Length-weight relationship and condition factor of white shrimp, *Penaeus merguiensis* in West Aceh waters, Indonesia

D F Putra[1]*, A A Muhammadar[1], N Muhammad[2], A Damora[1], A Waliul[1], M Z Abidin[1], N Othman[3]

[1]Department of Aquaculture, Faculty of Marine and Fisheries, Syiah Kuala University Kopelma Darussalam 23111, Banda Aceh Indonesia
[2]Department of Biology, Faculty of Mathematics and Natural Sciences, Syiah Kuala University Kopelma Darussalam 23111, Banda Aceh Indonesia
[3]Open University of Malaysia, Pulau Pinang Branch, Malaysia

*Email: dfputra@unsyiah.ac.id

Abstract. The present study aims to investigate the length-weight relationship and condition factor of *Udang Kelong*, White shrimp, *Penaeus merguiensis* in West Aceh waters, Indonesia. The sampling was conducted in May 2018 in Ujung Baroh Fish landing site, West Aceh District. We used a purposive sampling method by using mini trawl. A total of 55 shrimps consisted of 30 males and 25 females were found. The carapace length of male and female shrimp ranged from 2.38 to 6.59 cm and 2.87 to 6.58 cm. Body weight of male and female shrimp ranged from 2.4 to 28.09 g and 3.16 to 29.98 g. The statistic analysis showed that male and female shrimps belonged to isometric growth pattern. The correlation coefficients value expressed that both male and female showed a very strong relationship between length carapace and body weight (> 90%). The shrimp condition factor was ranged from 0.104 – 0.116.

1. Introduction

Located in equator line, Indonesia is recognized as one of an abundance of fisheries resources and natural diversity in the world [1,2]. *Udang kelong*, White shrimp, *Penaeus merguiensis* is one of the commercial fisheries production in Aceh. The result of the previous study showed that the shrimp has widely distributed along the eastern coast of Aceh, Indonesia [3]. However, based on field interview from fishermen, the population of white shrimp, *Penaeus merguiensis* in nature has dropped dramatically due to fishing exploitation activity. Therefore, it is necessary to develop the shrimp culture technology to support the demands of the market and to maintain the shrimp nature stock. Regarding this fact, a comprehensive and complete information is necessary to be collected. The data about bio-ecology of shrimp is important as the basis for the development of its culture.

One of the important bio-ecological information is the shrimp pattern growth including length-weight relationship. Previous work about shrimp growth pattern in other region and related white shrimp research has been reported [3,4,5,6,7,8,9,10]. However, the studies about bio-ecology of *Udang Kelong*, White shrimp, *Penaeus merguiensis* in West Aceh region has not been conducted.

It is necessary to obtain as much as possible data in order to fulfill the basic information not only for the development of shrimp culture but also to support the fisheries resources management. Therefore, in this research, we would like to investigate the length-weight relationship, condition factor value and sex ratio of *Udang kelong*, White shrimp, *Penaeus merguiensis* in West Aceh waters, Indonesia.

2. Materials and Methods

2.1. Sampling

The sampling was conducted in May 2018 at Ujung Baroh fish landing site, West Aceh district, Indonesia. We used a purposive sampling method to determine the sampling site. The shrimps were caught by using mini trawl (0.5 cm mesh size). Caliper (0.01 mm) and digital scales (0.01 g) were used to measure CL and BW. The measurement of carapace length (CL) and body weight (BW) were directly

conducted at the sampling site to maintain freshness validity. Determination of shrimp's sex was visually done by using a magnifying glass.

2.2. Research Parameters
The following variables were calculated:
The length-weight relationship was calculated using the formula [11]:

$$W = aL^b$$

Information :
W = Weight (g)
L = Carapace Length (cm)
a = The intercept on the Y-axis
b = Exponent/ slope
Condition factor was calculated by the formula [9].

a.   If isometric growth pattern (b = 3) we use the formula:

$$K = 10^5 \times W / L^3$$

b.   If allometric growth pattern (b ≠ 3) we use the formula:

$$K = W / (aL^b)$$

Information:
K = Condition factor
W = Weight (g)
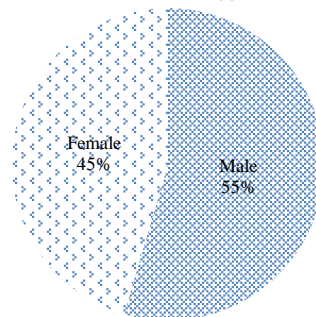L = Carapace Lenght (cm)
a dan b = Constanta
Sex ratio

Sex identification was based on female thelycum and male petasma. For each specimen, we measured carapace length (CL) – which extends from the orbital cavity to the posterior margin of the cephalothorax – using a caliper with 0.01 mm accuracy, and total wet weight (TW) with a digital measure of 0.01 g accuracy. Sex ratio (male : female) was being calculated using Chi-square test (χ^2), at a significance level of 95%, to test the difference of 1:1 [12].
The data were tabulated and analyzed by using multiple linear regression. The statistics software was using Microsoft excel 2010 version. Data presented in a graphic and tabular form.

3. Results and Discussion
A fifty-five *Udang Kelong*, White shrimp, *Penaeus merguensis* consisted of 30 male and 25 female were caught during the sampling (Figure 1). The result showed that the shrimp's carapace length and body weight ranged from 2.38 – 6.59 cm and 2.4 – 29.98 g, respectively (Table 1). The b value of male and female shrimp were 2.95 and 3.12. There are several ways to find out the shrimp size, including the measurements carapace length and body weight. The length-weight measurements of shrimp are done for the purpose of knowing conversion and length to weight or vice versa so that it can be used as a health prediction, obesity, and physiological productivity and conditions including gonadal development [13].

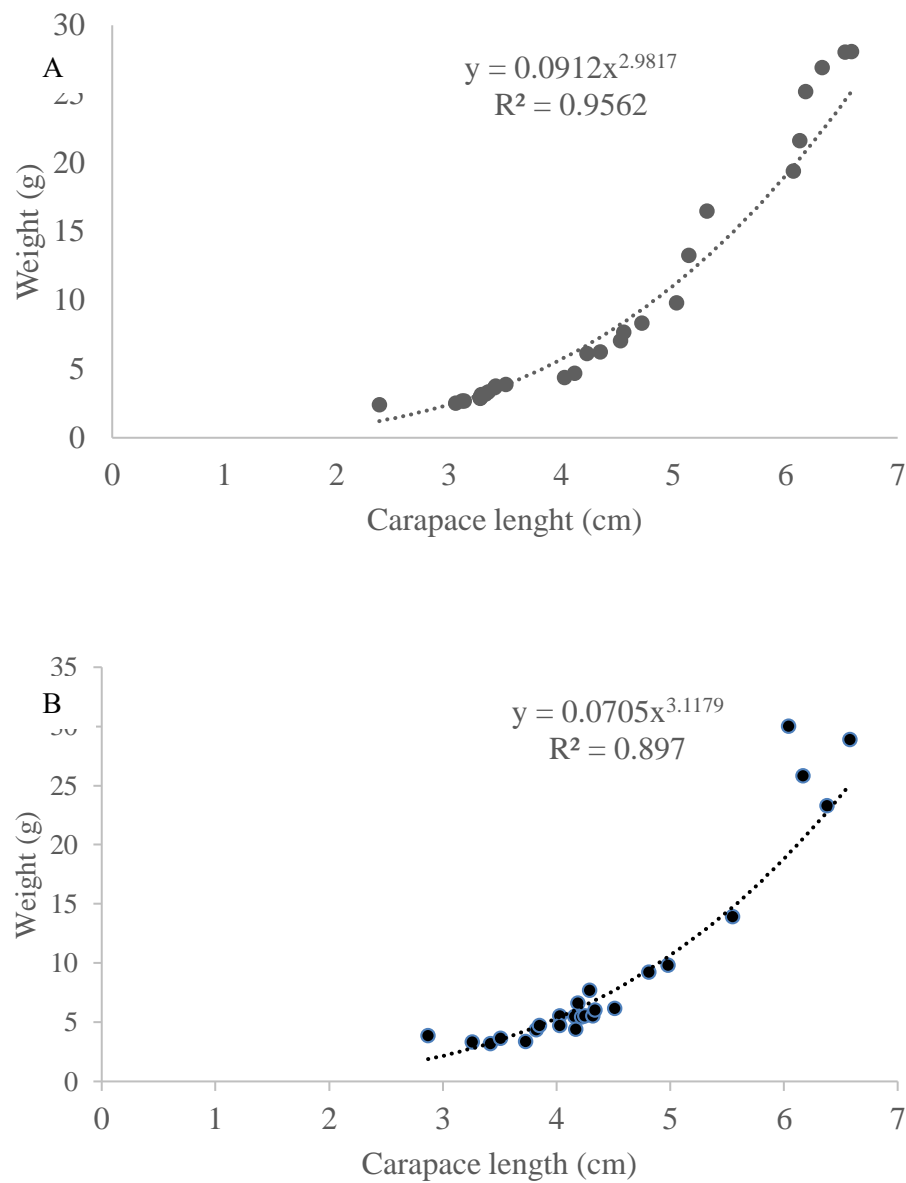*Udang Kelong, White shrimp, Penaeus merguiensis*
n = 55

Figure 1. The number of male and female of *Udang Kelong*, White Shrimp, *Penaeus merguiensis*

Table 1 showed that the type of shrimp's growth pattern was isometric, indicated that the carapace length and body weight of male and female shrimp were balancing. A similar result has been obtained by [15] showed that the growth pattern of *Penaeus Indicus* in Tanzania was isometric. Unlike research that has been done in North Sumatra and the North coast of Java, they showed the allometric growth pattern [3,4,14]. We assumed that the different region has different season time and sampling period, therefore it might affect the shrimp different pattern. The coefficient of correlation (r) of male and female shrimps were 0.95 and 0.93, subsequently. It showed that the relationship between carapace length and body weight of both shrimp's sex were very strong.

Table 1. The Result of the analysis of the length-weight relationship of white shrimp *Penaeus merguiensis*

No	Parameter	Male	Female
1	Carapace length range (cm)	2.38 - 6.59	2.87 - 6.58
2	Body weight range (g)	2.4 - 28.09	3.16 - 29.98
3	b value	2.95	3.12
4	Coefficient correlation (r)	0.95	0.93
5	Regression equation	$0.0912x^{2.9817}$	$0.0705x^{3.1179}$
6	T-test	Tcount < Ttable	Tcount < Ttable
7	Type of growth pattern	Isometric	Isometric
8	Number of samples (n)	30	25
9	Factor condition	0.12	0.10

The factor condition value of both male and female shrimp were 0.12 and 0.10 respectively. This result has the lower value than shrimp in North Sumatra and North coast of Java [3,14]. Condition factors are calculated to assess fish health in general, productivity and physiological conditions of fish populations [16,17]. This condition factor reflects the body's morphological characteristics, lipid content and growth rate [18]. We assumed that further frequent sampling is necessary to obtain the shrimp growth sequence data in West Aceh waters.

Figure 2. The length-weight relationship of male (A) and female (B) of *Udang Kelong*, White Shrimp, *Penaeus merguiensis*

Table 2. The sex ratio parameter of *Udang Kelong*, White shrimp *Penaeus merguiensis*

No	Sex ratio parameter	Male	Female
1	Percentage (%)	54.54	45.45
2	Sex ratio	1	0.83
3	Chi square test	0.45 < 3.84	

Table 2 showed that the sex ratio percentage of male and female shrimp were 54.54% and 45.45%. This indicates that the white shrimp, *Penaeus merguiensis* caught in West Aceh waters has an opportunity for the deeper frequency of spawning due to the mating chance will be smaller. If there is no balance in sex ratio, there will be potential degradation in spawning activity. Change in sex ratio can be caused by the intensity of the high exploitation from year to year, biological conditions, and environmental factors and selectivity of fishing gear [19].

4. Conclusions
A total of 55 shrimps consisted of 30 males and 25 females were found. The carapace length of male and female shrimp ranged from 2.38 to 6.59 cm and 2.87 to 6.58 cm. Body weight of male and female shrimp ranged from 2.4 to 28.09 g and 3.16 to 29.98 g. The statistic analysis showed that male and female shrimps belonged to isometric growth pattern. The correlation coefficients value expressed that both male and female showed a very strong relationship between length carapace and body weight (> 90%). The shrimp condition factor was ranged from 0.104 – 0.116.

Acknowledgments

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