The length-weight relationship of *Magallana gigas* in Krueng Cut, Province of Aceh, Indonesia

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Abstract. This study aims to determine the length-weight relationship of *Magallana gigas* in Krueng Cut, Banda Aceh City. The research was conducted in October 2020 at Krueng Cut River, Syiah Kuala District, Banda Aceh City. The oyster identification process was carried out at the Laboratory of Marine Biology, Faculty of Marine and Fisheries, Universitas Syiah Kuala. The method used in this study was simple random sampling method. In addition, water quality data were also collected in situ and substrate collected ex situ. The Ostreidae group found in Krueng Cut, Banda Aceh City is the *Magallana gigas* species. The average oyster found in Krueng Cut, Banda Aceh City is small with length growth ranging from 20 to 50.2 mm. The results showed that the growth pattern of *Magallana gigas* was classified as negative allometric at three research stations in Krueng Cut River, Banda Aceh, this was based on the value of $b < 3$. Environmental factors from the three research stations in Krueng Cut, Banda Aceh City are still within the normal limits of *Magallana gigas* life.

1 Introduction

Bivalves are widely distributed throughout coastal waters of Indonesia, especially in various shallow water ecosystems [1]. One of the potential bivalve species that can be developed in order to increase economic income is the oyster species. Oysters belong to the Ostreidae family of mollusc phyla that live in marine and brackish water habitats and usually live attached to mangrove roots, pier poles and various objects of dead coral rocks at the bottom of the waters [2]. Oysters tend to like warm waters and are protected from waves and sloping surfaces with mud, sand, gravel and rock substrates [3]

Oysters are one of the important potential resources in Indonesia, because in general oysters can be utilized for various human needs although only a few types are of high economic value [4]. One of the oyster species that is often consumed by the community is the meat oyster (Ostreidae). This species is a source of protein for local communities and plays an important role in the livelihood of fishing communities [5].

Assessment of the existence of oysters in nature must be done. It is necessary to know how the abundance in nature is still available sufficient for the balance of the ecosystem or even in a state of decline. One form of assessment of the morphometric biota is the

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relationship between length and weight of the ostreidae family on the coast. So far there is still very little research related to the length-weight relationship of meat oysters (Ostreidae) conducted in Aceh. The research that has been done includes [5; 6; 7]. However, research on length-weight relationships has never been conducted, especially in Krueng Cut, Banda Aceh, so this research is important to contribute to the development of oysters in Aceh in the future, especially for oyster conservation and cultivation. This study aims to determine the length-weight relationship of *Magallana gigas* in Krueng Cut, Banda Aceh City.

2 Material and Methods

2.1 Time and location

This research was conducted from October to November 2020 at Krueng Cut, Banda Aceh City (Figure 1).

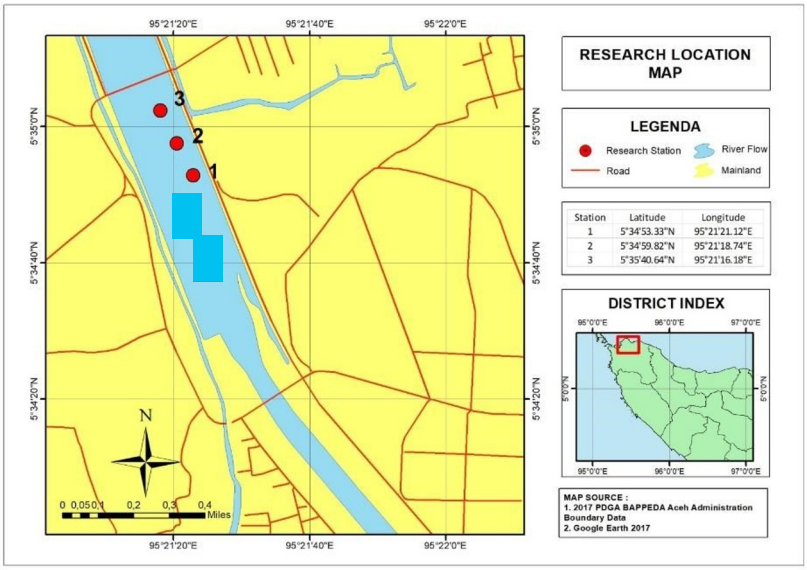

Fig. 1 Location research in Krueng Cut, Banda Aceh

2.2 Material

The tools and materials used in this study consist of Global Positioning System (GPS), Transect, Knife, Plastic samples, 10% formalin, thermometer, pH meter, refractometer, and DO meter.

2.3 Methods

Determination of the station point is determined with a distance of 10 m. When sampling oysters then placed transects in simple random sampling [8] which is done based on the stone throw (10 times each site). The oysters that have been found are put into a container and given 10% formalin. Then after the oyster sample is taken, the water quality parameters are measured in situ, while the substrate sample is inserted in a plastic containers and measured ex situ. Oyster, water and substrate samples are stored in a cool box and taken to the Marine

Biology Laboratory of the Faculty of Marine and Fisheries and the Soil Chemistry Laboratory of the Faculty of Agriculture, Universitas Syiah Kuala for analysis.

Oyster samples that have been preserved with formalin then identified morphologically based on mollusk identification book [9]. Then the sample is measured shell length (SL), shell width (SW), shell thickness (ST), content weight (WM), and total weight (SMW) to obtain morphometric measurements.

2.4 Data Analysis

The data analysis used in this study are 2, namely the analysis of growth patterns using a formula that refers to $W = {}_aL^b$ [10], then the determination of the class interval based on K = 1 + (3.32 Log n) [11].

3 Result and Discussion

3.1 Identified of *Magallana* sp.

Based on the results of identification using morphological parts of the outer shell and inside the shell using identification books and the World Register of Marine Science (WoRMS) website, the ostreidae found at the research site are thought to be *Magallana gigas* of pacific oyster (Figure 2). Generally, *Magallana* genus has an elongated shell, the left valve is always larger than the right valve and tends to cup. *Magallana gigas* has a white outer and inner shell is white, the former aductor muscle is colorless, lives in shallow waters with a depth of 3 m [5].

Fig. 2 *Magallana gigas*

The classification of *Magallana gigas* according to WoRMS updated in 2023 kingdom Animalia, phylum Mollusca, class Bivalvia, order Ostreida, family Ostreidae, genus *Magallana*, species *Magallana gigas*.

3.2 Size Frequency Distribution

The number of *Magallana gigas* found in the research location, Krueng Cut, was 172 individuals. The average oyster found in Krueng Cut, Banda Aceh is small with a length ranging from 20 - 50.2 mm (Figure 3).

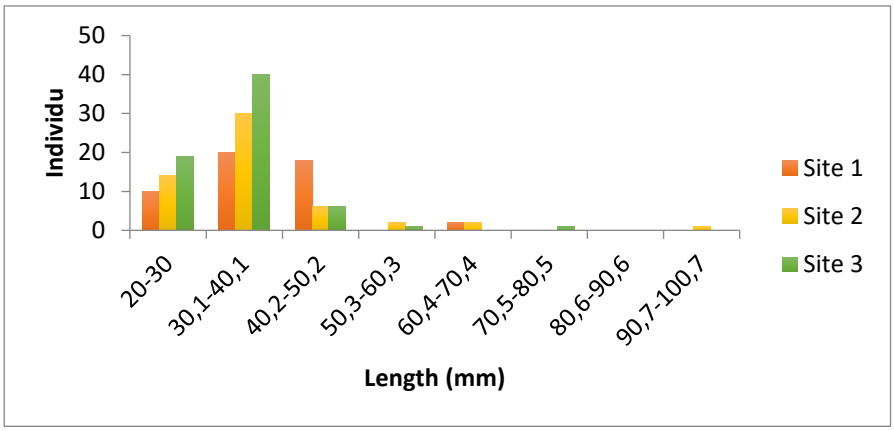

Fig. 3 Distribution of size length *Magallana gigas* in Krueng Cut

The length found at this location is almost similar to the length found by (Octavina et al., 2015). At this size, the results of the study [5] indicate that *Magallana* at that time was in a mature gonadal condition. However, in the study [12] the length of *Magallana* found was much longer, namely 70.24 mm, so it can be concluded that this kerrang can reach a higher length depending on the habitat conditions.

Furthermore, the observation of the weight class interval of *Magallana gigas* in Krueng Cut showed that the highest frequency of the three stations was in the size range of 7.4 - 8.4 g with a total of 28 individuals (Figure 4).

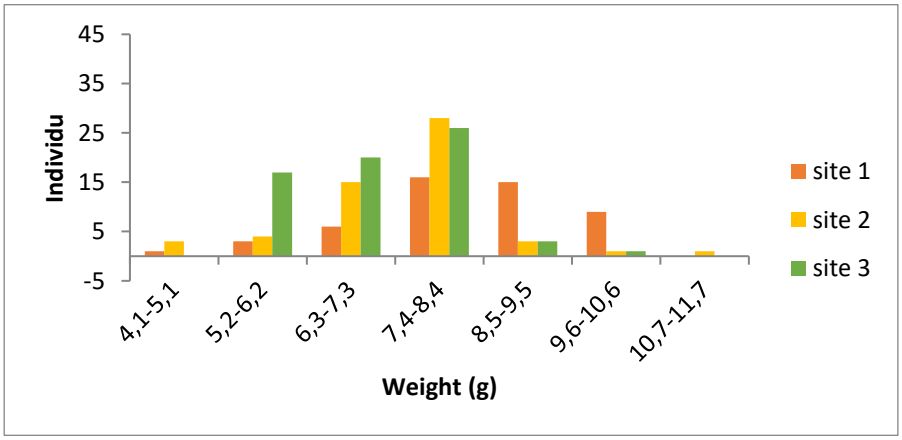

Fig. 4 Distribution of size weight *Magallana gigas* in Krueng Cut

The weight of meat or *Magallana* content in this study was higher in value compared to research [13]. The high value of *Magallana* content weight from this study is thought to be this group in the condition of collecting the entire body mass for spawning preparation so that the accumulation of energy for spawning can be optimal [5].

3.3 Length and Weight Relationship

Analysis of length-weight relationship is an important part of growth to compare the condition or relative health of certain populations or individuals. Growth is a biological process that is formulated as an increase in body length and weight within a certain period. Weight is considered as a function of length, the function value of length is the growth pattern (b value), the greater the b value indicates the better the condition of the waters [14; 6]

The length-weight relationship of *Magallana gigas* found in Krueng Cut is negative allometric (Figure 5). This is due to the indication of the b value criteria <3 [10]. Negative allometric pattern is a pattern of length increase faster than body weight increase.

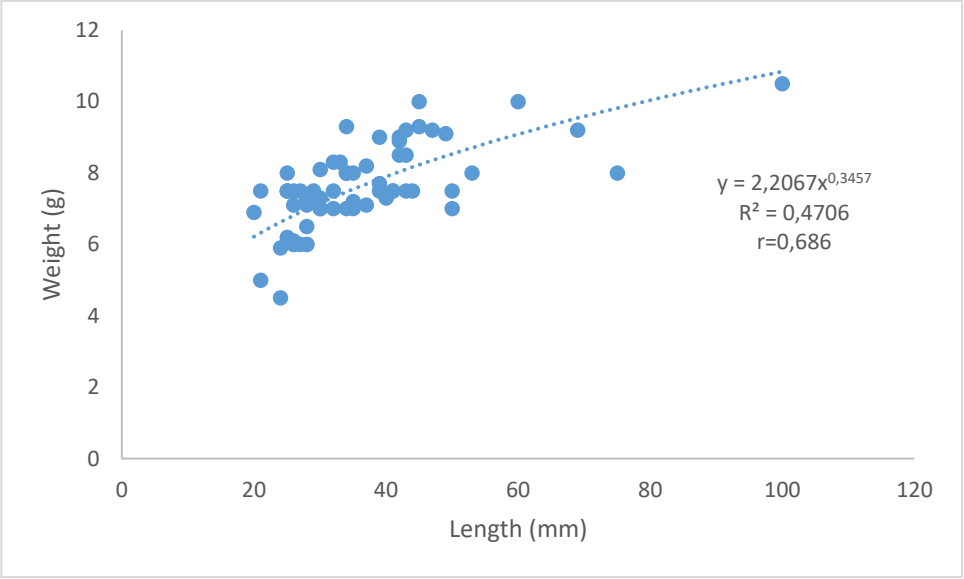

Fig. 5 Length-weight relationship *M. gigas* all site in Krueng Cut

Growth patterns can be seen from the b value in the relationship between body length and weight [16]. The increase or decrease in growth patterns that occur affects the b value and R^2 value found in *M. gigas*. Negative allometric growth in *M. gigas* is thought to be related to its flattened and elongated shape to achieve this shape, the increase in shell length is faster than the increase in weight. The suitability of the effect of body length on the total weight of *M. gigas* oysters can be seen based on the magnitude of the coefficient of determination (R^2).

Length growth is closely related to weight gain. According to [5] growth in shellfish is in the most prominent part, namely the shell, so that growth is an increase in the length of the shell followed by an increase in the body. The relationship between length and weight of meat oysters in Kuala Gigieng has a close correlation. Overall, the oyster growth pattern tends to be thin because the length-weight relationship curve formed tends to be sloping, thus indicating that length growth is faster than weight gain and growth tends to be unbalanced [17; 6; 2; 7].

The high and low value of b does not appear to be influenced by water quality parameters. The results of the analysis of water quality parameters consisting of temperature, salinity, pH, and DO have relatively constant values. The temperature at the three stations ranged from 33^0C to 34^0C and still supported the growth and reproduction of meat oysters. This is in accordance with the statement of [18] that *Magallana* is able to live in a temperature range of 5^0C to 35^0C (Optimum 11^0C to 34^0C) and still survive at temperatures of -50C.

The salinity range in Krueng Cut Banda Aceh is 10-13 ppt. salinity levels at the three stations still support the life of meat oysters. [19] stated that *Magallana* can tolerate a salinity range of 10 ppt to30 ppt (general range 20 ppt to 30 ppt).

The pH measurement value shows that in Kreung Cut, Banda Aceh City tends to be neutral with a range between 8.09 - 8.13. According to [20] meat oysters can live with a pH range of 6.80 to 9.25. However, if it is less or more than the pH range, the oyster will die. Dissolved Oxygen (DO) content at the three stations ranged from 6.96 mg/l to 7.2 mg/l where the highest DO level was located at station I which reached 7.2 mg/l. [21] stipulates that the dissolved oxygen content is >5 ppm for the benefit of marine tourism and marine biota. [5] said that *Magallana* can survive for 5 days in waters containing >1 mg/l dissolved oxygen. Thus it can be concluded that the water quality parameters in Krueng Cut are optimal conditions for the survival of *Magallana gigas* organisms.

4 Conclusion

The growth pattern of *Magallana gigas* tends to form a negative allometric pattern, which is a faster increase in length than weight gain, because the flat shape of the *Magallana gigas* oyster and its life at the bottom of the substrate makes *Magallana gigas* faster to increase body length compared to body weight in order to adapt to its environment. Physico-chemical factors of the aquatic environment are still below the quality standard threshold and support the life of *Magallana gigas* in Krueng Cut, Banda Aceh City.

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