Length – Weight Relationship Analysis and Condition Factor *Anadara granosa* In Panipahan, Rokan Hilir Regency, Riau Province

Manja Asmita, Rusdi Machrizal(*)
Faculty of Teacher Training and Education, Universitas Labuhanbatu,
Jl. SM Raja No 126 A, Aek Tapa Rantauprapat, Sumatra Utara, Indonesia
***Corresponding author:** rusdimachrizal@gmail.com

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Abstract

This research was conducted in the Rokan Hilir district with the aim of analyzing the length-weight relationship and condition factors of Anadara granosa. The aim is to provide information about the length of weight and condition factors of A. granosa which can be used as a reference in cultivation and further research. This research was carried out for 90 days from October to December 2021, in the waters of Panipahan, Rokan Hilir Regency. This length-weight relationship was calculated using a linear allometric model (LAM), while the condition factor was calculated using the Fulton formula (K) and relative weight (Wr). The results of the analysis of the length-weight relationship of A. granosa get a value of b <3 = 0.894, which is a negative allometric where the increase in length is faster than the growth in weight. With the value of relative weight (Wr) 71,325-149,883 and Fulton's condition factor (K) 75,372-387,106. This is caused by environmental conditions that are quite good in supporting A. granosa. in the waters of Panipahan, Rokan Hilir regency

Keywords: *Anadara granosa, condition factor, Length-weight relationship, Rokan hilir*

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INTRODUCTION

The pigeon clam (*Anadara granosa*) is a marine invertebrate and a group of soft-bodied animals with two shells. Conchs belong to Kingdom: Animalia, Phylum: mollusca, Class: bivalvia, Subclass: autobranchia, Order: arcida, Family: arcidae, Genus: Anadara (Sarbu et al., 2019). *A. granosa* can be found on the bottom of muddy waters or in mangrove forest areas. This clam is spread in the Indo-pacific region from East Africa to Follinisia, northern Japan to northern Australia. This animal likes to bury itself in the mud and live in tidal areas. As in general, the *A. granosa* mussel is a type of bivalve that lives at the bottom of the water and has the characteristic of being covered by two pieces of shell (valve) that can be opened and closed because there is a joint in the form of an elastic hinge that connects the two valves (Silva & Fernandes, 2021). The natural *A. granosa* takes 6 months to grow to 4 - 5 mm, while the cultivated mussel takes more than a year to grow to a size of more than 30 mm. As a filter feeder, *A. granosa* has the ecological function of being able to accumulate heavy metals (Cu, Cd, Zn, etc.) in its body (Gómez et al., 2021).

Cadmium is very dangerous for the survival of organisms including humans, because this metal is toxic. If the composition of cadmium metal in a water body is high, it indicates that the water body is polluted, because the metal can contaminate and accumulate in aquatic organisms and even in sediments (Jeklin, 2016). Cadmium can have harmful effects on the survival of organisms, including humans. Cadmium is known to be toxic and can cause damage to organs, nervous system, respiratory system, and reproductive and developmental disorders (Lei et al., 2019).

Efforts to reduce the heavy metal content are by treating the turtle shells by soaking in chalting agents in the form of citric acid as found in tamarind. *A. granosa* is one type of shellfish that has economic value with a price of Rp 15,000/20,000 (Herawati & Soedaryo, 2017). This is because dara mussels are seafood that is in great demand both inside and outside the region, this is related to its rich content of protein, iron, vitamin C, vitamin B12, and omega 3 fatty acids and 81.82% water content needed by the human body (Chen & Chen, 2019). This causes the dara mussel (*A. granosa*) to be one of the main targets of the Panipahan community's catch, which will lead to population decline (Raja et al., 2021). If the community continues to catch them, it is feared that it will adversely affect the sustainability of the population. The cultivation of dara mussels has been tried in various regions (Utama & Indrayani, 2021). The Panipahan people has also attempted to cultivate the mussels to maintain the *A. garnosa* population in nature. Mass-scale cultivation efforts require information on biological aspects, especially the growth of *A. granosa*.

One of the key parameters in the growth aspect is the length-weight relationship and condition factor. Length-weight relationships can also differ between species, between stocks from different fishing grounds, and even within the same sex (Siagian et al., 2017). Length-weight relationships are one piece of information to complement what needs to be known about mussel resource management, for example, in determining the selectivity of fishing gear so that only viable mussels are caught (Marasabessy, 2020). Growth is closely related to feed, which can provide tremendous nutrients and energy for growth (Pratiwi et al., 2011).

The growth rate will increase by increasing the amount of food eaten (Muttaqin et al., 2016). Based on the above, it is necessary to study the length-weight relationship and condition factors of *A. granosa* as basic information in an effort to determine appropriate cultivation techniques. So that in the end it can maintain the sustainability of the *A.granosa* population in Panipahan, Rokan hilir Regency.

METHOD

This research was conducted from October to December 2021. Dara mussels (*Anadara granosa*) were taken directly in the Panipahan waters of Rokan Hilir Regency. The method used in this research is hand sorting, where the clams are caught using a scoop and sorted directly by hand. Samples obtained were taken to Labuhan Batu

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University Laboratory to measure the length and weight. Biological parameters measured included the length, thickness, and width of the shell using calipers or a caliper with an accuracy of 0.1 mm. The total weight of the turtle shells was measured using analytical scales with an accuracy of 0.01.

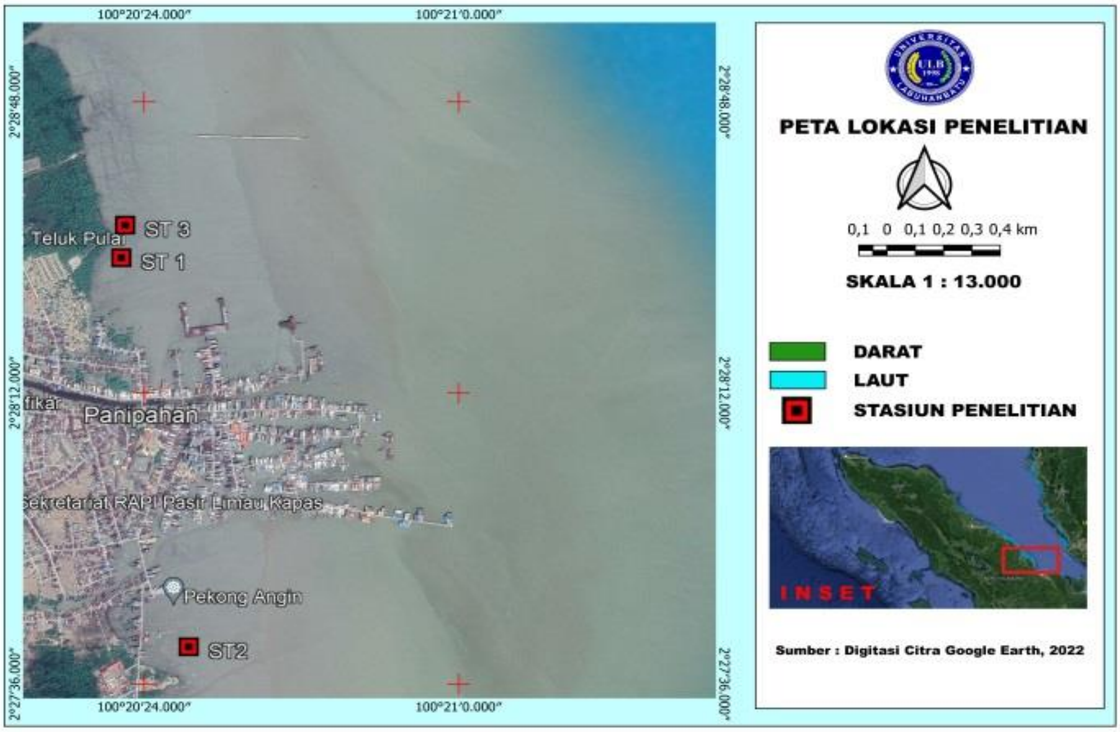


Figure 1. Map of Sampling Location

The determination of the sampling location was based on information from local residents who used to look for virgin clams (A. granosa). Samples were taken and weighed (g) with analytical scales and measured for total length (cm) using digital calipers.

Tabel 1. Research tools and materials

N0	Parameters	Tools	Object
1	Coordinate point	Global Positioning System	-
2	Sample taken	Sampan tanjak, jaring tangguk	*A. granosa*
3	Growth Pattern	Digital Scale (accuracy 0,1 gram), ruler, digital caliper (accuracy 0,1 mm) and millimeter paper	*A. granosa*
4	Documentation	Camera	*A. granosa*

Data Analisys

Length-weight Relationship

The analysis of the length-weight relationship is determined by using the equation (Cren, 1951):

$$W = {}_{a}L^{b} \qquad \text{...(1)}$$

where W: is the total weight of the mussel (g); L is the total length of the mussel (cm); a and b are linearisation constants through logarithmic transformation with the equation;(Draper & Smith, 1981).

Log W = Log a + b Log L……………………………….(2)

If value b = 3, then the length - weight relationship is isometric which means length and weight are the same. However, if b ≠ 3, the length-weight relationship is allometric. If b < 3, the length - weight relationship is negative allometric where length growth is more dominant than weight, then if b > 3 means the length - weight relationship is positive allometric where weight growth is more dominant than length (Shasia et al., 2021).

Condition Factor

Condition factor is a measure used to evaluate the health and body condition of organisms, especially fish and aquatic invertebrates. The condition factor is usually calculated by comparing the actual weight of the organism to the expected weight based on its body size. It provides an indication of the health, growth, and habitat quality of the organism. (Hadiyanto et al., 2017). In this study the relative weight coefficient (Wr) was calculated to predict the condition factor of each sample relative weight calculation formula (Wr) (Ferguson & Bell, 2000).

Wr = W / Ws x 100……………………………………….(3)

Note: *Wr=the relative weight, W= the weight of each sample; Ws= the predicted standard weight of the same sample as calculated from the combined length - weight regression through the distance between species (Ricker, 1975).*

K = WL^{-3} x 100…………………………………………….(4)

Note: *K= the condition factor; W= the weight in grams; L= the length in cm, 3= the length coefficient to test that the value of K tends to be close to 1.*

RESULTS AND DISCUSSION

During the study, 40 *A. granosa* were caught. The analysis showed that the total length (TL) of *A. granosa* ranged from 2.57 to 5.35 cm, the measured weight (W) was 19-45 g, the relative weight condition factor (Wr) was 71.325-149.883, the fulton condition factor (K) was 75.372-387.106 and the coefficient of determination (r2) was 0.378 and the b value was 0.894 (Table 2). The presence of Dara mussels in the period October to December 2012 was influenced by the season which at that time was the rainy season and with high sea waves and the weather worsened in the last sampling (Ubay et al., 2021).

The average length value is 3.419 cm and the average weight is 29.75 g. The results of the analysis of the length-weight relationship in dara mussels (*A. granosa*) showed a negative allometric growth pattern with a b value of 0.894 (b < 3), which means that the growth of mussel length is more dominant than the growth of its weight. Similar to the research of Setiawan et al. (2016) on feather clams (*A. antiquata*) by getting a b value of 2.5 (b<3). Research by Zulfahmi et al. (2021) on the *Tegillarca granosa* also obtained a negative allometric relationship with a b value of 2.53 to 2.75 (b<3).

Table 2. Parameter values observed in this research

No	Parameter	Value	Average
1.	Total length (cm)	2.57-5.35	3.419
2.	Weight observed, W (g)	19-45	29.75
3.	Weight prediction, Ws (g)	22.708-43.762	29.280
4.	Relative Weight (Wr)	71.325-149.883	101.641
5.	Fulton Condition Factor (K)	75.372-387.106	201.976
6.	Determination coeficient (r^2)	0,378	-
7.	Constanta **b**	0,894	-
8.	Growth Pattern	Negative Allometric	

Differences in growth patterns in mussels are caused by various factors including food availability, physical and chemical factors and predators. Ramses said that food and habitat factors can affect weight gain. This study identified that factors such as food availability, physico-chemical environmental conditions, and predation pressure can affect weight gain and growth of mussels. Adequate food and good habitat conditions have been shown to play an important role in promoting optimal growth in mussels (Gosling, 2018).

Anadara granosa that live in nature take 6 months to grow 4-5 mm. If the range of number values below 100 indicates problems with water conditions and lack of food availability or high predator density, if the Wr value is above 100 it means that the clam population is in good condition due to high food availability and low predator levels (Rusmiati et al., 2020). The variation in the value of the condition factor depends on the degree of gona maturity, food factors, sex and age, the condition factor indicates the good condition of the clam in terms of physical capacity to survive and produce (Chen et al., 2020).

A relatively closed weight factor to 100 indicates a stable population with sufficient food and lack of predation relative condition factor (Wr) weighting values falling below 100 for individuals or populations suggesting problems such as prey availability or high predator density. This may indicate problems such as insufficient prey availability or high predator density, as Suthers et al. (2019) found that the relative weight condition factor (Wr) closed to a value of 100 indicates a stable population with sufficient food availability and lack of predation pressure.

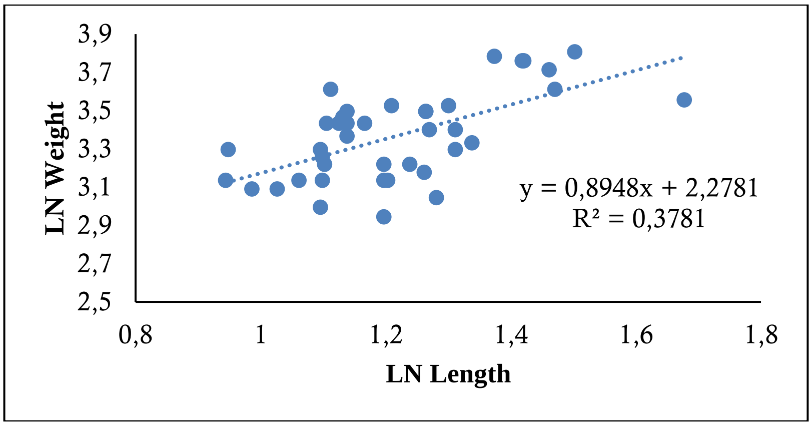
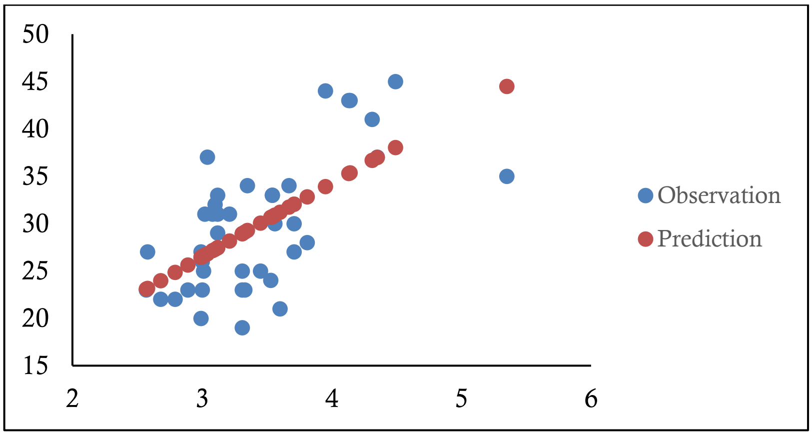


Figure 2. Length weight relationship curve of *A. granosa*



Figurre 3. Comparison of Observation and Prediction of length of weight of *A. granosa*

The negative allometric growth pattern reflects that the availability of feed relative to the presence of predators is balanced that the quality of panipahan water is still adequate to support the availability of shellfish, especially of *A. granosa*. Negative allometric growth patterns can reflect a balance between feed availability and the presence of predators in an ecosystem. When feed availability is relatively high and the presence of predators is not very dominant, organisms such as *A. granosa* can grow with negative allometric growth patterns (Smith & Johnson, 2021).

This can reflect a balance between feed availability and the presence of predators in the environment. In addition, the statement also implies that the water quality in these waters is still adequate to support the availability of *A. granosa* (Yeemin et al., 2020). The balance between feed availability and the presence of predators is important in aquatic ecosystems. When feed availability is relatively high and the presence of predators is not particularly dominant, organisms such as *A. granosa* can grow with negative allometric growth patterns. This suggests that sufficient feed availability allows organisms to grow at a slower rate as body size increases. In addition, it is important to consider water quality in supporting the availability of *A. granosa*. Good water quality, such as sufficient oxygen levels, low pollution levels, and stable environmental conditions, can provide adequate conditions for the growth and survival of *A. granosa* (Wang, 2020).

CONCLUSION

The growth pattern of *A.granosa* in Panipahan, Rokan Hilir Regency is negative allometric with a value of b<3. The condition of Panipahan waters as a habitat for *A. granosa* is still in a balanced state and can support the life of *A. granosa*.

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