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Length–Weight Relationship of Lambak Fish (*Labiobarbus ocellatus*) from Fishermen's Catches in the Batanghari River

Hubungan Panjang Berat Ikan Lambak (Labiobarbus ocellatus) Hasil Tangkapan Nelayan di Perairan Sungai Batanghari

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Abstract

Lambak fish (*Labiobarbus ocellatus*) is a freshwater species of ecological and economic importance in the Batanghari River. Basic biological information, particularly the length–weight relationship, is needed to understand growth characteristics and support sustainable fisheries management. This study aimed to analyze the size distribution and length–weight relationship of lambak fish based on fishermen's catches. Sampling was conducted in August 2025 through direct surveys of daily catches using traditional fishing gears. The length–weight relationship was analyzed using the equation $W = aL^b$. The results showed that the samples consisted of 22 females and 33 males. The total length of females ranged from 117–160 mm and males from 100–157 mm, with weight ranges of 15–36 g and 13–40 g, respectively. The regression coefficient (b) values of 2.1483 for females and 2.2459 for males indicated a negative allometric growth pattern. The coefficients of determination (R^2) of 0.6904 for females and 0.501 for males suggested relatively strong to moderate length–weight relationships. This growth pattern reflects the species' biological response to environmental conditions

Keywords: Lambak fish, Allometric growth, Batanghari River

Abstrak

Ikan lambak (*Labiobarbus ocellatus*) merupakan spesies ikan air tawar yang memiliki nilai ekologis dan ekonomis penting di Sungai Batanghari. Informasi biologis dasar, khususnya hubungan panjang–berat, diperlukan untuk memahami karakteristik pertumbuhan dan mendukung pengelolaan perikanan berkelanjutan. Penelitian ini bertujuan menganalisis distribusi ukuran dan hubungan panjang–berat ikan lambak berdasarkan hasil tangkapan nelayan. Pengambilan sampel dilakukan pada Agustus 2025 melalui survei langsung terhadap hasil tangkapan menggunakan alat tangkap tradisional. Analisis hubungan panjang–berat menggunakan persamaan $W = aL^b$. Hasil penelitian menunjukkan bahwa sampel terdiri atas 22 ekor betina dan 33 ekor jantan. Kisaran panjang total ikan betina adalah 117–160 mm dan jantan 100–157 mm, dengan kisaran berat masing-masing 15–36 g dan 13–40 g. Nilai koefisien regresi (b) sebesar 2,1483 pada betina dan 2,2459 pada jantan menunjukkan pola pertumbuhan alometrik negatif. Koefisien determinasi (R^2) sebesar 0,6904 pada betina dan 0,501 pada jantan mengindikasikan hubungan panjang–berat yang relatif kuat hingga moderat. Pola pertumbuhan ini mencerminkan respons biologis ikan terhadap kondisi lingkungan perairan.

Kata kunci: Ikan lambak, Pertumbuhan alometrik, Sungai Batanghari

1. Introduction

Labiobarbus ocellatus, commonly known as the Lambak fish, is a freshwater fish species belonging to the Cyprinidae family and is widely distributed in the inland waters of Sumatra Island. This species is ecologically and economically important, as it plays a role in the trophic structure of river ecosystems and serves as a food commodity for local communities. Ecologically, Lambak fish are strongly associated with riverine habitats, particularly flowing waters; therefore, their presence and population dynamics are highly influenced by environmental conditions (Froese & Pauly, 2024). In addition, Cyprinidae species inhabiting tropical waters are known to exhibit growth responses that are sensitive to habitat changes (Jusmaldi & Hariani, 2024).

In tropical river ecosystems, Lambak fish are exposed to various environmental pressures that may affect their growth and population structure. Changes in water quality, fluctuations in river discharge, habitat degradation, and fishing pressure have been reported as major factors influencing the biological condition of freshwater fish in tropical rivers. Such conditions potentially affect fish growth, size distribution, and physiological condition. Fish growth is one of the most important aspects of fisheries biology because it reflects the organism's response to environmental conditions and resource availability. One of the important habitats of the Lambak fish in Sumatra is the Batanghari River. The Batanghari River is the longest river on Sumatra Island and has strategic ecological and socio-economic significance. The river serves as a habitat for various freshwater fish species and supports capture fisheries activities for local communities in Jambi Province. Recent studies on the ecological condition of the Batanghari River indicate that human activities such as agriculture, settlements, and water transportation exert pressure on the river's environmental quality (Sinaga & Kurniawan, 2025).

In the context of fisheries resource management, basic biological information is an essential component. One of the most widely used parameters in fisheries biology studies is the length–weight relationship. This analysis provides insights into growth patterns, physiological condition, and energy allocation strategies in fish. Studies on the length–weight relationship not only describe growth aspects but also reflect the complex interactions between biological and environmental factors. Variations in fish growth patterns may be influenced by internal factors such as age and reproductive condition, as well as external factors such as habitat quality and fishing pressure. Therefore, site-specific studies are important because fish growth characteristics often vary among aquatic ecosystems.

Several previous studies on the Lambak fish in Sumatran waters have demonstrated variations in growth characteristics. A study conducted in the Kelekar River reported variations in growth patterns influenced by local environmental conditions (Putrayudha et al., 2023). Similar findings in other Cyprinidae species also indicate that growth parameters are strongly affected by habitat characteristics (Jusmaldi & Hariani, 2024). Although Lambak fish are among the commonly captured species in the Batanghari River, scientific information regarding their growth characteristics, particularly based on fishermen's catch data, remains limited. In fact, such data play an important role in understanding the biological dynamics of natural populations and supporting sustainable fisheries resource management efforts. Considering the importance of the Batanghari River as a freshwater fish habitat and a source of livelihood for local communities, research on the length–weight relationship of Lambak fish is highly relevant for enriching basic biological information and providing scientific data for fisheries management.

2. Material and Method

2.1. Time and Place

The study was conducted in the Batanghari River waters located in Tebat Patah Village, Taman Rajo Subdistrict, Muaro Jambi Regency, Jambi Province, Indonesia. Sampling was carried out in August 2025 at a sampling point located approximately at 1°29′44″ S and 103°39′09″ E. Fish were sampled in 10 replicates during the study period to obtain representative data on the fish community and biological characteristics.

2.2. Methods

Fish were collected using several fishing gears commonly operated by local fishers, including gillnets, trammel nets, and traps. The gillnets used had mesh sizes of 1.0, 1.5, and 2.0 inches, while the trammel nets had inner mesh sizes of 1.0 inches and outer mesh sizes of 4.0 inches. Fish traps used in the study measured approximately 100 cm × 50 cm × 50 cm. These gear specifications were selected to allow the capture of fish with different size classes and ecological characteristics. Sampling procedures followed the census method, in which all fish caught during each sampling repetition were collected and analyzed without subsampling. All captured fish were sorted by species, counted, and measured for total length and body weight. This procedure ensured that the entire catch composition was represented in the analysis of fish length–weight relationships and growth patterns.

2.3. Data Analysis

2.3.1. Length Distribution Analysis

The length distribution analysis was conducted to describe the size structure of the fish population in the Batanghari River. Total length data (cm) were grouped into length classes using the Sturges formula (Prasetyo et al., 2020):

$$k = 1 + 3{,}322 \log n$$

Where: k = number of length classes; n = total number of individuals

After determining the number of length classes, the relative frequency (%) for each class was calculated using the following equation.

$$\text{Relative Frequency (\%)} = \frac{\text{Number of individuals in each class}}{\text{Total number of individuals}} \times 100$$

The length distribution analysis provides information on fish size distributions, thereby enabling the identification of dominant size classes and the evaluation of population growth characteristics. In addition, the size distribution was used as a supporting indicator in assessing aspects of fish growth and gonadal maturity.

2.3.2. Length–Weight Relationship Analysis

The length–weight relationship was analyzed using the regression equation proposed by De-Robertis & Williams (2008); Muchlisin et al. (2010):

$$W = aL^b$$

Fish growth patterns were determined based on the value of b. The b value obtained from the calculation reflects the growth pattern of the fish population. When the value of b equals 3, the growth pattern is classified as isometric, indicating that weight gain is proportional to the increase in fish length. Conversely, when the value of b is not equal to 3, the growth pattern is classified as allometric.

Allometric growth patterns are further divided into two categories: positive and negative allometry. If the value of b is less than 3, the growth pattern is referred to as negative allometric growth, meaning that length increases more rapidly than body weight. On the other hand, if the value of b is greater than 3, the growth pattern is referred to as positive allometric growth, indicating that body weight increases more rapidly than fish length.

3. Result and Discussion

Based on the study results, a total of 22 females and 33 males were analyzed, as presented in Table 1. Differences in the number of individuals between sexes are commonly observed in fish population studies conducted in natural waters. This variation may be influenced by fishing gear selectivity, spatial distribution, and differences in biological behavior between sexes. An imbalance in sample size does not necessarily reflect the natural sex ratio of the population but may instead be influenced by ecological dynamics and fishing methods (Muchlisin et al., 2021).

Table 1. Length–weight relationship analysis of lambak fish

Parameter	Female	Male
Number of Samples (Individuals)	22	33
Total Length Range (mm)	117-160	100-157
Body Weight Range (g)	15-36	13-40
Regression Coefficient (*b*)	2.1483	2.2459
Coefficient of Determination (R^2)	0.6904	0.501
Growth Pattern	Negative Allometric	Negative Allometric

The total length range of the Lambak fish in this study showed considerable variation. Female fish had a length range of 117–160 mm, whereas male fish ranged from 100–157 mm. This size range indicates that the observed population consisted of several size groups. Variations in fish body length in natural waters are generally associated with differences in age, food availability, and habitat environmental conditions. In many freshwater fish species, females tend to attain larger body sizes than males, often related to reproductive energy requirements (Elliott et al., 2018).

The body weight range of Lambak fish females varied from 15–36 g, while males ranged from 13–40 g. Variations in body weight reflect individuals' physiological condition, which may be influenced by nutritional factors, gonadal maturity, and environmental conditions. The higher maximum body weight observed in males indicates differences in body composition between sexes. Condition factors and energy utilization efficiency strongly influence fish body weight; therefore, differences in body weight among individuals and sexes are commonly observed (Indarjo et al., 2021). The length–weight relationship analysis produced regression coefficient (*b*) values of 2.1483 for females and 2.2459 for males (Figure 1).

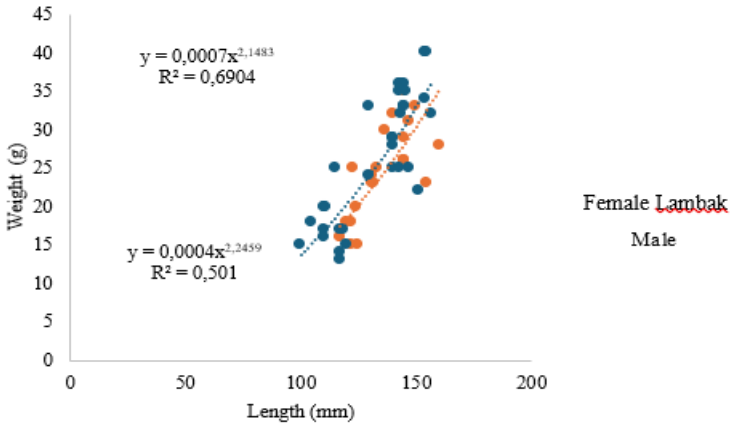

Figure 1. Growth pattern of female and male lambak fish

The coefficient of determination (R^2) obtained was 0.6904 for females and 0.501 for males. The R^2 value in females indicates a relatively strong length–weight relationship, in which most of the variation in body weight can be explained by variation in body length. In contrast, the R^2 value in males indicates a moderate relationship, suggesting that variation in male body weight is more strongly influenced by factors other than body length. Variations in R^2 values in fish length–weight relationship studies are common and are often associated with population heterogeneity, differences in individual physiological condition, and environmental variability (Putranto et al., 2019).

These findings are consistent with several studies conducted in other tropical rivers. For example, research on Cyprinidae fish in the Barito River reported *b*-values lower than 3 in Lambak populations, which were associated with fluctuating environmental conditions and unstable food availability throughout the seasons (Fitrianiet al., 2020). b<3 Similar results were also observed in the Musi River, where *b* values indicated a negative allometric growth pattern in both adult and juvenile Lambak fish, caused by competition pressure and variability in resource availability (Nurhayati et al., 2016).

On the other hand, several studies have reported variations in growth patterns in Lambak fish populations inhabiting rivers with more productive environmental conditions. For instance, in the Mahakam River, *b* values approached or even exceeded 3 in certain population segments, indicating a more proportional increase between body weight and body length (Putra et al., 2024). Similar findings have been reported in Indonesian freshwater ecosystems, where several cyprinid species exhibited isometric growth patterns under favorable environmental conditions and adequate natural food availability (Hutagalung et al., 2024).

These differences in growth patterns reflect the important role of environmental factors, such as food availability, stability of physicochemical parameters, and ecological pressures within each habitat. Habitats with abundant food resources and stable environmental conditions tend to support faster biomass growth, resulting in *b* values approaching or exceeding 3. Conversely, in environments with fluctuating resources, fish tend to prioritize length growth to improve movement efficiency and foraging ability, resulting in *b* values lower than 3 (Indarjo et al., 2021).

In addition to ecological factors, physiological variations among individuals, population size structure, and energy allocation strategies during the reproductive phase also influence the length–weight relationship in each Lambak fish population (Elliott et al., 2018). Therefore, the negative allometric growth pattern observed in this study is not an isolated phenomenon, but rather a consistent biological response to environmental conditions commonly found in most tropical rivers.

4. Conclusions

Labiobarbus ocellatus captured in the Batanghari River showed size variation: total length ranged from 117–160 mm in females, and 100–157 mm in males, and body weight ranged from 15–36 g in females and 13–40 g in males. The length–weight relationship analysis produced regression coefficient (*b*) values of 2.1483 in females and 2.2459 in males, indicating a negative allometric growth pattern, which suggests that body length increased faster than body weight. These findings provide important basic biological information to support the sustainable management of Lambak fish resources in the Batanghari River.

5. Suggestions

Based on the findings of this study, further research on reproductive biology, condition factors, and population dynamics of Lambak fish in the Batanghari River is necessary to support sustainable fisheries resource

management. In addition, monitoring of fishing activities and the maintenance of aquatic environmental quality should be strengthened to preserve fish habitats and ensure the sustainable utilization of Lambak fish populations.

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