Morphology and condition factor of signal barb fish (Labiobarbus festivus) at the Tasik River, South Labuhanbatu Regency, Sumatra Utara Province

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Abstract. The purpose of this study was to determine the morphometric and meristic characteristics, growth of Signal barb fish in the Tasik river. The method used in this research is a survey method. Morphometric characteristics of Signal barb fish Bodyweight (BW) ranges from 4-73 gr, Total Length (TL), Standard Length 6.3-15.5 mm (SL), Head Length (HL) 1.8-2.5, Snout Length (SL) 0.5, Dorsal Fin Height (DFH) 2.3, Dorsal Fin Length (DFL) 3-7, Eye Diameter (EM) 0.8, Tail Trunk Height (TTH) 0.8-1.8, Body Height (BH) 2-4.5, Pectoral Fin Length (PFL) 2 cm and Belly Fin Length (BFL) 2 cm. The meristic characteristics of Signal barb fish are the number of Linnea Literalis (LL) as many as 35-38 scale, 13 Circular Body Scales (CBS), 11-13 Front Fin Dorsal Scales (FFDS), the Scales Around the Tail (SAT) a total of 5, Dorsal Fin (DF) of DI. 23-26 fin radii, Ventral Fin (VF) of 9 fin radii, Pectoral Fin (PF) of 11-14, Anal Fin (AF) a total of 7 fin radii and a Caudal Fin (CF) a total of 20-22 fin radii. The growth pattern of signal barb fish in the Tasik River is negative allometric with the condition factor value an average value of 0.42

1. Introduction
South Labuhanbatu Regency is passed by the large Barumun river which passes through several districts, such as Sungai Kanan District, Kotapinang, and Kampung Rakyat. The Barumun River or Barumun Watershed is included in the Kualuh - Barumun River Basin (WS) which is a Cross Regency River Basin (Provincial Authority). Apart from the Barumun river, there are other small rivers such as the Kanan river, Aek Raso, Aek Kabaro, Aek Tasik, and so on. The Tasik river is widely used by the local community for fishing activities, one of the most commonly caught fish is signal barb fish (Labiobarbus festivus).

The Tasik river is a river that has dominant activities such as agricultural activities and fishing activities. Fishing is carried out continuously without paying attention to the sustainability of the fish, thus reducing the abundance of the fish. However, there is no clear data on the current growing conditions of Signal barb fish.

Signal barb fish is included in the family Cyprinidae but no data are showing the biology (morphometric and meristic) of the signal barb fish. Morphometry has the advantage of describing more accurately the index of body length, body width, and height which can identify differences between species, describing patterns of morphological diversity between populations [1]. Therefore, it
is necessary to research the growth and morphology of Signal barb fish in the river, so that the efforts to be carried out can run well and on target.

2. Materials and methods

2.1. Study site
This research was conducted for two months, namely on July-August 2020 in the Tasik river, Labuhanbatu Regency, North Sumatra Province. The map of the research location was shown in the map below.

![Figure 1. Map of research location (station 1: 01°56′41.1″LU dan 100°07′23.6″BT; station 2: 01°51′55.0″LU and 100°06′49.3″BT; station 3: 01°50′58.5″LU 100°06′44.2″BT).](image)

2.2. Procedures
Tools used in primary data collection include writing instruments, rulers with 1 mm accuracy, GPS (global positioning system), digital cameras, analytical scales, nets (2 ½ inches each), coolboxes, plastics, millimeter-block paper. The materials used in this study were signal barb fish (L. festivus) and label paper.

The research procedure was carried out starting from sampling in the Tasik river. Then the fish samples obtained were taken to the Laboratory of Aquatic Environment, Faculty of Agriculture, the University of North Sumatra for further research.

2.3. Data analysis

2.3.1. Relationship of length and weight. There are two kinds of growth patterns in fish, namely isometric growth (b = 3) if the increase in length and weight of the fish is balanced and the growth is allometric (b > 3 or b < 3). B > 3 indicates that the fish is fat/plump, where the weight gain is faster than the increase of length. b < 3 indicates the fish with the thin category, where the length gain was faster than the weight gain [2].
Weight can be thought of as a function of length. The relationship between length and weight was found with the formula [3].

\[ W = aL^b \]  

Where:
- \( W \) = weight (gram)
- \( L \) = length (cm)
- \( a \) and \( b \) = constant

To study the determination of the value of \( b \), the T-test is carried out, where there is an attempt to reject or accept the hypothesis made with the formula [2]:

\[ T_{\text{hit}} = \frac{b_1 - b_0}{S_{b_1}} \]  

Where:
- \( S_{b_1} \) = Standard Deviation \( b_i \)
- \( b_0 \) = Intercept
- \( b_1 \) = Slope (relationship of weight length)

2.3.2. Condition factor. Condition factor is the condition or loss of fish which is stated in numbers to show the condition of the fish in terms of physical capacity to survive and reproduce [3].

\[ K = \frac{W}{aL^b} \]  

Where:
- \( K \) = Condition factor
- \( W \) = Fish weight (g)
- \( L \) = total length of fish (cm)

3. Results and discussion

3.1. Morphology of signal barb fish (Labiobarbus festivus) in the Tasik river

The morphology of signal barb fish (Labiobarbus festivus) in the Tasik river was shown in figure 2 in below.

Figure 2. Signal barb fish (L. festivus).
Signal barb fish found in the Tasik river is known by observing the characteristics as in figure 2 which is different from other fish found in the Tasik river, which has a slender body shape and an elongated dorsal fin with a reddish color and tail to pretend. This is not much different from research [4], which explains that the shape of the slender body was upright, the head was blunt with large eyes, the mouth is subterminal, the body is covered with scales, the lateral line is not very clear, the tip of the dorsal fin and the caudal fin is dark, pectoral, pelvic and caudal fins are a reddish color, the type of caudal fin is forged.

3.1.1. Analysis of morphometric characters of signal barb fish in the Tasik river. Morphometric analysis of Signal barb fish in Tasik River was carried out by survey method with direct measurements using a ruler and a weight with a scale.

Table 1. Morphometric characters of signal barb fish in Tasik river.

| Morphometric characters | Observation result |
|-------------------------|--------------------|
| BW (gr)                 | 4-73               |
| TL (mm)                 | 82-19              |
| LS                      | 63-155             |
| LHL                     | 18-25              |
| SL                      | 0.5                |
| DFH                     | 2.3                |
| DFL                     | 3-7                |
| DE                      | 0.8                |
| HTT                     | 0.8-1.8            |
| H                       | 2-4.5              |
| PFL                     | 2                  |
| AFL                     | 2                  |

3.1.2. Analysis of the meristic characteristics of signal barb fish in the Tasik river. The meristic characteristics of Signal barb fish in the Tasik River are as follows, the number of Linnea Literalis (LL) is 35-38, the Body Circular Scales (BCS) are 13, the Dorsal Front Scales (DFS) are 11-13, the Scales around the Tail (SAT) of 5, Dorsal (DF) of DI.23-26 fin Ventral fin (VF) of 9 fin radii, Pectoral fin (PF) of 11-14, Anal fin(AF) of several 7 fin radii and Caudal fin (CF) totaling 20-22 fin radii. The results of the study are not much different from the identification book [3] which states that the fish Labiobarbus festivus has a total of 36-38 Linnea Literalis (LL), 13 Circular Scales, Dorsal Fin (DF) DI.21-26 Anal (AF) a sum of 1 hard radius 7 weak fin radius.

Table 2. Meristic characteristics of signal barb fish in the Tasik river.

| Meristic character | Meristic characteristics of signal barb fish |
|--------------------|---------------------------------------------|
| LL                 | 35-38                                       |
| BCS                | 13                                          |
| DFFS               | 11-13                                       |
| SAT                | 5                                           |
| DF                 | DI.23-26                                    |
| VF                 | VI.9                                        |
| PF                 | Pl.11-P14                                   |
| AF                 | AI.7                                        |
| CF                 | C20-22                                      |
3.1.3. Signal barb fish catch during the research. There were 109 Signal barb fish obtained during the study, consisting of 34 males and 75 females. The most number of female fish caught consecutively were at station 1, station 3, and station 2 with 27, 25, and 23 fish respectively. In the observation of the total number of male fish caught at station 3 and station 1 with the same number of 12 fish and the least male fish caught at station 2 with 10 tails.

![Figure 3](image)

**Figure 3.** Signal barb fish catch during the research.

3.1.4. Long frequency distribution. The most number of fish caught was in the class range 116-129 cm, totaling 53 fish and the lowest was in the class 144-157, which amounted to 4 fish, it shown in Figure 4. The difference in the number of length distributions will experience different growth because it has internal and external factors that affect the growth of these fish. [3] Internal factors are factors that are generally difficult to control, such as heredity, sex, age, parasites, and disease. The main external factors affecting fish growth are temperature and food.

![Figure 4](image)

**Figure 4.** Histogram of the long frequency distribution of the signal barb fish.

The length-frequency distribution of the Signal barb fishes (the collection was *L. festivus*) that was caught at each different. It is assumed that the population of male and female Kulare was different. However, there does not affect its availability, because at the size of fish caught have reached a size that can ripen the gonads due to suspicion that there is pressure due to both natural conditions and human factors, with long class frequencies with sizes 88-101 totaling 14 12 tails, 102-115, 116-129 cm
totaled 53 individuals during the study. This is following the statement [4] with the increasing maturity of the gonads, at the maturity level the gonads have not yet developed, the gonads will develop along with the increasing maturity of the gonads. Increasing the maturity of the gonads will increase the overall body weight, this will cause the value of the condition factor to increase.

3.1.5. Relationship length weight. The results of the long-weight relationship analysis results show that the results of the long-weight relationship have the following equation: \( \log W = 0.399 + (-32.10) \log L \) or in its exponential form is \( W = 0.506L^{-44.71} \) with the value of determination \( (R^2) = 0.855 \) and the relation coefficient \( (r) = 0.925 \) can be seen in Figure 5. This is supported by the opinion [2] which says that the analysis results of determination value obtained from the analysis of heavy long relationship are \( R^2 = 0.855 \) which shows that the length. The total body of the fish greatly affects the total weight of the Signal barb fish. If the value of \( R^2 \) was close to 1 then the total length of the fish will be growing along with the fish's body weight gain.

![Figure 5. Graph of relationship length of signal barb fish weight.](image)

The value of \( b \) depicts the growth pattern of Signal barb fish, the coefficient of determination shows the relationship between the value of \( x \) (weight) and the value of \( y \) (length), while the value of the coefficient illustrates the magnitude of the relationship between the length and weight of the curl. The results of the research obtained and the T-test have been found that the \( b \) value is smaller than 3, so it can be assumed that the growth pattern of Signal barb fish is negative allometric, meaning that the length growth is more dominant than the increase in body weight of the fish. According to [3] which states that based on the T-test 95% confidence interval, the value of \( T_{\text{obtained}} \), hit > \( T_{\text{table}} \) which means reject \( H_0 \), namely the growth pattern of Signal barb fish is negative allometric, namely the increase in length is faster than the weight gain. This result occurred due to a large number of Signal barb fish in a flat condition that had been collected during the study.

3.1.6. Condition factors. The condition factor (CF) of Signal barb fish in the Tasik river based on negative allometric growth patterns ranged from 0.164 to 0.728 with an average value of 0.425. The results of calculating the condition factor (FK) of Signal barb fish in the Tasik River were based on a negative allometric growth pattern were at station 1 the condition factor ranged from 0.431 to 0.164 with an average value of 0.442, at station 2 the condition factors ranged from 0.728 - 0.516 with The average value is 0.490 and at station 3 the condition factor ranges from 0.548 - 0.398 with an average value of 0.344. The value of the condition factor during the observation was quite fluctuating, and the condition factor value obtained was close to 1 where according to [5] it was stated that for fish whose condition factor value was 0-1, the fish was classified as flat or not fat, then [5] added that fish whose condition factor value is 1-3, then the fish is classified as fish whose body shape is flat.
Table 3. Values signal barb fish condition factor (*Labiobarbus festivus*).

| Observation station | Total (n) | Range       | Average |
|---------------------|-----------|-------------|---------|
| Station 1           | 39        | 0.431 – 0.164 | 0.442   |
| Station 2           | 33        | 0.728 – 0.516 | 0.490   |
| Station 3           | 37        | 0.548 – 0.398 | 0.344   |

Factor value calculated based on the condition average relative weight. The results of the data analysis showed that the conditions varied were 0.442, 0.490, and 0.344 indicated that the condition of the fish was slender and flat so that the waters of the Tasik River were still in an unbalanced state, which means that there was not enough food for these fish or there were still a lot of predators [6-8]. Apart from being influenced by food availability and predator density, the condition factor value is also influenced by biotic and abiotic factors, as well as whether the waters are managed or not.

4. Conclusions
The total number of Signal barb fish caught during the study was 109 fish with a slender morphological shape and an elongated dorsal fin with a reddish color and a forked tail. The growth pattern of Signal barb fish in the Tasik River was negative allometric with a factor value of the condition of the Signal barb fish ranging from 0.164 - 0.728.

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