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GROWTH PATTERNS AND GONAD MATURITY LEVELS OF (*Barbonymus schwanefeldii)* FISH IN THE BATANG ASAI SAROLANGUN RIVER

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ABSTRACT

The condition of the Batang Asai River in Sarolangun Regency, Jambi, has experienced a decline in water quality due to anthropogenic activities such as land clearing, settlement, and mining. This condition threatens the sustainability of fish populations, especially those from the Cyprinidae family, which are an important and environmentally sensitive group of fish for consumption, one of which is the lampam (*Barbonymus schwanefeldii*). However, scientific information on the bioecology of lampam in this region is very limited. Therefore, this research is needed to provide basic data to support adaptive conservation and fisheries management strategies. This study aims to analyze the growth patterns and gonadal maturity levels of lampam in the Batang Asai River, Sarolangun Regency, as a basis for inland fisheries management. A total of 113 fish, consisting of 64 males and 49 females, were observed. Male fish had a positive allometric growth pattern, while female fish had an isometric growth pattern. Analysis of Gonad Maturity Level (GML) found fish with GML I to GML IV, but immature gonads dominated the condition of the fish. In general, the water quality of the Batang Asai River still supports fish life, as can be seen from the growth patterns of the fish, but most of the fish found during the study were still immature despite the presence of fish with GML I to GML IV.

Keywords: *Barbonymus schwanefeldii*, Batang Asai River, GML, Lampam

1. INTRODUCTION

Currently, the aquatic ecosystem of the Batang Asai River, which is part of the Batanghari River Basin, is under pressure from anthropogenic factors such as household waste, gold mining, and environmentally unfriendly fishing practices, which have had a direct impact on fish habitats and populations. The decline in water quality can disrupt the balance of the ecosystem and threaten the survival of endemic species, especially fish with high economic value, one of which is the lampam (*Barbonymus schwanefeldii)*. The lampam is a freshwater fish with high economic value, both as a food fish and as an ornamental fish[1]. However, in recent years, there have been concerns about the decline of the lampam population in these waters due to environmental pressures and human activities that are harmful to the river ecosystem.

One of the problems often found in the Batang Asai River basin is fishing using tools and methods that are not environmentally friendly, such as the use of

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electric shocks. Some fishermen consider this method to be faster and easier for catching fish. Still, the significant impact it has on the balance of the aquatic ecosystem is not taken into account. The use of electric shocks can kill fish of all sizes, including larvae and mature broodstock, potentially leading to a drastic decline in fish populations in the long term. According to Maestro et al.[2], the use of destructive fishing gear, such as electric shocks and poison, has damaged natural habitats, reduced water quality, and disrupted the life cycle of fish from reproduction to growth.

In addition, illegal gold mining (PETI) also poses a serious threat to fish habitats in the Batang Asai River. This activity causes increased water turbidity and the entry of heavy metal particles such as mercury into the water. These conditions are thought to affect habitat quality and have a direct impact on fish physiology, including growth and gonadal maturation processes. Based on these conditions, it is necessary to conduct a study on the growth patterns and gonadal maturity levels of lampam in the Batang Asai River. The purpose of this study is to obtain important information about the growth and reproduction of lampam. By understanding the current condition of the lampam population, it is hoped that this will form the basis for managing fish resources in these waters, so that the lampam population can be maintained despite being under pressure from human activities.

2. RESEARCH METHOD

Time and Place

This study was conducted on the Batang Asai River in Sarolangun Regency in August 2025 at three stations representing different ecosystem conditions: Pulau Pandan Village (minimal anthropogenic activity), Sarolangun City (moderate to high activity), and Batu Kucing Village (near residential areas) (Figure 1).

Method

The method used in this research is a survey method. Samples were taken using the census method, where all lampam caught were used as samples. The tools used during the study included digital scales with an accuracy of 0.01 g to measure the weight of the fish, a meter to measure the length of the fish, and a dissecting kit to dissect and observe the fish gonads.

The research procedure was as follows: fish caught by fishermen were measured for total length (L) using a measuring device and weighed (W) using digital scales. The fish were then dissected using surgical scissors, and the sex and maturity level of the fish's gonads were observed. Water quality was measured at each station using the equipment provided.

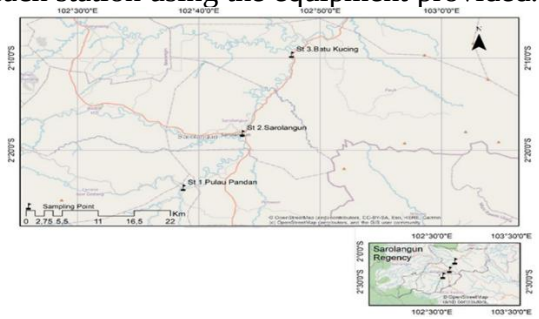

Figure 1. Map of lampam sampling locations in the Batang Asai River

Procedures

Data collection in this study was conducted through field surveys by collecting fish samples directly at predetermined stations. All data were systematically recorded and documented in field worksheets for further processing. Fish length and weight data were used to determine growth patterns. Meanwhile, fish observation data were used to determine the maturity level of fish gonads.

Data Analysis

Length-Weight Relationship

The relationship between length and weight in lampam can be identified through the following calculation[3]:

$$W = aL^b$$

Explanation:
W = Fish weight (g)
L = Total length of fish (mm)
a and b= constants

Fish growth can be categorized as allometric or isometric based on the value of b in the length-weight relationship. When b = 3, growth is isometric; if the value of b ≠ is 3, this indicates allometric growth, where the increase in fish weight is not proportional to the increase in length[4]. If b = 3, weight gain is proportional to length gain (isometric). If b < 3, length gain is faster than weight gain (negative allometric). If b > 3, weight gain is faster than length gain (positive allometric)[5]. Based on this hypothesis, the hypothesis was tested using the t-test:

$$t = \frac{3-b}{Sb}$$

Explanation:
S = Standard deviation
b = Constant

Then, the calculated t-test result is compared with the t-table value. If the calculated t-statistic t-value, then the value of b = 3, and if the calculated t-statistic < critical t-value, then the value of b ≠ 3.

Sex Ratio

The sex ratio of fish, according to Saputra et al.[6] is calculated using the following formula:

$$NK = Nbi/Nji$$

Explanation:
NK : Sex ratio
Nbi : Number of female fish
Nji : Number of male fish

Gonadal Maturity Level

The gonadal maturity level (GML) in this study refers to Omar[7] classification based on the shape, color, size, and development of the gonadal contents.

3. RESULT AND DISCUSSION

In this study, a total of 113 lampam were obtained, with total lengths ranging from 101 mm to 245 mm and an average length of 161.07 mm. Meanwhile, the recorded fish weight ranged from 12.96 g to 220.53 g, with an average weight of 66.31 g, as shown in the following Table 1.

Table 1. Length and weight of lampam in the Batang Asai River

Parameter	Lenght	Weight
Number of samples	113	
Minimum	101	12.96
Maximum	245	220.53
Average	161.0708	66.30673

The range of length and weight of lampam in the Batang Asai River shows that the samples collected consisted of individuals of varying sizes, from small to large fish. Lampam caught in the Belumai River in Serdang Regency, North Sumatra, were longer, with a maximum length of 295 mm. In the Mahaweli River, Sri Lanka, with a maximum size of 350 mm, and 360 mm in the Galas River, Kelantan[8-10].

Based on the total length size class range of the fish (Figure 2), the highest number of lampam was found in the 158–176 mm size class, with 41 fish, followed by the 177–195 mm class with 22 fish and the 139–157 mm class with 17 fish. The smaller size classes, namely 101–119 mm and 120–138 mm, yielded only 14 and 9 fish, respectively. Meanwhile, in the larger size classes, the frequency decreased, with 7 fish in the 196–214 mm class, 2 fish in the 215–233 mm class, and only 1 fish in the 234–252 mm class.

The distribution pattern of lampam based on fish length class frequency shows that the lampam population caught is dominated by medium-sized individuals, with far fewer small and large individuals. The same results were found for lampam in the Tasik River in South Labuhanbatu Regency, North Sumatra, where the highest catch was in the medium size class, while the small and large size classes were only caught in small numbers[11].

The growth pattern of lampam in the Batang Asai River, with the regression value of the relationship between fish length and weight, obtained a value of b Male 3.199578 and b Female 3.134102 (Table 2). In the Male fish, the b value shows positive allometric properties, namely, weight growth occurs faster than body length growth. This is consistent with the statistical

test results, where the calculated t-value is greater than the table t-value, so that the difference in b values from the isometric value (b = 3) is considered significant.

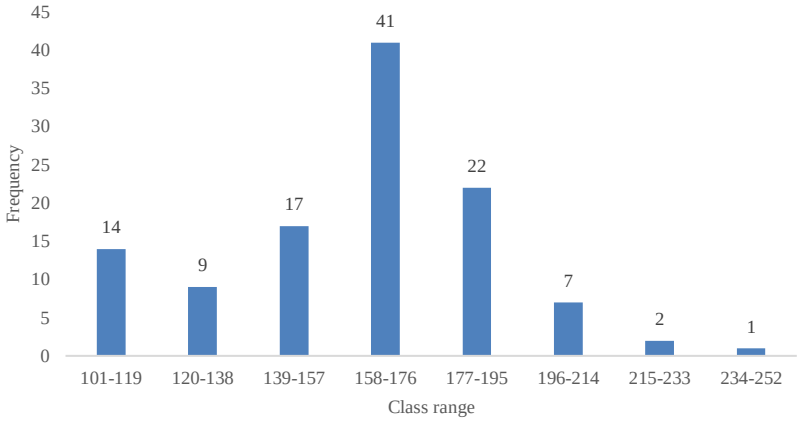

Figure 2. Number of lampams in the Batang Asai River based on the class range

Table 2. Results of the analysis of the length-weight relationship of lampam in the Batang Asai River

Parameter	Sex	
	Male	Female
Number of samples (n)	64	49
b	3,199,578	3,134,102
R	0,949199	0,903700
r	0,974268	0,950631
t-statistic	2.39700	1.07349
critical t-value	1.99962	2.01290

Based on the positive allometric nature of the length-weight relationship of male fish in the waters of the Batang Asai River, this means that male fish tend to experience a proportionally greater increase in body weight as they grow longer. Similar results were also obtained for the b value of the length-weight relationship of lampam caught in February and March in the Dempok River, Gampingan Village, Malang City, where the male fish caught exhibited positive allometry[12].

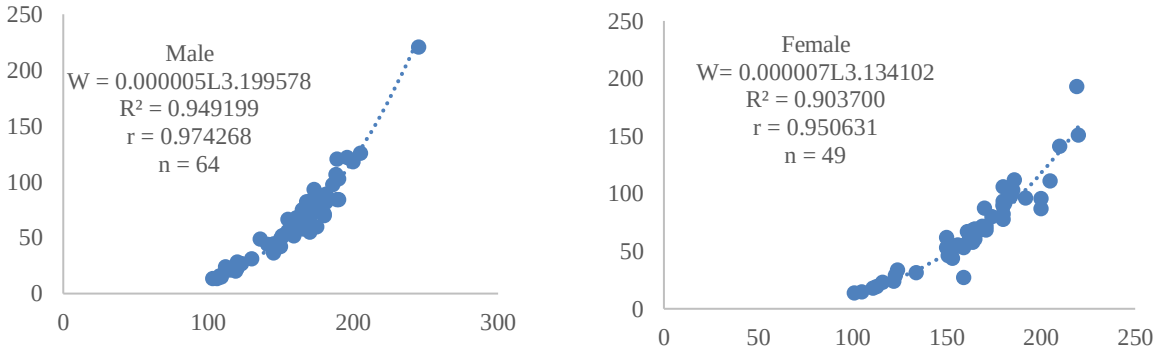

Figure 3. Length-weight relationship of lampam in the Batang Asai River

In female fish, the value is slightly above 3, but statistical calculations show that the t-statistic (1.073488) is smaller than the critical t-value (2.012896). This means that the value of b is not significantly different from 3, so that the growth pattern of female fish in this study is statistically classified as isometric, i.e., the increase in length and weight is balanced. Variations in the b value may arise due to differences in the number and diversity of fish sampled for research, which are influenced by season, gonadal maturity, and fishing intensity. High fishing pressure in a location can affect the life dynamics and growth patterns of fish populations. In addition, fish growth is also determined by many other factors, such as spawning, age, disease, parasites, the

presence of predators, food availability, water temperature, sampling methods, and water chemistry characteristics[13-16].

In the correlation analysis of the relationship between length and weight of lampam, the r value for male fish was 0.974268, and the r value for female fish was 0.950631. These values indicate that there is a 97% correlation for male and 95% for female between fish weight growth and fish body length. This is in line with research for Juaro in the Siak River, the coefficient of determination (R^2) is 0.9793 for females and 0.9219 for males, which is close to +1, indicating a strong relationship between length and weight growth[17]. However, different correlation results for lampam were found in the West Kalimantan River with a determination value of 0.81-0.89[18].

The number of male fish (64 fish) caught was greater than the number of female fish (49 fish). The ratio of male to female fish was 1:1.3. This shows that in this study, male lampam in the Batang Asai River dominated over female fish. This is different from several river locations in Indonesia where female lampam dominate the population, namely 1:2.33 in the Bunin River, 1:1.71 in the Keureuto River, and 1:1.56 in the Sikundur River, Aceh[19]. Furthermore, Baptista et al.[20]; Hyman et al.[21] stated that the distribution of male and female fish caught each month is greatly influenced by external factors, one of which is the availability of food, and human activities such as the fishing season.

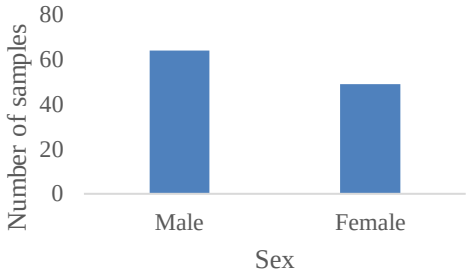

Figure 4. Sex ratio of lampam in the Batang Asai River

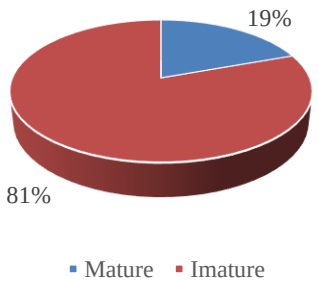

Figure 5. Percentage of lampam in the Batang Asai River based on reproductive status

Analysis of lampam reproduction in the Batang Asai River shows that out of 113 fish samples, 91 fish were immature and 22 were mature. This indicates that at the time of the study, the reproductive condition of lampam in the Batang Asai River was dominated by immature fish, accounting for 81%.

The high percentage of immature fish. This condition most likely occurred because the sampling period was not during the peak spawning season. Samples were collected in August, which is the transition period to the rainy season, while most fish from the Cyprinidae family usually begin spawning in early to mid-rainy season. According to the Indonesian Meteorology, Climatology, and Geophysics Agency, the rainy season is predicted to occur from September to November 2025. This is when there is an increase in water discharge and nutrient availability in the water. Most tropical freshwater fish, especially those in the cyprinidae family, spawn seasonally, with the peak spawning season occurring during the rainy season[22].

The gonadal maturity level found in lampam in the Batang Asai River ranged from GML I to GML IV. Most fish were in GML I condition, numbering 58 fish, followed by GML II with 33 fish, GML III with 11 fish, and GML IV with 11 fish. The number of fish in GML III and GML IV was only 11 each, indicating that only a small portion of the population was approaching or had reached reproductive maturity. This

pattern shows that at the time of sampling, the lampam population was not at the peak of the spawning season. The distribution of GML, which is dominated by the early level, may also reflect environmental factors, food availability, or sampling times that do not coincide with the optimal reproduction period. According to Kahar et al.[23], the peak spawning season for many cypriniform species occurs during periods of high rainfall.

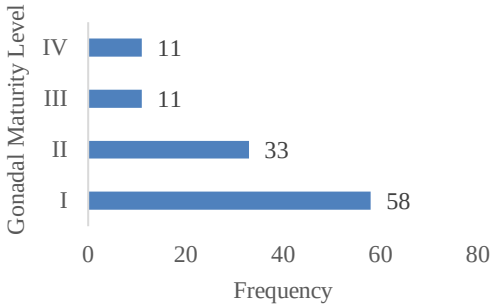

Figure 6. Number of lampam based on gonadal maturity level

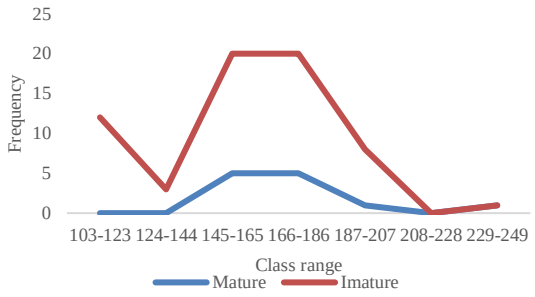

Figure 7. Length size distribution of male fish based on gonadal development

Figure 8. Distribution of female lampam length based on gonadal development

Based on the size class of male lampam, in the length classes of 103–123 mm and 124– 144 mm, all fish caught were immature, indicating that at this size, lampam have not yet entered the reproductive phase. Research by Aisyah et al.[8] shows that the analysis of the first size of male lampam with mature gonads was 193 mm.

The number of mature male lampam is dominated by those in the 145-165 mm and 166-186 mm size classes. This indicates that with a total body length of 145 mm are entering the phase of gonadal maturity. However, in the 187–207 mm length class, only one fish was mature, with the other seven still immature, indicating that not all medium to large individuals reach maturity at the same time, possibly influenced by environmental factors or individual physiological conditions. This is consistent with the statement by Widiana et al.[24] that differences in growth, feeding patterns, and water conditions can cause differences in the time it takes to reach gonadal maturity.

In this study, only 19% of male lampam and 20% of female lampam reached gonadal maturity, and in each size class, none showed a maturity rate of more than 50%. This condition indicates that most of the male and female lampam caught in the Batang Asai River are still in the growth phase and are not yet ready to reproduce (spawn). The low number of gonadally mature fish may indicate that fishing activities occur before the fish reach reproductive size, or that the sampling period did not coincide with the peak spawning season. Furthermore, according to Agusmassie[25] the size at which fish first reach gonadal maturity can be influenced by several factors, including season, sex, food

availability, gonadal development, and water quality.

4. CONCLUSION

The growth pattern of lampam in the Batang Asai River, Sarolangun Regency, is positively allometric in male fish and isometric in female fish. Male fish are found in greater numbers than female fish. Immature fish dominate the reproductive status of lampam.

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