

**LENGTH WEIGHT CORRELATION AND BIOLOGICAL ASPECTS
OF JERBUNG SHRIMP (*Fenneropenaeus merguensis*)
IN EAST LAMPUNG WATERS**

**Hubungan Panjang Berat dan Aspek Biologi Udang Jerbung (*Fenneropenaeus
merguensis*) di Perairan Lampung Timur**

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ABSTRACT

This research aims to determine the presence of biological aspects and distribution of banana shrimp in East Lampung by calculating a number of research parameters including length-weight correlation, gonad maturity level, sex ratio, condition factor, catch percentage, size structure, catch size, and physical and chemical parameters of water. For four weeks in May 2023, research sampling was conducted randomly from fishermen's catches at the Maringgai Hygienic TPI in East Lampung, using an exploratory descriptive approach. Based on the results of the research, banana shrimp caught in May had the largest percentage (31%) in the third week, while the first week had the lowest percentage (19%). Captured male banana shrimp ranged in length from 145 to 173 mm, while female banana shrimp ranged in length from 157 to 180 mm. Banana shrimp had a catch size of 51.1 mm. Banana shrimp have a negative allometric correlation based on length-weight analysis. In addition, the shrimp obtained had a condition factor value of 1.01. In the observation of level gonad maturity, only female banana shrimp were observed to have matured gonads, and the sex ratio of shrimp was 62% ♂ : 38% ♀ or 1: 0.61 which means unbalanced. In addition, there are supporting characteristics such as temperature ranging from 30.0 to 30.6°C, pH around 7.49 to 7.55 and salinity between 31.3 to 33.0 ppt.

Keywords: Biological Aspects, East Lampung Waters, Banana Shrimp

ABSTRAK

Penelitian ini bertujuan untuk mengetahui adanya aspek biologi dan distribusi udang jerbung di Lampung Timur dengan menghitung sejumlah parameter penelitian antara lain hubungan panjang-berat, tingkat kematangan gonad, rasio jenis kelamin, faktor kondisi, persentase tangkapan, struktur ukuran, ukuran tangkapan, serta parameter fisik dan kimia air. Selama empat minggu pada bulan Mei 2023, pengambilan sampel penelitian dilakukan secara acak dari

hasil tangkapan nelayan di TPI Higienis Maringgai Lampung Timur, dengan menggunakan pendekatan deskriptif eksploratif. Berdasarkan hasil penelitian, udang jerbung yang ditangkap bulan Mei memiliki persentase terbesar (31%) pada minggu ketiga, sedangkan minggu pertama memiliki persentase terendah (19%). Udang jerbung jantan yang ditangkap berukuran panjang antara 145 hingga 173 mm, sedangkan udang jerbung betina berukuran antara 157 hingga 180 mm. Udang jerbung mempunyai ukuran tangkapan 51,1 mm. Udang jerbung memiliki hubungan allometrik negatif berdasarkan analisis panjang-beratnya. Selain itu, udang yang diperoleh mempunyai nilai faktor kondisi sebesar 1,01. Pada pengamatan TKG hanya udang jerbung betina yang teramati sudah matang gonadnya, dan rasio jenis kelamin udang 62% ♂ : 38% ♀ atau 1 : 0,61 yang berarti tidak seimbang. Selain itu, terdapat karakteristik pendukung seperti suhu yang berkisar antara 30,0 sampai 30,6°C, pH sekitar 7,49 sampai 7,55 dan salinitas antara 31,3 sampai 33,0 ppt.

Kata Kunci: Aspek Biologi, Perairan Lampung Timur, Udang Jerbung

INTRODUCTION

One of the maritime countries that has the potential for shrimp fishing and trading in various regions is Indonesia (Suman *et al.*, 2022). East Lampung, which is located in the waters of Lampung Province, is part of the region in Indonesia with a relatively high level of shrimp distribution. In general, the fisheries industry, including shrimp, has the greatest impact on the growth and development of the economy of Lampung Province. One of the best native shrimp in Indonesian waters is the jerbung shrimp (*Fenneropenaeus merguensis*) which is widely distributed throughout the waters of East Lampung.

East Lampung Regency is one of the areas that produces the most fish in Lampung Province, according to data obtained from the Lampung Province Fisheries and Marine Service. The vast sea area is one of the factors that contributes to the increase in catches (Istiana *et al.*, 2023). However, the distribution of jerbung shrimp will be negatively impacted by illegal shrimp fishing which can result in a reduction in the supply of jerbung shrimp in the waters of East Lampung (Mollynda *et al.*, 2022). The potential and sustainability of shrimp resources in the ocean can be threatened by environmentally unfriendly shrimp fishing (Pane & Suman, 2020).

By examining various biological aspects of shrimp, such as length-weight relationships, gonad maturity levels, sex ratios, condition factors, catch percentages, size structures, catch sizes, and physical and chemical parameters of water, this study attempts to characterize the utilization of shrimp availability (*F. merguensis*) in the waters of East Lampung to maintain population stability and sustainable control efforts for shrimp populations in every Lampung waters.

METHODS

This research was conducted in May 2023, located at the Maringgai Higienis TPI, Jalan Raya Kuala Labuhan, Muara Gading Mas Village, Labuhan Maringgai District, East Lampung Regency, as a sampling site in the waters of East Lampung. The sampling approach and exploratory descriptive method were used to obtain research data. For four weeks, a total of 100 jerbung shrimp were sampled, with details of 25 jerbung shrimp selected randomly each week. The research samples in the form of jerbung shrimp collected from local fishermen were then placed in a styrofoam cool box to be analyzed for biological aspects with the main parameters observed, namely measuring body length and carapace using a ruler and digital caliper; measuring body weight using a digital scale; observing the level of gonad maturity and sex ratio using a magnifying glass. In addition, the use of a water quality tester to collect

seawater samples as a supporting parameter. The data obtained during the study were then analyzed, including:

Catch Percentage

Hasrun and Kasmawati (2022) explained that the number of catches (tons) is used to calculate the percentage of catch. To find out the composition of shrimp species, it can be calculated using the Krebs formula, namely:

$$P = \frac{n_1}{N} \times 100\%$$

Information:

P = Catch percentage value (%)

n_1 = Number of individual shrimp

N = Total catch

Size Structure

Analysis of the body size structure of the jebung shrimp will be very helpful in determining how often the shrimp are caught based on their size comparison. The frequency of the most frequently collected shrimp size indicates its size structure. The maximum, minimum, and average length of shrimp are all taken into account when calculating their size structure (Siraj *et al.*, 2019).

Catch Size

Comparison of sampling data during the study with other shrimp catch size reference data will produce a calculation value for the catch size that is suitable for shrimp to be caught (L50%). One calculation concept that involves plotting the total number of frequencies (cumulative) with the carapace length of each shrimp forms a standard logistic curve, of course this method can be used to measure shrimp catchability (Mollynda *et al.*, 2022).

Length-Weight Relationship

Length-weight relationship analysis is used to determine the growth characteristics of jebung shrimp. Depison *et al.* (2020), explained that the following equation is a formula for calculating the length-weight relationship:

$$W = aL^b$$

Information:

W = Weight (gram)

a = Numbers that have a fixed value

L = Total length/overall (mm)

b = Power of numbers

The pattern of shrimp growth system can be determined by using the b value of the shrimp length-weight relationship. The length-weight relationship is isometric if $b=3$, which indicates that the increase in weight is proportional to the increase in length. The relationship between weight and length is allometric if $b \neq 3$, if the value of $b > 3$ then it is called positive allometric (body weight increases faster than body length), and if the value of $b < 3$ then it is called negative allometric (body length increases faster than body weight) (Depison *et al.*, 2020).

Condition Factors

According to Nirmala *et al.* (2020), stated that shrimp with a condition factor value (Kn) between 2 and 4 are considered fat, while shrimp with a condition factor value between 1 and 2 are considered thin. Throughout the study, the condition factor value tended to range from one. Gurning *et al.* (2019), explained how to determine the condition factor value, namely if $b = 3$ with an isometric growth pattern, then calculate it using the formula:

$$Kn = \frac{10^5 W}{L^3}$$

If the calculation results show that the value of $b \neq 3$ or the growth pattern is allometric, then the condition factor calculation uses the formula:

$$Kn = \frac{W}{aL^b}$$

Information:

Kn = Condition factor value

W = Weight (gram)

L = Total length/overall (mm)

a and b = Regression value of the relationship between length and weight

Gonad Maturity Level

Observation of the shape, color, and development of gonad contents is used to visually determine the level of gonad maturity (TKG). Generally, changes in gonad color in the dorsal area are used to determine the level of gonad maturity of jerbung shrimp quickly and efficiently (Salim *et al.*, 2019).

Sex Ratio

Dahlan *et al.* (2017), explained that the calculation of the sex ratio of male and female jerbung shrimp can use the formula:

$$NK = \frac{\sum J}{\sum B}$$

Information:

NK = Sex ratio

$\sum J$ = Number of male shrimp individuals

$\sum B$ = Number of female shrimp individuals

In addition, Pane and Suman (2020), explained that to determine the sex ratio of male and female shrimp, a chi square test (X^2) is required using the formula:

$$X^2 = \frac{\sum (fo - fh)^2}{fh}$$

Information:

X^2 = Chi square value

fo = Frequency of observation results of male and female shrimp

fh = Frequency of male and female shrimp expectations

Physical and Chemical Parameters of Water

Harahap (2020), stated that temperature, pH, and salinity are environmental factors that have a significant impact on the existence of shrimp populations and growth in waters.

RESULT

Percentage of Catch

The percentage of jerbung shrimp catch during research in the waters of East Lampung is presented in Figure 1.

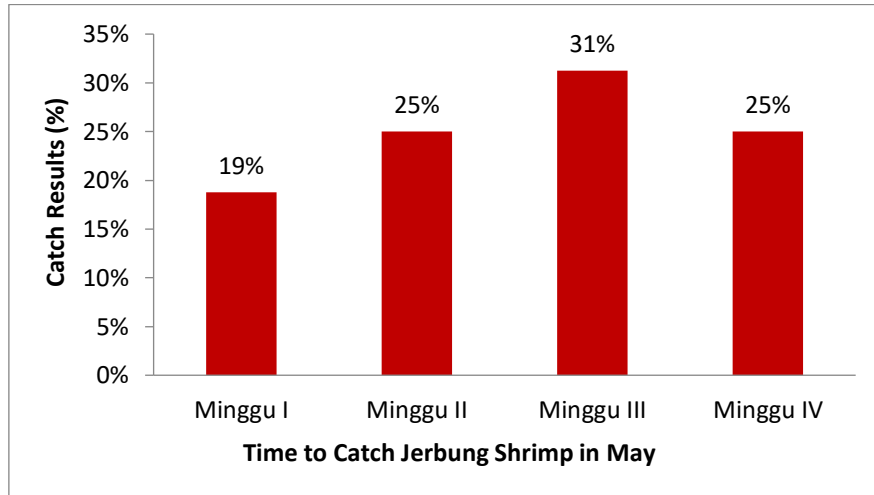


Figure 1. Biomass shrimp caught jerbung for 4 weeks observations in the waters of East Lampung

In the third week of May, the percentage of jerbung shrimp catches in the waters of East Lampung was the largest (31%), while in the first week of May the percentage of jerbung shrimp catches was the lowest (19%) (Figure 1).

Size Structure

The size structure of male and female jerbung shrimp during the study in the waters of East Lampung is presented in Figures 2 and 3.

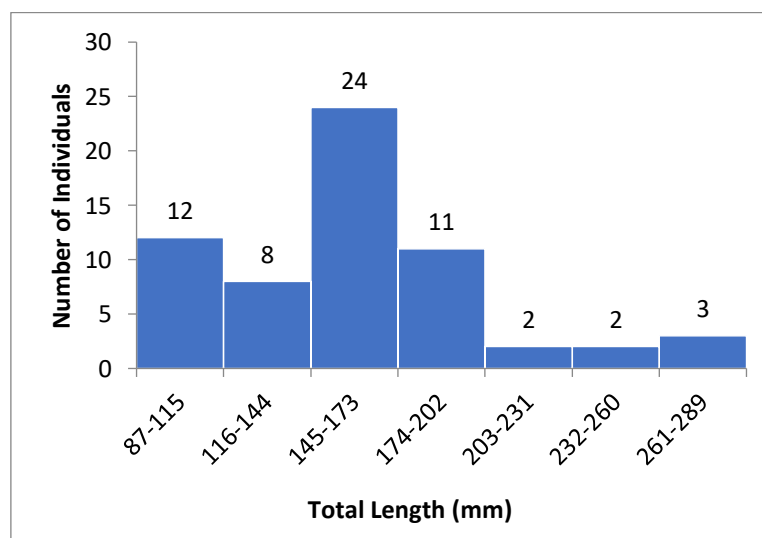


Figure 2. Structure size shrimp jerbung the captured male in the waters of East Lampung

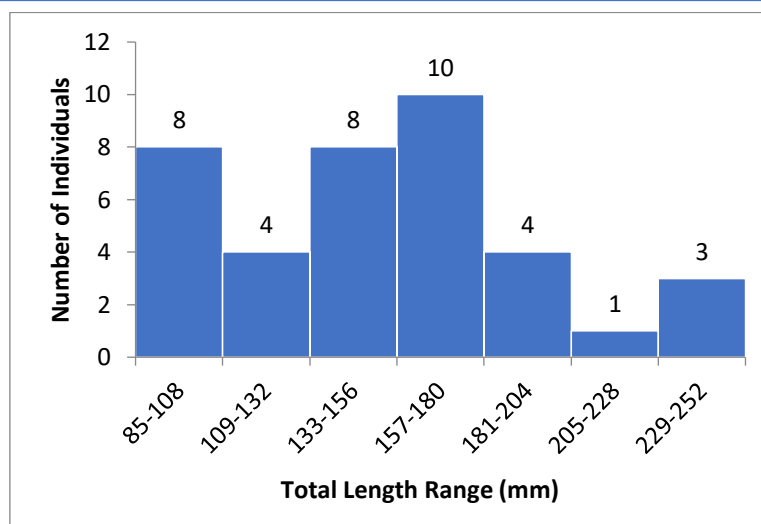


Figure 3. Structure size shrimp jebung female caught in the waters of East Lampung

Male jebung shrimp with body lengths ranging from 145 to 173 mm and female jebung shrimp with body lengths ranging from 157 to 180 mm dominated the jebung shrimp catches for four weeks in East Lampung waters (Figures 2 and 3).

Catch Size

The catchable size of jebung shrimp during the study in East Lampung waters is presented in Figure 4.

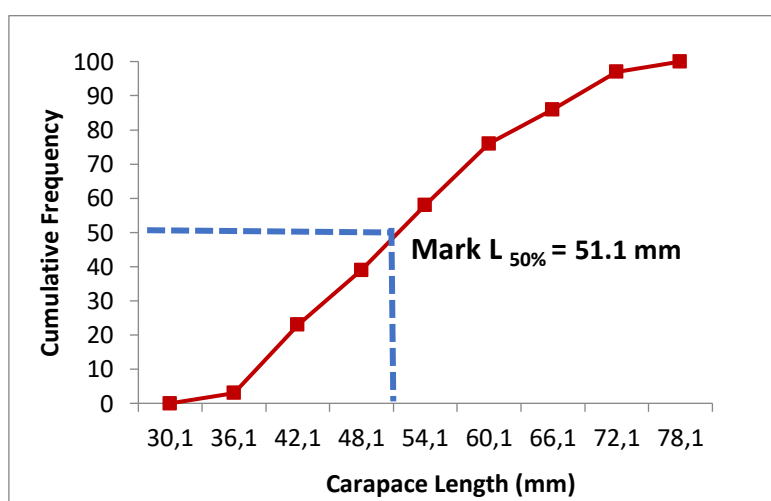


Figure 4. Size worthy catch shrimp jebung

The results of the catchable size plot (L50%) obtained an average carapace length value of jebung shrimp caught of 51.1 mm (Figure 4). This value indicates that 50% of the shrimp caught have a size of <51.1 mm and are not catchable. While the other 50% are >51.1 mm in size and are catchable shrimp.

Length-Weight Relationship

The results of the analysis of the length-weight relationship of male and female jebung shrimp during the study are presented in Figures 5, 6, and Table 1.

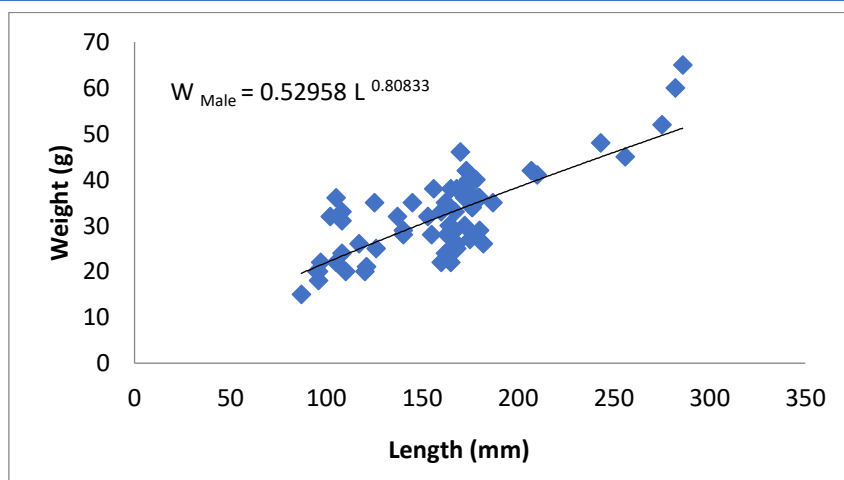


Figure 5. Relationship curve long heavy shrimp jerbung male

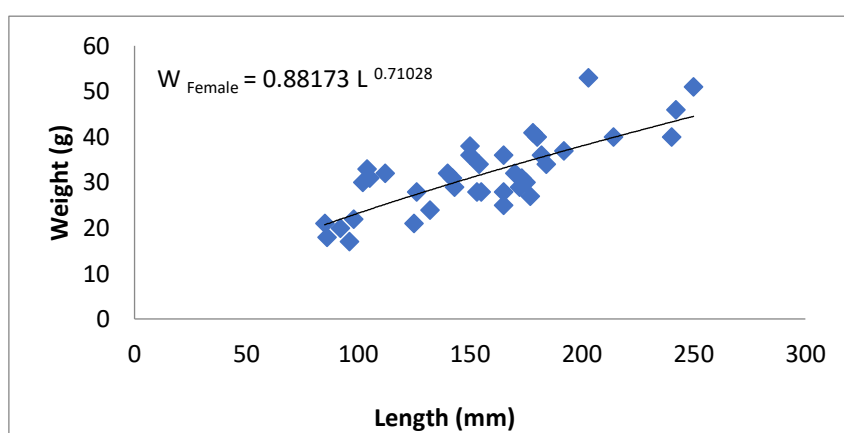


Figure 6. Relationship curve long heavy shrimp jerbung female

Table 1. Analysis results connection long heavy shrimp jerbung

| Parameter | Data and Calculation Results | |
|-------------------------------------|------------------------------|--------------------------|
| | Male | Female |
| Number of samples (n) | 62 | 38 |
| Value a | 0.52958 | 0.88173 |
| Value b | 0.80833 | 0.71028 |
| $W = aL^b$ | $W = 0.52958L^{0.80833}$ | $W = 0.88173L^{0.71028}$ |
| Total Length (mm) | 87 - 286 mm | 85 - 250 mm |
| Weight (g) | 15 - 65 g | 17 - 53 g |
| Coefficient Correlation (r) | 0.760362 | 0.778749 |
| Coefficient Determination (R^2) | 0.57815 | 0.60645 |
| T-test | t count > t table | t count > t table |
| Growth Pattern | Allometric Negative | Allometric Negative |

The results of the analysis of the relationship between the length and weight of jerbung shrimp show that the growth of male and female jerbung shrimp has a negative allometric growth pattern (Figures 5, 6 and Table 1), because the b value <3 indicates that the increase in length of jerbung shrimp is faster than its weight.

Condition Factor (Kn)

The condition factor of jerbung shrimp caught during the study in the waters of East Lampung is presented in Table 2.

Table 2. Shrimp condition factor values jerbung

| Parameter | Gender | |
|-----------------------|----------|----------|
| | Male | Female |
| Average Length (mm) | 159 | 154 |
| Average Weight (g) | 32.3 | 31.8 |
| Standard Error | 0.353006 | 0.538772 |
| Standard Deviation | 0.194425 | 0.170432 |
| Condition Factor (Kn) | 1.01 | 1.01 |

Male and female jerbung shrimp have the same condition factor value of 1.01 (Table 2), so that jerbung shrimp are categorized with a thin plumpness level because the Kn value < 3 means that the increase in body length is greater than the increase in weight.

Gonad Maturity Level

The gonad maturity level of female jerbung shrimp during the study in East Lampung waters is presented in Figure 7.

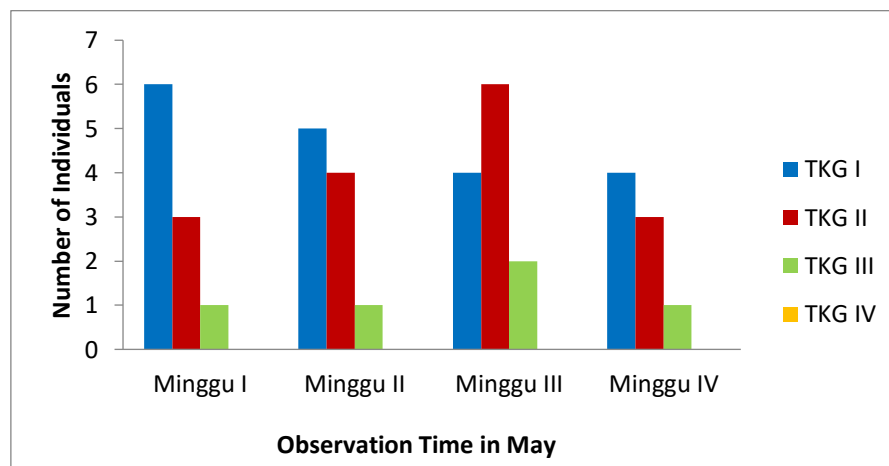


Figure 7. Gonad maturity level of shrimp jerbung female

Female jerbung shrimp caught in the waters of East Lampung were only found in TKG I to III. Meanwhile, it is known that the male jerbung shrimp have not fully developed gonads (Figure 7).

Sex Ratio

The sex ratio of jerbung shrimp during the study in the waters of East Lampung is presented in Table 3.

Table 3. Type ratio sex shrimp jerbung in the waters of East Lampung during 4 weeks of observation in May

| Parameter | Gender | |
|------------------------|--|--------|
| | Male | Female |
| Percentage (%) | 62% | 38% |
| Ratio Sex | 1 | 0.61 |
| <i>Chi square test</i> | X^2 value _{count} (2.20) < X^2 table value (7.81) | |
| Conclusion | Not balanced | |

The sex ratio of male and female jerbung shrimp caught in the waters of East Lampung was 1: 0.61. The number of male jerbung shrimp was more dominant than females, so the population was declared unbalanced (Table 3).

Physical and Chemical Parameters of Water

The physical and chemical parameters of the waters of East Lampung during the study are presented in Table 4.

Table 4. Physical parameter values East Lampung water chemistry

| Time | Water Conditions | | |
|----------|---------------------|------|----------------|
| | Temperature (° C) | pH | Salinity (ppt) |
| Week I | 30.4 | 7.54 | 33.0 |
| Week II | 30.0 | 7.49 | 31.3 |
| Week III | 30.6 | 7.55 | 33.0 |
| Week IV | 30.3 | 7.50 | 33.0 |

The water conditions in East Lampung have temperatures ranging from 30.0 to 30.6°C, pH around 7.49 to 7.55 and salinity between 31.3 to 33.0 ppt (Table 4).

DISCUSSION

Percentage of Catch

In the research results, the percentage of jerbung shrimp that were successfully caught using bag nets in the waters of East Lampung was highest in the third week of May (31%) and the lowest in the first week of May (19%). According to Hadi *et al.* (2022), the percentage of catch types is carried out as one way to evaluate the selectivity and friendliness of fishing gear. In addition, the difference in the percentage of jerbung shrimp catches by fishermen when they landed at the Maringgai Higienis TPI, East Lampung, was influenced by the factor of inappropriate fishing season patterns because the catches obtained in the May period were still relatively low compared to the June - December period last year.

Size Structure

To determine how often shrimp are taken in relation to their size, it is necessary to conduct observations related to the size structure or size distribution. Shrimp in East Lampung waters during the research period of around 4 weeks produced different size structures between males and females. In the first to fourth week of sampling, the number of male shrimp caught was dominated by body lengths ranging from 145-173 mm with a percentage of 39% or as many as 24 individuals. Meanwhile, the number of female shrimp caught was dominated by body lengths ranging from 157-180 mm with a percentage of 26% or as many as 10 individuals. According to Depison *et al.* (2020), differences in the size structure of the catch occur due to

the influence of factors related to organisms and environmental factors, including food availability, water temperature, current, waves, depth, brightness, and so on.

Catch Size

The results of the catchable size plot ($L_{50\%}$) obtained an average carapace length value of shrimp caught of 51.1 mm. This value indicates that 50% of the shrimp caught are <51.1 mm in size and are not suitable for catching. While the other 50% are >51.1 mm in size and are suitable for catching. The average length of the shrimp carapace caught during the study can vary. This can occur due to the influence of several factors. One of them is the physiological factors of each shrimp are different, as well as environmental conditions such as food availability, current, waves, depth, temperature, brightness, and so on (Siraj *et al.*, 2019).

Length-Weight Relationship

The results of the analysis of the length-weight relationship of jerbung shrimp show that the growth of male and female jerbung shrimp has a negative allometric growth pattern, because the b value <3, which means that the increase in length of jerbung shrimp is faster than the increase in weight. The difference in the increase in length and weight of shrimp is related to the age of the shrimp. According to Mollynda *et al.* (2022), the increase in length is very fast in small/young shrimp and conversely the increase in weight is very slow. Meanwhile, in adult shrimp, the increase in length is slow and the increase in weight is faster. In addition to the age factor, there are several other factors that also affect the growth characteristics of jerbung shrimp such as water temperature and fishing season.

Condition Factor (Kn)

The results of the condition factor analysis in this study showed that male and female jerbung shrimp have the same condition factor value, namely 1.01, so that jerbung shrimp are categorized as having a thin plumpness level because the Kn value <3, which means that the increase in body length is greater than the increase in weight and this growth pattern is called allometric growth. According to Selvia *et al.* (2019), the shrimp body is thin due to the influence of food, age, gender and gonad maturity. In addition, Hurriyani *et al.* (2022) stated that "the condition factor of an organism is influenced by several factors such as the number of organisms present, the condition of the organism, the availability of food and the condition of the aquatic environment such as temperature." The increasing value of the condition factor indicates a suitability between the organism and its environment and vice versa.

Gonad Maturity Level

The results of observations of TKG of female jerbung shrimp caught in the waters of East Lampung have TKG I to III and no TKG IV was found. Meanwhile, in male jerbung shrimp, it is known that the gonads have not fully developed so that gonad maturity was not found at all TKG levels. From the results of the analysis, it can be concluded that the jerbung shrimp found around the waters of East Lampung are categorized as partly mature gonads and partly ready to spawn. This can be seen from the absence of shrimp at TKG IV level. The peak spawning period of jerbung shrimp in the waters according to Murni and Dimenta (2021) occurs in January, April, August and November. These months are included in the peak spawning period of jerbung shrimp. Each region has a different peak spawning period for jerbung shrimp. The factors that cause differences in the peak spawning are likely influenced by environmental factors such as salinity, temperature and rainfall.

Sex Ratio

The sex ratio of male and female shrimp caught in East Lampung waters is 1: 0.61, where the number of male shrimp is more than the number of female shrimp, so the ratio is not balanced. According to Ardiansyah *et al.* (2022), if the male and female shrimp obtained are not balanced or the number of male shrimp is more than the number of female shrimp, it can be interpreted that the population of the shrimp is said to be less good for maintaining its sustainability. According to Prodhiana *et al.* (2022), the sex ratio in shrimp can change according to the samples found. In addition, the existence of a deviation factor from the sex ratio of 1: 1 can be caused by selective death events, different sexual behaviors, and unstable growth rates. In comparison, the sex ratio with a high male shrimp population can actually illustrate the threat of extinction of shrimp in each water.

Physical and Chemical Parameters of Water

The results of the analysis of the water conditions of East Lampung have temperatures ranging from 30.0 to 30.6°C, pH around 7.49 to 7.55 and salinity between 31.3 to 33.0 ppt. Environmental factors such as temperature, pH, and salinity can affect the existence and development of shrimp in the waters that are their natural habitat (Harahap, 2020). Based on the results of water temperature measurements at the research location, it ranges from 30.0 to 30.6°C. This water temperature range shows that the temperature measurement values obtained are still within good and relatively safe limits and do not cause stress to shrimp. This is in accordance with the statement of Simon *et al.* (2019), The estimated ideal temperature for aquatic biota is between 28 to 32°C. Then the pH size at the research location ranges from 7.49 to 7.55. This pH value is still relatively safe for the survival of shrimp in the waters. This is in accordance with the statement of Ala *et al.* (2018), generally marine and coastal waters have a relatively more stable pH and are in a narrow range, usually ranging from 7.6 to 8.3 which means they are alkaline. Based on the results of salinity measurements at the research location, the values obtained ranged from 31.3 to 33.0 ppt. According to Patty *et al.* (2020), high and low salinity can be influenced by various factors, such as water circulation patterns, evaporation, rainfall and river flow. So that these conditions still describe the fairly good salinity tolerance of shrimp because the salinity levels in these waters meet the standards of >30 ppt.

CONCLUSION

The balance of the shrimp population in the waters of East Lampung is influenced by a number of biological factors. The diversity of biological aspects shows the percentage of shrimp caught the most (31%) and the lowest (19%). The male shrimp caught have a body length of between 145 and 173 mm, while the female shrimp have a body length of between 157 and 180 mm. The ideal size for catching shrimp is 51.1 mm. Shrimp have a negative allometric relationship based on their length-weight analysis. The value of the condition factor of 1.01 indicates the level of thin shrimp plumpness. It is known that the male shrimp caught are not yet gonad mature, while the female shrimp are in TKG I to III. The ratio of the comparison of male shrimp is greater than that of female shrimp, so the population is considered unbalanced. Shrimp growth is quite stable by several physical and chemical parameters of water such as temperature ranging from 30.0 to 30.6°C, pH around 7.49 to 7.55 and salinity between 31.3 to 33.0 ppt. To better understand the utilization of the availability of jerbung shrimp in the waters of East Lampung, further research is needed on the biological aspects of jerbung shrimp in their natural habitat. In addition, to achieve sustainable jerbung shrimp conservation, socialization activities are needed regarding environmentally friendly shrimp fishing and determining the maximum size of shrimp that can be caught.

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