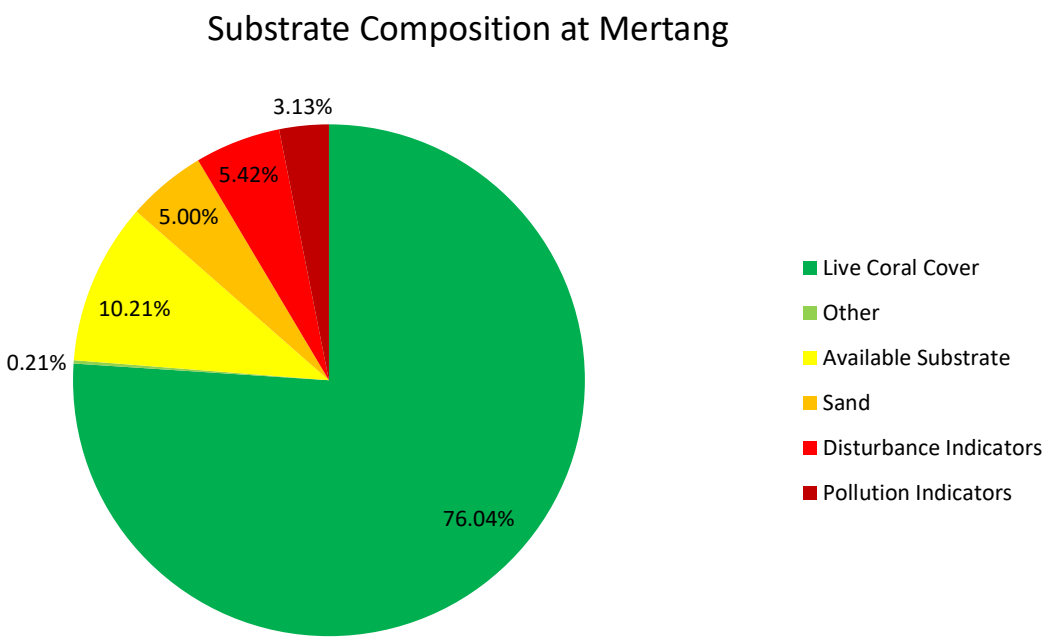


Sunda Shelf – Mertang

Mertang is an island in Mersing District, Johor and is approximately 11km off mainland. The island is near to Pulau Sembilang and Pulau Seri Buat. The island is not populated, has no protection status and is an important turtle nesting site.

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

Coral Cover and Health

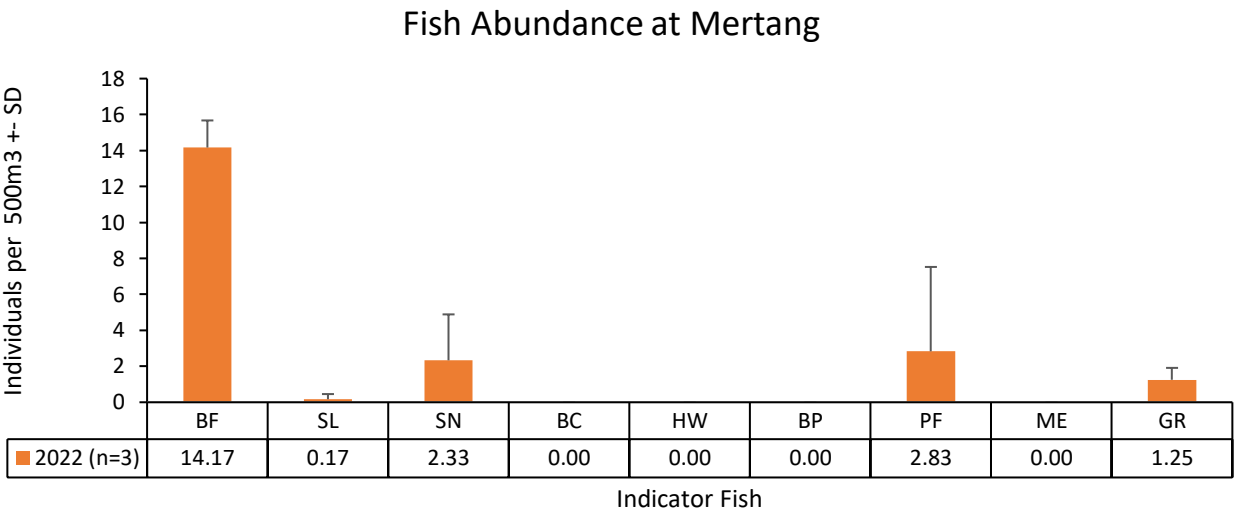


- Mertang reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 75.83%.
- In 'Excellent' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.

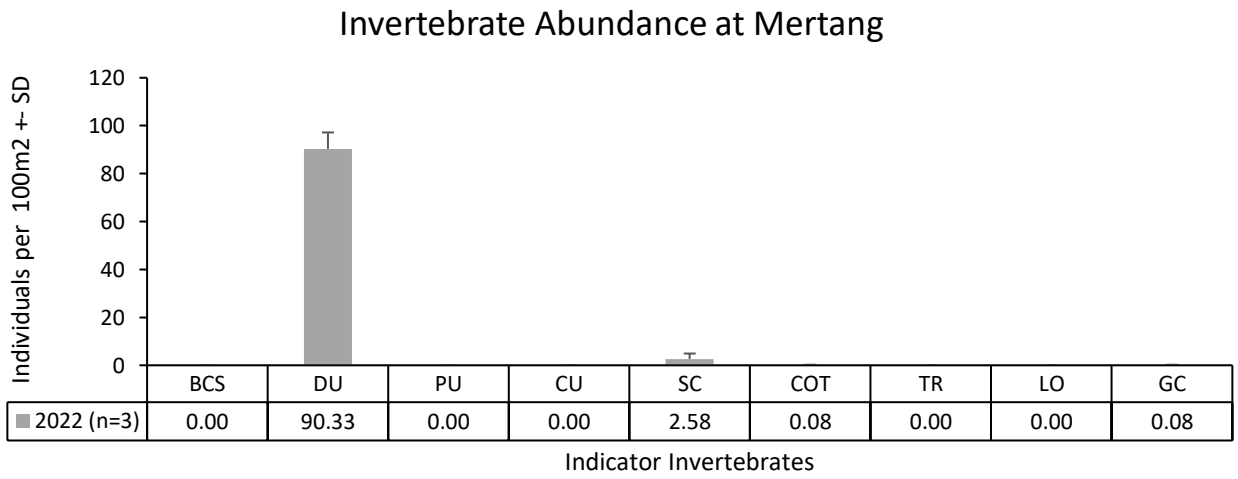
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.

Fish and Invertebrate



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

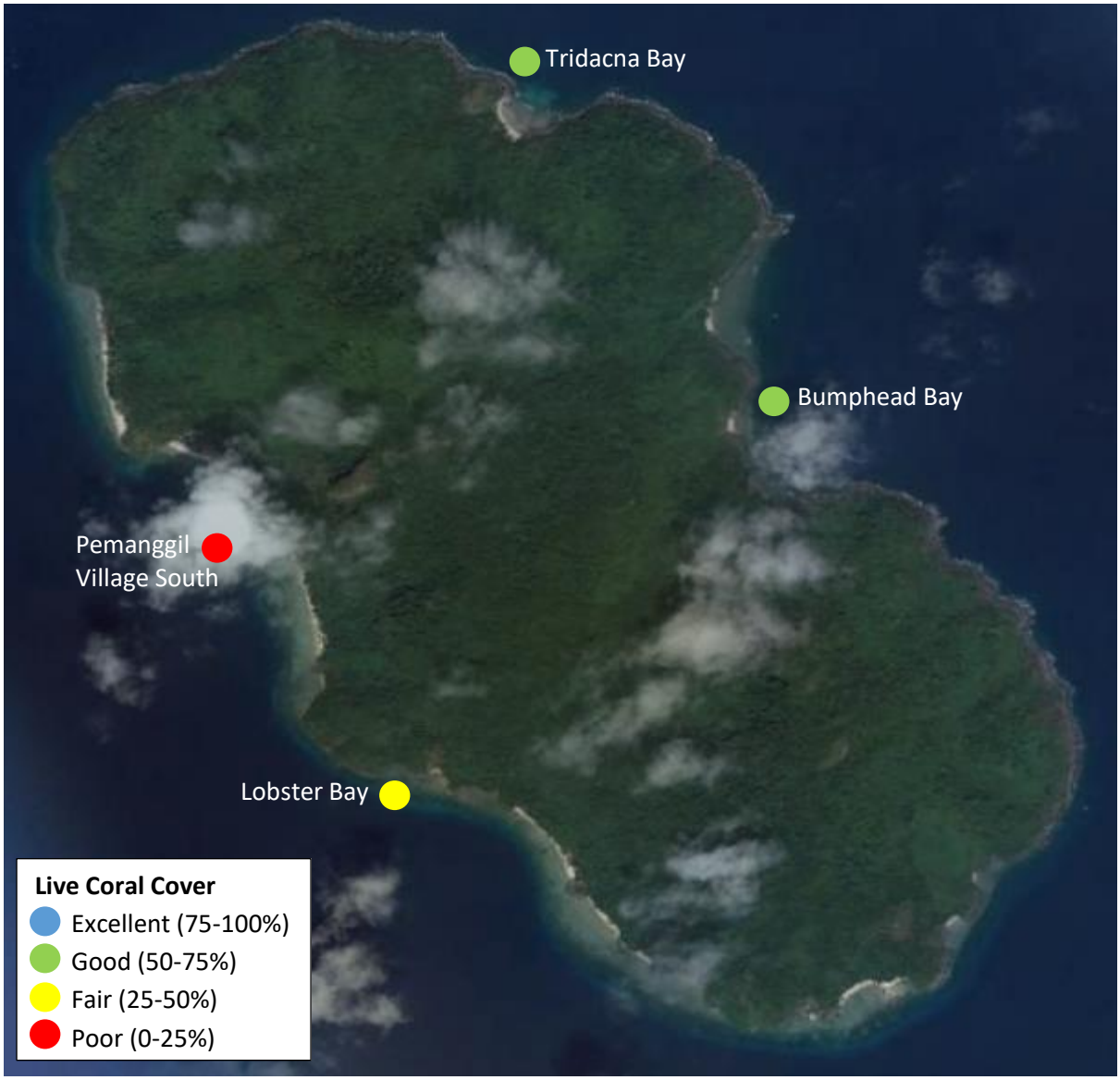


- Diadema urchin abundance is high.
- Invertebrates targeted for food are very low in abundance, except for sea cucumber.
- Indicators for curio trade are absent.
- Crown-of-thorns are not an issue in Mertang.

Sunda Shelf – Pemanggil

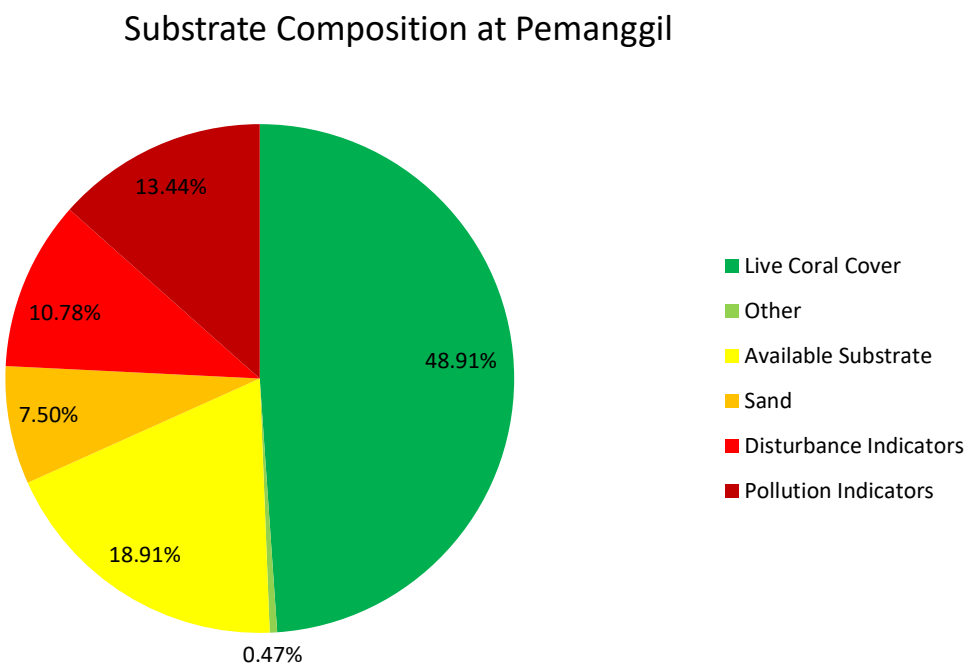
Pemanggil Island is approximately 45km east of Mersing off the East coast of Peninsular Malaysia. The island and its surrounding waters were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

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

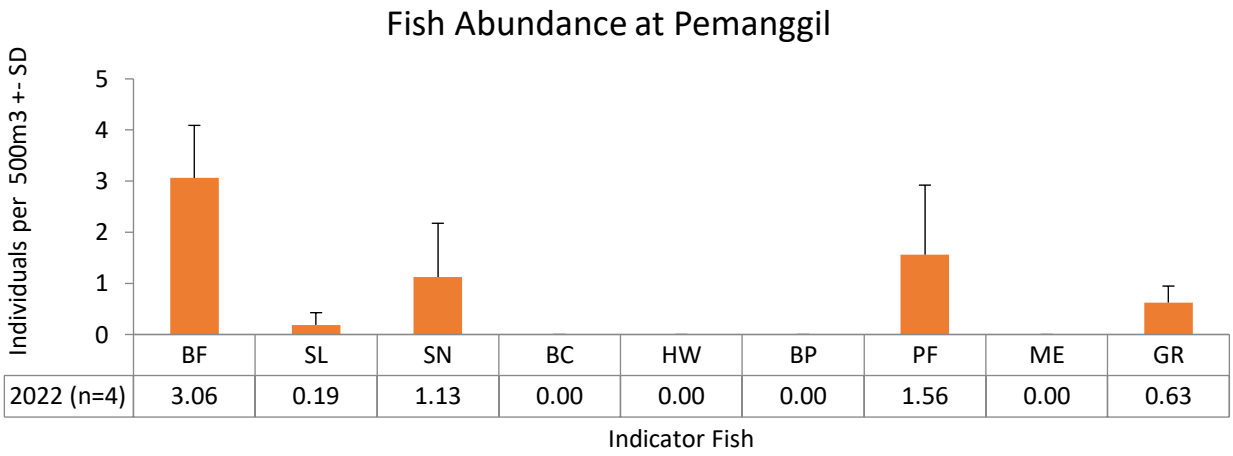


- Pemanggil reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 45%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- Rubble level is especially high at Pemanggil Village South which recorded 25%.
- Pollution indicators are high.
- Nutrient indicator algae level is high at all sites except Tridacna Bay.

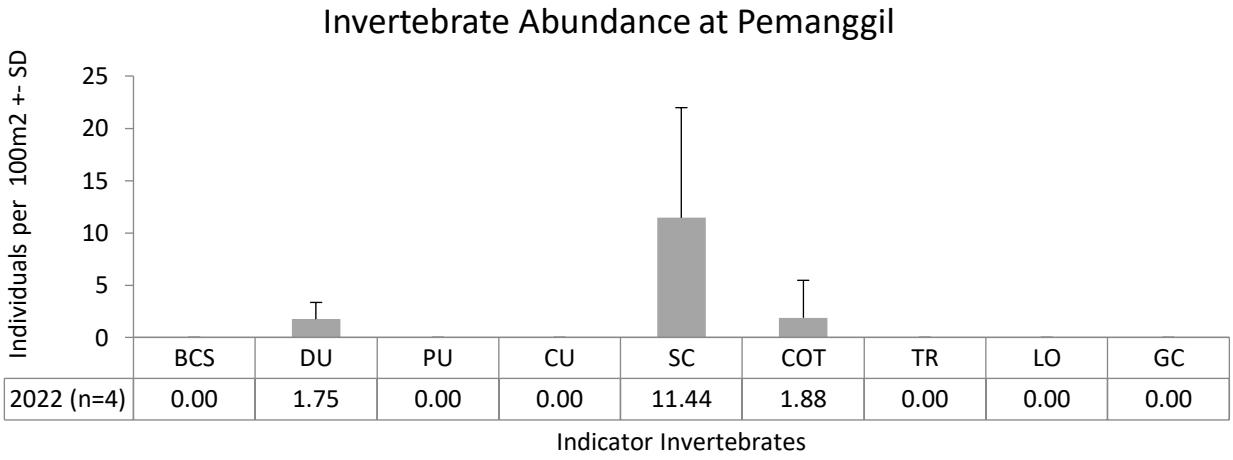
CORAL IMPACTS

- Boat anchor damage, discarded fishing net and trash were recorded.
- Crown-of-thorns predation was recorded.
- One site was impacted by warm water bleaching.

Fish and Invertebrate



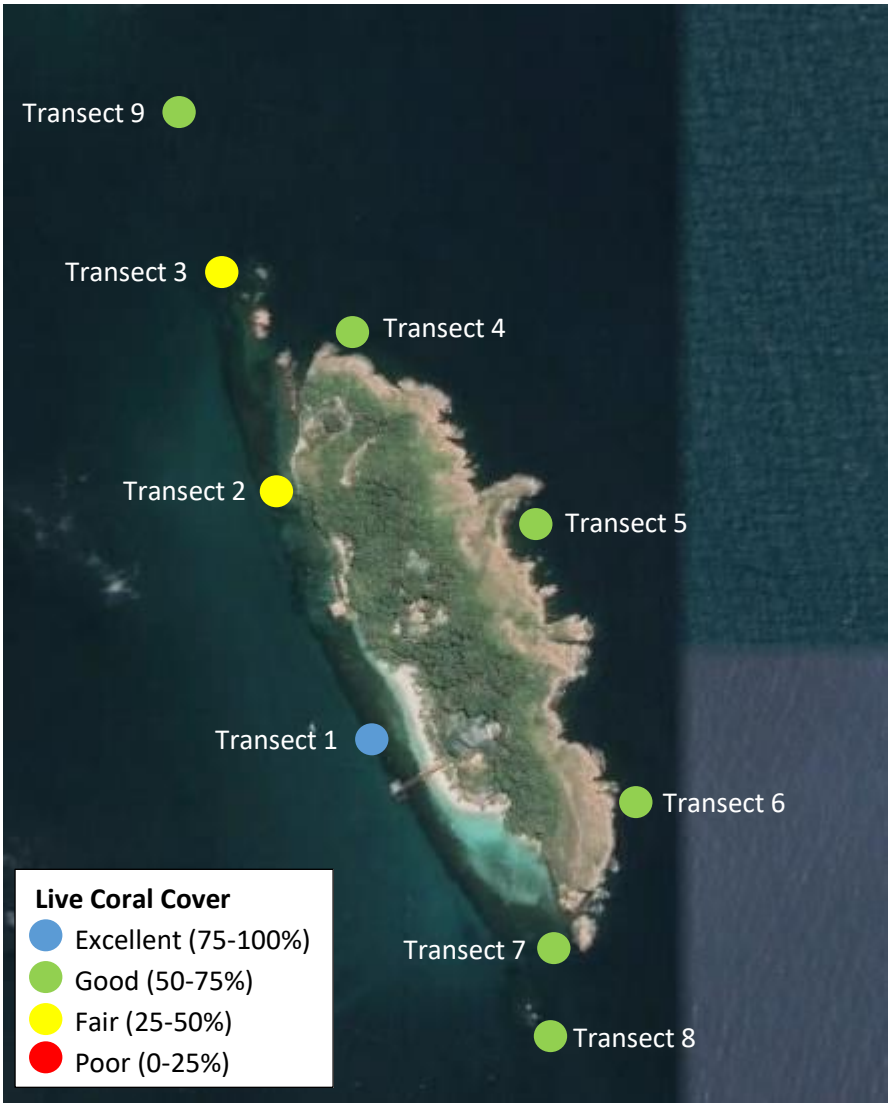
- Butterflyfish, indicator for aquarium trade, is recorded.
- Fish targeted for food are low in abundance.
- Indicators targeted for live-food fish trade are absent.
- This suggests that fish targeted for food are heavily harvested.



- Sea cucumber, indicator targeted for food, abundance is high.
- Invertebrates targeted for curio trade are absent.
- Crown-of-thorns are issue in Pemanggil.
- A healthy coral reef can support a population of 0.2-0.3 individuals per 100m^2, Pemanggil recorded 1.88.

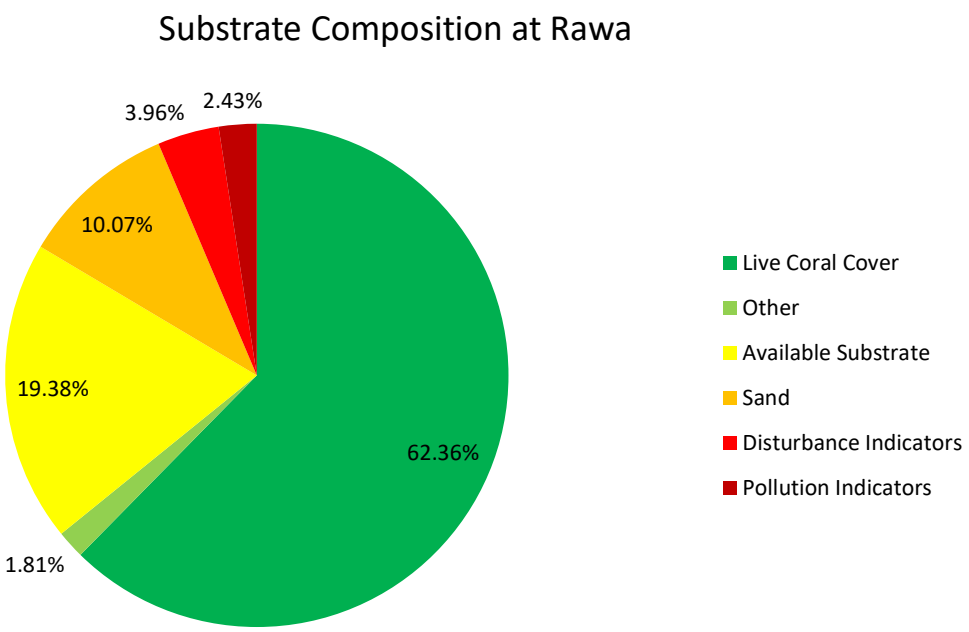
Sunda Shelf – Rawa

Pulau Rawa is under Mersing District, Johor and is accessible by speedboat from Mersing (20-30 minutes boat ride). Rawa is the local term for white doves, which are abundant on the island. Pulau Rawa is a small island and there are no proper roads, only a few walkways. There are two resorts on the island. One side of the island is a beach covered with white sand and the other side is a rocky vertical cliff. The island and its surrounding waters 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: 1 site has 'Excellent' coral cover, 6 are in 'Good' condition, and 2 shows 'Fair' health.

Coral Cover and Health

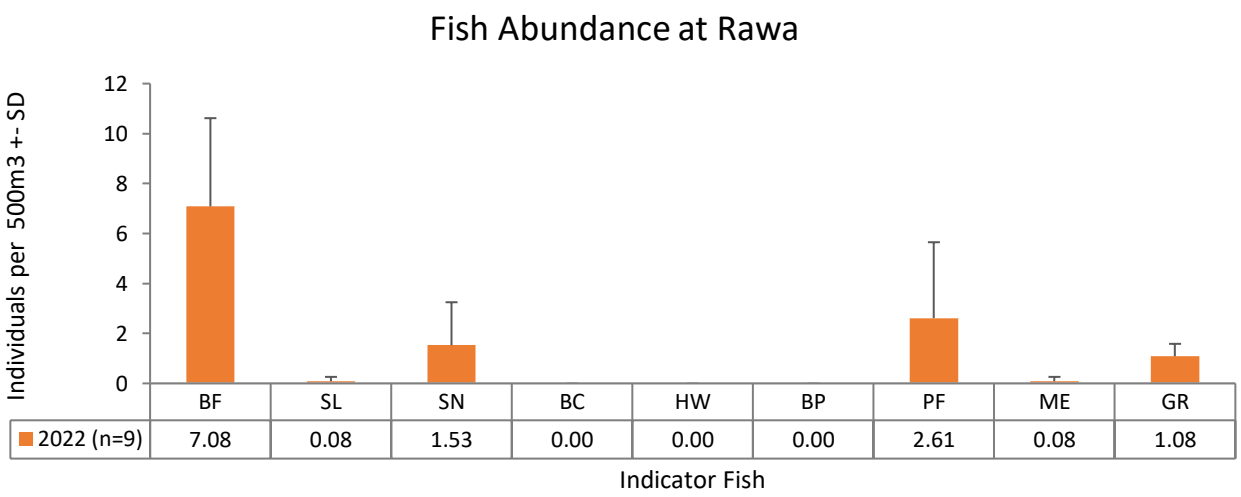


- Rawa reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 56.74%.
- In 'Good' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.
- Sand level is high. It is especially high at Transect 9 (21.25%) and Transect 3 (19.38%).

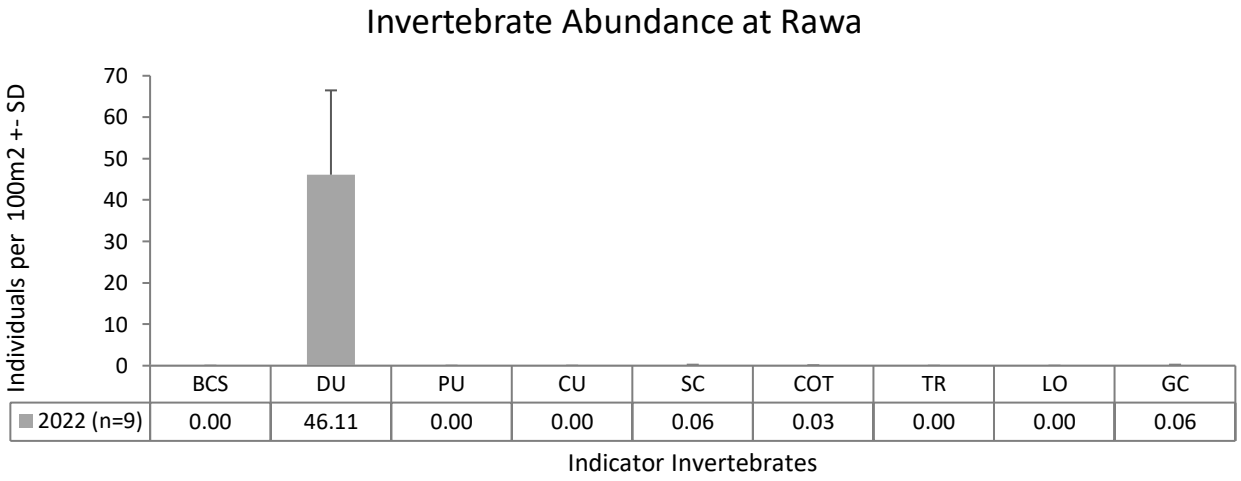
CORAL IMPACTS

- Discarded fishing nets and trash were recorded at many sites.
- Some sites were impacted by warm water bleaching.

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, abundance is high.
- Absence of indicators targeted for live-food fish trade.
- Fish targeted for food is low in abundance.
- This suggests that fish targeted for food are heavily harvested.

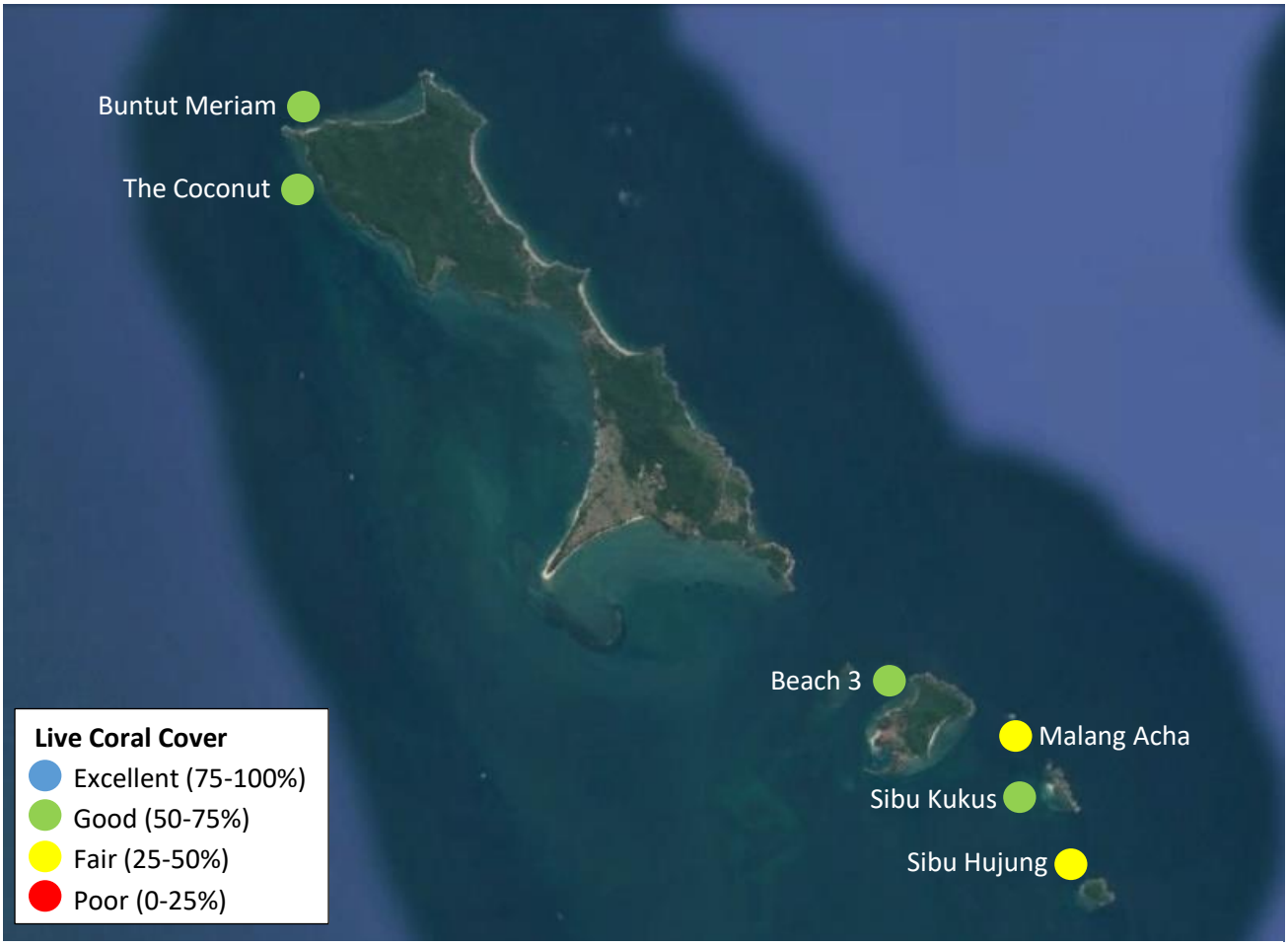


- Diadema urchin abundance is high.
- Invertebrates targeted for food are very low in abundance.
- Indicators for curio trade are absent.
- Crown-of-thorns are not an issue in Rawa.

Sunda Shelf – Sibu

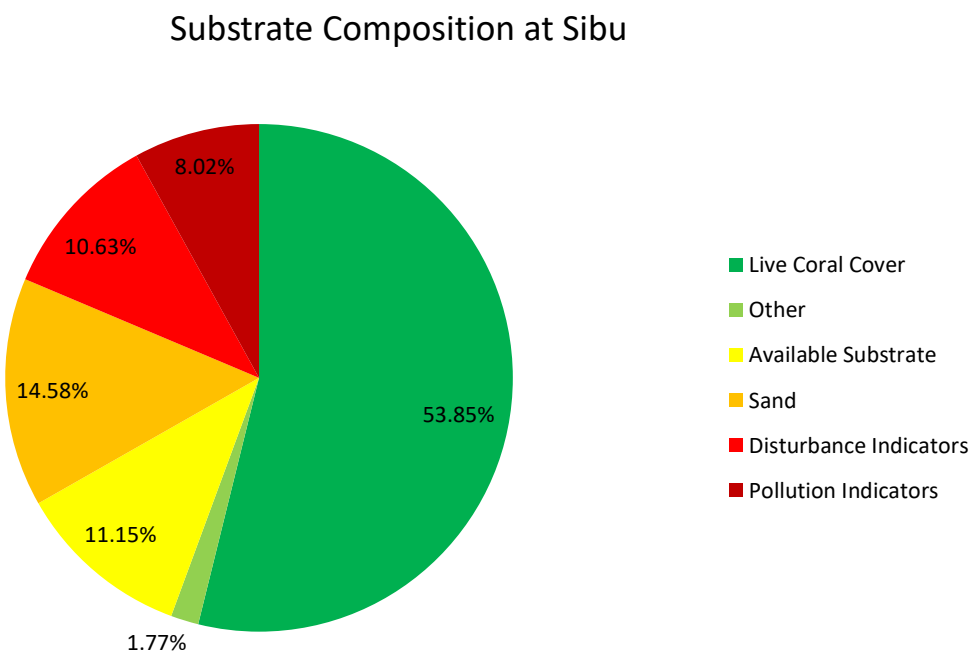
The Sibu archipelago, known locally by the name of the largest island, Sibu, is located less than 10km off the East coast of mainland Peninsular Malaysia. The waters surrounding the island group were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

Sibu 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 several small resorts.



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

Coral Cover and Health

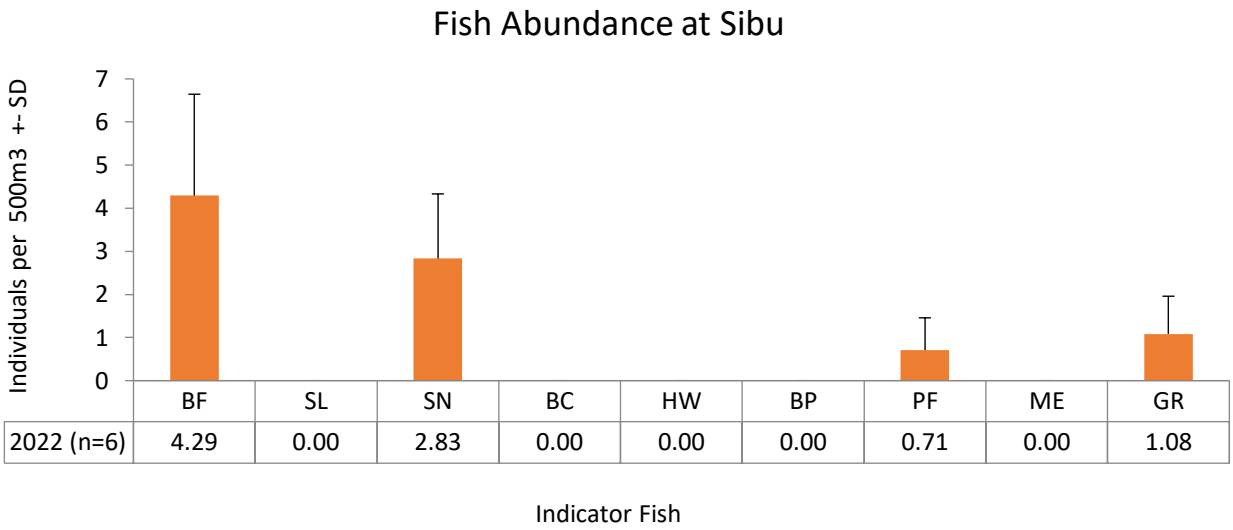


- Sibu reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 52.60%.
- In 'Good' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.
- Sand level is high. It is especially high at Sibu Kukus (28.75%) and Malang Acha (20%).
- Disturbance indicators are high.
- Silt level is high at many sites.
- Pollution indicators are slightly high.
- Nutrient indicator algae level is especially high at The Coconut
- Sponge level is especially high at Malang Acha, Buntut Meriam and Beach 3.

CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded.
- Some sites were impacted by drupella predation and warm water bleaching.

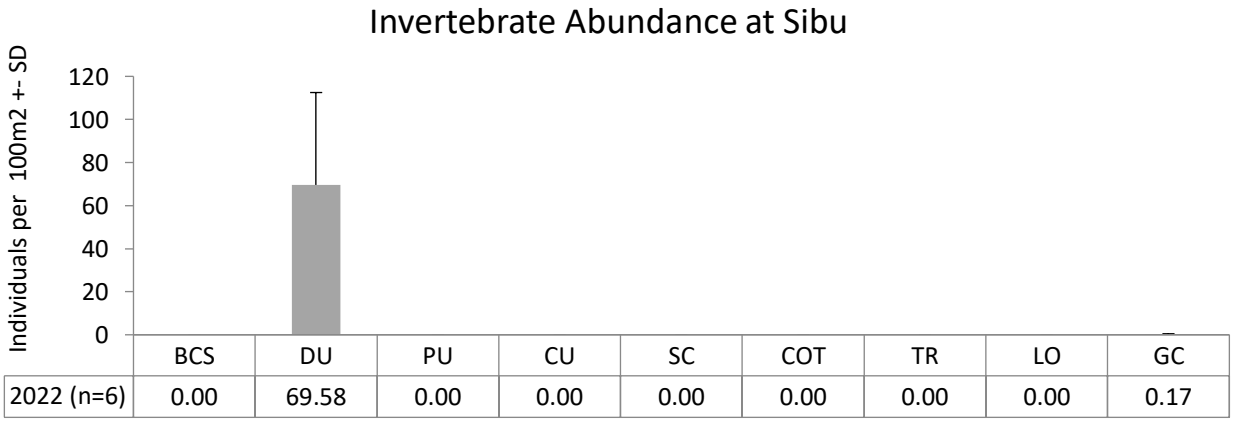
Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=6)	4.29	0.00	2.83	0.00	0.00	0.00	0.71	0.00	1.08

Indicator Fish

- Butterflyfish, indicator for aquarium trade, is recorded.
- Absence 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.

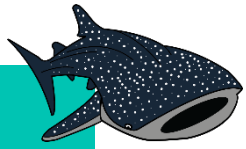


	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=6)	0.00	69.58	0.00	0.00	0.00	0.00	0.00	0.00	0.17

Indicator Invertebrates

- Only diadema urchin and giant clam are recorded.
- Diadema urchin abundance is high.
- Indicators for curio trade are absent.

RARE ANIMALS

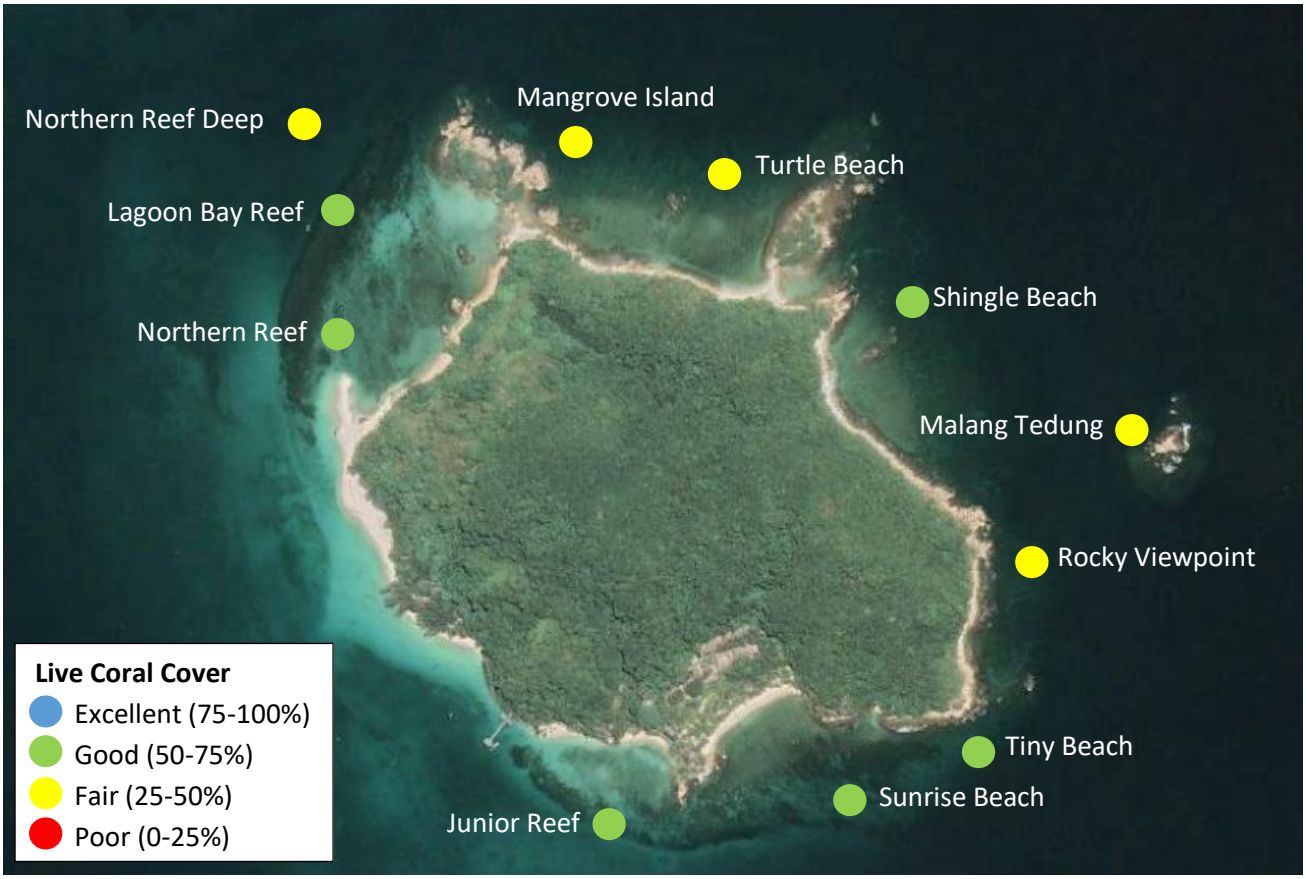


- Nurse shark was recorded.

Sunda Shelf – Tengah

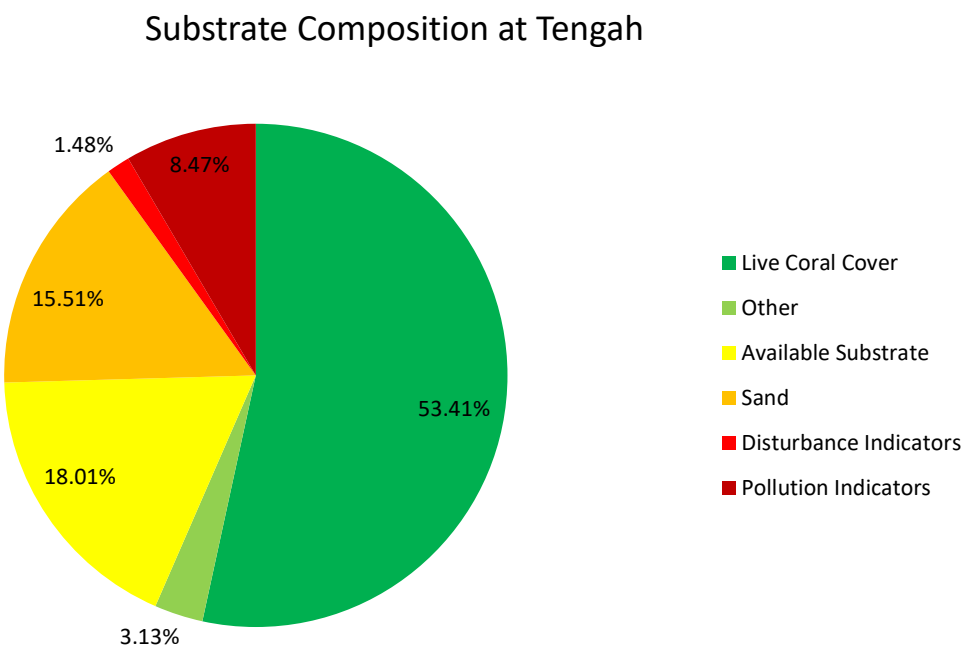
Pulau Tengah, meaning 'middle island', is a privately owned island and is located approximately 15km off the coast of Mersing, Johor. From 1975 to 1981, the island was home to over 100,000 Vietnamese 'boat people' when it was a United Nation Refugee Counsel Transit Camp for refugees waiting to start their new lives in Europe, Australia and North America. In 1985, it was one of the few islands gazetted as Marine Park under the Fisheries Act 1985 due to its abundant marine life and rare species of fish and coral.

The uninhibited island is home to an upscale resort and is accessible by the resort's private speedboat from the coastal town of Mersing. The speedboat ride takes about 20-30 minutes in good weather. Pulau Tengah's natural environment is rich with sightings of over 100 species of bird, over 300 species of flora, Pacific bottle-nose dolphins, blacktip reef shark, green and hawksbill turtles, otters and dugong.



Map showing the health categories of each survey site based on Live Coral Cover: 6 sites have 'Good' coral cover and 5 are in 'Fair' condition.

Coral Cover and Health

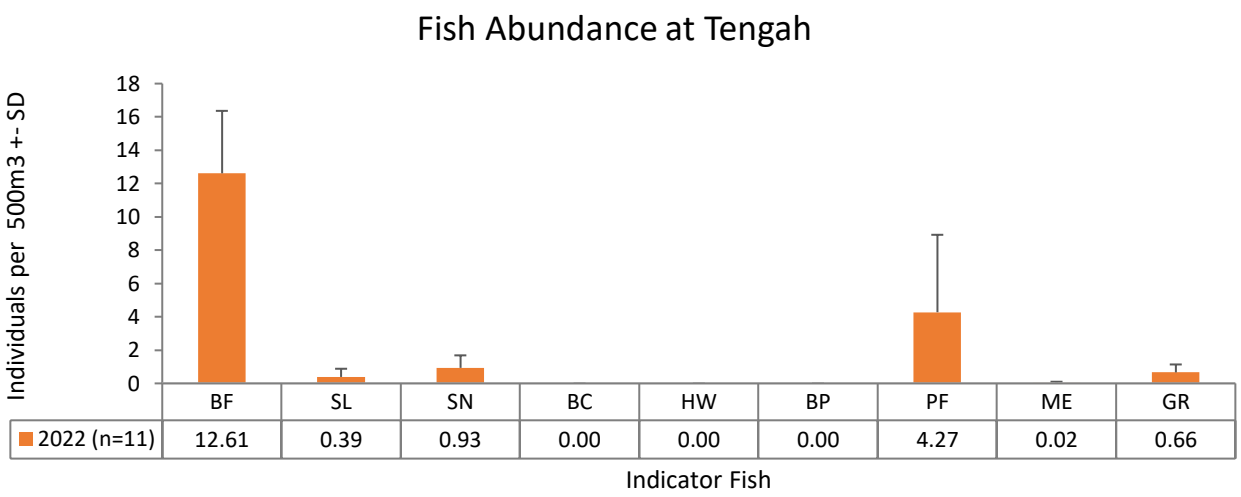


- Pulau Tengah reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 53.01%.
- In 'Good' condition and above the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is high.
- Sand level is high. The level is hight at all sites except Northern Reef and Lagoon Bay Reef.
- Pollution indicators are slightly high.
- Nutrient indicator algae level is especially high at Shingle Bay, Northern Reef and Malang Tedung.
- Sponge level is especially high at Northern Reef.

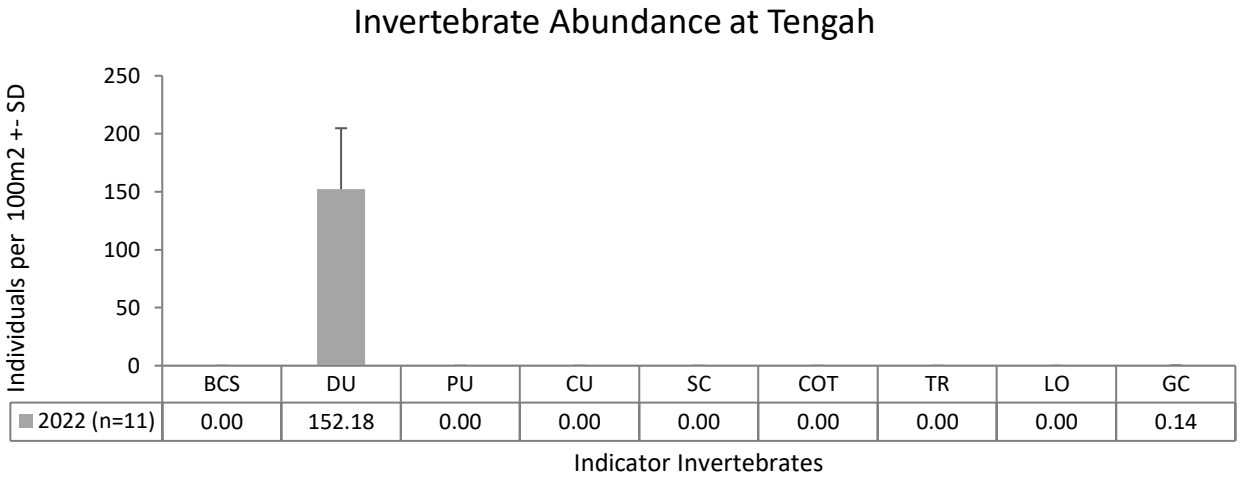
CORAL IMPACTS

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

Fish and Invertebrate



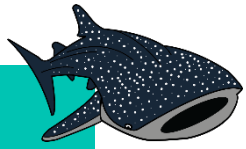
- Butterflyfish, indicator for aquarium trade, abundance is very high.
- Absence of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance, except for parrotfish.
- This suggests that fish targeted for food are heavily harvested.



- Only diadema urchin and giant clam are recorded.
- Diadema urchin abundance is high.
- Indicators for curio trade are absent.

RARE ANIMALS

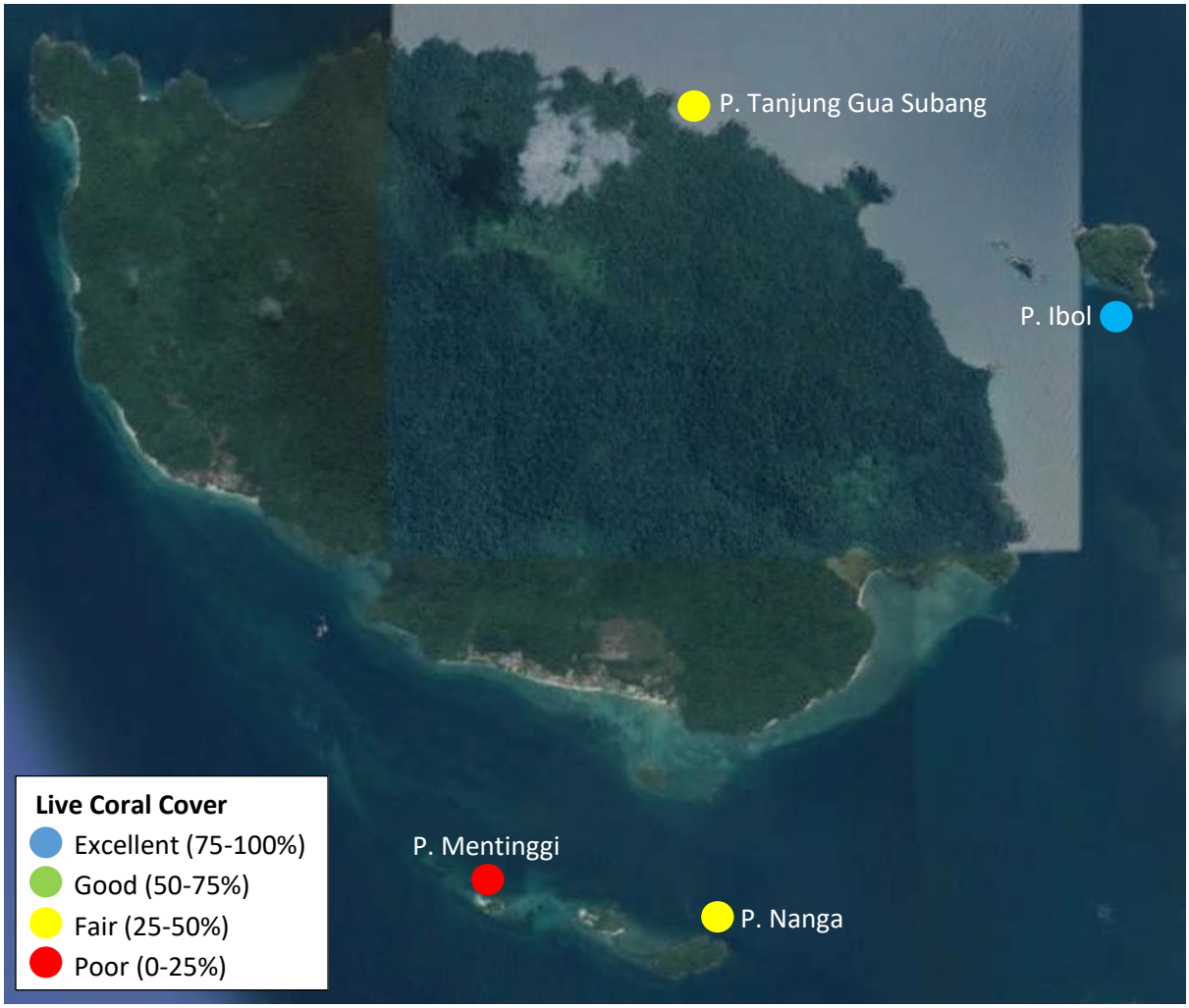
- Shark was recorded.



Sunda Shelf – Tinggi

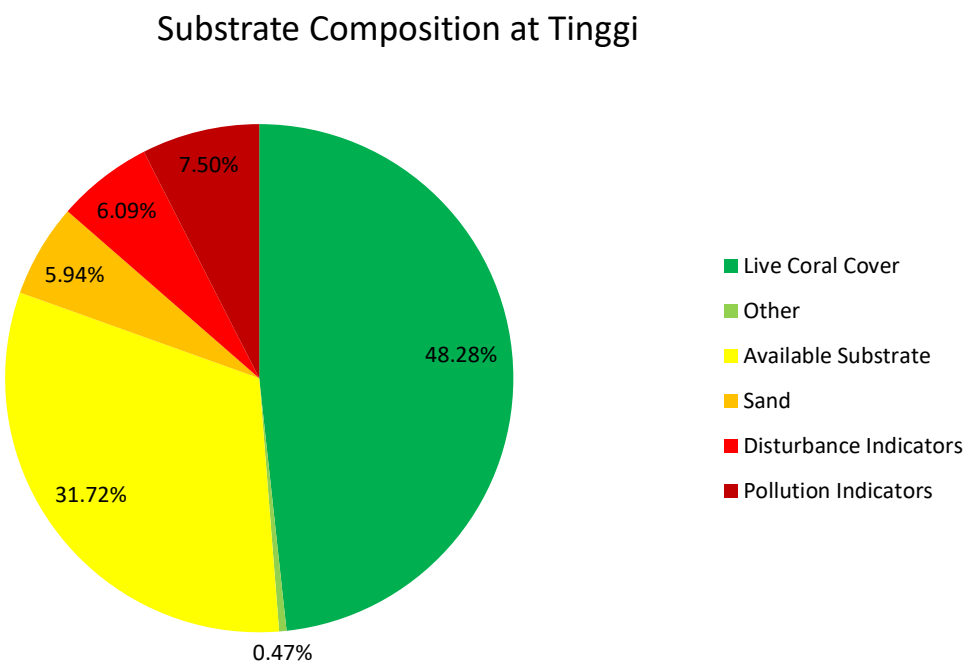
Tinggi Island is located less than 15km off the East coast of mainland Peninsular Malaysia. The island and its surrounding waters were gazetted as a Marine Park in 1994 under the Fisheries Act 1985 (Amended 1993).

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: 1 site has 'Excellent' coral cover, 2 are in 'Fair' condition, and 1 shows 'Poor' health.

Coral Cover and Health

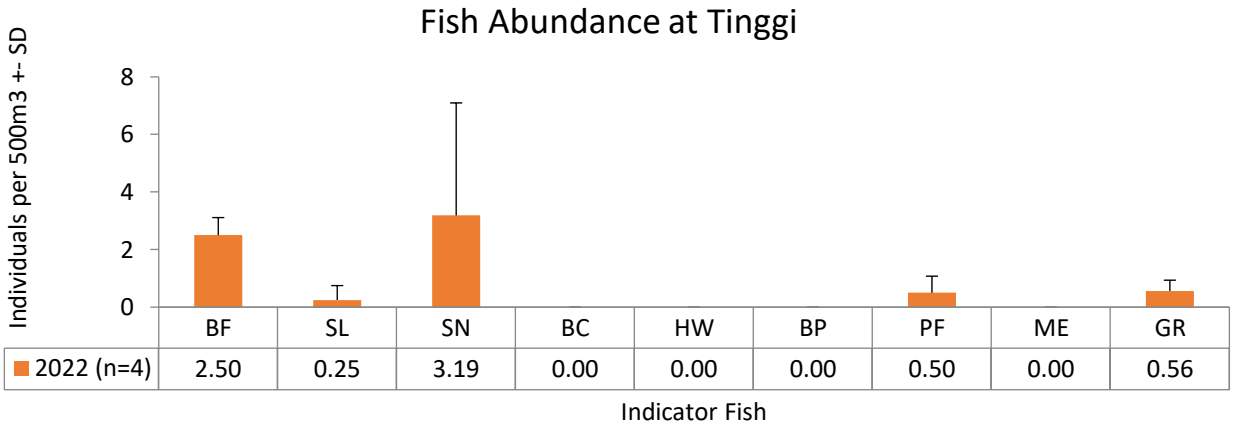


- Tinggi reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 37.03%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Pollution indicators are slightly high.
- Nutrient indicator algae and sponge level are especially high at Pulau Mentinggi.

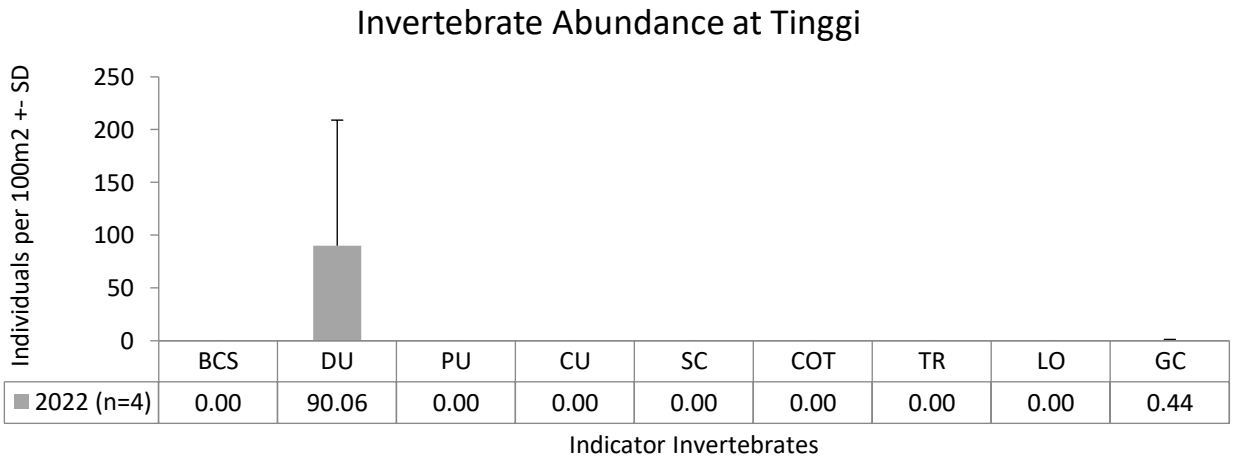
CORAL IMPACTS

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

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, is recorded.
- Absence 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.

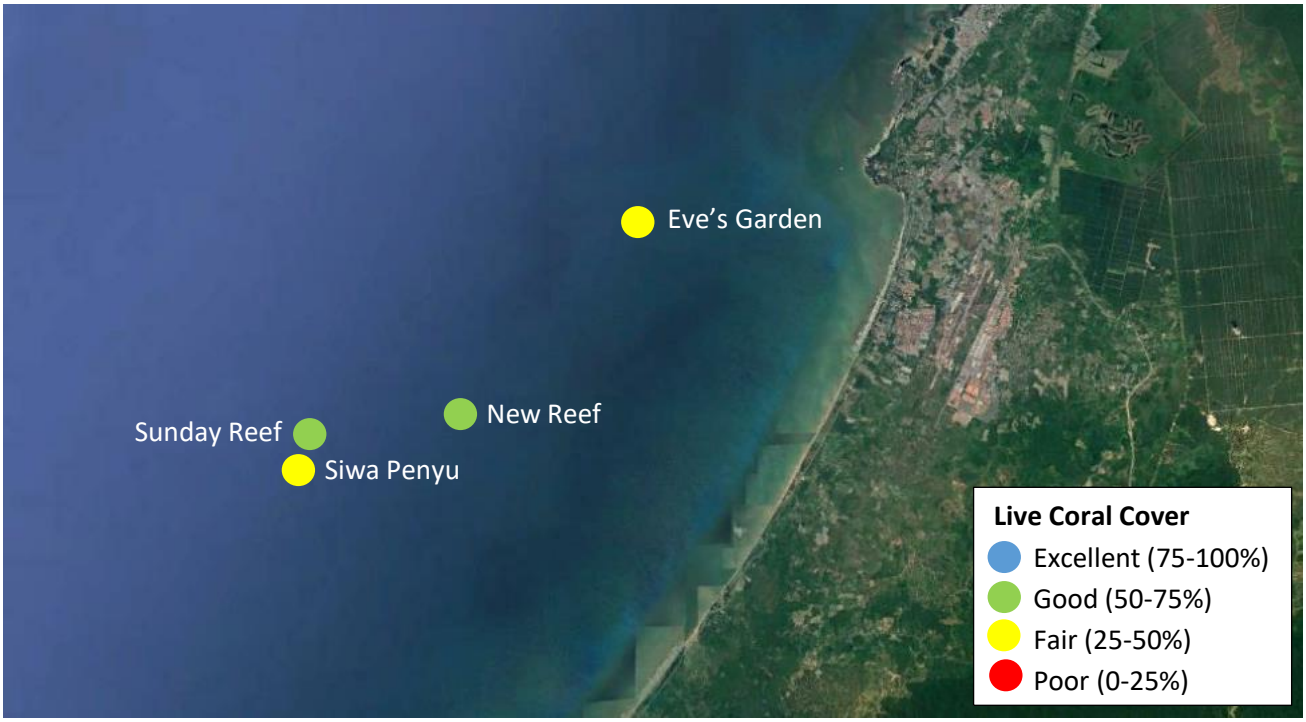


- Only diadema urchin and giant clam are recorded.
- Diadema urchin abundance is high.
- Absent of indicators for curio trade.

Sunda Shelf – Miri

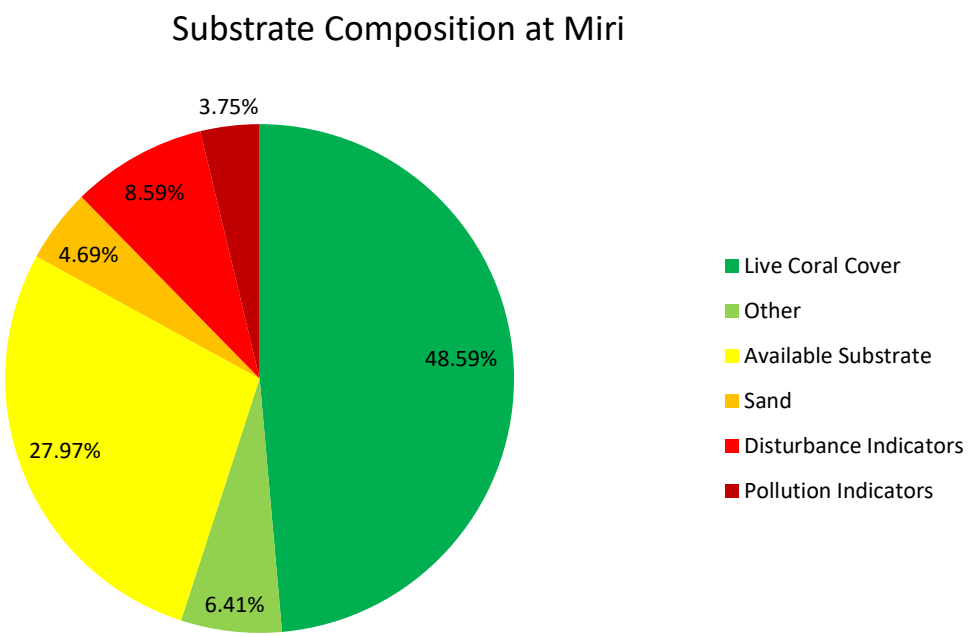
Miri is located in the north of Sarawak and is the State's second largest city. Miri is the birthplace of Malaysia's petroleum industry, which remains the major industry in the city, alongside timber and oil palm production and a growing tourism sector.

Miri has extensive submerged offshore reefs, generally flat in profile, in depths ranging from 7 to 30m. The reefs and surrounding waters cover an area of 186,930-hectare areas in the Miri and Sibuti districts, were gazetted as the Miri-Sibuti Coral Reef National Park in 2007 under the National Parks and Nature Reserves Ordinance. The national park is located in the maritime boundary between Bintulu town and Miri City and, after the Luconia Shoals, is the second largest offshore national park created in this state. Petroleum and gas mining, archaeological excavations, fishing and waste dumping are among the activities prohibited in the area. Those that do not threaten the undersea environment, like diving, boating and snorkelling, are allowed.



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

Coral Cover and Health

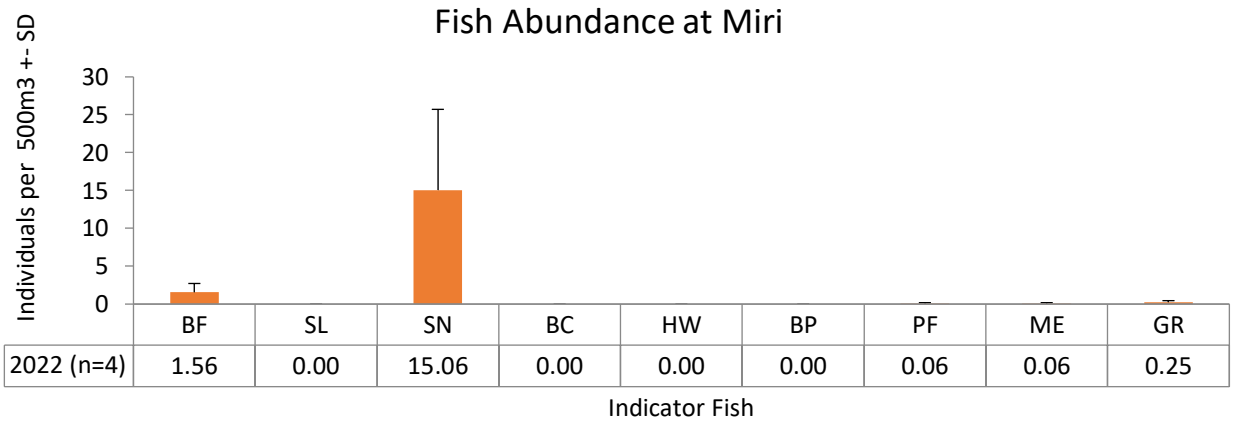


- Miri reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 43.13%.
- In 'Fair' condition and below the Sunda Shelf region average (53.34%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are slightly high.
- Rubble level is especially high at New Reef and Sunday Reef.
- Silt level is especially high at Sunday Reef

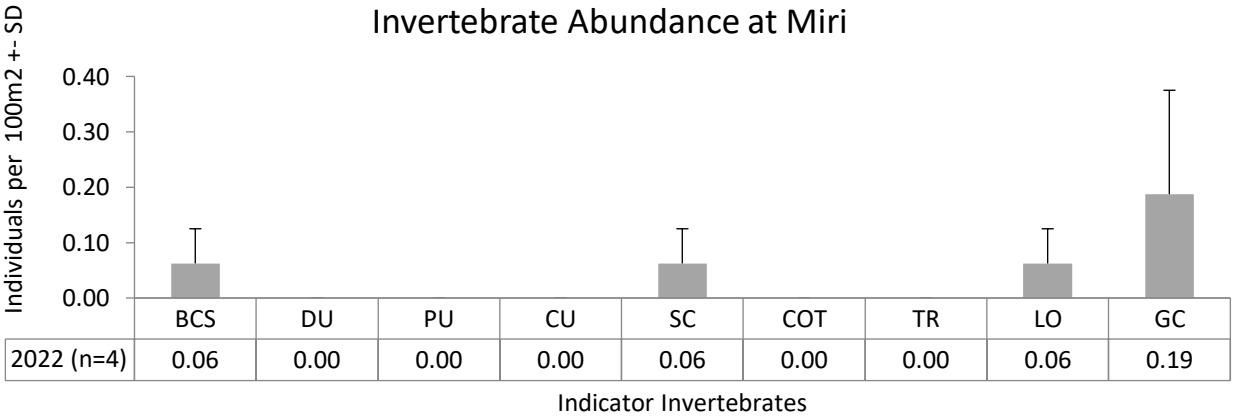
CORAL IMPACTS

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

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, is recorded.
- The abundance of snapper, fish targeted for food, is high.
- Fish targeted for food are very low in abundance, except for snapper.
- Absence of indicators targeted for live-food fish trade.
- This suggests that fish targeted for food are heavily harvested.



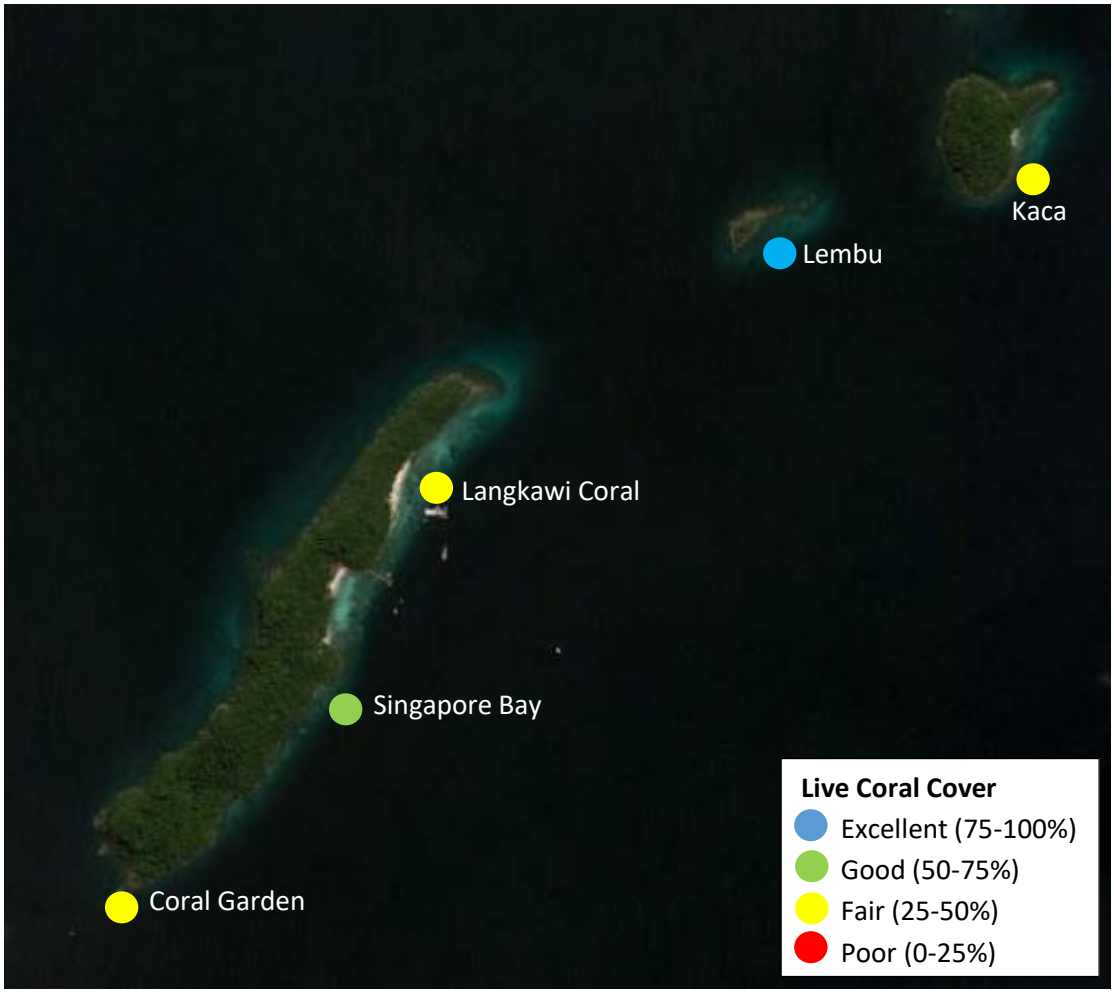
- Invertebrates targeted for food are very low in abundance.
- Banded coral shrimp, indicator for curio trade, is recorded.

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).

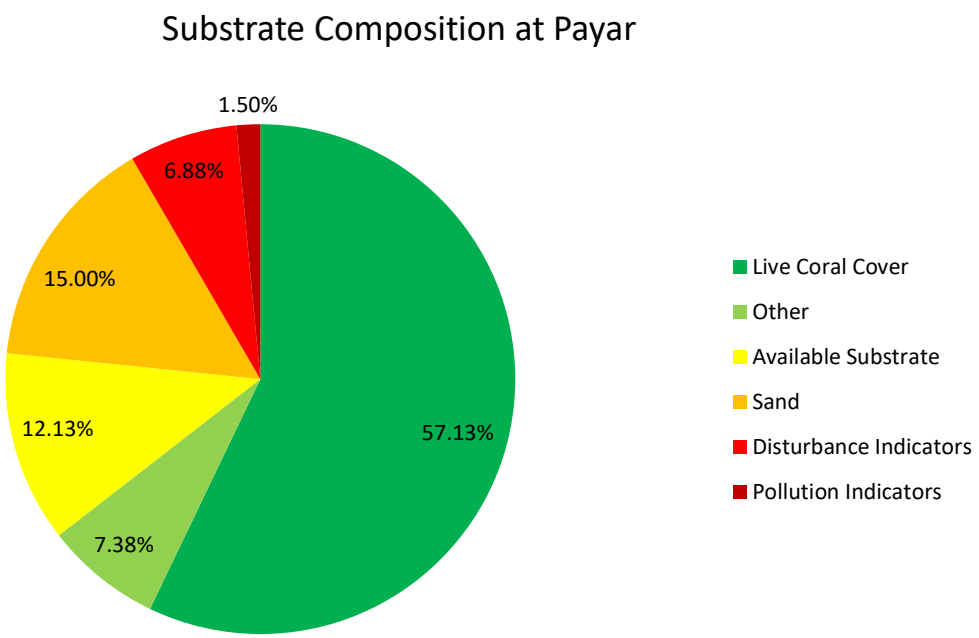
The island is a popular destination for tourists (mainly from Langkawi) famous for its corals and reef fishes. Measuring 2km long and 0.25km wide, its sheltered waters are ideal for snorkelling, diving and swimming.

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.



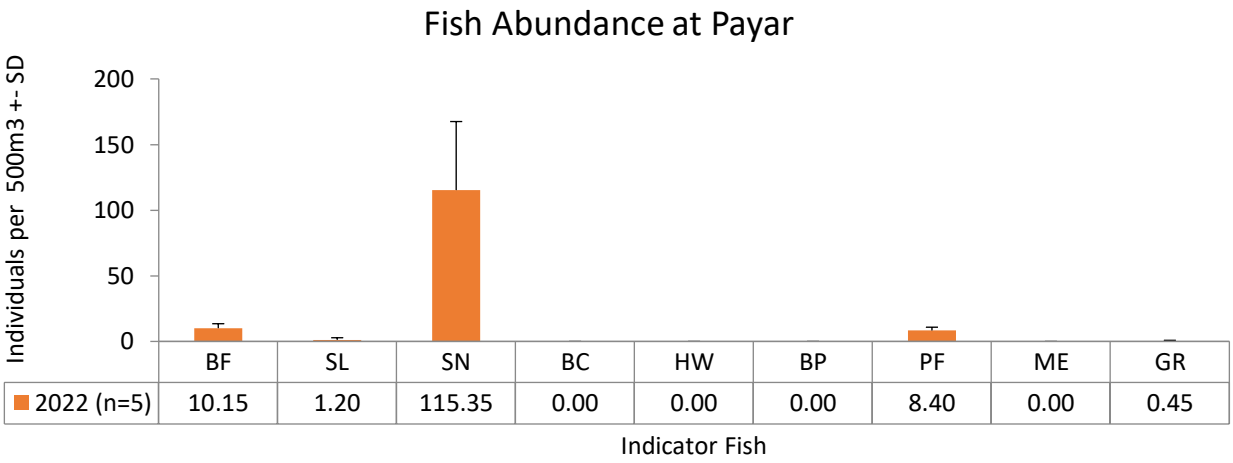
Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Excellent' coral cover, 1 is in 'Good' condition and 3 show 'Fair' health.

Coral Cover and Health

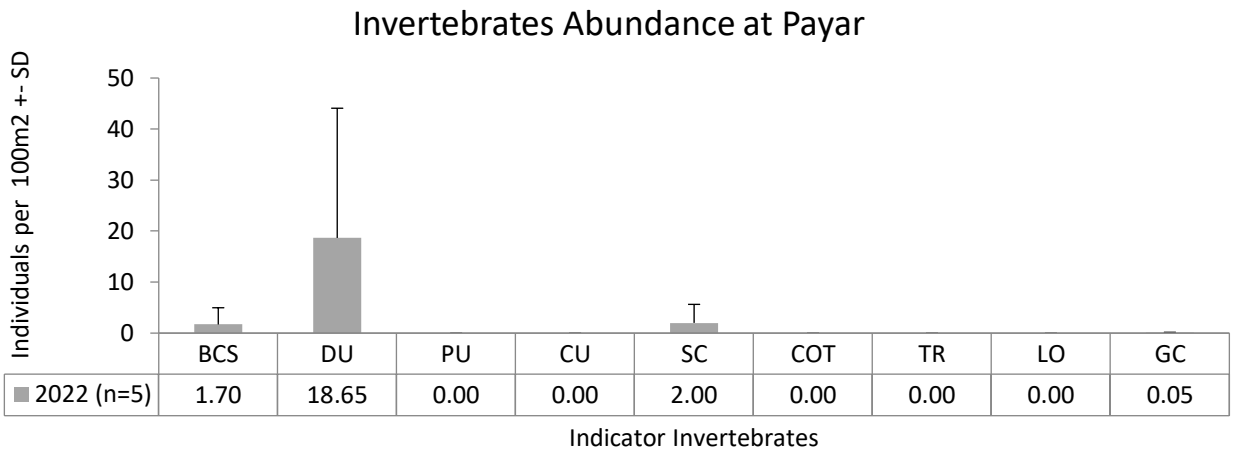


- Payar reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 57%.
- In 'Good' condition and above the Malacca Strait region average (37.47%).
- Available substrate for coral recruits to attach is high.
- Sand level is high. It is especially high at Langkawi Coral which recorded 40.63%.

Fish and Invertebrate



- Snapper abundance, fish targeted for food, is very high.
- Fish targeted for food are low in abundance, except for snapper and parrotfish.
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Absence of indicators targeted for live-food fish trade.



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

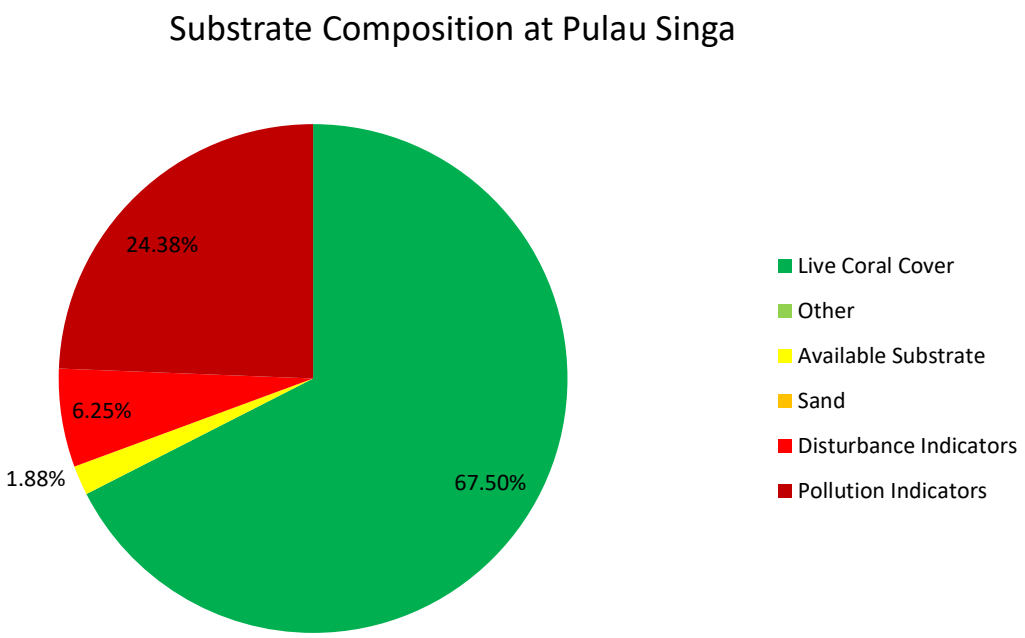
Malacca Strait – Pulau Singa Besar

Pulau Singa is located in the southwest of Kuah and around 17 km from the Langkawi coast. It is a large island in the Langkawi archipelago and is nestled between Pulau Beras Basah and Pulau Dayang Bunting. Pulau Singa is an unexplored and secluded with almost no amenities.

Only one site has been surveyed at Pulau Singa, a very limited sample.

Map showing the health categories of each survey site based on their live coral cover: the site has 'Good' coral cover.

Coral Cover and Health

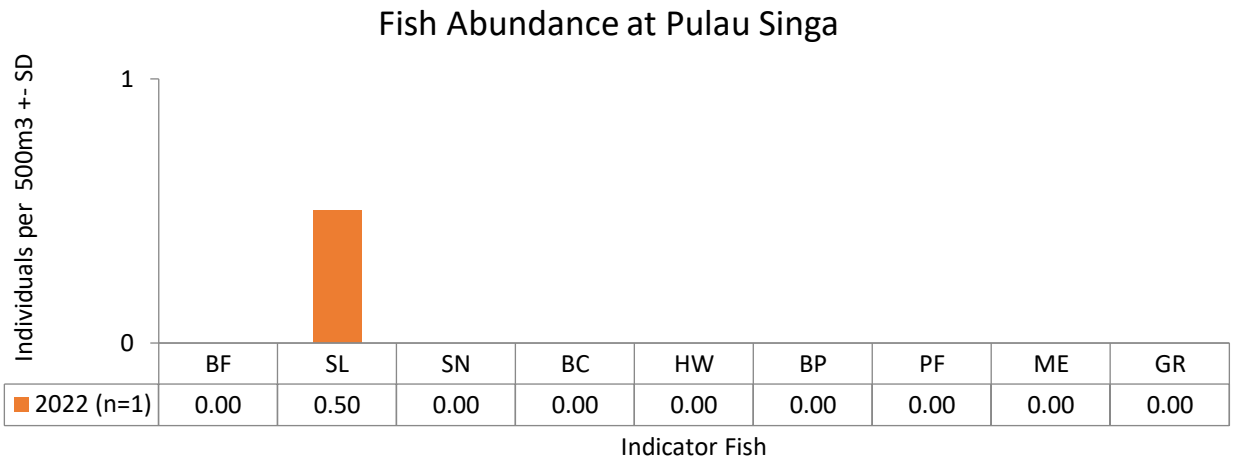


- The reef at Pulau Singa is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 67.50%.
- In 'Good' condition and above the Malacca Strait region average (37.47%).
- Pollution indicators are very high, attributed by nutrient indicator algae.

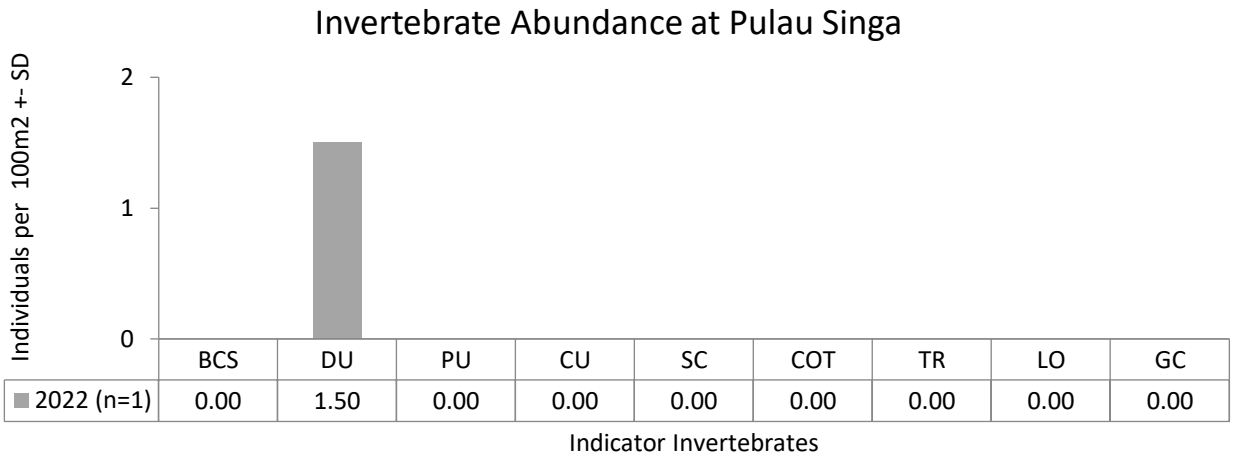
CORAL IMPACTS

- Discarded fishing net was recorded.

Fish and Invertebrate



- Only snapper is recorded and the abundance is very low.
- Absent of indicators targeted for aquarium trade and live-food fish trade.



- Only diadema urchin is recorded.

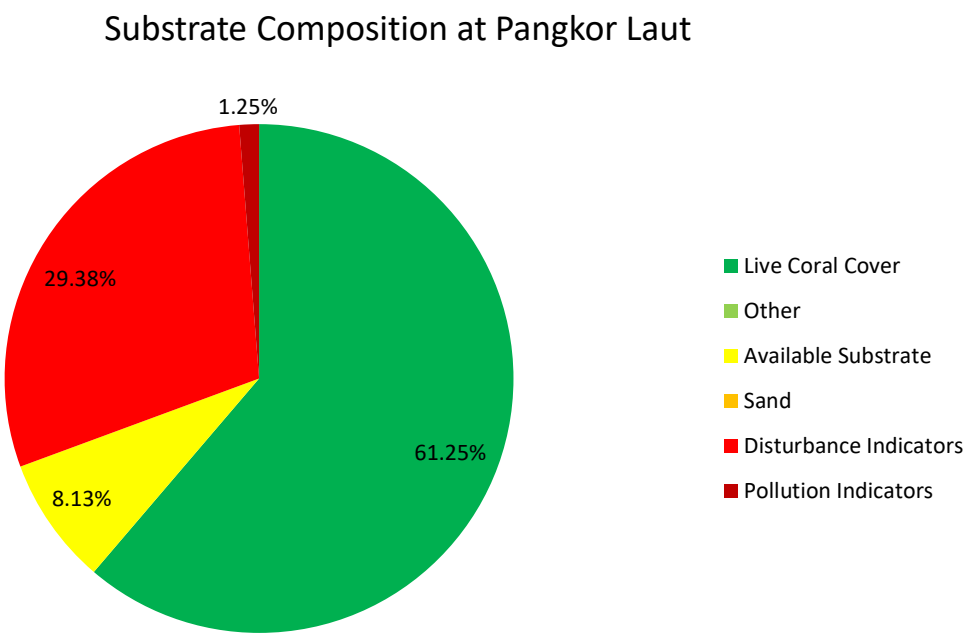
Malacca Strait – Pangkor Laut

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

Only one site has been surveyed at Pulau Pangkor Laut, a very limited sample.

Map showing the health categories of each survey site based on their live coral cover: the site has 'Good' coral cover.

Coral Cover and Health

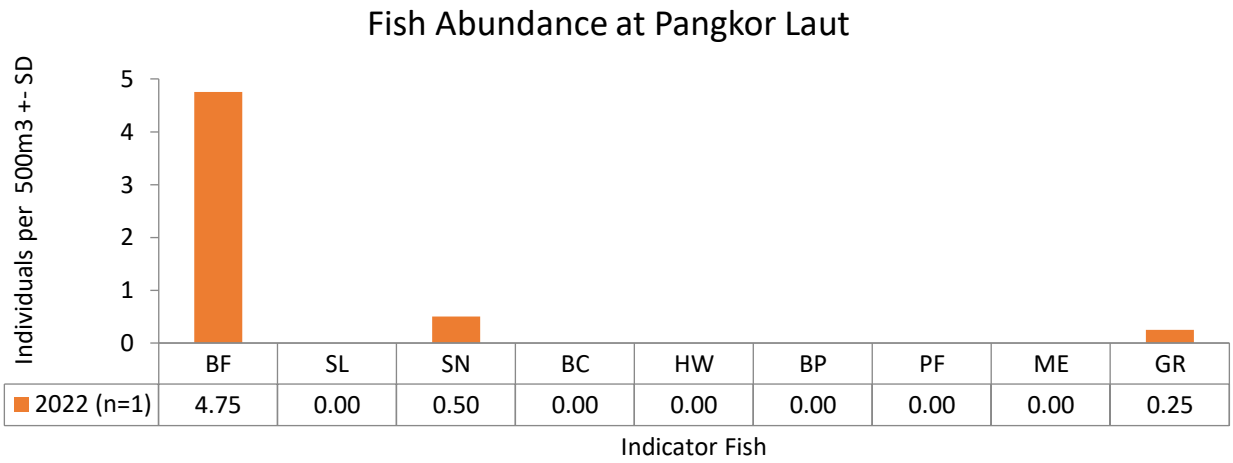


- The reef at Pangkor Laut is dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 61.25%.
- In 'Good' condition and above the Malacca Strait region average (37.47%).
- Disturbance indicators are very high, attributed by rubble.

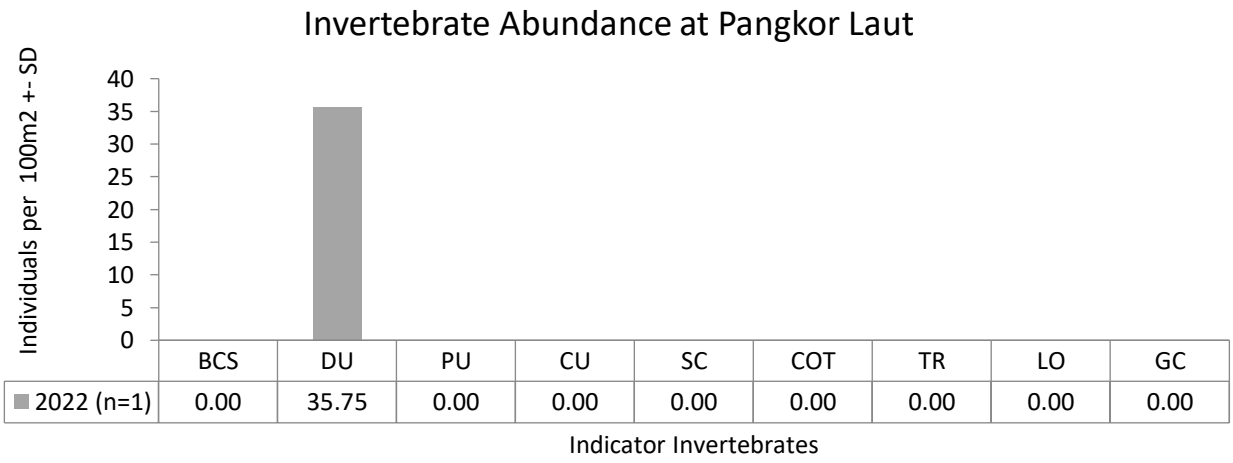
CORAL IMPACTS

- Discarded fishing nets and trash were recorded.

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, is recorded.
- Fish targeted for food are very low in abundance
- Absent of indicators targeted for live-food fish trade.

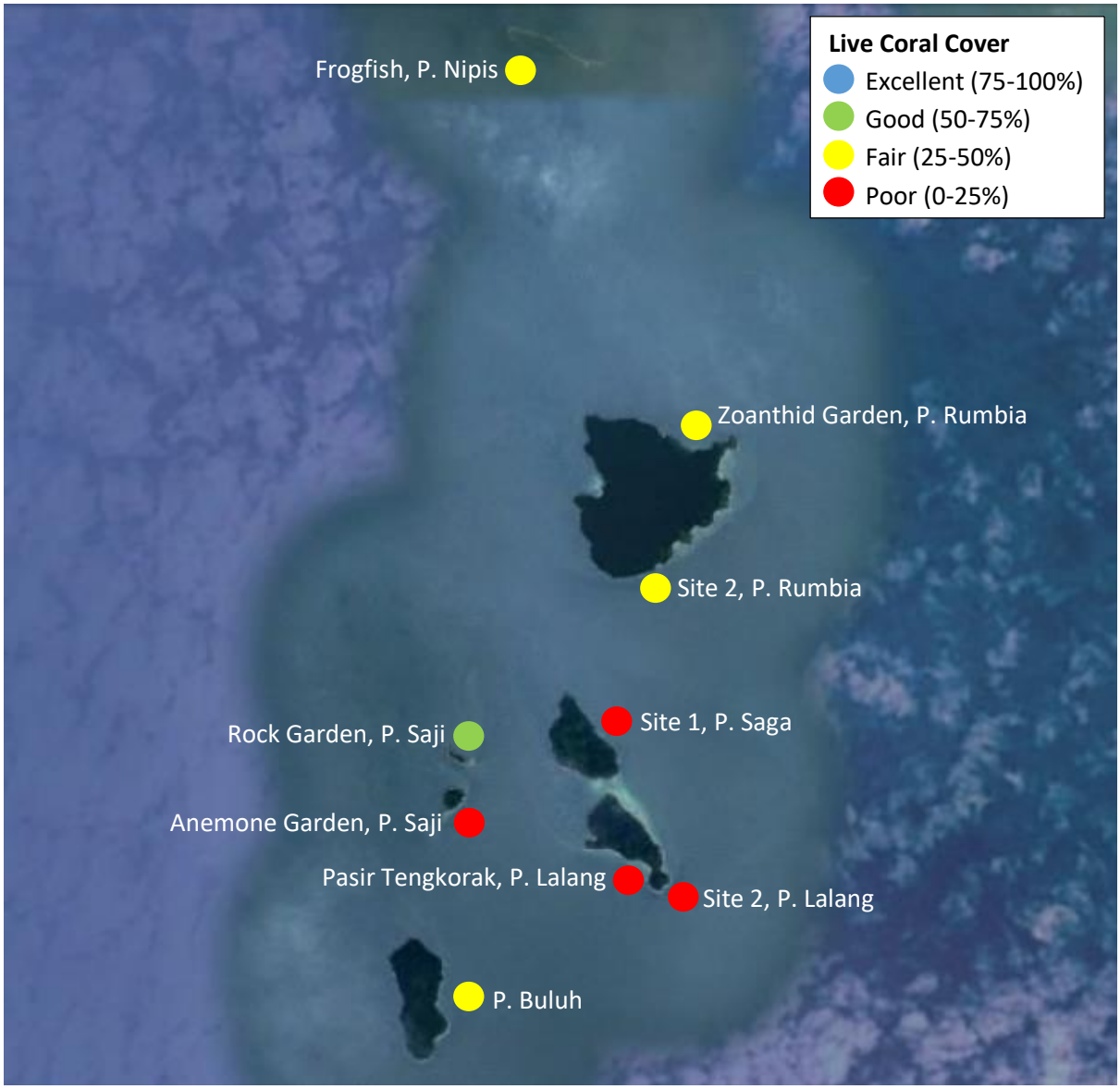


- Only diadema urchin is recorded and the abundance is high.

Malacca Strait – Sembilan

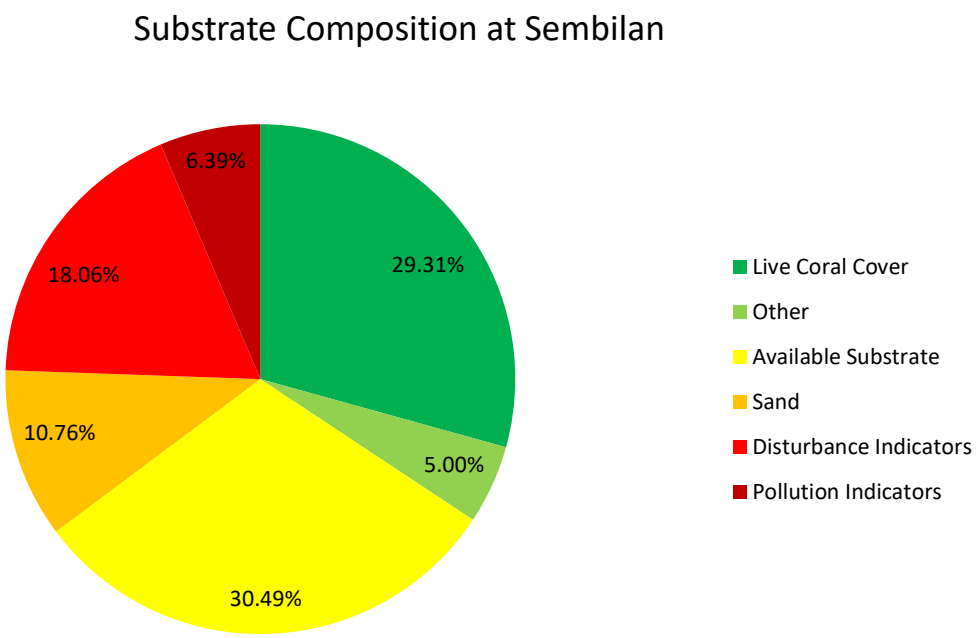
The Sembilan Islands consist of a cluster of nine islands (Pulau Agas, Pulau Payong, Pulau Nipis, Pulau Rumbia, Pulau Lalang, Pulau Saga, Pulau Buluh, Black Rock and White Rock) which are located some 20km from the coast of Perak (Lumut), off the west coast of Peninsular Malaysia, in the Straits of Malacca.

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



Map showing the health categories of each survey site based on their live coral cover: 1 site has 'Good' coral cover, 4 are in 'Fair' condition and 4 show 'Poor' health.

Coral Cover and Health

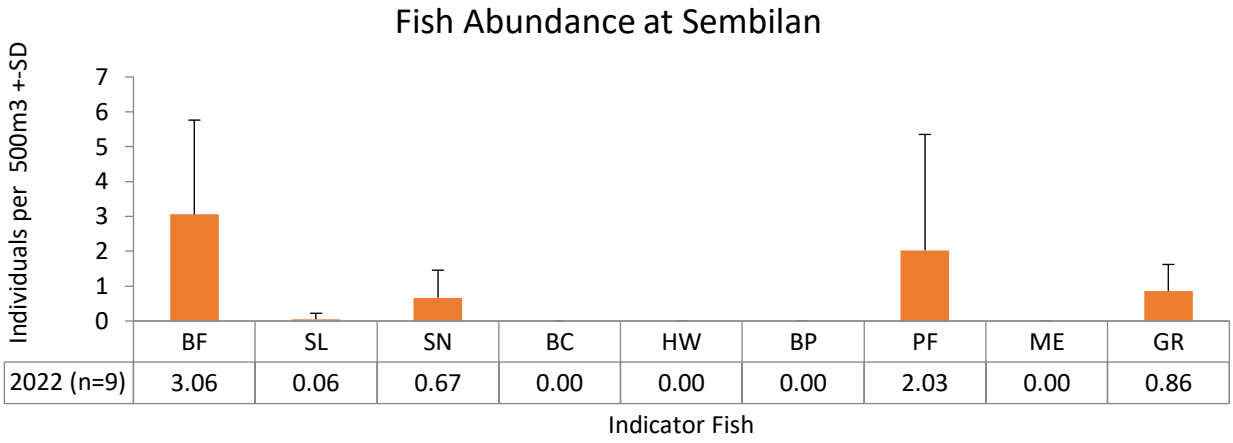


- Sembilan reefs are dominated by available substrate, which is rock, for coral recruits to attach.
- Mean hard coral (reef builder) cover is 24.65%.
- In 'Fair' condition and below the Malacca Strait region average (37.47%).
- Sand level is high. It is especially high at Zoanthid Garden, Pulau Rumbia which recorded 32.50%.
- Disturbance indicators are high.
- Rubble level is high at all sites, except Frogfish, Pulau Nipis and Rock Garden, Pulau Saji North. The level is especially high at Pasir Tengkorak, Pulau Lalang which recorded 38.13%.
- 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

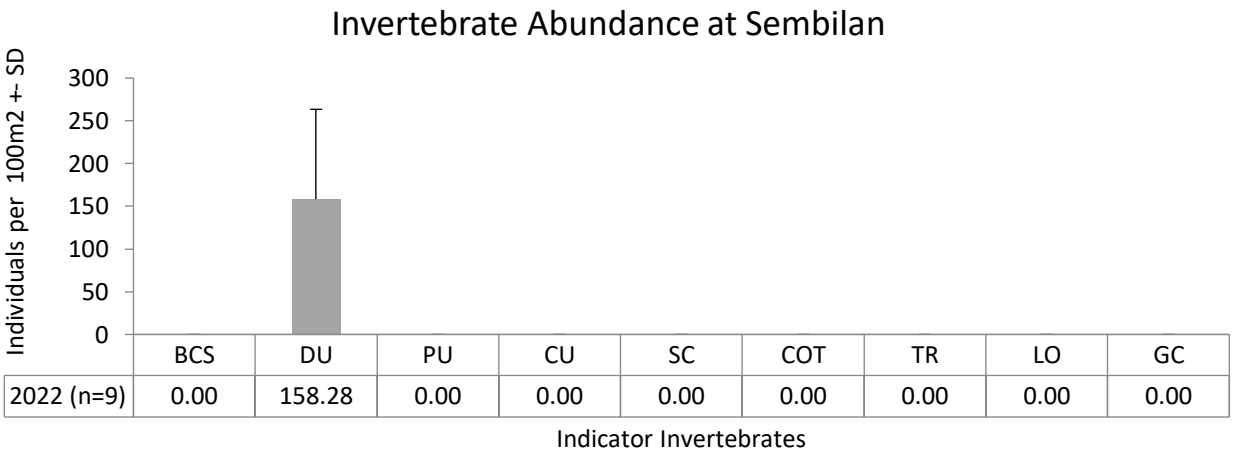
- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.

Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=9)	3.06	0.06	0.67	0.00	0.00	0.00	2.03	0.00	0.86

- Butterflyfish, indicator for aquarium trade, is recorded.
- 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.



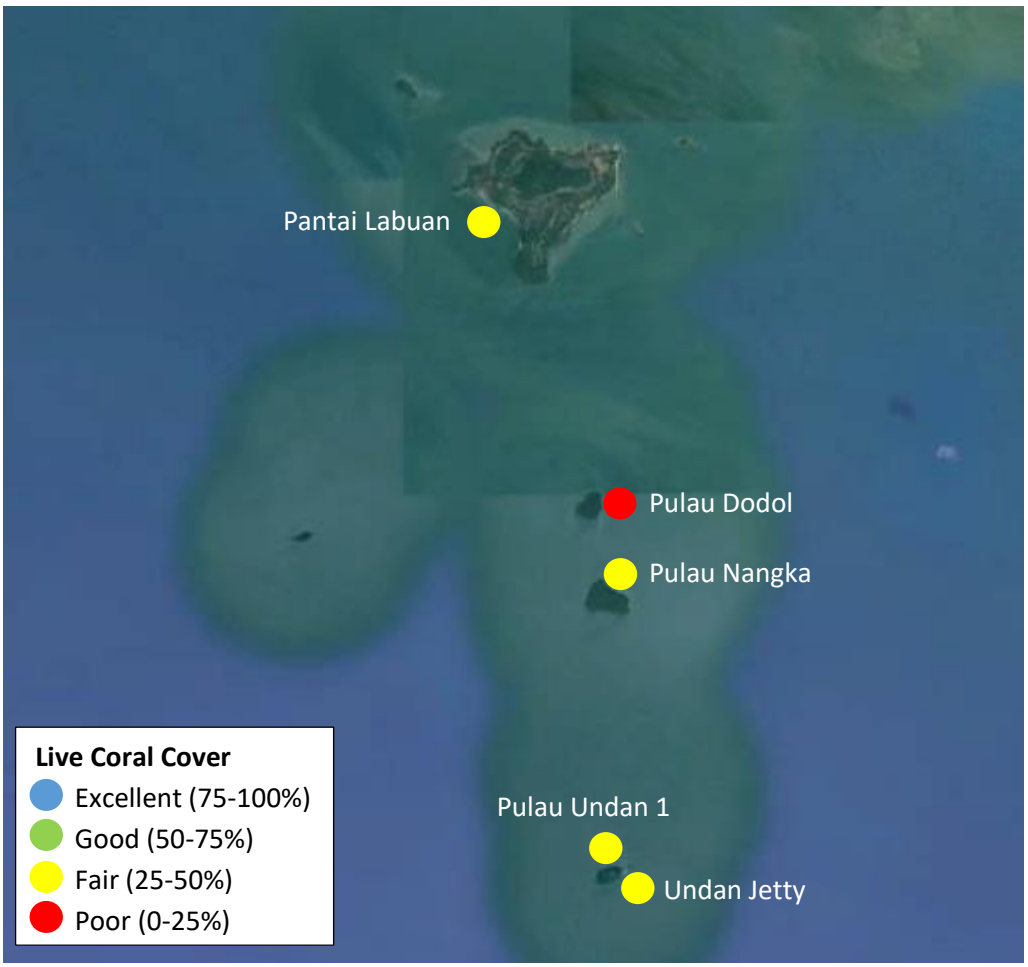
	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=9)	0.00	158.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Malacca Strait – Malacca

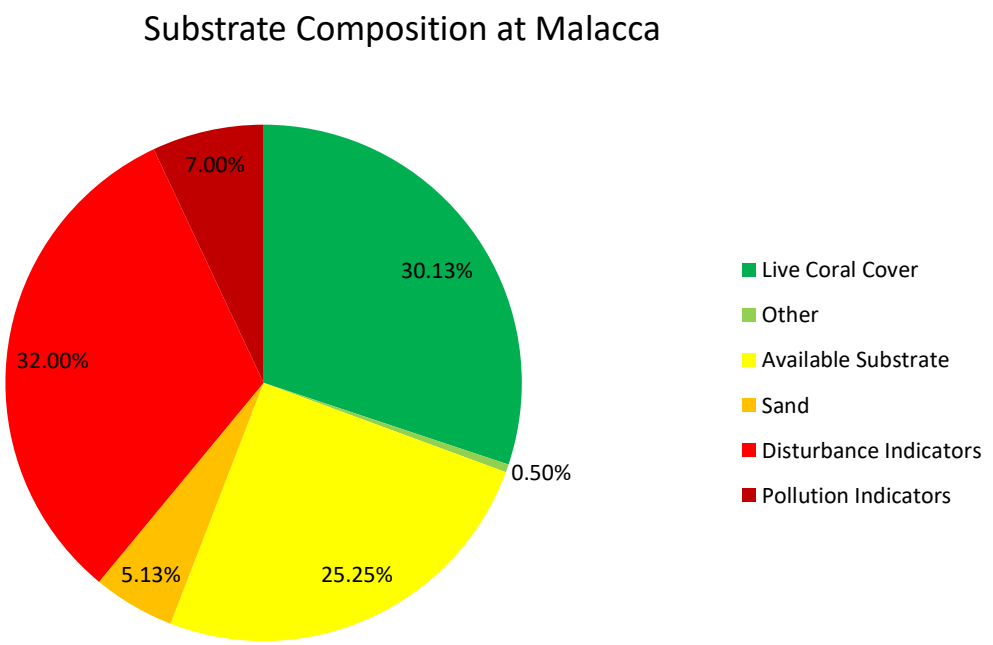
There are a number of islands off the state of Malacca. Pulau Besar is the largest island. It is popular for its ancient graves, tombs and mausoleums which are scattered around the island. The island has a number of other attractions such as old wells, uniquely shaped rocks, village of elves, elves' 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 and 1 is in 'Poor' condition.

Coral Cover and Health

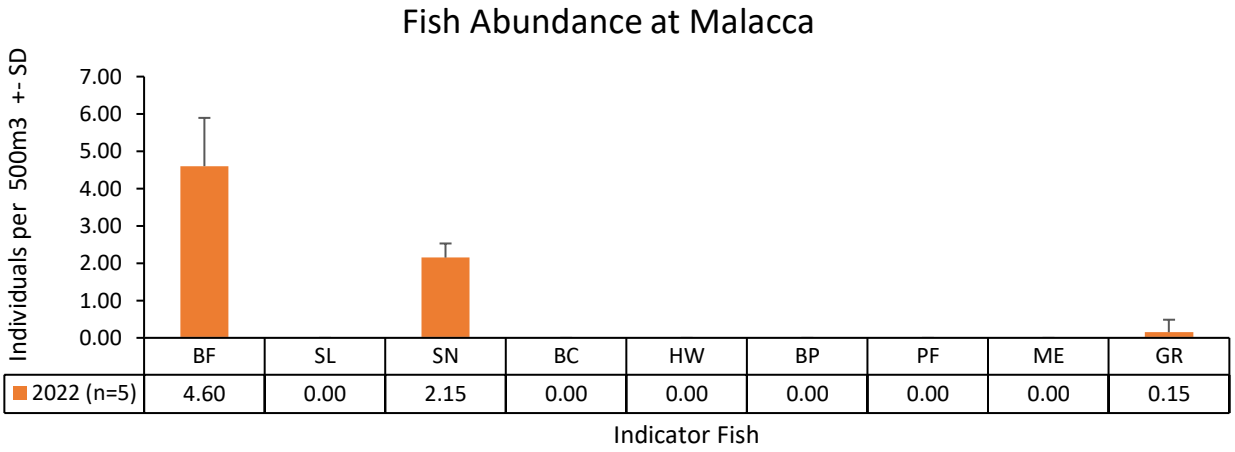


- Malacca reefs are dominated by disturbance indicators.
- Silt level is very high at all sites except Pantai Labuan.
- 56.88% of Pulau Nangka and 63.75% of Pulau Dodol consist of silt.
- Malacca mean hard coral (reef builder) cover is 28.50%.
- In 'Fair' condition and below the Malacca Strait region average (37.47%).
- Available substrate for coral recruits to attach is very high.
- Pollution indicators are slightly high.
- All the above are considered signs of unhealthy reefs. While available substrate for coral recruits to attach to is very high, high level of disturbance and pollution indicators may deter coral growth if they are not dealt with.

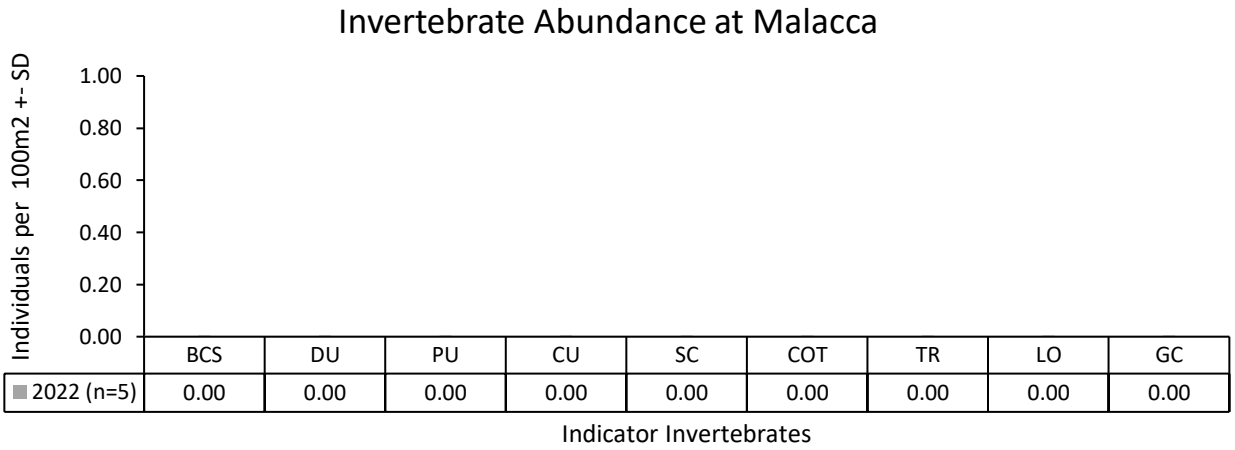
CORAL IMPACTS

- Discarded fishing net and trash were recorded.

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, is recorded.
- Absence 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.



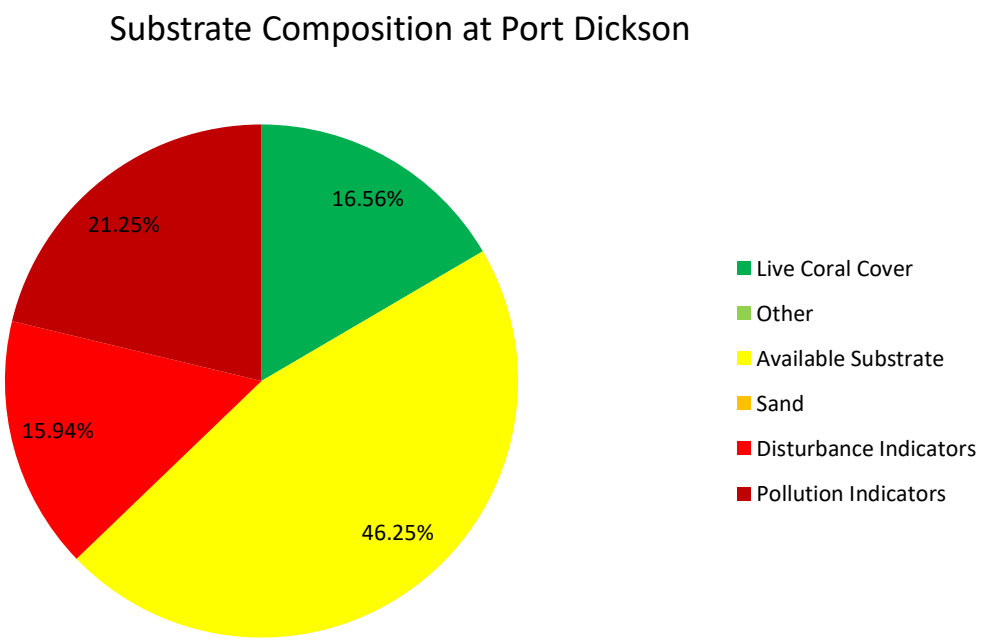
- Complete absence of indicator invertebrates.

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.

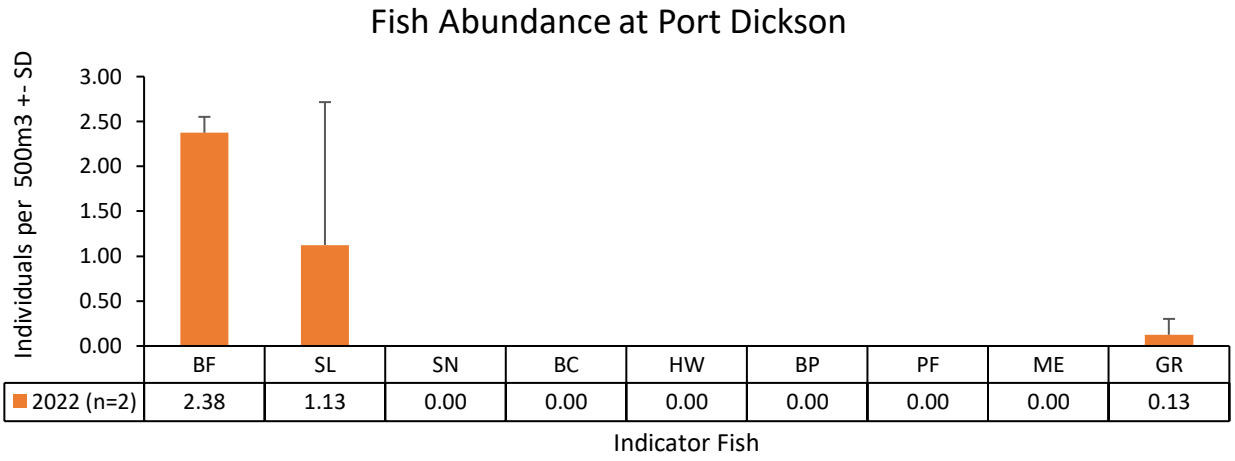
Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Fair' coral cover and 1 is in 'Poor' condition.

Coral Cover and Health

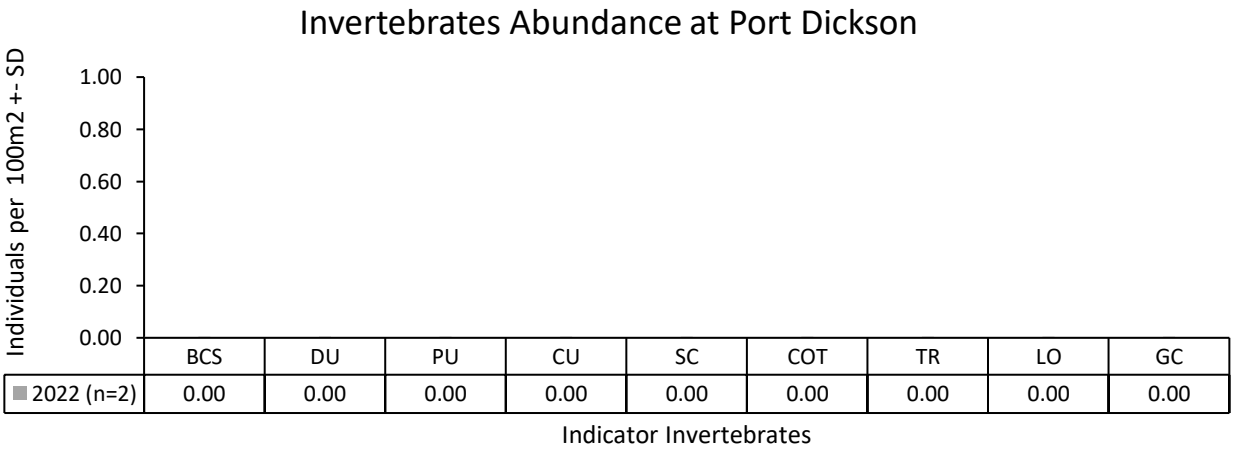


- Port Dickson reefs are dominated by available substrate, which is rock, for coral recruits to attach.
- Mean hard coral (reef builder) cover is 16.56%.
- In 'Poor' condition and below the Malacca Strait region average (37.47%).
- Disturbance indicators are high.
- Silt level is high at both sites.
- Pollution indicators are very high.
- Nutrient indicator algae level is very high at both sites.
- 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 coral growth if they are not dealt with.

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, is recorded.
- 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.

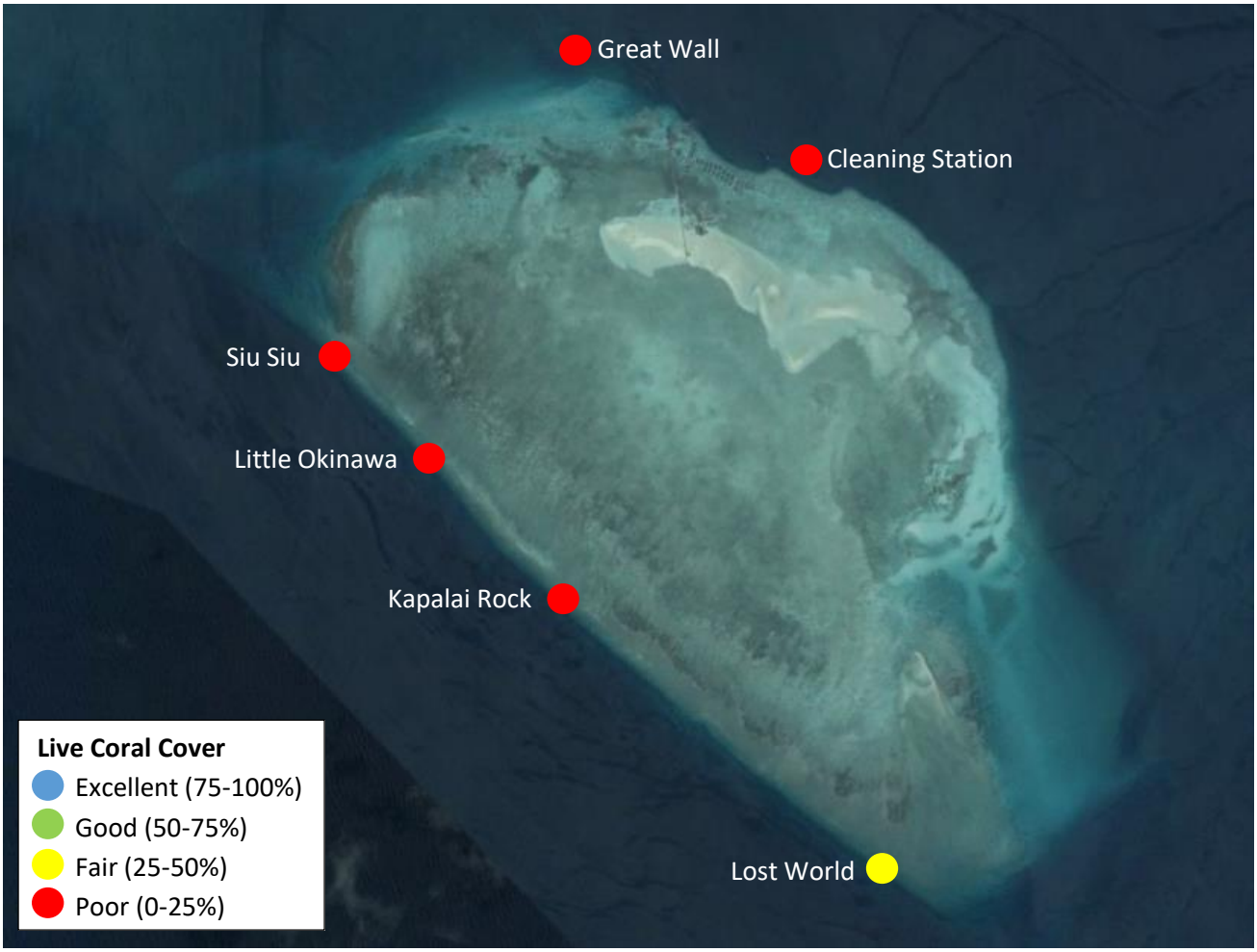


- Complete absence of indicator invertebrates.

North Borneo – Kapalai

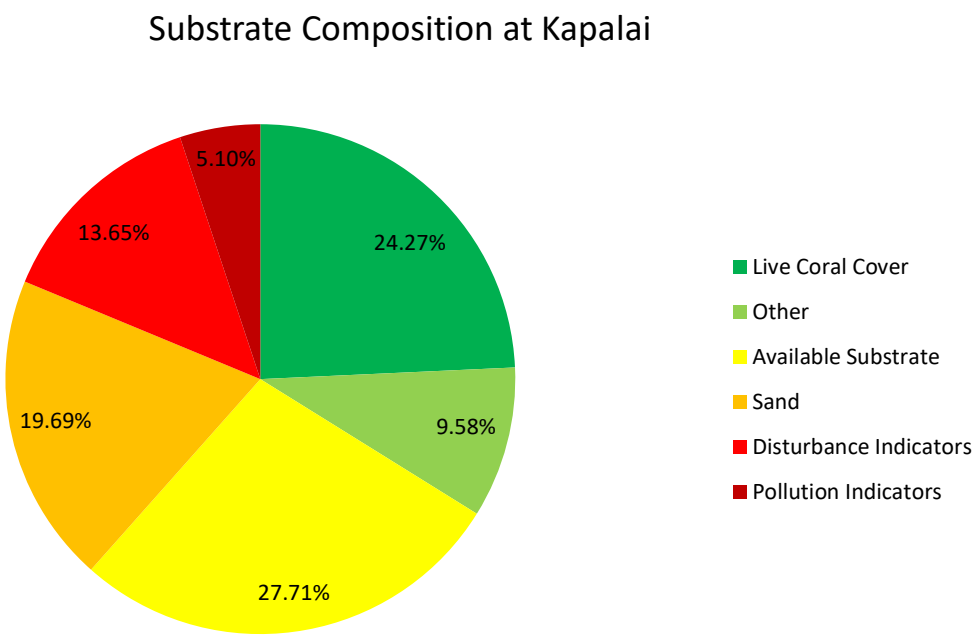
Kapalai Island is located near Semporna, Sabah and is 15 kilometres from Sipadan Island. Though it is called an island, it is actually a sandbar situated on Ligitan Reef. Kapalai used to be a real island with vegetation but erosion over the last few hundred years has reduced the island to sea level. 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: 1 site has 'Fair' coral cover and 5 are in 'Poor' condition.

Coral Cover and Health

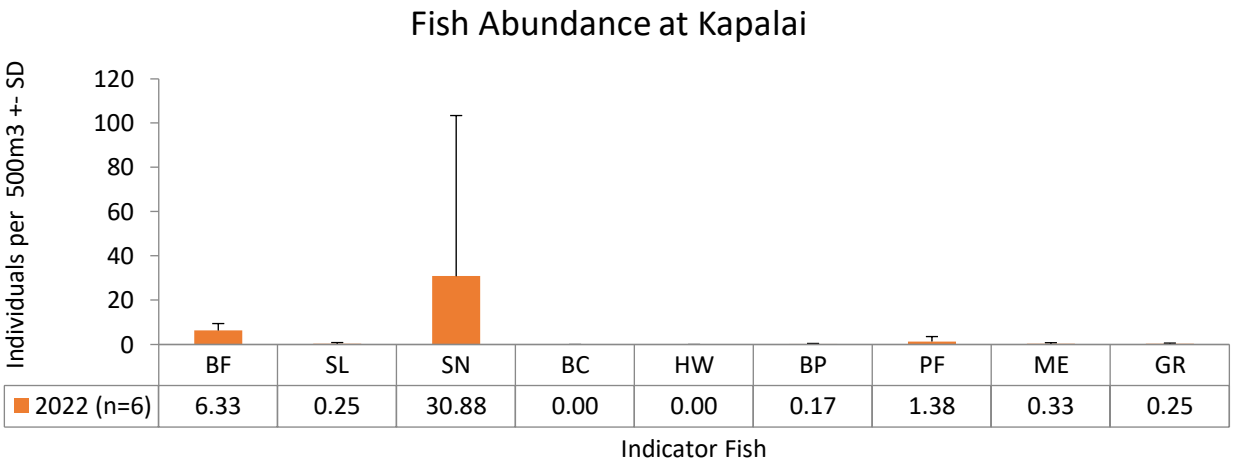


- Kapalai reefs are dominated by available substrate, which is rock, for coral recruits to attach.
- Mean hard coral (reef builder) cover is 21.25%.
- In 'Poor' condition and below the North Borneo region average (43.31%).
- Sand level is high. The level is especially high at Cleaning Station which recorded 40%.
- Disturbance indicators are high.
- Rubble level is high at all sites.
- 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.

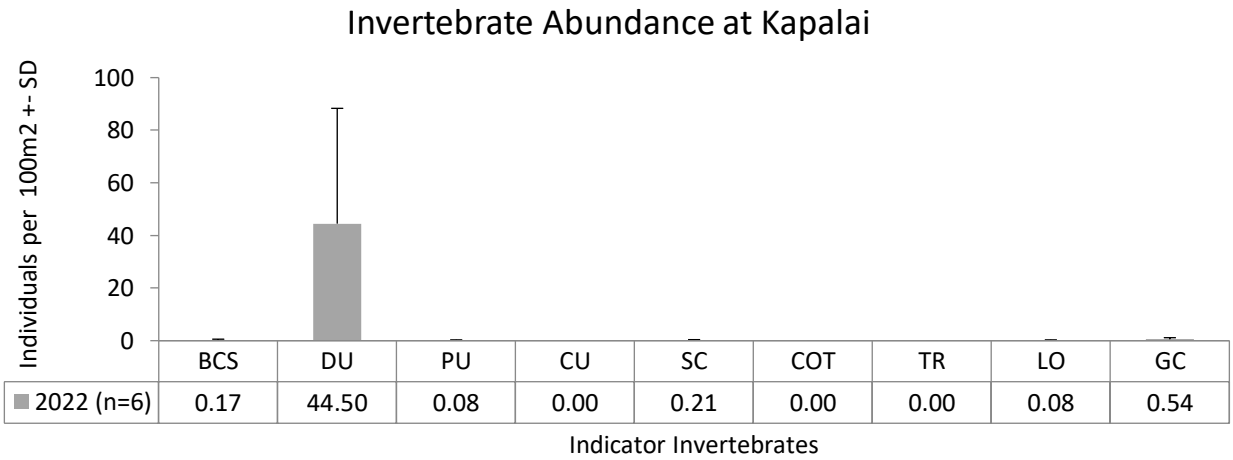
CORAL IMPACTS

- Boat anchor damage, discarded fishing net and trash were recorded at many sites.
- Coral damage due to fish bombing was recorded.
- All sites were impacted by warm water bleaching.
- Drupella predation was recorded.

Fish and Invertebrate



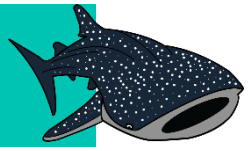
- Bumphead parrotfish, indicator targeted for live-food fish trade, are recorded.
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Snapper, fish targeted for food, abundance is high.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted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



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

RARE ANIMALS

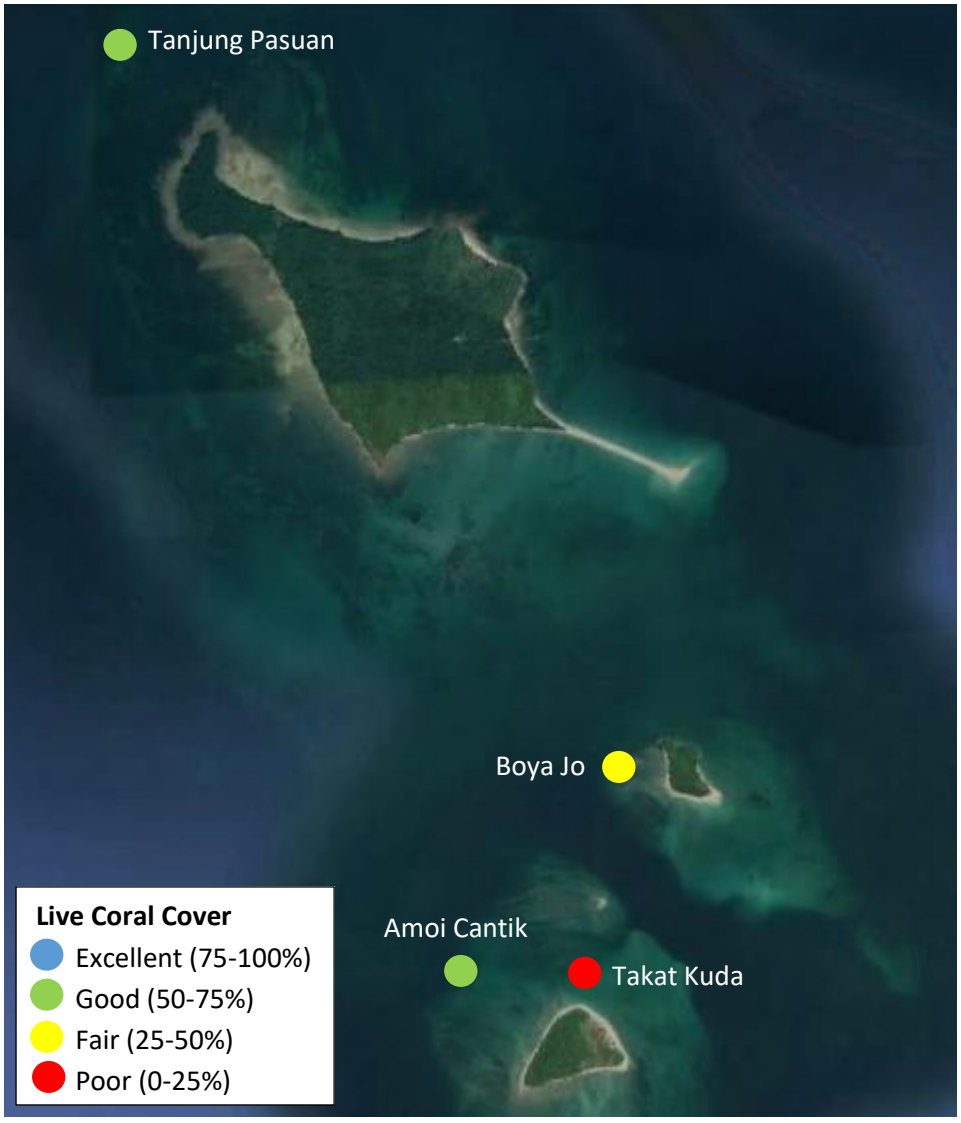
- Turtles were recorded at many sites.



North Borneo – Labuan

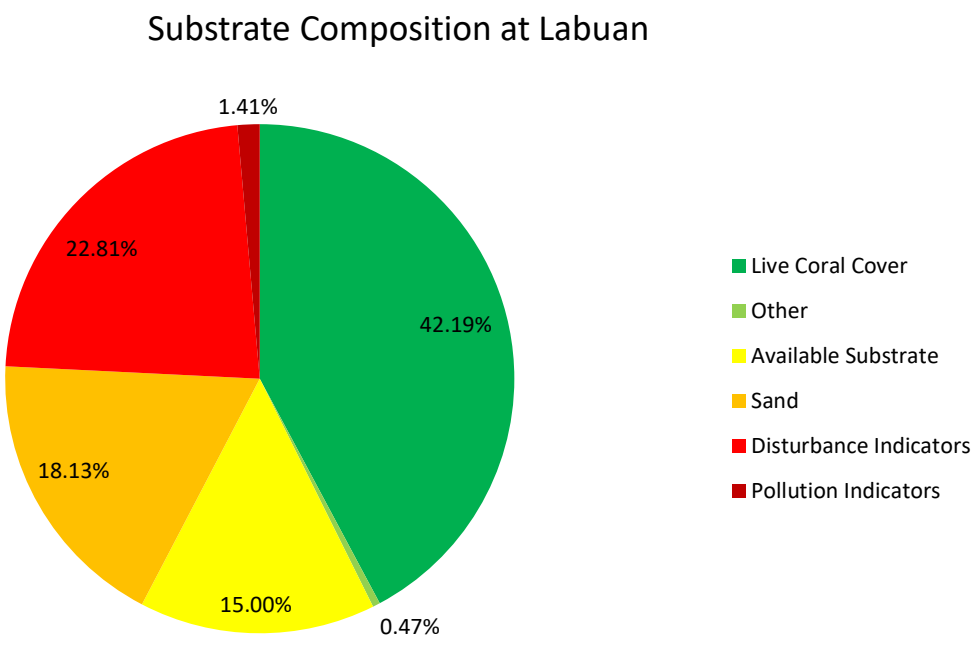
Labuan, officially the Federal Territory of Labuan, is a federal territory of Malaysia. Labuan is made up of one large island and six smaller islands (Pulau Daat, Pulau Burung, Pulau Kuraman, Pulau Papan, Pulau Rusukan Besar and Pulau Rusukan Kecil), and is located off the west coast of Sabah. Labuan is best known as an offshore financial centre offering international financial and business services since 1990 as well as being an offshore support hub for deep water oil and gas activities in the region. It is also a tourist destination for people travelling through Sabah and for scuba divers.

Three out of the six smaller islands form the Labuan Marine Park; they are Pulau Kuraman, Pulau Rusukan Besar and Pulau Rusukan Kecil. These three islands are located 2km off the southern part of Labuan main island. These islands are sparsely populated and are popular with expatriates, divers and those who travel between Labuan and Brunei.



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 show 'Poor' health.

Coral Cover and Health

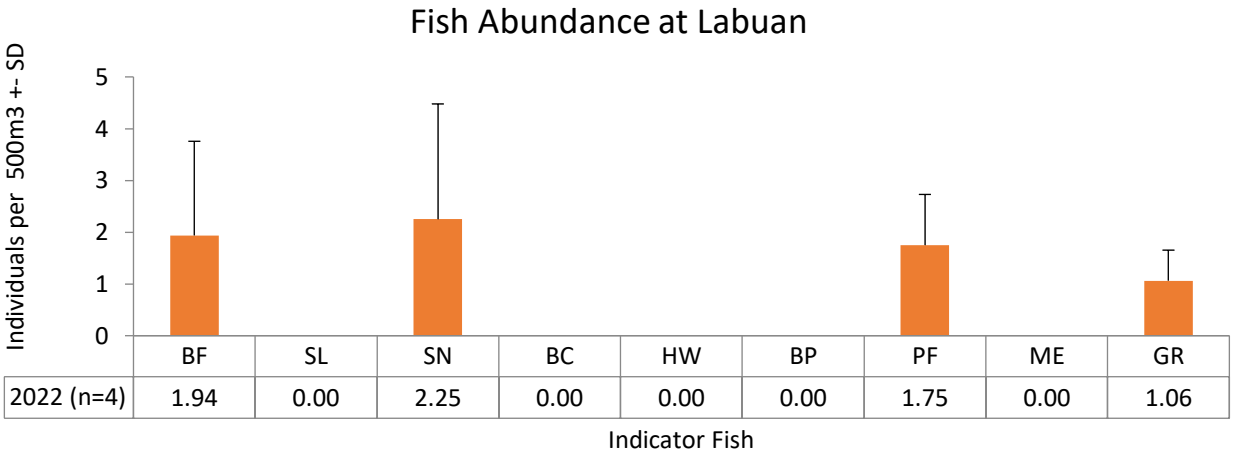


- Labuan reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 41.41%.
- In 'Fair' condition and below the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is high.
- Sand level is high.
- Disturbance indicators are very high.
- Rubble level are very high at Takat Kuda (47.50%) and Boya Jo (33.13%).

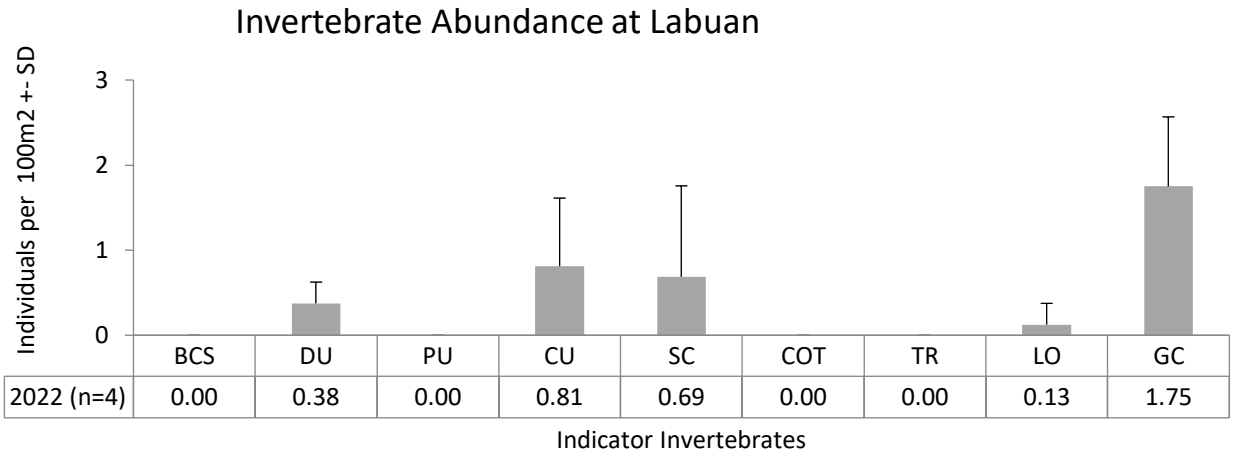
CORAL IMPACTS

- All sites recorded microbial mats on the reef.

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, is recorded.
- Absence of indicators targeted for live-food fish trade.
- Fish targeted for food are low in abundance.
- This suggests that fish targeted for food are heavily harvested.



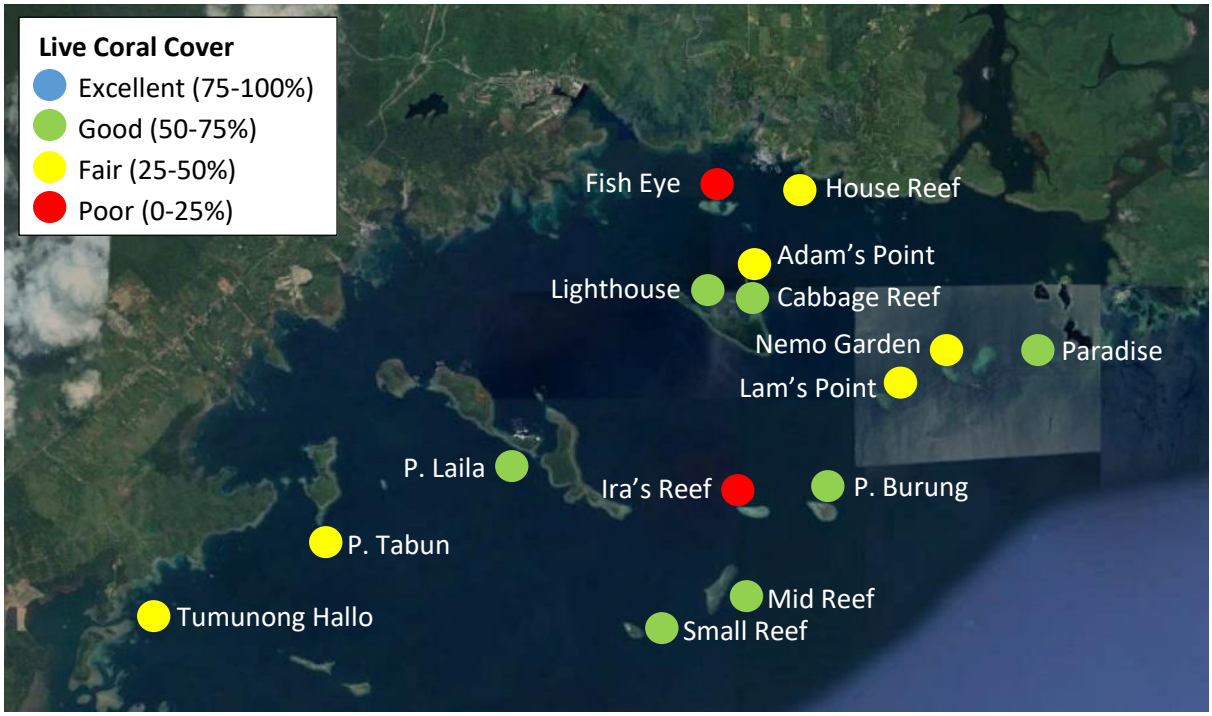
- Invertebrates targeted for food are low in abundance.
- Indicators for curio trade are absent.

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).

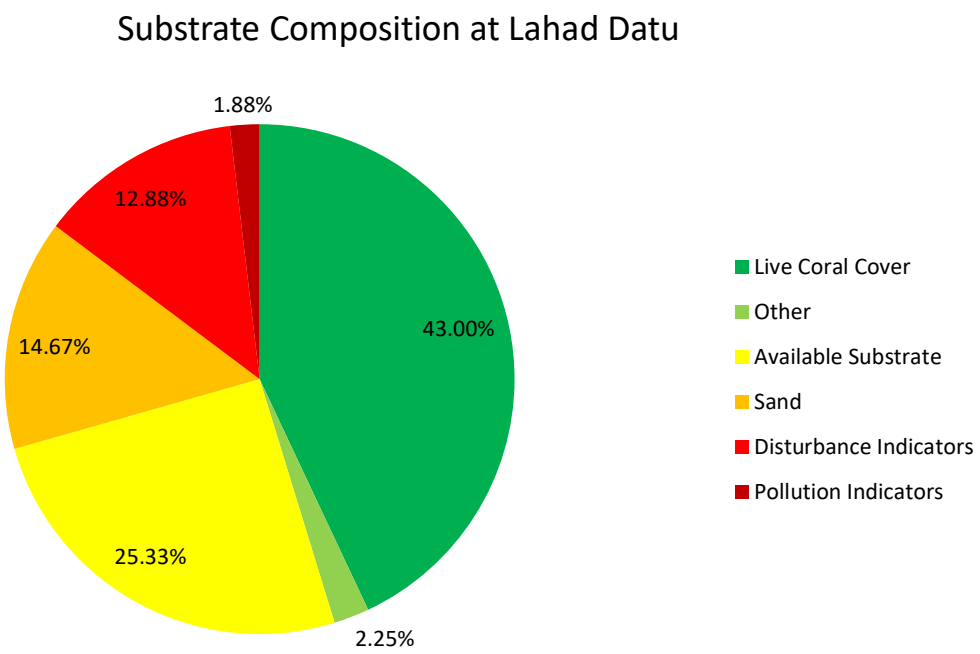
Currently, there is little development along the coastal areas of Lahad Datu. In Lahad Datu itself, tourism is still limited, though Sabah Urban Development Corporation is trying to promote greater investment in infrastructure. There are two well-known nature-based tourism attractions near to Lahad Datu: 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 and submerged reefs.



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

Coral Cover and Health

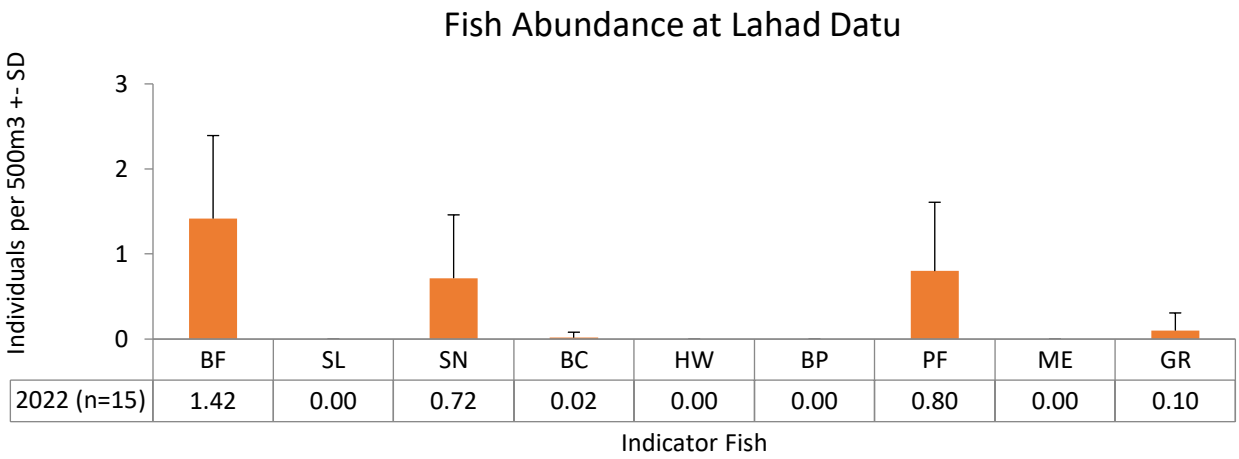


- Lahad Datu reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 40.96%.
- In 'Fair' condition and below the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is especially high at Ira's Reef (48.13%) and Lam's Point (30%).
- Disturbance indicators are high.
- Rubble level are high at many sites and especially high at Ira's Reef, Nemo Garden, Lam's Point, Pulau Burung and Fish Eye.
- Silt level is especially high at Tumunong Hallo which recorded 18.13%.

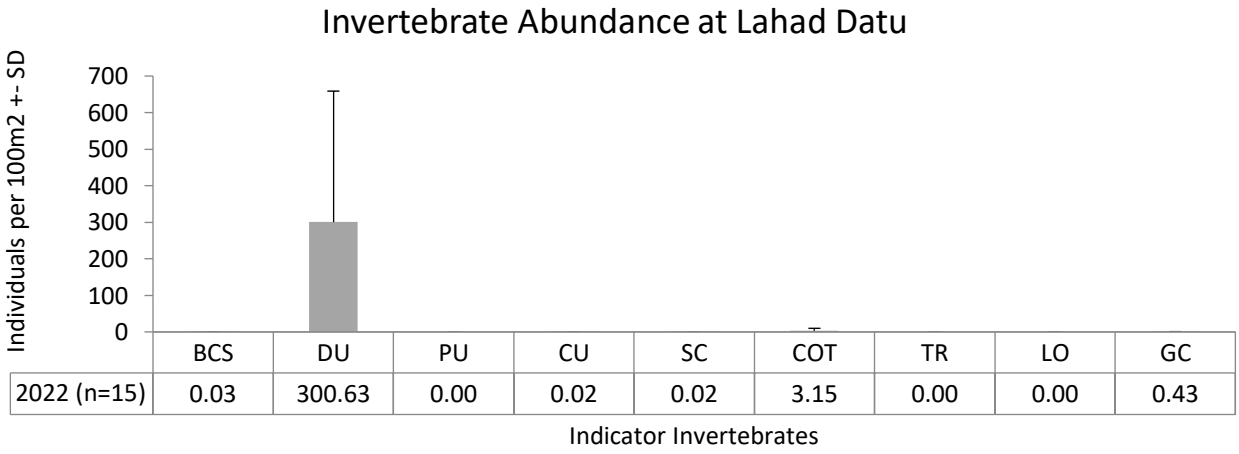
CORAL IMPACTS

- Boat anchor damage, dynamite fishing, discarded fishing net and trash were recorded at many sites.
- Crown-of-thorns and drupella predation were recorded.

Fish and Invertebrate

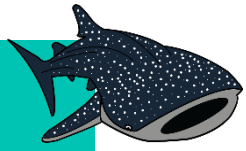


- Butterflyfish, indicator for aquarium trade, is recorded.
- Fish targeted for food are very low in abundance.
- Absent of indicators targeted for live-food fish trade.
- This suggests that fish targeted for food are heavily harvested.



- Diadema urchin abundance is very high.
- Banded coral shrimp, indicator for curio trade, is recorded.
- Invertebrates targeted for food are very low in abundance.
- Crown-of-thorns are serious issue in Lahad Datu. A healthy coral reef can support a population of 0.2-0.3 individuals per 100m^2, Lahad Datu recorded 3.15.

RARE ANIMALS



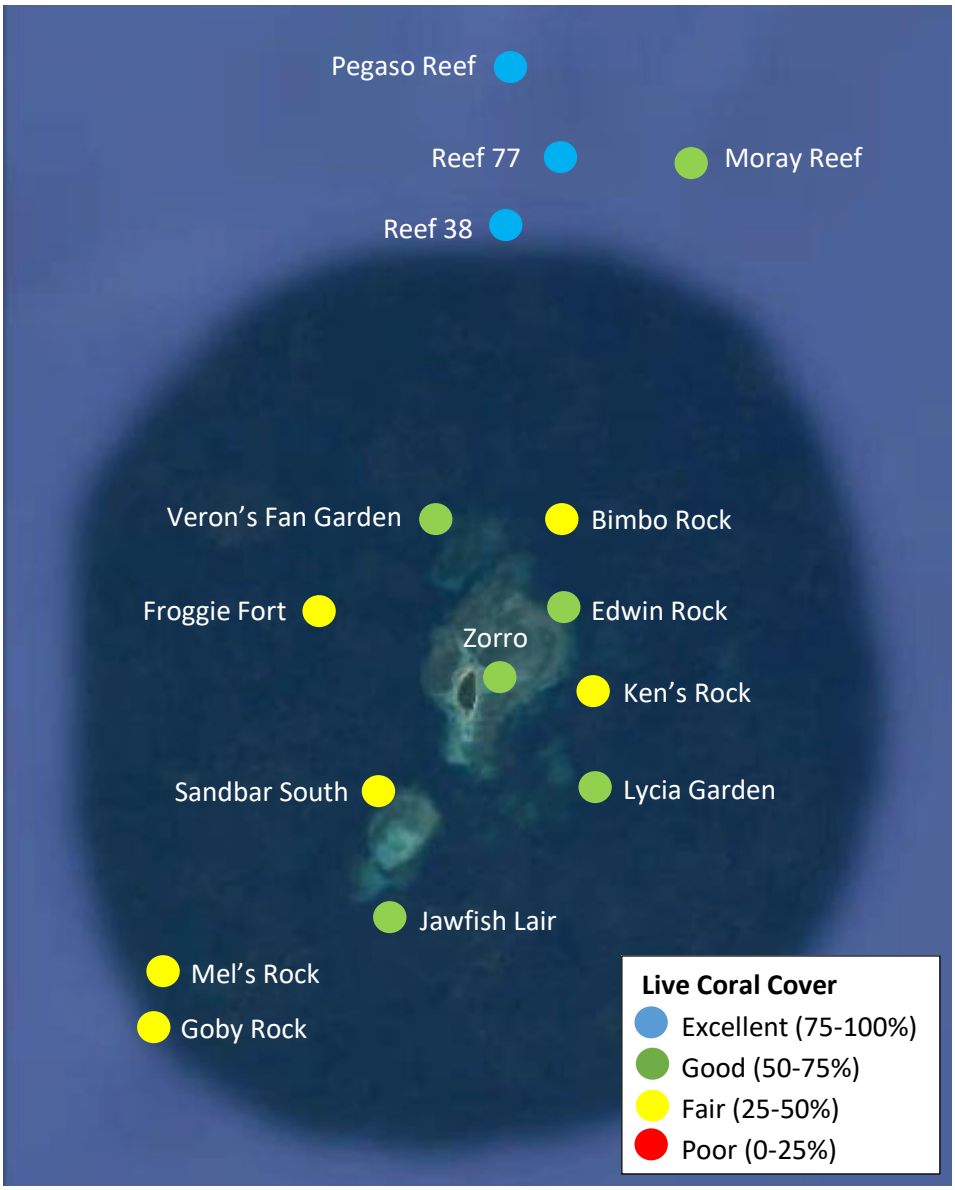
- Turtles were recorded.

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.

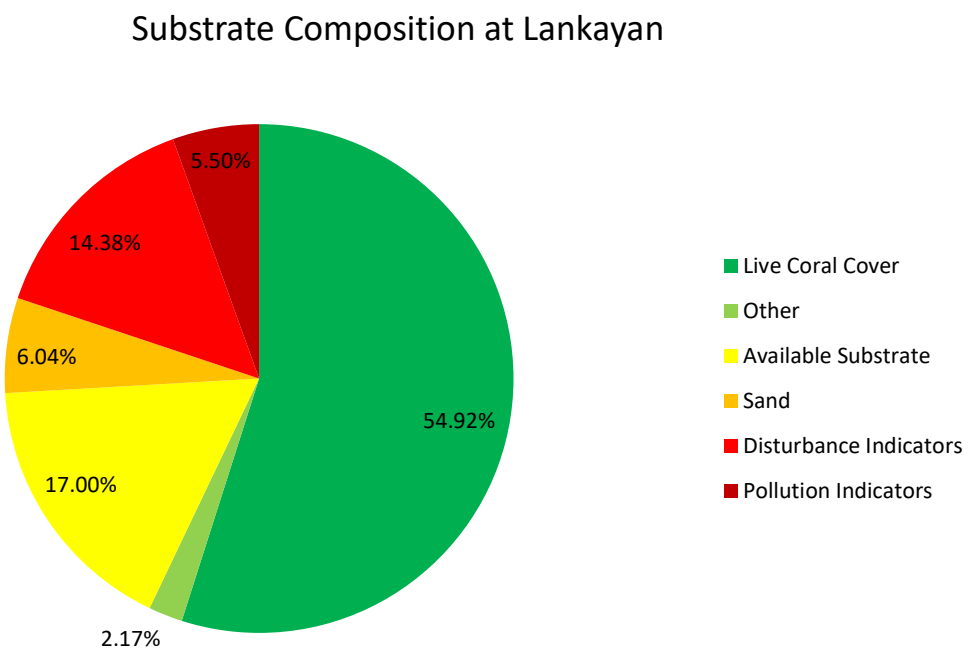
SIMCA is remote and distant from populated areas and no communities exist on the islands within the protected area. However, the SIMCA area is known to be a traditional fishing ground and is fished by both artisanal and commercial fishers from Sandakan, Kudat and the Philippines.

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 km^2 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 their live coral cover: 3 sites have 'Excellent' coral cover, 6 are in 'Good' condition and 6 show 'Fair' health.

Coral Cover and Health

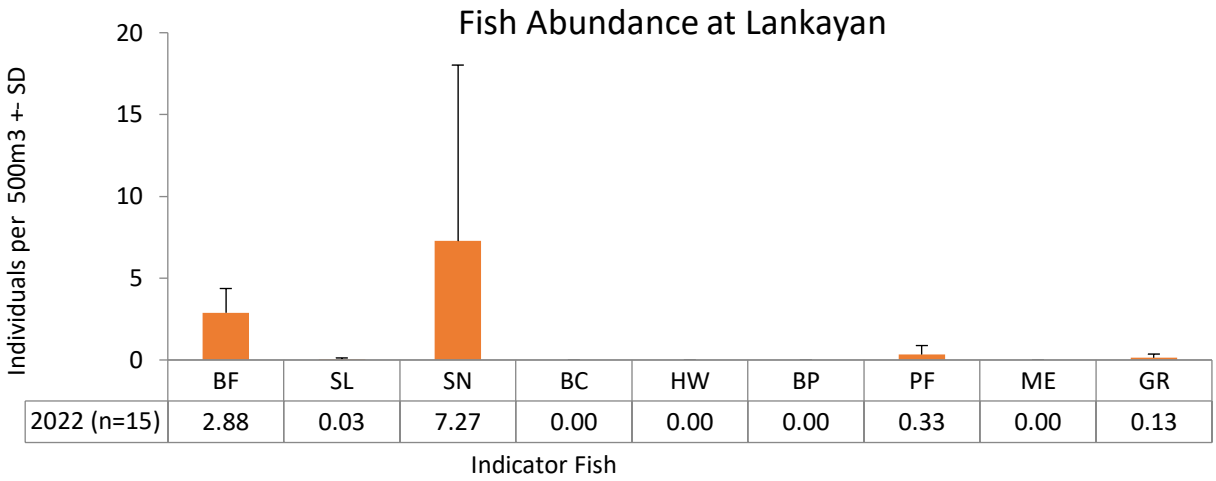


- Lankayan reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 53.46%.
- In 'Good' condition and above the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- Rubble level is especially high at Sandbar South (32.50%) and Froggie Fort (31.25%).

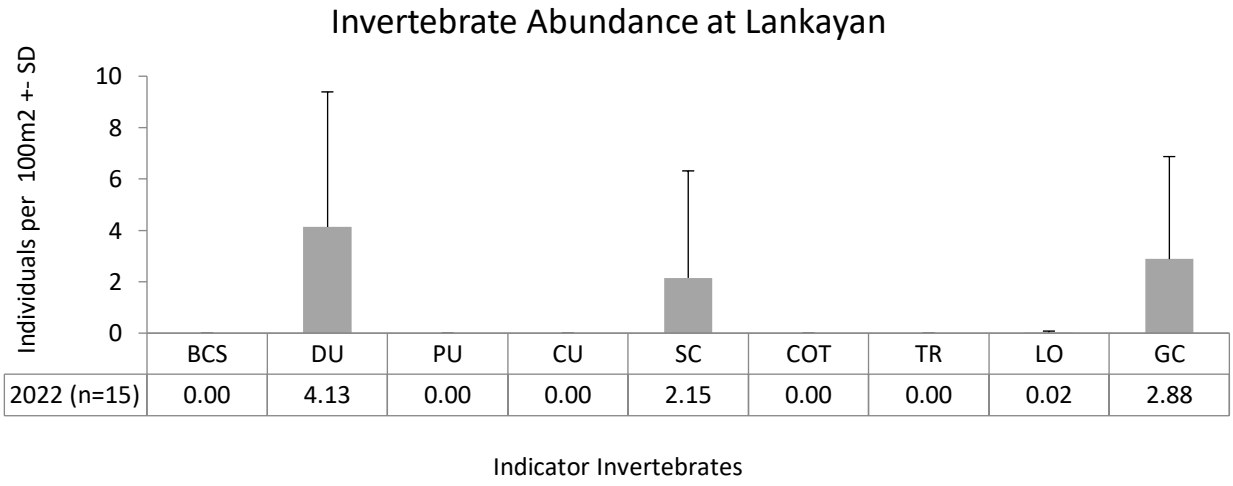
CORAL IMPACTS

- Discarded fishing nets and trash were recorded at some sites.
- Many sites were impacted by warm water bleaching.

Fish and Invertebrate



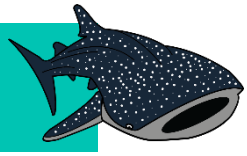
- Snapper abundance is high.
- Fish targeted for food are very low in abundance, except for snapper.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Indicators targeted for live-food fish trade are absent.
- This suggests that fish targeted for food are heavily harvested.



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

RARE ANIMALS

- Sharks and turtle were recorded.

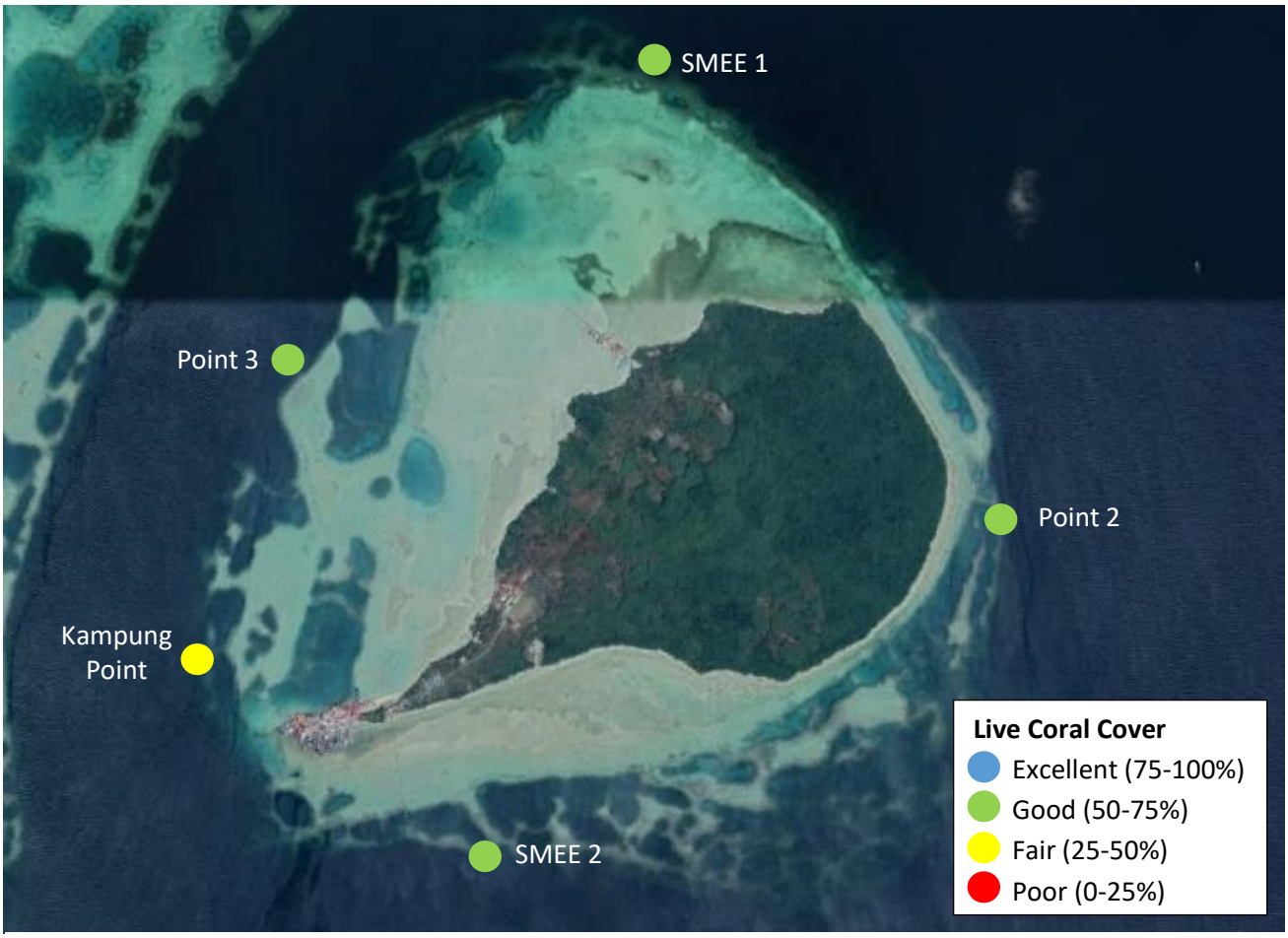


North Borneo – Larapan

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.

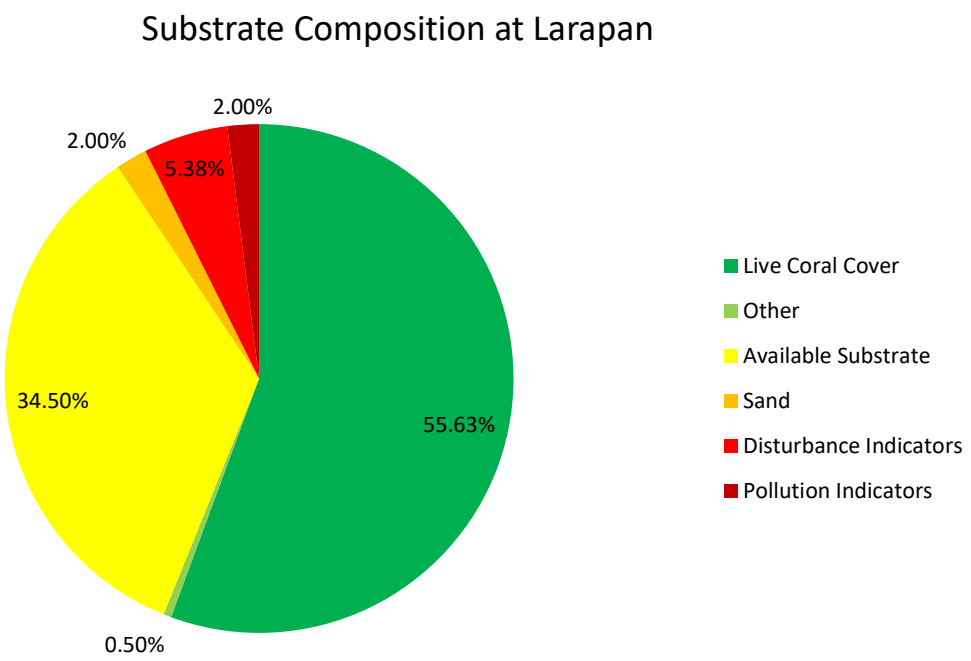
The island is a fishing village and a hotspot for fish bombing. Gleaning activities are popular amongst the locals. It is not a popular diving or snorkelling site. In terms of natural resources, the island has rich marine biodiversity, especially its coral reefs.

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: 4 sites have 'Good' coral cover and 1 is in 'Fair' condition.

Coral Cover and Health

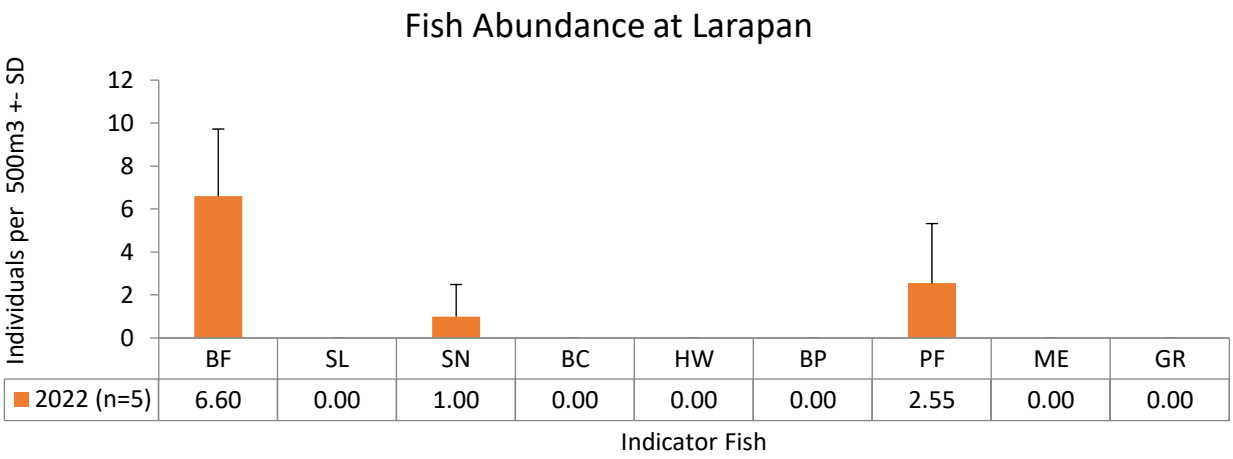


- Larapan reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 51.75%.
- In 'Good' condition and above the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is extremely high.

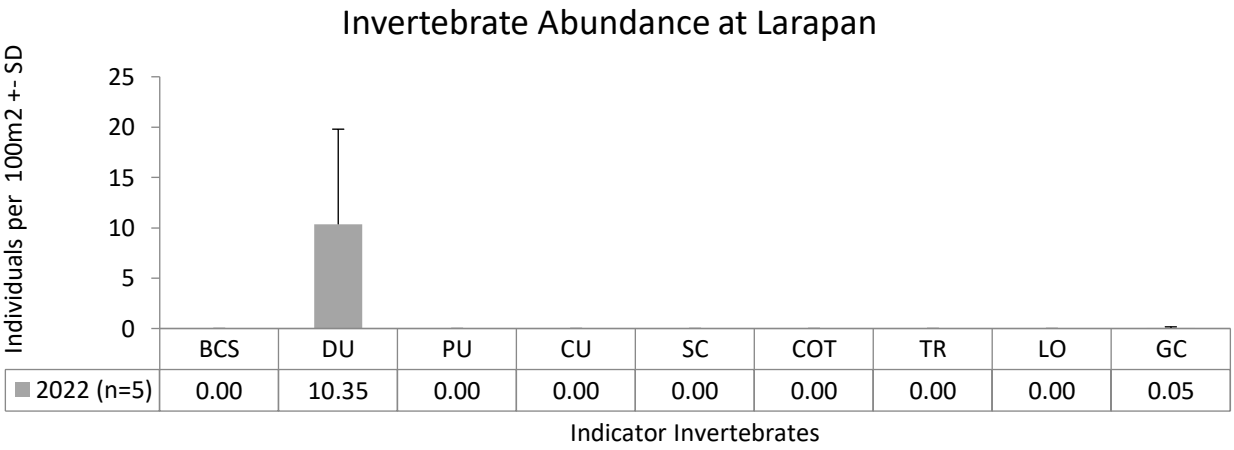
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.
- Coral damage due to fish bombing was recorded at all sites. Blast was heard during surveys.
- Drupella predation was recorded at two sites.
- All sites were impacted by warm water bleaching.

Fish and Invertebrate



- Butterflyfish, indicator for aquarium trade, abundance is high.
- Absent of fish targeted for live-food fish trade.
- Fish targeted for food are low in abundance.
- This suggest that fish targeted for food are heavily harvested.



- Only diadema urchin and giant clam are recorded.
- Indicators for curio trade are absent.

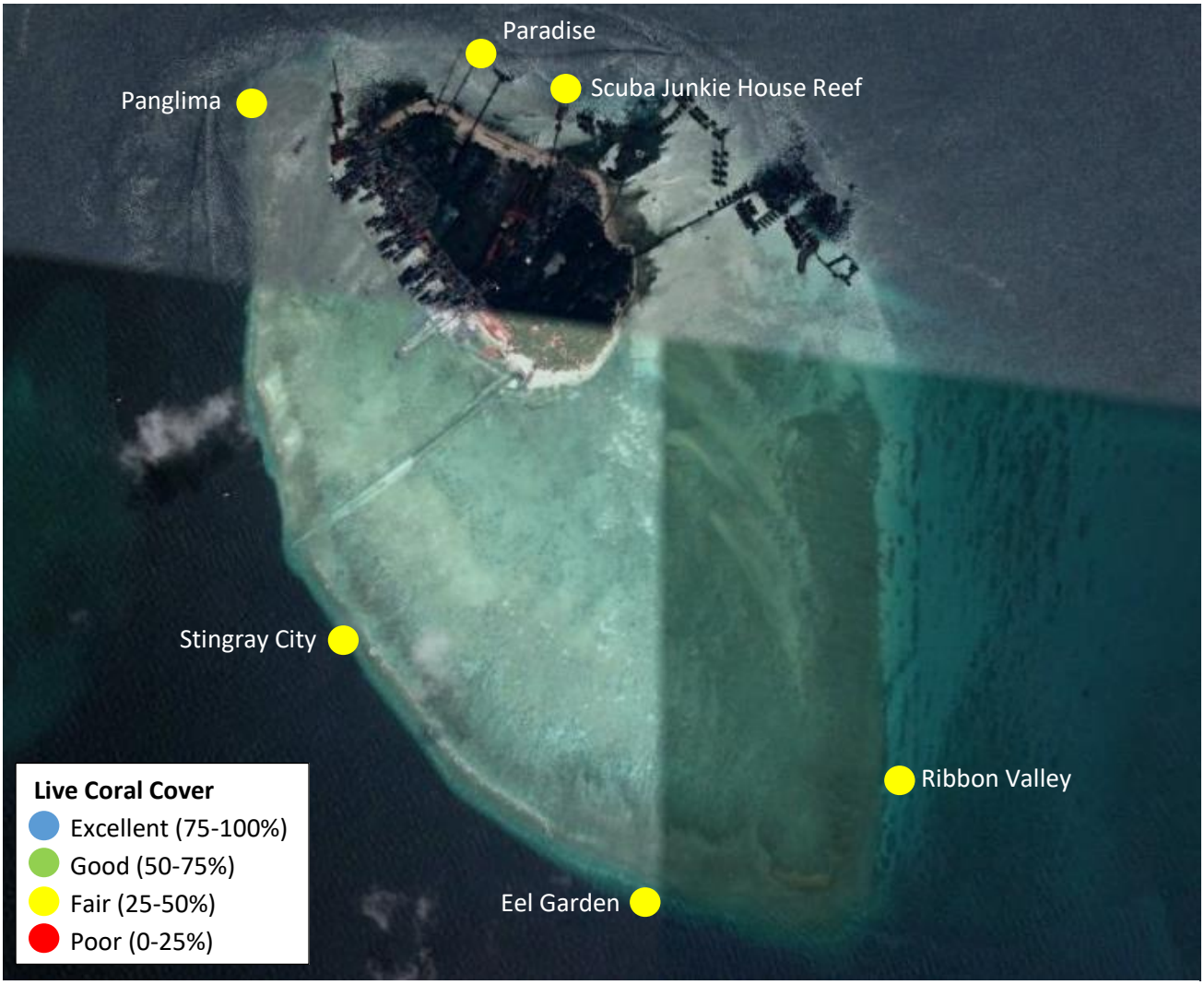
RARE ANIMALS

- Turtle was recorded.

North Borneo – Mabul

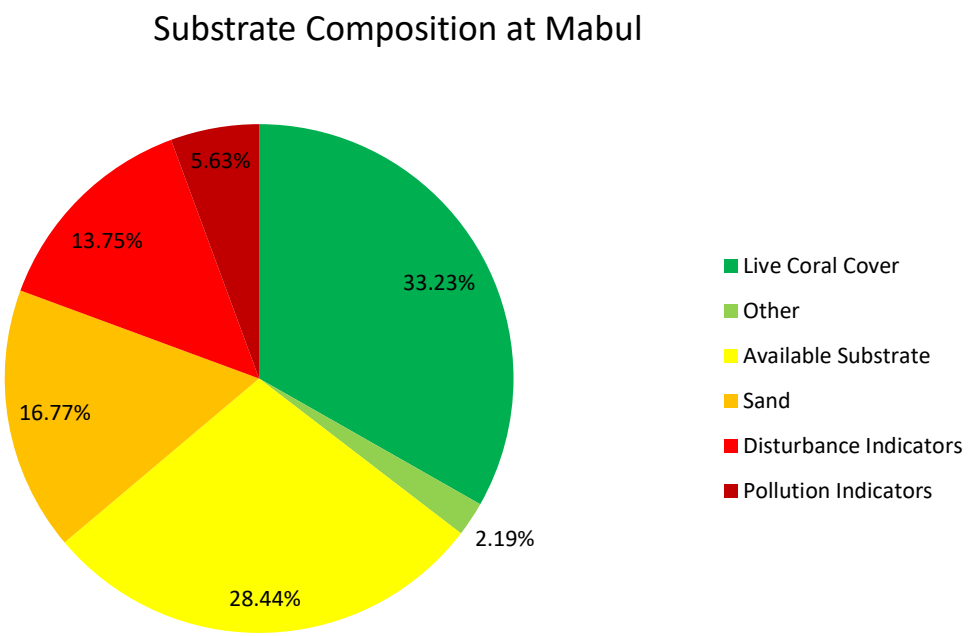
Mabul is a small island off the south-eastern coast of Sabah. The island has been a fishing village since the 1970s. In the 1990s, it first became popular to divers due to its proximity to Sipadan Island, 15km away. This 20-hectare piece of land surfaces 2–3 m above sea level, consists mostly of flat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

There are several dive resorts operating on Mabul Island, which 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: 6 sites have 'Fair' coral cover.

Coral Cover and Health

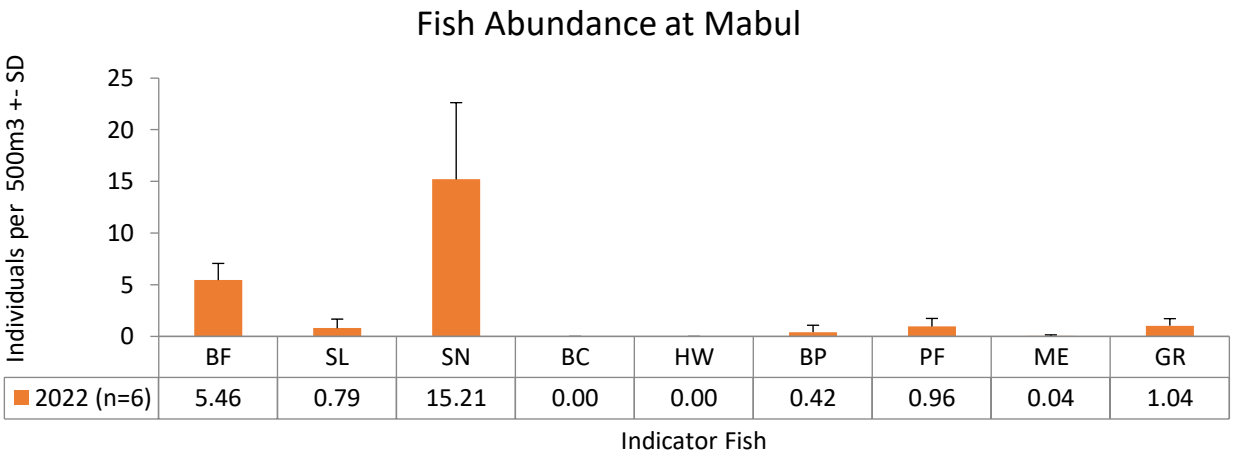


- Mabul reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 28.54%.
- In 'Fair' condition and below the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is high at all sites except Eel Garden and Stingray City.
- Disturbance indicators are high.
- Rubble level is high at many sites.
- The level of recently killed coral is high at Panglima which recorded 11.88%.

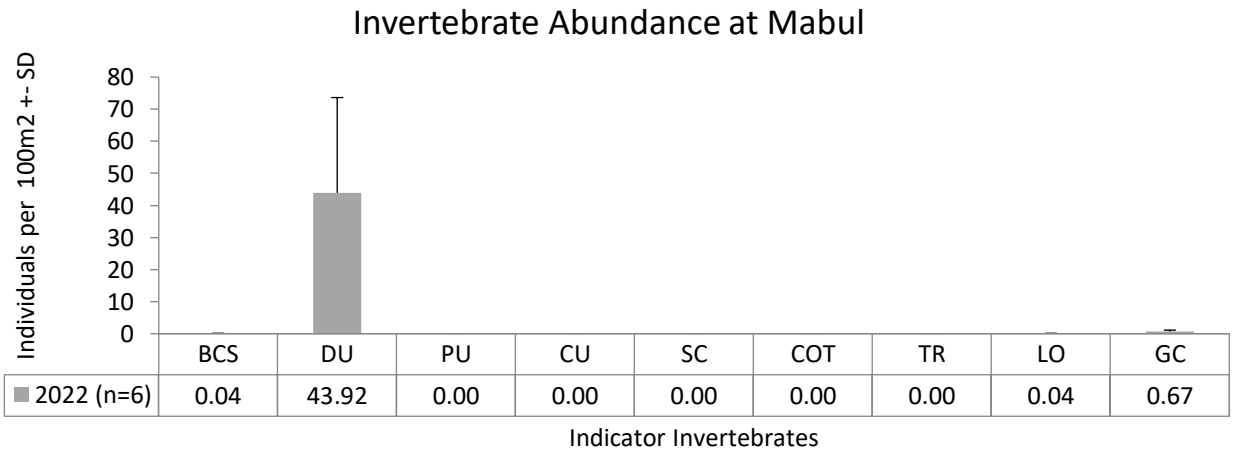
CORAL IMPACTS

- Boat anchor damage, discarded fishing nets and trash were recorded at many sites.
- Coral damage due to fish bombing was recorded.
- All sites were impacted by warm water bleaching.

Fish and Invertebrate



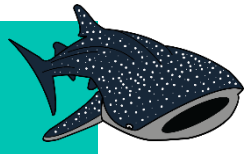
- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.



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

RARE ANIMALS

- Turtles and eagle rays were recorded at few sites.



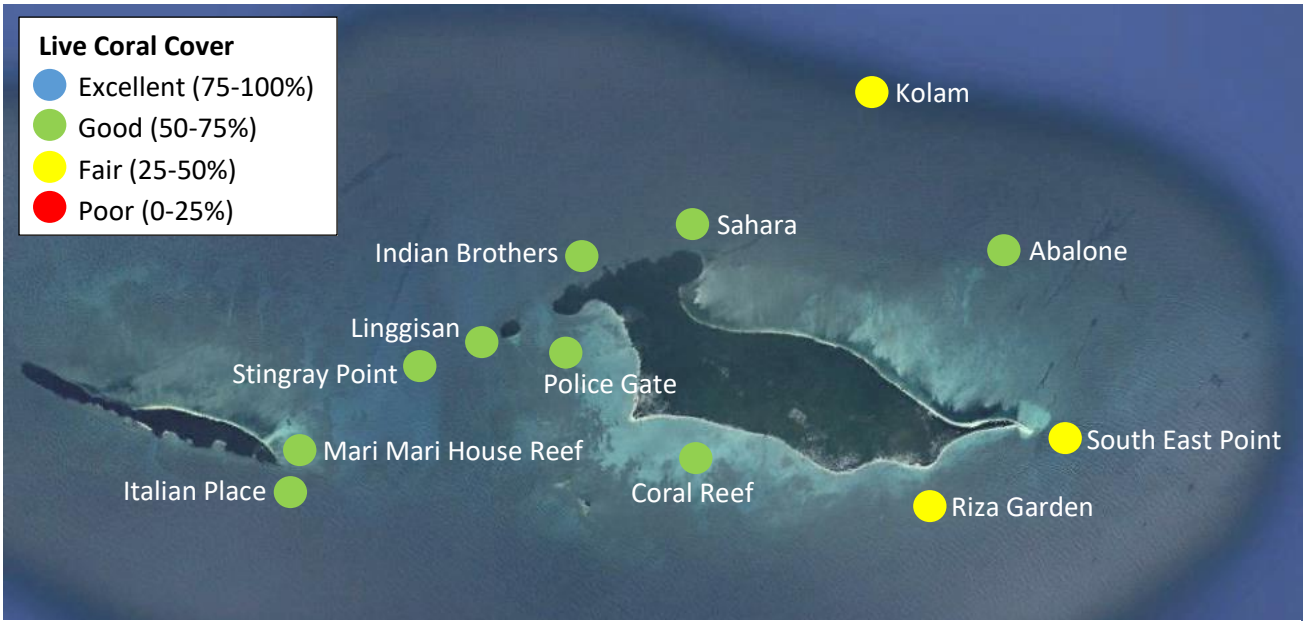
North Borneo – Mantanani

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 Linggisan.

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.

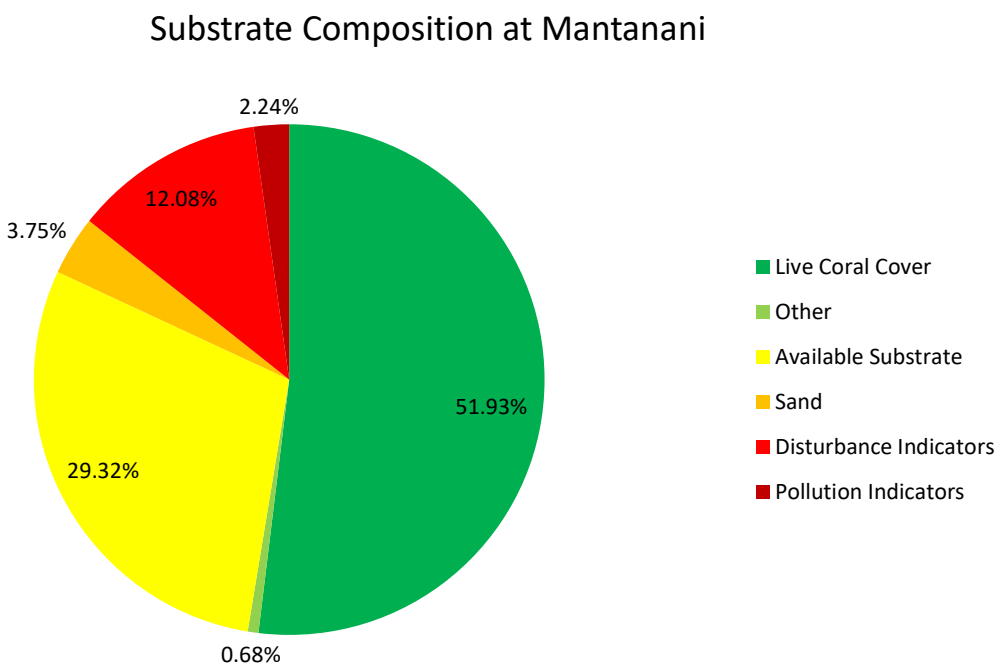
Mantanani is an increasingly popular snorkelling and diving destination, and tourist numbers have grown ten-fold in the last eight years, mainly day trippers from Kota Kinabalu. The number of tourism operators is increasing and there are plans for further development.

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: 9 sites have 'Good' coral cover and 3 are in 'Fair' condition.

Coral Cover and Health

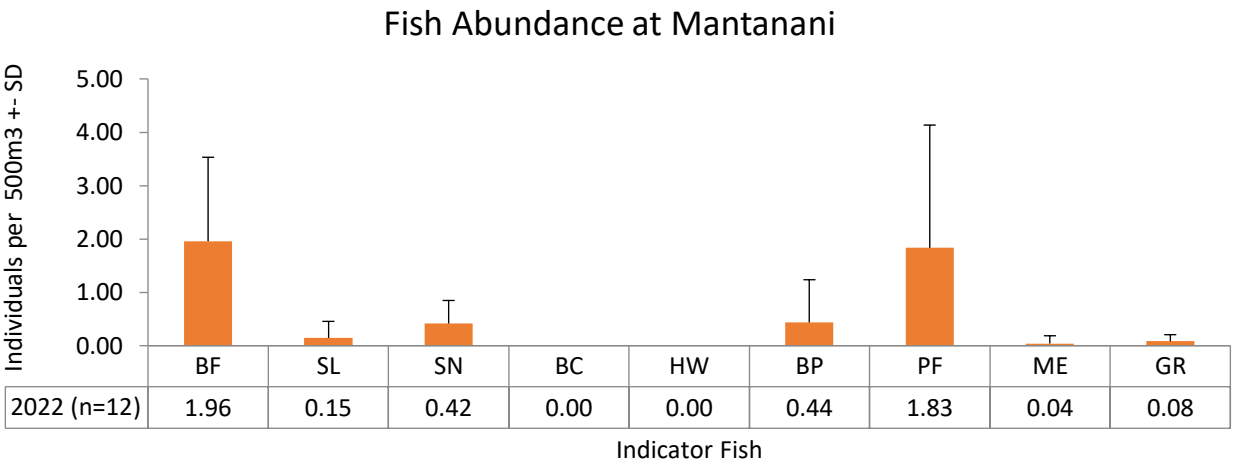


- Mantanani are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 50.57%.
- In 'Good' condition and above the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are high.
- Rubble level is high at many sites. The level is especially high at Coral Reef (29.38%), Riza Garden (25.63%) and South East Point (21.88%).
- Fish bombing is common in Mantanani; this may explain the high level of rubble.

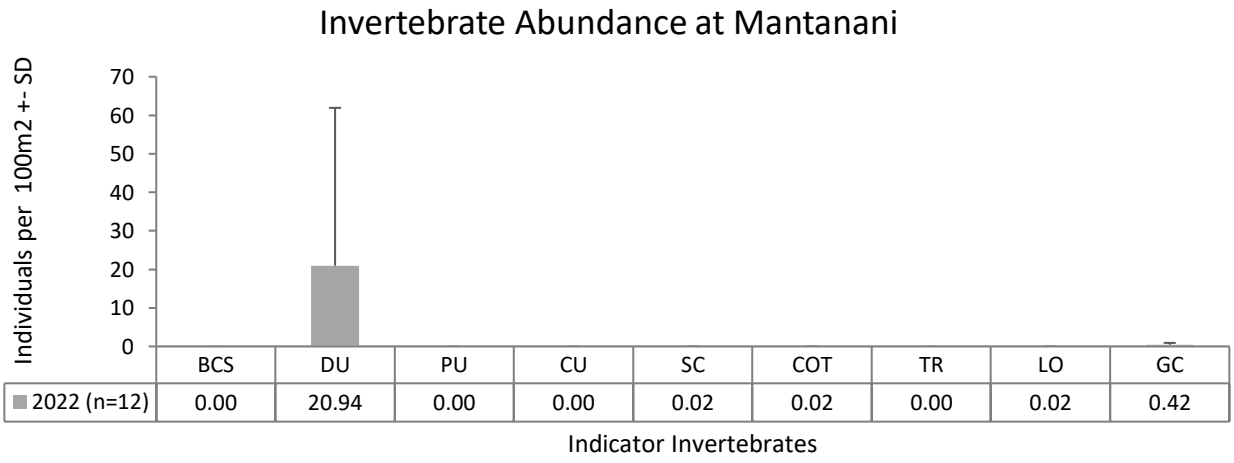
CORAL IMPACTS

- Discarded fishing net and trash were recorded at some sites.
- Coral damage due to fish bombing was recorded. 3 blasts were heard during surveys at one site.
- Some sites were impacted by warm water bleaching.

Fish and Invertebrate



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



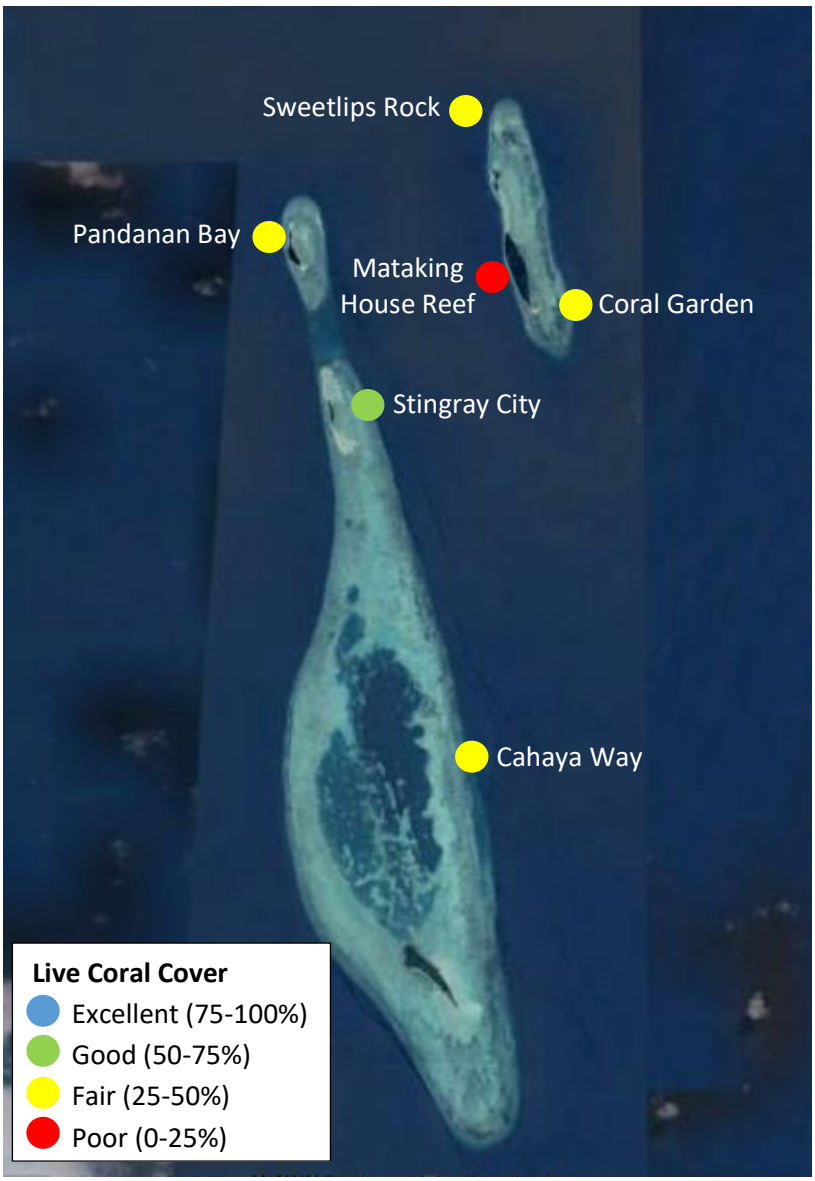
- Diadema urchin abundance is high.
- Invertebrates targeted for food are very low in abundance.
- Absent of indicators for curio trade.
- Crown-of-thorns are not an issue in Mantanani.

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.

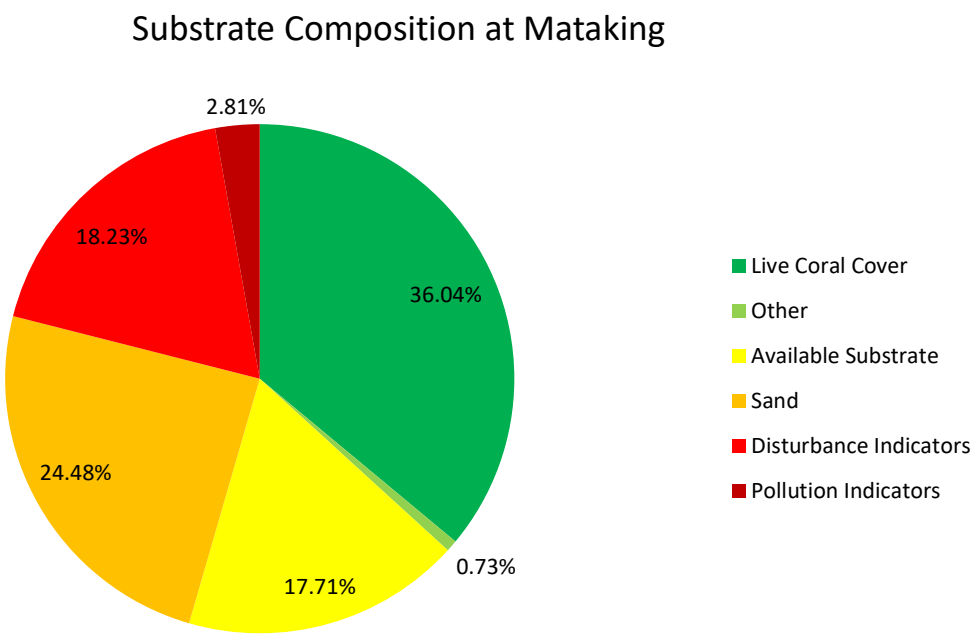
While the island has no legal protected status, the presence of the resort has effectively created a small protected area, keeping fishermen (including fish bombers) away from parts of the reefs surrounding the island.

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 'Good' coral cover, 4 are in 'Fair' condition and 1 shows 'Poor' health.

Coral Cover and Health

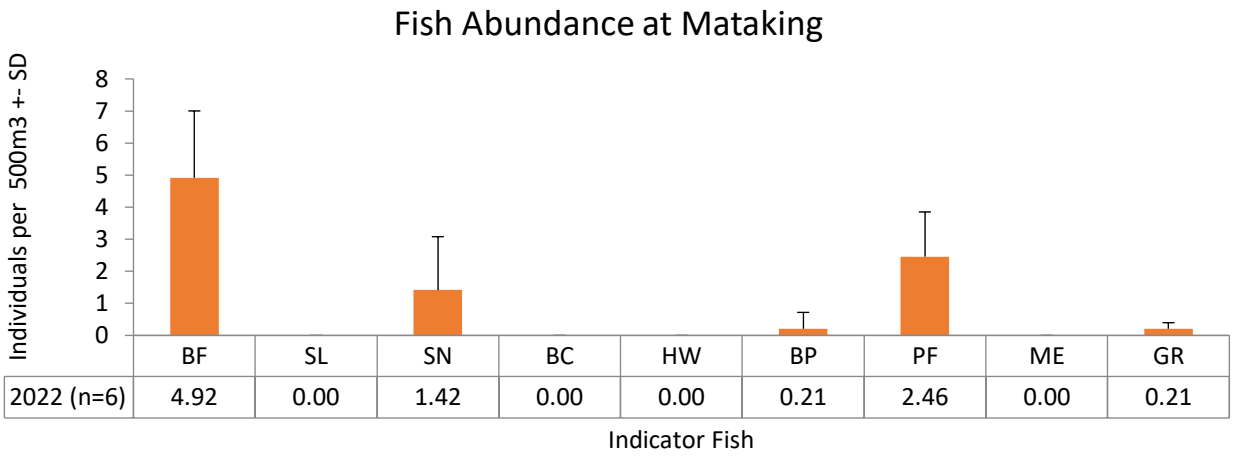


- Mataking reefs dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 34.27%.
- In 'Fair' condition and below the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is high.
- Sand level is very high. It is especially high at Mataking House Reef (66.88%) and Pandanan Bay (40.63%).
- Disturbance indicators are high.
- Rubble level is high at many sites. The level is especially high at Coral Garden (40%) and Cahaya Way (33.13%).

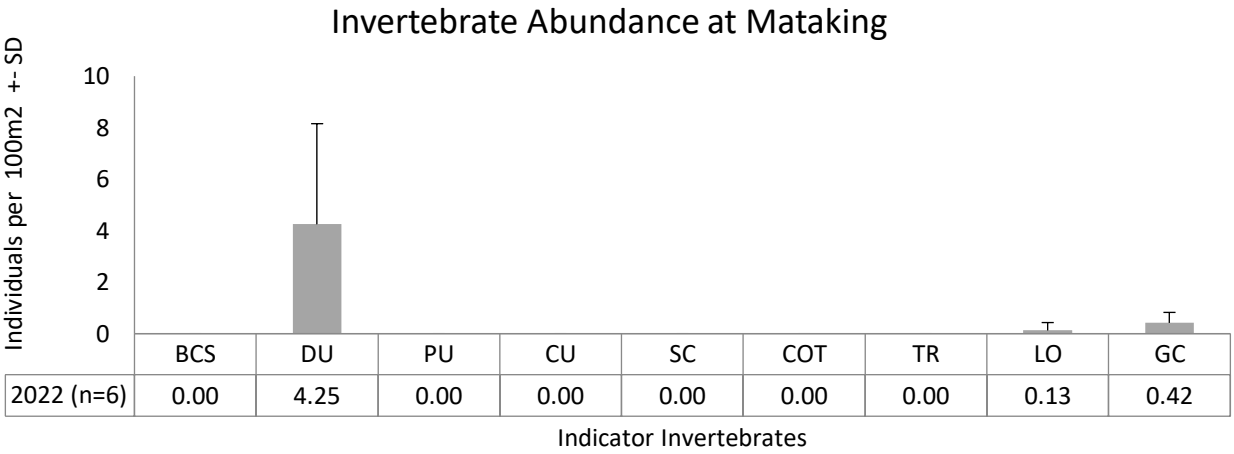
CORAL IMPACTS

- Boat anchor damage, discarded fishing net and trash were recorded at many sites.
- All sites were impacted by warm water bleaching.
- Drupella predation was recorded at many sites.

Fish and Invertebrate



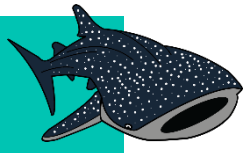
- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Fish targeted for food are low in abundance, except for parrotfish.
- This suggests that fish targeted for food are heavily harvested.



- Invertebrates targeted for food are very low in abundance.

RARE ANIMALS

- Turtles were recorded at many sites.



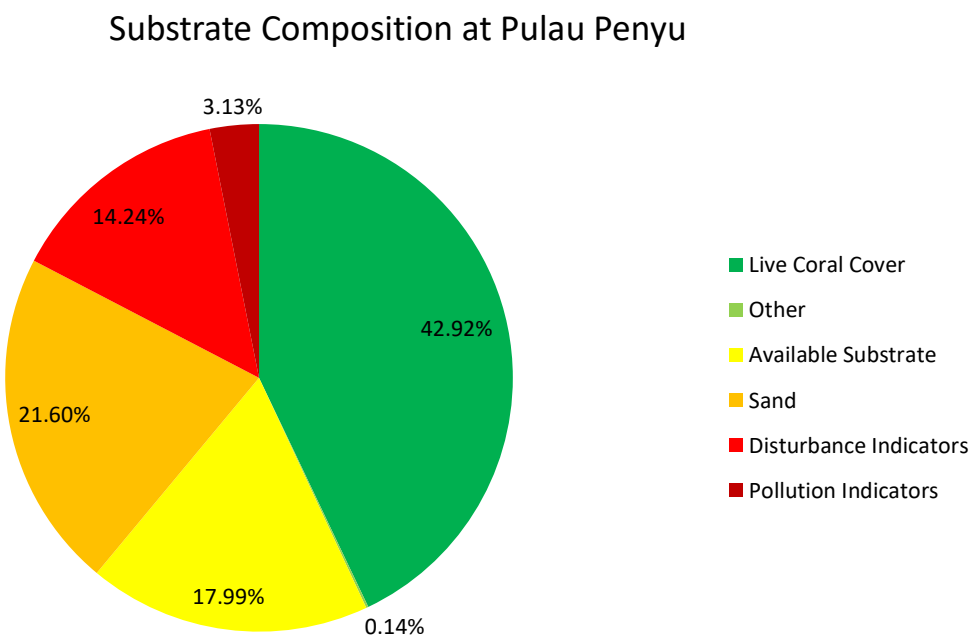
North Borneo – Pulau Penyu

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 17.4km^2 and administered by Sabah Parks.

Only on Selingan are there chalets for overnight visitors, and those who wish to see the turtles laying 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.

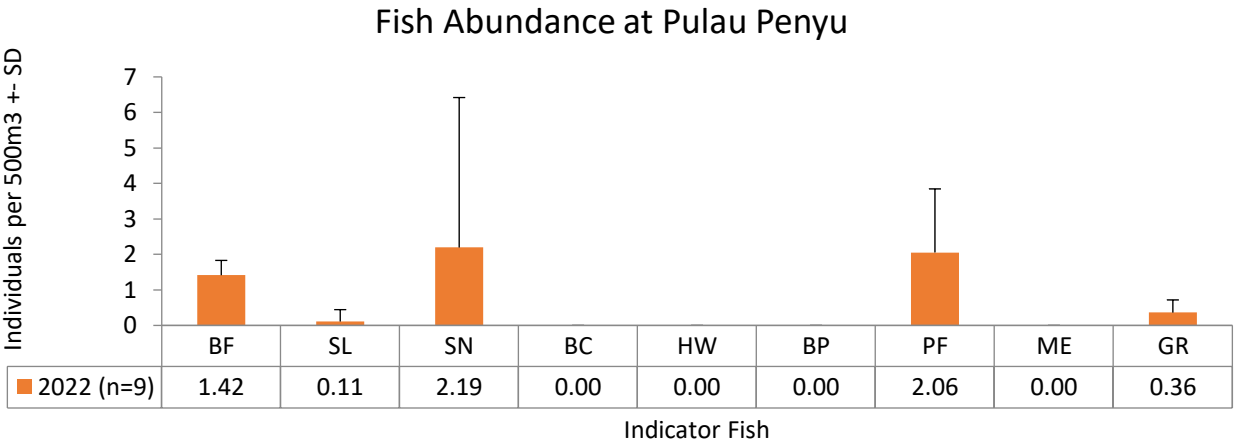
Map showing the health categories of each survey site based on Live Coral Cover: 2 sites have 'Excellent' coral cover, 4 are in 'Fair' condition and 3 show 'Poor' health.

Coral Cover and Health

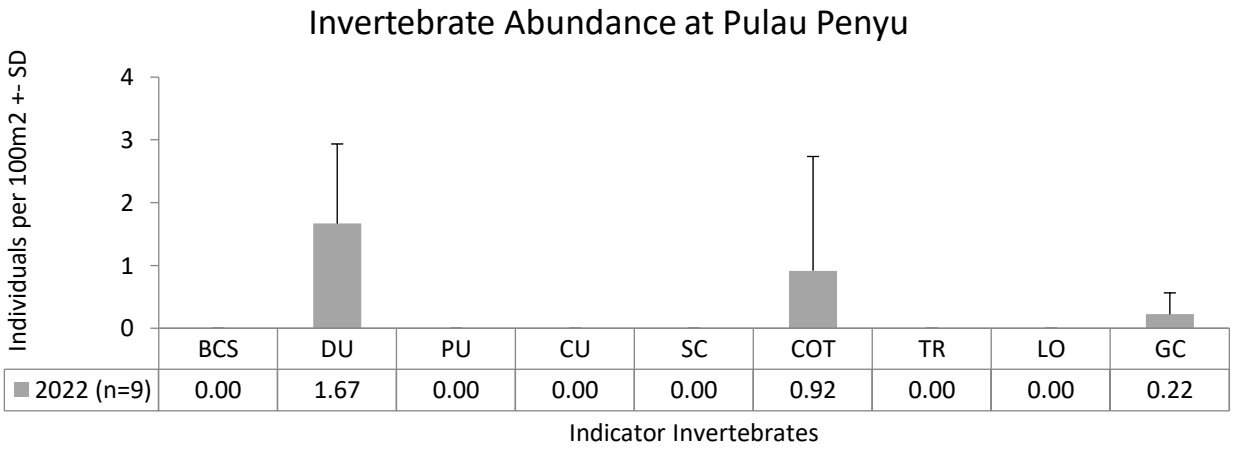


- Pulau Penyu reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 40.90%.
- In 'Fair' condition and below the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is high.
- Sand level is very high. The level is especially high at Pulau Bakungan 1 (10m) and Pulau Bakungan 2 (10m), both recorded over 55%.
- Disturbance indicators are high.
- Rubble level is especially high at Mid Reef 5m (21.88%).
- Silt level is especially high at Selingan 10m which recorded 22.50%.

Fish and Invertebrate



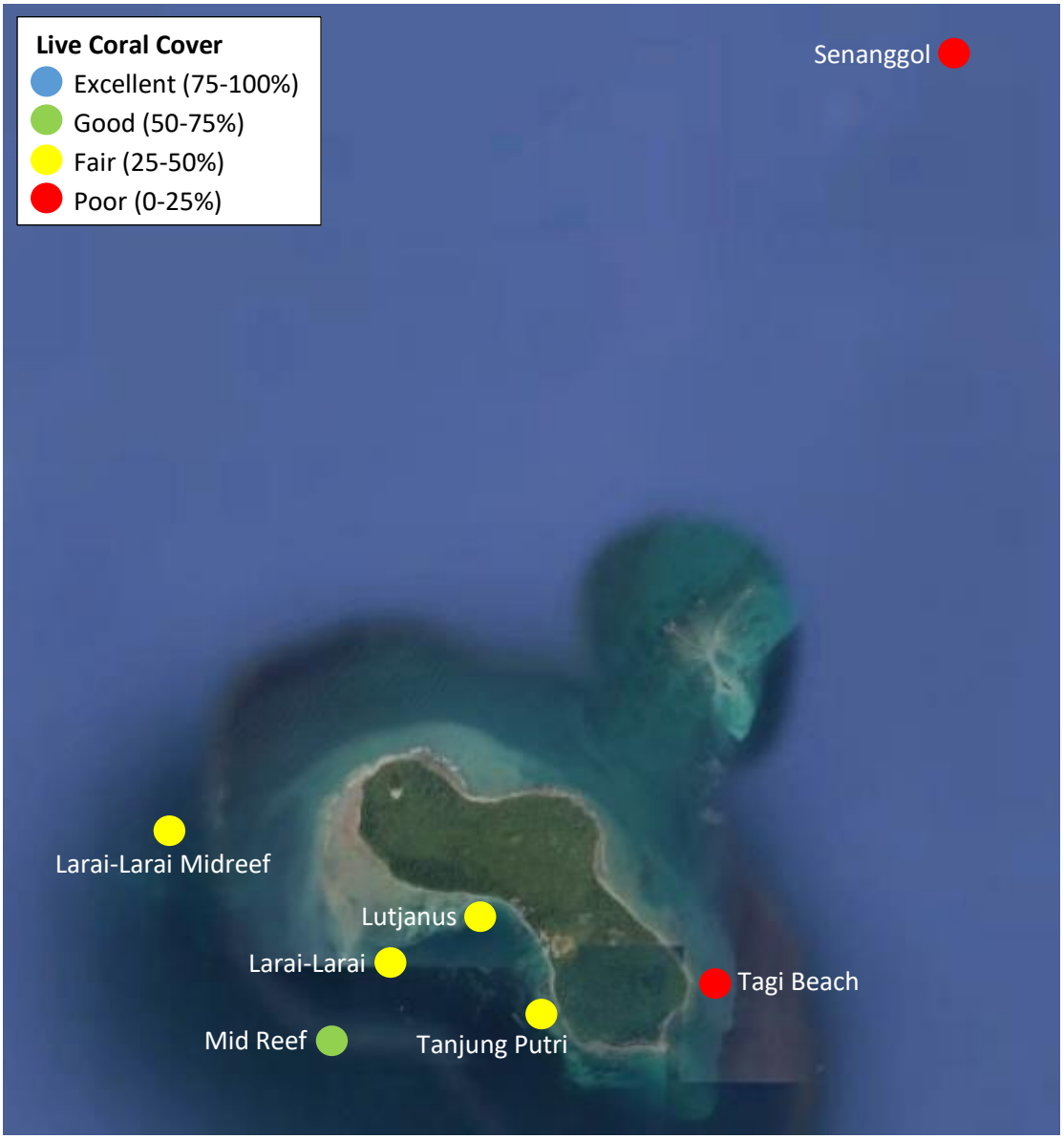
- Butterflyfish, indicator for aquarium trade, is recorded.
- Indicators targeted for live-food fish trade are absent.
- Fish targeted for food are low in abundance.
- This suggests that fish targeted for food are heavily harvested.



- Indicators for curio trade are absent.
- Invertebrates targeted for food are very low in abundance.
- Crown-of-thorns are issue in Pulau Penyu. A healthy coral reef can support a population of 0.2-0.3 individuals per $100m^2$, Pulau Penyu recorded 0.92.

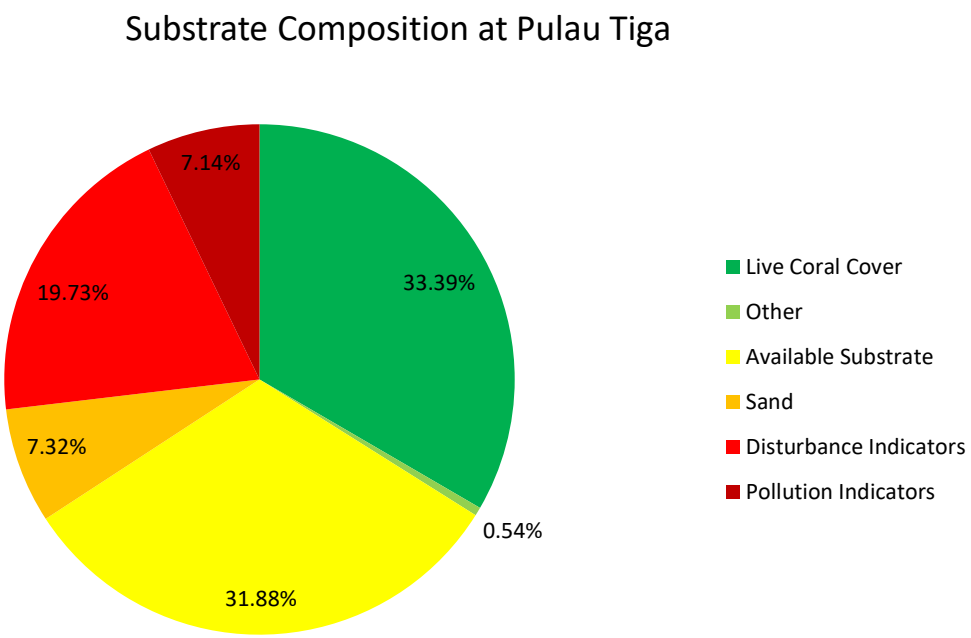
North Borneo – Pulau Tiga

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 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: 1 site has 'Good' coral cove, 4 are in 'Fair' condition and 2 show 'Poor' health.

Coral Cover and Health

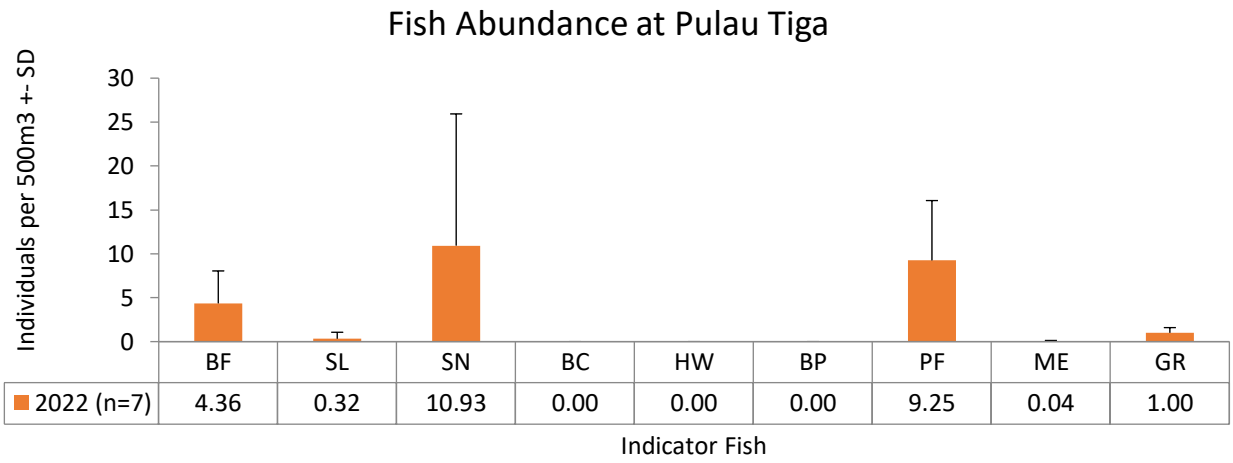


- Pulau Tiga reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 25.63%.
- In 'Fair' condition and below the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are high.
- Rubble level is high at all sites.
- Pollution indicators are slightly high.
- Nutrient indicator algae level is especially high at Tagi Beach, Larai-Larai and Larai-Larai Midreef.

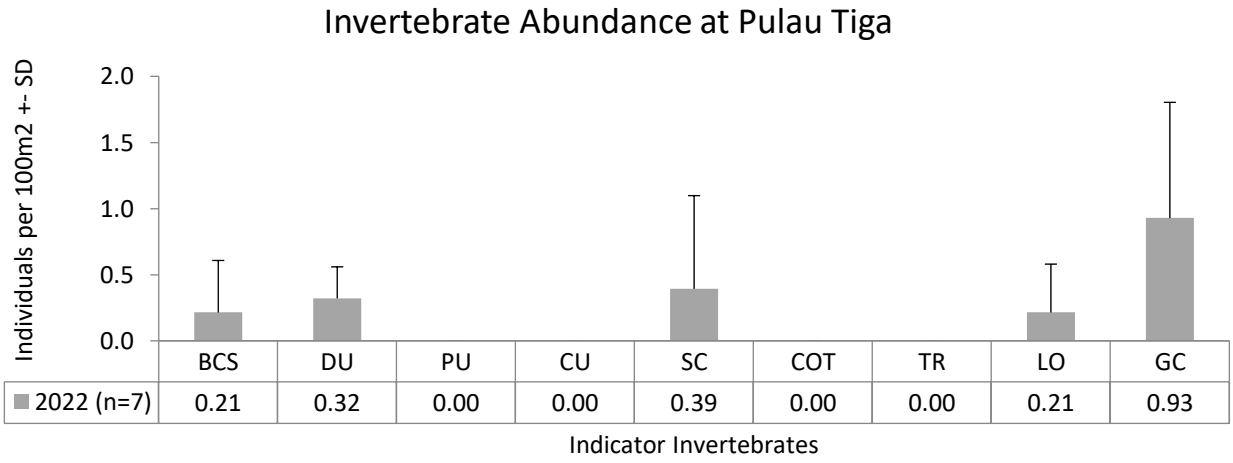
CORAL IMPACTS

- Some sites were impacted by warm water bleaching.

Fish and Invertebrate



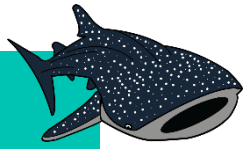
- The abundance of snapper and parrotfish, fish targeted for food, is high.
- Fish targeted for food are very low in abundance, except for snapper and parrotfish.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Absence of indicators targeted for live-food fish trade.



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

RARE ANIMALS

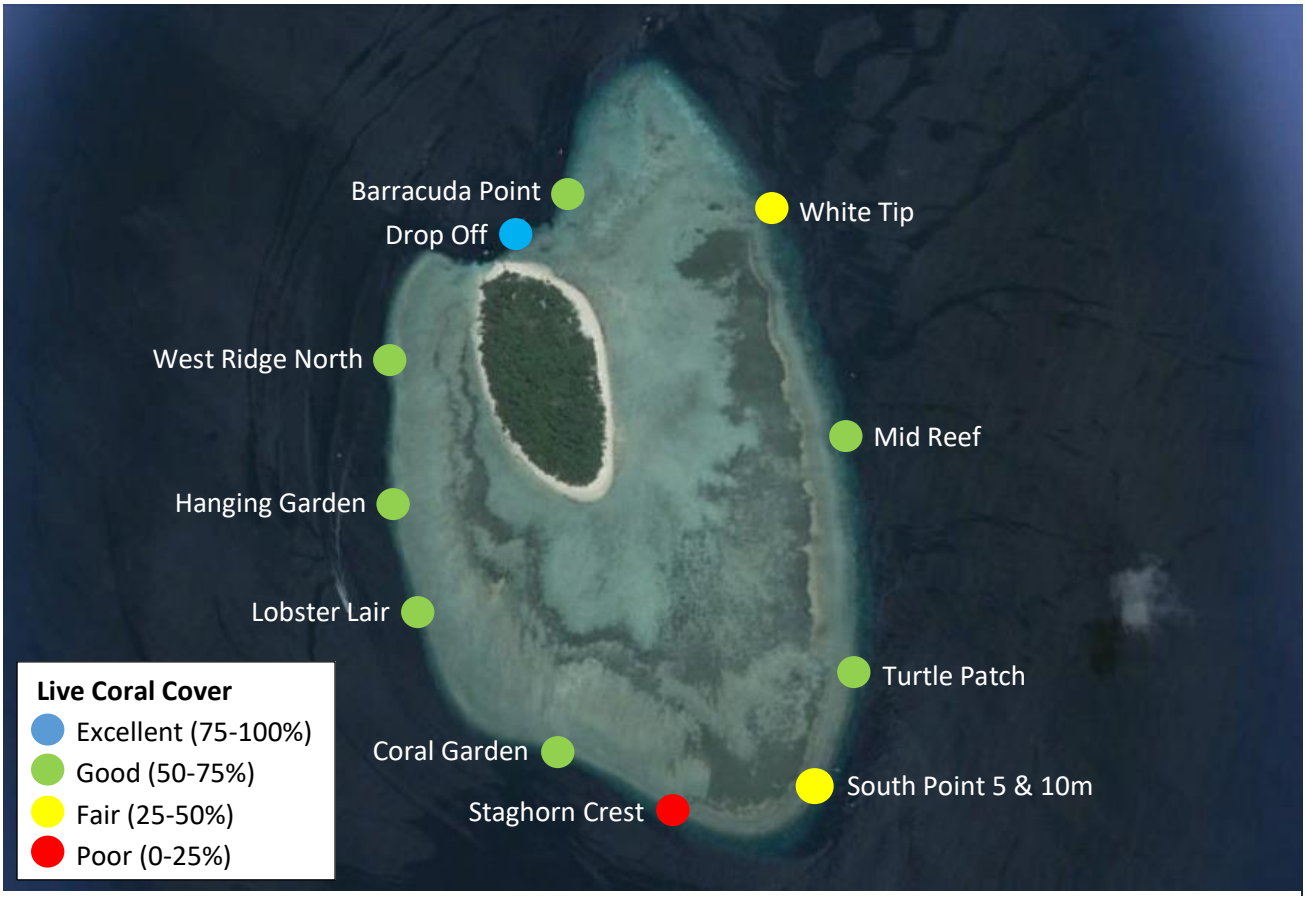
- Bamboo shark was recorded.



North Borneo – Sipadan

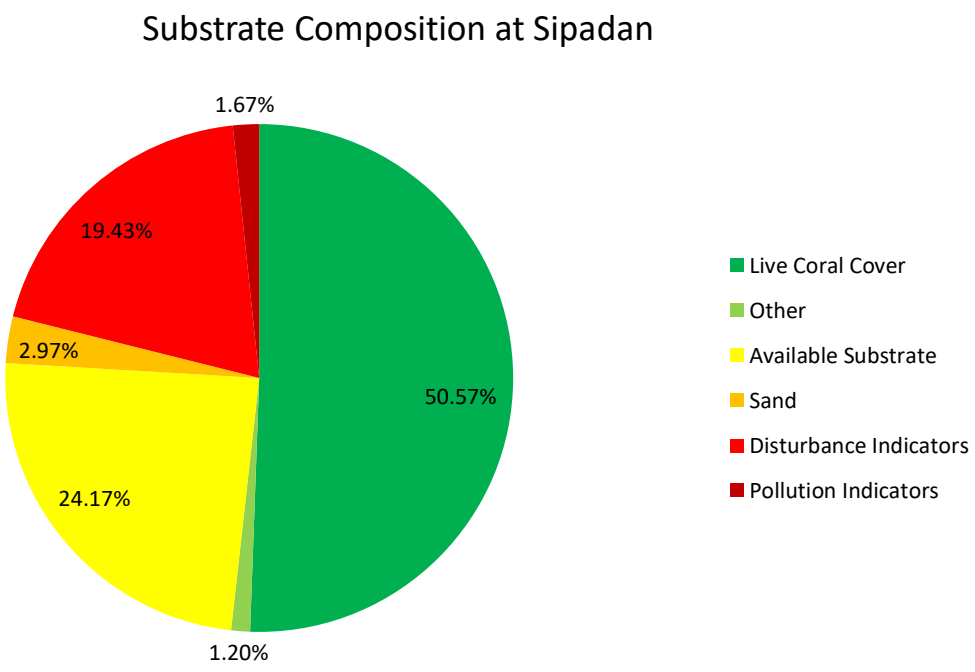
Sipadan is the only oceanic island in Malaysia, rising 600 metres from the seabed and rated by many dive journals as one of the top destinations for diving in the world. Sipadan is located in the Celebes Sea off the east coast of Sabah. It was formed by living corals growing on top of an extinct volcanic 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: 1 site has 'Excellent' coral cover, 7 are in 'Good' condition, 3 show 'Fair' health and 1 is in ‘Poor’ state.

Coral Cover and Health

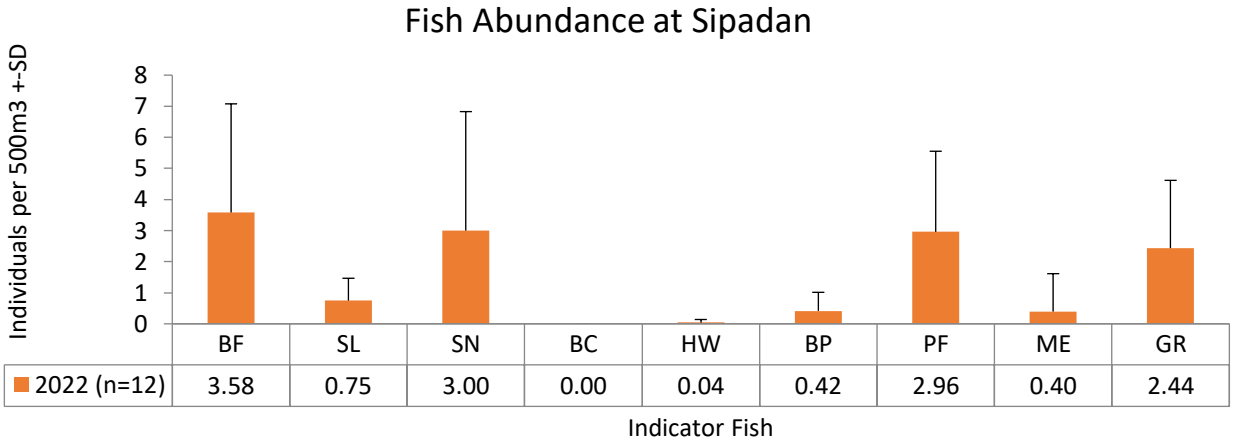


- Sipadan reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 42.29%.
- In 'Good' condition and above the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is very high.
- Disturbance indicators are high.
- Rubble level is high at many sites. The level is especially high at Staghorn Crest (51.25%), South Point 10m (43.75%), Mid Reef (35.63%) and White Tip (35%).

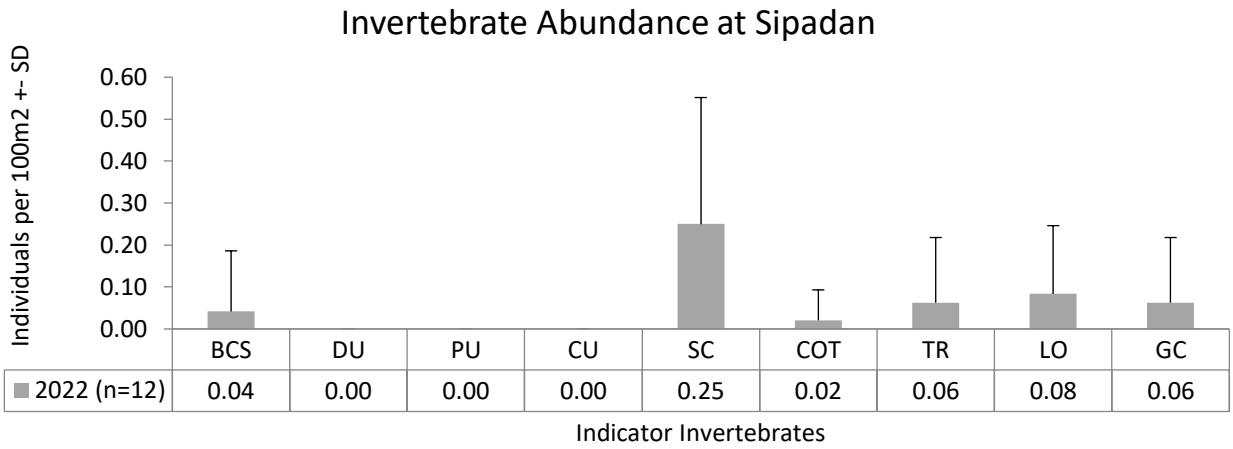
CORAL IMPACTS

- Discarded fishing net was recorded.

Fish and Invertebrate



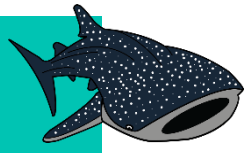
- Humphead wrasse and bumphead parrotfish, indicators targeted for live-food fish trade, are recorded.
- Butterflyfish, indicator for aquarium trade, is recorded.
- Many fish targeted for food are recorded.



- Banded coral shrimp and triton, indicators for curio trade, are recorded.
- Very low abundance of invertebrates targeted for food.
- Crown-of-thorns are not an issue in Sipadan.

RARE ANIMALS

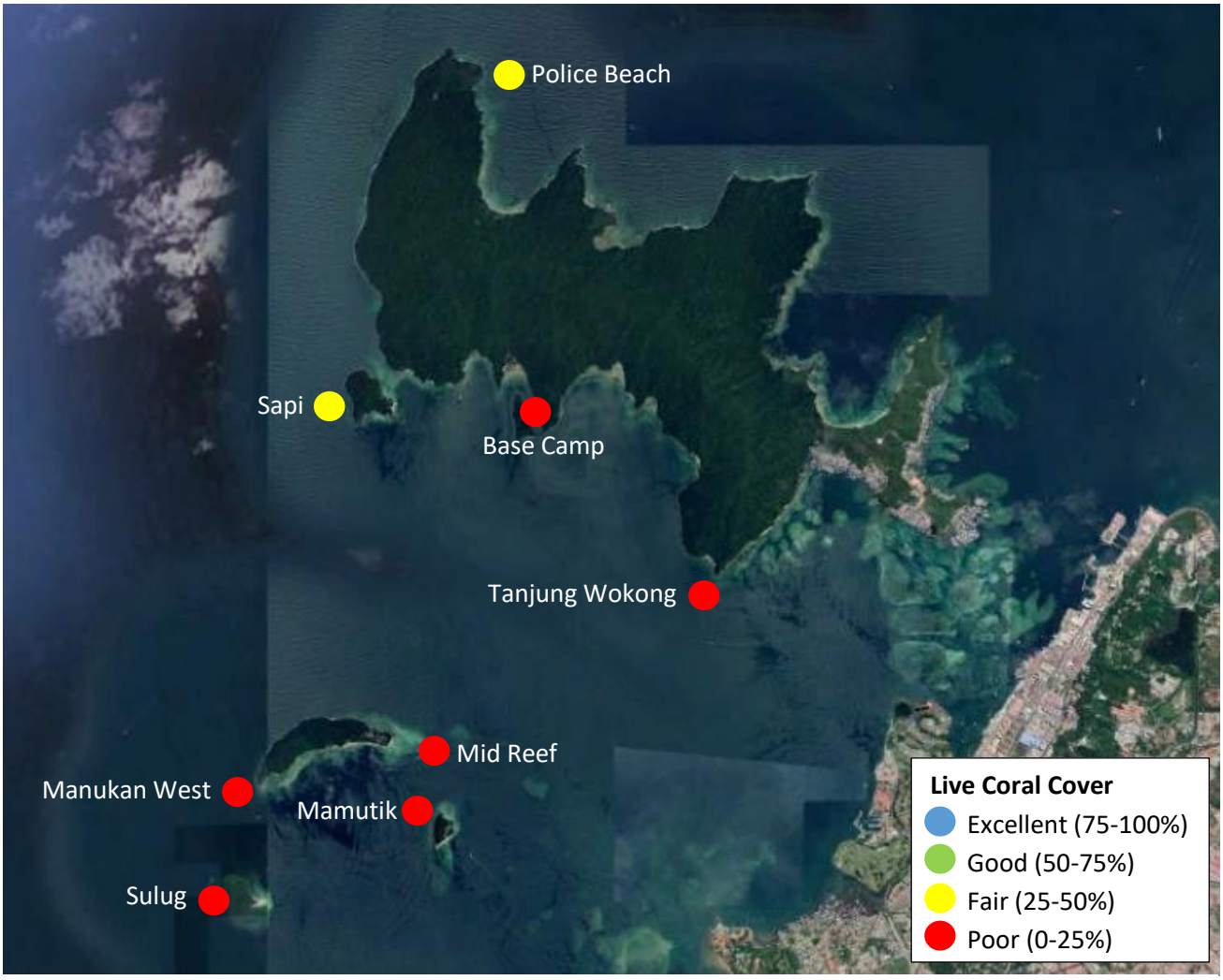
- Sharks and turtles were recorded at many sites.



North Borneo – Tunku Abdul Rahman Park

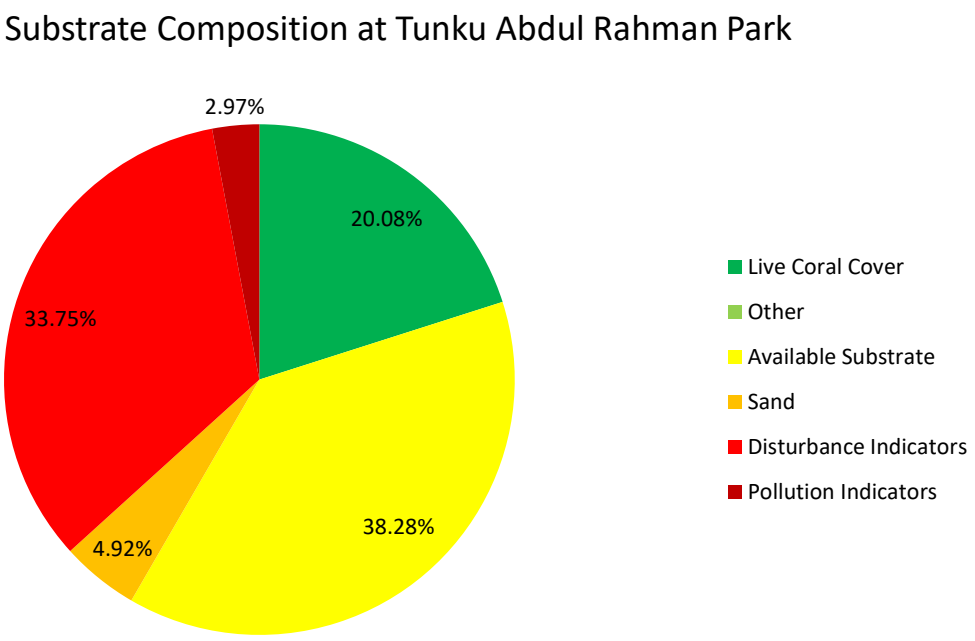
Tunku Abdul Rahman Park is located between 3 to 8 km off Kota Kinabalu, the capital of Sabah, and covers an area over 4,929 hectares, two thirds of which covers the sea. There is a cluster of islands in the Park comprising Pulau Gaya, Pulau Sapi, Pulau Manukan, Pulau Mamutik and Pulau Sulug. The reefs 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 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: 2 sites have 'Fair' coral cover and 6 are in 'Poor' condition.

Coral Cover and Health

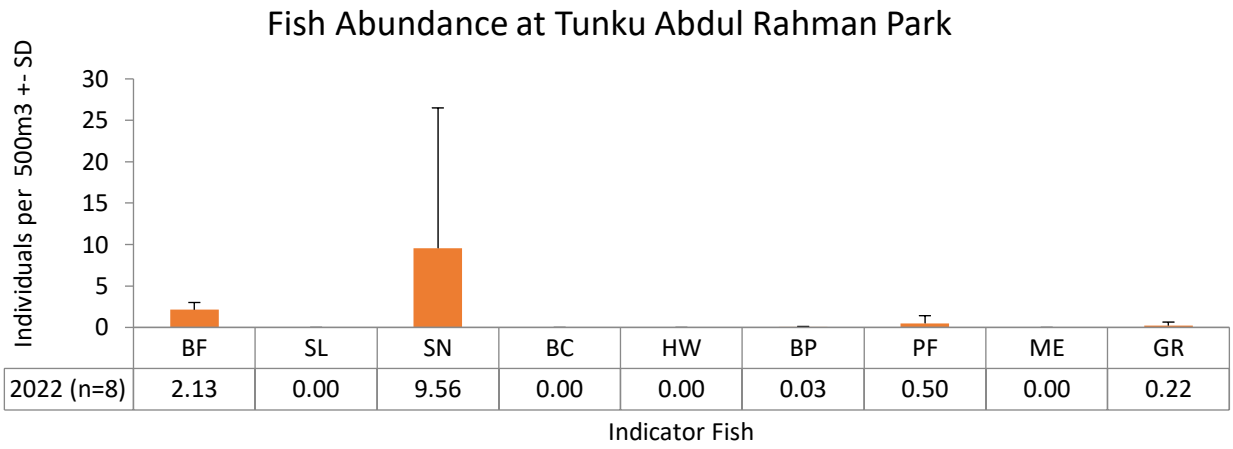


- Tunku Abdul Rahman Park reefs are dominated by available substrate, which is rock, for coral recruits to attach.
- Mean hard coral, reef builder, cover is 17.81%.
- In 'Poor' condition and below the North Borneo region average (43.31%).
- Disturbance indicators are extremely high.
- Rubble level is very high at all sites. The level is especially high at Base Camp, Mamutik, Manukan West and Sulug; all sites recorded over 50%.
- 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 corals growth if they are not dealt with.

CORAL IMPACTS

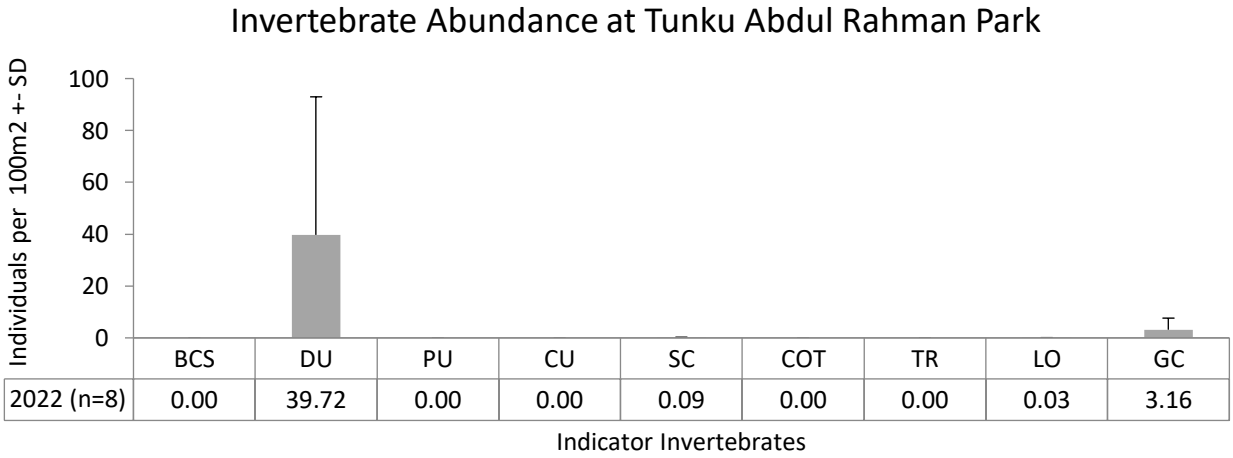
- Discarded fishing nets and trash were recorded.
- Some sites were impacted by warm water bleaching.

Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=8)	2.13	0.00	9.56	0.00	0.00	0.03	0.50	0.00	0.22

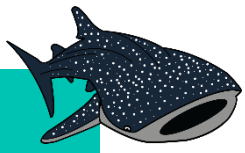
- Butterflyfish, indicator for aquarium trade, is recorded.
- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Snapper abundance is high.
- Fish targeted for food are very low in abundance, except for snapper.
- This suggests that fish targeted for food are heavily harvested.



	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=8)	0.00	39.72	0.00	0.00	0.09	0.00	0.00	0.03	3.16

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

RARE ANIMALS



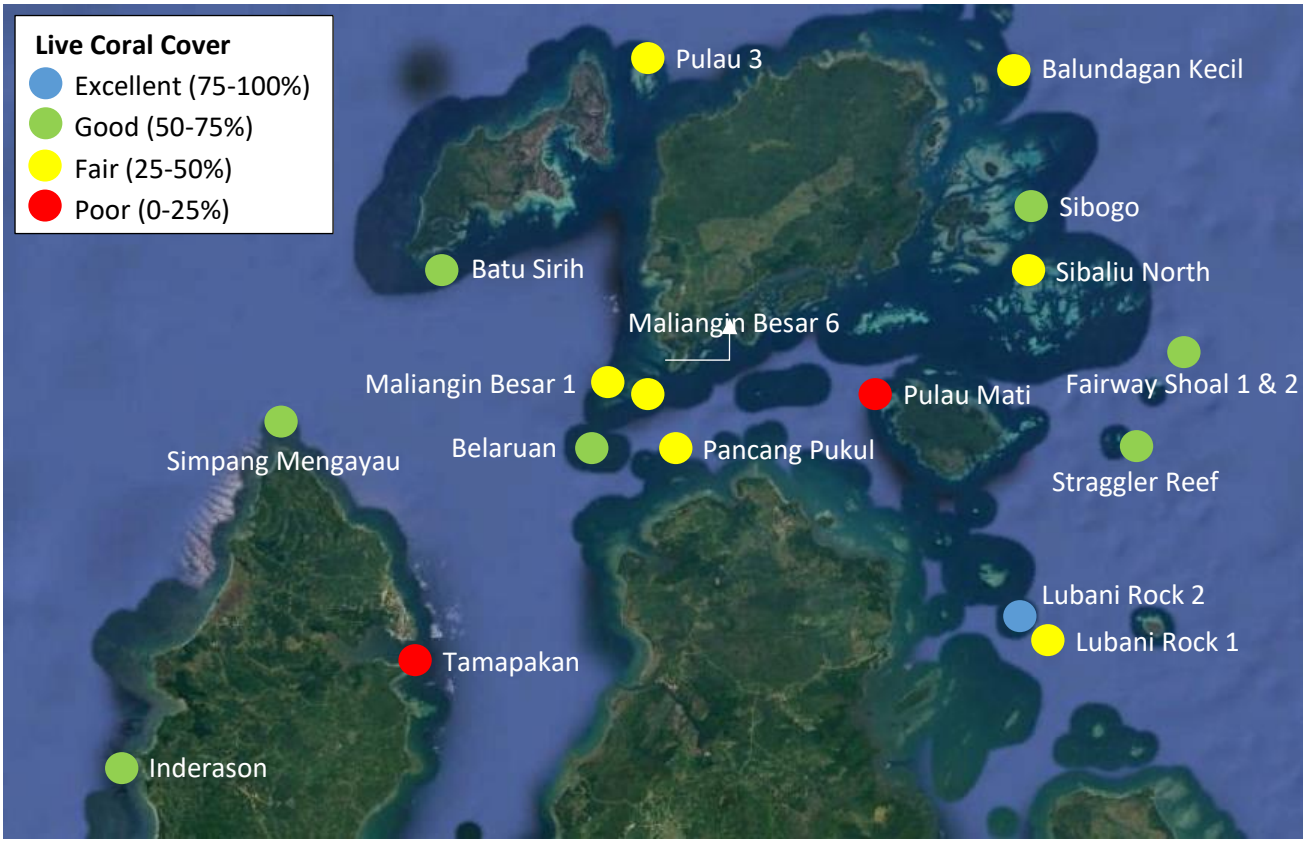
- Shark was recorded.

North Borneo – Tun Mustapha Park

Tun Mustapha Park is a marine park located off the north coast of the state of Sabah, Malaysia. It comprises an area of 898,762.76 hectares with more than 50 islands and islets located across Kudat, Pitas and Kota Marudu districts. The park received Cabinet in March 2003 under Parks Enactment 1984. Formally established on 19 May 2016, the park safeguards globally important marine ecosystems that are threatened with overexploitation.

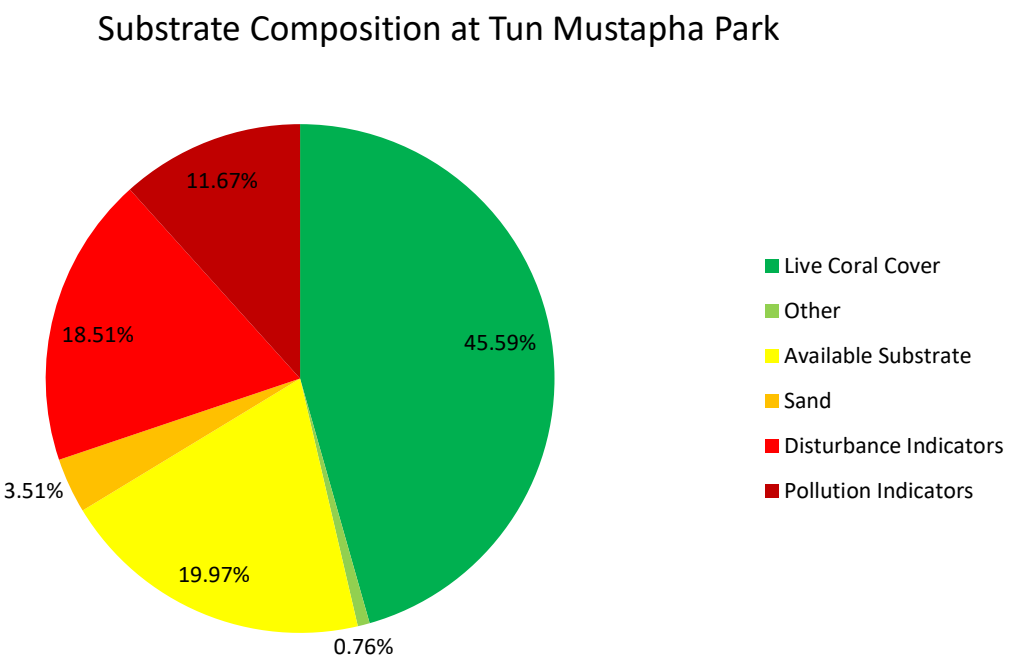
Tun Mustapha Park is the largest multiuse marine protected area in Malaysia and one of the richest marine flora and fauna complexes in the world. It is home to mangrove, seagrass and coral reef habitats which are critical breeding sites and habitats for various marine species and also migratory animals such as turtles, marine mammals and whaleshark.

Tun Mustapha Park also provides source of livelihood for over 80,000 coastal inhabitants of diverse ethnic groups. The concept for the park is to be a multiple use, managed area which includes areas for strict protection, tourism, artisanal fishing and commercial fishing among others. A multi-stakeholder group made up of government agencies and the local communities had worked to realise the gazettement of the park.



Map showing the health categories of each survey site based on Live Coral Cover: 1 site has 'Excellent' coral cover, 8 are in Good' condition, 7 show 'Fair' health and 2 are in ‘Poor’ state.

Coral Cover and Health

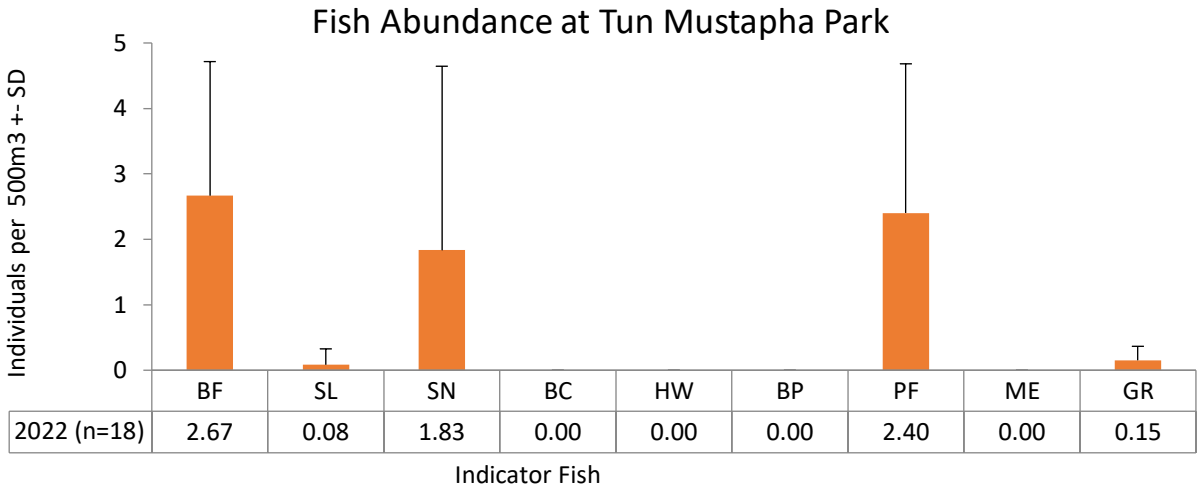


- Tun Mustapha Park's reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 43.54%.
- In 'Fair' condition and above the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is high.
- Disturbance indicators are high.
- The level of recently killed coral is especially high at Fairway Shoal 1 which recorded 11.88%.
- Rubble level is high at many sites. The level is especially high at Pulau Mati which recorded 40.63%.
- Silt level is high at many sites. The level is especially high at Maliangin Besar 6 (46.88%) and Baladungan Kecil (43.13%).
- Pollution indicators are high.
- The level of nutrient indicator algae is high at many sites. The level is especially high at Balundagan Kecil, Pulau 3 and Belaruan, all recorded over 22%.
- Sponge level is especially high at Pulau 3 which recorded 10.63%.

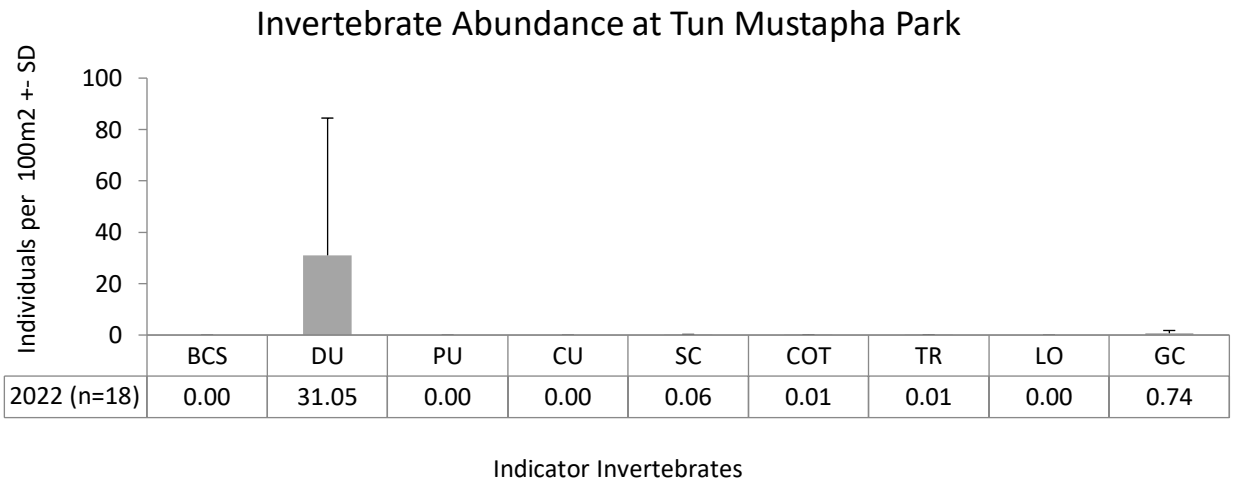
CORAL IMPACTS

- Boat anchor damage, dynamite fishing, discarded fishing nets and trash were recorded.
- Drupella predation and impact due to warm water bleaching were recorded at many sites.

Fish and Invertebrate



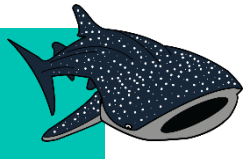
- Butterflyfish, indicator for aquarium trade, is recorded.
- Fish targeted for food are very low in abundance, except for snapper and parrotfish.
- Indicators targeted for live-food fish trade are absent.
- This suggests that fish targeted for food are heavily harvested.



- Triton, indicator for curio trade, is recorded.
- Very low abundance of invertebrates targeted for food.
- Crown-of-thorns are not an issue in Tun Mustapha Park.

RARE ANIMALS

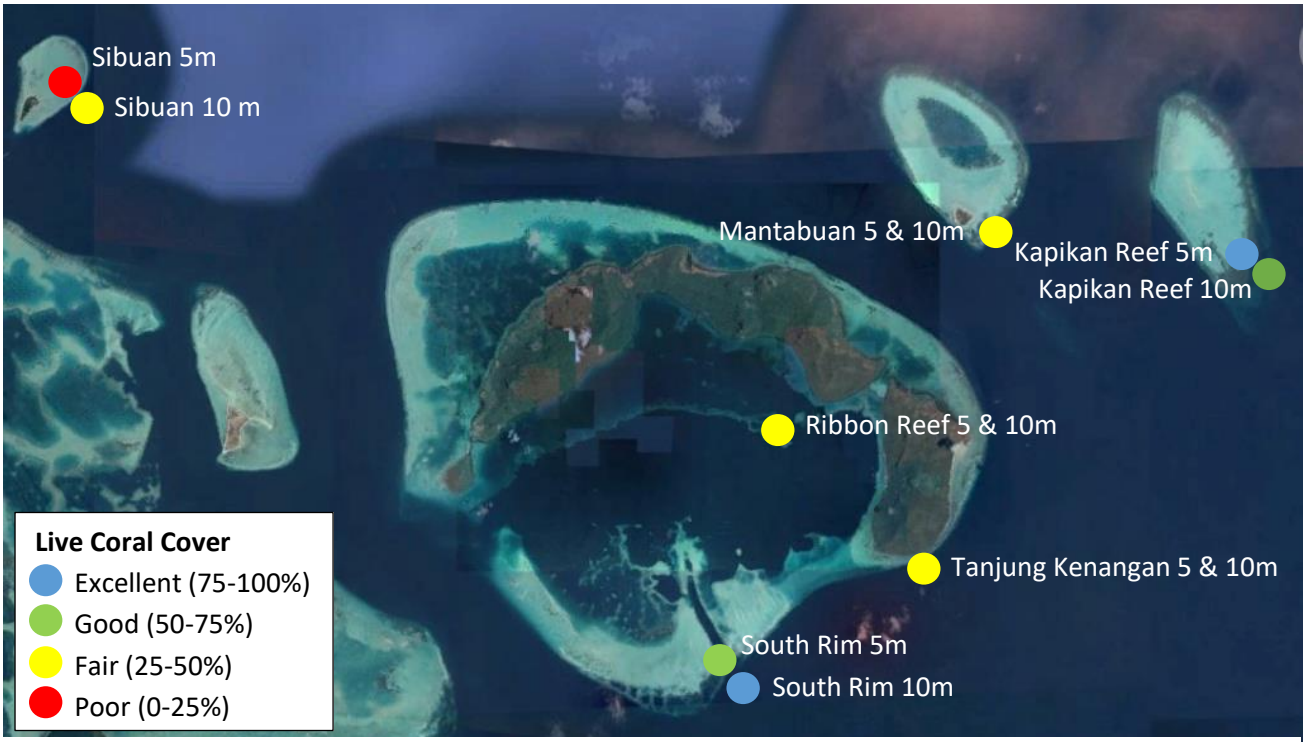
- Coral cat shark and sea snake were recorded.



North Borneo – Tun Sakaran Marine Park

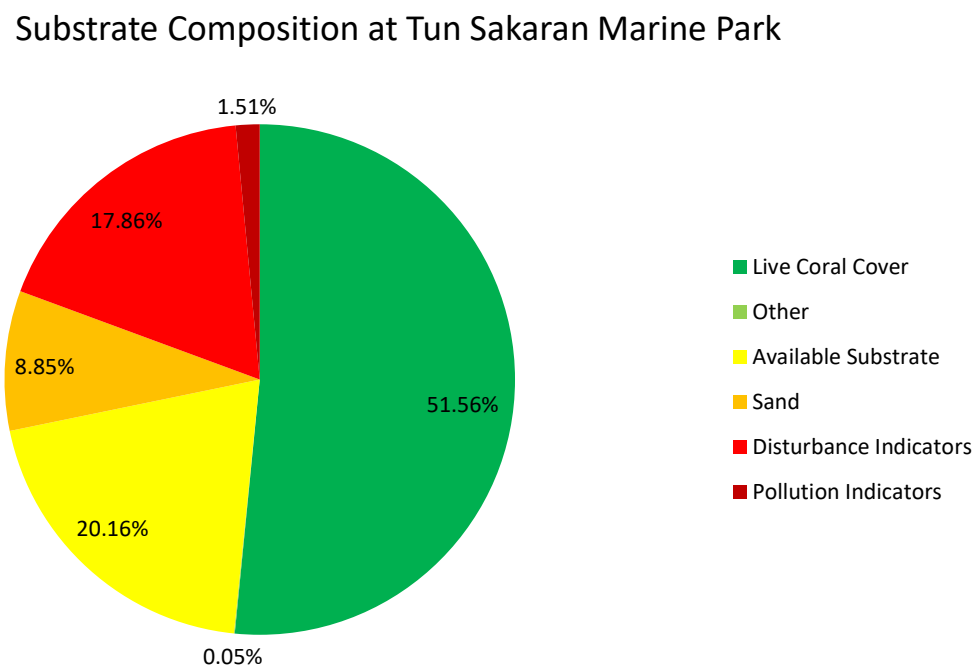
Tun Sakaran Marine Park is a marine park located off the east coast of the state of Sabah in Malaysia. It consists of the islands of Bodgaya, Boheydulang, Sabangkat, and Salakan, the sand cays of Maiga, Sibuan, and Mantabuan, and the patch reefs of Church and Kapikan.

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: 2 sites have 'Excellent' coral cover, 2 are in Good' condition, 7 show 'Fair' health and 1 is in ‘Poor’ state.

Coral Cover and Health

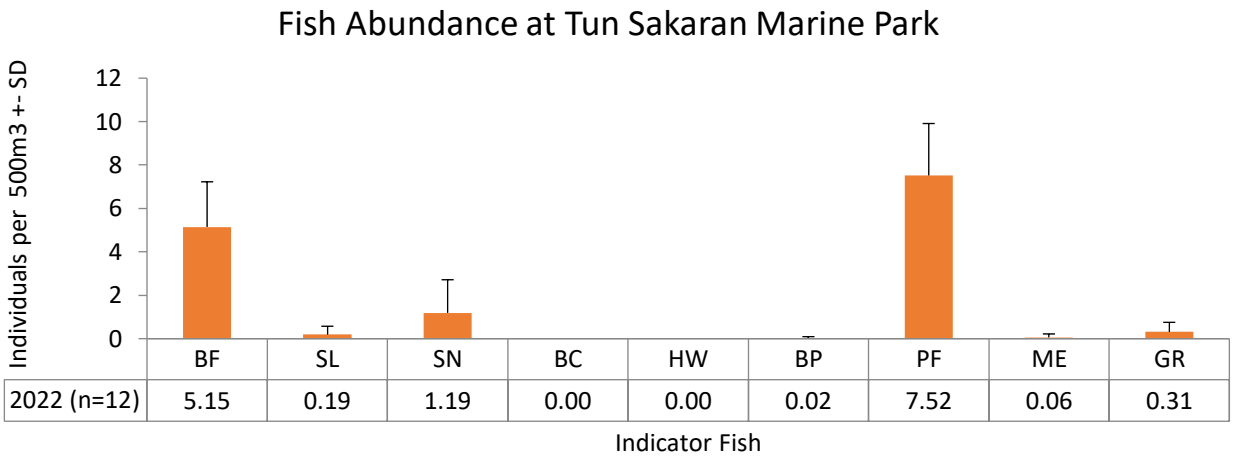


- Tun Sakaran Marine Park reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 40.26%.
- In 'Good' condition and above the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is especially high at Mantabuan 10m which recorded 23.13%.
- Disturbance indicators are high.
- Rubble level is high. The level is especially high at Sibuan 5m and 10 which recorded 58.75% and 39.38% respectively.

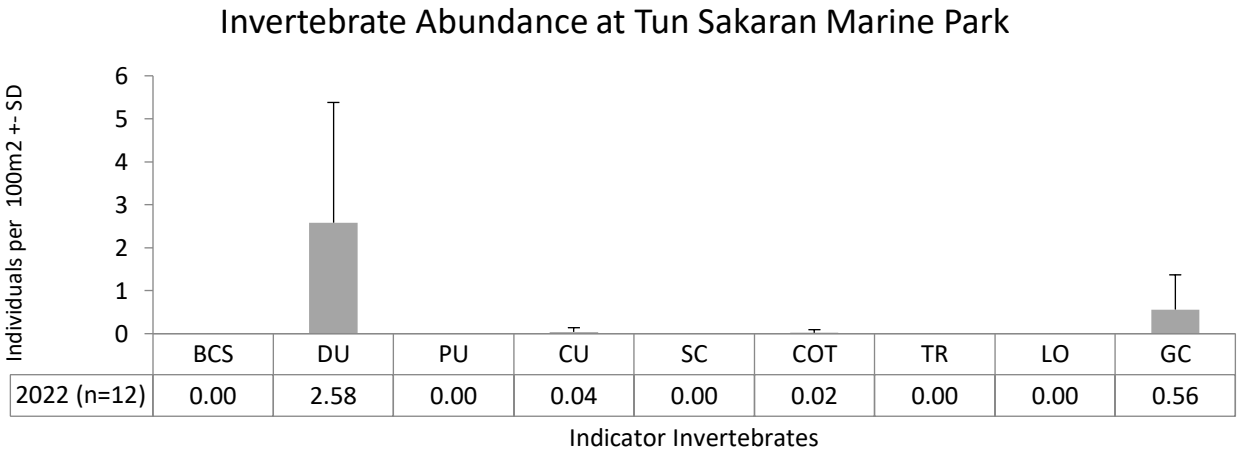
CORAL IMPACTS

- Dynamite fishing, discarded fishing nets and trash were recorded.

Fish and Invertebrate



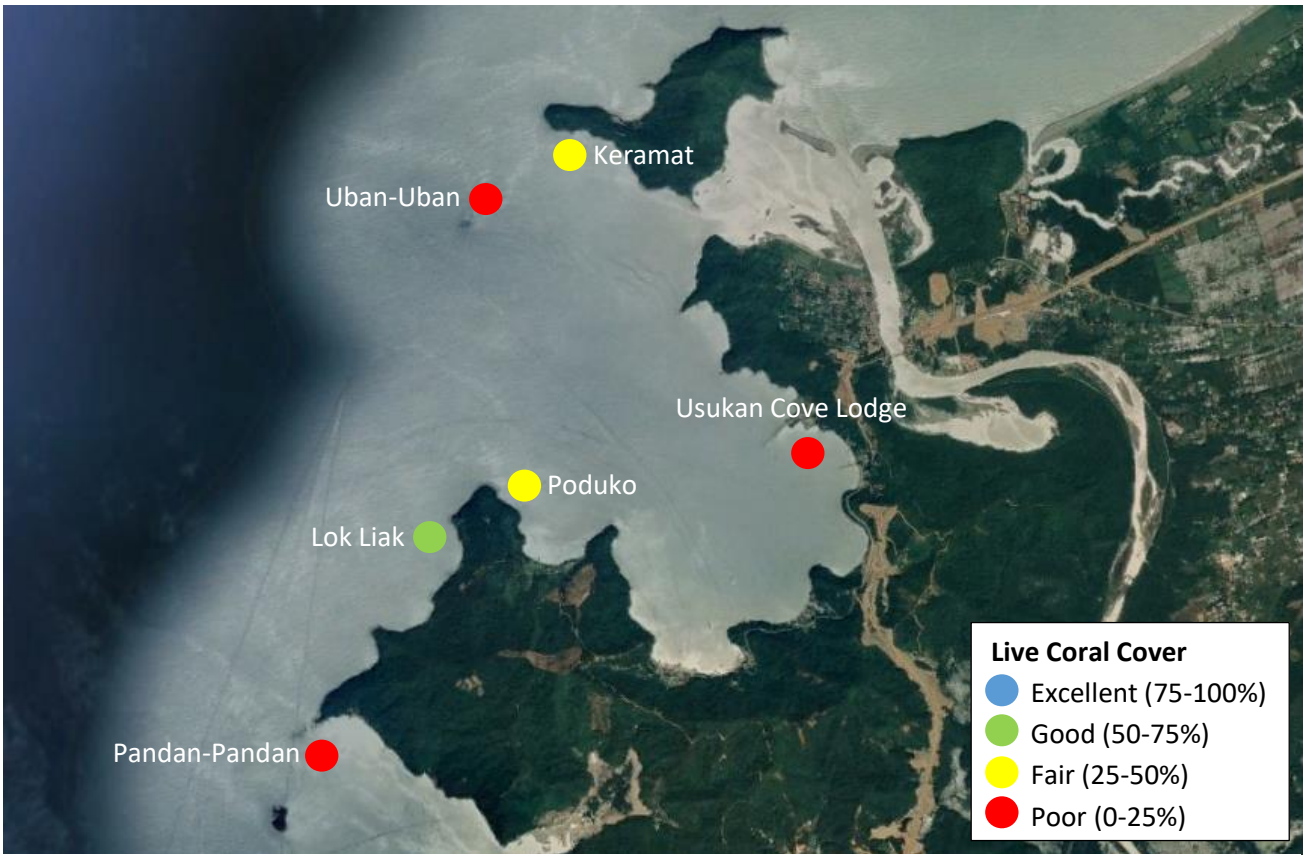
- Bumphead parrotfish, indicator targeted for live-food fish trade, is recorded.
- Butterflyfish, indicator for aquarium trade, abundance is high.
- Parrotfish, fish targeted for food, abundance is high.
- Fish targeted for food are very low in abundance, except for parrotfish.
- This suggests that fish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



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

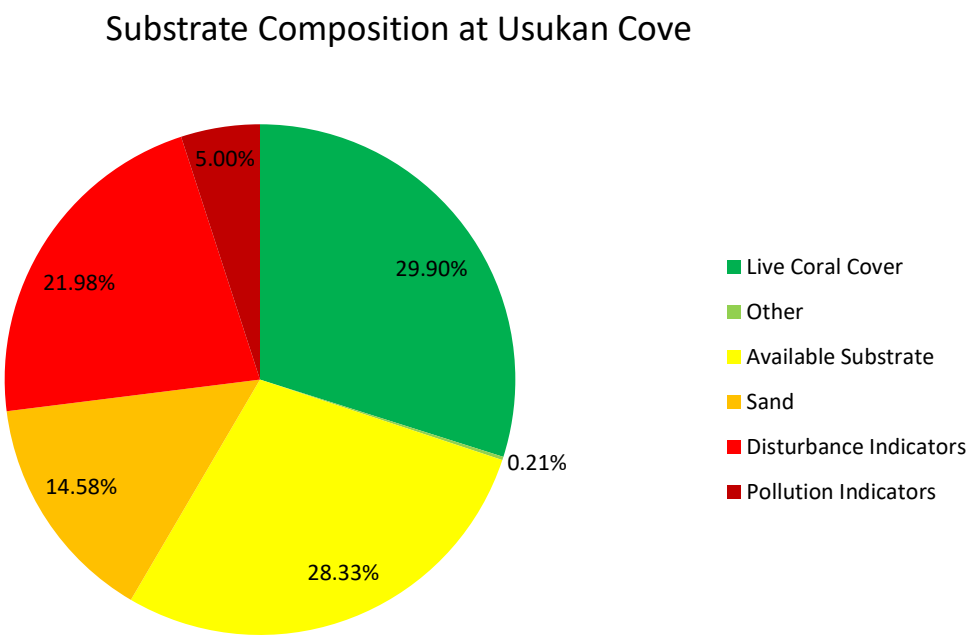
North Borneo – Usukan Cove

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, 2 are in 'Fair' condition, and 3 show 'Poor' health.

Coral Cover and Health

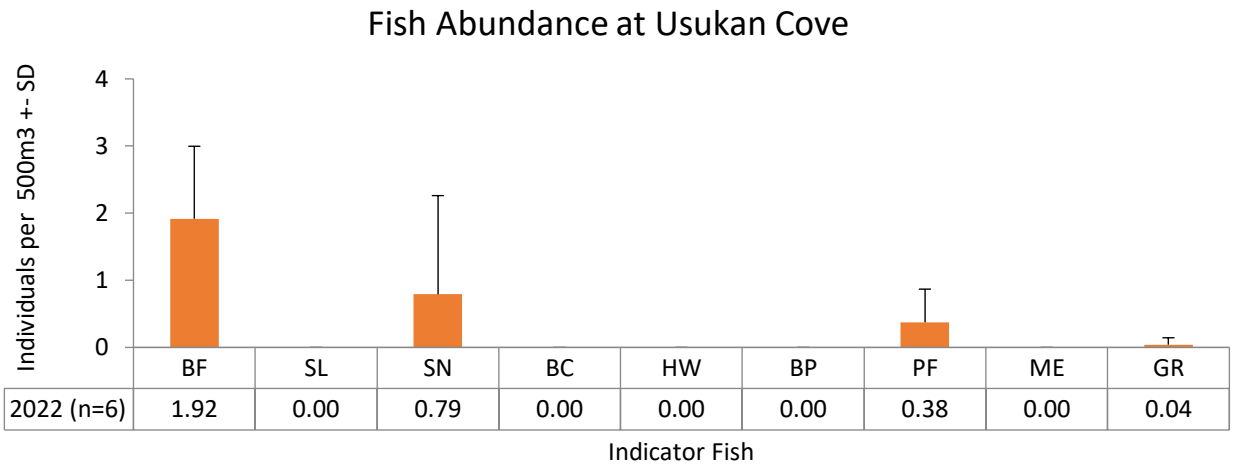


- Usukan Cove reefs are dominated by live coral cover, which is mainly hard coral.
- Mean hard coral (reef builder) cover is 29.48%.
- In 'Fair' condition and below the North Borneo region average (43.31%).
- Available substrate for coral recruits to attach is very high.
- Sand level is high. The level is especially high at Pandan-Pandan and Uban-Uban, both recorded over 20%.
- Disturbance indicators are very high.
- Rubble level is especially high at Pandan-Pandan and Uban, both recorded over 30%.
- Silt level is very high at Usukan Cove Lodge, recording 43.75%.

CORAL IMPACTS

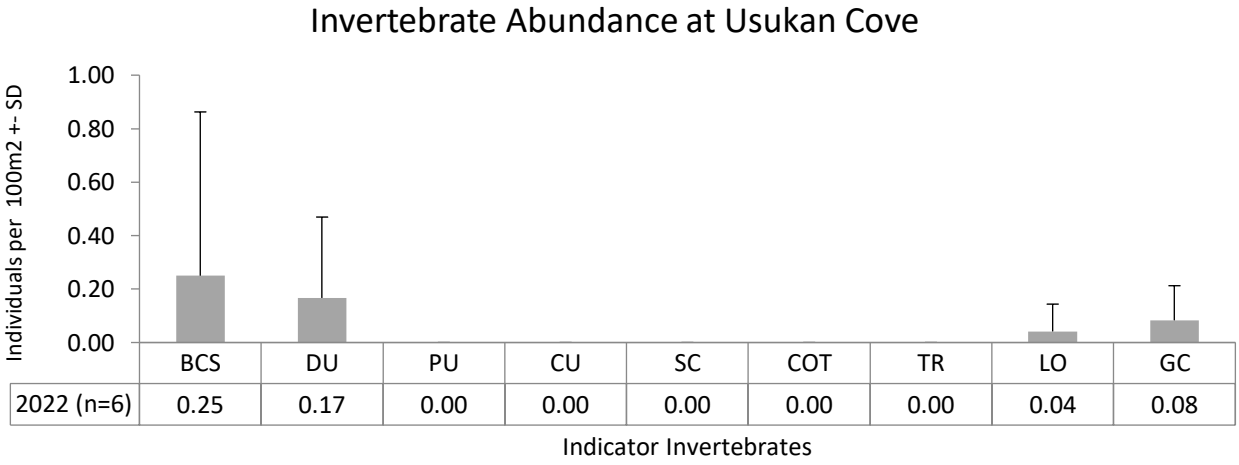
- Drupella predation and fishing activities were observed.

Fish and Invertebrate



	BF	SL	SN	BC	HW	BP	PF	ME	GR
2022 (n=6)	1.92	0.00	0.79	0.00	0.00	0.00	0.38	0.00	0.04

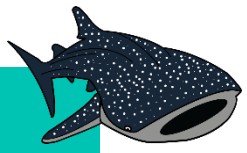
- Butterflyfish, indicator for aquarium trade, is recorded.
- Absence of indicators targeted for live-food fish trade.
- Fish targeted for food are very low in abundance.
- This suggests that fish targeted for food are heavily harvested.



	BCS	DU	PU	CU	SC	COT	TR	LO	GC
2022 (n=6)	0.25	0.17	0.00	0.00	0.00	0.00	0.00	0.04	0.08

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

RARE ANIMALS



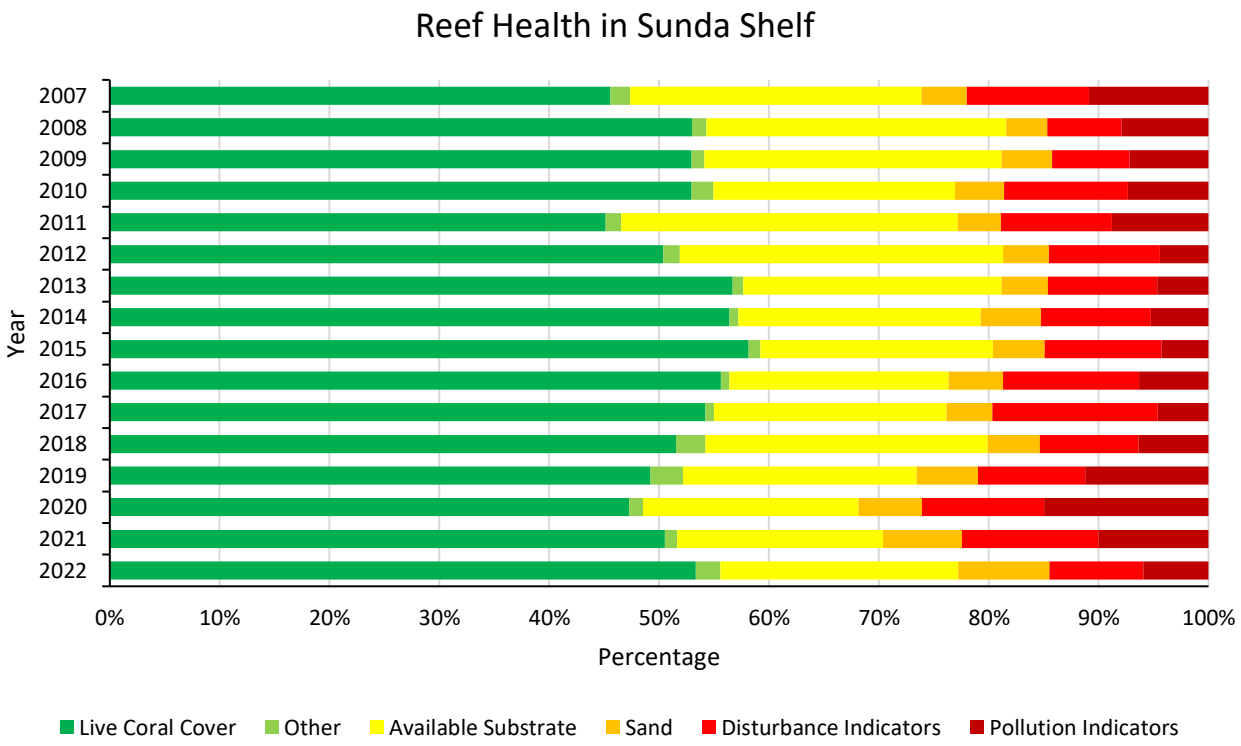
- Nurse shark was recorded.

4. 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 16 years to assess changes to Malaysia's reefs over the period, separated into three eco-regions: Sunda Shelf, Malacca Strait and North Borneo.

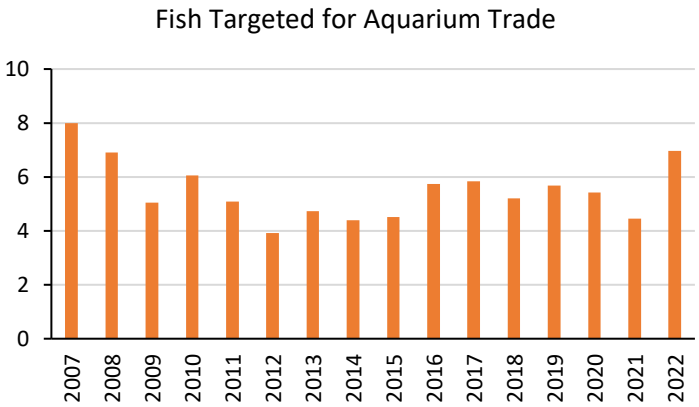
Sunda Shelf

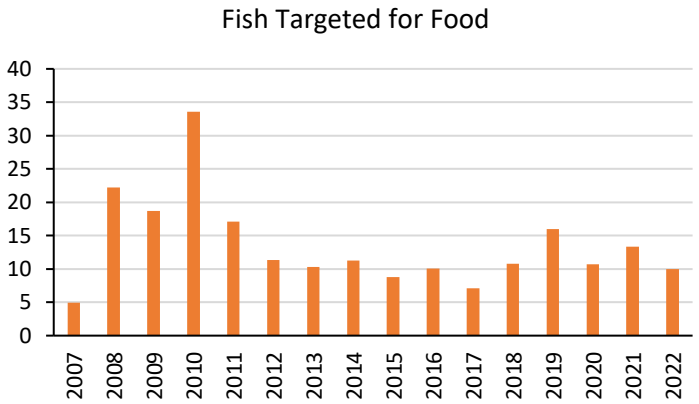
Coral Cover and Health

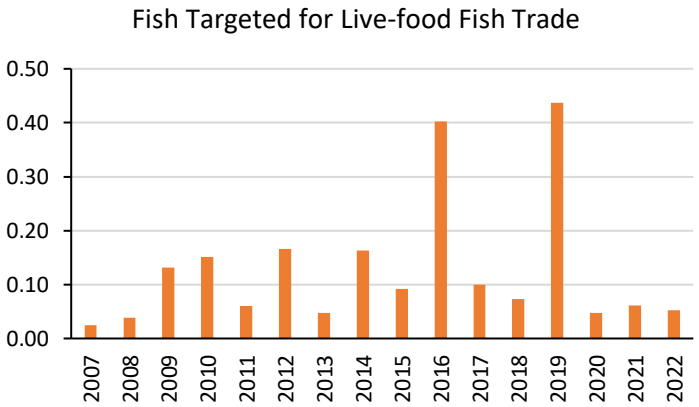


- From 2015 to 2020, the reefs in Sunda Shelf deteriorated, as reflected by the decrease in live coral cover.
- From 2020, reef health shows some improvement. The improvement is mainly attributed to recovery of reefs in Terengganu following damage caused by storm Pabuk in 2019 (particularly reefs at Bidong & Yu, Perhentian, Redang and Tenggol).
- In 2022, reef health continues the trend from 2020, with some improvement. One reason for this could be the restrictions on tourism during the Covid-19 pandemic, pointing to a possible management measure that would see reef areas closed temporarily to allow them to recover.
- Available substrate for coral recruits to attach to is high, indicating possible chance of further reef recovery if human impacts are dealt with.

Fish

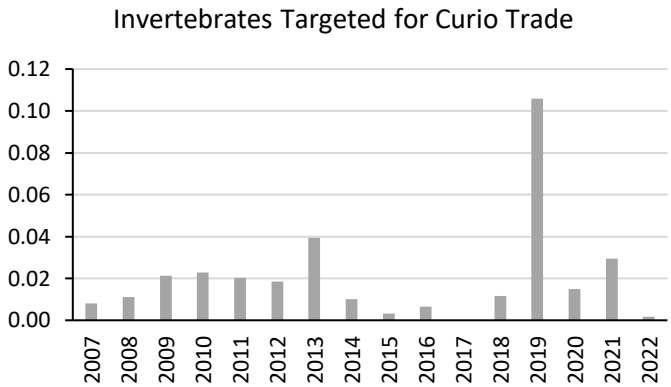


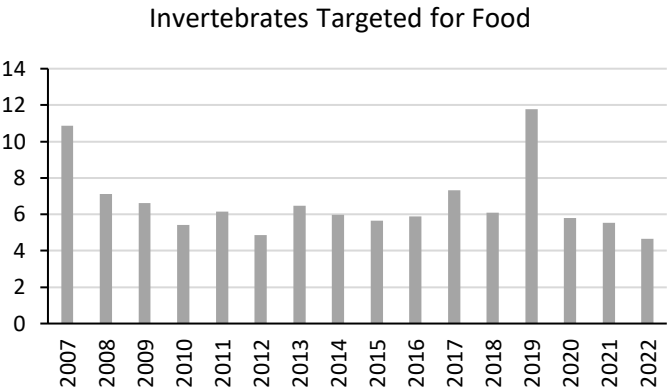


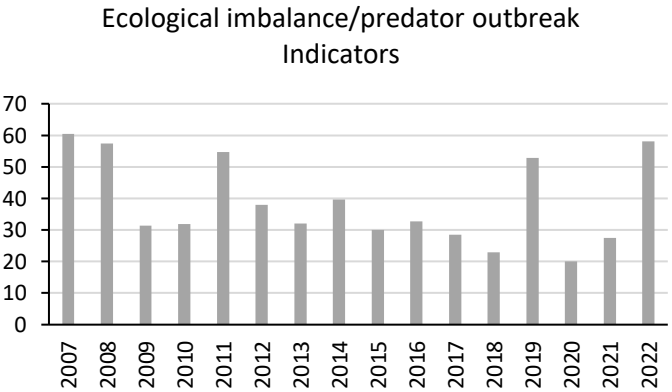


- The abundance of fish targeted for aquarium trade is little changed over the years.
- The abundance of fish targeted for food does not change much. The high abundance from 2008 to 2011 was contributed by snappers.
- Very low abundance of fish targeted for life-food fish trade, with spikes in 2016 and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

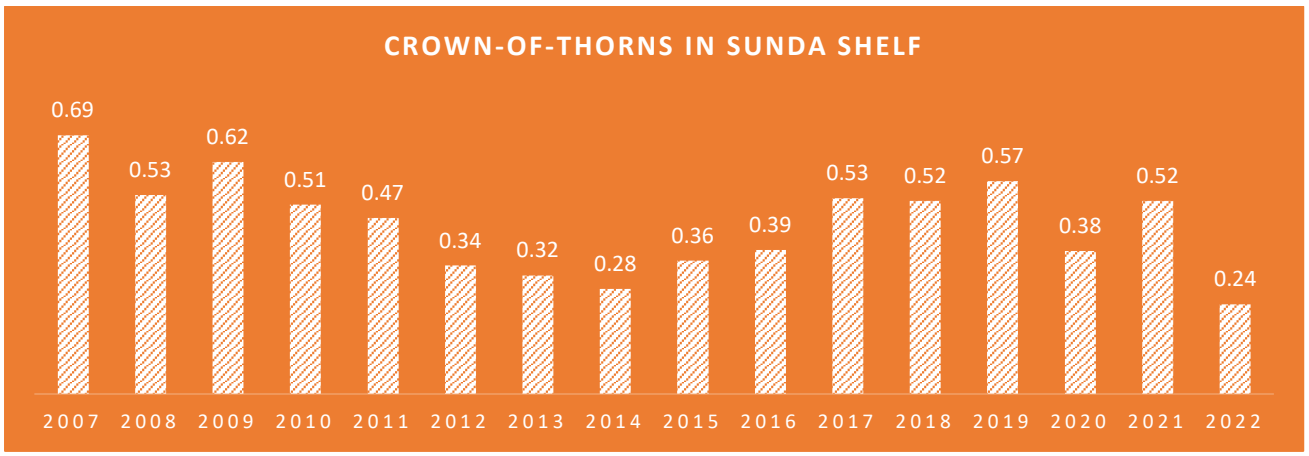
Invertebrate





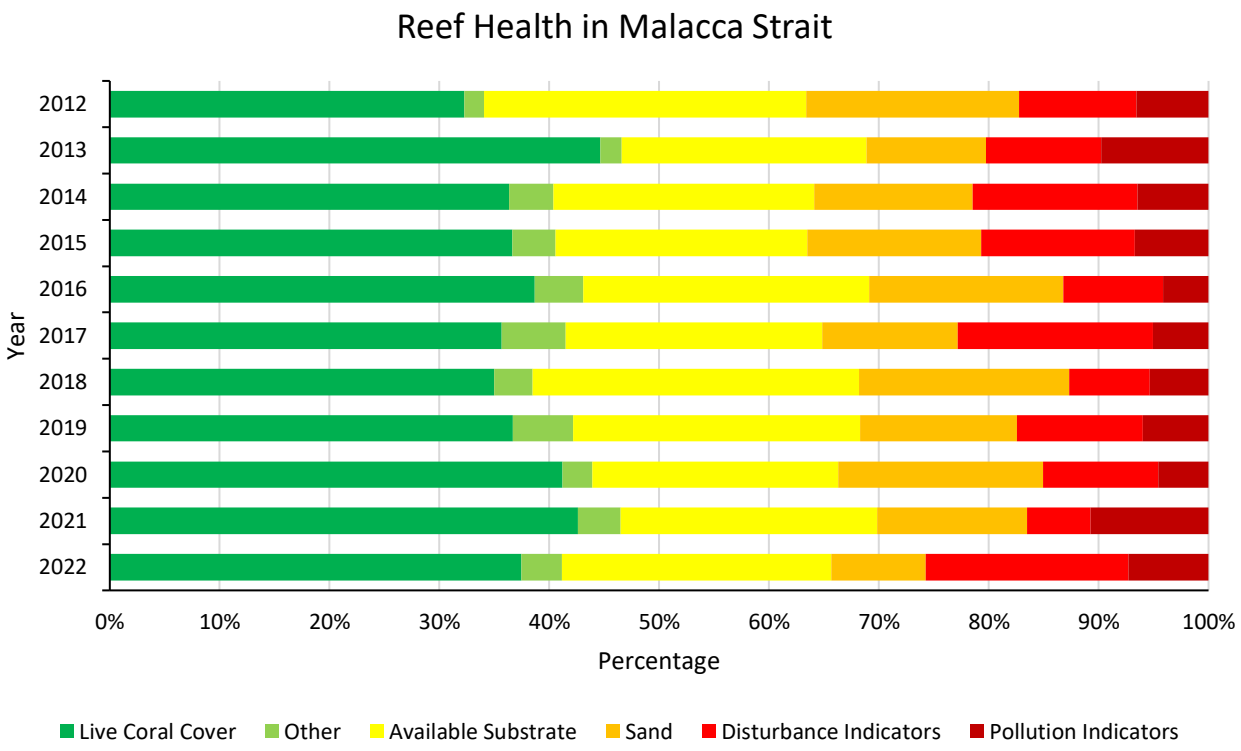


- Very low abundance of invertebrates targeted for curio trade.
- Abundance of indicators targeted for food have remained similar over the years.
- Indicators for ecological imbalance/ predator outbreaks have been inconsistent over the years.
- In 2022, the abundance of crown-of-thorns has reduced and is within what a healthy reef can support (0.2-0.3 individual per $100m^2$).



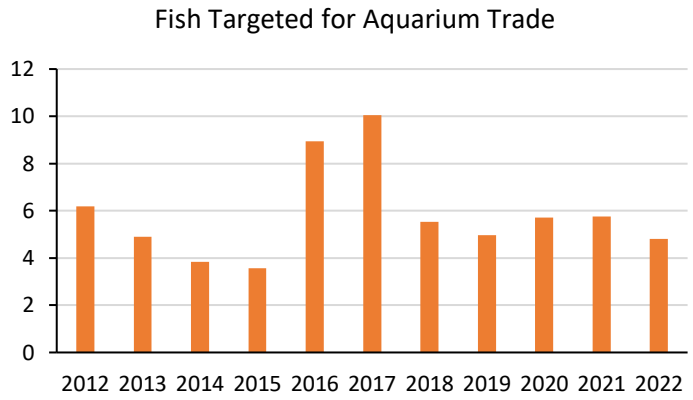
Malacca Strait

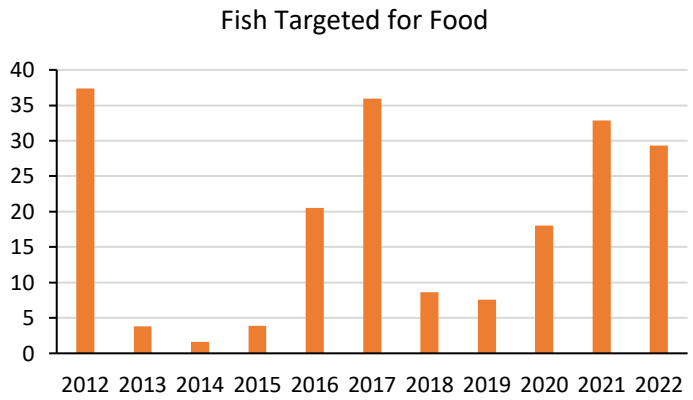
Coral Cover and Health

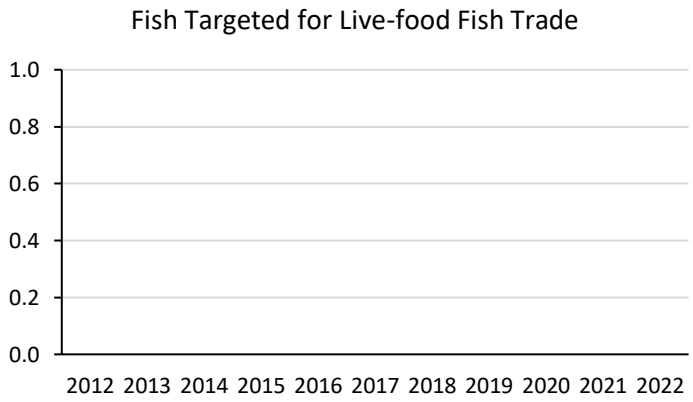


- The reefs in Malacca Strait have maintained more or less the same from 2012 to 2018.
- From 2019 to 2021, the reefs show improvement, reflected by the increase in live coral cover.
- The improvement is likely due to reduced physical damage caused by human activities and/or storm, as reflected by the decrease in disturbance indicators.
- In 2022, the reefs have deteriorated. The deterioration is probably due to a combination of several factors – increased disturbance indicators, elimination of some survey sites and addition of new survey sites.

Fish

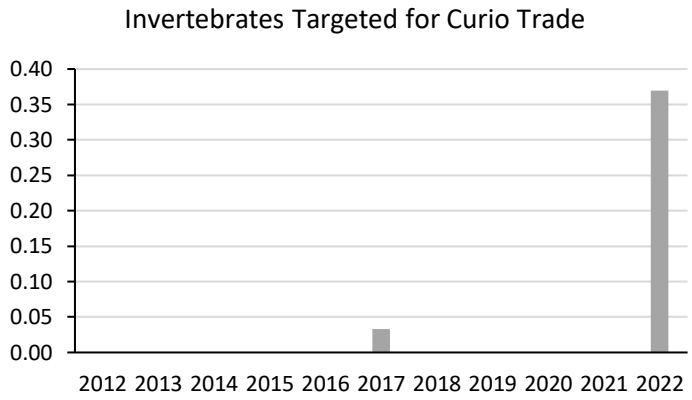


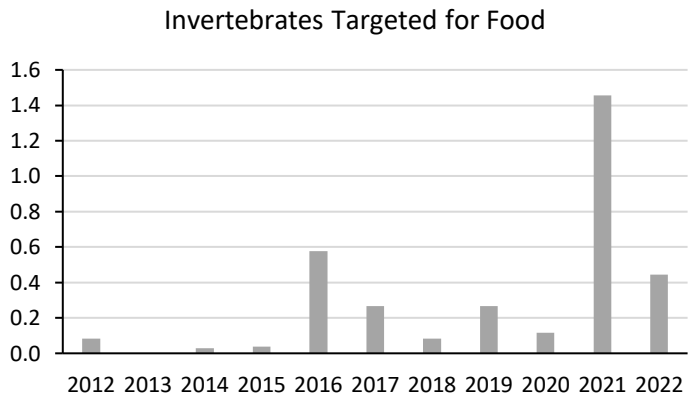


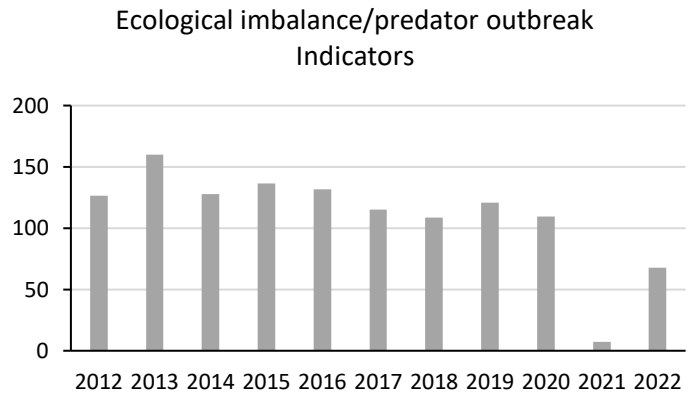


- Fish targeted for live-food fish trade have never been observed and recorded.
- The abundance of fish targeted for the aquarium trade is more or less the same over the years.
- Fish targeted for food is mainly comprised of snappers.
- The abundance of fish targeted for food is inconsistent over the years.

Invertebrate



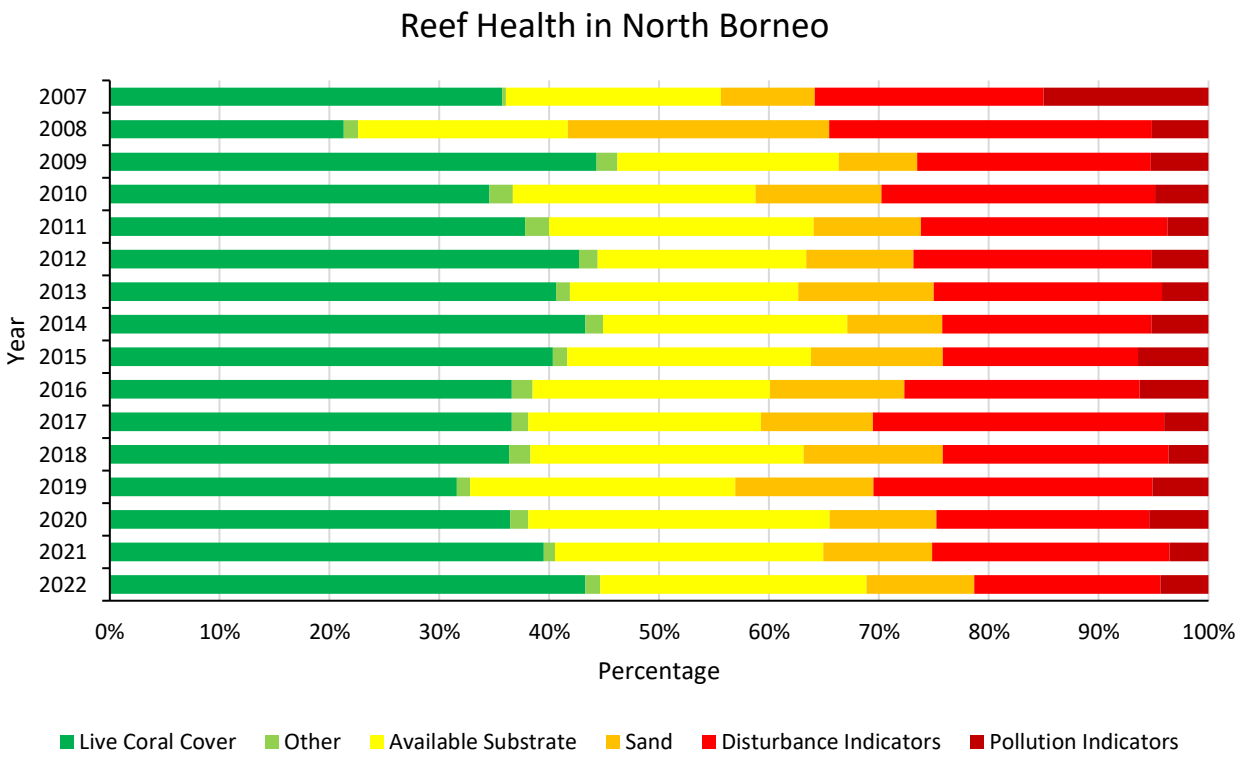




- Invertebrates targeted for curio trade are only observed and recorded twice, in 2017 and 2022.
- Very low abundance of invertebrates targeted for food. The spike in 2021 is considered to reflect the addition of Malacca and Port Dickson that year, rather than an actual increase in the abundance of invertebrates targeted for food.
- Ecological imbalance/predator outbreak indicators are attributed solely to 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.

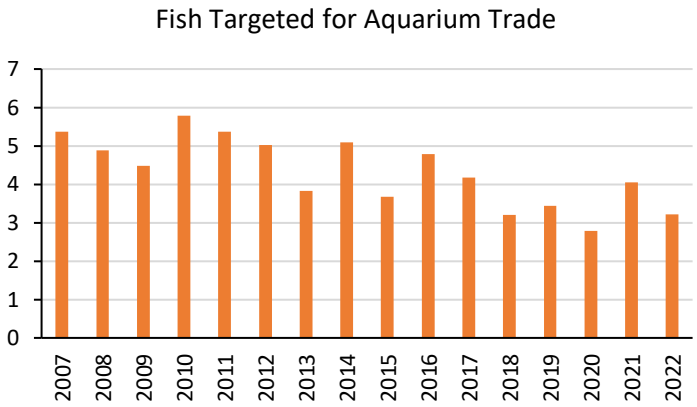
North Borneo

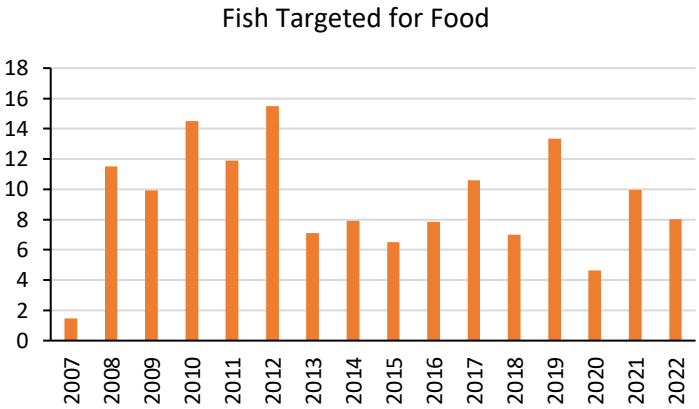
Coral Cover and Health

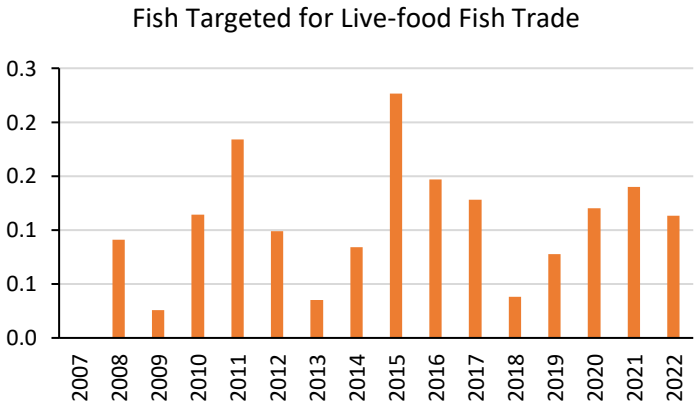


- The health of reefs in North Borneo show less variation than in other areas over the years.
- Since 2019, reef health shows some improvement, similar to that observed in the Sunda Shelf. The reason is likely to be the same – restrictions on tourism during the Covid-19 pandemic, pointing to a possible management measure that would see reef areas closed temporarily to allow them to recover.

Fish

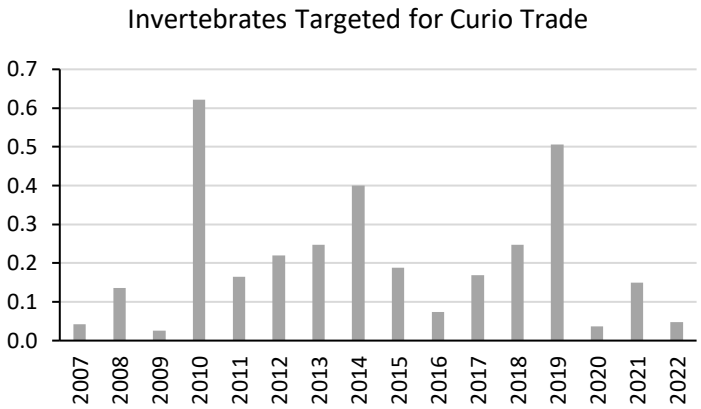


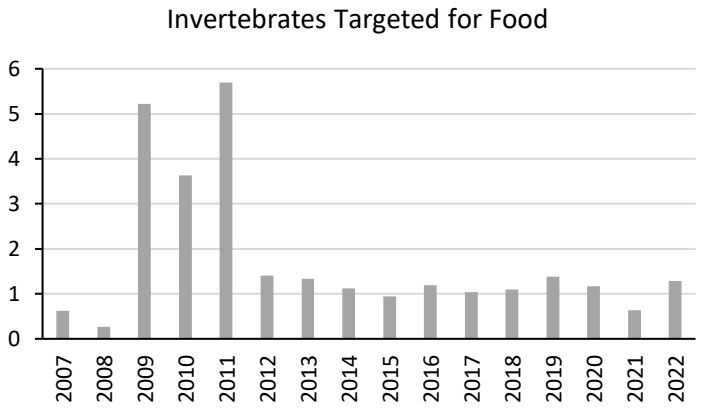


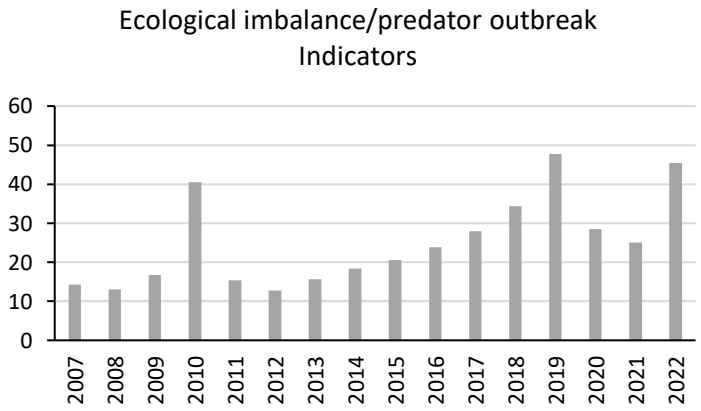


- The abundance of fish targeted for aquarium trade, food and life-food fish trade is inconsistent over the years.

Invertebrate





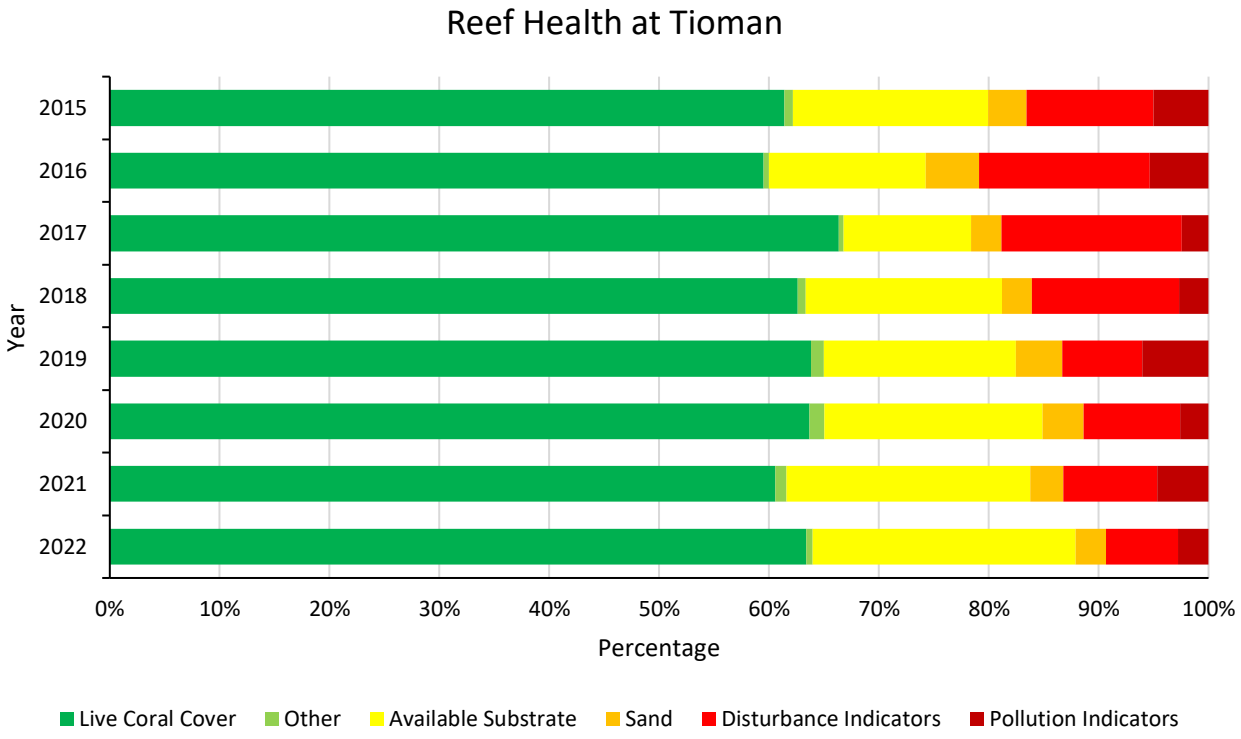


- The abundance of invertebrates targeted for curio trade and indicators for ecological imbalance/predator outbreak is inconsistent over the years.
- Very low abundance of invertebrates targeted for food.

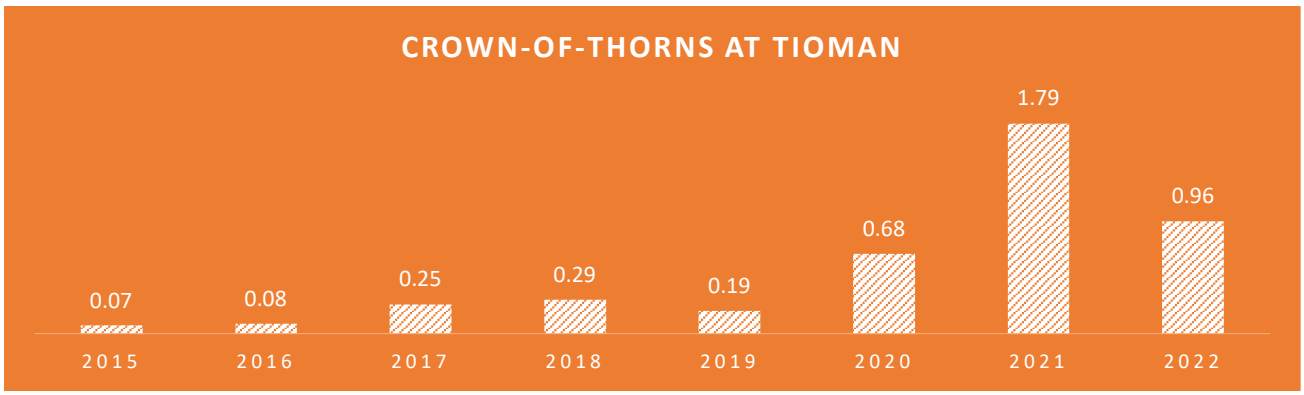
Local Changes in Reef Health

This section provides details of the health of coral reefs around Malaysia over the years, from 2015 to 2022. Only islands/areas with permanent sites that were surveyed every year are included in this section.

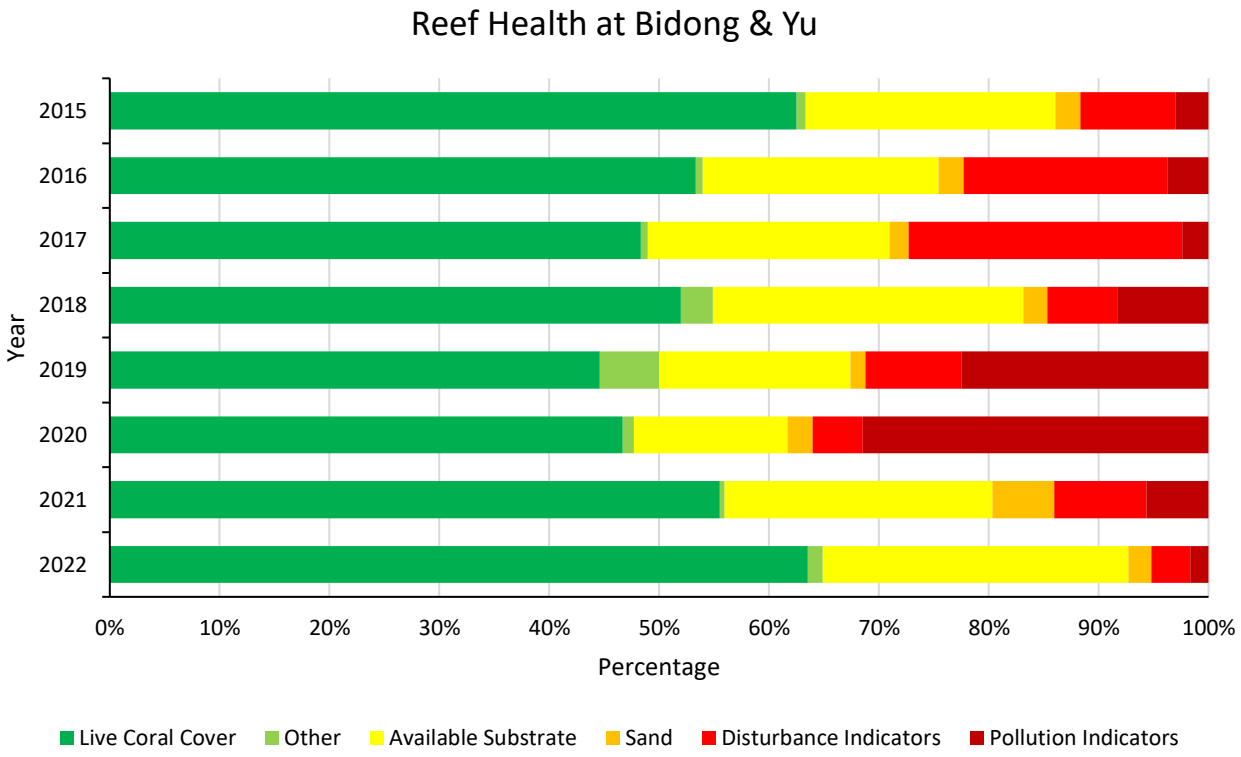
Sunda Shelf – Tioman



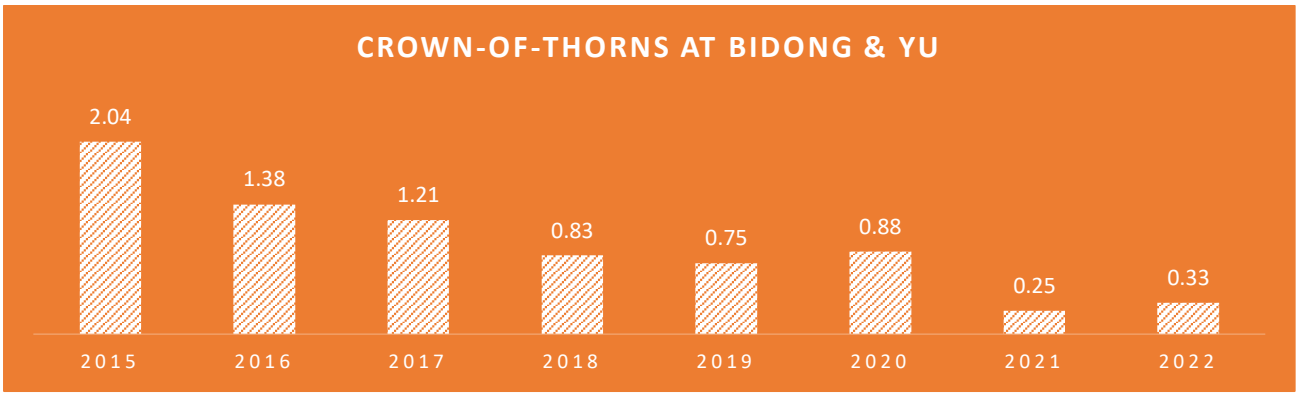
- Tioman reefs have maintained in 'good' condition.
- Disturbance indicators have decreased.
- Since 2020, the population of crown-of-thorns is above what a healthy reef can support (0.2-0.3 individual per 100m^2). The increase in crown-of-thorns abundance is probably due to Covid-19 pandemic which hampered culling efforts – local Movement Control Order prohibited all diving activities. In October 2021, the Movement Control Order was lifted and crown-of-thorns culling efforts were resumed. In 2022, the abundance of crown-of-thorns has reduced. Nevertheless, the abundance is still a cause for concern and existing efforts by reef managers to control the population need to be heightened.



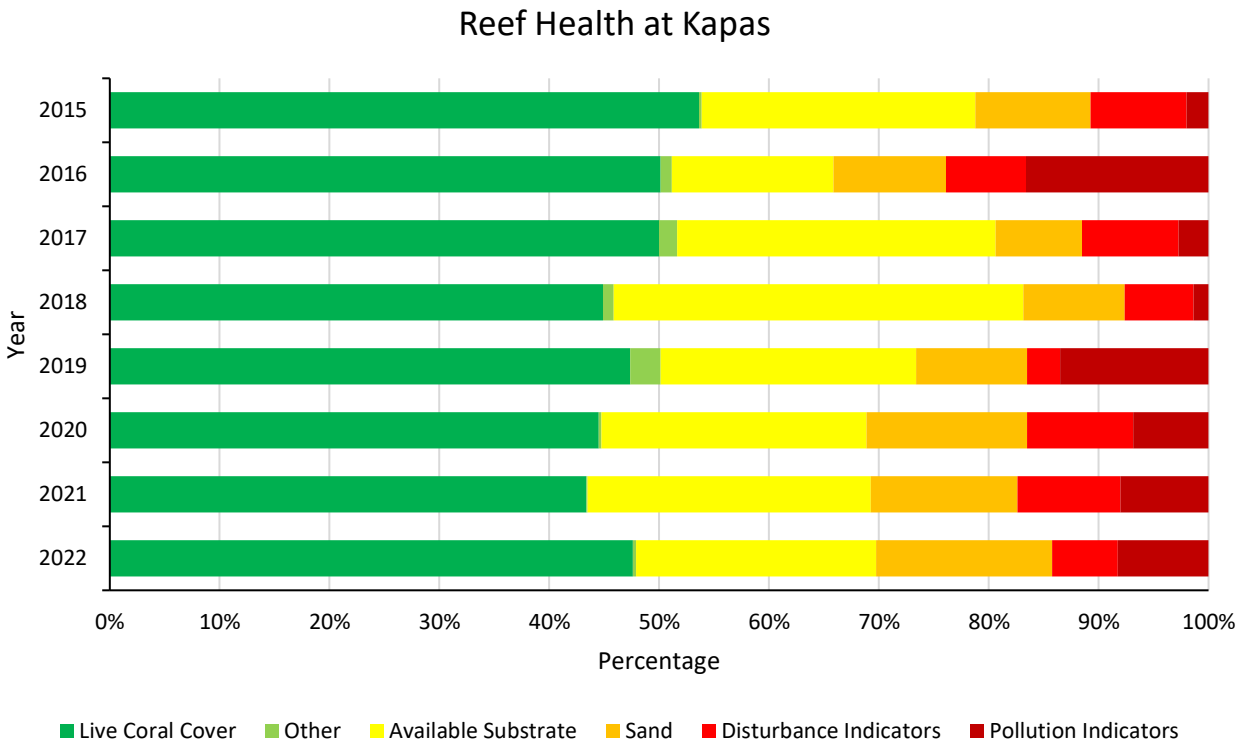
Sunda Shelf – Bidong & Yu



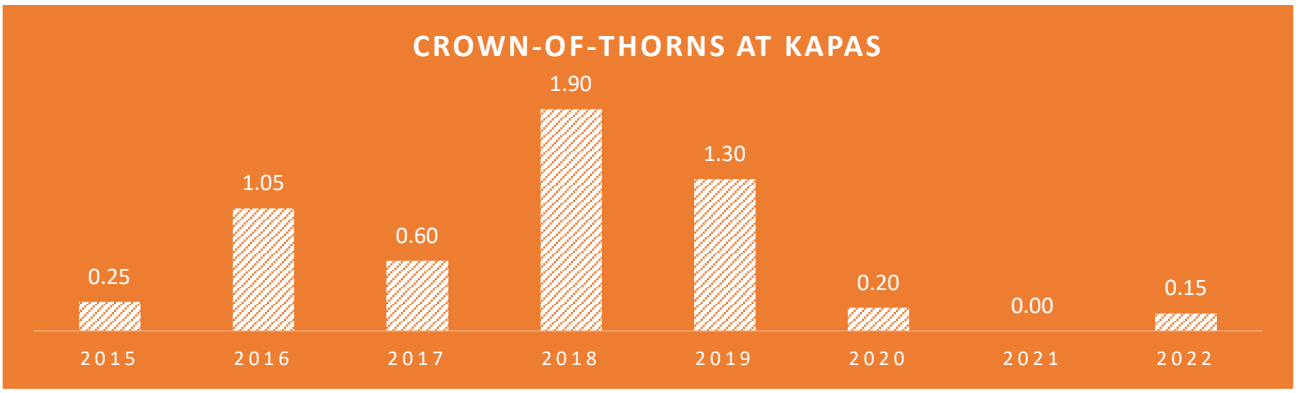
- From 2015 to 2017, live coral cover shows a declining trend due to increasing disturbance indicators.
- The decrease in live coral cover in 2019 is probably due to Tropical Storm Pabuk which struck Bidong and Yu in January that year, causing major physical damage to shallow reefs. However, reefs have recovered slightly since then.
- 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 $100m^2$).
- 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 since 2020.



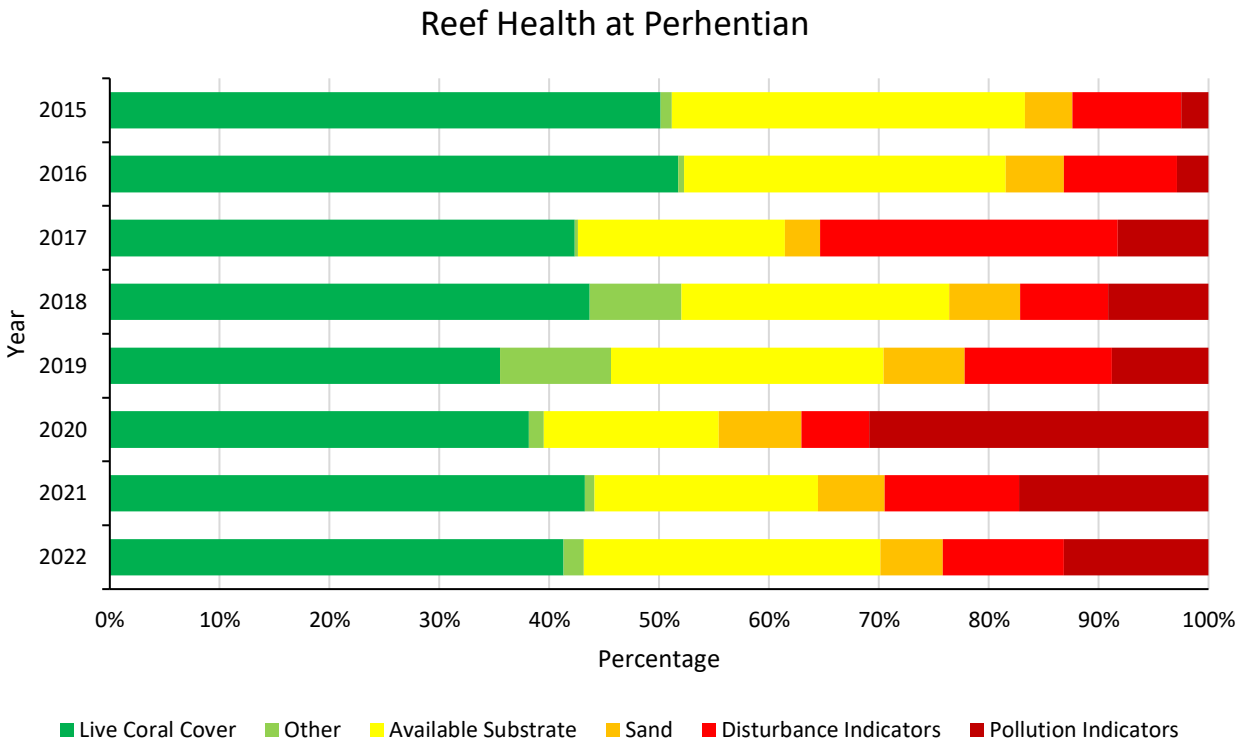
Sunda Shelf – Kapas



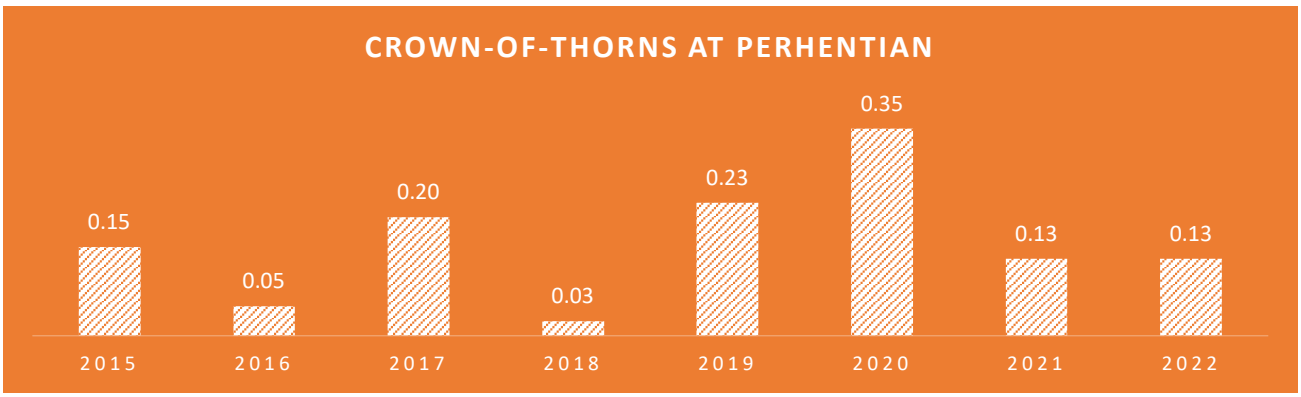
- Kapas reefs have deteriorated from 'good' to 'fair' condition, as reflected by the decrease in live coral cover.
- The decrease in live coral cover is likely due to raised level of nutrient in the waters around the island, as reflected by the increase in pollution indicators, and crown-of-thorns outbreak.
- In 2022, the reefs show some improvement.
- 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 $100m^2$).



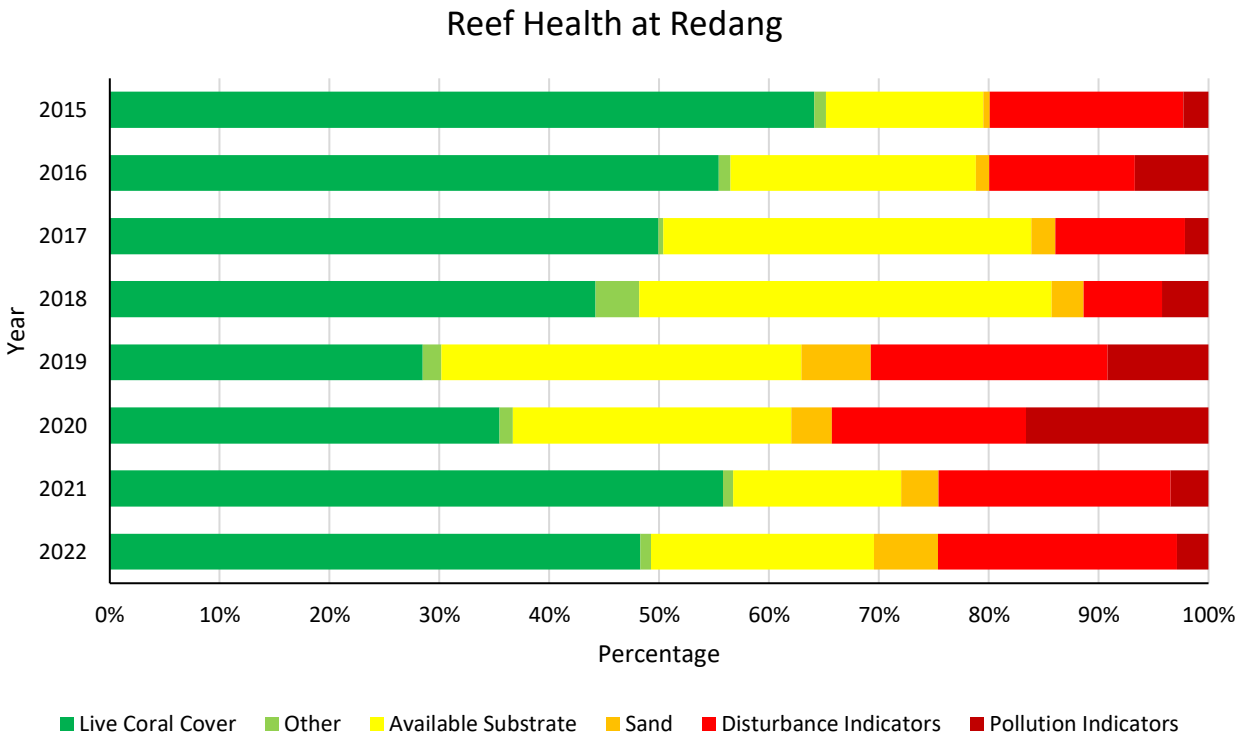
Sunda Shelf – Perhentian



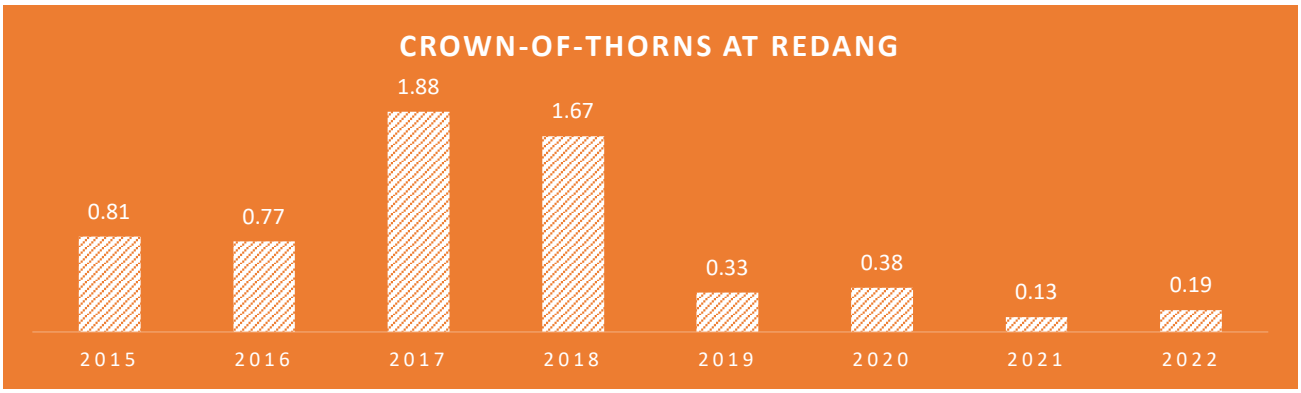
- The decrease in live coral cover in 2017 is likely due to physical damage caused by human activities.
- The decrease in 2019 is probably due to Tropical Storm Pabuk which struck Perhentian in January that year, causing major physical damage to shallow reefs. Both are reflected by the increase in disturbance indicators.
- In 2020 and 2021, the reefs show signs of recovery, as reflected by the increase in live coral cover; In 2022, the reefs have deteriorated slightly.
- Pollution indicators increased significantly in 2020. This could be the cause of increase in crown-of-thorns abundance that year. Starting 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.



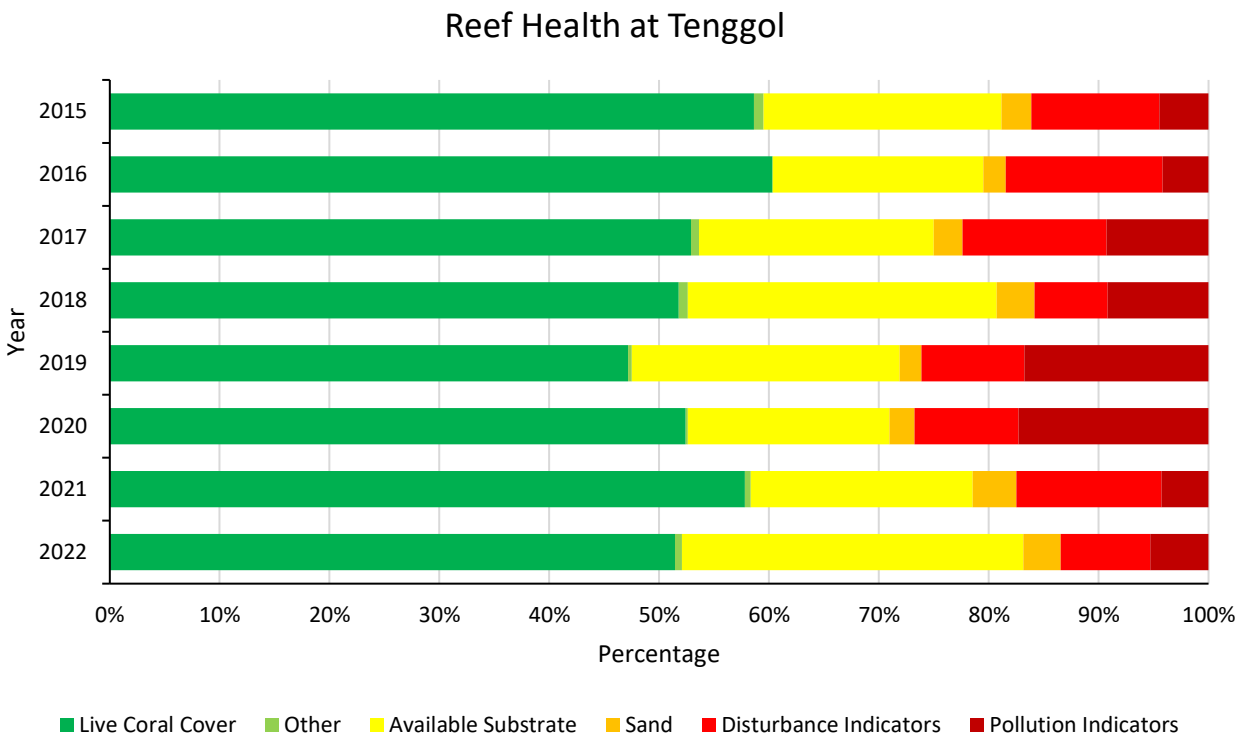
Sunda Shelf – Redang



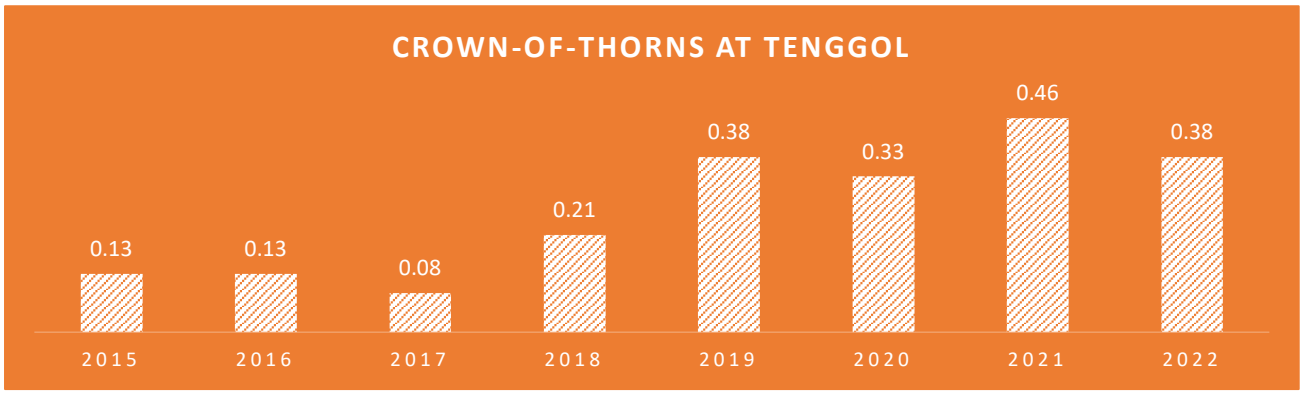
- The decrease in live coral cover from 2016 to 2018 is likely due to very high abundance of crown-of-thorns, which is above what a healthy reef can sustain (0.2-0.3 individual per 100m^2).
- The sharp decrease in live coral cover in 2019 is probably due to Tropical Storm Pabuk which struck Redang in 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 has decreased significantly. The population has remained low ever since and is now within what a healthy reef can sustain (0.2-0.3 individual per 100m^2).
- Reduced abundance of crown-of-thorns and pollution indicators allow Redang reefs to recover from Tropical Storm Pabuk damage. This is reflected by the increase in live coral cover in 2020 and 2021.
- In 2020 and 2021, the reefs show improvement; In 2022, the reefs deteriorated again.



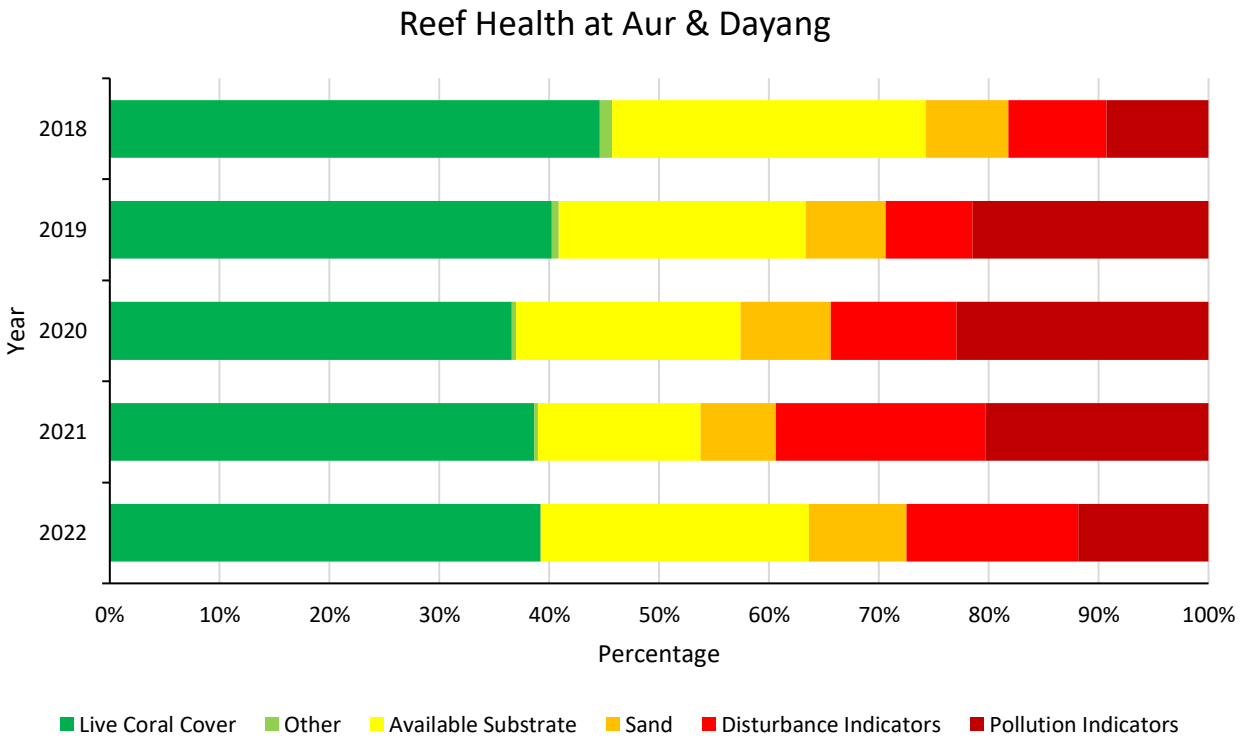
Sunda Shelf – Tenggol



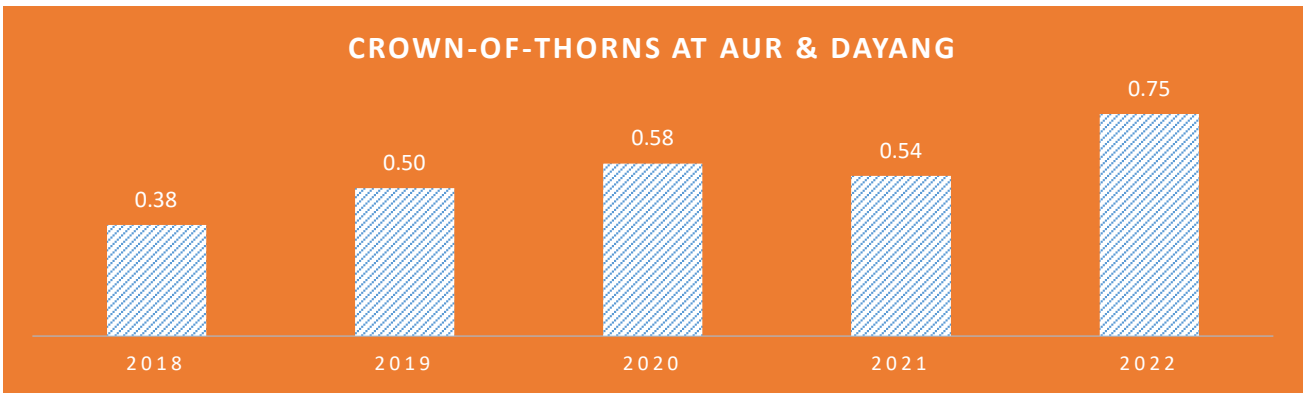
- The decrease in live coral cover in 2017 and 2018 is likely due to raised level of nutrient in the waters around the island, as reflected by the increase in pollution indicators.
- The decrease in 2018 is also contributed by the increase in crown-of-thorns abundance.
- The sharp decrease in 2019 is 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 water-shed runoff which increase external nutrient loads. It also causes sediment resuspension contributing to increase internal nutrient loads.
- In 2020 and 2021, the reefs show improvement; In 2022, the reefs deteriorated again.
- Since 2019, the abundance of crown-of-thorns has increased to above what a healthy reef can sustain (0.2-0.3 individual per 100m^2). This is a cause for concern and efforts need to be taken by reef managers to control the population.



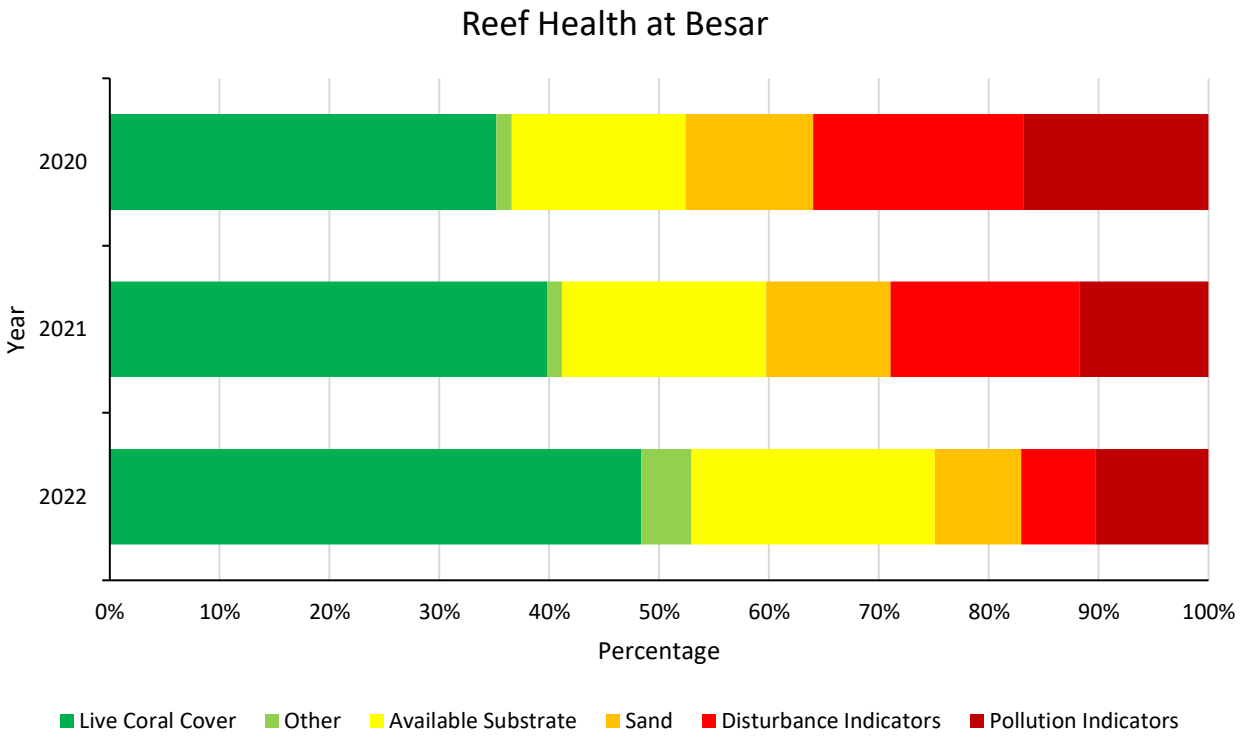
Sunda Shelf – Aur & Dayang



- From 2018 to 2020, Aur and Dayang 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, raised level of nutrient in the waters around the island and crown-of-thorns outbreak, as reflected by the increase in disturbance and pollution indicators and crown-of-thorns abundance during that period.
- From 2021 onwards, the reefs show some improvement.
- Pollution indicators have decreased. Reduced pollution indicators allow Aur and Dayang reefs to improve.
- The abundance of crown-of-thorns in Aur and Dayang is above what a healthy reef can sustain (0.2-0.3 individual per 100m^2) and is showing an upward trend. This is a cause for concern and efforts need to be taken by reef managers to control the population.
- Available substrate for coral recruits to attach is high, possible chance of reef recovery if human impacts and crown-of-thorns outbreak are dealt with.

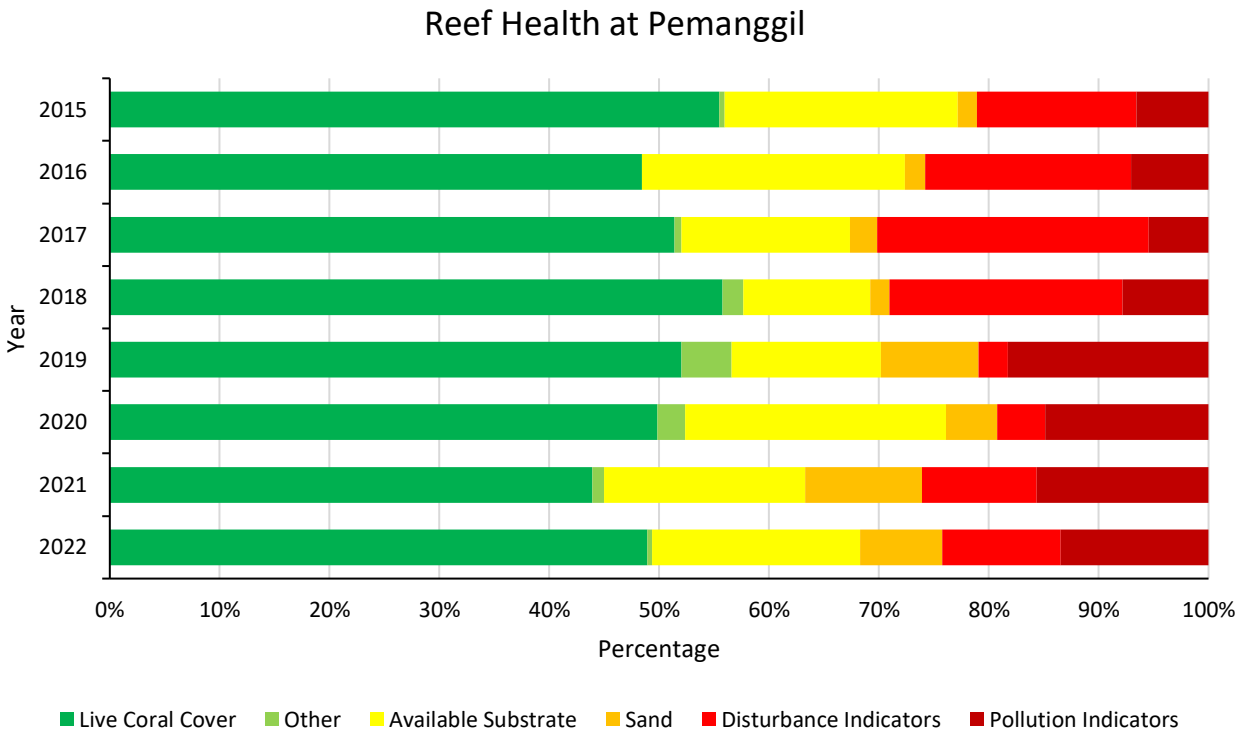


Sunda Shelf – Besar

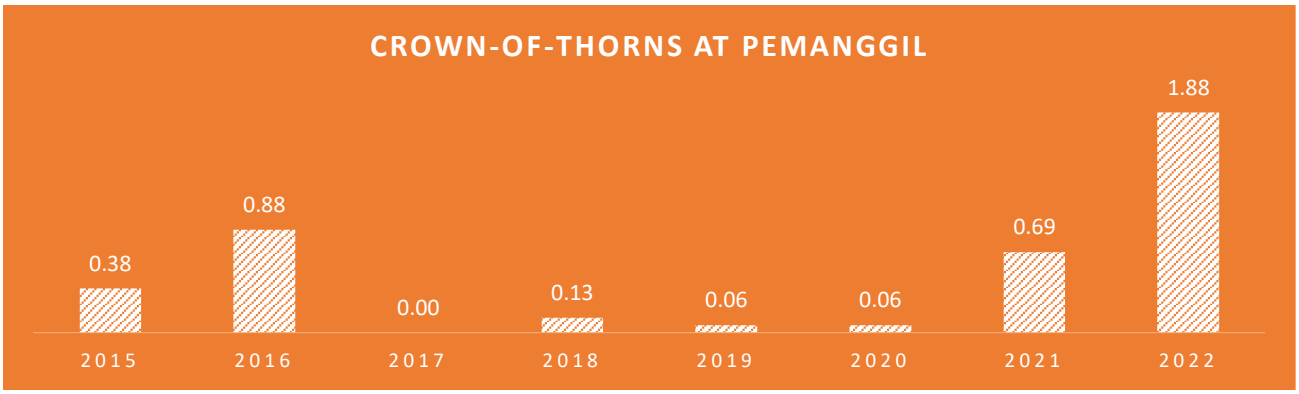


- Pulau Besar reefs have improved over the years, as reflected by the increase in live coral cover.
- Disturbance and pollution indicators have decreased. Reduced disturbance and pollution indicators allow Pulau Besar reefs to improve.
- Available substrate for coral recruits to attach is very high, possible chance of continuous improvement of reefs health if human impacts are dealt with.

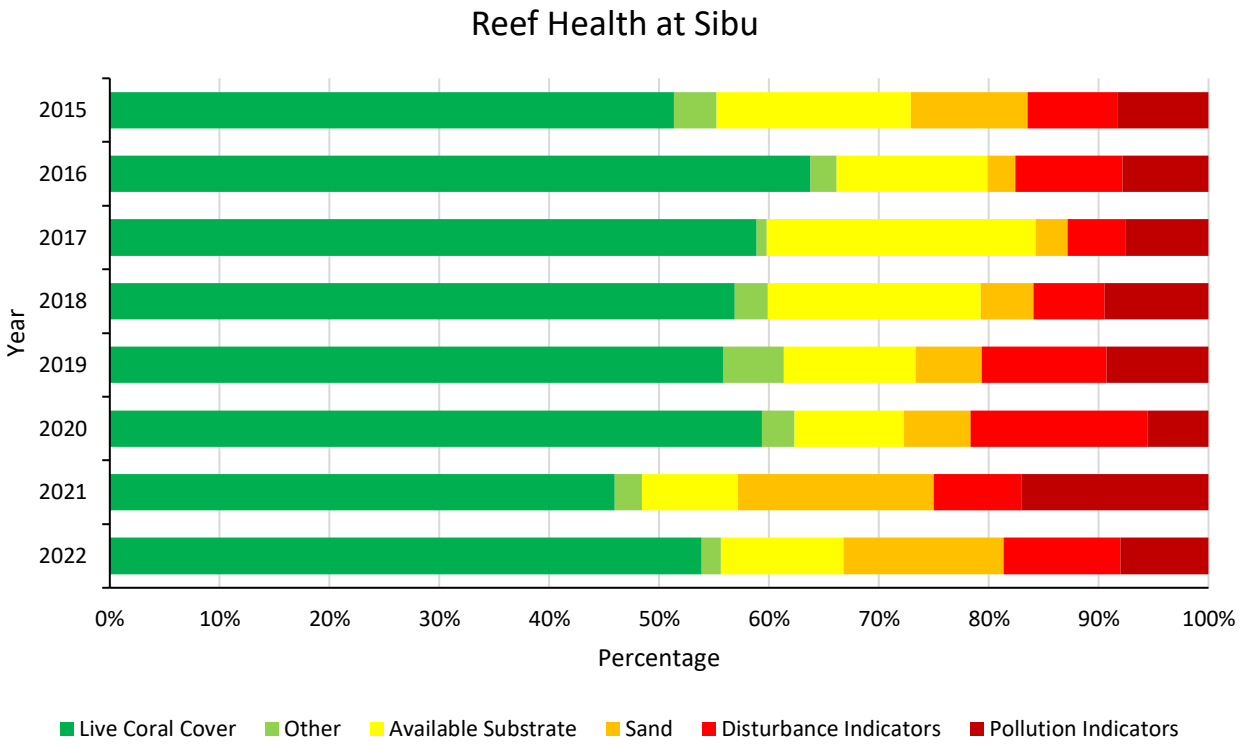
Sunda Shelf – Pemanggil



- 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 the significant increase in crown-of-thorns abundance.
- From 2017 to 2020, the abundance of crown-of-thorns has decreased. In 2021 and 2022, the abundance has increased significantly to above what a healthy reef can sustain (0.2-0.3 individual per 100m^2). 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.
- In 2022, the reefs show improvement.
- Disturbance indicators is showing an upward trend over the last 4 years.
- Available substrate for coral recruits to attach is high, possible chance of reef recovery if human impacts are dealt with.

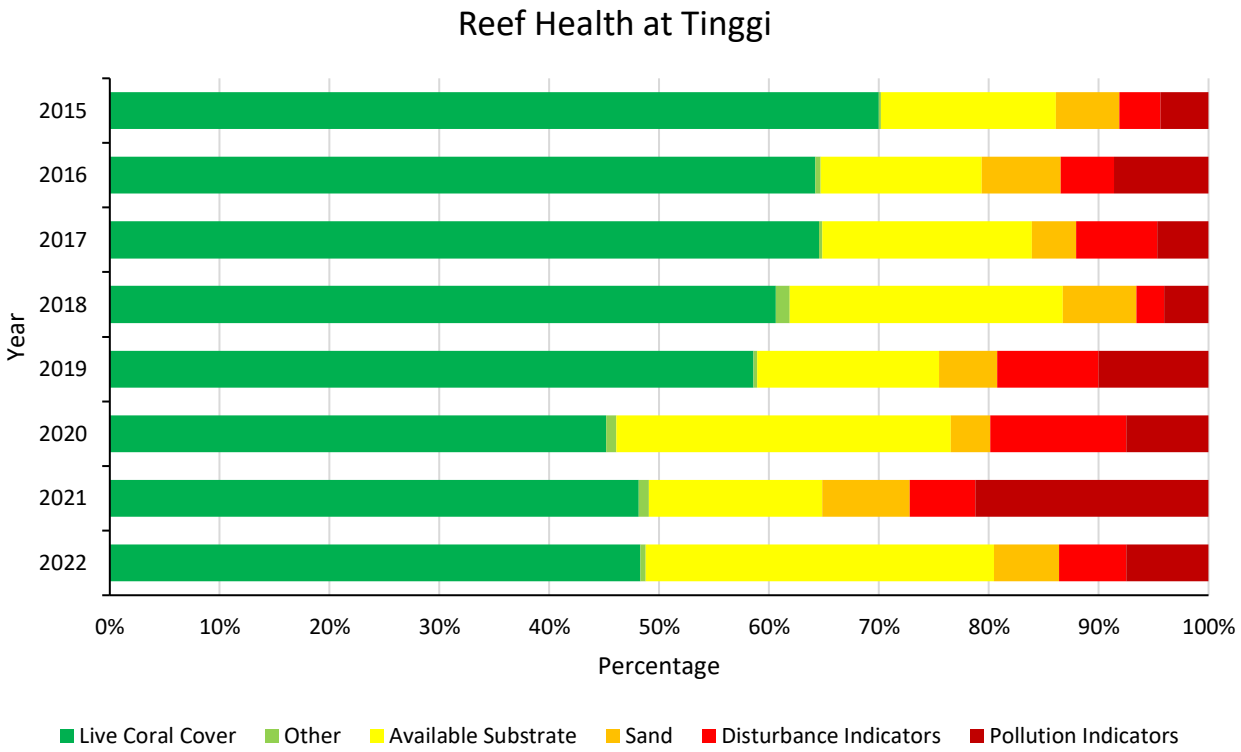


Sunda Shelf – Sibu



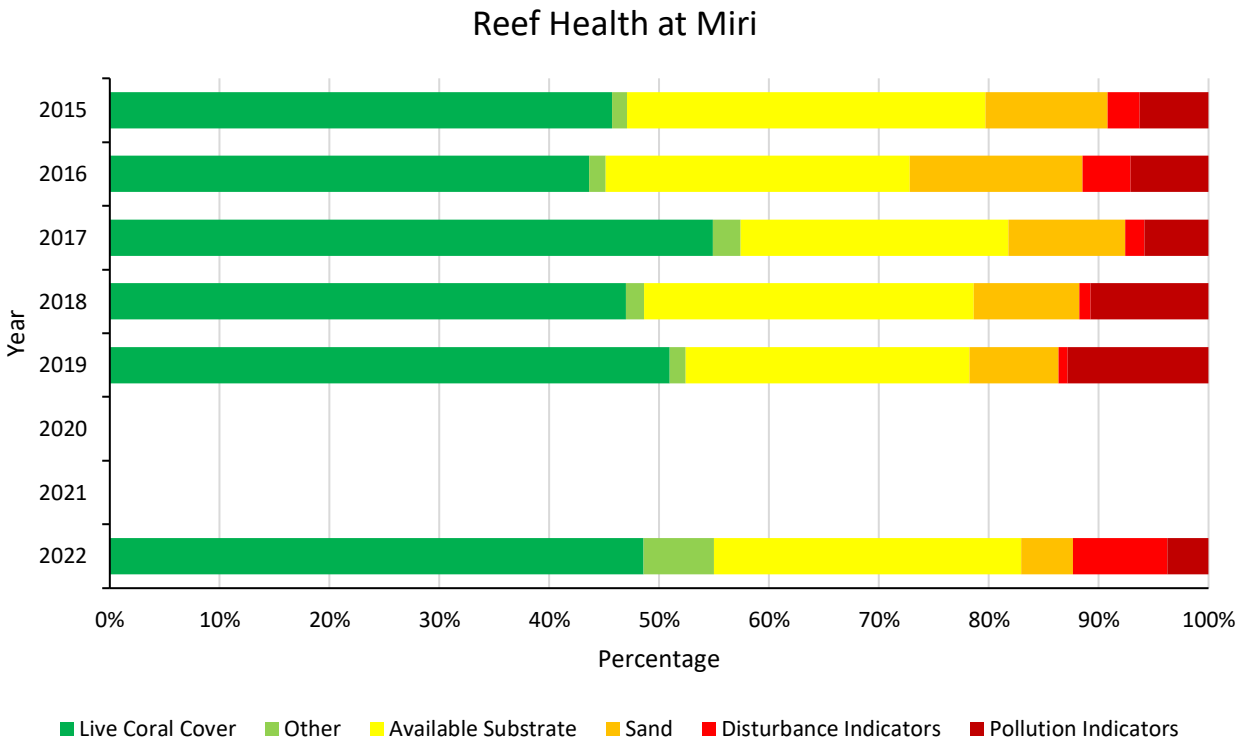
- Sibu reefs have maintained in 'good' condition over the years.
- In 2021, the reefs have deteriorated, as reflected by the decrease in live coral cover. The decrease is probably due to raised level of nutrient in the waters around the island, as reflected by the increase in pollution indicators.
- In 2022, the reefs show improvement.
- Physical damage caused by human activities and/or storm have increased. This is not only reflected by the increase in disturbance indicators, 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 high, possible chance of reef recovery if human impacts are dealt with.

Sunda Shelf – Tinggi



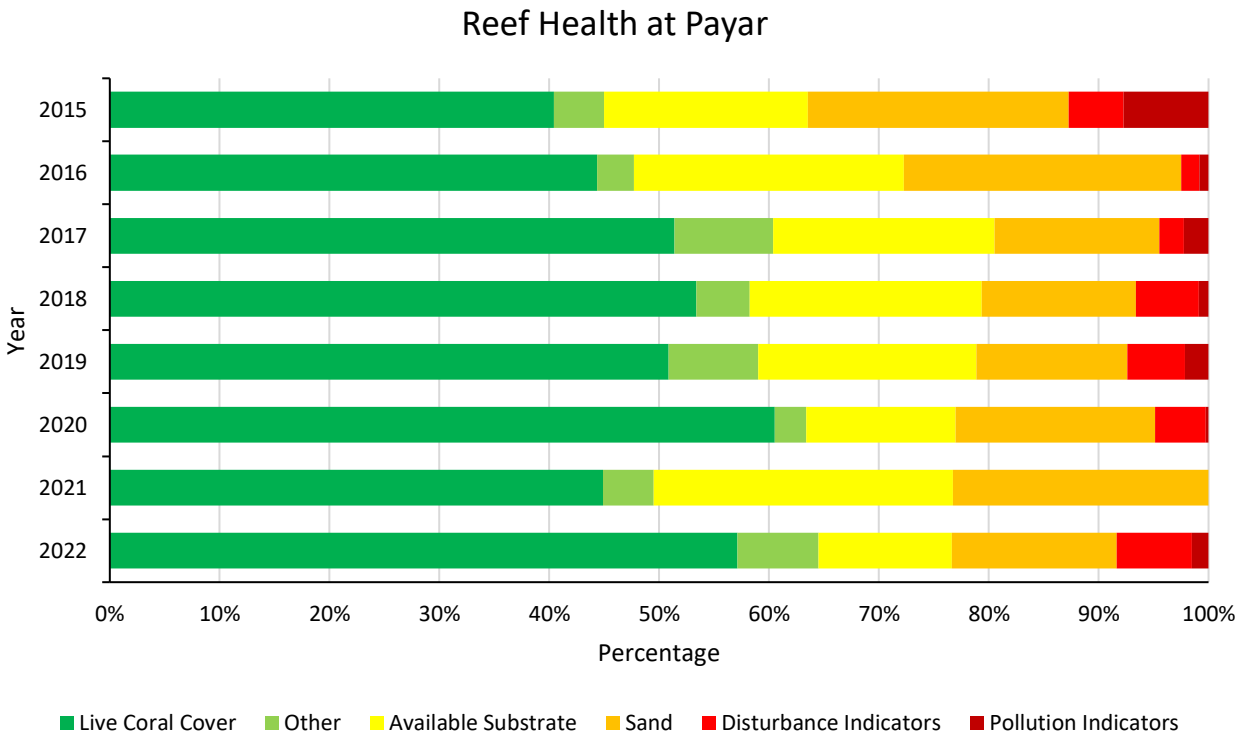
- Tinggi reefs have deteriorated from 'good' to 'fair' condition, as reflected by the decrease in live coral cover.
- The decrease is likely due to physical damage caused by human activities and/or storm, as reflected by the increase in disturbance indicators, and raised level of nutrient in the waters around the island, as reflected by the increase in pollution indicators.
- From 2021 onwards, the reefs show improvement, though there was a slight decline in 2022.
- Available substrate for coral recruits to attach is high, possible chance of reef recovery if human impacts are dealt with.

Sunda Shelf – Miri



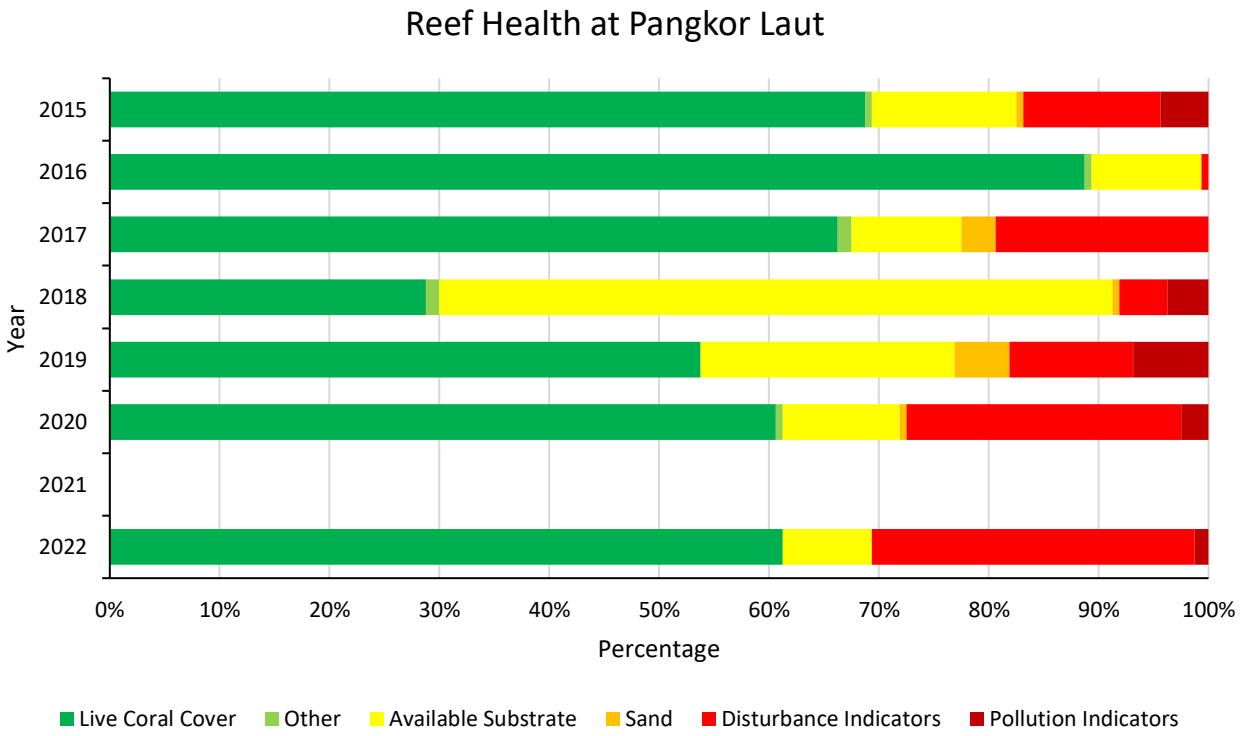
- The health of Miri reefs shows variation over the years.
- The decrease in live coral cover in 2022 is considered to reflect the elimination of 3 permanent sites and addition of 1 new site, rather than an actual decrease in live coral cover.
- No survey data was collected in 2020 and 2021 due to Covid-19 pandemic which hampered survey efforts.

Malacca Strait – Payar



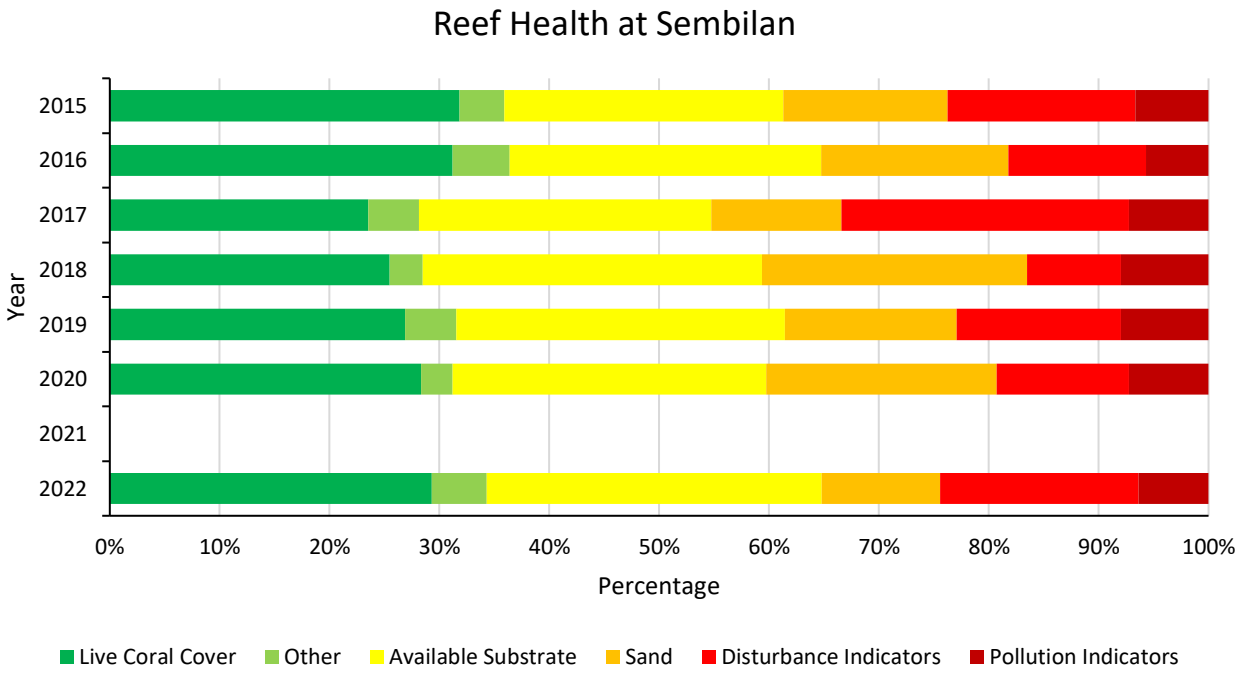
- Payar reefs have improved from 'fair' to 'good' condition, as reflected by the increase in live coral cover.
- The increase in live coral cover is likely due to decrease level of nutrient in the waters around the islands, as reflected by the decrease in pollution indicators.
- The cause of the drastic decrease in live coral cover in 2021 is not known.

Malacca Strait – Pangkor Laut



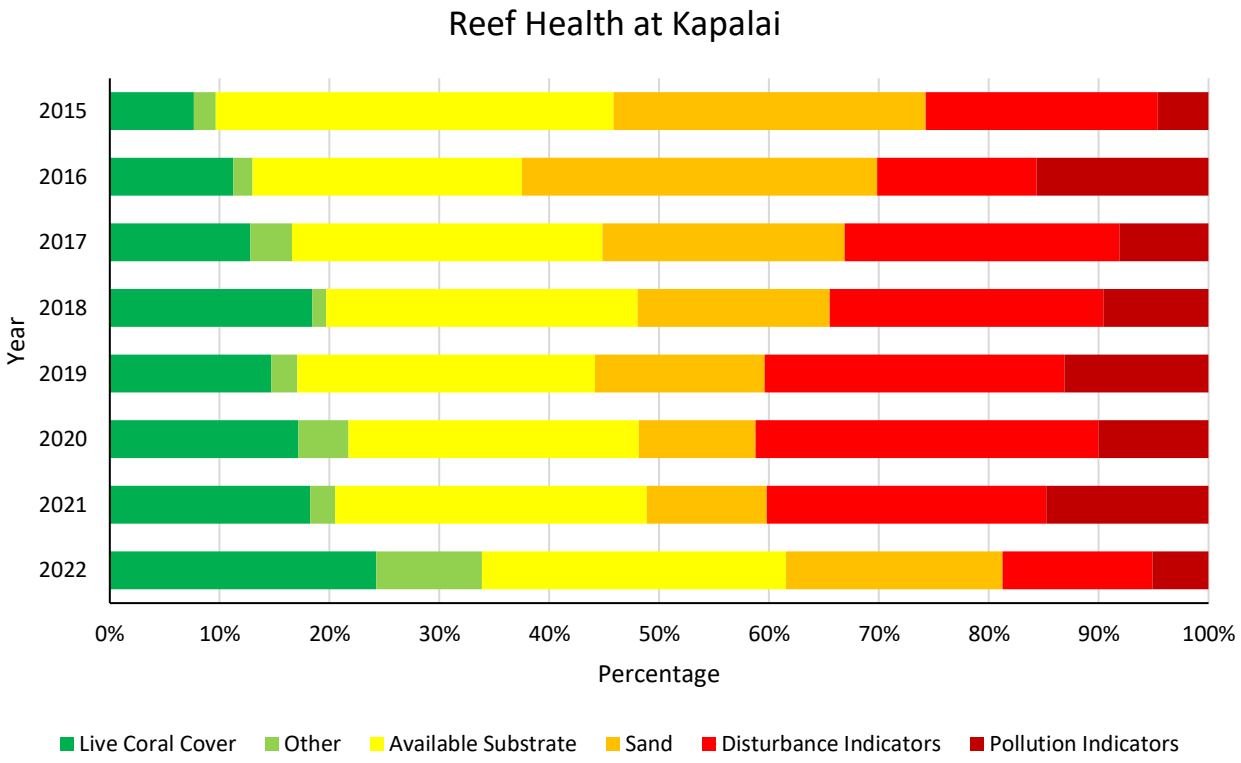
- Pangkor Laut reefs have maintained in 'good' condition.
- The cause of the drastic decrease in live coral cover in 2018 is not known.
- Disturbance indicators have increased.
- No survey data was collected in 2021 due to Covid-19 pandemic which hampered survey efforts.

Malacca Strait – Sembilan



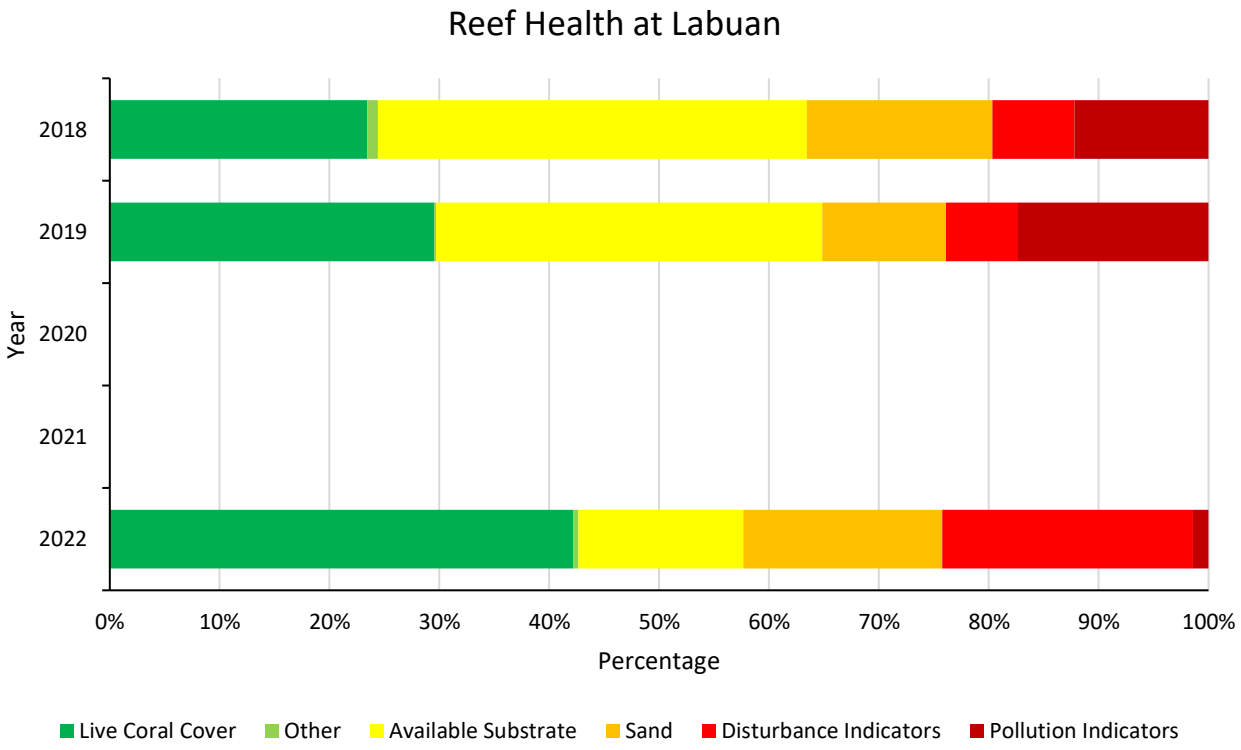
- Sembilan reefs have maintained in 'fair' condition.
- The decrease in live coral cover in 2017 is most likely due to physical damage caused by human activities, as reflected by the increase in disturbance indicators. In 2017, there was a massive construction on the beach at Pulau Lalang. Under the directive of Perak state government, structures built on the beach were removed later that year and the island is closed for boat landing until today.
- In 2018, the reefs show recovery and have been showing recovery since.
- No survey data was collected in 2021 due to Covid-19 pandemic which hampered survey efforts.
- Available substrate for new coral recruits to attach to is very high, possible chance of complete reef recovery if human impacts are in check.

North Borneo – Kapalai



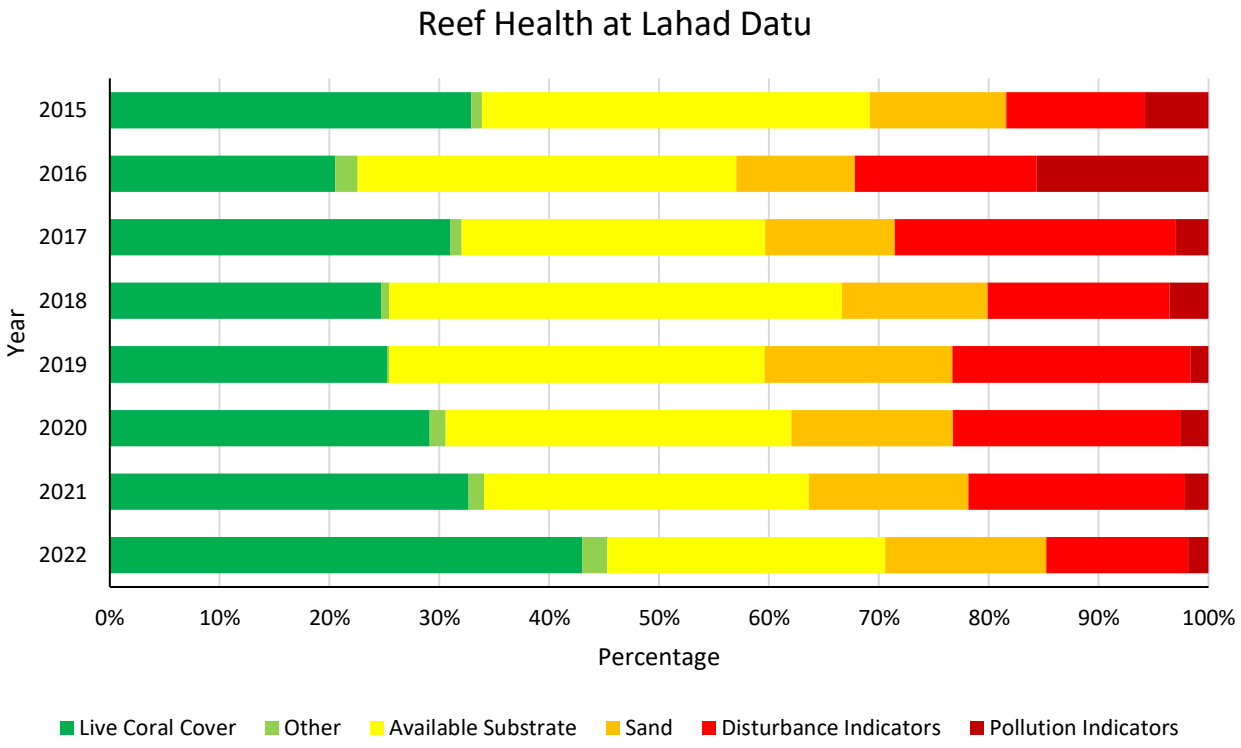
- Kapalai reefs have improved from 'poor' to 'fair' condition, as reflected by the increase in live coral cover.
- Sand level has decreased over the years. Decreasing amount of sand can be an indication of decreasing disturbance.
- Reduced disturbance allows Kapalai reefs to improve.
- Available substrate for coral recruits to attach is very high, possible chance of continuous improvement of reefs health if human impacts are dealt with.

North Borneo – Labuan

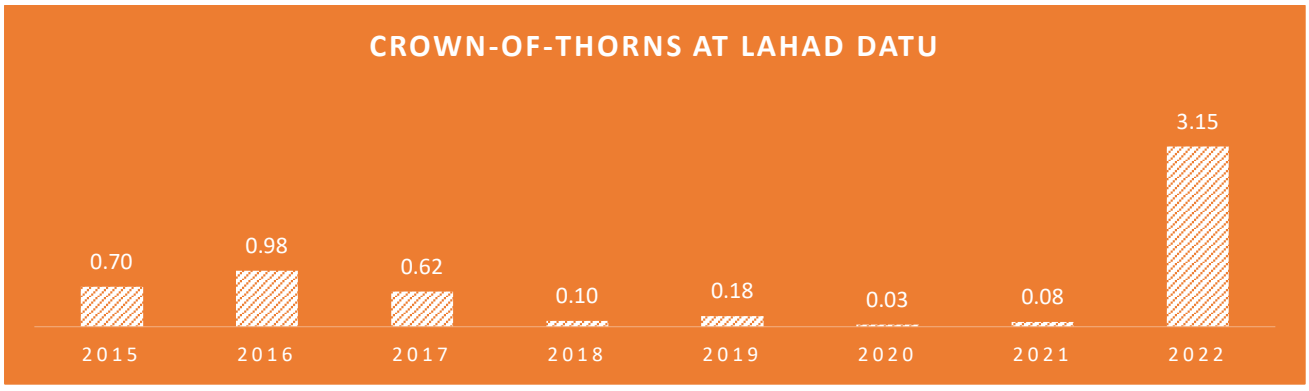


- Labuan reefs have improved from 'poor' to 'fair' condition, as reflected by the increase in live coral cover.
- In 2022, disturbance indicators have increased significantly while pollution indicators have decreased significantly.
- The sharp increase in live coral cover in 2022 is probably due to a combination of few factors – reduced pollution indicators, elimination of 1 permanent site and addition of 1 new site.
- No survey data was collected in 2020 and 2021 due to Covid-19 pandemic which hampered survey efforts.
- Available substrate for coral recruits to attach is high, possible chance of continuous improvement of reefs health if human impacts are dealt with.

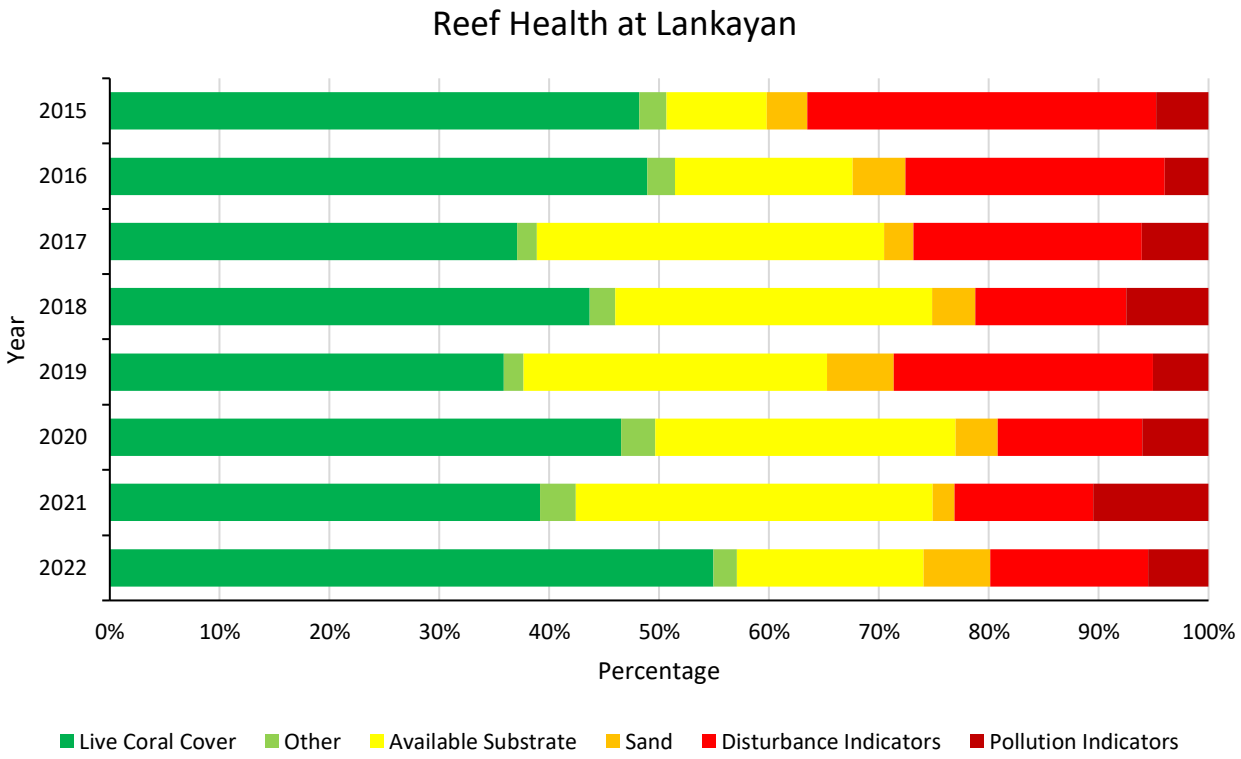
North Borneo – Lahad Datu



- Lahad Datu reefs have improved over the years, as reflected by the increase in live coral cover.
- Disturbance indicators have decreased. Reduced disturbance indicators allow Lahad Datu reefs to improve.
- From 2015 to 2017, the abundance of crown-of-thorns was above what a healthy reef can sustain (0.2-0.3 individual per 100m^2). In 2022, the abundance has increased significantly and is way above the acceptable limit. This is a cause for concern and efforts need to be taken by reef managers to control the population.

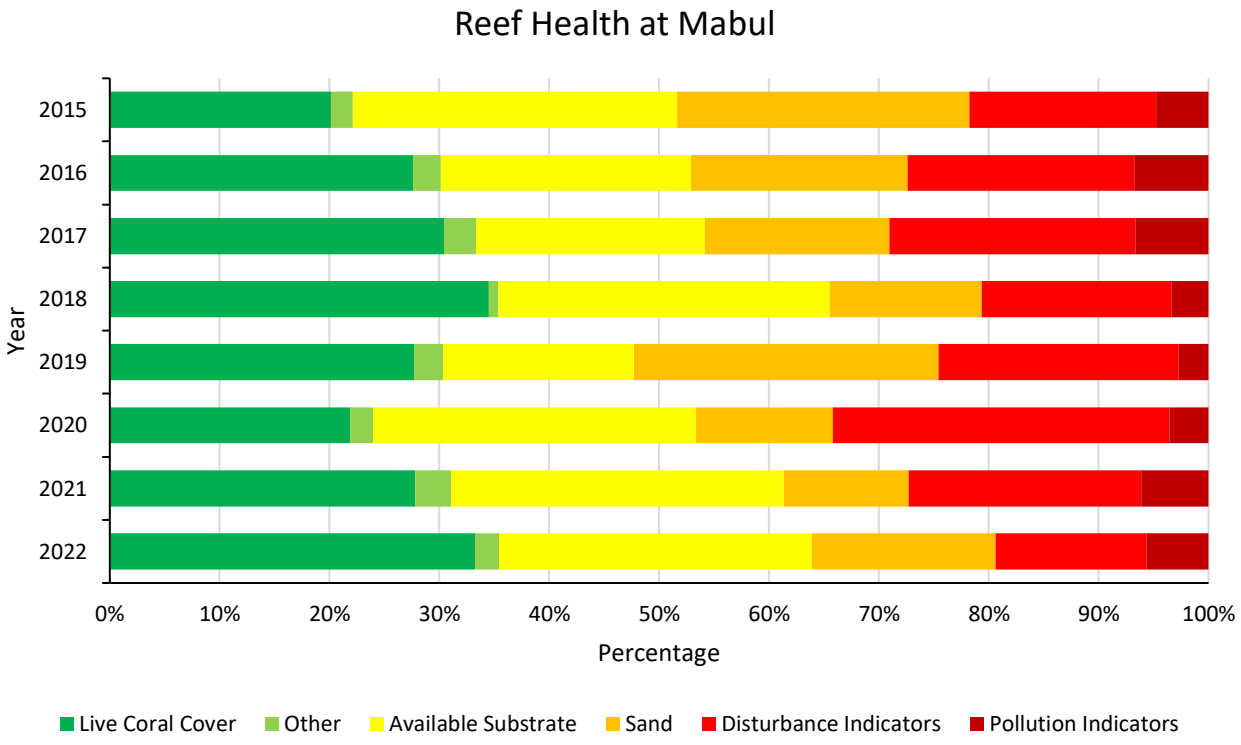


North Borneo – Lankayan



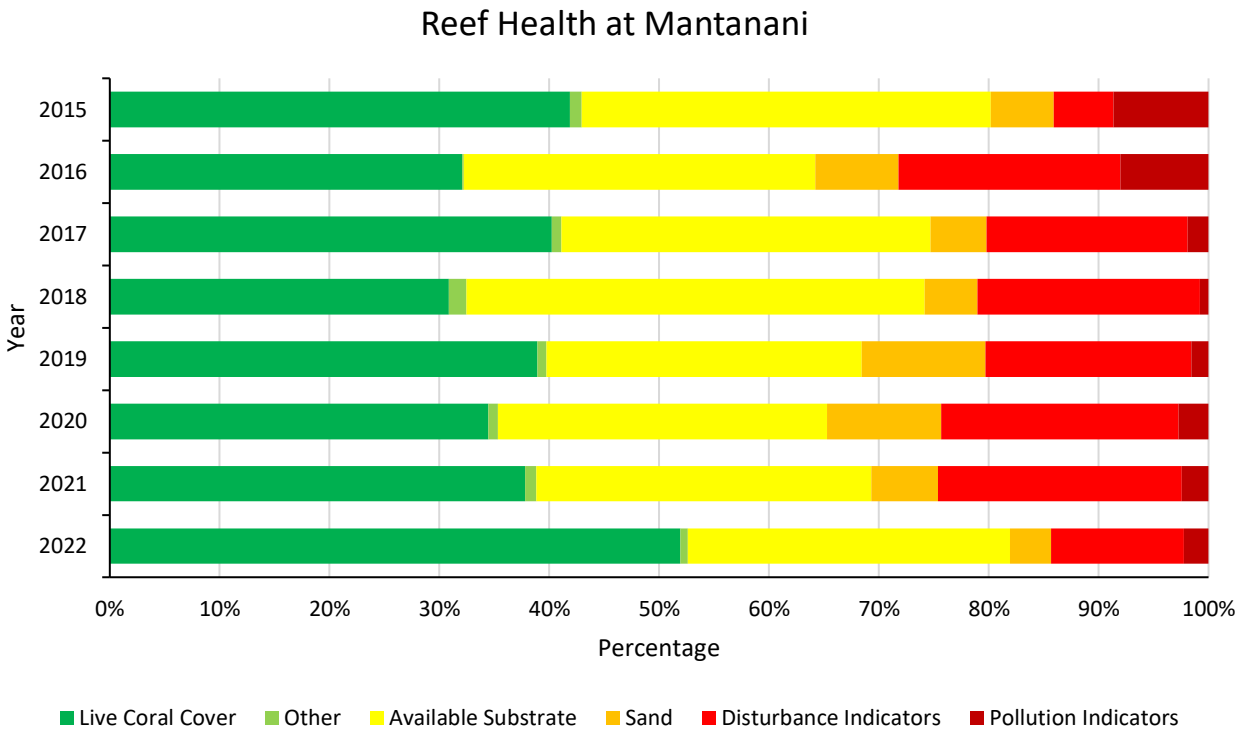
- The health of Lankayan reefs shows variation over the years. Overall, the reefs have improved, as reflected by the increase in live coral cover.
- The decrease in live coral cover in 2021 is considered to reflect the elimination of 9 sites that year (due to Covid-19 pandemic which hampered survey efforts).
- Disturbance indicators have decreased. Reduced disturbance allows Lankayan reefs to improve.
- Available substrate for coral recruits to attach is high, possible chance of reef recovery if human impacts are dealt with.

North Borneo – Mabul



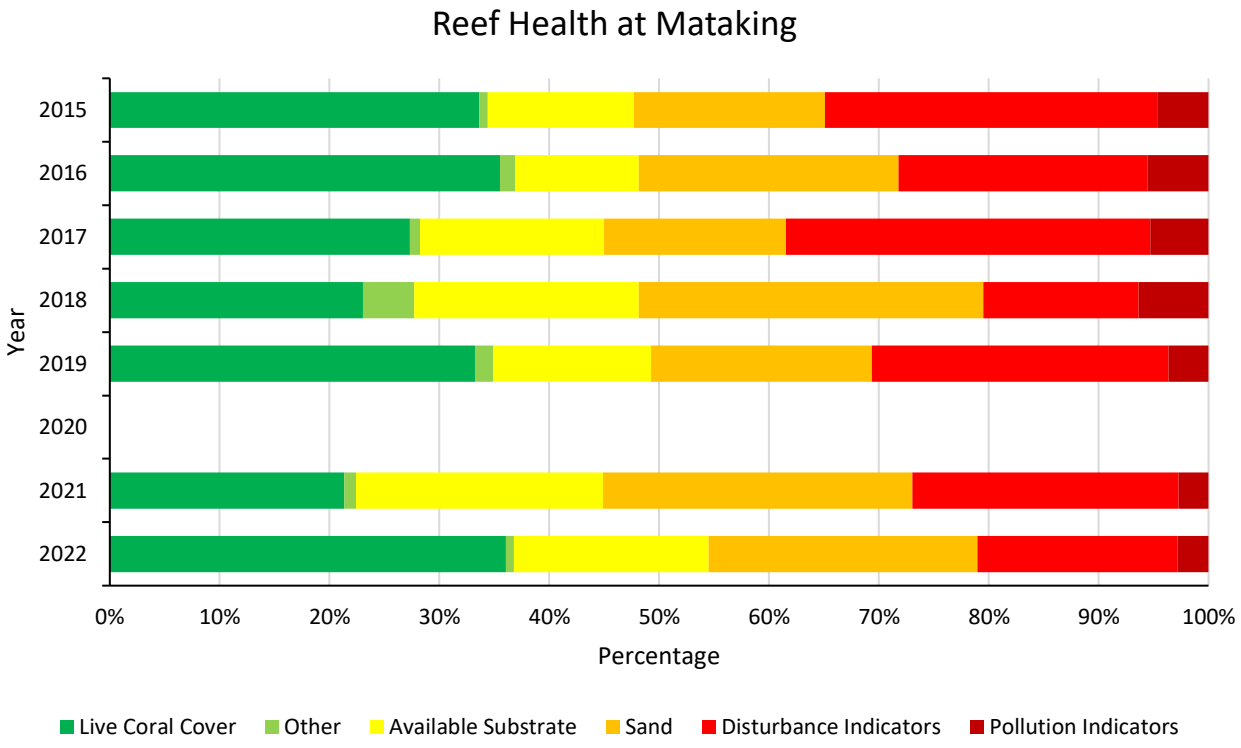
- From 2015 to 2018, the health of Mabul reefs showed improvement, as reflected by the increase in live coral cover. Sand level decreased during that period. Decreasing amount of sand can be an indication of decreasing disturbance. Reduced disturbance allows the reefs to improve.
- From 2018 to 2020, 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.
- From 2021 onwards, Mabul reefs showed improvement. The improvement is likely due to reduced physical damage, as reflected by the decrease in disturbance indicators.
- Available substrate for coral recruits to attach is very high, possible chance of further reef recovery if human impacts are dealt with.

North Borneo – Mantanani



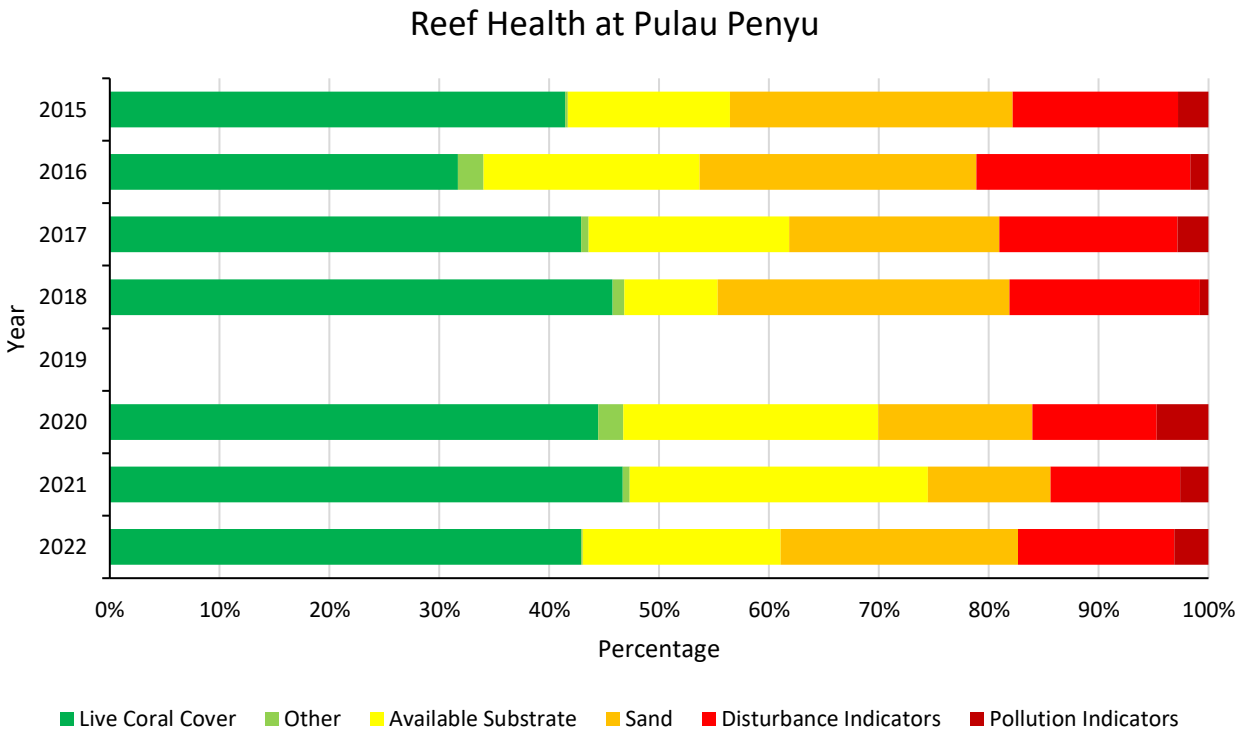
- The health of Mantanani reefs shows variation over the years. Overall, the reefs have improved, as reflected by the increase in live coral cover.
- The increase is likely due to reduced level of nutrient in the waters around the island, as reflected by the decrease in pollution indicators.
- Available substrate for coral recruits to attach is very high, possible chance of further reef recovery if human impacts are dealt with.
- In 2020 and 2021, the reefs show improvement.

North Borneo – Mataking

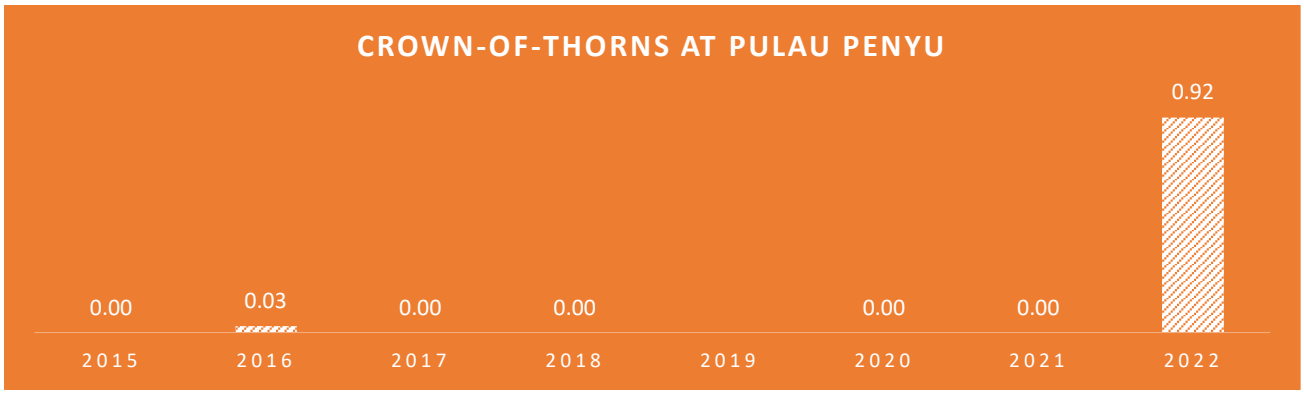


- The health of Mataking reefs shows variation over the years. Overall, the reefs have improved, as reflected by the increase in live coral cover.
- The increase is likely due to reduced physical damage caused by human activities and/or storm as well as reduced level of nutrient in the waters around the island, as reflected by the decrease in disturbance and pollution indicators.
- No survey data was collected in 2020 due to Covid-19 pandemic which hampered survey efforts.
- Available substrate for coral recruits to attach is high, possible chance of further reef recovery if human impacts are dealt with.

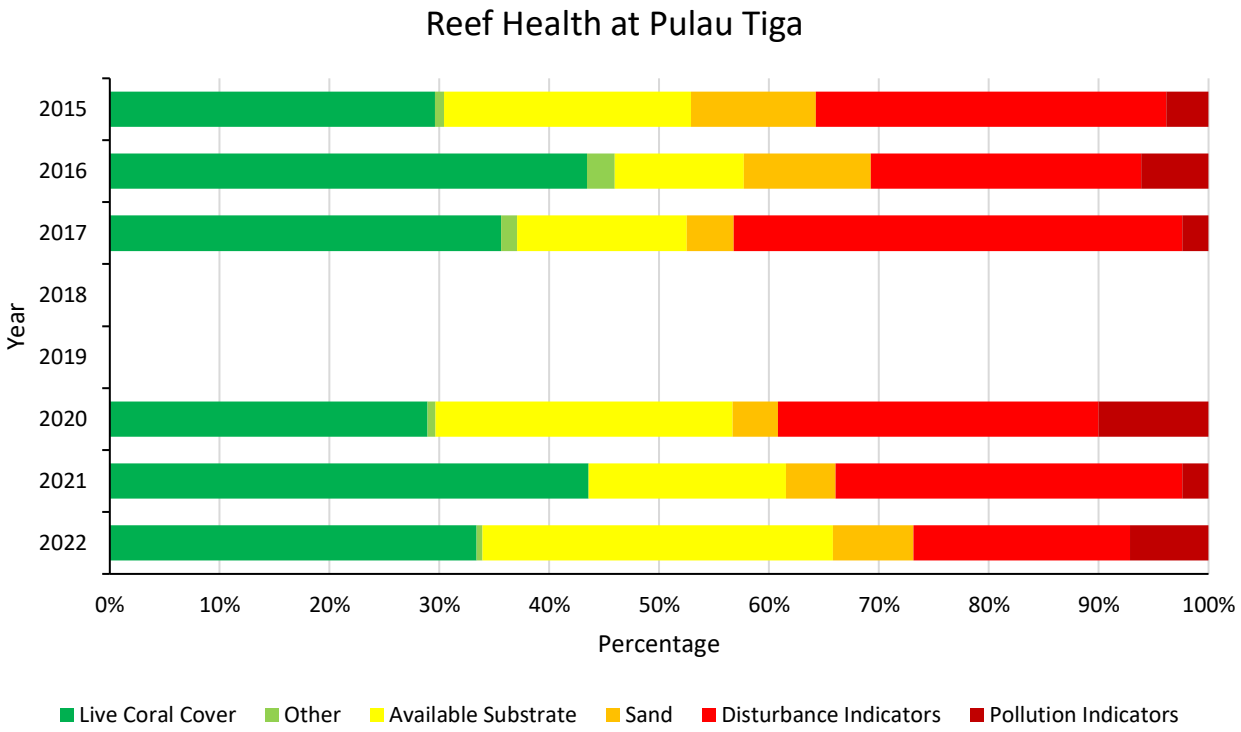
North Borneo – Pulau Penyu



- Pulau Penyu reefs have maintained in 'fair' condition.
- In 2022, the abundance of crown-of-thorns has increased drastically and is above what a healthy reef can sustain (0.2-0.3 individual per 100m^2). This is a cause for concern and efforts need to be taken by reef managers to control the population.

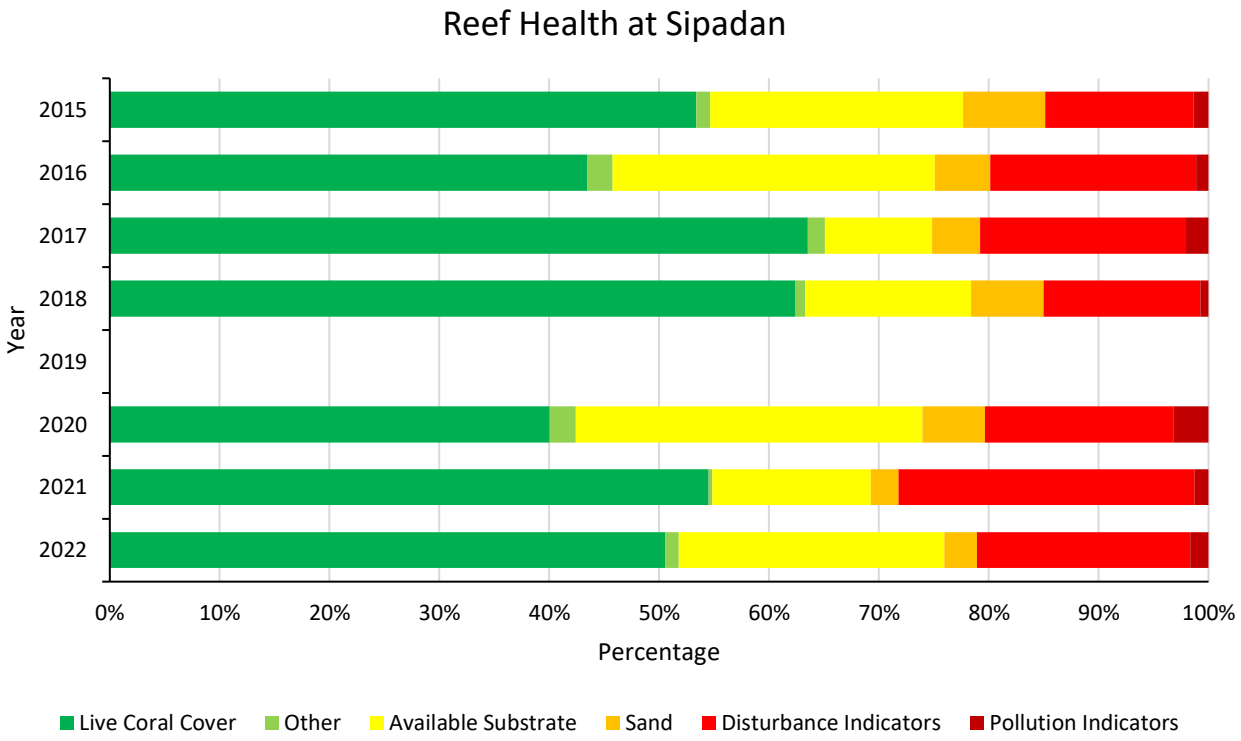


North Borneo – Pulau Tiga



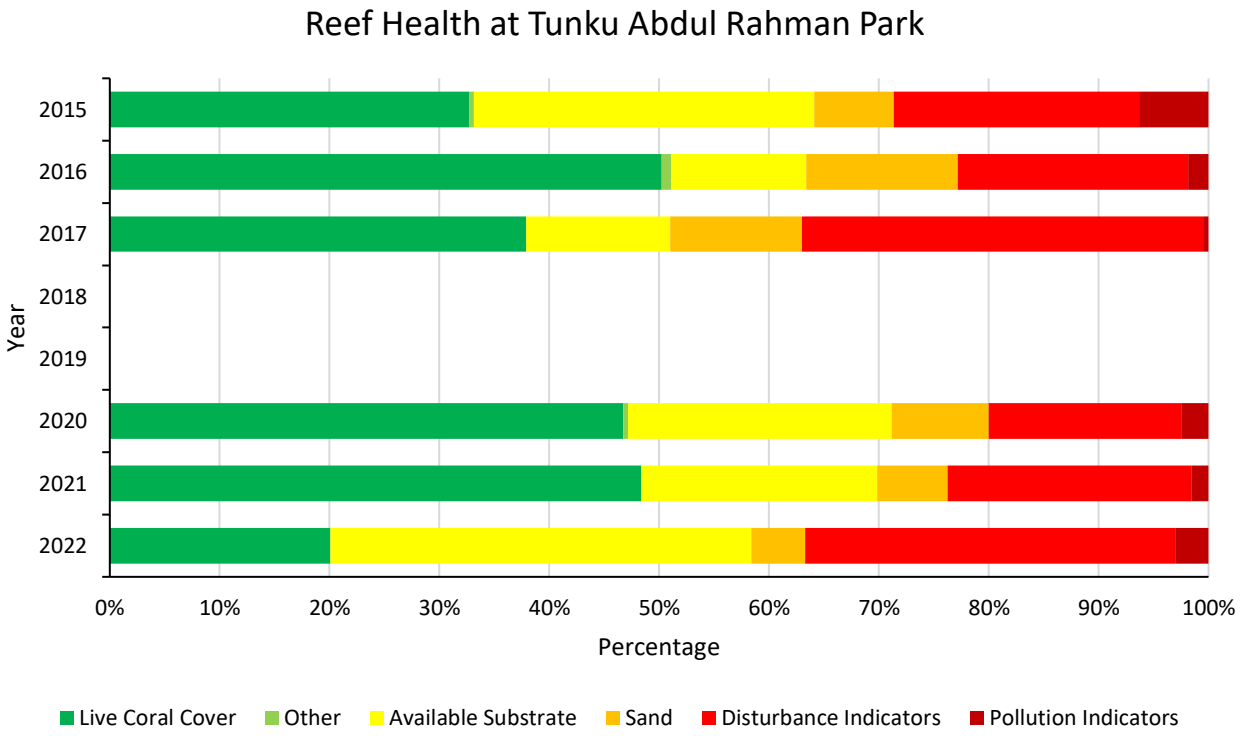
- The health of Pulau Tiga reefs shows variation over the years.
- Disturbance indicators has reduced.

North Borneo – Sipadan

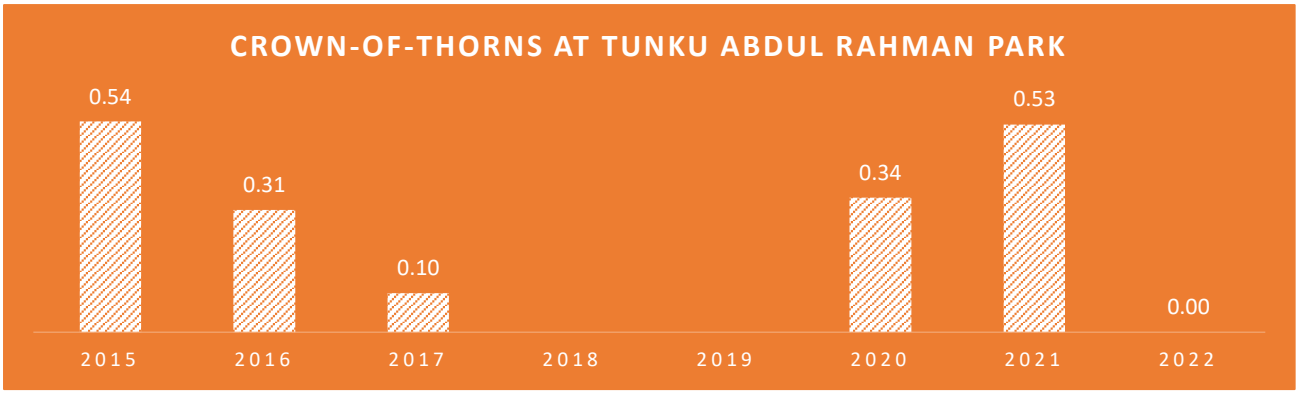


- The health of Sipadan reefs shows variation over the years. In 2021, the reefs show improvement; In 2022, the reefs deteriorated again.
- The spike in live coral cover in 2017 is considered to reflect the elimination of 4 sites that year, rather than an actual increase in live coral cover.
- Pollution indicators remain low.

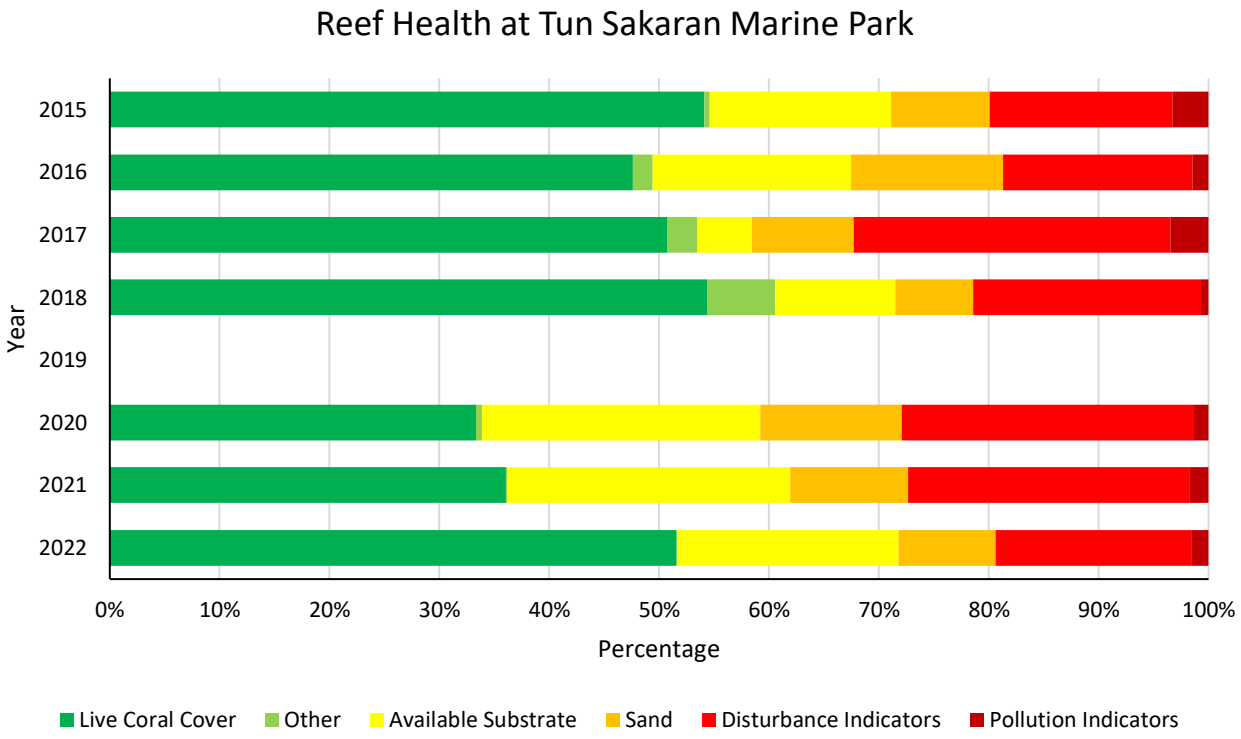
North Borneo – Tunku Abdul Rahman Park



- The health of Tunku Abdul Rahman Park reefs shows variation over the years.
- In 2022, the reefs have deteriorated drastically; no obvious reason has been identified.
- Disturbance indicators have increased over the last 3 years.
- Available substrate for coral recruits to attach is very high, possible chance of reef recovery if human impacts are dealt with.
- In 2022, crown-of-thorns is no longer an issue in Tunku Abdul Rahman Park.

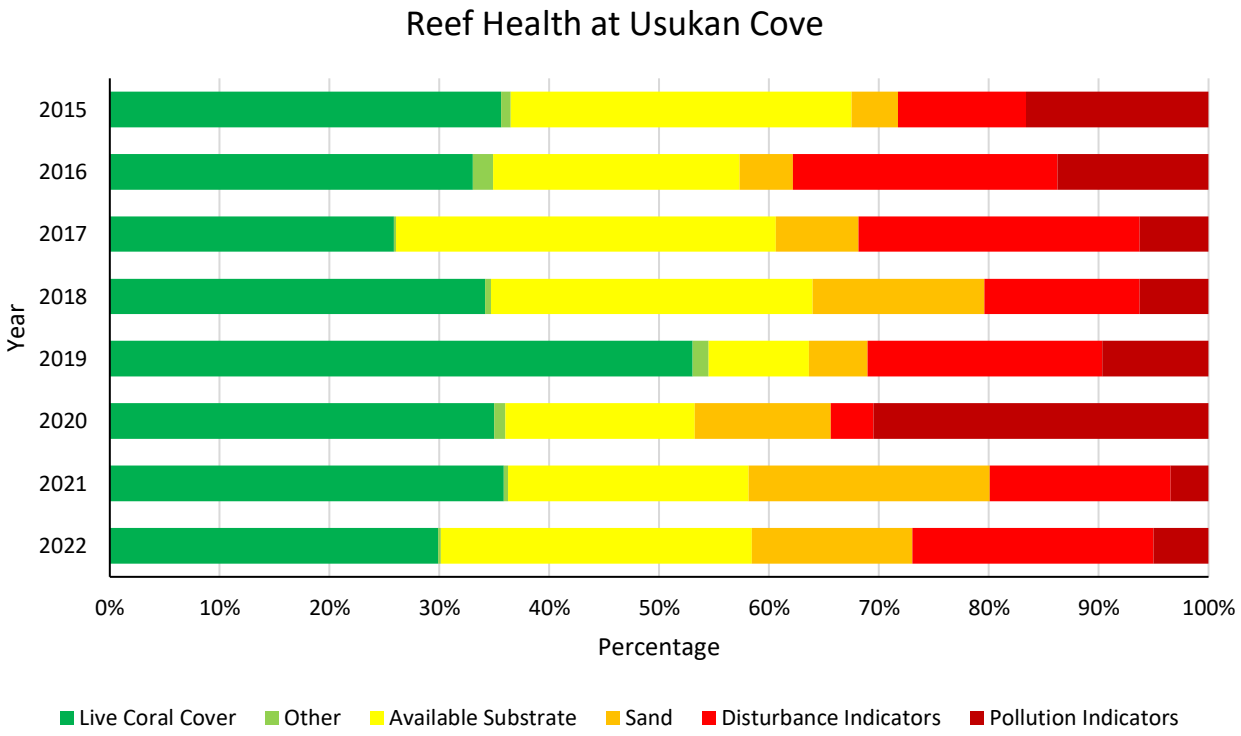


North Borneo – Tun Sakaran Marine Park



- In 2020, Tun Sakaran Marine Park 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 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.
- From 2021 onwards, the reefs show improvement.
- Available substrate for coral recruits to attach is very high, possible chance of further reef recovery if human impacts are dealt with.

North Borneo – 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.
- The decrease in live coral cover in 2022 is most likely due to physical damage caused by human activities and/or storm, as reflected by the increase in disturbance indicators.
- Disturbance and pollution indicators show variation over the years.

5. Summary & Recommendations

Summary

The improvement in coral reef health noted from our 2021 survey programme has continued into 2022. Most sites saw a further small increase in Live Coral Cover (LCC), a key coral reef health indicator, from 2021 to 2022, extending a trend noticed between 2019 through to 2021. Only three locations showed a reduction in LCC, attributed to specific local conditions (e.g. storms).

Contrasted against this, as in previous years, the abundance of most fish and invertebrate indicators continues to be low, suggesting either historical over-fishing or on-going fishing pressure. This raises a concern about poaching in those survey sites that are in protected areas.

The presence of disturbance indicators highlights on-going trends in the trajectory of reef health and both local impacts (such as sewage pollution) and global impacts (such as ocean warming) are once again visible in survey data.

However, it is worth emphasising that some indicators of disturbance that reflect human impacts (e.g. Nutrient Indicator Algae, Recently Killed Coral) have reduced over the last 2-3 years, perhaps supporting earlier suggestions that reefs can recover when stressors are reduced. Tourism numbers were significantly reduced at the height of the Covid-19 pandemic during 2020 and 2021; while 2022 saw most of the world emerging from the pandemic, tourism numbers have not yet recovered to pre-covid levels.

Recommendations

2022 marked the year of recovery from the Covid-19 pandemic. Economic activity has resumed, and with it tourists have started to return. Although recovery was patchy and slow, indications are that by 2023 or 2024 numbers will have recovered to pre-pandemic numbers. We believe that three topics should be the focus for greatest attention when it comes to coral reef conservation.

First, based on the data presented above from surveys conducted during 2022, we recommend once again that coral reef managers in Malaysia focus on building the resilience of coral reefs by addressing the local impacts that are affecting reef health:

- **Physical damage** – mainly by tourists and boat operators: training courses for boat operators; encourage dive operators to join the Green Fins programme; eco-friendly snorkelling guide training for snorkel guides; consider limiting number of tourists to particularly sensitive area (following the practice already long-established at Sipadan Island)
- **Sewage pollution** – from resorts on tourist islands: encourage resorts to upgrade sewage treatment; increase water quality testing; implement septic tank maintenance programmes.
- **Coastal development** – on mainland and islands: rigorously enforce planning controls in sensitive islands; ensure EIAs are completed and EMPs are prepared and implemented.
- **Fish populations** – manage fishing effort to ensure herbivore populations are maintained.

The historical data available for the various reef areas can be used to identify the specific issues facing each major coral reef location, and individual action plans can be drawn up. RCM is in the process of finalising resilience-based management plans for the major islands off the East coast; these can form the basis of medium term planning for resilience building in those areas; addition plans are needed for other areas.

Second, and complementary to the above, the recently concluded Kunming-Montreal Global Biodiversity Framework provides a guide for which actions should be prioritised to improve conservation of coral reefs in Malaysia. Three elements should receive specific attention:

- **Reducing threats:** Several targets focus on reducing threats to biodiversity, and these could usefully form the basis for action plans to protect coral reefs. The targets cover ecosystem restoration, spatial planning, sustainable use and invasive alien species among others; addressing these various topics would strengthen management, an important element of target 3.
- **Role of local populations:** Target 22 highlights the role of Indigenous Peoples and Local Communities in managing natural resources. RCM strongly supports a participatory approach to management and we firmly believe that the Reef Care programme introduced by DoFM in 2020 provides an ideal platform to further enhance the role of local communities in managing the marine ecosystems on which they rely for food and livelihoods. Our programme in Tioman, the Tioman Marine Conservation Group, has shown that community participation brings numerous benefits (e.g. greater awareness of the need for marine parks; improved reef health) and we recommend that DoFM support the establishment of a joint management body to integrate Reef Care into Marine Park management.
- **Holistic management:** mangroves, seagrasses and coral reefs are connected ecologically, yet they are managed separately. RCM is increasingly looking to include these other coastal marine ecosystems in its conservation programmes. Managing these three ecosystems holistically meets the demands of the GBF and also brings additional conservation and community benefits. We recommend identifying measures, techniques and institutions that will enable closer integration of the management of these ecosystems.

Finally, RCM recommends taking a broader view of marine resource management than simply focusing on the coral reefs in existing Marine Parks. Such an approach, termed “Seascape Management” would allow the creation of large managed areas (contributing to Target 3 of the GBF) and would allow the inclusion of both “ecological connectivity” (the north-south connectivity between coral reefs from Johor to Kelantan) and “functional connectivity” (the west-east connectivity between coastal mangroves, seagrass meadows and coral reefs) into management. It would also allow management to consider un-surveyed – and unprotected – reefs off the coast in areas such as Kuantan coastal waters, where shoals can be identified from maritime charts, but where few surveys have been conducted to assess the extent and health of coral reefs. Such an approach would likely create significant conservation outcomes.

6. Conclusion

The Covid-19 pandemic greatly affected the communities that had become accustomed to relying on coral reefs for their livelihoods via the tourism industry. Although coral reefs in many places around Malaysia appear to have emerged from the pandemic healthier than before, the return of economic activity – specifically tourism – and the pressures on ecosystems that it brings – will need to be managed in such a way as to ensure the needs of local communities are met at the same time ecosystem conservation is maximised.

The window of opportunity to review our approach to tourism will close soon unless action is taken to address the need for change. The trends highlighted by a Tourism Malaysia study that indicate changes in tourism preferences need to be reviewed and taken into account in tourism planning – and marine ecosystem management. The move away from mass tourism to niche tourism offers opportunities to protect both ecosystems *and* communities, both of which can be negatively affected by tourism. Providing opportunities for stakeholders to participate in management, and building resilience will contribute to economic growth and healthier and more productive ecosystems.

We encourage the Department of Fisheries Malaysia to bring stakeholders together to discuss these challenges and derive solutions that benefit all.

Acknowledgements

Reef Check Malaysia cannot work in isolation and we partner with government and the private sector.

We are grateful to Department of Fisheries Malaysia for taking the responsibility to carry out Reef Check surveys at some Marine Parks and non-Marine Parks islands.

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

We are grateful to Ministry of Tourism, Culture and Environment Sabah for funding Reef Check surveys at many islands in Sabah.

Reef Check Malaysia cannot work in isolation and we continue to maintain a close working relationship with the DoFM 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 2022 survey programme and conservation efforts:

In addition, we work with our:

Board of Trustees who provides advice on governance and fund raising

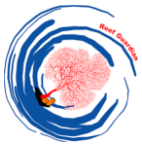
- Lim Jit Cheng
- Kevin Hiew
- Ruth Yeoh
- Datuk Hiswani Harun

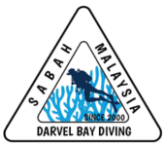
Scientific Advisory Council to ensure our work is scientifically robust

- 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.

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- Abdul Ajis Bin Taib
- Ibrahim bin Ajak
- Wan Ruzzainie Bin Wan Arman
- Dyg Amira Fithriyaani
- Ian Levi Jackery
- Karim Anak Jampong
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- Muhamad Maziz Bin Hamzah
- Asyraf Bin Md. Shah
- Ahmad Khairul Syafiq Bin Ahmad Rahim
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- Abu Abdul Rashid Bin Ali
- Mohd Atif bin Salimon
- Yusri bin Mohamed Noor
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- Mohd Alzam Mohd Affandy
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- Abdul Jalil Mapait
- Mohd Nara bin Hj Ahmad
- Tengku Husin Tengku Kadir
- Hidayah Halid
- Aimi Osman
- Sharuhuzilla bin Ngah
- Izarenah binti Md Repin
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- Tuan Muhd Arif
- Tan Cheng Mei
- Atikah Abdullah
- Ghazali Abu Bakar
- Kamal
- Zaki
- Muhammad
- Quek Yew Aun
- Nazmi
- Normah
- Achier Chung
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- Rudy Agansai
- Muhammad Shaleh Bin Bural
- Rashidi Bin Alpasain
- Muhammad Addin bin Mazni
- Moksidi Pistino
- Claudius Jalani
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- Mohd Fairus
- Farid Aris
- Ali Mara
- Rizan Jonggi
- Juneidy Bahai
- Mohd Yusof bin Bural

Appendix 1: Survey Sites

Site Name (Sunda Shelf)	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 Bulan	Lang Tengah	5 47.807 N 102 53.978 E
Broler North	Lang Tengah	5 48.149 N 102 53.613 E
Summer Bay House Reef	Lang Tengah	5 47.666 N 102 53.531 E
Tanjung Telunjuk	Lang Tengah	5 47.251 N 102 54.146 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
Site 1	Rhu	5 49.949 N 102 36.595 E
Site 2	Rhu	5 49.551 N 102 36.777E
Site 3	Rhu	5 49.829 N 102 36.961 E
Site 4	Rhu	5 49.592 N 102 36.910 E
Site 5	Rhu	5 49.582 N 102 36.661 E
Site 6	Rhu	5 49.752 N 102 36.515 E
Site 7	Rhu	5 49.958 N 102 36.725 E
Site 8	Rhu	5 49.945 N 102 36.877 E
Site 9	Rhu	5 49.706 N 102 36.985 E
Site 10	Rhu	5 49.871 N 102 36.527 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
Teluk Rajawali	Tenggol	4 48.931 N 103 40.824 E
Turtle Point	Tenggol	4 48.364 N 103 40.468 E
Atlantis Bay	Aur/Dayang	2 28.271 N 104 30.633 E
P. 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
Mirage	Besar	2 25.823 N 103 58.718 E
Palenting	Besar	2 27.408 N 103 58.298 E
Rapang	Besar	2 27.503 N 203 58.758 E
Teluk Buluh	Besar	2 26.543 N 103 58.385 E
Teluk Kalih	Besar	2 25.398 N 103 59.410 E
Teluk Meriam	Besar	2 26.672 N 103 59.309 E
Teluk Meriam South	Besar	2 26.127 N 103 59.610 E
Transect 1	Gual	2 31.964 N 103 58.128 E
Transect 2	Gual	2 32.106 N 103 58.093 E
Transect 3	Gual	2 32.252 N 103 58.105 E
Transect 4	Gual	2 32.205 N 103 58.198 E
Transect 5	Gual	2 32.096 N 103 58.235 E
Transect 6	Gual	2 31.988 N 103 58.198 E

Transect 7	Gual	2 31.807 N 103 58.241 E
Transect 8	Gual	2 31.745 N 103 58.282 E
Transect 9	Gual	2 31.894 N 103 58.280 E
Transect 1	Harimau	2 33.512 N 103 56.825 E
Transect 2	Harimau	2 33.460 N 103 56.705 E
Transect 3	Harimau	2 33.510 N 103 56.540 E
Transect 4	Harimau	2 33.625 N 103 56.462 E
Transect 5	Harimau	2 33.673 N 103 56.567 E
Transect 6	Harimau	2 33.650 N 103 56.775 E
Transect 7	Harimau	2 33.634 N 103 56.861 E
Transect 1	Hujung	2 29.326 N 103 56.964 E
Transect 2	Hujung	2 29.745 N 103 56.850 E
Transect 3	Hujung	2 29.549 N 103 56.824 E
Transect 4	Hujung	2 29.705 N 103 57.001 E
Transect 5	Hujung	2 29.627 N 103 57.259 E
Transect 6	Hujung	2 29.440 N 103 57.343 E
Transect 7	Hujung	2 29.214 N 103 57.316 E
Transect 8	Hujung	2 29.183 N 103 57.133 E
Transect 9	Hujung	2 29.009 N 103 57.367 E
P. Lima	Lima	2 13.099 N 104 08.990 E
Tokong Sanggul	Lima	2 13.377 N 104 08.082 E
Transect 1	Mensirip	2 32.865 N 103 57.701 E
Transect 2	Mensirip	2 32.914 N 103 57.602 E
Transect 3	Mensirip	2 32.995 N 103 57.497 E
Transect 4	Mensirip	2 33.093 N 103 57.505 E
Transect 5	Mensirip	2 33.195 N 103 57.488 E
Transect 6	Mensirip	2 33.147 N 103 57.619 E
Transect 7	Mensirip	2 32.977 N 103 57.685 E
Mertang Barat	Mertang	2 39.194 N 103 52.755 E
Mertang Tengah	Mertang	2 39.152 N 103 52.983 E
Mertang Timur	Mertang	2 38.886 N 103 53.216 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
Transect 1	Rawa	2 31.112 N 103 58.490 E
Transect 2	Rawa	2 31.331 N 103 58.406 E
Transect 3	Rawa	2 31.514 N 103 58.343 E
Transect 4	Rawa	2 31.464 N 103 58.455 E
Transect 5	Rawa	2 31.295 N 103 58.626 E
Transect 6	Rawa	2 31.067 N 103 58.702 E
Transect 7	Rawa	2 30.934 N 103 58.651 E
Transect 8	Rawa	2 30.848 N 103 58.626 E
Transect 9	Rawa	2 31.668 N 103 58.321 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
Northern Reef	Tengah	2 28.754 N 103 57.377 E
Lagoon Bay Reef	Tengah	2 28.855 N 103 57.375 E
Mangrove Island	Tengah	2 28.904 N 103 57.551 E
Turtle Beach	Tengah	2 28.878 N 103 57.676 E
Shingle Beach	Tengah	2 28.776 N 103 57.818 E
Malang Tedung	Tengah	2 28.672 N 103 57.992 E
Rocky Viewpoint	Tengah	2 28.561 N 103 57.922 E
Tiny Beach	Tengah	2 28.416 N 103 57.869 E
Sunrise Beach	Tengah	2 28.378 N 103 57.767 E
Junior Reef	Tengah	2 28.365 N 103 57.582 E
Northern Reef Deep	Tengah	2 28.907 N 103 57.341 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
Eve's Garden	Miri	4 20.567 N 113 53.892 E
Siwa Penyu	Miri	4 16.575 N 113 48.998 E
Sunday Reef	Miri	4 17.226 N 113 49.173 E
New Reef	Miri	4 17.767 N 113 51.231 E

Site Name (Malacca Strait)	Island	Coordinate
Coral Garden	Payar	6 03.371 N 100 02.157 E
Kaca	Payar	6 04.389 N 100 03.444 E
Langkawi Coral	Payar	6 03.951 N 100 02.606 E
Lembu	Payar	6 04.293 N 100 03.067 E
Singapore Bay	Payar	6 03.639 N 100 02.472 E
Singa	Pulau Singa	6 13.489 N 99 44.636 E
Pangkor Laut	Pangkor Laut	4 11.393 N 100 32.899 E
Pasir Tengkorak, P. Lalang	Sembilan	4 00.162 N 100 32.802 E
Site 1, P.Saga	Sembilan	4 00.732 N 100 32.694 E
Site 2, P. Lalang	Sembilan	4 00.099 N 100 32.945 E
Site 2, P. Rumbia	Sembilan	4 01.344 N 100 32.874 E
Zoanthid Garden, P. Rumbia	Sembilan	4 01.926 N 100 33.000 E
P. Buluh	Sembilan	3 59.650 N 100 32.048 E
Anemone Garden, P. Saji	Sembilan	4 00.390N 100 32.088 E
Frogfish, P. Nipis	Sembilan	4 03.450 N 100 32.382 E
Rock Garden, P. Saji	Sembilan	4 00.684 N 100 32.106 E
Pantai Labuan	Malacca	2 06.546 N 102 19.357 E
Pulau Undan 1	Malacca	2 02.944 N 102 20.021 E
Undan Jetty	Malacca	2 02.869 N 102 20.119 E
Pulau Nangka	Malacca	2 04.483 N 102 20.017 E
Pulau Dodol	Malacca	2 04.933 N 102 19.983 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

Site Name (North Borneo)	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
Amoi Cantik	Labuan	05 11.460 N 115 08.142 E
Boya Jo	Labuan	05 12.112 N 115 08.558 E
Takat Kuda	Labuan	05 11.475 N 115 08.510 E
Tanjung Pasuan	Labuan	N 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 Eye	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
Bimbo Rock	Lankayan	6 31.240 N 117 55.763 E
Edwin Rock	Lankayan	6 30.806 N 117 55.499 E
Froggie Fort	Lankayan	6 30.806 N 117 54.337 E
Goby Rock	Lankayan	6 28.745 N 117 53.448 E
Jawfish Lair	Lankayan	6 29.182 N 117 54.670 E
Ken's Rock	Lankayan	6 30.393 N 117 55.651 E
Lycia Garden	Lankayan	6 29.895 N 117 55.634 E
Mel's Rock	Lankayan	6 29.140 N 117 53.584 E
Moray Reef	Lankayan	6 33.125 N 117 56.141 E
Pegaso Reef	Lankayan	6 33.726 N 117 55.210 E
Reef 38	Lankayan	6 32.619 N 117 55.201 E
Reef 77	Lankayan	6 33.124 N 117 55.482 E
Sandbar South	Lankayan	6 29.900 N 117 54.681 E
Veron's Fan Garden	Lankayan	6 31.259 N 117 54.944 E
Zorro	Lankayan	6 30.470 N 117 55.218 E
Kampung Point	Larapan	4 33.319 N 118 35.396 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
Mid Reef	Pulau Penyu	6 10.402 N 118 04.287 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
Balundangan Kecil	Tun Mustapha Park	7 21.045 N 117 21.140 E
Batu Sirih	Tun Mustapha Park	7 11.403 N 116 52.805 E
Belaruan	Tun Mustapha Park	7 02.075 N 117 00.187 E
Fairway Shoal 1	Tun Mustapha Park	7 07.155 N 117 30.555 E
Fairway Shoal 2	Tun Mustapha Park	7 07.119 N 117 30.458 E
Inderason	Tun Mustapha Park	6 46.560 N 116 36.969 E
Lubani Rock 1	Tun Mustapha Park	6 53.152 N 117 22.949 E
Lubani Rock 2	Tun Mustapha Park	6 53.698 N 117 22.338 E
Maliangin Besar 1	Tun Mustapha Park	7 05.563 N 117 01.547 E
Maliangin Besar 6	Tun Mustapha Park	7 04.880 N 117 03.267 E
Pancang Pukul	Tun Mustapha Park	7 02.027 N 117 04.408 E
Pulau 3	Tun Mustapha Park	7 21.380 N 117 03.283 E
Pulau Mati	Tun Mustapha Park	7 04.877 N 117 14.872 E
Sibaliu North	Tun Mustapha Park	7 11.390 N 117 22.213 E
Sibogo	Tun Mustapha Park	7 13.974 N 117 23.099 E
Simpang Mengayau	Tun Mustapha Park	7 02.966 N 116 44.665 E
Straggler Reef	Tun Mustapha Park	7 02.632 N 117 27.910 E
Tampakan	Tun Mustapha Park	6 51.651 N 116 51.681 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