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Length–Weight Relationship Of Fourfinger Threadfin (Eleutheronema Tetradactylum) Caught In Tungkal Ilir

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Abstract— The senangin fish *(Eleutheronema tetradactylum)* is one of the high-value fishery resources in Tungkal Ilir Subdistrict, Tanjung Jabung Barat Regency; however, information regarding the relationship between length and weight remains limited. This study aims to analyze the relationship between length and weight of senangin fish (*Eleutheronema tetradactylum*) landed in Tungkal Ilir Subdistrict, Tanjung Jabung Barat Regency. Sampling was conducted from February to March, 2026, in Tungkal Ilir Subdistrict, using an observational method with purposive sampling. The sample consisted of 400 senangin fish caught in gillnets with mesh sizes of 1.5 inches and 2 inches. The samples were separated by sex male and female. The data analyzed included length-weight relationships, condition factor, size classes, and first catch size. The results showed that male senangin fish caught using 1.5 inch gillnets exhibited an isometric growth pattern (b = 3.0547). Meanwhile, female senangin fish exhibited a negative allometric pattern (b = 2.3452). In the 2 inch gillnet, both male and female senangin fish exhibited negative allometric growth patterns with b values of 2.4362 and 2.6522, respectively. The correlation coefficients ranged from 0.8382 to 0.9657, indicating a strong to very strong relationship between length and weight. Condition factor values averaged between 0.8010 and 0.9794 for the 1.5-inch gillnet and between 1.0013 and 1.0024 for the 2-inch gillnet, indicating that the fish were in relatively good physical condition. These results show that the 1.5 inch and 2-inch gillnets are more selective in catching male senangin fish by targeting those with mature gonads. Thus, the length-weight relationship of senangin fish exhibits different growth patterns based on sex and mesh size.

Keywords: Condition factor, *eleutheronema tetradactylum,* first-catch size, gillnets, length-weight relationships.

I. INTRODUCTION

Tanjung Jabung Barat Regency is a tidal area consisting of public waters and the sea that can be optimally exploited. Tanjung Jabung Barat is renowned for the potential of its capture fisheries sector; the waters of Kuala Tungkal are estuarine waters the confluence of seawater and river water and fishermen in these waters use a variety of fishing gear (Lubis, 2022). The fishing gear commonly used in Tungkal Ilir Subdistrict consists of six types: togok, sondong, gillnets, trawls, rawai, and bubu. Fishermen in this area primarily use gillnets; in 2015, a total of 305 gillnet units were recorded as operational (Lisna et al., 2018). This classification allows fishermen to catch fish of different sizes. Based on a survey of the mesh sizes of gillnets commonly used by fishermen including 1.5 inch and 2 inch the varying mesh sizes often result in the capture of fish of diverse sizes, including those that have not yet reached the minimum legal size. Such fishing practices have the potential to disrupt the long-term sustainability of fish populations and may lead to the extinction of fish in their natural habitats.

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The main catch in gillnets are the senangin fish (*Eleutheronema tetradactylum*), the gulamah fish (*Panna microdon*), and the lomek fish (*Harpadon nehereus*) (Miradni et al., 2024). The senangin (*Eleutheronema tetradactylum*) inhabits the bottom of water bodies, particularly in coastal and shallow areas, and is often found in large rivers; its primary diet consists of small fish, shrimp, and various other benthic organisms. This fish typically ranges in size from 45 to 50 cm, is classified as a demersal species, and is often sold fresh. Its distribution covers coastal waters, particularly in the Java Sea, eastern Sumatra, along Kalimantan, South Sulawesi, and the Arafura Sea (Genisa, 1999). The senangin fish (*Eleutheronema tetradactylum*) is also abundant in brackish waters and estuaries and is even found in river waters. The muddy water conditions in Kuala Tungkal are well-suited to the habitat of the senangin fish, which prefers brackish and muddy waters (Fauzi, 2021).

The senangin fish (*Eleutheronema tetradactylum*) is a species of fish with high economic value that is widely sold in the market and enjoys high demand (Ramadan et al., 2023). The high price and market demand for senangin fish in Kuala Tungkal have encouraged fishermen to catch fish using nets with varying mesh sizes; if this practice continues, it will lead to the future extinction of this fish species and damage fishery resources. Therefore, it is important to implement a fish resource management approach that considers biological aspects, including analyzing the relationship between fish length and weight. To date, there is still limited information regarding the length-weight relationship of senangin fish (*Eleutheronema tetradactylum*) caught in Tungkal Ilir, West Tanjung Jabung Regency.

II METHODOLOGY

A. Research Methodology

The study was conducted from February 4 to March 10, 2026, in Tungkal Ilir Subdistrict, Tanjung Jabung Barat Regency.The The equipment and materials used in this study included: 400 senangin fish (*Eleutheronema tetradactylum*), consisting of 241 males and 159 females. The equipment used for the study included: a cutting mat and a measuring tape to measure fish length, a scale to measure fish weight, gloves, writing utensils to record data, a camera for research documentation, and a laptop for data processing. The research procedure began with the preparation of equipment and materials: preparing the research equipment and materials. Sampling: samples of Senangin fish (*Eleutheronema tetradactylum*) were collected when fishermen landed their catch. Next, measurement and weighing: total length was measured using a cutting mat and a 1-mm precision tape measure, as described in (Sparre and Venema 1999; Badriah 2022), while weight was measured using a digital scale with a precision of 0.1 g. The samples were then separated by sex.

The method used in this study is the observational method. The observational method is a data collection technique conducted through observation, accompanied by recordings of the condition of the target object. The sampling technique used in this study is purposive sampling (Hasibuan, 2023). Purposive sampling is a technique for determining a sample that is carried out intentionally based on specific criteria (Etikan et al., 2016). This technique was applied intentionally, taking into account the *Eleutheronema tetradactylum* fish landed at Tungkal Ilir, with a catch of 10 fish per repetition for each mesh size, and 20 repetitions were conducted.

B. Data Analysis

A. Data Relationship Between Length and Weight

The data on fish length and weight measurements were analyzed using frequency distribution graphs created in Microsoft Excel. To determine the fish growth pattern, an analysis of the relationship between fish length and weight was conducted using the following equation (Effendie, 2002).

$$W = a\ Lb$$

If linearized using a logarithmic transformation, the following equation is obtained:

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

Notes: W (y) is the weight of the fish (g), L (x) is the total length of the fish (cm), and a and b are constants. The value of b is used to determine the growth pattern, which is classified as b < 3 (negative allometry): length growth is faster than weight growth; b = 3 (isometric): length and weight growth are balanced; b > 3 (positive allometry): weight growth is faster than length growth. Next, a t-test was conducted to test these hypotheses mathematically using the equation (Supeni et al., 2021).

$$t = \frac{b1 - b0}{sb1} \; ; \; Sb1 = \sqrt{\frac{1}{n-2}\left((sy/sx)2 - b0^2\right)}$$

Notes: b_1 = value of b, b_0 = 3, Sb_1 = standard deviation of the coefficient b. Conclusion (95% confidence level): if the calculated t-value is greater than the table t-value, the relationship is allometric; if the calculated t-value is less than the table t-value, the relationship is isometric.

B. Condition Factor

If the increase in weight is proportional to the increase in length, the fish's growth is isometric; thus, the equation for calculating the condition factor is (Effendie, 2002; Wulandari and Gustomi, 2020)

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

If growth is allometric that is, if increases in length and weight are not proportional then the equation for calculating the condition factor is (Effendie, 2002):

$$K = \frac{W}{a\, L^b}$$

Notes: K = Condition factor, W = Fish weight, L = Fish length, a and b = Constants. The value of K can indicate the fish's condition and water quality based on the fish's state. The decision-making criteria are as follows: If $0 \leq K \leq 0.99$, the fish is underweight; if $1 \leq K \leq 3$, the fish is in normal condition; and if $K > 3.1$, the fish is overweight (Effendie 2002; Dharmawan et al., 2025).

C. Class Interval

How to calculate the class interval using the formula (Walpole 1995; Rahantan, 2012).

$$K = 1 + (3{,}3 \log n)$$

$$I = R/K$$

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Notes: K = Number of Classes, N = Number of Data Points, I = Class Interval, R = Largest Value/Smallest Value. After determining the class intervals, the data is arranged from smallest to largest and grouped into classes. Then, the values for each class are plotted on a histogram to visualize the distribution of the sample.

D. Length at first capture (Lc)

The length at gonadal maturity (Lm) for male Senangin fish (*Eleutheronema tetradactylum*) is 20.99 cm (Lelono et al., 2021). The length at first capture (Lm) of a gonadally mature female Senangin fish (*Eleutheronema tetradactylum*) is 40.39 cm (Firdaus et al., 2021). Analysis of the mean length at first capture (Lc) was performed using the total length frequency distribution with a logistic approach (Sparre & Venema, 1998; Alnanda et al., 2020), using the following equation:

$$\text{SL est} = \frac{1}{1 + \exp(a + b \text{ x } L)}$$

Notes: SL = estimated value, L = class length midpoint (cm), a and b = constants. Thus, the values of a and b can be calculated using linear regression estimates:

$$\text{Ln}=\left\lfloor \frac{1}{\text{SLc}} - 1 \right\rfloor = a - bxL$$

III Result and Discussion

3.1. Result

Relationship Between Length and Weight

Results of an analysis of the relationship between the length and weight of male and female senangin fish (*Eleutheronema tetradactylum*) caught using gillnets with mesh sizes of 1.5 inch and 2 inch. The Relationship Between Length and Weight of Male and Female Senangin Fish (*Eleutheronema tetradactylum*) Caught in 1.5-Inch Gillnets.

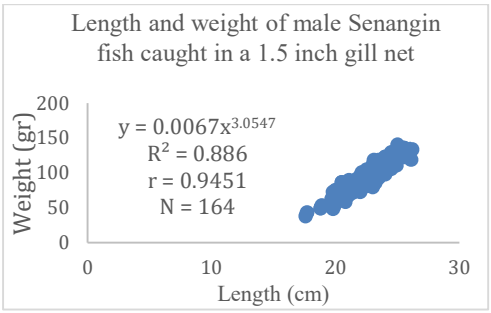

Figure 1. The relationship between the length and weight of male senangin fish caught in 1.5 inch gillnets

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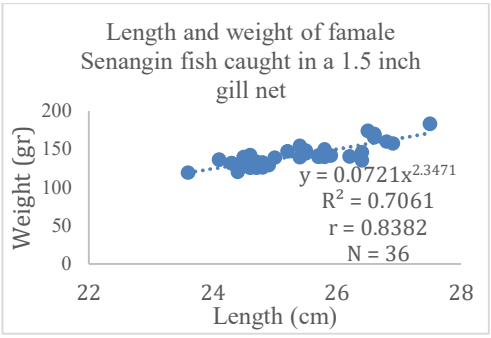

Figure 2. The relationship between the length and weight of famale senangin fish caught in 1.5 inch gillnets

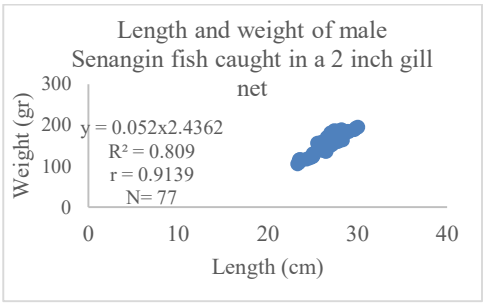

Figure 3. The relationship between the length and weight of male senangin fish caught in 2 inch gillnets

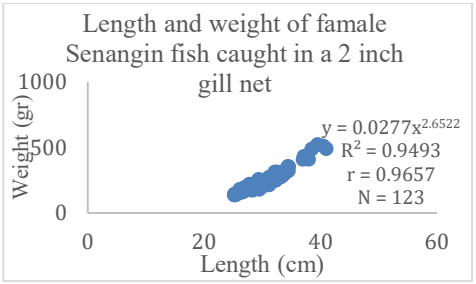

Figure 4. The relationship between the length and weight of famale senangin fish caught in 2 inch gillnets

B. Conditional factors

TABLE 1. CONDITION FACTOR OF SENANGIN FISH (*ELEUTHERONEMA TETRADACTYLUM*) CAUGHT IN 1.5 INCH GILLNET

Fish sex	**Notes**		
	Average	***Maximum***	***Minimum***
Male	0,8010	1,0029	0,6248
Female	0,9770	1,0830	0,8519

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TABLE 2. CONDITION FACTOR OF SENANGIN FISH (*ELEUTHERONEMA TETRADACTYLUM*) CAUGHT IN 2 INCH GILLNET

Fish sex	Notes		
	Average	***Maximum***	***Minimum***
Male	1,0024	1,1349	0,8900
Female	1,0013	1,1741	0,8200

C. Class Interval

The distribution of gillnets with mesh sizes of 1.5 and 2 inch in Tungkal Ilir Subdistrict, Tanjung Jabung Barat Regency, is shown in figure 4, 5, 6, and 7.

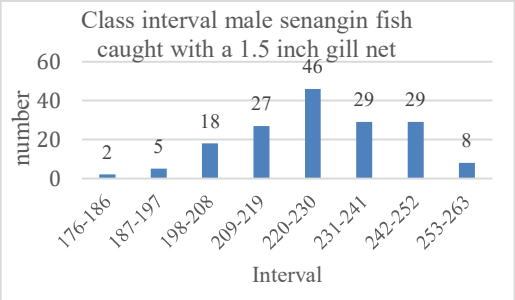

Figure 5. Class interval male senangin fish caught with a 1.5 inch gill net

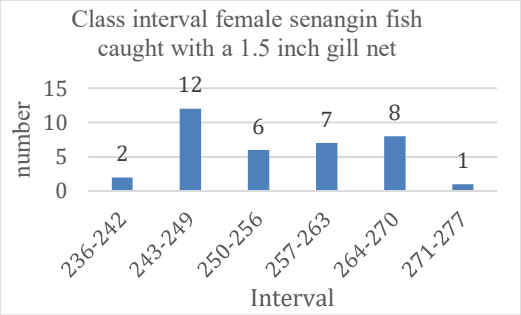

Figure 6. Class interval female senangin fish caught with a 1.5 inch gill net

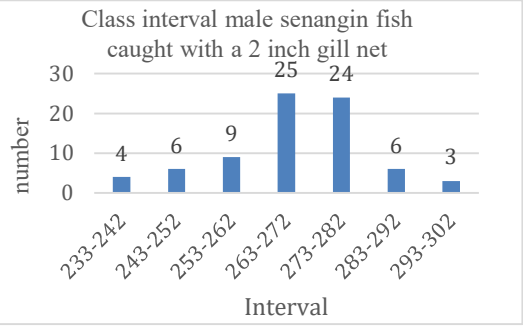

Figure 7. Class interval male senangin fish caught with a 2 inch gill net

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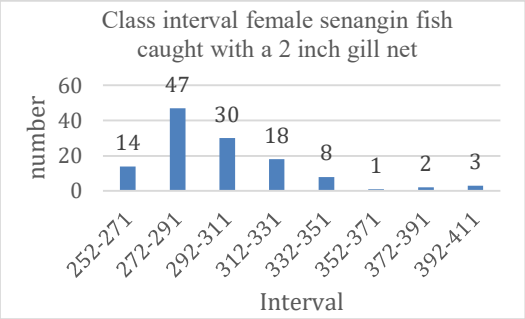

Figure 8. Class interval female senangin fish caught with a 2 inch gill net

3.2. Discussion

A. The relationship between the length and weight of male senangin fish caught in 1.5 inch gillnets

Based on Figure 1, the regression equation is $y = 0.0067x^{3.0547}$, with a b-value of 3.0547. Since the b-value is greater than 3 (b > 3) and, based on the t-test, the calculated t-value is less than the critical t-value, this indicates that the growth pattern of male senangin fish is isometric. This suggests that increases in length and weight are balanced. This differs from the study by Andriani (2022), which analyzed the relationship between the length and weight of male senangin fish and found a positive allometric growth pattern with the equation $y = 0.007 \times 3.05$.The coefficient of determination (R^2) obtained was 0.886. This value indicates that 88.06% of the increase in weight is influenced by the increase in fish length (Ramses et al., 2020). Meanwhile, 11.94% is influenced by other factors such as age, sex, natural food availability, and aquatic environmental conditions (Baihaq et al., 2025).

According to Dharmawan et al. (2025), the R^2 value indicates that the equation accurately represents the actual conditions in nature and suggests a very strong relationship between length and weight, wherein an increase in fish weight is accompanied by an increase in length. According to Rohmawati (2017) as cited in Fauzi (2021), a coefficient of determination value approaching one indicates that the production model can explain the strength of the relationship between the dependent variable and the independent variable, expressed as a percentage (%). The coefficient of determination (R^2) statistically indicates the level of fit and the significance of the relationship between the independent variable (fish length) and the dependent variable (fish weight) (Lawadjo et al. 2021). A correlation coefficient (r) of 0.9451 indicates a very strong correlation.

B. The relationship between the length and weight of female senangin fish caught in 1.5 inch gillnets

Based on Figure 2, the regression equation is $y = 0.0721x^2 + 3.3471$. The value of b is <3 (3.3452); a value of b less than 3 (b < 3) indicates that the growth pattern of female senangin fish is negatively allometric. These findings are consistent with a study conducted by Shopa et al. (2025) on the species *Eleutheronema tetradactylum*, which also demonstrated a negative allometric growth pattern. In that study, the equation relating length and weight was $Y = 2.5432x - 3.9984$. The use of gillnets with a mesh size of 1.5 inches tends to catch smaller fish compared to nets with larger mesh sizes, which may affect the length-weight relationship values obtained. Shopa et al. (2025) state that the R^2 value is used to indicate the strength of the relationship between fish length and weight.

The coefficient of determination (R^2) for female senangin fish was 0.7128. This value indicates that 71.28% of the increase in weight is influenced by the increase in fish length (Ramses et al., 2020), while 28.72% is influenced by other factors such as age, sex, natural food availability, and aquatic environmental conditions (Baihaq et al., 2025). The coefficient of determination (R^2) is the square of the Pearson correlation coefficient, which indicates the proportion of variation in one variable that can be explained by another variable (Hutasuhut et al., 2025). A correlation coefficient (r) value of 0.8466 indicates a strong correlation. According to Akbar (2021), this correlation coefficient indicates the strength of the correlation between variables.

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C. The relationship between the length and weight of male senangin fish caught in 2 inch gillnets

Based on Figure 3, the regression equation is $y = 0.052x^2 + 2.4362$, with a slope of 2.4362. The growth pattern of male senangin fish exhibits negative allometry. Consistent with the study by Lelono et al. (2021), the equation $y = 0.02x^2 + 2.846$ and $R^2 = 0.891$ were obtained for fish caught in the waters of Lekok, Pasuruan, East Java. This indicates that the increase in body length occurs more rapidly than the increase in weight.

The coefficient of determination (R^2) obtained was 0.809. This value indicates that 80.9% of the variation in weight is explained by the variation in body length (Ramses et al., 2020). Meanwhile, 19.1% of the variation in weight is influenced by other factors such as age, sex, natural food availability, and aquatic environmental conditions (Baihaq et al., 2025). The correlation coefficient (r) of 0.9139 indicates a very strong correlation.

D. The relationship between the length and weight of famale senangin fish caught in 2 inch gillnets

Based on Figure 4, the regression equation is $y = 0.0277x^2 + 2.6522$. (b) is 2.6522. Based on the growth pattern of female senangin fish, the growth is negatively allometric. This indicates that the increase in body length occurs faster than the increase in body weight. These results differ from those of Gelis et al. (2026) in the waters of Mendahara Ilir, East Tanjung Jabung Regency, where the regression equation $y(w) = 0.005523X(L)^{3\cdot\ 1116}$, with a b-value of 3.1116 for female senangin fish and a coefficient of determination (R^2) of 0.9623. Biological conditions (gonadal development and food availability), physiological conditions, and aquatic environmental factors (temperature, pH, salinity, and geographic location) play a significant role in determining the b value (Putri et al., 2024). Differences in growth patterns between male and female senangin fish may also be influenced by their biological characteristics. According to Zamidi et al. (2012), the senangin fish (*Eleutheronema tetradactylum*) is a protandrous hermaphrodite species. Furthermore, Pla et al. (2021) state that protandrous hermaphrodites undergo a sex change from male to female during their life cycle.

The coefficient of determination (R^2) was 0.9493. This value indicates that 94.93% of the increase in weight is influenced by the increase in fish length (Ramses et al., 2020). Meanwhile, 5.07% of the variation in weight is influenced by other factors such as age, sex, natural food availability, and aquatic environmental conditions (Baihaq et al., 2025). The magnitude of the R^2 value indicates that there is a strong relationship between body length and body weight (Hasan and Afriani, 2021). The correlation coefficient (r) of 0.9657 indicates a very strong correlation.

E. Condition factor of male and female Senangin fish caught with 1.5 inch gill nets

Based on Table 1 for the 1.5-inch gillnet, the average condition factor (K) for male senangin was 0.8010 and for female senangin was 0.9794. The minimum and maximum condition factor values for male senangin ranged from 0.6248 to 1.0029. Meanwhile, for female senangin, the condition factor values ranged from 0.8519 to 1.0830; this range indicates similar body conditions between the two sexes.

Based on these criteria, the average condition factor value of 0.8010 for male senangin indicates good body condition because it is below 1. Meanwhile, the average condition factor value for female senangin fish, at 0.9794, indicates a relatively poor body condition because it is slightly below 1. This aligns with Effendi's criteria in Dharmawan et al. (2025), which state that if $0 \leq K \leq 0.99$, the fish's physical condition is considered thin. According to Afriansyah and Cahyani (2024), a condition factor value above 1 indicates that the condition of wild senangin fish remains good.

F. Condition factor of male and female Senangin fish caught with 2 inch gill nets

Based on Table 2, which presents the results of the condition factor (K) analysis, the average condition factor for male senangin fish (*Eleutheronema tetradactylum*) was 1.0024 and for females, 1.0013. These values indicate that the average condition factor for both sexes falls within a nearly identical range, suggesting that the biological condition and welfare levels of both male and female individuals are relatively similar. The condition factor (K) is used to describe the level of body condition or physical health of fish based on the relationship between their body length and weight.

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Based on these criteria, the average condition factor values for male (1.0024) and female (1.0013) senangin fish were above 1, indicating that the condition of senangin fish in the wild remains good (Afriansyah and Cahyani, 2024). This is consistent with Effendi's criteria in Dharmawan et al. (2025), where $1 \leq K \leq 3$ indicates that the fish are not too flat or thin and that water conditions are good. Furthermore, (Febriani, 2010, as cited in Aisyah, 2017) explains that a high condition factor in fish indicates gonadal development, whereas a low condition factor indicates that the fish are not receiving sufficient food intake. Differences in condition factor values can be influenced by age, environmental conditions, gonadal maturity, food availability, and behavior; these values reflect that the relationship between fish length and weight indicates proportional growth, so that physiologically, the fish can be categorized as being in good condition. According to Zahid et al. (2022), a Kn value > 1 indicates good growth conditions, while a Kn value < 1 indicates less favorable growth conditions.

G . Class interval male senangin fish caught with a 1.5-inch gill net

Length classes measured in millimeters (mm), with the distribution data divided into 8 length classes; each class contains 11 subclasses, with the longest class at 262 millimeters (mm) and the shortest at 176 millimeters (mm). Most of the male senangin fish were caught in the 220–230 mm length class, totaling 46 individuals, while only 2 were found in the lowest class, 176–186 mm. This distribution indicates that the majority of senangin fish caught in Tungkal Ilir Subdistrict fall into the medium- to large-size groups. These size differences may also be influenced by sex, as male senangin fish generally have smaller body sizes than females (Findra et al., 2023). When compared to the size of female fish in this study, male fish tended to be smaller. These results reinforce the finding that female fish have larger body sizes than males, Several other studies have shown similar results, including a study of senangin fish (*Eleutheronema tetradactylum*) in the waters of Mendahara Ilir, East Tanjung Jabung, where male senangin fish measured 178–497 mm, while females measured 215–637 mm (Gelis et al., 2026).

H. Class interval female senangin fish caught with a 1.5 inch gill net

Based on Figure 6 above, it can be seen that the length class intervals, measured in millimeters (mm), are divided into 6 class intervals, with each class containing 7 subintervals; the highest class interval is 275 millimeters (mm) long, and the lowest is 236 millimeters (mm) long. The most frequent length class for the senangin fish is the 243–249 mm range, with 12 fish, while the lowest class, 271–277 mm, contains only 1 fish.

I. Class interval male senangin fish caught with a 2 inch gill net

Based on Figure 7 above, it can be seen that the length class intervals, measured in millimeters (mm), are divided into 7 class intervals, with each class having 10 subintervals; the highest class interval is 300 millimeters (mm) and the lowest is 233 millimeters (mm). The highest male senangin fish length data was in the 263–272 (mm) range, with 25 fish, while the lowest class interval was in the 293–302 (mm) range, with 3 fish. Anggrayni and Zainuri (2022) stated that a 2-inch gill net can catch larger fish compared to a 1.5-inch gill net.J. Class interval female senangin fish caught with a 2-inch gill net.

J. Class interval female senangin fish caught with a 2 inch gill net

Based on Figure 8 above, it can be seen that the length class intervals, measured in millimeters (mm), are divided into 8 classes, with each class containing 20 subintervals; the highest class interval is 410 millimeters (mm) long, and the lowest is 252 millimeters (mm) long. The largest number of female senangin fish was found in the 272–291 (mm) length class, totaling 47 fish, while the lowest class, ranging from 352 to 371 (mm), contained only 1 fish.

K. Length at first catch (Lc) of male senangin fish

Based on the results of a study of catches from 1.5-inch and 2-inch gillnets, the length at first capture (Lc) of male senangin (*Eleutheronema tetradactylum*) was found to be 22.6 cm and 26.7 cm, respectively; meanwhile, according to a study by Lelono et al. (2021), the length at first gonadal maturity (Lm) was 20.99 cm. Comparing the length at first gonadal maturity (Lm) with the length at first capture (Lc) is an important benchmark in fisheries resource management (Kurnia et al., 2022). These values indicate that the length at first capture is greater than the length at first gonadal maturity (Lc > Lm), suggesting that the majority of the senangin fish caught had already reached gonadal maturity before being captured by fishing gear. The results of this study are

consistent with the research by Lelono et al. (2021) in the waters of Lekok, Pasuruan, which found an Lc value of 24.66 cm and an Lm value of 20.99 cm, resulting in an Lc > Lm condition. The researchers concluded that the caught fish were predominantly gonad-mature and that the fishing gear used was selective.

The results of this study show that senangin fish caught in the waters off Kuala Tungkal had the opportunity to reproduce before being caught. This indicates that the mesh size used in this study was still sufficiently selective with respect to the size of gonadally mature fish. Thus, the fishing activities conducted pose a lower risk of stock depletion than if the majority of the fish caught were still below the Lm size.

L. Length at first catch (Lc) of female senangin fish

Based on the results of a study of catches from 1.5 inch and 2 inch gillnets, the length at first capture (Lc) of female senangin (*Eleutheronema tetradactylum*) was found to be 25.44 cm and 29.69 cm, respectively. Meanwhile, the length at first maturity (Lm) based on the study by Firdaus et al. (2021) was 40.39 cm. These results show that the Lc value is smaller than the Lm value (Lc < Lm). This indicates that most of the senangin fish caught in the waters of Kuala Tungkal are still smaller than the size at which they first reach gonadal maturity, meaning that most of the fish have not yet had the opportunity to reproduce before being caught.

IV CONCLUSION

Based on the results of this study, it can be concluded that the relationship between the length and weight of senangin fish (*Eleutheronema tetradactylum*) caught using 1.5 inch gillnets shows different growth patterns based on sex. Male senangin fish exhibit an isometric growth pattern. In contrast, female senangin fish exhibit a negative allometric growth pattern. In 2-inch gillnets, both male and female senangin fish exhibit a negative allometric growth pattern. The correlation coefficient (r) values indicate a strong to very strong relationship between the length and weight of senangin fish, meaning that increases in body length are closely followed by increases in body weight.

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