Length-Weight Relationship and Condition Factor of Freshwater Fish *Osteobrama belangeri* (Valenciennes, 1844) collected at Thirimarlar Market in Mandalay

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Abstract

This study was carried out from May, 2020 to December, 2020. The relationship between length and weight of *O.belangeri* was calculated by establishing correlation and regression between the two parameters. The regression coefficient 'b' values varied from 3.3597 to 3.8029 for different length groups of *O.belangeri*. The correlation coefficient 'r' was found to be 0.9542 (group A) and 0.9327 (group B). The result indicated that there was a good correlation between length and weight of the fish. On the basis of length-weight data, the regression equations of body-weight on total body length were calculated in the study. The values of condition factor (K) of *O.belangeri* were also computed and found that the species performed well. The maximum of 'K' value was found 1.26 in *O.belangeri* (group B).

Keywords: *Osteobrama belangeri*, Length-weight, Condition factor

Introduction

Fishes exhibit growth in length and the increment in weight, both this developmental activities during its lifetime. Habitat condition of fishes has a direct proportional relationship with that of length-weight and the relationship vary accordingly. Hence, the growth of a fish is thought species specific but it can considerably vary among species inhabiting different geographical location (Kachari, *et al*., 2017).

Length-weight relationship gives the condition and growth patterns of fish. It provides important information concerning the structure and function of fish populations (Hirpo, 2013). Length-weight relationship (LWR) of fishes is important in fisheries and fish biology because they allow the estimation of the average weight of the fish of a given length group by establishing mathematical relation between them (Sarkar *et al*., 2008). This relationship is used by fishery researchers and managers for two main purposes: one is to predict the weight from the length of a fish and second to compare the average associated parameters between fish groups spatially or temporally (Muzzalifah *et al*., 2015). LWR is used to obtain information about the condition of fishes in order to determine whether somatic growth is isometric or allometric (Ujjania *et al*., 2012).

Fulton's condition factor (K) is widely used in fisheries and fish biology studies. This factor is calculated from the relationship between the weight of a fish and its length, with the intention of describing the "condition" of that individual fish (Froese, 2006).

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The condition factor is a measure of various ecological and biological factors such as degree of fitness, gonadal development and the suitability of the environment with regard to the feeding condition (Mac Gregoer, 2012). The information about welfare of fish due to its physiological state can be assessed with condition factor 'K'. Thus, the maintenance of ecosystem equilibrium that depends upon adequate management of life cycle of fish species can be improved by condition factor (Imam *et al*., 2010). When condition factor value is higher, it means that the fish is in a better condition. The different values of condition factor 'K' are indicative of the state of degree of food source availability in its habitat (Khallaf *et al*., 2003). Thus, this parameter is of great importance in fishery assessments, more importantly for proper exploitation and management of fish population (Haimovici and Velasco, 2000).

Osteobrama belangeri is a species of ray-finned fish in the genus *Osteobrama*, it was found in the Indian state of Manipur, but has been extirpated there and is found only in aquaculture and in Myanmar. Although the species is listed as near threatened species according to IUCN status with sizeable population available in Myanmar, it is extinct in the wild in Manipur (Wikipedia Website, 2021).

During development, organisms generally increase in size (length, weight). The needed key factors are the quantity of food available, the number of fish using same food source, temperature, oxygen and other water quality factors to influence the growth of fish. Every animal exhibits the growth both in length and in weight and their relationships between these two are important and applied. The length-weight relationship is one of the standard methods in biological information and it is of great importance in fishery assessments. Mathematical relationship between the two variables, length and weight is established. It is useful for computing the biomass of a sample of fish from the length-frequency of that sample particularly.

Therefore, this study was conducted to estimate the length-weight relationship of *O.belangeri* and to assess the well-being of this species that light on the status of its habitat.

Materials and Methods

Study area and Sample collection

In order to study the biology of freshwater fish *O.belangeri*, 80 fish specimens were collected twice a month from May 2020 till December 2020 at Thirimarlar market in Mandalay (Fig. 1).

Length-weight measurement

The length of fish was measured by tape with centimeter scale to the nearest centimeter and body weights were measured by digital balance to the nearest gram. The total lengths (cm) were measured as distance from the snout with mouth closed to the tip of the caudal fin.

Length-weight relationship (LWR)

The samples collected for *O.belangeri* were divided into two length groups i.e. 10.0-20.0 cm, and 21.0-30.0 cm and named as A, and B respectively. After grouping, the relationship (correlation and regression) between total body length and body weight for each group was calculated using the formula of Froese (2006), $W = aL^b$ and logarithmically transformed into log W = log a + b log L where 'W' is the weight of the fish (in gram) and 'L' is the total length of the fish (in centimetre). The parameters 'a' is the intercept and 'b' is allometric coefficient. It is possible to determine the growth pattern of a species through the allometric coefficient (b), which is isometry when b=3, positive allometry when b>3 and negative allometry when b<3 (Jobling, 2002). Goodness of fit was determined using the correlation coefficient (r). In computing linear regression between total length and weight of the collected fish samples, the confidence limit was set to be 95%.

Condition factor (K)

The condition factor (K) was determined using length and weight data of fish samples. The condition factor was calculated by using formula K = 100*W/L3 (Fulton, 1904), where 'W' is total weight of fish and 'L' is total length of fish. All statistical analysis was done in Excel 2016.

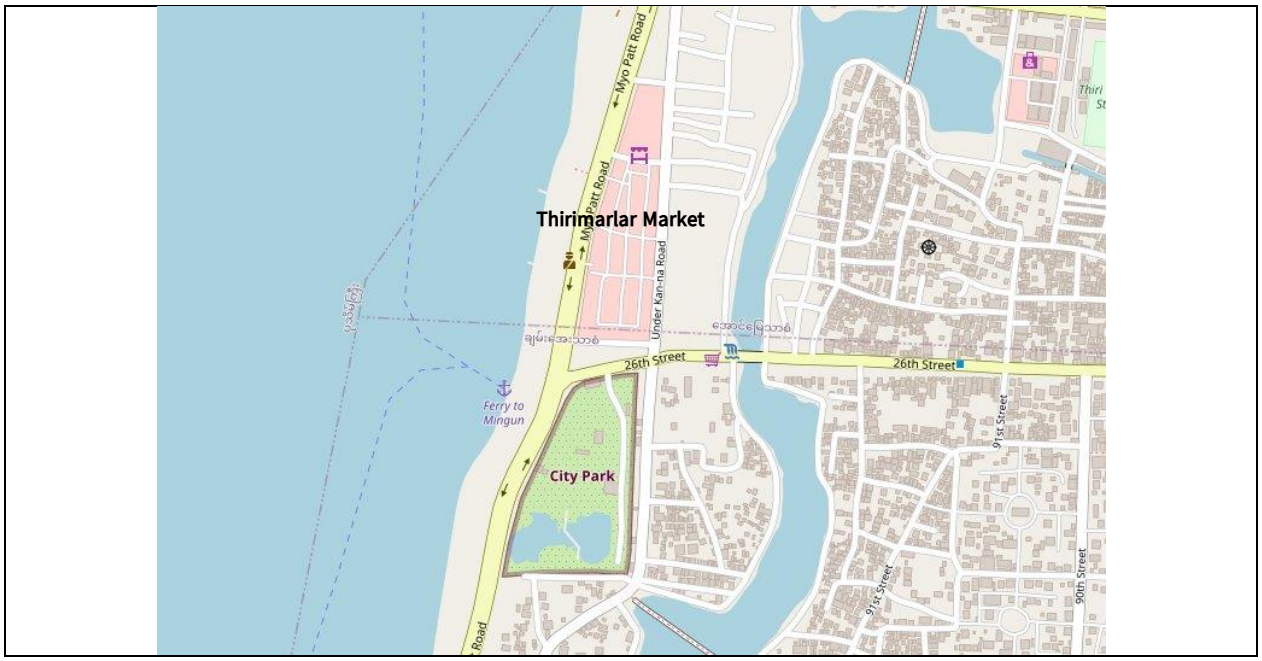

Fig. 1. Map of Study Area, Thirimarlar Market (Source: Open Street Map)

Results

Systematic position of the studied species

Phylum - Chordata

Class - Actinopterygii

Order - Cypriniformes

Family - Cyprinidae
Genus - *Osteobrama*
Species - *Osteobrama belangeri* (Valenciennes, 1844) (Plate 1)
Common name - Manipur osteobrama
Vernacular name - Nga-phan-ma

Biological studies

Biological studies in fishes encircle fairly wider aspects of fish body functions. Therefore, it is impossible to touch all aspects in details. In the study, only the following aspects of the fish biology of *O.belangeri* had been observed with below:

(A) Length-weight relationship
(B) Condition factor

(A) Length-weight relationship

For the purpose, the selected fishes for the study were grouped into two length groups i.e., group A - 10.0 to 20.0 cm and group B - 21.0 to 30.0 cm. *O.belangeri* from sampling site was primarily dominated by A length-group (68.75%) followed by B (31.25%) respectively (Table.1 and Fig.2).

The statistical relationships of total body length with body weight of *O.belangeri* were calculated for different length-groups. A highly significant correlation was found between total body length and body weight for all the length-groups (Table.1). The highest 'r' value (0.9542) was in 'A' length group followed by 'B' (0.9327). The vales of constant 'a' and exponent 'b' were determined from the linear regression with log-transformed data to verify the 'cube law' for the studied species. The values of exponent 'b' were observed more than 3. These values were 3.3597 and 3.8029 for 'A' and 'B' respectively. On the basis of length-weight data, the regression equations of body weight on total body length were calculated.

Length groups (cm)	Equation
10-20	y = -2.4129 + 3.3597x; r = 0.9542
21-30	y = -2.9755 + 3.8029x; r = 0.9327

The length weight relationship plot is presented in Fig. 3 and Fig. 4.

(B) Condition factor

The mean values of condition factor (K) for all the length-groups of *O.belangeri* were shown in (Table 2 and Fig. 5). The values of condition factor for the different length-groups of *O.belangeri* ranged between 1.09 and 1.26 and the highest values of condition factor was 1.26 from the length group B. In length group A, the value of condition factor was 1.09.

Table 1. Correlation of total body length (cm) with body weight (g) of *Osteobrama belangeri* at different length groups

Sr. No.	Length (cm)	Group	No. of fish	Frequency (%)	Mean TL±SD	Mean BW±SD	'a' value	'b' value	'r' value
1	10-20	A	55	68.75	17.41± 2.09	60.82± 24.24	-2.4129	3.3597	0.9542
2	21-30	B	25	31.25	21.77± 1.52	133.40± 41.50	-2.9755	3.8029	0.9327

Table 2. Condition factor of *Osteobrama belangeri*

Sr. No.	Length groups (cm)	Mean Condition factor (K)
1	10-20	1.09
2	21-30	1.26

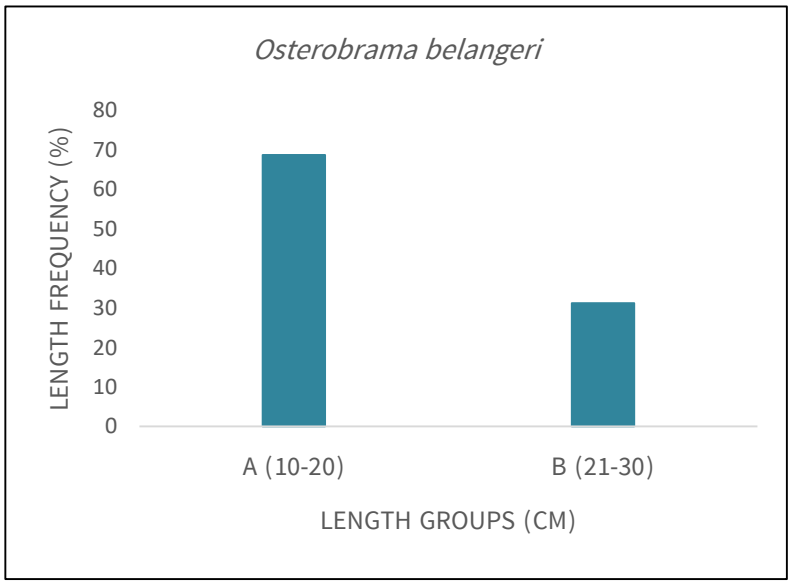

Fig. 2. Length frequency distribution of *Osteobrama belangeri*

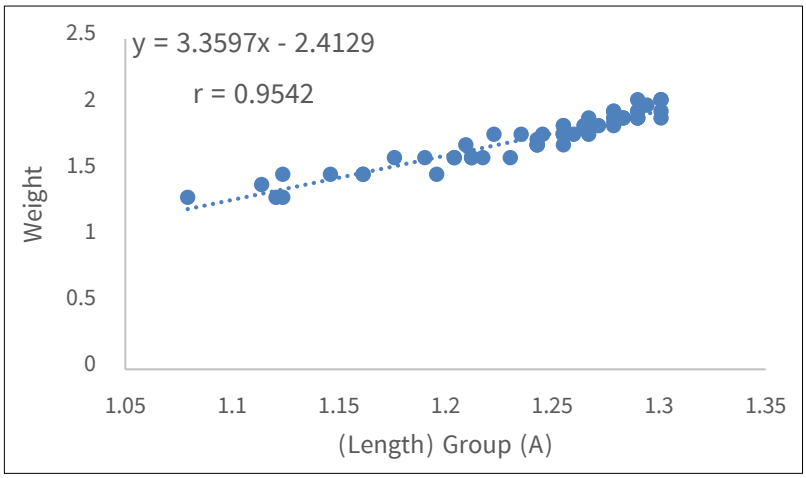

Fig. 3. Relationship between length and weight of *Osteobrama belangeri* (group A)

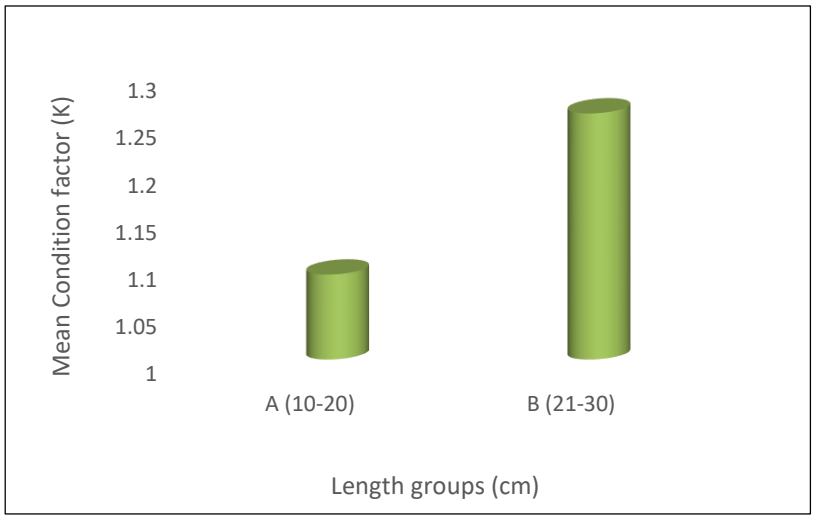

Fig. 4. Relationship between length and weight of *Osteobrama belangeri* (group B)

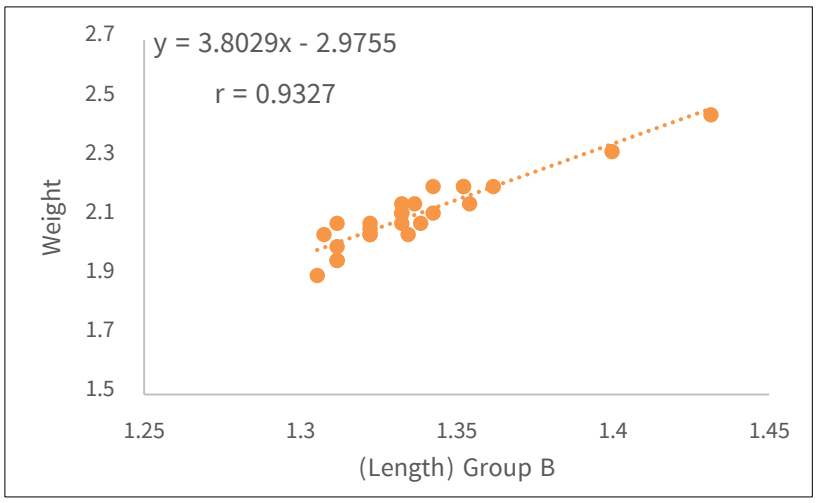

Fig. 5. Condition factors for each length group

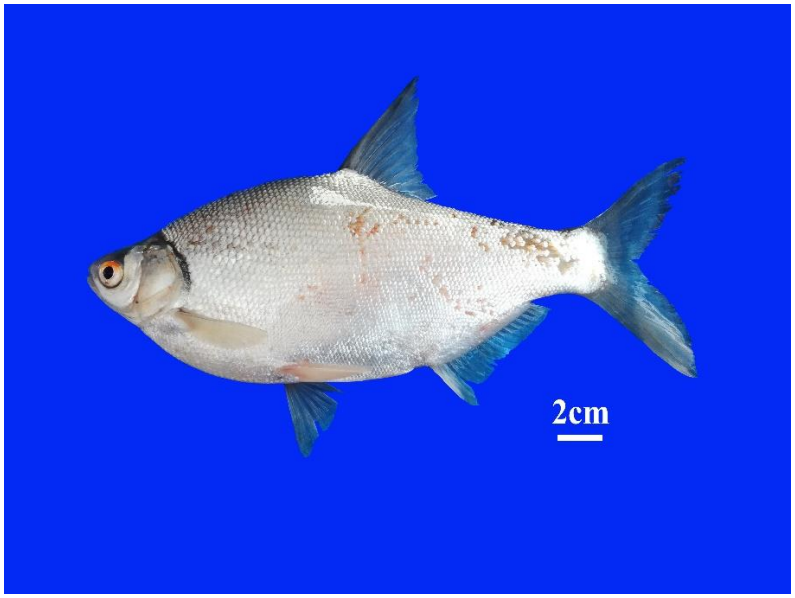

Plate 1. *Osteobrama belangeri*

Discussion

Length weight relationship for any fish species provides its growth performance and well-being in relation to habitat. It helps in monitoring the status of fish for obtaining optimum yield. The studies on length-weight relationship widely attracted the fishery biologists. The length-weight relationship of *O.belangeri* had been discussed by Win Mar *et al.*, (2011), Pwint Thu Aye (2012) and Thin Wai Aung (2021) from different localities.

A total of 80 specimens was used for the study of length weight relationship and condition factor. The statistical relationships of total body length with body weight of *O.belangeri* were calculated for different length groups; Log W = -2.4129 + 3.3597 Log L with r = 0.9542 in group A and Log W = -2.9755 + 3.8029 Log L with r = 0.9327 in group B. The correlation coefficient 'r' was indicating highly significant value of the result in both groups. The similar finding was reported by Pwint Thu Aye (2012). She observed that a significant linear relationship between total body length and weight of *O.belangeri* from four study sites in Mone Creek Dam. The strong relationship between total body length and weight of *O.belangeri* was also reported by Win Mar *et al.*, (2011) from Magway environs and Thin Wai Aung (2021) from Sawlue In (Lake), Singu Township.

The weight of the fish increases logarithmically with an increase in length and with the value of 'b' lying between 2.5 and 3.5 but usually close to 3.0 (Froese, 2006). The value of 'b' usually remains constant at '3' in an ideal fish (Carlander, 1969), but under natural conditions the value of 'b' usually ranges between 2.5 and 4 (Allen, 1938).

In the present study, the 'b' values were calculated to find out whether the fish is growing allometrically or isometrically. They can be enabled to decide the growth pattern of fish. The 'b' values obtained from *O.belangeri* were 3.3597 in group A and 3.8029 in group B, so it can be

concluded that positive allometric growth had been observed. A positive allometric growth for *O.belangeri* was reported by Thin Wai Aung (2021) as the 'b' value obtained was more than 3 from Sawlue In (Lake), Singu Township. Pwint Thu Aye (2012) also reported that length-weight relationship of *O.belangeri* was found at four study sites in Mone Creek Dam. The growth coefficient 'b' was 3.330 at site (1). The slope value of site (1) found in *O.belangeri* was higher than the other study sites: 'b'=2.962 at site (4), 'b'=2.776 at site (2) and 'b'=2.390 at site (3). Using the same methodology, Pwint Thu Aye (2012) found positive allometry and negative allometry for *O.belangeri* from Mone Creek Dam. Win Mar *et al*., (2011) observed that isometric growth of *O.belangeri* with 'b' value was 3.06 from Magway environs. Difference in 'b' values can be attributed to one or more factors such as ecological conditions of the habitats or variation in the physiology of the animals are responsible for growth rate variations in the same species from different localities (Le Cren, 1951).

Condition factor (K) is the physiological indicator of the well-being fish in any water body. In the present study, the 'K' values of *O.belangeri* varied 1.09 in group A and 1.26 in group B. The calculated 'K' value was more than '1' for each length group, it can be concluded that the fitness of the studied species was good in the ecosystem. It was indicated that a sign of good health status of fish as well as the environmental suitability. Nikos (2004) commented that fish sufficiently fed would have K ≥1 while undernourished K is less than '1'. The higher 'K' value for *O.belangeri* was reported by Thin Wai Aung (2021). She supported that the 'K' value in the case of *O.belangeri* was 1.10 and such value of 'K' was due to the suitability of the water body for fish growth and the fish were being fed adequately. Similarly, the higher 'K' values for *O.belangeri* were also reported by Pwint Thu Aye (2012). She observed that the condition factors are varying from 1.47, 2.47, 2.74 and 2.04 at site 1, site 2, site 3 and site 4. She also reported that such values of 'K' were indicative of the well growth and fatness in terms of condition factor at these sites. According to Gupta *et al*., (2011) the difference in condition factor could be due to difference of gonad development as well as the availability of food organisms at a particular time.

Conclusion

In conclusion, the length and weight of the studied fish species were highly correlated to each other. The present study was also concluded that the regression coefficient 'b' showed the positive allometric growth in both length groups. The observed condition factor of species for both length groups were in good condition. This study may be useful in providing relevant information for understanding the biology of the fish and estimation of fish condition in its environment.

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