



Length-Weight Relationships and Condition Factors of Tigawaja Fish (*Nibea sp.*) Landed on PPI Cikidang Pangandaran West Java

Yasinta Anggararatri, Dyahruri Sanjayasari*

Fisheries and Marine Science Faculty, Jenderal Soedirman University, Purwokerto, Indonesia

Corresponding author: dyahruri.sanjayasari@unsoed.ac.id

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ABSTRACT

Tigawaja fish (*Nibea sp.*) is a demersal fish that is commonly found in Indonesian waters. Tigawaja fish is a white-fleshed fish that contains about 18% protein, 0.03% total fat, vitamin A, niacin, calcium, and sodium. However, there are still few studies that discuss the growth characteristic of Tigawaja fish, hence, the management of Tigawaja fish resources cannot be optimized. Current study aims to determine the relationship between length and weight and condition factors of Tigawaja fish. Data collection was carried out at PPI Cikidang Pangandaran, West Java in February 2021. The field work method used random sampling of fish landed at PPI Cikidang Pangandaran. The parameters measured including the length and weight of the fish, and the data were analyzed descriptively. The results showed that the growth pattern of Tigawaja fish landed at PPI Cikidang Pangandaran was negative allometric with b value at 2.71. Regression analysis of the relationship between length and weight of Tigawaja fish resulted a coefficient of determination R^2 of 85.69% indicating a very strong relationship between length and weight of Tigawaja fish. The results of the condition factor values have an average of 1.41 and relative weight with an average of 101.30. The results of the regression analysis of the relationship between condition factors and relative weight resulted a coefficient of determination R^2 of 76.18% showed the relationship was very strong.

Keywords: Tigawaja fish, length, weight, condition factor, relative weight, PPI Cikidang Pangandaran

ABSTRAK

Ikan Tigawaja (*Nibea sp.*) merupakan ikan demersal yang banyak ditemukan di perairan Indonesia. Ikan tigawaja merupakan ikan berdaging putih yang mengandung sekitar 18% protein, 0,03% total lemak, vitamin A, niasin, kalsium, dan natrium. Namun masih sedikit penelitian yang membahas tentang karakteristik pertumbuhan ikan Tigawaja, sehingga pengelolaan sumber daya ikan Tigawaja belum dapat dioptimalkan. Penelitian ini bertujuan untuk mengetahui hubungan antara panjang dan berat dengan faktor kondisi ikan Tigawaja. Pengambilan data dilakukan di PPI Cikidang Pangandaran, Jawa Barat pada bulan Februari 2021. Metode kerja lapangan menggunakan random sampling ikan yang didaratkan di PPI Cikidang Pangandaran. Parameter yang diukur meliputi panjang dan berat ikan, dan data dianalisis secara deskriptif. Hasil penelitian menunjukkan bahwa pola pertumbuhan ikan Tigawaja yang didaratkan di PPI Cikidang Pangandaran adalah alometrik negatif dengan nilai b sebesar 2,71. Analisis regresi hubungan panjang dan berat ikan Tigawaja menghasilkan koefisien determinasi R^2 sebesar 85,69% yang menunjukkan hubungan yang sangat kuat antara panjang dan berat ikan Tigawaja. Hasil nilai faktor kondisi memiliki rata-rata 1,41 dan bobot relatif dengan rata-rata 101,30. Hasil analisis regresi hubungan antara faktor kondisi dan bobot relatif menghasilkan koefisien determinasi R^2 sebesar 76,18% yang menunjukkan data yang diperoleh sangat kuat.

Kata kunci: Ikan Tigawaja, panjang-berat, faktor kondisi, bobot relatif, PPI Cikidang

1. Introduction

Indonesia as an archipelagic country has 18,306 islands united by the sea with a coastline of 81,000 km. Indonesia has enormous marine

potential which contains approximately 7000 species of fish (Talib, 2017). Indonesia's marine fishery potential reaches 10.5 million tons per year. The marine and capture fisheries sectors

are the mainstay in supporting national development. In 2015, the Government targets to place Indonesia as the largest producer of fishery products in the world. This causes the fisheries sector to continue to strive to achieve targets through increasing the quality and quantity of production (Suryanti et al., 2018).

One of the fish resource commodities in Indonesia is Tigawaja Fish. Tigawaja fish (*Nibea* sp.) is a by-catch of demersal fish. Tigawaja fish can be caught in almost all Indonesian waters and can be found at a relatively cheap selling price (Astuti, 2017). These fish live in groups and like muddy waters. This fish includes carnivorous fish, the food is small shrimp and small fish. Tigawaja fish is one of the fish resources that can be recovered (renewable resources), but if it is not managed properly, there will be a decline in stock. The decrease in fish stocks in the waters can be affected by fishing activities (Anggraeni et al., 2016).

One of the contributors to capture fisheries in Indonesia is the Fish Landing Base (PPI) which is used as a fish landing site in the West Java region. Pangandaran waters have enormous potential for marine resources. Therefore, fish resources in Pangandaran waters must be utilized optimally (Oktavera et al., 2019). Efforts that can be made to evaluate the availability of fish resources are to know the growth characteristics and condition factors.

The long-term relationship in fisheries biology is a significant knowledge to be studied, especially for the benefit of fisheries management. The length-weight relationship is one way to determine the growth characteristics of fish. The length-weight relationship can explain changes in individual size, show growth patterns of organisms, obtain an index of population physical conditions, fish age, mortality and evaluate habitat quality (Setiawan et al., 2019).

Condition factors are parameters used to compare species welfare between populations, and also indicate the physiological status of fish. The physiological status of fish itself is influenced by intrinsic factors such as gonadal development, organic reserves, and the presence or absence of food in the stomach. In addition, physiological status is also influenced by extrinsic factors such as feed availability and environmental variations (Sinaga et al., 2018). Therefore, the aim of this study is to knowing the relationship between length and weight of Tigawaja fish and also knowing the relationship between growth characteristics and condition factors of Tigawaja fish which landed in PPI Cikidang Pangandaran West Java.

2. Materials and Methods

The method used in this study was the field survey method. The survey was conducted by sampling Tigawaja fish (*Nibea* sp.) with a random sampling method from fish caught by fishermen at PPI Cikidang Pangandaran West Java. Primary data collection was carried out by randomly measuring 20% of Tigawaja's fish catches in one day. Sampling was carried out at PPI Cikidang Pangandaran, West Java in February 2021. Tigawaja fish used in this study is the catch of fishermen at PPI Cikidang Pangandaran, West Java.

The total length of the fish was measured with a measuring instrument and weighed with a scale. The total length was measured from the leading end of the head to the last end of the tail. The relationship between length and weight is calculated using the equation according to Richter (2007):

$$W = aL^b$$

where W is total weight of fish (g), L is total length of fish (mm), a and b is constant.

If the general formula is transformed into logarithms, we will get the equation $\text{Log } W = \text{Log } a + b \text{ Log } L$, which is a linear equation or a straight line equation. Then from the equation it can be determined the value of a, while W and L are known. Here's how to find Log a:

$$\text{Log } a = \frac{\sum \text{Log } W \times \sum (\text{Log } L)^2 - \sum \text{Log } L \times \sum (\text{Log } L \times \text{Log } W)}{N \times \sum (\text{Log } L)^2 - (\sum \text{Log } L)^2}$$

The value of b is determined by the formula:

$$b = \frac{\sum \text{Log } W - (N \text{ Log } a)}{\sum \text{Log } L}$$

Based on the above calculation, the type of growth is determined based on the value of b. Each value is interpreted as follows: the pattern of the length-weight relationship is positive allometric, if $b > 3$ (weight gain is faster than length gain), then isometric with a value of $b = 3$ (the increase in fish length and weight gain is balanced) and negative allometric, if $b < 3$ (length gain is faster than weight gain) (Effendie, 1979 in Prihatiningsih et al., 2017).

The relative weight (Wr) is calculated using the equation according to Rypel and Richter (2008):

$$Wr = \frac{W}{W_s} \times 100$$

where Wr is relative weight, W is Weight (g), and W_s is Predicted standard weight ($W = aL^b$) per individual.

The K coefficient (Fulton condition factor) is calculated based on Okgerman (2005) using the following formula:

$$K = WL^{-3} \times 100$$

where K is Fulton's condition factor, W is weight of fish (g), L is fish length (cm), and -3 is the length coefficient or correction factor. Then a regression analysis was performed using the data from W and K

3. Result and Discussion

3.1. Description of PPI Cikidang Pangandaran Location

The Cikidang Fish Landing Base (PPI) is located in Babakan Village, Pangandaran District, Ciamis Regency, West Java Province. The geographical location of PPI Cikidang is at 7° 40' 56.3" South Latitude and 108° 40' 18.8" East Longitude.

Administratively, PPI Cikidang is located in Babakan Village, Pangandaran District. PPI Cikidang has an area of 6.04 km² with a population of 11,103 people in Babakan Village. Most of the people make a living in the agricultural and fishing sectors (rice farming, secondary crops, and fishermen). Aside from being one of the access areas for fishermen to enter and exit, PPI Cikidang is also the pulse of capture fisheries activity in West Java Jawa (Ministry of PUPR, 2021).

3.2. Length-Weight Relationships of Tigawaja Fish

Based on the study that has been done, data on the Tigawaja fish that were caught and landed at PPI Cikidang were obtained. The data were 15 Tigawaja fish with a minimum length of 23.5 cm and a maximum of 54.5 cm with an average of 33.3 cm. Then for the body weight of Tigawaja fish, the minimum is 237 grams and the maximum weight is 2800 grams with an average of 655.5 grams. The fish length was measured horizontally from the tip of the upper jaw to the tip of the tail. According to the reference of Fischer & Whitehead (1974), generally Tigawaja fish have a size of 30-40 cm, with a maximum size of 60 cm. This fish is usually found at a



Figure 1. Tigawaja Fish Length Measurement



Figure 2. Tigawaja Fish Weight Measurement

depth of 40 m of the sea. This fish feeds on other small fish and invertebrates. The process of measuring the length and weight of the Tigawaja fish can be seen in Figure 1 and 2.

The results of the analysis of the length and weight relationship data obtained in this study showed that the Tigawaja fish which landed at PPI Cikidang had a negative allometric growth pattern with a b value of 2.71. In other words, it is stated that the growth of the body length of the Tigawaja fish is faster than the growth of its body weight. Determination of this growth pattern is done by using the resulting b value. If the value of b = 3, then the growth pattern is isometric or the weight gain is equivalent to the growth of fish length and if the value of b ≠ 3, then the growth pattern is allometric. The allometric growth pattern is divided into two, namely positive allometric and negative allometric. If the value of b < 3 is called negative allometric which means the length increase is faster than the weight gain, while if the b value is > 3 it is called positive allometric which means that the weight gain is faster than the increase in length (Ramses et al., 2020).

The results of the regression analysis of the length-weight relationship of Tigawaja fish can be seen in the graph above (Figure 3). From the results of the analysis, a linear graph is presented and the regression equation $y = 64.601x - 1495.3$ is obtained with a coefficient of determination R² of 85.69%. The high coefficient of determination indicates a very strong relationship between the length and weight of the Tigawaja fish or the increase in the length of the fish's body greatly affects the increase in body weight of the fish. This is in accordance with the literature according to Nduru (2014), the coefficient of determination (R²) can be used as information about the suitability of a model. If the R² interval is between 0.80 - 1.00, it is very strong, if the interval 0.60 - 0.799 is strong, if the interval 0.40 - 0.599 is quite strong, if the interval 0.20 - 0.399 is low, and if the interval is 0.20 - 0.399, it is low. 0.00 - 0.199 including very low.

Length-weight relationships can explain changes in individual size, show growth patterns of organisms, obtain an index of population physical conditions, fish age, mortality and evaluate habitat quality (Fitrianisa et al., 2020). The study of the relationship between length and weight of fish is a mathematical correlation between two variables that can be useful for predicting the quality of individuals in the population. This includes estimating the weight of the fish length and converting the catch in weight to the number of fish in relation to determining stock abundance at a given location or time. The relationship between length and weight of fish aims to be able to see the growth pattern of fish with length and weight parameters. In other words, the length-weight relationship is used to estimate the weight through length or vice versa (Supeni et al., 2021).

The difference in length and weight between each fish can be influenced by various factors, which are divided into internal factors and external factors. Internal factors are difficult to control, while external factors are easy to control. Internal factors include heredity, sex, parasites and disease. While the external factor is food, in this case food is the most important factor because excess food can cause fish to grow more rapidly. Other external factors are water quality, such as temperature, dissolved oxygen and carbon dioxide (Sasmita et al., 2018).

3.3. The Relationship of Condition Factors with the Relative Weight of Tigawaja Fish

Based on the study that has been done, the results of the calculation of the condition factor value range from 1.02 to 1.83 with an average of 1.41. The condition factor value stated that the fish were in good condition and the fish were less flat. This is in accordance with Kresnasari's statement (2020), fish with condition factor values ranging from 2-4 have a slightly flat body, while 1-3 for fish that have a less flat body. The variation in the value of the condition factor is thought to be due to competition in utilizing the same food source. In addition, the value of the condition of fish fatness is influenced by size, age, sex and the level of gonad maturity of the caught fish.

The results of the calculation of the relative weight of Tigawaja fish obtained during this study ranged from 77.15 to 145.87 with an average of 101.30. The average value of relative weight (W_r) in PPI Cikidang is more than 100, this indicates that the waters of PPI Cikidang are supportive for the growth of Tigawaja fish and the density of predators is still balanced. This is in accordance with the literature according to Nasir (2016), if the relative weight value is below 100 it indicates a problem such as lack of prey availability or high density of predators, and vice versa if it is above 100 it indicates high prey availability or low predator density. In addition to the availability of food, aquatic environmental factors and management of fisheries resources can also affect condition factors.

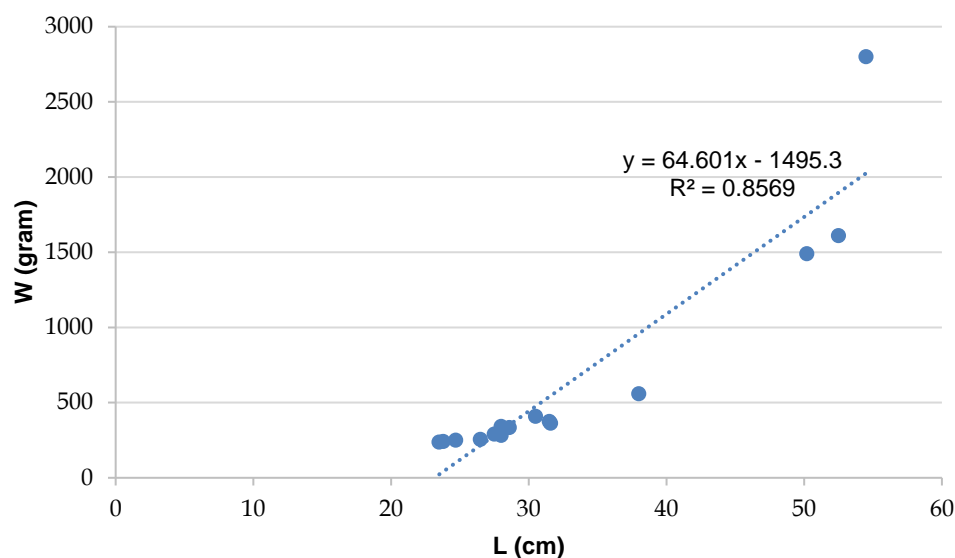


Figure 3. Tigawaja Fish Length-Weight Relationship Graph

The relationship factor value of the condition was calculated based on the average of the relative weights. The calculation results show that the relative weight value is obtained with an average of 101.30 and an average condition factor value of 1.41 which means the fish are in good condition and the fish are less flat and the waters are supportive for fish growth. This is in accordance with Fitrianisa's statement (2020), if the value of relative weight (Wr) is below 100, it indicates a problem such as low availability of prey or high density of a predator. On the other hand, if the relative weight value (Wr) is above 100, it indicates the availability of an excess prey or a low density of a predator. In addition to the availability of feed or predators, biotic, abiotic and fisheries management factors can also influence various condition factors. Condition factors are calculated to assess the general fish health, productivity and physiological condition of the fish population (Fitrianisa et al., 2020).

The results of the regression analysis of the relationship between condition factors and the relative weight of Tigawaja fish can be seen in the graph above. The results of the analysis obtained the regression equation $y = 59.14x + 18.006$ with a coefficient of determination R^2 of 76.18% (Figure 4). The coefficient of determination is in the range of 0.60 – 0.799, this indicates that the relationship between condition factors and the relative weight of Tigawaja fish is strong. This is in accordance with the literature according to Ndruru (2014), the coefficient of

determination (R^2) can be used as information about the suitability of a model. If the R^2 interval 0.80 - 1.00 is very strong, the interval 0.60 - 0.799 is strong, the interval 0.40 - 0.599 is quite strong, the interval 0.20 - 0.399 is low, and the interval 0.00 - 0.199 is included very low.

The condition factor is the ratio of the weight of the fish to the cube of its length, which is a factor that describes the fatness of the fish (Kresnasari, 2020). The relative weight (Wr) and coefficient (K) of the condition factors were used to evaluate the condition factors of each individual. The relative weight (Wr) was determined based on the Rypel and Richter (2008) equation, namely $Wr = (W/W_s) \times 100$. Where Wr is the relative weight, W is the weight of each fish, and W_s is the standard weight predicted from the sample. The same because it is calculated from the combined length-weight regression through the distance between species (Fitrianisa et al., 2020). Variations in the value of relative weight (Wr) are most likely caused by ecological factors. Relative weight (Wr) can be used to compare fish of different lengths, from different fishing areas (Sinaga et al., 2018).

The condition factor is an index value that shows the health condition of the fish (Ramses et al., 2020). The condition factor is a condition that states the fatness of the fish with numbers, where the calculation uses data on the length and weight of the fish. The condition factor shows the condition of the fish both in terms of physical capacity to survive and reproduce and

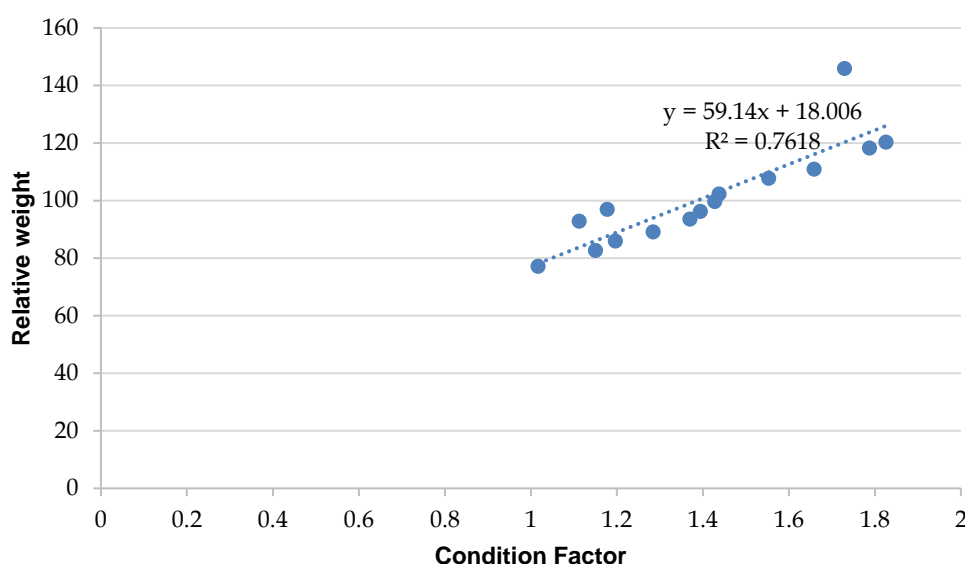


Figure 4. Graph of Relationship between Condition Factors and Relative Weight of Tigawaja Fish

can also show and compare the suitability of the fish's environmental habitat indirectly (Umage et al., 2020). One of the important derivatives of growth is the condition factor or ponderal index or often referred to as the K factor. The condition factor indicates the good condition of the fish in terms of physical capacity for survival and reproduction. The use of commercial condition factor values has an important meaning in determining the quality and quantity of fish meat available for consumption (Effendie, 2002).

4. Conclusion

Based on the results and discussions that have been obtained, it can be concluded that the relationship between length and weight of Tigawaja fish (*Nibea sp.*) which landed at PPI Cikidang in this study was negative allometric with a value of $b < 3$ and has a very strong correlation because R^2 is close to 1. Then the relationship between relative weight and condition factors of Tigawaja fish (*Nibea sp.*) which landed at PPI Cikidang in this study showed that the fish were in good condition, less flat in shape, and the waters of PPI Cikidang were still supportive for the growth of Tigawaja fish (*Nibea sp.*) and had a correlation which is closely related to the coefficient of determination R^2 of 76.18%.

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