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Morphometric Characteristics and Condition Factors of Green Shells *(Perna viridis)* in The Waters of Randusanga Kulon Brebes, Central Java

Karakteristik Morfometri dan Faktor Kondisi Kerang Hijau (Perna viridis) di Perairan Randusanga Kulon Brebes, Jawa Tengah

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ABSTRACT

Green mussel (Perna viridis) is one of the species of bivalve class that is commonly found in the waters of Randusanga kulon, Brebes, thus becoming one of the sources of income for the people in the area. The purpose of this study was to determine the morphometric condition of green mussels based on length and weight and condition factors of green mussels in Randusanga kulon waters. Was used in this study regression analysis quantitative method. The results of the study showed the green mussel morphometry average length was 11.78 cm ± 1.51 with average weight was 90.749 gr ± 24.1. The value of b from the length-weight relationship of green mussels is 0.0045, meaning that the value of b <3 is allometrically negative, namely the growth of length faster than its weight. The condition factor of green mussels was 1.02, which is classified as having a good proportions and indicates a decent water condition.
Keywords: *Condition Factors, Green Mussels, Morphometry,Growth, Randusanga Kulon*

ABSTRAK

Kerang hijau *(Perna viridis)* merupakan salah satu spesies dari kelas bivalvia yang banyak ditemukan di perairan Randusanga kulon, Brebes, sehingga menjadi salah satu sumber pendapatan masyarakat di daerah tersebut. Tujuan dari penelitian ini adalah untuk mengetahui kondisi morfometrik kerang hijau berdasarkan panjang dan berat serta faktor kondisi kerang hijau di perairan Randusanga kulon. Metode yang digunakan dalam penelitian ini adalah metode kuantitatif berupa analisis regresi. Hasil penelitian menunjukkan morfometri kerang hijau panjang rata-rata adalah 11,78 cm ± 1,51 dengan berat rata-rata 90,749 g ± 24,1. Nilai b dari hubungan panjang-berat kerang hijau adalah 0,0045, artinya nilai b < 3 bersifat allometrik negatif, yaitu pertumbuhan panjang lebih cepat dibandingkan dengan beratnya. Faktor kondisi kerang hijau sebesar 1,02 yang tergolong memiliki proporsi yang baik dan mengindikasikan kondisi perairan yang layak.
Kata Kunci: *Faktor Kondisi ,Kerang Hijau, Morfometri, Pertumbuhan, Randusanga Kulon*

INTRODUCTION

Green mussels (Perna viridis) are soft animals (mollusca), classified as two-shelled animals (bivalves), and live in the sea. *Green mussels* generally have a length between 65-85 mm, but the maximum length can reach 165 mm (Fauzi, 2022). This species is a very prospective mariculture commodity in Indonesia. Referring to the statistical data of the Ministry of Marine Affairs and Fisheries in 2011, the volume of shellfish production (Blood Clams, Green Clams, Oysters, Scallops, Pearl Clams, Mussels) amounted to 54,801 tons and in 2012 amounted to 50,460 tons or a decrease of 8%. The volume of shellfish production in Indonesia from 2010-2015 was 2,869 tons, 12,991 tons, 16,348 tons, 18,896 tons and 15,623 tons, respectively (Dinas Kelautan dan Perikanan, 2015). Scallop species can be cultivated with low production costs but high profitability. In addition to being easy to cultivate, *green mussels* are a nutritious food source with a low price and high protein content (Fauzi, 2022). Therefore, this species is in demand by *green mussel* farmers in coastal Indonesia.

Green mussel species are distributed along the coasts of the Indo-Pacific region. Many countries have cultivated *green mussels* due to their high economic value. The success of *green mussel* farming must still be supported by ideal environmental conditions. Some factors that must be considered in *green mussel* cultivation are site protection, water quality conditions (physical and chemical), water fertility, availability of natural seeds and social infrastructure. Appropriate environmental parameters will affect the growth of *green mussels* (Andriyani *et al*., 2019). Therefore, the cultivation of *green mussels* must pay attention to several factors to support the quality of the *green mussel* itself. *Green mussels* are *filter feeders* that are commonly found in the Java Sea. The coastal waters of Brebes are one of the water areas that are rich in marine products such as fish, bivalves, molluscs and crustaceans. One of the productions from the fisheries sector that is superior in Brebes is *green mussels (Perna viridis)* (Suryono *et al.*, 2019).

Striking differences in environmental conditions can make a real difference to the growth of mussels and can affect the reproduction process of mussels. Reproduction can be used as an indicator of population under ideal conditions for organism survival. Different water conditions affect clam growth (Gaol, 2017). Assessment of aquatic ecological parameters for aquaculture development is necessary to produce a representative and comprehensive estimate of water quality conditions. Suitable water environment parameters will affect the growth of *green mussels* such as depth, water temperature, salinity and oxygen content. In addition, environmental parameters such as turbidity, current, salinity and temperature are generally most important in the selection of aquaculture sites as they have been shown to influence the growth rate of *green mussels*. Determining the cultivation site for *green mussel* cultivation also needs to consider the abundance of food and the presence or absence of predators and other disturbing organisms (Sagita, 2018).

Morphometry is a characteristic related to the size of the body or body parts of an organism. This size is one of the things that can be used as a taxonomic characteristic when identifying organisms. The size in question is the distance between one body part to another. The measurement results are usually expressed in centimeters or millimeters, this size is called absolute size (Gaol, 2017). Morphometry is very useful to determine the growth of *green mussels* quantitatively. *Green mussel* resources need to be managed properly, so that natural stocks are always available. The dynamics of *green mussel* (*Perna viridis*) population growth in nature need to be studied so that quantitative stock status can be obtained and can be used as a stock estimate for the community and alternative fisheries management. The frequency distribution of length and weight of *green mussels* as basic data can be used to determine the growth rate, which is a major consideration factor in determining fisheries management strategies for *green mussel* resources (Ubay, 2021). Therefore, studies on morphometry and condition factors of *green mussels (Perna viridis)* in Randusanga Kulon waters need to be carried out because until now they are still limited.

RESEARCH METHODS

Sampling in this study was carried out once, in January 2023 in Randusanga Kulon Waters, Brebes, then observed in the Aquatic Resources Ecobiology Laboratory, Faculty of Fisheries and Marine Science, Jenderal Soedirman University.

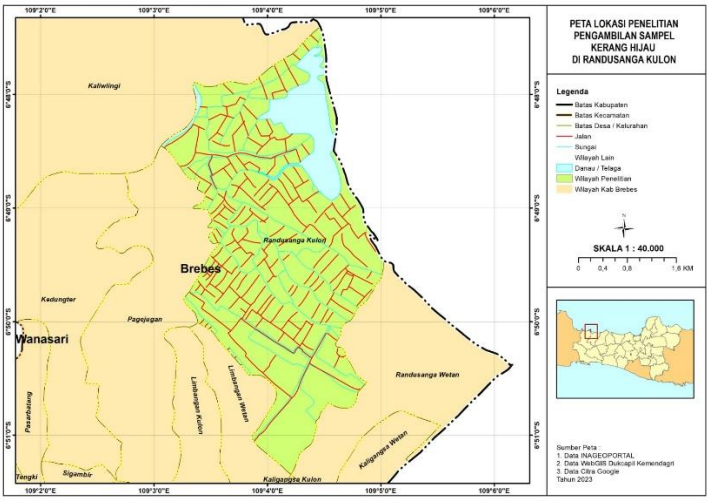

Figure 1: Map of the Research Location
Source: Inageoportal Data, Year 2023

Research Work Procedure

A random sample of 300 *green mussels* was taken. *Green mussels* come from the waters around Randusanga kulon village with muddy substrates and polluted water conditions. And analyzed in the laboratory of the Faculty of Fisheries and Marine Sciences. Morphometric parameters observed included length, width, meat weight and total weight. Clam shells were measured in length from the anterior end to the posterior end horizontally placed on a millimeter block and then measured using Image-J. Measurement of content weight and total weight of *green mussels* was carried out using a digital balance pocket gold scales 0.01 g. Measurement of total weight was carried out by weighing the entire shell and its contents that were still together, then measuring each content weight by weighing the mussel meat after being separated from the shell.

The morphometric characteristics of *green mussels (Perrna viridis)* in this study were determined based on the constant value b of the length-weight relationship using the King (1995) formula, namely $W = aL^b$, where W, L, a and b are weight (grams), length (cm) and constant, respectively. The constant value b=3 is isometric and b#3 is allometric. Values of b>3 or b<3 growth is positively allometric and negatively allometric. The correlation relationship between length and weight also produces a correlation coefficient r value that indicates the closeness of the relationship between the two factors.

Condition factor is an effective instrument that can show changes in mussel condition throughout the year. Condition factor can describe the fatness of mussels expressed based on length and weight data. Calculation of condition factor values was done according to Acharya and Dwivedi, (1985).

$$\text{Condition factor} = \mathbf{K} = \frac{W}{aL^b}$$

Description:
F = Condition factor
W = Average weight of mussels (g)
L = Average length of mussels (cm)

a and b = Constants

The condition factor is classified into thin, medium and fat categories if the condition factor value has a value ranging from 0-1, then the mussel is classified as not fat. If the condition factor value is 1-3, then the mussel is classified as fat. Condition factor values ranging from 1-3 indicate that the water conditions are good and *green mussels* are suitable for consumption, while condition factor values <1 indicate poor water conditions and are not yet suitable for consumption (Shasia *et al.*, 2021).

Data Analysis

The results of morphometric measurements of *green mussels* are presented in tables and figures analyzing the relationship between length and weight for the development of *green mussel* aquaculture. The length of *green mussels* is measured using Image-J software while the analysis used in this study is regression analysis using Excel software. This regression analysis is to determine the morphometric relationship of length and weight of *green mussels* using independent variables (X) with one independent variable (Y). After the regression test is carried out, it is continued by doing the t test, namely by calculating t count and t table. If t count < t table then accept H0, b = 3 is called isometric growth, meaning the growth of length and weight is balanced and if t count > t table then reject H0, b≠3 is called allometric, meaning the growth of length and weight is not balanced. Then if the r value is close to 1, it means that there is a strong relationship between length and weight, and if the r value is not close to 1, it means that the relationship between length and weight of green mussels is weak *(Shasia et al.*, 2021). Then the data obtained are processed using descriptive methods.

RESULTS AND DISCUSSION

This study used a sample of 300 individual *green mussels (Perna viridis).* The *green mussels* sampled varied in length and weight. *Perna viridis* has an average length of 11.78 cm ± 1.51 and an average weight of 90.749 g ± 24.1. Furthermore, the proportion of *green mussel* meat using a sample of 27 individuals obtained 17.32%. These results are in accordance with the reference that *green mussels* generally have a length between 65-85 mm (6-8 cm), but the maximum length can reach 165 mm (16.5 cm) (Gosling, 2004). Meanwhile, the weight data based on the data above does not match the reference obtained, namely the maintenance of *green mussels* with the hanging rope method for 5 - 6 months, with a result of 19 - 20 g/head (WWF, 2015). Different cultivation processes also affect the quality of the weight of the *green mussel* itself.

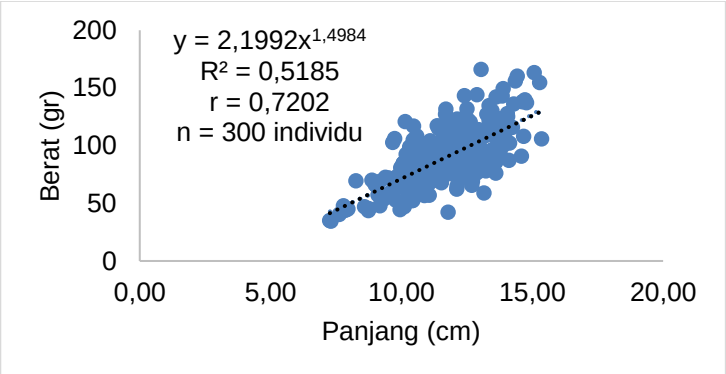

Figure 2. Morphometric Correlation of Length and Weight of *Green Mussels (Perna viridis)* in Randusanga Kulon

Based on the results of the analysis of the length-weight relationship of *green mussels* using a scatter graph has a length-weight relationship model is $W = 2.1992L^{1.4984}$. The results of this study show the correlation coefficient (r) is 0.7202. These results indicate that there is a closeness between length and weight of 72.02%. The reference to the value of the correlation coefficient (r) is to use a reference from (Sugiyono, 2017)

which states that the relationship is strong or close allegedly due to the availability of sufficient food and also a favorable environmental situation for the growth of *green mussels*.

The value of b from the length-weight equation of *green mussels* is 0.0045, meaning the value of b <3. This is in accordance with the references obtained stating, the rate of change in relative animal body shape during the growth process, in the study of allometric growth, the constant b is also known as the allometric coefficient. Illustrative conditions that show the relationship, the most appropriate parameter is shell length (Hemachandra, 2011). Similarities or differences in growth patterns of *green mussels* in a body of water may occur, influenced by factors such as physiological conditions of *green mussels* and environmental conditions related to competition, food availability, temperature, salinity, currents and waves (Rochmady *et al.*, 2012).

In another study stated that the results of a sample of 300 *green mussels* at Banyuurip, East Java beach in a tancap I, tancap II, tancap III, tancap IV, and tancap V showed that tancap I dominated the size of mussels around 13-24 mm (15%). The variable results in the study of *green mussels* in this study have a relative b value that is negative allometric (<3) where length growth is more dominant than height, width, total weight, and meat weight. Therefore, based on the data above, the results of *green mussel* research in Randusangan kulon waters and on Banyuurip beach are not much different, namely both have negative allometric variables.

Based on the data and calculated with the existing condition factor formula, the condition factor for green mussels is 1.02, which is classified as having a more dominant body (Shasia *et al.*, 2021). The difference in condition factor in each individual size can be influenced by the age and reproductive strategy of the individual, because the species of living things can determine whether an individual can accumulate energy for its growth or for reproductive preparation. Diverse size distribution conditions indicate high variation in condition factors. Condition factors are the result of complex interactions between many factors, namely food, temperature, salinity, metabolic activity, especially gonadal growth and reproductive processes (Aban *et al.,* 2017). Catching or harvesting *green mussels* should be at the highest condition factor in order to get fertile *green mussels* (Thippeswamy, 2008).

Another reference mentioned that the condition factor of *green mussels* is said to be fertile when the higher the condition factor value, illustrating the tendency of a higher level of gonadal maturity. Variations in the level of gonadal development are indicated by the condition factor and gonadal index values. Condition factor values appear to increase along with the level of gonadal maturity (Aristizabal, 2010). The difference in condition factor at each size interval is thought to be caused by the age and reproductive strategy of the individual. The difference in condition factor at each size is caused by the age and reproductive strategy of the individual, because it can determine whether an individual can accumulate energy for its growth or for reproductive preparation (Baron, 2006). One of the factors supporting the success of *green mussel* management is the continuous availability of food in a body of water so that shellfish as filter feeders can live well. Food is a growth support factor, so the availability of natural food greatly affects the growth of *green mussels* (Hidayat, 2017).

Natural foods such as plankton greatly affect the biota in these waters because plankton are the main producers in the waters as well as natural food for *green mussels.* Plankton is divided into 2, namely phytoplankton and zooplankton. If the abundance of phytoplankton in a body of water is high, it will lead to high productivity of the water (Asyifa, 2021). Growth is closely related to food, because the nutrients and energy needed for growth come from food (Pratiwi *et al.*, 2011). The energy contained in phytoplankton can be channeled to various other ecosystem components through the food chain, through this food chain all marine organisms depend on phytoplankton either directly or indirectly. Diatoms (Bacillariophyceae), dinophagelates (Dynophyceae) are groups of phytoplankton that are often found in tropical waters (Andriyani *et al.*, 2019).

Green mussels get their food by filtering particles from a body of water. The presence of plankton, which when experiencing high growth in a body of water, will be toxic to *green mussels*, this will also affect *green mussels,* because *green mussels* only eat the best particles or granules and are also preferred for their energy needs (Asyifa, 2021). Other factors such as water characteristics also affect the morphometry of *green mussels,* such as the temperature of Randusanga kulon waters ranging from 27-30^{0}C where it is at the optimum temperature to support the growth of *green mussels* while the salinity value ranges from 24-28.5% and is classified as good for *green mussel* cultivation (Handayani, 2021). Therefore, the availability of food such as plankton in Randusanga Kulon waters will affect the relationship between length and weight and differences in supporting factors can affect the value of the *green mussel* condition factor in this study.

CONCLUSIONS

Based on the research and calculations that have been carried out, it can be concluded that*. Green mussels* have negative allometric characteristics and the relationship between length and weight of 72.02%. The condition factor of *green mussels* in Randusanga kulon waters is to 1.02 and categorized as good proportions and indicates a decent water condition.

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