

STATUS OF CORAL REEF IN FRONT OF SHANGRI-LA TANJUNG ARU
RESORT, KOTA KINABALU, SABAH.

CLEMENT LIEW KET HIN

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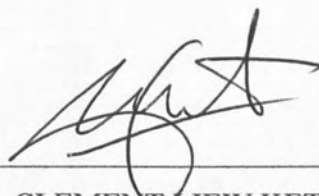
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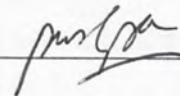
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ABSTRACT

This study was conducted at five stations at Tanjung Aru reef. Status of the reef was assessed using the Reef Check method which comprise of the fish belt transect, invertebrate belt transect, point sampling and coral impacts. A vertical substrate profile was examined by laying a transect-line vertically and the substratum type was recorded using the Line Intercept Transect (LIT) method. Sediment deposition rate was studied by placing two sediment traps at each depth of 4m and 8m where the transect-line was laid. Traps were replaced every 30 days for three months. Collected sediments were further examined using the grain size analysis method. A total of 36 targeted fishes were recorded at 4m and 51 targeted fishes at 8m while the total number of invertebrates recorded at 4m were 83 individuals and there were only 9 individuals at 8m. Out of the five stations surveyed, coral coverage at stations 3 and 5 were good while the other stations were categorised as “fair”. Station 2 had highest degree of coral impacts with a total degree of 7. Fishing activities were the main impacts because fish nets, craters from blast fishing and illegal fishing method were observed in the study area. The mean sediment deposition rate at 4m was $3.98 \pm 0.76 \text{ mg/cm}^2/\text{day}$ while at 8m it was $7.61 \pm 1.72 \text{ mg/cm}^2/\text{day}$. Lowest rate recorded was $2.87 \text{ mg/cm}^2/\text{day}$ in station 1 at 4m and highest was $9.50 \text{ mg/cm}^2/\text{day}$ in station 5 at 8m. The grain size analysis shows that the sediments in the study area are either categorized as “fine” or “very fine silt” according to the Udden-Wentworth (1922) size class scale. It is suggested that Tanjung Aru reef be gazetted into a marine park to prevent overfishing and further damage from both illegal and destructive fishing methods.



STATUS BATU KARANG DI HADAPAN SHANGRI-LA TANJUNG ARU RESORT, KOTA KINABALU, SABAH.

ABSTRAK

Kajian ini dijalankan di lima stesen yang terpilih di kawasan terumbu karang Tanjung Aru. Asas kajian status terumbu karang adalah dengan menggunakan kaedah tinjauan terumbu karang yang meliputi transek ikan, transek invertebrat, kaedah sample bertitik dan impak batu karang. "Vertical substrate profile" diperiksa dengan meletakkan pita transek secara menegak dan jenis substratum direkodkan dengan menggunakan kaedah "Line Intercept Transect". Kadar sedimentasi dikaji dengan menempatkan dua perangkap endapan pada kedalaman 4m dan 8m di mana terletaknya pita transek. Perangkap telah diganti dengan set yang baru setiap 30 hari selama tiga bulan dan bahan endapan yang dikumpul telah dikaji melalui kaedah analisa saiz butiran. Terdapat 36 ikan sasaran yang direkodkan pada 4m dan 51 ikan sasaran pada 8m. Jumlah haiwan invertebrata yang direkod pada 4m ialah 83 individu manakala hanya 9 individu pada 8m. Antara lima stesen ditinjau, liputan terumbu karang di stesen 3 dan 5 adalah baik manakala tiga stesen yang lain dikategori sebagai sederhana. Stesen 2 merekodkan darjah impak batu karang yang tertinggi iaitu 7. Aktiviti perikanan merupakan impak utama di kawasan kajian kerana terdapat banyak jaring ikan, kawah akibat pengeboman ikan dan kaedah perikanan haram telah ditemui di tapak kajian. Min bagi kadar enapan sedimen pada 4m ialah $3.98 \pm 0.76 \text{ mg/cm}^2/\text{hari}$ manakala pada 8m ialah $7.61 \pm 1.72 \text{ mg/cm}^2/\text{hari}$. Kadar terendah yang direkodkan ialah $2.87 \text{ mg/cm}^2/\text{hari}$ di stesen 1 pada 4m dan tertinggi ialah $9.50 \text{ mg/cm}^2/\text{hari}$ di stesen 5 pada 8m. Analisa saiz butiran menunjukkan bahawa enapan di kawasan kajian dikategori sebagai kelodak halus atau sangat halus (Udden-Wentworth, 1922). Adalah dicadangkan bahawa terumbu karang di Tanjung Aru diwartakan sebagai terumbu taman marin untuk mencegah perikanan berlebihan dan kerosakan lanjut daripada kaedah perikanan yang haram dan membinasakan.



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LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
MPAs	Marine Protected Areas
PSA	Particle size analyzer
TARP	Tunku Abdul Rahman Park
LIT	Line Intercept Transect
psu	Practical Salinity Units



CHAPTER 1

INTRODUCTION

1.1 Coral Reef

Coral polyps are classified under the phylum Cnidaria and class Anthozoa. A polyp is made of two layers of cells called epidermis and gastrodermis. All cnidarian polyps have a radially symmetrical cylinder body with an oral opening surrounded by tentacles. The tentacles may be arranged in multiples of six or eight depending on the subclass. Any of the tiny coral polyps are capable of secreting hard calcium carbonate to form a hard skeleton for protection. The skeleton may be perforate (porous) or imperforate (solid) with both of them serving the same purpose, to connect between the polyps. A polyp also has a special tissue called the coenosarc that is able to stretch over the surface of the coral to combine with another same species of polyp. This is how the polyps grow in size. As they grow larger in numbers forming into a colony, they are now called coral. A coral colony may consist of thousands of polyps (Barnes, 1987; Lalli & Parsons, 1995).

A large diverse collection of corals forms a coral reef. Coralline algae help to build a reef by cementing several corals together with compounds of calcium while



other organisms such as molluscs donate their calcareous part of body (Cousteau, 1985; Nyabakken & Bertness, 2005). A coral reef is defined as an ecosystem that comprises of a diverse collection of biological communities interacting with one another and also to the environment itself. Among some of the organisms that are found in a coral reef are Porifera, Polychaeta, Gastropoda, Crustacea, Echinodermata and Pisces.

Generally, reefs are classified into three types. They are the fringing reef, barrier reef and atolls. Fringing reefs are coral reefs that grow in shallow waters extending seaward directly from the shore, bordering the shoreline and surrounding an island. Barrier reefs border shorelines too, but at a greater distance separated from land by a lagoon. These reefs grow continuously and often largely parallel to the coast. If the coral reef continues to grow upwards forming a fringing reef around an island that subsides completely below sea level, the annular reef is called an atoll. Atolls are usually circular or oval, with a lagoon in the center. Atolls can be found in the deep sea as well as on the continental shelf. Emerged reef platform may form one or more islands and the gaps in between the reef provide an access to the central lagoon (Levinton, 1995; Lalli & Parsons, 1995; Sumich, 1996).

Most reefs are found within the 20°C surface isotherm because most Hermatypic (Reef building) corals can tolerate the mean annual water temperature of about 23-25°C. All together there are approximately 6,000 species of Anthozoans in the world, and they are all marine species (Pechenik, 1991). Up to 75% genera and 85% species of corals are distributed in Pacific waters (Wilkinson, 1987). About



32.3% of the world's coral reefs alone are found in Southeast Asia where it is known as the center of biodiversity (Tun *et al.*, 2004).

1.2 Importance of Coral Reefs

1.2.1 Ecological Importance

For an ecosystem that covers less than 1 percent of the Earth's surface, coral reefs provide environmental and economic services to millions of people. Coral reefs are considered as one of the most diverse and precious ecosystem in the world. It has the greatest development of complex symbiotic associations. The gross primary productivity in a reef is estimated to be 1500-5000g C/m²/year, while in the open tropical oceans it is 18-50g C/m²/year (Atkinson, 1992). Even though tropical marine waters have limited nutrients, the productivity is still relatively higher compared to other ecosystems. By providing food and shelter, the habitat supports about 4,000 species of fish and hundreds of other species. It is estimated that there may be 1 to 8 million species of organisms living in and around coral reefs waiting to be discovered. (Reaka-Kudla, 1997).

Half of the world's calcium content that enters the sea is taken up and bound into the reef as calcium carbonate (CaCO₃). Each bound calcium atom requires the incorporation of a molecule carbon dioxide. Therefore, the reef plays an important role in the carbon cycle by removing 700 billion kg of carbon per year. Carbon being a source of greenhouse gas combines with oxygen to form carbon dioxide. Corals on



the other hand assist in reducing the effect of global warming by locking up carbon in its CaCO_3 skeletons.

Coral reefs are also natural breakwaters resisting wave action and preventing erosion of coastline, property damage and loss of life. Reefs also protect highly productive wetlands, ports and harbours and the economies they support. People live near coral reefs in order to gain benefits from its protection and production. In tropical areas, reefs are important for land building, forming islands and altering the continental shorelines (Goreau *et al.*, 1979).

1.2.2 Economic Importance

Coral reefs provide source of protein and source of raw materials for the food industry. These sources have provided economic value in fisheries and food industries. In developing countries, coral reefs contribute about one-quarter of the total fish catch, providing critical food resources for tens of millions of people (Jameson *et al.*, 1995; Bryant *et al.*, 1998).

Coral reef ecosystem also provides benefits for the tourism sector. Healthy reefs in Marine Protected Areas (MPAs) that are restricted to all fishing activities (Maipol, 2001) improves local economy via diving tours, water sports activities, hotels, restaurants and other businesses based in the reef's vicinity. Apart from that, it also reduces the unemployment rate by providing jobs for the locals.



Coral reef is also a source for medicines that can be derived from marine animals and plants. Acyclovir, the first antiviral compound approved for humans were derived from a Caribbean sponge that was used against herpes infections of the skin and nervous system since 1982 (Garrison, 2004). Esteinascidian 743, a derivative of tunicate was found useful in the treatment of skin, breast and lung cancers (Garrison, 2004). A new compound derived from cyanobacteria has been proven to stimulate the immune system of test animals by 225% and cells in culture by 2,000% (Garrison, 2004). This drug may be useful in treating AIDS (Garrison, 2004). In the future, drugs from marine organisms may be the most valuable marine resources.

1.3 Study Site

Kota Kinabalu city is located at the west coast of Sabah. Tanjung Aru (Figure 1.1) is only about 7 km from Kota Kinabalu city center. Tanjung Aru is a small town and is famous for its beach with the abundance of tall casuarinas or Aru trees that grace the shoreline. Tourist and locals come to view the spectacular sunsets. Restaurants and hawker stalls are seen along the beach selling food and drinks. The famous 5-star Shangri La Tanjung Aru Resort offers a variety of water sports for the active visitor. The study area is located in front of this resort.





Figure 1.1 Tanjung Aru in the map of Sabah.

(Source from www.reefbase.org)

1.4 Objectives of Study

The aim of this study was to determine the current status of the reef in the study area.

Simultaneously, it was also to provide information about the reef for future reference.

The specific objectives of this study were:

1. To conduct a baseline study on coral reef status in Tanjung Aru.
2. To determine the sediment deposition rate in the study area.
3. To determine the particle size of sediment in the study area.

1.5 Significance of Study

The reef in Tanjung Aru is not known by many. The reef has not even been named yet. People tend to forget about the reef except for fishermen where they occasionally go there to fish for food. Mr. Bujang, the boatman from UMS who used to fish in Tanjung Aru, stated that destructive tools such as spears, bombs and cyanide have been commonly used on the reef.

As a result of the constant stress from land and water activities, the study area had been proposed to be gazetted as part of the Tunku Abdul Rahman marine park under Sabah Parks in early December 2004 to prevent any further damage to the reef. Unfortunately, no scientific data has been provided. This is because no research has been conducted on the reef previously. It is hoped that by conducting this feasibility study, it will provide baseline data for the reef to be gazetted for protection under Sabah Parks or as “house reefs” of Shangri La Tanjung Aru Resort.

By doing a Reef Check survey on the reef, the current status of the reef can be acquired for further effective management. Managing and restoring the coral reef ecosystem is neither easy nor cheap. Knowing the status and identifying the threats to the reef helps to ease management effectively at a lower cost.

A study on sedimentation rates and particle size serves as a foundation for further calculations (Brown *et al.*, 1994) such as bedload transport rate, sediment transport rate and settling velocity (Soulsby, 1997). Whether sediment input is a threat to the corals in the reef can also be studied. In a detailed study, questions such as



where does the sediment come from, what is the sediment input and how fast is the sediment input can be answered. Answering these questions can aid us in better management of both marine and land activities because no matter what we do on land, will eventually end up into the sea.



CHAPTER 2

LITERATURE REVIEW

2.1 Reef Structure

A reef consists of several zones. However, not all reefs have the typical zonation pattern. The two most significant physical factors determining zonation are water motion and light penetration (Nyabakken & Bertness, 2005). Physical factors are responsible for broad, large-scale zonation patterns while biological interactions like competition, predation and grazing forms a small scale “patchiness” reef. Combinations of both physical and biological factors create a conspicuous zonal pattern. Figure 2.1 shows the coral zonation on a typical reef.

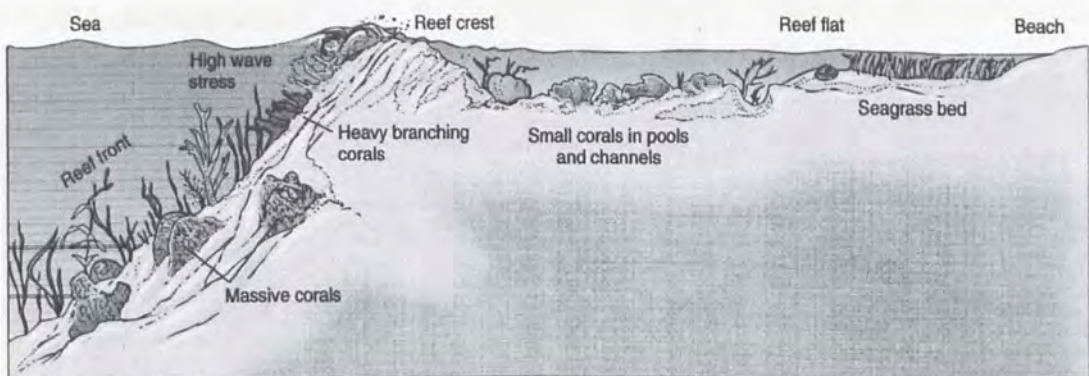


Figure 2.1 Coral zonation of a typical reef.

(Source from Karleskint *et al.*, 2006)



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