



**SUBSTRATE AND SOFT CORAL COMPOSITON AND DIVERSITY AT KATORI
MARU SHIPWRECK, KUCHING**

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**Bachelor of Science with Honours
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Masters

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**Substrate and soft coral community composition and diversity at Japanese
shipwreck, Sarawak**

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This dissertation is submitted in partial fulfilment of the requirement for the degree of
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Aquatic Resources Science and Management Programme
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2015

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MOHAMMAD FAIZ BIN SUDIN

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LIST OF ABBREVIATIONS

Abbreviation	Description
PVC	Polyvinyl Chloride
ARs	Artificial reefs
m	meter

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Abstract

Coral reefs are main component of marine ecosystem. They act as sources of food and nursery breeding ground for fishes. Soft corals are the component inside the coral reefs that helps in shaping the ecosystem. Artificial reefs have been used as recreational purpose and tourism industry. There is no data being recorded about Japanese shipwreck in Kuching. The objectives are to determine the composition and percentage cover of soft community at Japanese shipwreck; to map the location of soft coral community for the navigational purposes; to relate distribution of soft coral in relation to substrate type at shipwreck. Random quadrat method was used to determine the soft coral composition and percentage cover. From the result, percentage of soft coral is ranging from 22% to 44%. The highest is at Stern Port followed by Bow Starboard, Bow Port and Stern Starboard. Only one genus been found which is *Juceella sp.* Sand dominated almost all the stations which is highest at Stern Port. The distribution of *Juncella sp.* are depending on abundance type of substrate.

Keywords: Katori Maru shipwreck, artificial reefs, Katori Maru, biodiversity, substrate, random quadrat

Abstrak

*Terumbu karang merupakan komponen utama di dalam ekosistem marin. Ia merupakan sumber makanan dan tempat pembiakan bagi ikan. Karang lembut merupakan salah satu komponen di didalam terumbu karang yang membantu dalam membentuk ekosistem. Tukun tiruan telah dijadikan pusat rekreasi and pelancongan. Kapal karam merupakan contoh tukun tiruan. Tiada data yang di rekodkan mengenai kapal karam jepun yang terletak di Kuching. Objektif adalah untuk mengetahui komposisi and peratusan litup bagi karang lembut; memetakan lokasi karang lembut untuk tujuan pelayaran ; mengaitkan taburan karang lembut dengan jenis substrata di kapal karam itu. Kuadrat secara rawak di gunakan untuk mendapatakn data menegenai kposisi dan peratusan litup bagi karang lembut. Berdasarkan keputusan yang diperolehi, peratusan karang lembut ialah dari 22% sehingga 44%. Peratusan tertinggi ialah di Buritan Kiri diikiuti oleh Luan Kanan, Luan Kiri and Buritan Kanan.. Satu genera sahaja di temui iaitu *Junceella sp.* Manakala pasir mendominasi semua stesen dan paling tinggi di Buritan Kiri. Populasi *Junceella sp.* dipengaruhi oleh jenis substrat.*

Kata kunci: kapal karam Katori Maru tukun tiruan, biodiversity, substrata, kuadrat rawak

1.0 INTRODUCTION

Coral reefs are major contributor for marine organisms which can be found within tropical and subtropical water. They have calcareous structure that can be found in shallow water. They are main sources of food (Cole, 2008). Coral reefs are associated with organism such as seaweeds, sea pens and other marine life in shaping the ecosystem. Coral reefs have had an important role in restructuring the ecosystem for the past 200 million years (Hoegh, 1999). Southeast Asia cover up to 28% of global coral reefs which have the most extensive and diverse coral reefs. (Burke *et al*, 2011). In recent years, a global increase in population contributes additional stress to reefs system in the form of terrestrial runoff, pollution, coral mining, and recreational activities, which has led to the increased mortality rate of coral (Hawkins *et. al.*, 1999). As stated by Bruno and Seigh, (2007) coral reef cover has been declined at a rate of 1% per year for the last 20 years and rate of 2% per year between 1997 and 2003 in Indo-Pacific. According to Sherman, *et al.*, (2001) shipwreck is one of the types of artificial reefs which can provide similar ecological function as natural habitat, including developing epibiotic communities that create microhabitat for motile species. Due to their ability to create habitat for various marine life they are often popular among divers and snorkelers.

Artificial reefs are also one of the ways to restore the damaged natural reefs ecosystems that cause by the fish bombing and trawling. There are many different type of structure been used, including formed concrete modules, concrete block, fish aggregating devices (FADs), polyvinyl chloride (PVC), used tires, and other materials of opportunity (bridge rubble, shipwreck, car bodies and *etc.*) (Sherman, *et al.*, 2001). Soft coral usually associated with the substrate that living together with them. Substrates are important for the growth of coral itself. The planule settle down at certain period of time and attach to the

substrate. Coral is immotile organism, hence it needs the substrate to against the water current.

There are five shipwreck located in Sarawak. One of them, which is almost 1 hour from the Santubong is Katori Maru. It is a Japanese shipwreck, which been attacked by the Dutch in 1941. Katori Maru shipwreck is historically and aesthetically valuable. So that it should be preserved and conserved for the further study.

There a few study of soft coral community on artificial reefs. Recent study was conducted by Kumar and Geetha (2012) entitled 'Fouling community on shipwreck site in the Gulf of Mannar, India'. Previous research was conducted by Natasha, (2012) on colonization of artificial reef balls in Talang-Satang National Park, Sarawak. The research is emphasizing on hard coral community. So this study is concentrated on soft coral community in Katori Maru shipwreck in Sarawak due to no data has been recorded in Japanese shipwreck in Sarawak so it would be the first scientific research to be conducted. So, this study is focusing on the soft coral diversity and the substrate at the shipwreck. The species diversity of soft coral and substrate in the shipwreck will be calculated. The relationship between distribution of soft coral and the type of substrate will be determined. The pictures of soft coral and substrate will be taken for identification.

The objective are, (1) To determine the composition and percentage cover of soft community at Japanese shipwreck; (2) To map the location of soft coral community for the divers; (3) To relate distribution of soft coral in relation to substrate type at shipwreck.

2.0 Literature review.

2.1 Definition of substrate.

Substrate is a surface on which animal and plant live. It plays an important role in process of coral development and growth. It is biologically generated and the corals are subjected to numerous factors which affect growth, form and distribution (Luckhurst, 1978). The artificial substrates come from manmade things. Examples of substrates are coral rubble, shipwreck, and hard structure.

2.2 Artificial substrate vs Natural substrate.

Artificial substrates are devices that are made up from natural or artificial things and material of various composition and configuration that are placed in water for a predetermined period of exposure and depth for the colonization of indigenous macro invertebrate communities (Klemm *et al*, 1990). Natural substrates are things that are naturally exist in the ecosystem such as sand, rock, coral rubble, and others. Substrates are important in the life stage of corals where the planulae will settle down and attached on it.

2.3 Coral reefs.

Coral reefs are restricted to the tropics region only. They are located between 30°S and 30°N which is in the topical belt demarcated by the Tropics of Capricorn and Cancer (Odum, 1992). This is due to their growth are depending on water temperature. Coral reefs are composed of calcium carbonate. Only a few outermost cell layer of the coral are alive, with calcium carbonate skeleton beneath the living tissue. Corals are composed of polys, which produces asexually as budding off. This can produces colonies of polys which are able to grow and expend regularly. High temperature will affect their growth on metabolic,

physiology and reproductive system. Coral is a general term that being used to describe a variety of related form belonging to the animal Phylum Cnidarian (Johnston, 1986).

2.4 Taxonomy of Soft coral.

Kingdom: Animalia

Phylum: Cnidaria

Class: Anthozoa

Subclass: Octacorallia

Order: Alcyonacea (Lamouroux, 1812)

The subclass of Octacorallia includes soft corals, gorgonians, and sea pens. Soft coral classified into three orders: Helioporacea, Alcyonacea, and Pennatulacea (Ellis & Sharron, 1999). They have known as the Octocorals. Soft coral poses eight tentacles or multiple of eight compare to six tentacles or multiple of six found in hard coral. Tentacles of soft corals are also easily distinguished by rows of very obvious lateral projections or pinnacles along each side. At the polyps contains nematocyst, packed with poisonous stinging tips and specialized tissues (coenenchyme) that connects and distributes food throughout the colony (Aw, 2001). The formation of coenenchyme around new polyp and asexual budding of the colony are types of soft coral growth (Ellis & Sharron, 1999). Soft corals are usually found in all reef habitats, from shallow reef flats to depth of 60m on abyssal walls which are in small congregations beneath table corals, cavern edges, reefs walls and slopes where there is constant water movement (Aw, 2001).

2.4.1. Environmental requirement for soft coral.

Soft coral distribution and abundance are influenced by environmental factors such as light, temperature, currents, water flows, and substrates (Zeevi and Benayahu, 1999). According to Ellis and Sharron (1999), the range temperature for soft coral to grow is

between 24.2- 35.5 C, pH is varied from 8.35-8.45, and the light intensity is 26,000 lux. Population growth for soft coral are disturbed, if exposed to the less suitable physical conditions such as steep slopes, wave exposed shallow water, or shelter from flow (Fabricius, 1997).

2.4.2. Common type of soft corals.

Most of soft corals lack of hard skeleton which is calcium carbonate that usually can be found in hard coral. Their skeleton is flexible, which is made up of protein called gorgonin. They also contain sclerites that helps to strengthen their base. They have contain calcium carbonate but only in small clump called spicules. The common type of soft coral tree ferns or flower soft corals, leathery soft coral, soft tree or scrub coral, sea fans, sea whips and sea pens. (Aw, 2001).

2.4.3 Importance of soft corals.

Soft corals are important nursery ground for both pelagic and demersal fish species (UNEP, 2004). They provide a natural protection to diverse organism, such as algae, sponges, copepods, polychaetes, and fishes. Most juveniles of reef fishes are found in shallow-water biotopes and the larger fishes are mostly found in deeper water in coral reef area.

2.5 Artificial reefs (ARs).

Artificial reefs are man-made submerged structures, such as shipwrecks, it offer substrata for settlement of planulae and fouling assemblages (Svane and Petersen, 2001). They provide the hard substrates for the local habitat where none previously existed (Sheehy and Vik, 2010). The establishment of an artificial structure influenced the surrounding underwater ecosystem. Traditional artificial reefs are only focused of food production

(Seaman, 2002). ARs have been used for various economic and ecological purpose, including the increase of fishery yield and production, as well as for recreational diving, prevention of trawling, aquaculture, conservation of biodiversity and to test ecological theories (Seaman, 2002). Japan's artificial reef been made by engineer, built of durable, nonwaste, prefabricated materials, placed in scientifically, selected sites in shallow and deep water (Bohnsack et. al., 1985).

2.6 Katori Maru shipwreck.

It was a troop carrier during World War II, which on its way to invade South-east Asia, including Borneo. On the Christmas Eve 1941, the Japanese shipwreck was intercepted by Dutch forces on its way to Kuching together with other vessels. The Dutch launched an attacked against the Katori Maru and gave a serious damaged and to make it worst, Dutch submarine, KXIV launched a torpedo that make Katori Maru sank to bottom of the South China Sea (Saufi, pers. comun.,1 October, 2014). The total length of the shipwreck is 150m and the width is about 18m. The total depth is about 21.4 m.

2.7 Recent study on shipwreck.

There are few study being recorded on shipwreck. The recent one is by Kumar and Geetha (2012). Their study is about fouling community on shipwreck site in the Gulf of Mannar, India. The objective of their study are to take census of the benthic communities in the sunken ship that served as an artificial reef and was regarded by local fisher folks as a major fishing site. The method that they have been used are Line Intercept Transect (LIT) and belt transect. LIT was used to calculate the census of benthic community and the belt transect was used to determine the abundance of fishes. The result showed that, soft coral community dominated the area more than the hard coral community.

3.0 Material and methods.

3.1 Study site.

The study on substrate and soft coral community composition and diversity has been conducted at Japanese shipwreck which is located 1 hour and 15 minutes from the Santubong in Sarawak by using speed boat. The name for the Japanese shipwreck is Katori Maru. It is located 50km from the mainland the shipwrecked lie at the bottom of South China Sea near the coast of Santubong, Kuching. According to Teo, pers. comun., 19 June, 2014, Katori Maru depth is from 21m bottom and 16m from deck. The total length of the Katori Maru shipwreck is 160 m. Whole structure of this wreck is still intact and under good visibility condition, Katori Maru can be seen from the surface. Based on personal communication with the PADI diving instructor, he told the exact location where can be found most abundance of soft coral community.

3.2 Sampling Technique.

Before fieldtrip, some preparations has been done. Such as making quadrates using pvc pipe and nylon string. The size of the quadrates is 0.5m per quadrants. Then, the equipment for SCUBA diving have been tested and calibrated in order to be in good condition.

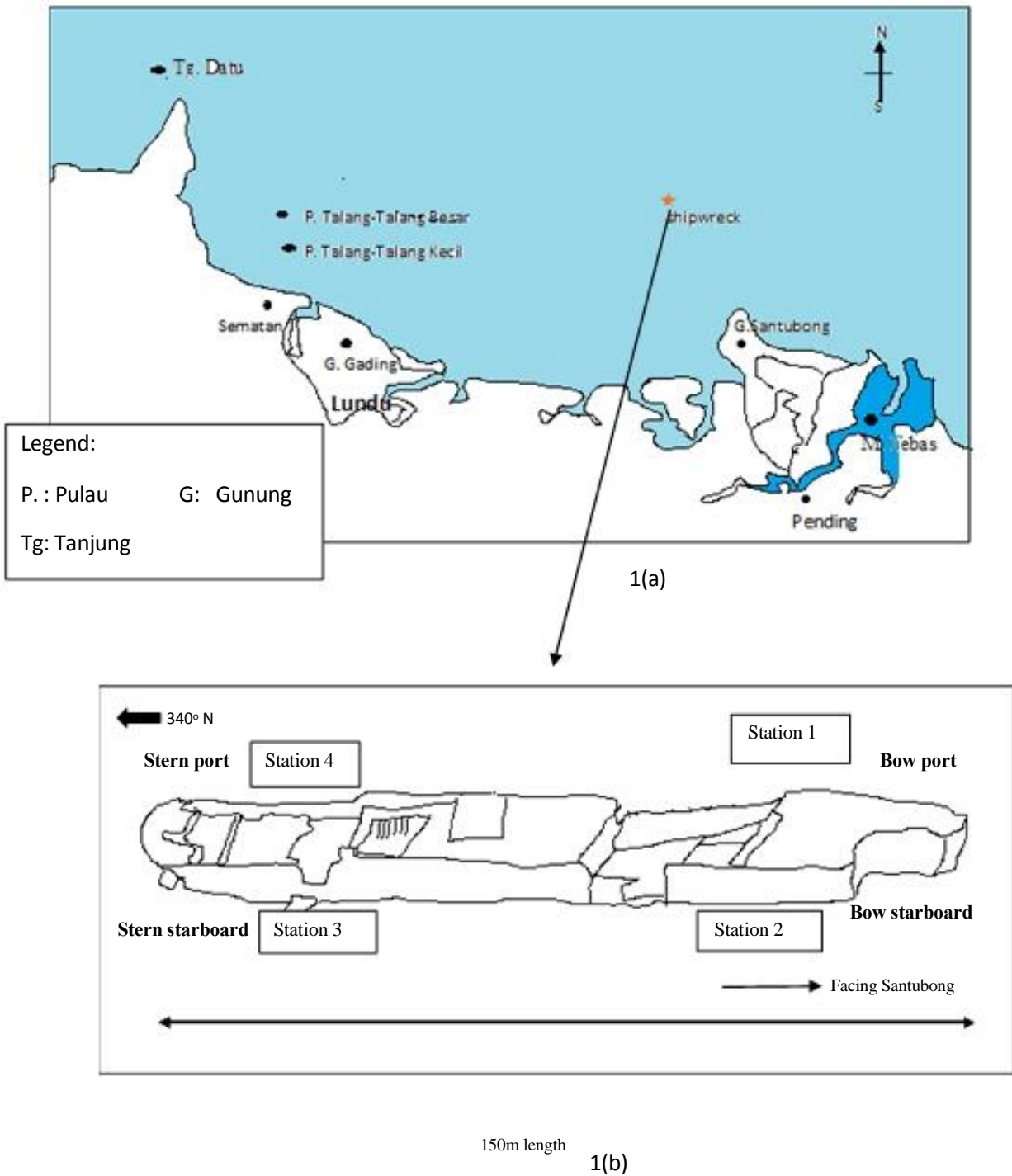


Figure 3(a): The map of Santubong, Sarawak ; Figure 3(b): Katori Maru, Japanese shipwrecked

Sources from Premier Marine & Scuba Centre.

3.3 Data collection

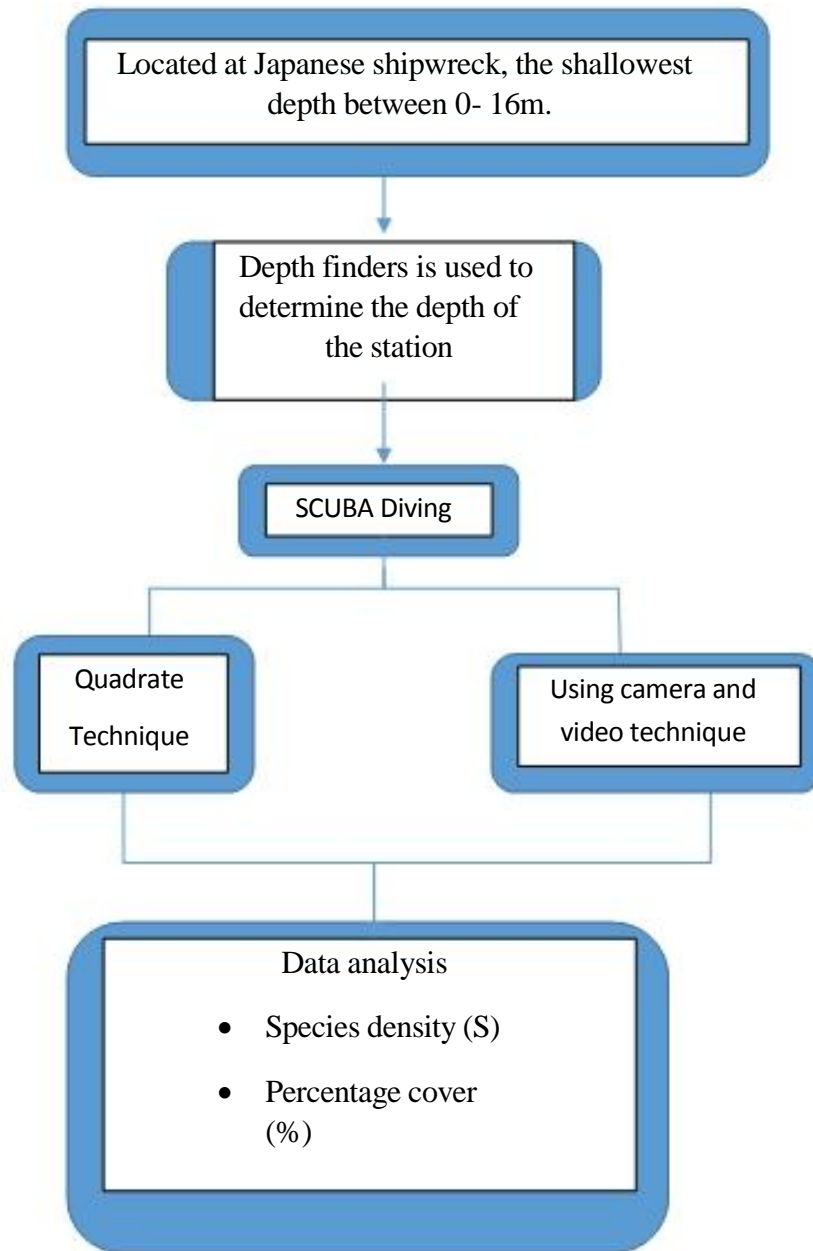


Figure 3.1: The schematic diagram shows the sampling event. Depth finder is used to determine the exact depth of Katori Maru. Quadrates technique and camera video technique will be used to gather information of soft coral composition on shipwrecked. Some soft corals will be brings back to laboratory for further analysis. Data gather will be analysed statistically using percentage cover formula.

3.4 Field methods.

3.4.1 Depth finder

Depth finder was used in order to measure the depth of water body at the shipwreck. It have the ability to quickly collect data from any dock, bridge or boat due to it is small in size.

3.4.2 Advanced Scuba diving

Advanced scuba diving was used due to the open water scuba diving depth allowed is limited. The depth of the shipwreck is 21m till the bottom. An advanced scuba diving certificate is needed in order to carry out the two (2) techniques which is random quadrat technique and camera video technique in order to determine the composition and diversity of substrate and soft coral community at Katori Maru shipwrecked. The shipwreck is still intact and there are certain area that on the shipwreck was covered by sand.

3.4.3 Random quadrat technique

Quadrat was put on the random places of soft coral community areas and the value will converted into percentage cover. The area of the quadrat is 0.5m x 0.5m which make the area is 0.25m². The shipwreck was divided into 4 station and random site was chosen. Each station, several replicate was taken to minimize error and to get more accurate data.

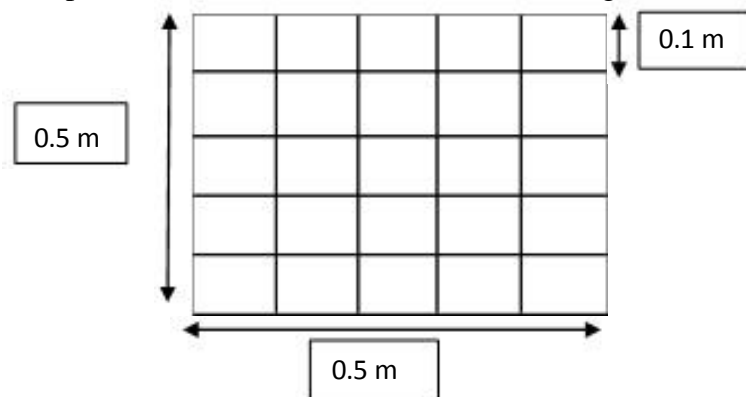


Figure 3.2: PVC quadrat frame of measurement size 0.5 m width x 0.5 m length.