The length-weight relationship and condition factor of *Barbonymus gonionotus* from Nyaung Kaing In, Sagaing Division, Myanmar

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Abstract

The length-weight relationship and condition factor of *Barbonymus gonionotus* from Nyaung Kaing In, Sagaing Division, Myanmar were carried out from October, 2016 to February, 2017. A total of 100 specimens were selected randomly during the study period. The length-weight relationship was calculated by using the regression analysis. The results showed that the average (b) values of all samples were 3.20 indicating the positive allometric pattern. The average condition factor (K) was 2.9 and the average correlation coefficient (r) was 0.99. Therefore this result indicated that there was a good correlation between length and weight of the fish. Moreover, the condition factor (K) value greater than 1 indicated good condition of the fish inhibiting the aquatic ecosystem is conducive for the optimum growth of this fish.

Key words: Length-weight relationship and condition factor, *Barbonymus gonionotus*, Nyaung Kaing In, Myanmar
1. Introduction

Length-weight relationship (LWR) of fishes are important in fisheries and fish biology because they allow estimation of the average weight of the fish of a given length group by establishing a mathematical relation between them (Sarkar et al., 2008). LWR parameters (a and b) are useful in fisheries science in many ways, to estimate weight of individual fish from its length, to calculate condition indices, to compare life history and morphology of populations belonging to different regions and to study ontogenetic allometric changes (Sani et al., 2010).

Length-weight relationship can be used to predict weight from length measurements made in the yield assessment (Pauly, 1993). Fish can attain either isometric growth, negative allometric growth or positive allometric growth. Isometric growth is associated with no change of body shape as an organism grows. Negative allometric growth implies the fish becomes more slender as it increase in weight while positive allometric growth implies the fish becomes relatively stouter or deeper-bodied as it increases in length (Riedel et al., 2007).

Condition factor is an expression of relative fatness of fish and generally larger values of K, indicates better condition of the fish. This factor is calculated with the intention of describing the condition of a particular fish from the relationship drawn between weight of the fish and length (Froese, 2006).

This fish species is a major source of animal protein and macronutrients in the diet of people and use as food fish. This species is a herbivorous species and has become increasingly
popular in countries owing to its rapid growth and the fact that it attains marketable size in 3-4 months has a bright silvery appearance and good taste (Ahammad et al., 2009).

Length-weight relationships give information on the condition and growth patterns of fish. Condition factor studies take into consideration the health and general well-being of a fish as related to its environments. Hence, the present study aims to provide information on the length-weight relationship and condition factor of *Barbonymus gonionotus* from Nyaung Kaing In.

2. Materials and Methods

2.1 Study Site

Nyaung Kaing In is located in Monywa Township, Sagaing Division, Myanmar which lies between Latitudes 21° 54’45¨ to 22°00’ N and Longitudes 95°6’0¨ to 95°11´15¨ E (Fig. 1).
2.2 Study Period

This study period lasted from October 2016 to February 2017.

2.3 Collection and measurement of specimens

A total of 100 fish number *Barbonymus gonionotus* were collected from Nyaung Kaing In. The sample collection was made once per month, twenty specimens for each time. The standard length of each fish was measured using a ruler to the nearest (1.0 cm). The body weight was taken on the electric balance to the nearest (0.01) g (Plate 1).

2.4 Identification of study species

Identification was made according to Talwar and Jhingran (1991) and Jayaram (2013).

2.5 Statistical analysis

The statistical relationship between length and weight parameters of specimens was established by using the formula of Froese (2006).

\[ W = aL^b \]
The degree of well-being of the fish was expressed by condition factor.

\[ K = 100 \times \frac{W}{L^3} \]

Froese (2006)

All the statistical analysis was done in Excel 2010.

3. Results

This study provides the information related to length-weight relationship and their growth performance for a total of 100 individuals of *Barbonymus gonionotus* belonging to family Cyprinidae were evaluated.

The ranges and mean values of standard length and body weight of *Barbonymus gonionotus* were shown in Table 1. In October 2016, the mean of SL values was 11.97 and the mean of \( W \) values 55.93. In November 2016, the mean (SL) was 11.40 and the mean (\( W \)) was 45.77. In December 2016, the mean (SL) was 12.63 and \( W \)-mean was 62.11. In January 2017, the mean of SL and \( W \) values were 12.92 and 66.88 whereas in February 2017, the mean (SL) was 12.04 and \( W \)-values was 62.78.

**Table 1** Ranges and mean values of standard lengths and body weights of study species from Nyaung Kaing In

| Months           | Standard length (SL)(cm) | Body weight (BW)(g) |
|------------------|--------------------------|---------------------|
|                  | Range        | Mean       | Range      | Mean       |
| October, 2016    | 10.0 - 17.5 | 11.97      | 27.85 - 166.10 | 55.93      |
| November, 2016   | 9.1 - 16.5  | 11.40      | 19.29 - 141.29 | 45.77      |
| December, 2016   | 10.5 - 18.5 | 12.63      | 34.10 - 197.57 | 62.11      |
| January, 2017    | 10.1 - 15.5 | 12.92      | 25.33 - 107.90 | 66.88      |
| February, 2017   | 10.1 - 17.5 | 12.04      | 25.33 - 166.10 | 62.78      |
The values of regression coefficient (a and b) were presented in Table 2. The intercept (a) values of the fish were 0.019 (October, 2016), 0.014 (November, 2016), 0.024 (December, 2016), 0.013 (January, 2017) and 0.017 (February, 2017) respectively.

**Table 2** Length-weight relationship parameters and condition factors of study species from Nyaung Kaing In

| Moths           | Number | Regression coefficient | Correlation coefficient (r) | Condition factor (K) |
|-----------------|--------|------------------------|----------------------------|----------------------|
|                 | a      | b                      |                            |                      |
| October, 2016   | 20     | 0.019                  | 3.17                       | 0.99                 | 2.97                |
| November, 2016  | 20     | 0.014                  | 3.27                       | 0.99                 | 2.77                |
| December, 2016  | 20     | 0.024                  | 3.06                       | 0.99                 | 2.88                |
| January, 2017   | 20     | 0.013                  | 3.30                       | 0.99                 | 2.89                |
| February, 2017  | 20     | 0.017                  | 3.21                       | 0.98                 | 2.99                |
| Average         | 20     | 0.017                  | 3.20                       | 0.99                 | 2.90                |

a - Intercept of the regression  
b - Regression coefficient
The corresponding exponent ($b$) values were 3.17 (October, 2016), 3.27 (November, 2016), 3.06 (December, 2016), 3.30 (January, 2017) and 3.21 (February, 2017). The exponent ($b$) values of these fish were greater than 3 and indicated positive allometric growth pattern. The values of correlation ($r$) were ranged between 0.98 and 0.99 observed in Table 2 and Figure 2 to 6. The correlation coefficient ($r$) values of all samples were close to 1.

The correlation coefficient ($r$) between SL and BW was found to be 0.99 and 0.98. Thus the result indicated that there is a good correlation between length and weight of the fish.

![Graph](attachment:graph.png)

**Fig. 2** Length-weight relationship of *Barbonymus gonionotus* in October, 2016
**Fig. 3** Length-weight relationship of *Barbonymus gonionotus* in November, 2016

\[
W = 0.014L^{3.268} \\
R^2 = 0.976 \\
r = 0.99 \\
n = 20
\]

**Fig. 4** Length-weight relationship of *Barbonymus gonionotus* in December, 2016

\[
W = 0.024L^{3.057} \\
R^2 = 0.983 \\
r = 0.99 \\
n = 20
\]
Fig. 5 Length-weight relationship of *Barbonymus gonionotus* in January, 2017

\[ W = 0.013L^{3.299} \]
\[ R^2 = 0.972 \]
\[ r = 0.99 \]
\[ n = 20 \]

Fig. 6 Length-weight relationship of *Barbonymus gonionotus* in February, 2017

\[ W = 0.017L^{3.212} \]
\[ R^2 = 0.969 \]
\[ r = 0.98 \]
\[ n = 20 \]
4. Discussion

Length-weight relationship (LWR) of *Barbonymus gonionotus* from Nyaung Kaing In was established to demonstrate their growth performance correspondence with their sampling site. In nature, body composition of cold-blooded animals is usually changed with their physiological mechanisms especially observed in their unfavorable condition. Actually, these species are apparent preference for still water habitats rather than flowing waters.

The results showed that the highest coefficient of b value was recorded in January where the average b value of all samples was 3.20 indicating the positive allometric pattern. When the regression coefficient value is more than 3.0, the fish grow the positive allometric pattern according to Riedel et al., 2007. According to Le Cren (1951), variation in growth rate of the same species during different months are influenced by many factors such as environmental factors, food supply, ecological conditions of the habitats or variation in the physiology. Muchlisin (2010) reported that the seasonal changes cause fluctuations in food resources in water and affect the growth condition of fish.

In the present study, correlation coefficient (r) was the average value of 0.99. It was found that the more the weight of the body increased the larger, the standard length increased. Chheng et al., (2004) reported that the correlation coefficient between standard length and body weight measurement found to be 0.99. Therefore, there is correlation between the body weight and the standard length of the fish in this study.

In the present study, condition factor (K) of silver barb was fallen into a good category with the average value of 2.9. Jin et al., (2015) reported that (K) value is used to evaluate the
sensitivity and healthy condition of fish. As the growth pattern, the (K) value is also influenced by age, sex and season according to Barnham and Baxter (1998). Moreover (K) value greater than 1 indicated good condition of the fish (Le Cren, 1951). So, the condition factor (K) value greater than 1 indicated good condition of the fish inhibiting the aquatic ecosystem is conducive for the optimum growth of this fish.

5. Conclusion

Thus, from the present findings, it can be concluded that length-weight relationship of *Barbonymus gonionotus* was slightly deviated from the isometric growth pattern (b = 3) and did not follow the cube law. The (b) values for samples were found positive allometric growth rates. The (r) value indicated that this relationship was positive in different length group. The (K) value was above the ideal value and indicated that the species were in good conditions in their natural habitats. Moreover, it also provides baseline information on the length weight relationship and condition factor of *B. gonionotus*.

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