Carapace Length-Weight Relationship and Condition Factors of *Macrobrachium rosenbergii* in The Rivers of Riau Province, Indonesia

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**Abstract.** *Macrobrachium rosenbergii* in Riau Province are almost found in all inland waters, especially in the big rivers, namely Indragiri, Kampar, Siak and Rokan. This species are still the main catch of fishermen even the catch has decreased. Deforestation along the watershed, decreasing water quality and habitat have a very bad impact on *Macrobrachium rosenbergii*. This study was conducted to determine the relationship of carapace length-weight and the condition factor of *Macrobrachium rosenbergii* in the rivers of Riau Province. The study used a survey method from May to June 2021. Data collection was carried out in the rivers of Riau Province at the center for giant prawns. Sampling was done randomly from the catches of fishermen. The biological parameters measured were carapace length and weight. The results showed that the relationship between carapace length and weight of giant prawns in the Siak River, Rokan River and Kampar River are $0.0008L^{2.8473}$, $0.0049L^{2.3906}$ and $w = 0.0014L^{2.643}$, respectively. The length of the carapace can determine the weight of prawns up to 78.62-96.62%, where the relationship between carapace length and weight is very close. The growth pattern of giant prawns is allometric and the condition factor is 1.03-1.05.

**1. Introduction**

Giant prawns (*Macrobranchium rosenbergii*) is one of the important freshwater commodities that have high economic value. The distribution of giant prawns in Riau Province is very wide, almost found in all inland waters, especially in large rivers such as Indragiri, Kampar, Siak and Rokan. In 1974-1994 giant prawns became a leading commodity in Riau Province, this was due to the very high potential of giant prawns resources along the river in Riau Province [1]. Naturally, the inland aquatic system in Riau Province is separated by geographical barriers, so that the major rivers (Indragiri River, Kampar, Siak and Rokan) in Riau Province are not connected to each other, but in the early 80s, changes began to occur. environmental conditions in the giant prawn habitat. This happened because in the period 1982-1983, land clearing was carried out throughout the Indonesian mainland covering an area of 36 million ha, including Riau Province [2]. Although giant prawns are still the main catch of fishermen, the catch has decreased.

In addition to deforestation along the watershed which has resulted in a decrease in water quality, pressure from fishing activities has also contributed to the decline in fisherman catches in 3 major rivers in Riau Province. This is because giant prawns are a promising superior commodity. As a result, there is a decrease in the catch and the smaller the size of the giant prawns caught. In order to manage
giant prawns resources in Riau Province to remain sustainable, it is necessary to carry out rational management by considering input from the biological aspect. This study aims to analyze the length-weight relationship and condition factors of giant prawns (Macrobrachium rosenbergii) in the rivers of Riau Province. The results of this study are expected to be used as input for population studies and policies for the management of giant prawns in Riau Province.

2. Methodology
Giant prawns are collected from the catches of fishermen from 3 different rivers, namely the Siak River (Okura), Kampar River (Teratak Buluh) and the Rokan River. The sample collection was carried out in May and June 2021. The carapace length of giant prawns was measured using a caliper with an accuracy of 1 mm. Weight measurement using a digital scale with an accuracy of 0.01 grams. Visual observations were made to determine gender and sexual development. Analysis of the length-weight relationship using equations [3] [4] and [5], namely:

\[ W = a L^b \]

Information :
W = prawn weight (gr),
L = carapace length (mm),
a = constant
b = exponential value between 2-5

Based on these equations, it can be seen the growth pattern of shrimp length and weight. The b value obtained is used to determine the growth pattern. Then a t-test was performed for the b value obtained at a 95% confidence interval (=0.05) to determine the similarity to the number 3. If the value of b=3 means the growth pattern is isometric, b>3 and b<3 then the growth pattern is allometric.

To analyze the condition of giant prawns, it is necessary to know the relative weight (Wr) and the condition factor index (K). The relative weight (Wr) is calculated using equation [6], namely:

\[ Wr = \left(\frac{W}{W_s}\right) \times 100 \]

Information :
Wr = relative weight,
W = weight of each shrimp
Ws = the predicted standard weight obtained from the relationship between length and weight.

Factor analysis of giant prawns condition using the equation [7] & [5]:

\[ Kt=102W/L^3 \]

Information :
Kt = condition factor,
W = the average weight of giant prawns (g),
L = the average length of giant prawns (mm).

3. Result and Discussion

3.1 Relationship of Length and Weight
Giant prawns (M. rosenbergii) caught at 3 stations representing 3 major rivers in Riau Province from May to June 2021 were 69 individuals (Figure 1). Overall, giant prawns have carapace lengths
ranging from 22.8-77.1 mm or an average of 54.3 mm. The total weight ranged from 6.1 to 185.67 g or an average of 179.87 (Figure 2.).

The length-weight relationship can indicate the growth characteristics of giant prawns. Analysis of the length-weight relationship between giant prawns from the Siak River (Okura) obtained a value of $b = 2.8473$, giant prawns from the Rokan River with a value of $b = 2.3906$ and giant prawns from the Kampar River with a value of $b = 2.643$. The equation of the relationship between length and
weight on the Siak River (Okura) \( w = 0.0008L^{2.8473} \), on the Rokan River \( w = 0.0049L^{2.3906} \) and the Kampar River \( w = 0.0014L^{2.643} \). From a value of \( b \) to a value of 3, giant prawns caught in 3 rivers in Riau Province have a value of \( b < 3 \) (negative allometric) which means that the length increase of both sexes is faster than the weight gain (Figure 3).
3.2 Condition Factor
Based on the results of the study indicate that the lowest condition factor value is at the location of the Siak River (Okura). It can be seen that the condition factor decreases as the carapace length size class increases.

Table 1. Condition Factor in Each Locations

| No | Locations | Condition Factor |
|----|-----------|------------------|
| 1  | Okura     | 1,03070116       |
| 2  | Rokan     | 1,05842265       |
| 3  | Kampar    | 1,03466165       |

The highest frequency distribution of giant prawns was found in the 38–45 mm class range, while the lowest length was found in the 70–77 mm class range. In general, the giant prawns caught were dominant in the carapace size of 38-45 mm.

Data on the relationship between length and weight of shrimp (M. rosenbergii) is one of the parameters that can be used to analyze the growth pattern of a group of shrimp that is useful in fisheries management activities [8]. Based on the test on the value of $b$, for the caught giant prawns, the results of the growth properties of giant prawns differ in each river having a value of $b < 3$ (negative allometric) where the allometric growth is negative, namely the increase in the length of the shrimp is faster than the increase in weight (lean), this is presumably because aquatic environmental conditions and food that does not support the life of giant prawns in these waters. This is in accordance with the opinion [9] which states that the value of $b$ to show the length-weight relationship is influenced by ecological and biological factors. Ecological factors include season, water quality, temperature, pH, salinity, geographical position and sampling technique [10]; [11]. Biological factors include: gonadal development, feeding habits, growth phase and sex [12]; [13]. Changing environmental conditions can cause fish conditions to change so that the length-weight relationship will deviate from the cubic law [14].
In Table 1 it can be seen that there is a tendency to decrease the condition factor with increasing age (carapace length as a function of age). The condition factor is an indicator to determine the effect of the environment on the physical condition as measured by the function of body weight compared to its length. Theoretically, to determine the condition factor, the ratio of diameter to individual weight is used. If the environmental conditions are bad, it will cause a decrease in body weight and if the environmental conditions are good and enough nutrition, the weight will increase. Condition factors can be influenced by food availability, age, sex ratio and gonad maturity level 1 [15].

4. Conclusion
It has been seen that the relationship between the length and weight of giant prawns is influenced by environmental factors and food availability. The influence of environmental factors and low food availability causes a negative allometric growth pattern.

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