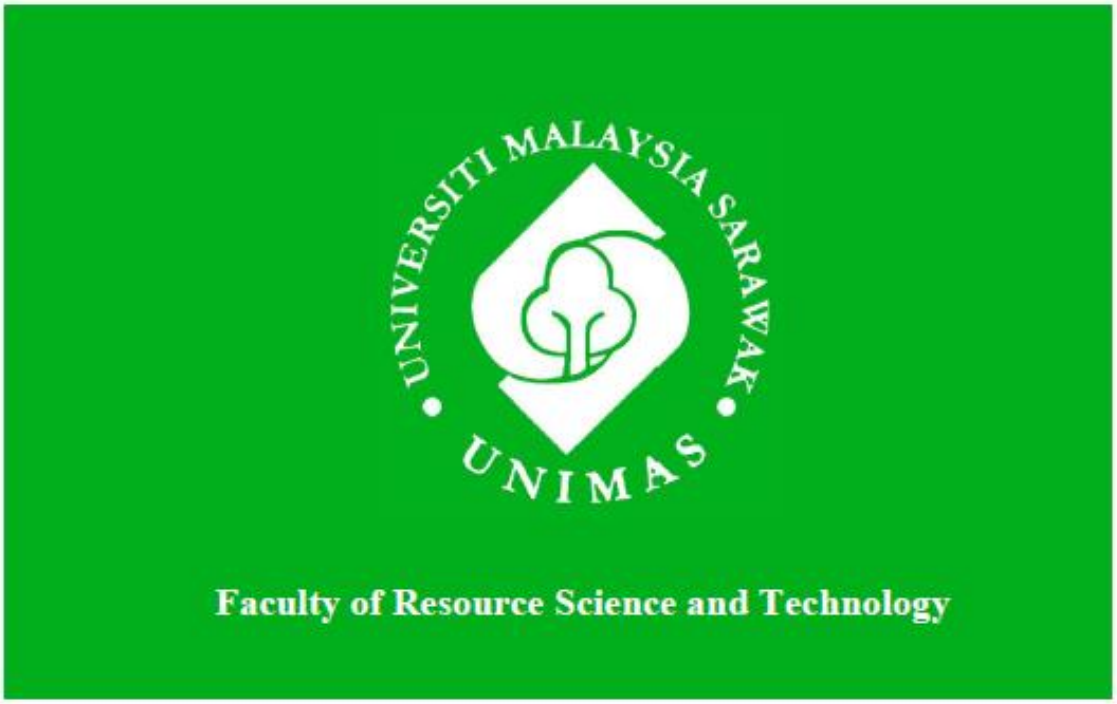

STATUS OF HARD CORAL COMMUNITY COMPOSITION AND DIVERSITY AT TALANG-SATANG ISLANDS, SARAWAK

Ahmad Adli Bin Abdul Wahap

Bachelor of Science with Honors
(Aquatic Resource Science and Management)
2015

UNIVERSITI MALAYSIA SARAWAK

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List of Abbreviations

Abbreviation	Description
$CaCO_3$	Calcium Carbonate
BTT	Belt Transect Technique
PIT	Point Intersect Technique
SCUBA	Self Contain Underwater Breathing Apparatus
GPS	Global Positioning System
PSBS	Pulau Satang Besar South
PTBW	Pulau Talang Besar West
PTBE	Pulau Talang Besar East

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Status of Hard Coral Community Composition and Diversity at Talang-Satang Islands, Sarawak

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ABSTRACT

One of the important resources can be found in Sarawak is the coral reefs around the coastal area. Previous research that conducted by the Reef Check Malaysia 2013 state that hard coral cover in Talang-Satang Islands was in good condition which higher than the average for reefs of the Sunda Shelf region. The objective of this study is to determine the present percentage cover of scleractinian species at Talang-Satang Islands. It is also to find the composition of coral genus diversity to compare between the selected sites. Besides, this study also aims compare the extent of coral bleaching at different sites in Talang-Satang Islands. The coral cover survey was carried out using PIT. The results were significant, with 55% average live coral cover. The results compared with the previous studies and were found no significant differences. A total of 16 genera were samples. Shannon-Weiner Diversity Index shows 1.90; Simpson Diversity Index shows 0.20; Pielou's Evenness Index shows 0.69 and Berger-Parker Dominance Index shows 0.28. PSBS shows the highest coral bleahing with 16% followed by PTBE with 2% and PTBW with 1%. More research need to be done to protect this important resources.

Keywords: Scleractinian species, diversity, coral bleaching, Talang-Satang Islands, coral reef.

ABSTRAK

Salah satu sumber penting yang boleh didapati di Sarawak adalah terumbu karang di sekitar kawasan pantai. Kajian sebelum ini yang dijalankan oleh Reef Check Malaysia 2013 menyatakan bahawa peratus terumbu karang di Pulau Talang-Satang berada dalam keadaan yang baik lebih tinggi daripada purata bagi terumbu di rantau Sunda Shelf. Objektif kajian ini adalah untuk menentukan peratusan litupan spesies scleractinian di Pulau Talang-Satang. Ia juga adalah untuk mencari komposisi kepelbagaian genus terumbu karang untuk dibandingkan dengan kawasan lain. Selain itu, kajian ini juga bertujuan membandingkan tahap pelunturan karang di kawasan yang berbeza di Pulau Talang-Satang. Kajian peratus litupan karang telah dijalankan dengan menggunakan PIT. Keputusan juga ketara perbezaannya, dengan 55% purata litupan karang. Keputusan dibandingkan dengan kajian sebelum ini dan didapati tiada perbezaan yang signifikan. Sebanyak 16 genera dikaji. Shannon-Weiner menunjukkan 1.90; Simpson Indeks menunjukkan 0.20; Pielou menunjukkan 0.69 dan Berger-Parker Dominance Indeks menunjukkan 0.28. PSBS menunjukkan pelunturan karang tertinggi dengan 16% diikuti oleh PTBE dengan 2% dan PTBW dengan 1%. Lebih banyak penyelidikan perlu dilakukan untuk melindungi sumber-sumber yang penting ini.

Kata Kunci: Spesies Scleractinian, kepelbagaian, pelunturan karang, Pulau Talang-Satang,terumbu karang.

1.0 Introduction

The coral reef is one of the most important resources that contribute in Malaysia's economy. This coral reef needs to be protected and always monitored because it is not just economically valuable but it is also ecologically valuable resources. Malaysia has 3,600 km^2 of coral reef that divided into three groups which are Peninsular of West Malaysia, Sarawak and Sabah. The abundance of this coral reef influence the government to establish Marine Park or National Park so that the coral reef can be protected from any unresponsible body that may harm the coral reef.

Even though Sarawak is the largest state in Malaysia, but only limited amount of coral reefs area that can be found in Sarawak which is only at the southest of Sarawak and offshore islands. Among all of the coral reef in Kuching area, there is one place that has the most diversity of coral which is Talang-Satang National Park (Awang et al., 2003). Talang-Satang National Park can be divided into four islands which are Satang Besar, Satang Kecil, Talang Besar and Talang Kecil.

Although this islands are situated near to the mainland, only limited amount of study that have been carried out in that islands especially Satang Besar Island and Talang Besar Island. Due to lack of data, the objective of this study is to determine the current percentage cover of hard coral in selected sites around the Talang-Satang National Park and to compare it with previous studies that have been done in that sites so that the growth and status of the hard coral found around the Talang-Satang Islands can be monitored.

Even though the government has stated that Talang-Satang Island as national park, there is still problem facing by the coral reef area and mostly the problem comes from human itself. Problem such as illegal fishing causes threat to the coral reef because the fishing line or the anchor from the boat may stuck to the coral that finally causes the damage to the coral when the line is pulled.

According to Cleary et al. (2005), high species diversity of scleractinian corals is usually found in habitats with distinct environmental gradients, such as exposure to wind, wave and terrestrial inputs. Shallow fringing reef cause the coral easily expose to the wind. This will affect the species diversity of hard coral in Talang-Satang Islands. Several studies on the onshore–offshore species richness patterns of hard corals have been carried out in tropical coral reef systems (Becking et al., 2006).

Besides, this study also to obtain more detailed of the diversity indices on the type of genus present so that it can be compared between selected sites and can be used for future studies. Species evenness, species diversity and species richness will be calculated from the obtained data and it will be compare to other coral reefs in Malaysia.

The data that will be obtained can be used to observe the extent of bleaching between selected sites in Talang-Satang Islands. There are various factors that can cause coral bleaching in these selected sites. The data that will be obtained can be used for future studies.

The main objectives of this study are, (1) To determine the current percentage cover of hard coral in Talang-Satang Islands, (2) To obtain more detailed of the diversity indices on the type of genus present and (3) To observe the extent of coral bleaching at Talang-Satang Islands.

2.0 Literature Review

2.1 Coral Reefs

2.1.1 Coral Taxanomy

Coral reefs are colonies of tiny animals found in marine waters that contain few nutrients. Coral reefs are formed by underwater structures made from calcium carbonate. Corals are marine invertebrates in class Anthozoa of phylum Cnidaria that living in colonies of polyps. Species richness of coral reefs is determined by several factors such as geological history, ecological processes and physical environment (Hoeksema 2007; Veron et al. 2009), of which habitat heterogeneity is dominant (Hoeksema and Moka 1989; Cornell and Karlson 1996; Karlson 1999; Karlson and Cornell 1999).

Corals can be divided into two groups which are ahermatypic corals and hermatypic corals. Ahermatypic corals are non-reef building corals. This type of coral does not have photosynthetic zooxanthellae. Zooxanthellae is an organism that live within the coral polyp and provide nutrient to the coral. According to Schuhmacher and Zibrowius (2006), the skeleton of this corals are proteinaceous instead of calcarus.

Unlike ahermatypic corals, hermatypic corals have symbiotic relationship with zooxanthellae. According to Marshall and Schuttenberg (2006), 90% of nutrient gain by the corals are come from zooxanthellae. The skeleton of hermatypic corals are made from Calcium Carbonate ($CaCo_3$) which is also called as aragonite.

2.1.2 Hard Corals

Hard corals also called as Scleractinia are marine coral that produce hard skeleton. Scleractinia is the largest order which contains hermatypic reef building corals. Hard corals can be either solitary or compound. Most of hard corals have small polyps ranging from 1-3 centimetres but there is certain solitary species that have size until 25 centimetres (Barnes & Robert, 1982). Families such as Acroporidae, Agariciidae, and Anthemiphylliidae are included in the order Scleractinia.

2.2 Coral Reefs Sampling Technique

The Belt Transect Technique (BTT) is one of the common method used in Reef Check. SCUBA (self-contained underwater breathing apparatus) is used to carry out the BTT. Transect will be placed on top of the coral reef area that have been selected.

Besides, Video Technique also one of the corals reefs sampling technique. This technique can be used to study a wider area and it can remain underwater for long period of time. Furthermore, Point Intersect Technique (PIT) also used in coral reefs sampling technique. Nadon and Stirling (2006), stated that this technique is the most effective in determining coral cover and diversity. According to Beenaerts and Berghe (2005), PIT method is more faster compare to line and belt transect technique.

2.3 Coral Diversity in Malaysia

According to Wood et al. (1977), the earlier coral reef biodiversity survey in Malaysia was conducted by Elizabeth Wood in the early 70's in the west coast of Sabah. The recent survey by the Malaysian Marine Park Authority with the help of Coral Cay foundation, UK and local Universities expertise have produced a significant finding on coral reefs associated faunal biodiversity in the Marine Park (Mazlan et al.,2004). According to Harborne et al. (2000), there are 330 total number of coral species with additional eight undescribed species have been found during the survey. There are 252 species of coral comprising 71 genera found in Pulau Banggi, Sabah (Fenner, 2001b). Fenner (2001a) also conducted a coral survey in 9 sites around Miri. He found that 203 and 66 genera of hard coral with number of species ranging from 41-108 at each site. There are 221 coral species comprising 66 genera found in the east coast of Malaysia (Harborne et al, 2000). There are 68 species were just identified and it makes the total species of coral known to be found in Malaysia to 323. High level of hard coral species can be found in Redang Island, Malaysia (Comley et al, 2004). By using Shannon Diversity Index it found that species diversity in that area ranging from 2.41-4.26. There is 221 coral species from 14 families in Kg. Tekek, Tioman Island (Affendi et al, 2005).

2.4 Threats Facing Coral Reefs

There are various threats facing coral reefs around the world especially in Malaysia such as pollution, coastal development, over-fishing, destructive fishing, and tourism related activities. Mostly the threats are come from human activities. Burke et al. (2002) stated that over 85% of the corals reefs in Malaysia are threatened and the type of threats facing Malaysian reefs different by location.

Mostly coral reefs in Malaysia were destroyed by the destructive fishing. Destructive fishing such as blast and poison is a method that using cyanide or dynamite that cause coral damage to kill all reef life for short-term profits. Sabah particularly one of the area that use this method to maximize catch. This cause destruction of coral reefs and removal of various fish species. Pilcher and Cabanban (2000) stated that decreasing of several important fish species in Sabah due to blast fishing.

2.4.1 Coral Bleaching

According to previous survey in the surrounding reefs in Malaysia, much of the dead coral may attributable to the natural hazard such as the 1998 bleaching event that give negative effect to the marine parks (Mazlan et al.,2004).Coral bleaching is the process where the chlorophyll or also called as brown pigment that found in the polyps was lost at certain condition (Fitt et al., 2001). The chlorophyll can be found inside the zooxanthellae where these algae inhabit inside the polyps. Coral is considered bleached when there is a visible lightening of the normal coloration state, translating to an approximate loss of 50% of the zooxanthellae. Bleached coral can be seen easily when there is image of stark white corals on a reef. This is considered to be severe bleaching, meanwhile mass bleaching defined as when an entire community of corals has become partly or totally bleached. The zooxanthellae only can live at certain condition and cannot withstand if there is stressor that occur at their habitat. Stressor is a chemical or biological agent, environmental condition, external stimulus or an event that causes stress to an organism. limit. There are various stressor that can cause coral bleaching such as increasing or decreasing sea water temperature, solar radiation, reduced salinity and because of bacterial or other infections (Kushmaro et al., 1996). According to Brandt and McManus (2009), this factor may kill the coral if not threat properly.

3.0 Materials and Methods

3.1 Survey Site

Talang-Satang National Park consists of four islands which are Satang Besar, Satang Kecil, Talang Besar and Talang Kecil. The chosen study site for this research is in Pulau Satang Besar and Pulau Talang Besar. Figure 3.1 shows the location of each station sampled, Pulau Satang Besar South (Station 1), Pulau Talang Besar West (Station 2) and Pulau Talang Besar East (Station 3). Pulau Satang Besar is located near to coastal area of Santubong and it takes about 40 minutes to arrive at Pulau Satang Besar from Telaga Air. Meanwhile for Pulau Talang Besar is located near to coastal area of Sematan. During the trip to the Pulau Satang Besar, the weather was not very good because of the strong wave and wind.

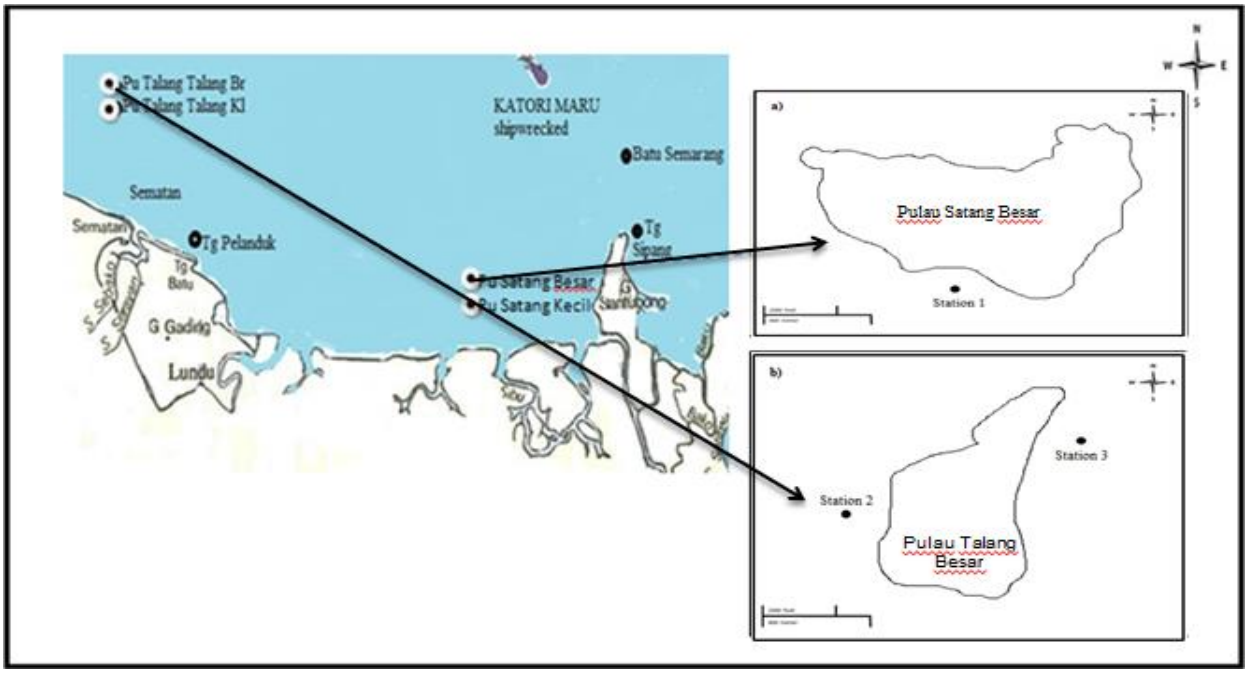

Figure 3.1: The map of Sarawak included Pulau Satang Besar and Pulau Talang Besar.

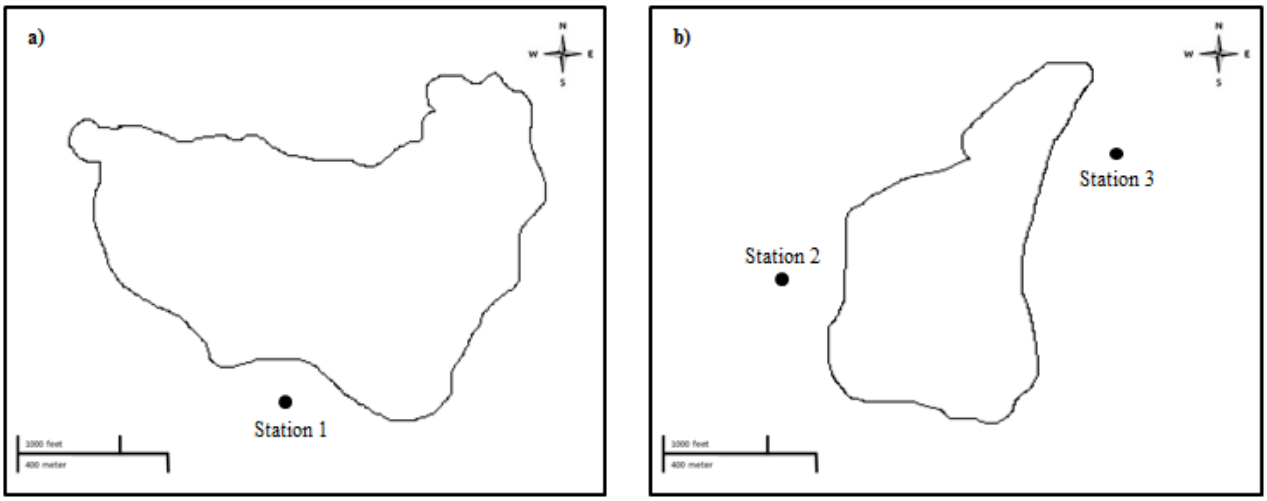

Figure 3.2: Map of (a) Pulau Satang Besar (station 1), (b) Pulau Talang Besar (station 1 and station 2)

Table 3.1 GPS coordinates of sampling stations around the Talang-Satang Islands.

Stations	**Coordinates**
Station 1	01° 46.8’ 36” N, 110° 09’ 42” E
Station 2	01° 55’ 0.2” N, 109° 46’ 12.9” E
Station 3	01° 55’ 12” N, 109° 46’ 52.5” E

3.2 Coral Cover Survey

The technique that has been used in this research is the point intercept transect method (PIT). This method use to estimate the hard coral cover in the reefs of the Talang-Satang Islands. According to English et al. (1994), point intercept transect method (PIT) can be used to estimate the percentage cover of coral at specific area. Photography and video monitoring also have been used. Camera was prepared and checked if it is functioning correctly. Information that was recorded included the date, location, site and transect numbers and any irregularities during recording. The camera (Panasonic Lumix DMC-FT3) was position above and parallel to the transect line so that the picture easily identified and clearer. Figure 3.2 shows the Point Intercept Transect method that has been used during the survey. Transect line was placed on top of the coral reef area that have been selected. Starting from the back reefs until the reef ends. Transect line were straighten and tighten. A 100 m transect line was deployed and along it every 0.5 m of transects were surveyed. Every 10 m a quadrat with size 0.5 m x 0.5 m was placed on the top of the coral.

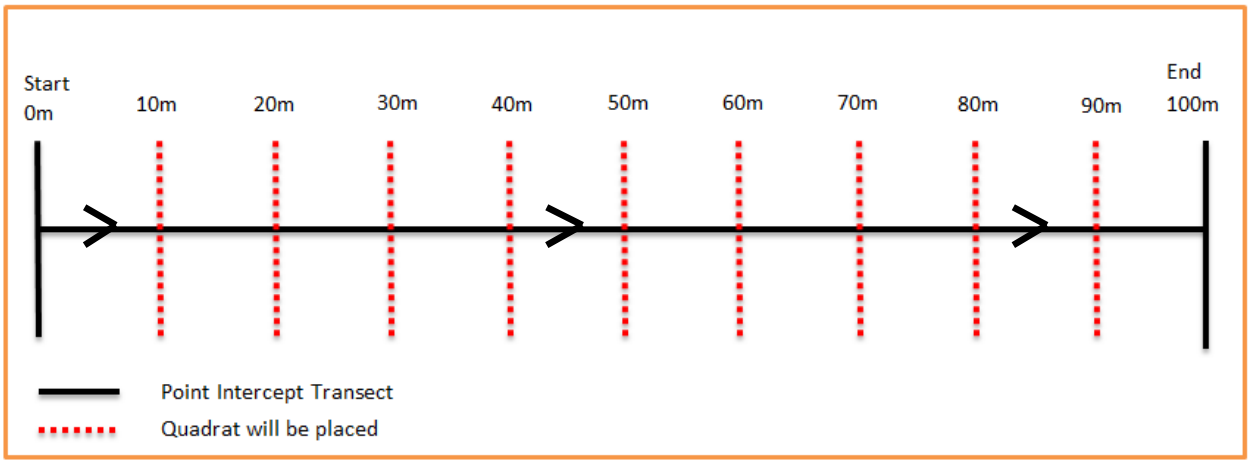

Figure 3.3: The Point Intercept Transect method

A picture has been taken so that coral identification can be done after the sampling. This process involved two people which have their own role. First person observed and took note every genus of the coral every 0.5 m meanwhile the second person took picture of the coral so that it easily to identify. The process of taking picture during that time was challenging because of the strong current and the visibility is very low. It is because of the turbidity is very high during that time due to king tide.

3.3 Coral Diversity Survey

Point Intercept Transect (PIT) was used to identify the genus diversity of the corals found around the Talang-Satang Islands. A 100 m transect line were laid seaward and perpendicular to the shore. Each data point was set at 0.5 m intervals along the transect line. Each coral that found on the data point were given a value of 1 and the genus was identified. The abundance of the coral genus were counted at the end of the survey as the sum of all occurrences in each data point across the transect line.

3.4 Coral Identification

Coral has been identied up to genus level using the Indo Pacific Coral Finder (Kelly, 2009). The first step was to select a Key Group based on visual cues and growth forms such as size of coral, branching or not branching, meandering ridges or valley, soft or hard coral, and colonies or solitary. The final step was by checking the result based on look-alike pages. Besides, coral also identified using CORALS - INDO-PACIFIC FIELD GUIDE (Erhardt & Knop, 2005) and CORALS OF AUSTRALIA AND THE INDO-PACIFIC (Veron, 1993).

3.5 Survey Methodology

Figure 3.4 shows the flowchart of the survey methodology that used during survey at Talang-Satang National Park. GPS (GARMIN) coordinates was recorded before entering the water. Transect line was laid on the coral and tighten so that the line will maintain in position. Time and depth has been taken before beginning the survey by using depth finder and stopwatch. Picture has been taken every 0.5 m of the transect line. The data was analysed after

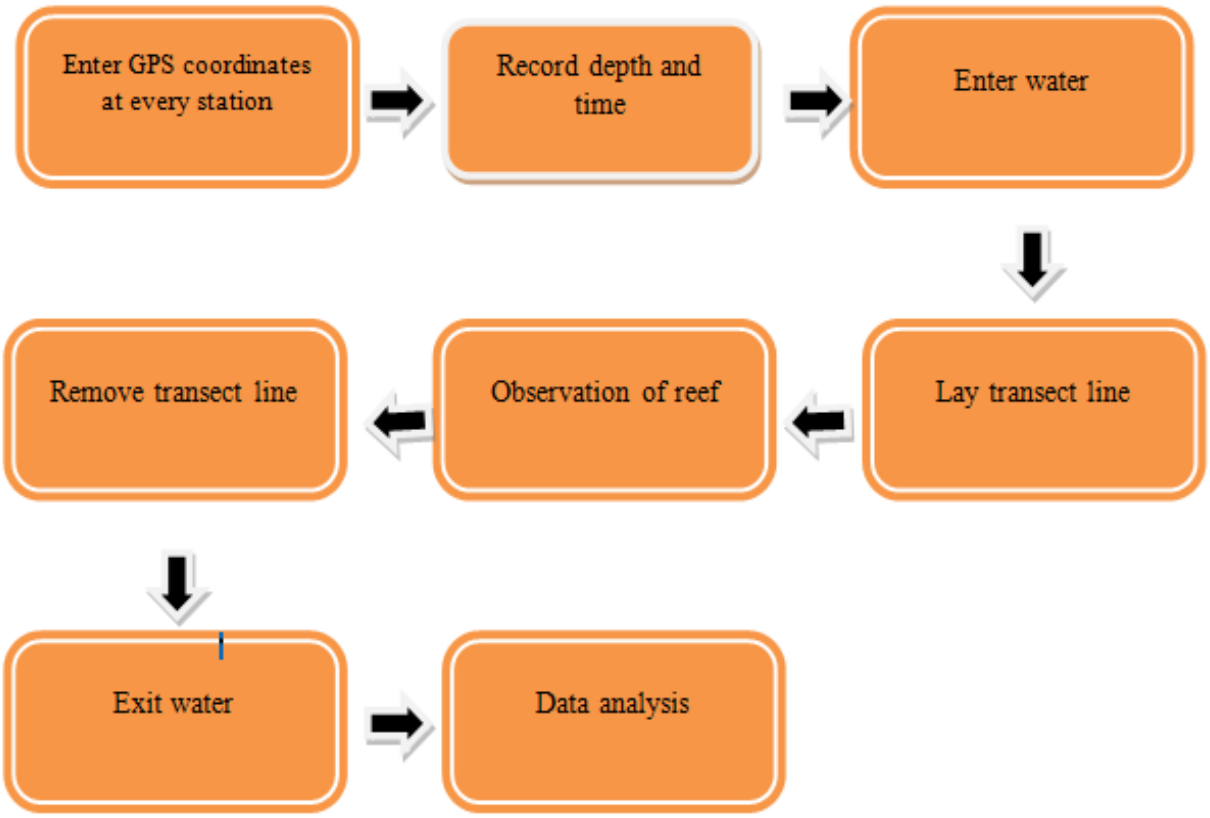

Figure 3.4: Flowchart of the survey methodology that used during sampling

3.6 Data Analysis

There were three different diversity indices used to determine the diversity of coral genera found around the Talang-Satang Island. Data analysis that included in the result was the genus abundance, evenness, and richness. Shannon-Weiner Index used to identify the species diversity, Simpson Diversity Index (λ) basically measure the possibility of a coral of the same genera being randomly sample twice during the survey (Simpson, 1949).

Pielou Evenness used to identify the species evenness. Evenness describes how close numerically or even in number of each genus in the environment. The value must be in range between 0 until 1. When the value is near to 0 it shows least evenness and 1 means maximum evenness. Meanwhile, Berger and Perker (1970), state that the Berger-Parker Index was also used to measure the numerical importance of the most abundant species.

The three different diversity indices used combine with the genus richness will form the Hill's diversity number which correspond to the effective genus richness in which rare genus are showing less weight than the common genus found.