Detailed Profiling of the Coral Reefs in Pulau Aur, Johor Darul Takzim

Zulfigar Yasin & Aileen Tan Shau-Hwai

School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia

ABSTRACT

Detailed profiling has been made on the coral reefs of Pulau Aur, Johor Darul Takzim, using SCUBA diving and underwater photography. Thirteen locations were surveyed around the island, which comprised of Pulau Aur, Pulau Dayang, Pulau Lang and Pulau Pinang. Cross-sections of the reef profiles for survey locations are presented in this paper.

Keywords: Coral reef profiling; Pulau Aur

Introduction

The geographical location of Malaysia is in the centre of the Indo-West Pacific Region, a region with rich biodiversity. This region is considered to have the richest species diversity of marine life in the world (Briggs, 1974). The coral reef of this region is considered to have the greatest species assemblage in the world. However, very limited studies have been conducted on the coral reefs of this region. Several researchers have provided descriptions and ecological information on the following reef areas; the east coast reefs of Peninsular Malaysia (Sheppard and Wells, 1988), the Straits of Malacca (Pillai and Scheer, 1974), Kapas Island (De Silva et al., 1984), Tioman group of islands (Pillai and Scheer, 1974), Redang Island (Ibrahim and Sidik, 1992; 1993; Kushairi, 1998) and Bidong Islands (Mohd. Zaki et al., 1999). However, to date, no detailed report has been carried out on the coral reefs of the southern islands of Peninsular Malaysia.

Pulau Aur is the outermost island amongst the islands located on the southeast of Peninsular Malaysia, approximately 67km offshore from the town of Mersing, Johor. It is located at the co-ordinates 2^{o} 28'N and 104^{o} 30'E in the South China Sea. It comprises several islands namely Pulau Aur, Pulau Dayang, Pulau Pinang and Pulau Lang. A large part of the island is rocky and covered by tropical rain forest and isolated coconut plantations. The main island is bordered by fringing reefs and the intertidal habitats are made up of rocks, patches of mangroves as well as sandy shores.

The ecological assessment study carried out by Wetlands International showed that Pulau Aur has a rich marine biodiversity, with 114 coral species and 180 reef- associated

fish species. Out of these, four hard corals and 13 fish species are new records to Malaysia. Pulau Aur remains in a relatively pristine nature due to low human population pressures and small-scale tourism development.

There have been several studies done on the marine macrobenthic fauna of the Pulau Aur group of islands, for example the study on the diversity of sea cucumbers (Zulfigar et al., 2007) and giant clams (Tan, 2001), but till today, no description of the coral reefs of Pulau Aur has been published. Therefore, this paper attempts to provide a detailed profiling of the coral reef in Pulau Aur, Johor.

Materials and Methods

Thirteen locations were surveyed in Pulau Aur from 5 September to 12 September 2005. Table 1 and Figure 1 show the locations of the sampling sites. The survey was conducted using scuba diving, and underwater photographs were taken. A detailed profile of the coral reefs at Pulau Aur is given. It aims to provide a reef profile and the underwater features of the main reef areas around the islands. The specific features on a particular dive location may differ slightly, but the profiles summarised the reef characteristics concerned based on the many scientific surveys of the area.

Results and Discussion

The location of the coral reefs are given in Figure 2 with the reef types described in Table 2. Below is a detailed description of each of the island in the Pulau Aur group.

Pulau Aur

Pulau Aur is the main island in the group. It has the largest area of reefs, which surround most of the islands. These reefs are exposed to both the Northeast and Southwest monsoon – the latter bearing the more extensive reef areas.

Although the coral cover on this island is wide, the reef is experiencing the negative impact of human development, with alga beds sometimes smother the coral and cover the bottom.

On exposed areas (on the north and northeast) of the island where monsoonal waves hit the coast – coral development in the shallow areas is stunted. In the south and southeast area where there are extensive subtidal reef flats pockets of good reefs remain (Figure 3). However, crown-of-torn infestations has taken its toll on the hard corals in recent years where extensive colonies of the staghorn corals have been destroyed. Reefs at Teluk Kador (Figure 4) on the north point of the island contain pockets of high diversity areas.

TABLE 1: The Latitude and Longitude of the Sampling Locations in Pulau Aur Group, Johor Darul Takzim

Code	Location name	Latitude	Longitude	Max. dive depth (m)
D1	Pulau Dayang (Northwest)	2º 28'54.0" N	104º 29'55.8" E	12.7
D2	Pulau Dayang (North)	2º 28'43.5" N	104º 30'11.8" E	12.0
D3	Pulau Dayang – Rayner's Rock	2º 28'55.0" N	104º 30'20.9" E	18.4
D4	Pulau Dayang (North) – Teluk Jawa	2º 28'42.2" N	104º 30'15.3" E	11.0
D5	Pulau Aur (North)	2º 28'20.2" N	104º 30'42.3" E	11.9
D6	Pulau Aur (North) – Teluk Kador	2º 28'19.4" N	104º 30'46.8" E	11.6
D7	Pulau Aur (East)	2º 27'32.4" N	104º 31'49.2" E	12.0
D8	Pulau Pinang (West) – Tanjong Bercium	2º 26'17.6" N	104º 32'38.6" E	24.4
D9	Pulau Pinang (West)	2º 26'17.6" N	104º 32'38.6" E	19.6
D10	Pulau Pinang (Southwest)	2º 28'02.2" N	104º 32'39.3" E	18.5
D11	Pulau Pinang – Pinnacles 1	2º 25'09.0" N	104º 31'59.9" E	18.4
D12	Pulau Aur (Southwest) – Teluk Dalam to Tanjong Jongkar	2º 26'03.7" N	104º 30'42.6" E	18.0
D13	Pulau Lang -Tanjong Lang	2º 27'39.9" N	104º 29'08.1" E	9.5

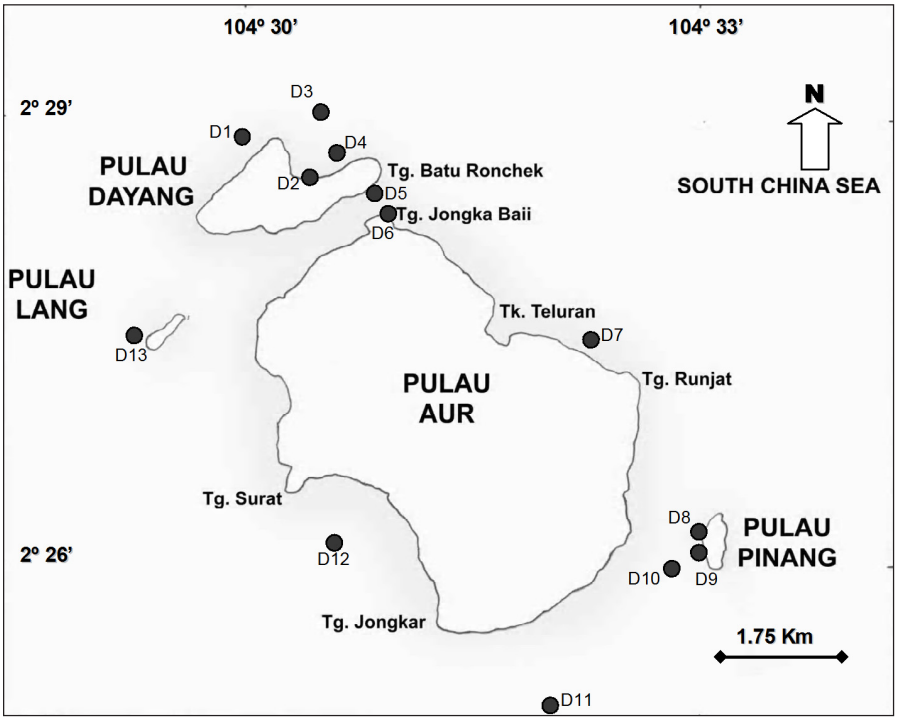

FIGURE 1: The Sampling Locations in the Pulau Aur group, Johor Darul Takzim

TABLE 2: The Reef Types Commonly Found at Pulau Aur

Reef Type	Location	Description
Fringing reef	• Pulau Dayang (North) • Pulau Dayang (North): Teluk Jawa • Pulau Aur (North): Teluk Kadar • Pulau Aur (Southwest): Teluk Dalam to Tanjong Jongkar	Most of these reefs lie close to the sandy beaches and at the centre of bays on the islands. They fringe the shores that gradually slope to the sea and typify most of the reefs at Pulau Aur. A typical cross section of the reef can be describes as an expanse of reef flat that lies in the intertidal zone adjacent to the shoreline. This then gradually slopes to the reef edge where the gradient becomes steeper. At the bottom of the slope is usually sand. The richest coral area is found near the reef edges.
Escarpment reef	• Pulau Lang: Tanjong Lang • Pulau Aur (East) • Pulau Aur (North) • Pulau Pinang (West): Tanjong Bercium • Pulau Pinang • Pulau Dayang: Rayner's Rock	These reefs are found next to steep rocky outcrops. The outcrops often extend below the waters surface. These escarpment reefs may also form on the rocky outcrops away from the main islands such as at Rayner's rock near Pulau Dayang. Here encrustations of corals form on the submerged substrates. Areas protected from high wave impacts usually harbour the larger and elaborate coral colonies. Below this zone soft corals may predominate.
Submerged reef	• Pulau Pinang: Pinnacles 1 • Pulau Pinang (Southwest)	Several reefs at Pulau Aur lie away from the islands and form submerged reefs. These are associated with rock formations that lie below the sea surface. The location of these reefs is sometimes marked by fishermen or divers and these peaks can sometimes be observed from the surface where sporadic colonies of hard corals predominate. In the shaded and deeper locations gorgonian sea fans and soft corals form the main fauna. These reefs are often subjected to strong current.
Patch reefs		Interspersed throughout the island group are patch reefs. These are exemplified by coral rubble and coralline algae that are cemented together and form the main substrate. The reefs form patches that may lie in shallow as well as deeper waters that determine the presence of hard corals in the area. Patch reefs harbour their special kind of fauna. Where algal and soft coral patches are common, higher densities of the nudibranch mollusc are usually present.

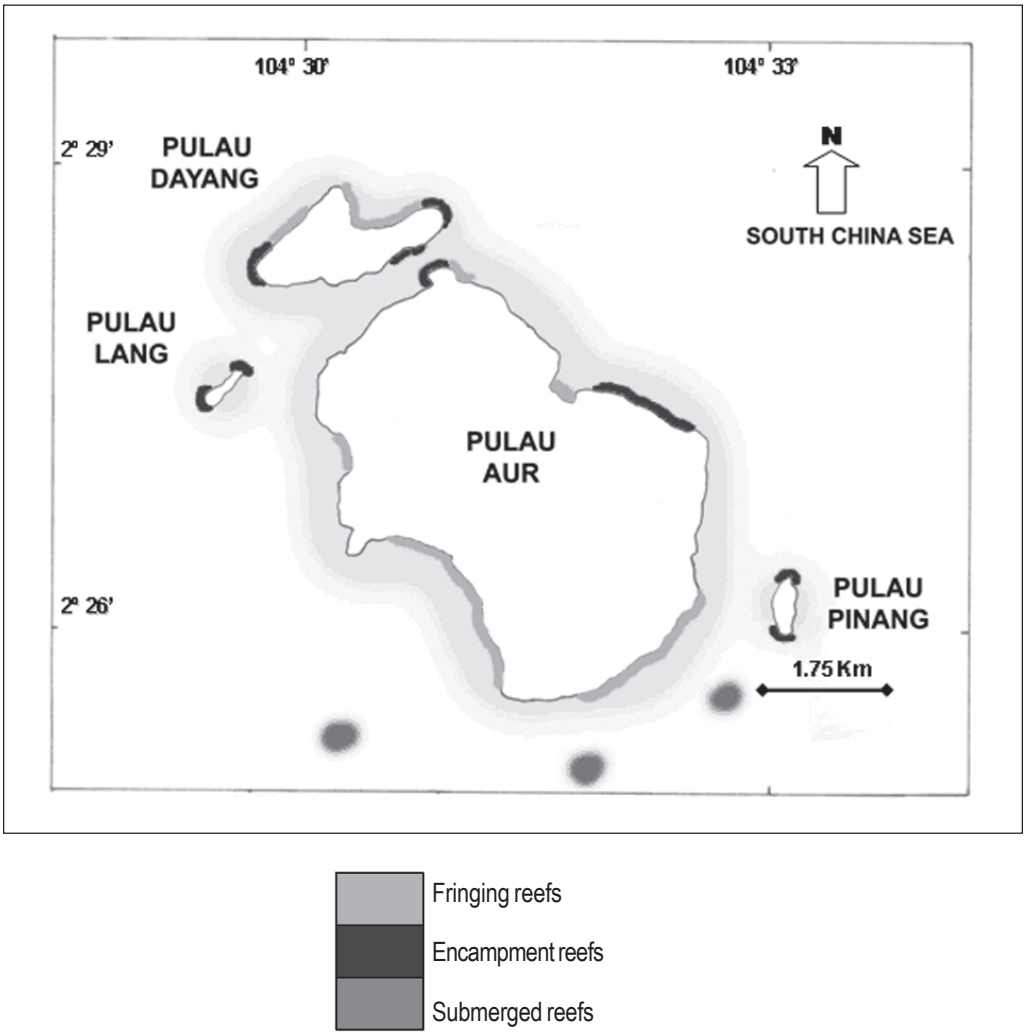

FIGURE 2: Location and Types of Coral Reefs in the Pulau Aur group, Johor Darul Takzim

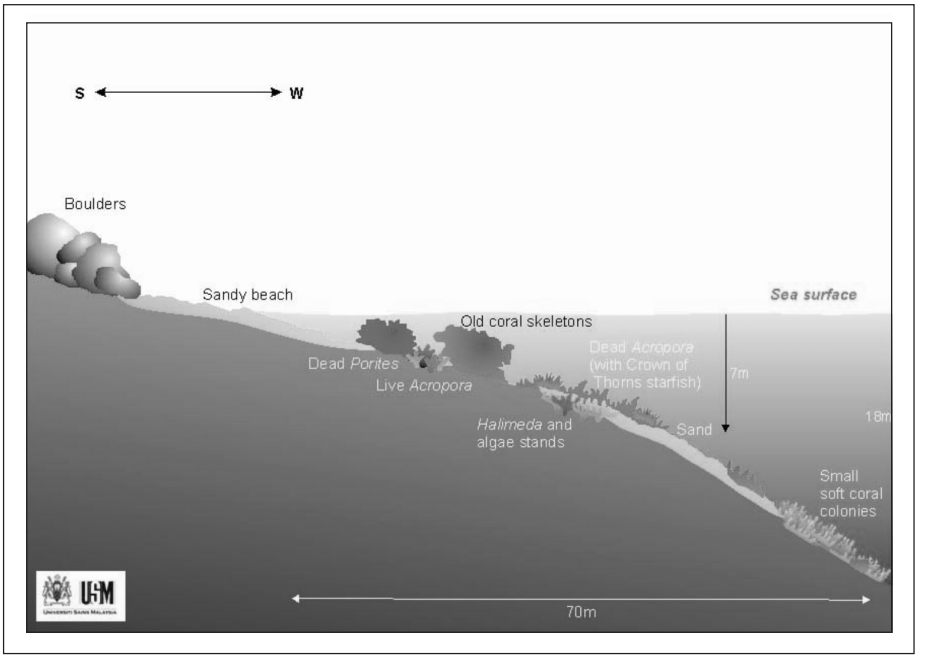

FIGURE 3: Teluk Dalam – Tanjung Jongkar

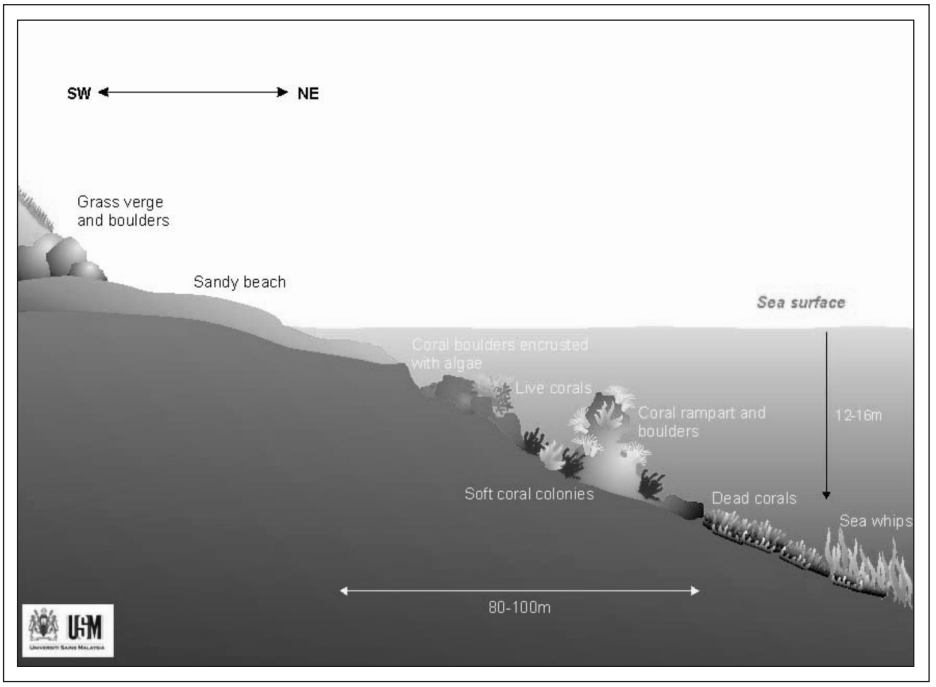

FIGURE 4: Pulau Aur – Teluk Kador

Pulau Dayang

Pulau Dayang is located to the north of Pulau Aur. It is the second largest island of the group and separated by narrow straits. Within the straits, the water current can be strong especially during the spring tides. The reef is characterised by beds of soft corals, sea anemones and some gorgonian sea fans on the slope. Reef development is poor except within some areas that lie between large granite boulders.

The reef is more developed on the north coast of Pulau Dayang, especially within the large bay area of Teluk Jawa (Figure 5). Here the sloping terrestrial granite slopes replace the sandy beaches that are found within the straits. Below the water line, hard corals colonise the shallow waters with the encrusting varieties forming the dominant coral types. In deeper waters, there is a slow replacement by encrusting hard corals and the soft coral species. Beyond these are coral rubble and sand before the reef slopes into deeper waters.

At the western entrance of the straits are a group of rocky outcrops locally known as 'Batu Rakit' or Rayner's rock. Hard coral colonies are represented by the boulder species of *Porites* that in turn form the base for other encrusting corals (Figure 6). Numerous colonies of soft corals, especially from the genus *Nepthya* are common on the sides of boulders and small caves. Tabulate *Acropora* is also found in the area. Coral rubble and debris accumulate at the base of these rocks.

Pulau Lang

Pulau Lang is the smallest island in the Aur group. It lies to the west of the main island. It too is a granite outcrop elongated in a northeast to southwest direction. All the reefs on this island can be classified as escarpment reefs which slope steeply to the sea bottom. Stunted hard coral colonies are found in the shallower areas with sporadic growth on the shoulders of the submerged granitic rocks (Figure 7). Below these, soft corals and sponges can be found interspersed with the more dominant encrusting corals and coralline rubble. The island itself is exposed to the southwest monsoon and reef development is relatively poor.

Pulau Pinang

Pulau Pinang lies to the west of Pulau Aur in a north to south direction. It is a steep granite outcrop that extends below the water's surface. The rocky outcrop is covered with coconut palms and the *Pandanus* fronds. Most of the well developed coral colonies lie at the north and south point of the island, but this well developed colonies are limited to a narrow band of between 10-20 metres (Figure 8). This zone is shared by soft corals and gorgonians. Encrusting species of the hard corals – *Acropora* and *Pocillopora* are common. Deeper still (beyond 20 metres) hard corals only form small individual colonies. Here, relatively dense stands of the sea whips *Juncella* spp. predominate. Pulau Pinang is subjected to strong underwater current, but the rich underwater life found here makes the reef the most diverse site encountered within the Pulau Aur group.

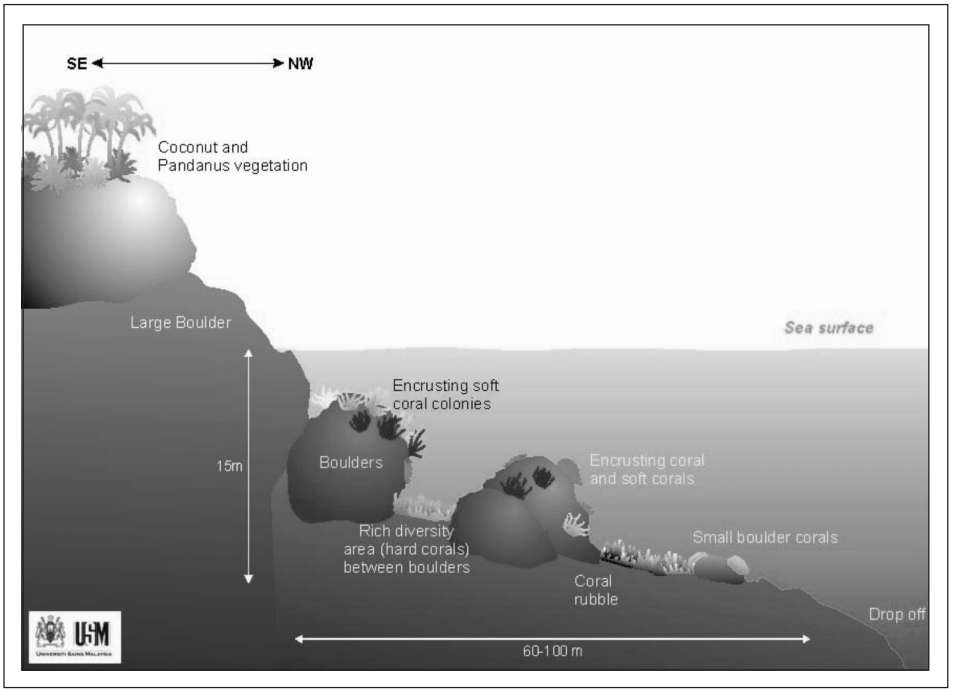

FIGURE 5: Pulau Dayang (North-West) – Teluk Jawa

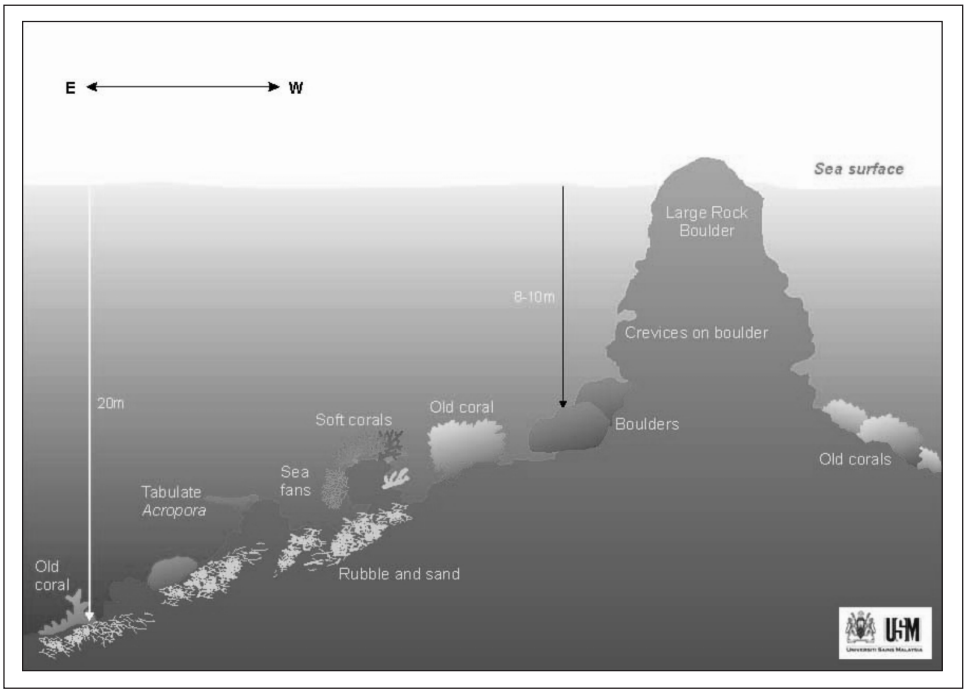

FIGURE 6: Pulau Dayang – Batu Rakit

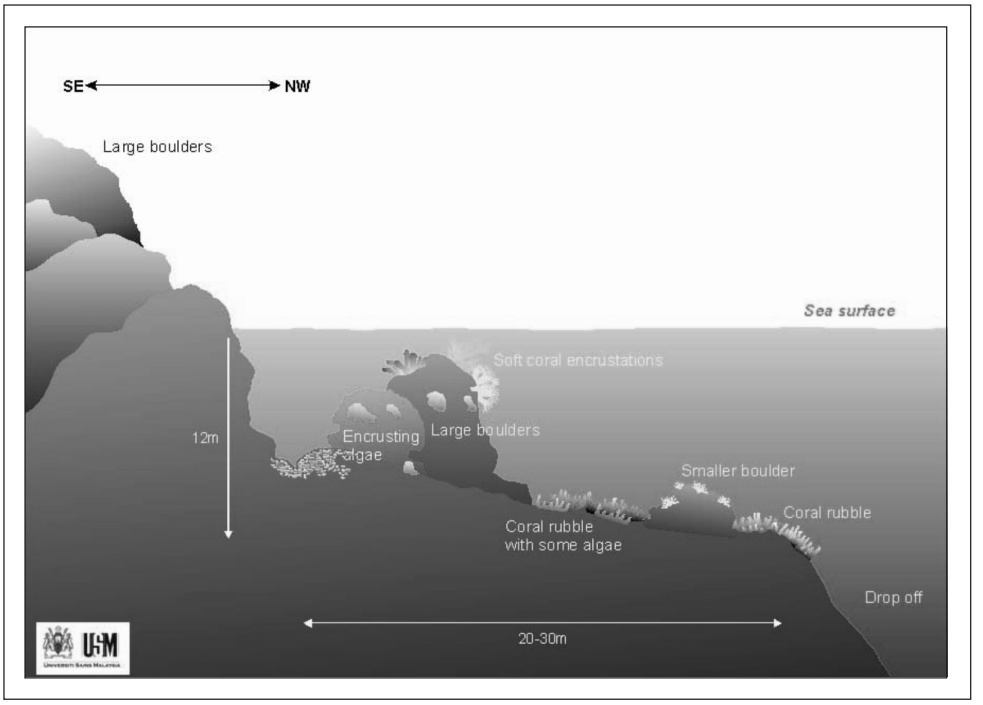

FIGURE 7: Pulau Lang (North) – Tanjung Letak Pari

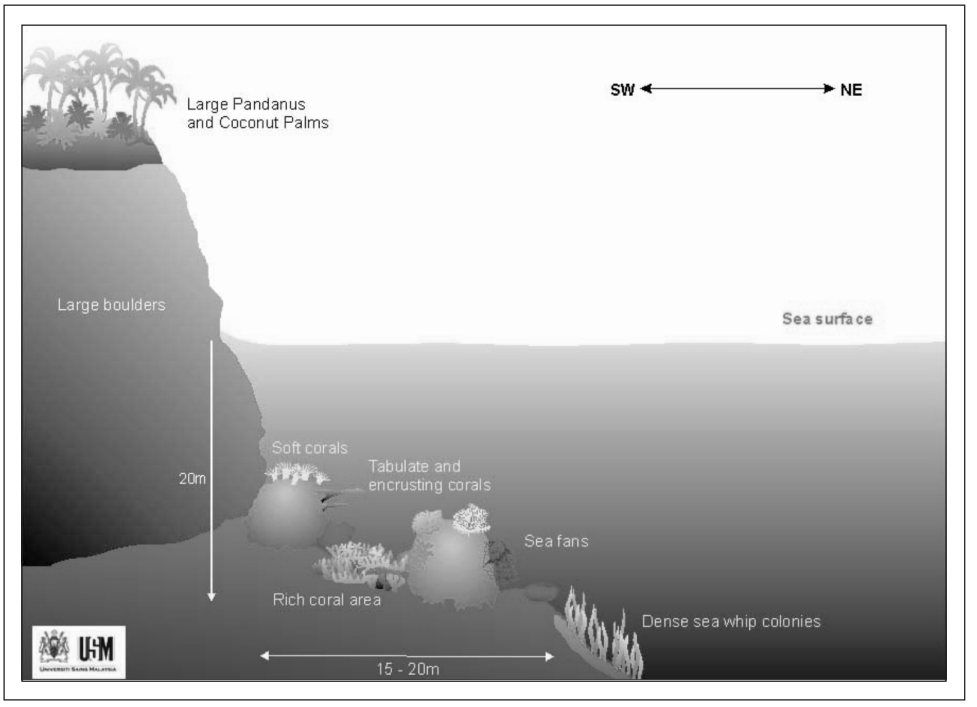

FIGURE 8: Pulau Pinang – Tanjung Batu Bercium

Rocky Outcrops and Submerged Reefs

South of Pulau Aur are several submerged reefs known as 'the Pinnacles' to the local diving community. These are boulder formations whose top lies below the waters surface. They are usually marked by fishermen or diving buoys. The top of 'the Pinnacles' does not support high coral cover with the occasional tabulate *Acropora* and encrusting species *Porites* and brain corals (Figure 9). Light levels are too low to maintain the development of dense coral colonies; instead, soft corals and sea fans predominate. Some of the sea fan colonies are more than 2 metres across. Soft corals colonise the crevices on the boulders competing with the stinging hydroids and leather corals. At the base of these structures the main substrate is usually sand and rubble. Sea whips and soft corals predominate as do the benthic fauna such as sea cucumbers and starfishes.

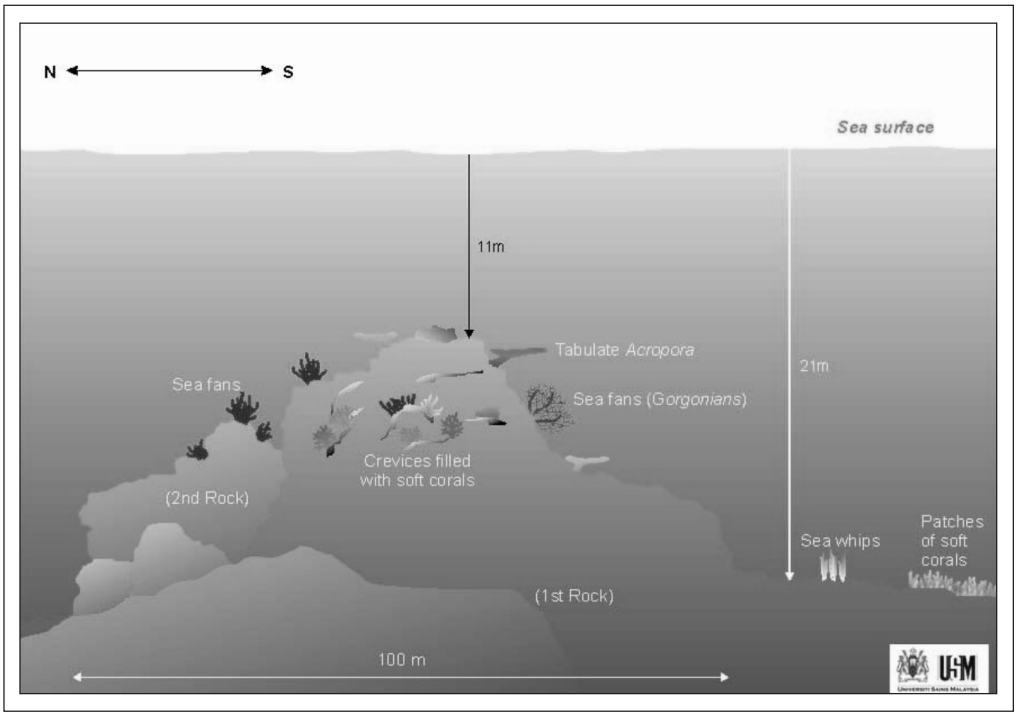

FIGURE 9: The Pinnacles (Pulau Aur)

Conclusion

With a detailed profiling of the coral reefs in Pulau Aur, the roles of the coral reefs in relation to the flora and fauna of Pulau Aur can be analyzed and characterized.

Acknowledgement

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