Faculty of Resource Science and Technology

THE INTERACTION BETWEEN CRAB AND PEANUT WORM COMMUNITIES AT HARD SUBSTRATE AREA OF PANTAI PUTERI KUCHING, SARAWAK.

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(37894)

Bachelor of Science with Honours
(Aquatic Resource Science and Management)
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PhD ☐

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Nur Atikah bt Abu Shaharin

(37894)

This project report is submitted in partial fulfillment of the requirements for the Degree of Bachelor of Science with Honours
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UNIVERSITI MALAYSIA SARAWAK
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DECLARATION

I hereby declare that no portion of this dissertation has been submitted in support of an application for another degree of qualification of this or any other university or institution of higher learning.

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The project entitled The Interaction Between Crab And Peanut Worm Communities At Hard Substrate Area Of Pantai Puteri Kuching, Sarawak.was prepared by Nur Atikah bt Abu Shaharin and submitted to the Faculty of Resource Science and Technology in partial fulfillment of the requirements for the Degree of Bachelor of Science (Honours) in Aquatic Science and Resource Management.

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Abstract

Study on population density of the crabs and the peanut worms were conducted across the rocky area at Pantai Puteri in order to see the relationship between them on 21 February 2015. The objectives of this study are (1) determine the density of crab and peanut worm; (2) confirm the prey-predator relationship between peanut worms and crabs and (3) analyse the gut content of the crabs. Results showed that the highest crab density was at the 30 m and 60 m and the highest peanut worm density was at 30 m. There was a significant negative correlation between crab and peanut worm (Pearson Correlation, $r = 0.730$; $p = 0.031$). However, the result of the laboratory feeding showed that the crab did not feed on peanut worm. In addition, the gut content analysis of crab showed that the crab did not consume on the peanut worm and the major food item is algae. As a conclusion, there is interaction between the crab and peanut worm but they are not the prey and predator relationship. The interaction is probably competition between them for suitable living space.

Key words: Peanut Worm, Crabs, Gut Content, Predator relationship, Competition

Abstrak

Kajian tentang kepadatan cacing sipunkula dan ketam telah dijalankan untuk memerhati hubungan di antara dua organisma ini di kawasan Pantai Berbatu, Pantai Puteri pada 21 Februari 2015. Objektif kajian adalah (1) menentukan kepadatan ketam dan cacing sipunkula (2) mengesahkan hubung kait antara ketam dan cacing sipunkula (3) menganalisa kandungan isi perut ketam. Hasil kajian menunjukkan kepadatan ketam yang tertinggi pada jarak 30 m dan kepadatan cacing sipunkula juga pada 30 m. Terpadat hubungan kait yang kait yang signifikan secara negatif antara kepadapatan ketam dan cacing sipunkula (Korelasi Pearson , $r = 0.730$; $p = 0.031$). Walaubagaimanapun, hasil daripada experimen ketam di makmal, ketam tidak memakan cacing sipunkula. Tambahan pula, hasil analisa kandungan isi perut menunjukan ketam tidak juga memakan cacing sipunkula dan makanan utama ketam adalah alga. Kesimpulannya, terdapat interaksi antara ketam dan cacing sipunkula tetapi bukan hubungan mangsa – pemangsa. Hubungan antara ketam dan cacing sipunkula mungkin persaingan ruang tempat tinggal.

Kata kunci: Cacing wak-wak, Ketam, Kandungan Usus, Hubungan mangsa-pemangsa, Persaingan

1.0 Introduction

Intertidal rocky shores are rock platforms which is continuous stretches of rock with microhabitat such as pools or crevices. Besides that, the habitat also physically complex, with the changes of slope; the presence of rock pools, gullies, crevices and boulders which increase the range of habitat and the number of organism of species present.

Most substrate of rocky shore is stable where provide a secure surface for variety of organism such as shore crab, oyster, and barnacles. Some of crab's family, they are preferring hard substrate such as oyster bed, tide pool on rock, under stones (Melo, 2008). Similarly, for some of the family of sipuncula that prefer live in crevices between and under rocks (Cutler, 1994).

Sipuncula known as peanut worm which a small phylum of non -segmented coelomate worm that have existed since the Cambrian (Huang et al., 2004). Next, the peanut worm is sources of energy to the other organism rock surface, or the sediment itself into biomass (Cutler, 1994). Peanut worm available as food item for gastropods, crabs, and peoples (Cutler, 1994).

There are a lot of previous studies about the crab predation at the rocky shore such as prey preference of the stone crab *Platyxanthus crenulatus* (Laitano et al., 2013) and feeding of spider crab *Maja squinado* in rocky subtidal of the Ria de Arousa (north-west Spain) (Bernadez et al., 2000).

Most of published paper assigned that crab is the main predator to many marine invertebrates such as portunid crab predation on juvenile hard clams: effects of substrate type and prey density (Sponaugle and Lawton, 1990) and natural diet and feeding habits of *Thalamita crenata* (Decapoda: Portunidae) (Cannicci et al.,1996).

There are well studied that crab prey on Foraminifera, sponges, hyroid, gastropods, clam shell and polychaete (Squires, 2003). The last previous study about the crab prey on peanut worm is about around 1920 (Cutler, 1994). However, that study is not focus on community of peanut worm and crabs at hard substrate and there is no study about the interaction between the peanut worm and crab.

As major predator within community, crab gives significant effect on community structure by influencing the population density of their prey (Ropes, 1968; Siddon & Whitman, 2004). Therefore, this study would like to find the interaction between the crab and peanut worm as they are prey and predator.

The objectives of this investigation are 1) to determine the density of crab and peanut worm, 2) confirm the prey-predator relationship between peanut worm and crab and 3) analyse the gut content of the crab.

2.0 Literature Review

2.1 Tidal Zone at the Rocky Shore

Rocky shore is divided into three zones which are splash zone, intertidal zone and sub-tidal zone (Figure 1). The splash zone is above the area of mean high water springs, (MHWS). Then, the intertidal zone is the area between the mean high water springs, (MHWS) and the area of mean low water spring (Smith, 2013).

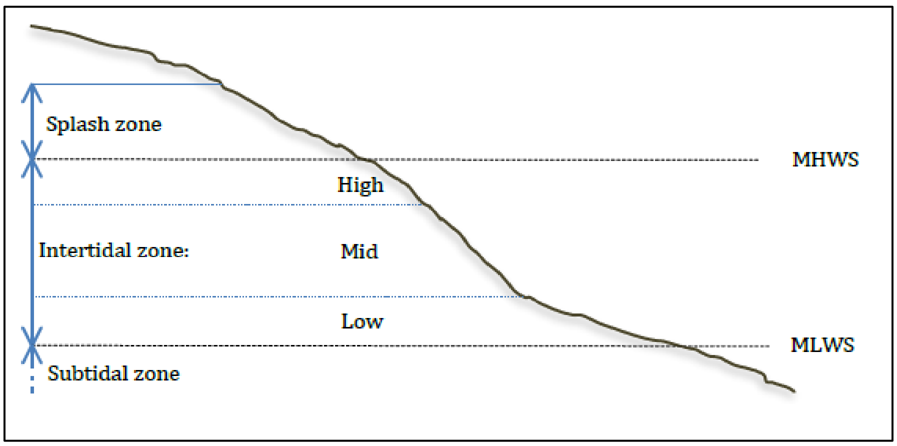

Figure 1 : the zones at the rocky area. (Adopted from: Smith, 2013)

2.2 Background of Peanut Worm

The common name for sipuncula is peanut worms and they are marine worm. Peanut worm's bodies consist of unsegmented trunk and retractable introvert. Most of them have an array of tentacles at its distal end. Sipuncula is being recognised as phylum and may closely relate to mollusks or annelids although the relationships have not yet been resolved (Maxmen et al, 2003).

In Sarawak, the local name of *Sipunculus nudus* are Wak-wak Tunggal and Wak-wak Tampas. Sipuncula are obvious from all major ocean depths and climatic environment (Cutler,1994).

2.3 Peanut Worm Community Inhabiting at Hard Substrate

Cutler (1994) indicates that peanut worm can be found in most marine habitats, from the intertidal zone to abyssal depth. Some of them live in crevices between rock and under rock, within sponges or algal mat, and algal holdfast. According to Gibbs (1987), a few species of peanut worm prefer to bore into coral, sedimentary rocks such as shale or sandstone or unique material such as decaying whale‘s skull.

Five family of peanut worm which are Golfingiidae, Phascolionidae, Phaschosomatidae, Themistidae and Aspidosiphonidae were recorded that prefer to inhabit hard substrate (Shulze, 2008). Hammer and chisel was used to obtain undamaged specimen as they cannot be forced or pulled intact from rock (Shulze, 2008).

2.4 Crab Community Living at Hard Substrate

There are several crabs that prefer to inhabit at hard substrate such as coral, rock, and gravel. Melo (2008) reported that there were 49 species of crab that live at hard substrate. Besides that, six species of Portunidae were found to live at hard substrate at coral rubble (Spiridonov & Neumann, 2007).

2.5 Gut Content Analysis

The choice of an analytic method that best fits to what is really observed in gut contents analysis has been concern for many authors, including Hynes (1950), Hyslop (1980) and Bowen (1983) who discuss the four main methods: occurrence, numerical, weight and volumetric frequencies.

According to Lima-Junior and Goitein (2001) frequency occurrence is the simple measurement occurrence as it dealing with the stomach food observation. In addition, it's also important in evaluate the abundance of the food item in the samples.

3.0 Materials and Methods

3.1 Study Site

The samplings were conducted on 23 December 2014 and 21 February 2015 at rocky shore area of Pantai Puteri, Kuching Sarawak (Figure 2). The samples of peanut worm and crab were was collected from the rocky area during low tide. The coordinates were determined by using Global Position System (MAP 62 GARMIN).

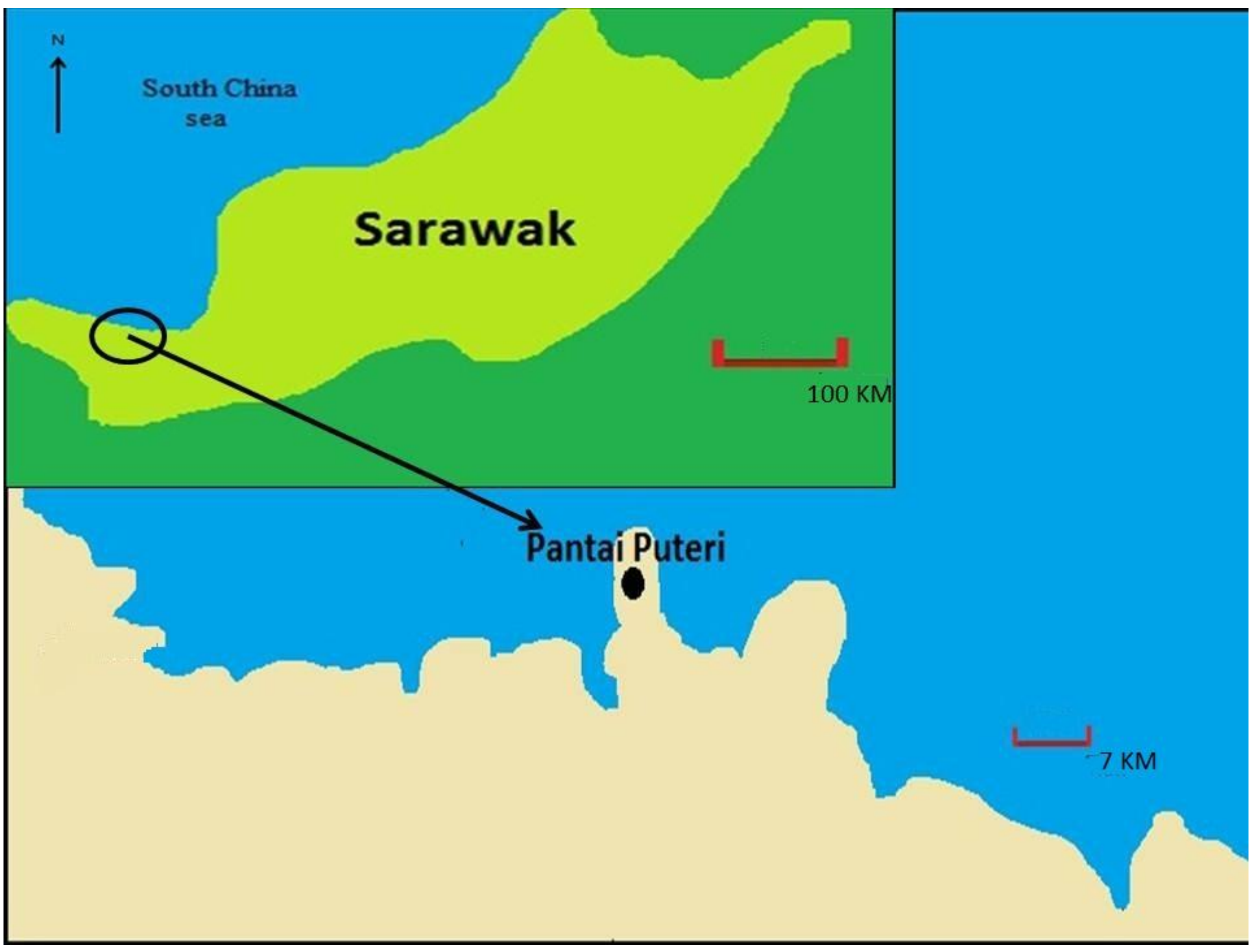

Figure 2: Location of Pantai Puteri in Sarawak

3.2 Field Work

3.2.1 Distribution of Peanut Worm and Crab across the Intertidal Zone

Three line transect was set up from the high tide area to low tide area at the rocky area as shown in (Figure 3). The distance from high tide area to low tide area was measured using range finder (Bushnell ELITE 1500). There were 10 stations during first fieldtrip while six stations during second field trip. The sampling conducted within in length interval which every 10 m (figure 4). The number of stations was depending on the width of the rocky shore area (figure 3). The size started decrease in station seven and for the first fieldtrip. Meanwhile, the second fieldtrip the size started decrease in station three.

Figure 3: The width of Rocky area of Pantai Puteri is not uniform. The width area of A is wider than B

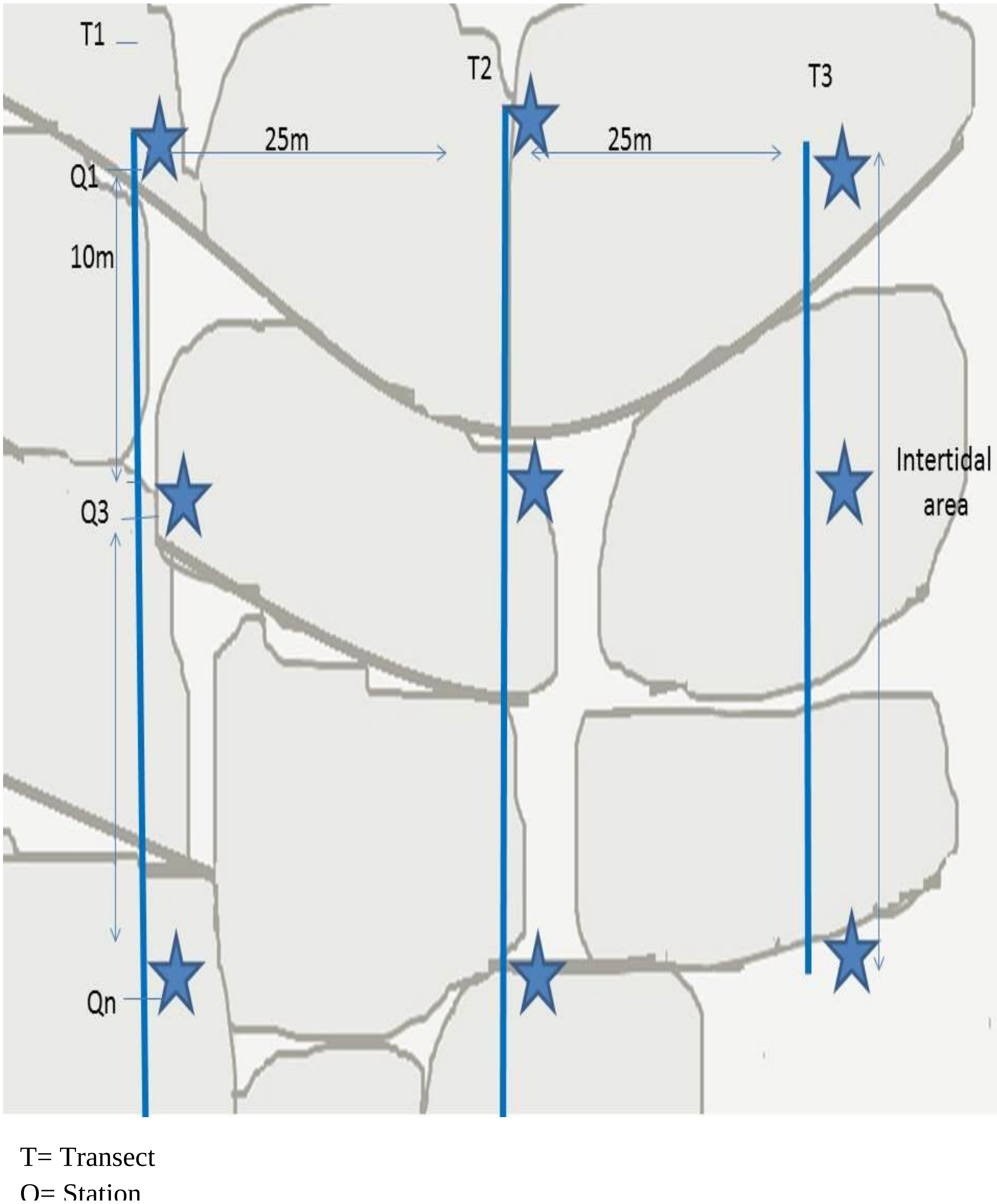

Figure 4: Illustration of three line transect across the intertidal zone

3.2.2 Sampling of Peanut Worm and Crab for the Population Density.

A total of 440 individual peanut worms and 165 individual of crabs were collected during the second field trip. The crabs and peanut worms obtained approximately 1 kg from dead oyster bed that attached to rock by scrapping the dead oyster (figure 5) with hammer and chisel (Cutler, 1994). Then, the detached rock oyster shells were put in the plastic sample and weight on the weighing scale (Tanita KD 200). The density of peanut worm and crabs were calculated using the formula number of organisms was divided with the 1 kg of the oyster shell. Then, the live peanut worms were stored in plastic bottle sample containing 500 ml of seawater and labeled it for feeding experiment in the laboratory.

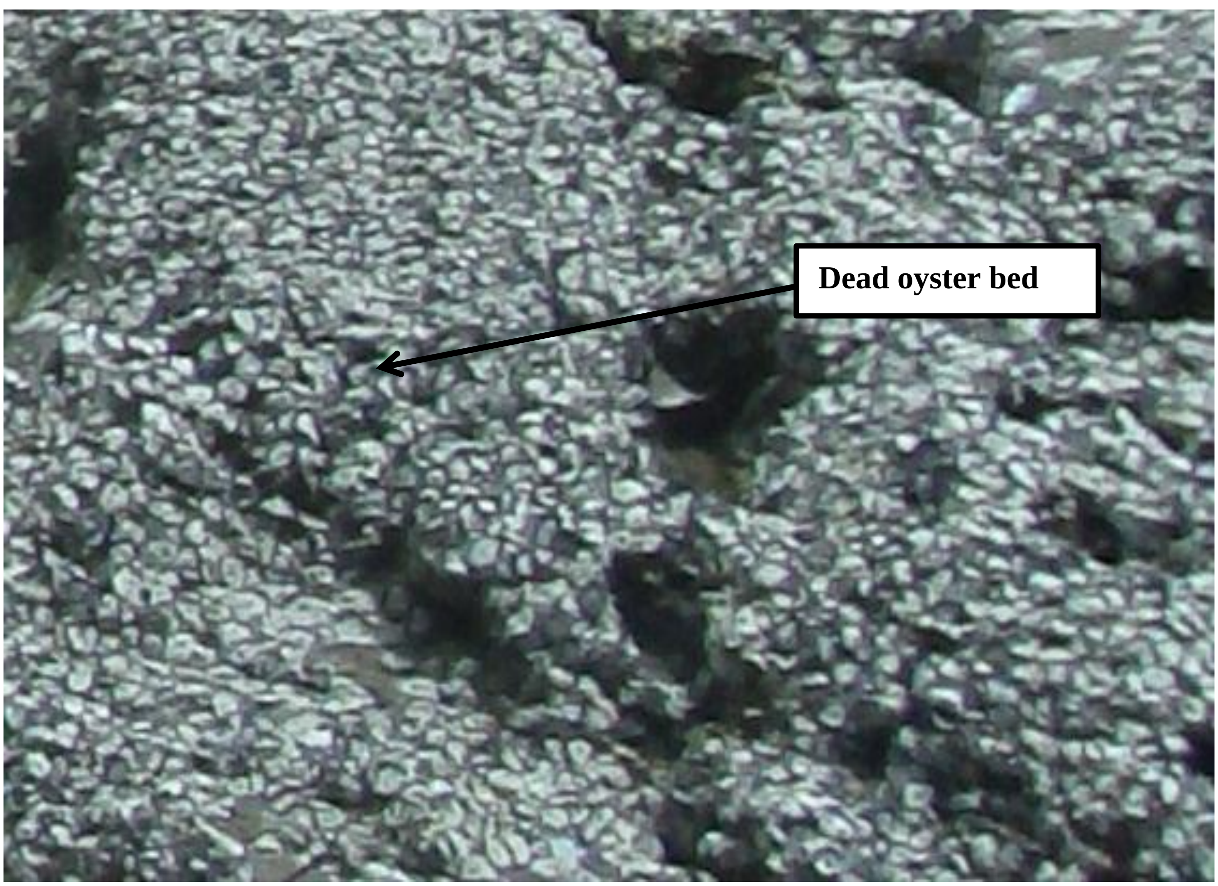

Figure 5: The dead oyster bed that attached to rock at Pantai Puteri.

3.2.3 Crab Sampling for Feeding for Feeding Experiment and Gut Content Analysis

A total of 113 crabs and 267 peanut worms were collected during the first field trip. Only 93 from total crabs were preserved for gut content analysis. The crabs was injected by 10% formalin solution to preserved the stomach content (Elner, 1981). Then, 20 live crabs were stored in plastic bottle and labeled it for laboratory feeding in the laboratory. Then, the live peanut worms were stored in plastic bottle sample containing 500 ml of seawater and labeled it for laboratory feeding in the laboratory (Figure 6).

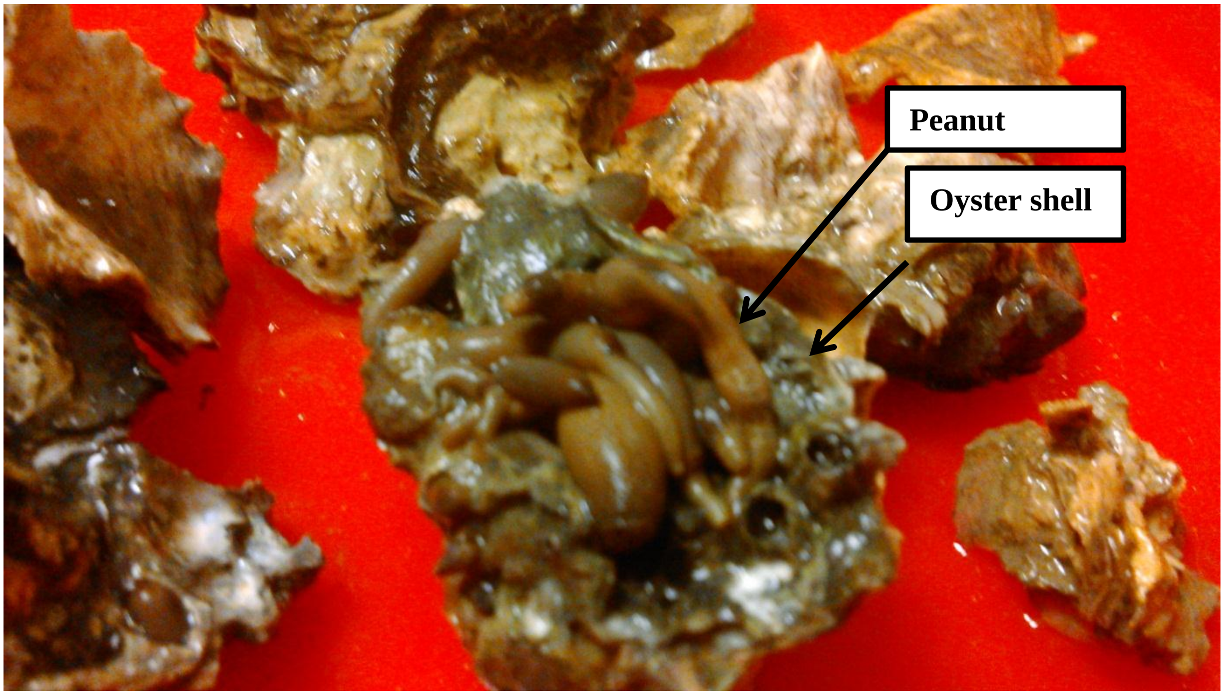

Figure 6: Peanut Worms attach to oyster shell

3.3 Laboratory Works

3.3.1 Crab and Peanut Identification

The crab was identified to the family level used the taxonomy key by (Ng, 1998). The parts involved in crab's identification were the carapace, chela and dactyl. The Peanut worm was identified by their family used the taxonomy key by Cutler (1994).

3.3.2 Laboratory Feeding

The live crabs were placed in the aquarium. Then, it will be starved for 24 hours before place the peanut worm was placed in the same aquarium (Donahue et al., 2009). The observation was made as the crab is prey on peanut worm within (one hours). The interaction between crab and the peanut worm was studied. Besides that, the laboratory feeding also conducted two conditions. First laboratory feeding the crab and peanut worm placed in the presence of light. Second laboratory feeding, the crabs were served with the chopped peanut worm and in the dark. Third laboratory feeding, the crabs were selected according its family and put together with the peanut worm in the dark condition.

3.3.3 Dissection of Crab and Gut Content Analysis

The crab dissected under stereomicroscope (MOTIC SMZ-168 SERIES) using needle and four representative gut samples from the crab the different family were analysed under inverted microscope (Olympus 1X71/1X51). The gut fullness will be identified by visually estimating the percentage of gut volume occupied by the content (the point's method). Each one will be assigned a score in terms of its relative importance visually, as compared to the level of fullness (Williams, 1981).

In addition, the frequency occurrence method was used to see the frequency number of sipuncula that can be found in the crab's stomach.

The formula for percentages point (Hynes, 1950).

$$P = (F/A)*100$$

Where:

P: Percentage points of each item
F: Total number of each item
A: Total points of all item