AN ASSESSMENT OF THE CORAL REEF, SEAGRASS AND SEAWEED BEDS AT GAYANA ECO RESORT, GAYA ISLAND, SABAH.

TAN LE PING

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ABSTRACT

This study was conducted at Gayana Eco Resort (06°00'46.84''N, 116°02'59.07''E) located in the Malohom Bay of Gaya Island. Snorkeling and diving surveys were carried out to determine the major marine ecosystems in the study area. Coral reefs and seaweed ecosystems were determined to be the major marine ecosystems. An assessment on the status of coral reefs of 3 sites were selected for Reefcheck survey which comprised of the fish belt transect, invertebrate belt transect, point sampling and coral impacts. The seagrass and seaweed beds percentage coverage surveys were done according to the Line Transect and Quadrat method. There were 6 stations selected for the survey. The data collected from all the surveys were mapped to show the distributions of coral reefs, seagrass and seaweed bed of the study area. The total indicator fishes recorded in the study area were 41 individuals and 53 individuals in the shallow and mid reef respectively. While, there were 281 individuals of invertebrates recorded at the shallow reef and 9 individuals from the mid reef. In addition, the percentage of hard coral cover in the study site was categoried under poor condition which was less than 25%. Moreover, the study area was recorded with high degree of coral impacts which due to the general trashes and others factors. Besides that, there was fishing activities observed during the survey. *Halodule sp.* and *Enhalus sp.* were the two species of seagrass determined within the study sites. But only *Halodule sp.* was found in the quadrate of the survey with the percentage cover of 8.65%. On the other hand, *Sargassum sp., Turbinaria sp., Padina sp. and Halimeda sp.* were the four species of seaweeds that found in the area. The total percentage of seaweed coverage in the study site was 21.73%. Lastly, the collected data was put into map to show the spatial extent of the coral reefs, seagrass and seaweed beds of the study area.

STATUS BATU KARANG, RUMPUT LAUT DAN RUMPAI LAUT DALAM LINGKUNGAN KAWASAN GAYANA ECO RESORT, PULAU GAYA, SABAH.

ABSTRAK

Kajian ini dijalankan di Gayana Eco Resort (06°00'46.84''N, 116°02'59.07''E) yang terletak di Teluk Malohom, Pulau Gaya. Aktiviti menyelam dan berenang dengan snorkel dijalankan bagi menentukan majoriti ekosistem air laut yang terdapat dalam lingkungan kawasan kajian. Terumbu karang dan rumpai laut didapati merupakan ekosistem majoriti di tempat kajian . Kajian tentang status terumbu karang dijalankan dengan menggunakan kaedah "Reefcheck" yang meliputi transek ikan, transek invertebrat, kaedah sample bertitik dan impak batu karang. Tiga stesen terpilih dijalankan tinjauan "Reefcheck". Kajian atas kadar liputan bagi rumput laut dan rumpai laut dijalankan berasaskan kaedah pita transek dan kuadrat. Enam stesen dipilih untuk menjalankan tinjaun tersebut. Terdapat 41 ekor dan 53 ekor ikan sasaran masing-masing direkodkan di kawasan cetek dan kawasan dalam . Di samping itu, 281 individu dan 9 individu bagi haiwan invertebrate masing-masing dijumpai di kawasan cetek dan dalam juga. Terumbu karang di kawasan kajian dicategorikan sebagai lemah disebabkan peratusan liputannya yang kurang daripada 25%. Darjah impak bagi batu karang di kawasan kajian adalah tinggi disebabkan wujudnya sampah sarap yang banyak dan faktor lain. Manakala, akitiviti menangkap ikan ditemui semasa menjalankan kajian .Dua spesis rumput laut iaitu *Halodule sp.* dan *Enhalus sp.* dijumpai di kawasan kajian. Tetapi hanya *Halodule sp.* direkodkan bagi kajian peratusan litupan atas sebab *Enhalus sp.*tidak dijumpai dalam stesyen kajian bagi kaedah pita transek dan kuadrat. Peratusan litupan bagi rumput laut *(Halodule sp.)* adalah sebanyak 8.65% . Selain itu, empat spesis rumpai laut yang dijumpai ialah *Sargassum sp. , Turbinaria sp., Padina sp.* dan *Halimeda sp.* Jumlah peratusan litupan bagi rumpai laut adalah sebanyak 21.73%. Selepas kajian tersebut, data yang dikumpul dan diplotkan dalam peta kawasan kajian yang menunjukkan taburan bagi terumbu karang, rumput laut dan rumpai laut .

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LIST OF ABREVIATIONS

ASEAN	Association of Southeast Asian Nations
TARP	Tunku Abdul Rahman Park
GER	Gayana Eco Resort
MERC	Marine Ecology Research Center

CHAPTER 1

INTRODUCTION

1.1 Major Marine Ecosystems in Sabah

Malaysia is a country with diverse marine ecosystems with 4800 km of beaches and 1007 offshore islands (Musa, 2003). These marine ecosystems are found along the countries' coastlines and islands in the territorial waters and also Exclusive Economic Zone. Coral reefs, seagrass beds and mangrove forests are the three major and also most important marine ecosystems of Malaysia. Other ecosystems are sandy beaches, muddy shores and estuaries (Mohd, 1995).

The three major marine ecosystems of Malaysia play important roles in the socio-economy and also to the environment. It has been documented that there is a significant correlation between mangrove ecosystem and the fisheries activities (Mohd, 1995). All these ecosystems contribute to the economic activities such as tourisms and fisheries industries in term of the economic value. There was a total of 326 species of fishes from 40 families that were recorded in the reefs of Malaysia with the most number recorded in the east Malaysia (Wilkinson, 1994).

The marine environment of Malaysia is abundant and diverse with over 500 species of corals that support various fishes and invertebrates. But, the reefs in the west coast of the Peninsular that are highly sedimented were remarkably different from the oceanic reefs off Sabah (Wilkinson, 1994). According to Oakley et al. (2000), the northern coastline of Sabah has a vigorous coral growth in a series of offshore reefs and islands. The Banggi Island which is located in the north of Sabah has relatively high species diversity and high coral cover. The eastern of Sabah has extensive patch reefs and stretches of fringing reefs. Although sedimentation and destructive fishing has increased gradually, the offshore islands have high species of diversity. No mangroves are found in the northeastern part of Borneo, but seagrasses are usually found behind many fringing reefs. In the leeward reef slopes of Mabul Island, there are dense mixes of seagrasses (Oakley et al., 2000).

According to Wilkinson (1994), the west coast of Peninsular Malaysia has probably the best example of sustainable mangrove utilization. Malaysia had a total of 647 thousand hectares of mangrove forest, which is the third largest coverage globally. There are 57% and 27% found in Sabah and Sarawak, respectively (Wilkinson, 1994).

Studies have been carried out in Malaysia by Universiti Pertanian Malaysia on documenting the distribution of 13 species of seagrass in Malaysian waters. Most of the seagrass beds in Peninsular Malaysia have been destroyed through land reclamation, dredging for the access of ports and also trawling activities. In addition, Sabah and Sarawak also associated with trawling activities (Wilkinson, 1994).

1.2 Objectives of Study

The main objective of this study is to assess the status of coral reefs, seagrass beds and also seaweed beds in the Gayana Eco Resort. At the same time, this study was carried out to provide information for future reference. The specific objectives are:

1. To determine the major marine ecosystems of the study site.
2. To determine the status of the coral reef at the study site.
3. To identify the distribution and diversity of seagrass and seaweed.
4. To map the spatial extent of coral reef, seagrass and seaweed beds.

1.3 Significance of Study

By conducting the assessment on reefs, seagrass and seaweed meadows, the data and condition of current status will be useful for further effective management in Gayana Eco Resort. It is hoped that the information of this study may serve as the baseline data and aid of the future researches by the Marine Ecology Research Center.

In addition, it is also hoped that this feasibility study may provide important information to promote public awareness of the ecological and economic importance and crisis faced by these marine ecosystems. It has to be solved by conservation efforts and educating the local people and also tourists who are visiting the resort.

CHAPTER 2

LITERATURE REVIEW

2.1 Coral Reef

Coral reef is defined as an ecosystem which comprises of a diverse collection of biological communities interacting among each other and also with the environment. It supports a diverse community of marine plants and animals. According to Rachello-Dolmen et al. (2007), coral reefs are found along one-sixth of the coast throughout the world. Coral reefs have been estimated to occupy 17% of the earth's total area, which represent 600 000 square miles of the earth's surface. Corals are found all over the world, but they are only well developed in the tropic region. Around 32.3% of the coral reefs in the world are found in the Southeast Asia, which is also known as the center of biodiversity (Tun et al., 2004).

Coral reefs are large geological structures that are entirely built up by the biological activity of marine communities. They are made up of enormous amounts of calcium carbonate and limestone, which are deposited by the living organisms. The essential deposition of calcium carbonate to the reefs are primarily produced by corals, calcareous algae and others calcium carbonate secreting organisms. Corals are

classified under the taxonomy phylum of Cnidaria, class of Anthrozoa and the order of Scleractinia (Castro & Huber, 2005).

Hermatypic or reef building corals can only be found in the tropic region while ahermatypic corals which do not form reefs are distributed worldwide (Nybakken,1997). The most vital of reef-builders is the group of scleractinian corals. Almost all of the reef building corals have the symbiotic algae, zooxanthellae that lives within the coral tissue which help the corals to manufacture their calcium carbonate skeleton. Corals are able to carry out the reef framework without the existence of zooxanthellae, but the process of reef building will be very slow (Castro, 2005). Zooxanthellae not only play a critical role in nourishing the host coral by assisting in the deposition of skeleton, they also feed the coral with the organic matter which they produce through photosynthesis. Coral colonies reproduce either by asexual or sexual reproduction. In the case of asexual reproduction, the coral polyps bud off the new polyps.

Coral reefs are rich ecosystems that grow in low nutrient waters. Reefs are the coral communities that grow by building their structures upward and outward. The most favorable conditions for the reef to grow are warm tropical water, with large amount of light energy, low sedimentation, low nutrient and rock as the base for corals to grow (Wilkinson, 1994). Most of the reefs are found in waters bounded by 20°C of surface isotherm. The optimal developments of coral reefs are in waters with the mean annual temperatures within the range of 23°C to 25°C. Moreover, coral reefs are limited by water depth (Karleskint et al., 2006). Most of the reefs are found in the depths of 25m or less where light can penetrate. This is due to the symbiotic

organisms zooxanthellae that required sunlight to carry out photosynthesis (Nybakken, 2004).

Generally, coral reefs are classified into three categories, which are atolls, fringing reefs and barrier reefs (Castro, 2005; Nybakken, 1997). Fringing reefs and barriers reefs could be found in the coral reefs zone throughout world's ocean; atolls predominate in the tropical Pacific Ocean. The Indo-Pacific is the region which contains that highest diversity of coral species (Kennish, 2001).

2.2 Seagrass Bed

Seagrasses are flowering plants that have adapted to live in the sub-tidal of marine environment (Fortes, 1994; Nybakken et al., 1997; Short et al., 2007). The life cycle of seagrasses is similar to the growth form of land grasses. The erect shoots which grow from the rhizomes creep over the bottom by extending through the rhizome system. Sea grasses generally extend the population growth by asexual reproduction through the rhizome system (Levinton, 2001).

Seagrasses can grow into thick and abundant beds which usually consist of more than one species. Seagrass beds are usually carpeted along the coast of soft bottoms (Castro, 2003), but some may inhabit in the hard substrate (Kennish, 2001). It is occasionally well developed in the shallow and sheltered waters along the coast by isolated patches to thicker carpets which will completely blanket the bottom. They are also able to grow in the region of estuaries which associates with mangrove forest. According to Castro (2003), only 50 to 60 species of seagrasses which belong to 12

genera (Kennish, 2001) are known and most of them are found in the tropical and subtropical area. The Tropical Indo Pacific region has the most abundance of seagrass species (Short et al., 2007).

Seagrass distributions are affected by the physical-chemical factors, light, temperature, turbidity, salinity, current and also wave actions (Kennish, 2001).Seagrasses grow in the reefs and rocky regions (Wong et al., 1996). The maximum depth for sea grasses to grow and extend is affected by the light penetration. Hence, the turbidity of water will greatly reduce as the sea grasses extend (Levinton, 2001).

According to Nyabakken (1997), seagrass have a standing biomass of 2 kg/m^2. In addition, the seagrass meadows are normally well defined with a visible boundary from the unvegetated region. It is various in sizes from the isolated patches to a continuous carpet which covers many square kilometers. Seagrasses are abundant and occur in the mid-intertidal zone. Most of the seagrass species have the similar in appearance by having the long, thin, strap like leaves with air channel (Nybakken , 1997).

2.3 Seaweed Bed

Seaweed is known as macroalga or macrophyte which is a kind of non-flowering plant that are inhabitants of rocky shores and other marine habitats. Some of the seaweed undergoes chemosynthesis to produce organic matter rather than photosynthesis. While, some other seaweeds are not primary producer and will generally be parasites

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