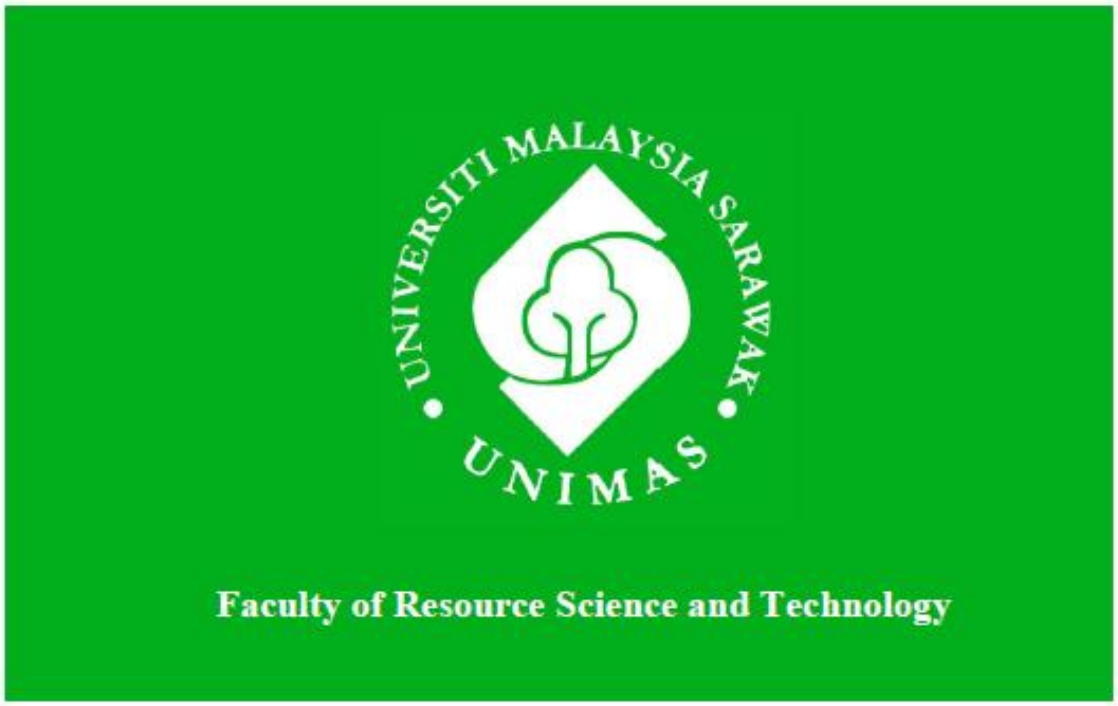


# THE CORRELATION BETWEEN FECUNDITY AND LENGTH-WEIGHT OF GIANT FRESHWATER PRAWN *Macrobrachium rosenbergii* IN BATANG KAYAN, LUNDU, SARAWAK.

**Nur Nazifah Binti Mohamad**

**(35130)**

**Bachelor of Science with Honours**
**(Aquatic Resource Science and Management)**
**2015**

UNIVERSITI MALAYSIA SARAWAK

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# THE CORRELATION BETWEEN FECUNDITY AND LENGTH-WEIGHT OF GIANT FRESHWATER PRAWN, *Macrobrachium rosenbergii* IN BATANG KAYAN, LUNDU, SARAWAK.

**Nur Nazifah Binti Mohamad**

**(35130)**

**This project report is submitted in partial fulfillment of the requirements for STF3015**
**Bachelor of Science with Honours**
**(Aquatic Resource Science and Management)**
**Faculty of Resource Science and Technology**
**UNIVERSITI MALAYSIA SARAWAK**
**2015**

**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.

_____

NUR NAZIFAH BINTI MOHAMAD

Aquatic Resource Science and Management
Department of Aquatic Science
Faculty of Resource Science and Technology
Universiti Malaysia Sarawak

The project entitled "The correlation between fecundity and length-weight of *Macrobrachium rosenbergii* in Batang Kayan, Lundu, Sarawak" was prepared by Nur Nazifah Binti Mohamad 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 Resource Science and Management.

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In the name of Allah S.W.T., the Merciful and the Almighty. Alhamdullillah, I am finally able to complete my Final Year Project. Million thanks directed to my supervisor, Dr Khairul Adha A. Rahim for all the advice and guidance throughout the study.

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**TABLE OF CONTENT**

**Page**

## TABLE OF CONTENT

## LIST OF ABBREVIATIONS

| | |
|---|---|
| BO | Brown Orange |
| CL | Cephalothorax Length |
| FAO | Food and Agriculture Organization of the United Nations |
| G | Grey |
| O | Orange |
| PO | Pale Orange |
| TL | Total Length |
| TW | Total Weight |
| TWE | Total Weight Eggs |
| W | Weight |

## LIST OF TABLES

## LIST OF FIGURES

# The correlation between fecundity and length-weight of giant freshwater prawn, *Macrobrachium rosenbergii* in Batang Kayan, Lundu, Sarawak.

**Nur Nazifah Binti Mohamad**

Aquatic Resource Science and Management
Department of Aquatic Science
Faculty of Resource Science and Technology
Universiti Malaysia Sarawak

## ABSTRACT

This study was conducted to determine the correlation between fecundity with length and weight of *Macrobrachium rosenbergii* (de Man, 1879) at Batang Kayan, Lundu. The giant freshwater prawn was caught using traditional method such as 'belat', fishing rod and 'bubu' by the local fisherman. A total of 48 berried females were collected. The fecundity of 48 samples has been estimated through gravimetric approach. As fecundity was estimated, the relationships with female body size and weight have been expressed in linear regression with positive correlations. The total eggs number of giant freshwater prawn at Batang Kayan was from 7478 to 55,054. There is a strong correlation between fecundity and total length ($r$ = 0.8008) and fecundity and total weight ($r$ = 0.876) of berried femaleof giant freshwater prawn at Batang Kayan, Lundu, Sarawak.

**Keywords:** Batang Kayan; *Macrobrachium rosenbergii*; giant freshwater prawn; fecundity; length-weight; correlation

## *ABSTRAK*

*Kajian ini dijalankan untuk mengkaji hubungan di antara kesuburan dengan panjang dan berat* Macrobrachium rosenbergii *(de Man, 1879) di Batang Kayan, Lundu. Udang galah air tawar ini ditangkap mengggunakan cara tradisional seperti belat, rod memancing dan bubu oleh nelayan tempatan. Sebanyak 48 ekor udang galah betina yang bunting ditangkap. Kesuburan 48 sampel telah diukur dan ditimbang. Setelah kesuburan dikira, hubungan di antara saiz dan berat udang galah betina telah dipaparkan dalam bentuk regressi lurus dengan hubungan yang positif. Jumlah telur yang dikira adalah diantara 7478 dan 55,054.Terdapat korelasi yang kukuh antara kesuburan dengan jumlah panjang (r = 0.8008) dan kesuburan dengan jumlah berat (r = 0.876) udang galah air tawar yang bunting di Batang Kayan, Lundu, Sarawak.*

***Kata kunci:*** *Batang Kayan;* Macrobrachium rosenbergii*; udang galah air tawar; kesuburan; panjang-berat; kolerasi*

## 1.0 Introduction

Giant freshwater prawn or *Macrobrachium rosenbergii* (de Man, 1879) is native to the Southeast Asia (FAO, 2010)**.** This species is widely dispersed in tropical and subtropical zones (Holthuis, 2000). As the population increases, the demand of the freshwater prawn also increases. As reported by New (2000), *M. rosenbergii* become commercially important crustaceans that are widely fished and farmed in ponds and rice fields throughout its natural habitat.

In Southeast Asia, this giant freshwater prawn has evolved to survive in the brackish water of the estuaries and also freshwater rivers (Sandifer *et al*., 1975). This species is usually found in turbid conditions water (New and Singholka, 1985). This shown as the prawn needs brackish water during its larvae developmental stages and then will adapt to freshwater in the river.

However, there was still limited study in Batang Kayan, Lundu for *M. rosenbergii* (Azahari, 2014). Thus, the main objectives of this study were to determine the fecundity of *Macrobrachium rosenbergii* and to investigate the relationship between fecundity with length and weight of berried *Macrobrachium rosenbergii* at Batang Kayan, Lundu, Sarawak.

## 1.1 Objective

The objectives of this study were:

I. To determine the fecundity the *Macrobrachium rosenbergii* at Batang Kayan, Lundu, Sarawak.

II. To investigate the relationship between fecundity with length and weight of *Macrobrachium rosenbergii* at Batang Kayan, Lundu, Sarawak.

## 2.0 Literature Review

### 2.1 Morphology

*Macrobrachium rosenbergii* (De Man, 1879) belongs to family Palaemonidae. De Man (1879) described that *M. rosenbergii* has an elongated body with circular shape in cross-section (Figure 1). The prawn's body consists of two distinct parts which is the cephalothorax. The body also consists of 14 segments (a fusion of the head and thorax), the first one being vestigial, and six abdomen segment. The prawn's cephalothorax is covered by a hard dorsal shield called the carapace. This carapace ends anterodorsally in a teethed and long rostrum. Below is the classification for *M. rosenbergii* according to Holthuis (1980) and Bowman and Abele (1982).

Kingdom Animalia

Phylum Arthropoda

Subphylum Crustacea (Pennant, 1977)

Class Malacostraca (Latereille, 1806)

Order Decapoda (Latereille, 1803)

Family Palaemonidae (Rafinesque, 1815)

Genus *Macrobrachium* (Bate, 1866)

Species *rosenbergii* (de Man, 1879)

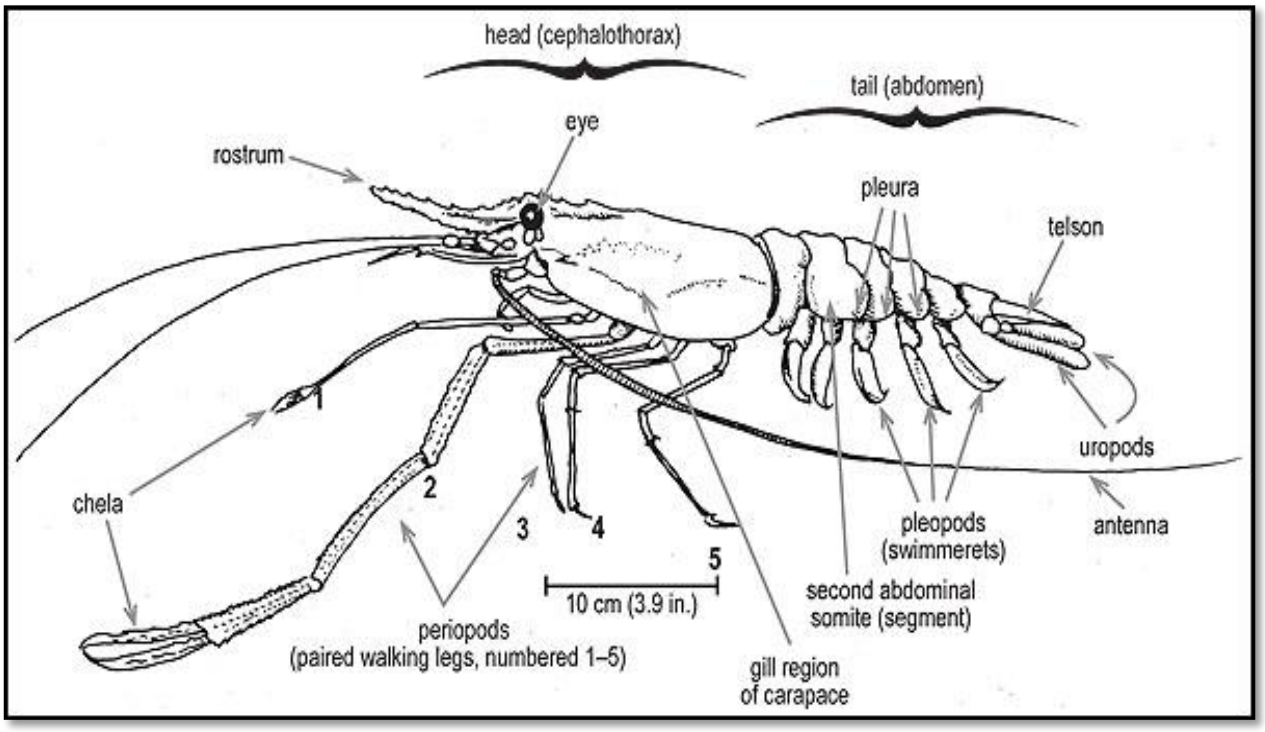


Figure 1 shows the external morphology of *M. rosenbergii* (Hicks and Pierce, 2011).

## 2.2 Life Cycle

With about 200 species distributed through Southeast Asia, the morphometric varies among different geographical populations. It possibly dissimilar due to distinct genetic structure and environmental conditions (Waldman *et al.,* 1988). As for the past 30 years of aquaculture techniques been establish (FAO, 2010), pond and cage aquaculture have been popular and establish among people. Moreover, aquaculture of *M. rosenbergii* has been cultured by many countries even to temperate zones in different parts of Asia, Africa and both Americas (New, 1990). Since the species can be caught almost elsewhere, studies are conducted in many less superior and poorly-developed countries in Asia (Wowor, 2007) such in Thailand and Vietnam. In hatchery conditions, the female of the giant freshwater prawn could lay eggs three to four times per year and fully mature female prawns lays 80,000 to 100,000 eggs per spawn (New, 2005).

Female *M. rosenbergii* complete the life cycle by migrate from downstream into estuaries and free living larvae will hatches in brackish water (Kurup and Harikrishnan, 2000). Thus, *M. rosenbergii* are one of the most commercially important crustaceans throughout its natural distribution (New, 2000) and are commercially essential in the world as a primary inland cultured species (New, 1995).

### 2.3 Food and feeding habits

According to Holthius (1980), genus *Macrobrachium* are consume as food hence, economically important crustacean. Jayachandaran and Joseph (1992) stated that half of *Macrobrachium* species are potentially sustainable for aquaculture. More of being omnivorous, prawn also feeds on variety of foods including in the same species (Sharma and Subra, 2005). Prawn also eats phytoplankton, zooplankton, algae and any muscle pieces of fish (Chopra, 1939). While for post larvae feeds on pure animal diet compare to feeds on mixed diet of algae and *nauplii* (William, 1958). In farming condition, in order to get more uniform construction of large prawns in pond, feeding is needed (Tidwell *et al.*, 2004) such as zooplankton and Oligochaete worms.

## 2.4 Fecundity

Fecundity use to determine the total number of mature ova in ovary (Bagenal, 1968). Nikolskii (1969) stated that fecundity is significant in successful management of the stock. This is because fecundity study estimates the possible juvaniles reproduce per culture thus provide estimate capacity of population (Abowei *et al.,* 2006). Manna and Raut (1991) stated in different species, the number of eggs is different. Bal and Rao (1990) reported that the individual of same species produces different number of eggs depends on the length, weight, age and environmental condition.

Information on fecundity is important in providing future production of brood prawn for management strategies of prawn hatcheries. It also accommodating in estimating number of spawned requires for producing desired quality of seeds for farming. The egg's colour changes from dark green to transparent. In transparent colour of eggs was seen with two black spots in eggs (Sharma and Subra, 2005).

Daniels *et al.* (1992) suggested that as the water temperature decreases, the number of eggs decreases whilst, the time of eggs development increases with the promoted growth of fungal. Law (1991) stated smaller females were more efficient in terms of egg production per body weight which in hatchery condition the production of eggs per unit time is crucial. Thus, fecundity can be determined by counted eggs during spawning.

According to Ling (1969), the eggs of *M. rosenbergii* are slightly elliptical with long axis of measurement of 0.6 – 0.7 mm. The colour of eggs is orange and changes to grey-black few days before hatch. Studied by D' Abramo (2003), normal egg development has a series of colour from pale orange (PO), orange (O), brown orange (BO) to grey (G) which grey (G) usually hatch within 24 – 72 hours.

## 2.5 Water Condition

Abiotic factors such as water temperature, salinity, pH level, alkalinity and dissolved oxygen are crucial for growth and development of *M. rosenbergii.* Water quality influences the rate of growth (length) of freshwater prawns. Thus, temperature, pH, salinity, turbidity and dissolved oxygen are important in fecundity of *M. rosenbergii*.

### 2.5.1 Temperature

The adult prawns can tolerate a wide range of temperature at 18ºC to 34ºC (New, 1990). The optimum temperature range is, however, believed to be from 26ºC to 31ºC (Daniels *et al.,* 2000) which brought temperature to be a main aspect for spawning.

In addition, water temperature plays a major role in ovarian maturation, moulting and spawning. For the peak spawning temperature of *M. rosenbergii*, it is ranging from 29ºC to 30.5ºC (Rao, 1991). Chavez Justo *et al.* (1991) also conducted study on the effects of three water temperatures (24ºC, 28ºC and 32ºC) on growth rate and frequency of reproductive moults.

The increase of water temperatures, 32ºC can improve the growth rate and the female's reproductive moult more than temperatures of 24ºC and 28ºC. Based on Rogers and Fast (1986), reported that *M. rosenbergii* were stressed by temperatures below 22ºC. The tolerance time to extreme temperature depends basically on the age and size.

### 2.5.2 Salinity

Salinity is a measure of the dissolved salts in water. Larvae of *M. rosenbergii* need saline water for growth and development. The salinity is one of important factors for larval rearing phase of M. rosenbergii (Daniels *et al.,* 2000). Despite the fact that estuarine conditions vary, in order to maintain steady salinity from hatching to metamorphosis as recommended by New & Singholka (1985), the salinity frequently used at least 12 psu. A range of optimal salinity values for *M. rosenbergii* of larval is 12 – 16 psu (Sandifer *et al.,* 1977) and 10 – 15 psu (New, 1990). It is vital that all the females hatch their eggs within three days to achieve a good larval survival rate (Weimin, 2007).

Even though juvenile and adult stages of prawn can live in wide range of salinity however, freshwater habitat is more preferable for growth and reproductive activities. In captivity, a salinity of 18 psu could be survived by larval stages (George, 1969). Mortality of post-larval of *M. rosenbergii* takes place at 25 psu and rapidly increases at more than 30 psu (Sandifer *et al.,* 1975). Brooders are usually held in a variety of salinities between fresh to brackish water less than 15 psu (Daniels *et al.,* 2000). When berried females are kept in brackish water, New (1990) found that the hatchability of the eggs was higher than in freshwater.

### 2.5.3 pH

High pH can cause mortality as it directly creates a pH imbalance to the prawn tissue. Although freshwater prawns have been successfully raised in ponds where pH is ranges from 6.0 – 10.0, pH is more recommended to be 6.5 – 9.5. Stated by Law *et al.* (2002), the optimum pH for *M. rosenbergii* is pH 7.0. It is found that the egg hatchability

of *M. rosenbergii* is extremely sensitive to the pH in brackish water. It also stated at 12 psu, the highest hatchling rate was 92.2% at pH 7.0. When the pH changes to 6.5 or 7.5, the egg hatchling rate decreased to 5.0% and 13.3% respectively.

### 2.5.4 Turbidity

Turbidity affects the colour and clarity of the water. According to Ewa *et al.* (2011), water at downstream is more turbid compared to upstream as the accumulation of excess organic which deplete the concentration of oxygen in water. It also stated that the higher turbidity increases the water temperature as suspended particles absorb the heat. This in turn, reduces the concentration of dissolved oxygen (DO) as warm water holds less DO than cold water. White (1994) stated the higher the turbidity of water, the lower the amount of light can penetrate into the water which reduces the photosynthesis process and decreases the production of DO.

### 2.5.5 Dissolved Oxygen

According to Ewa *et al.* (2011), dissolves oxygen in water is the amount of oxygen content in water body. Respiration of prawn requires oxygen in the water by diffusion across the gills. Prawn metabolism adapts to limiting oxygen concentrations in culture water, swimming or increase in digestion or metabolism of feeds (Neill and Bryan, 1991).

Generally, the metabolic demand for oxygen in aquatic animals is double or triple with every 10ºC raise within the range of temperature that the animal can tolerate (Boyd and Zimmermann, 2010). Thus, the higher feeding rates also likely to increase the quantity if organic matter and increase feeding rates. Body size can influence the dissolved oxygen

(DO) need for aquatic crustacean species. Sandifer and Smith (1985) reported that the larger individual prawns require more DO than the smaller ones. These conclude that the larger individuals are more vulnerable to low oxygen concentrations.

## 2.6 Disease

According to D' Abramo *et al.* (2003), major crisis that always affect the production of freshwater prawn is diseases. This due to lower amounts of total biomass in production ponds associate to marine shrimp enterprises. Nevertheless, as stocking rate and biomass per unit area increases, the potential for disease-related mortality likewise increases. Some freshwater prawns in pond population may expose with shell disease that is bacterial in origin and exoskeleton (Pillai *et al,* 2010). Commonly exposure is cause by physical damage to the shell. Nevertheless, the disease does not fatal as it can be removed by shedding the old shell and the production of new uninfected shell (D' Abramo *et al.,* 2003).

However, any stress or disease related condition can adversely affect freshwater prawn (FAO, 2006). In hatchery phase, stress may occur due to the poor water quality and increases with present of diseases that takes place result from the production of bacteria caused by undesirably high organic load (New and Kutty, 2010). In addition, therapeutic treatment is recommended by addition of oxolinic acid at 1 mg/L (1 ppm) to the water. Moreover, aeration devices must be located at deep end of pond adjacent to drain basin area to minimize the accumulation of sediment and maintaining proper levels of dissolve oxygen (DO).

## 2.7 Relationship of Fecundity with Length and Weight

*M. rosenbergii* may spawn three to four times per year (Ling, 1969) or more than four times yearly (Rao, 1991). Development in sexually mature *M. rosenbergii* females involves the physiological processes of moulting, somatic growth, and ovarian development (Cavalli *et al.,* 2001).

O' Donovan *et al.* (1984) reported that 90% of *M. rosenbergii* caught from Israeli pond was small females and it was in the warmer breeding season, the female prawn were observed to carry eggs under pleopod. Law (1991) stated smaller females were more efficient in terms of egg production per body weight; in a hatchery situation the production of eggs per unit time is crucial.

Nevertheless, Rao (1991) stated that the larger the female linearly related with weight, the higher the reproduction. As a result, aquaculturist usually selects the larger females for reproduction. Hence, the length and weight of the prawn is directly proportional to fecundity of prawn.