Length-Weight Relationship and Condition Factor of Some Silurid and Percoid Fishes from Northern Part of Meiktila Lake

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Abstract

Length-weight relationship and condition factor of five commercially important freshwater fish species namely *Clarias batrachus*, *Parambasis ranga*, *Oreochromis* sp., *Glossogobius giurius* and *Channa harcourtbutleri* from Northern Part of Meiktila Lake, Meiktila Township were investigated during December 2019 to September 2020. Total length and weight of these fishes ranged from 4.6 to 42.5 cm and 1.0 to 562.8 g respectively. The "b" values (2.8657 to 3.0666) indicated that the growth pattern of these fishes was quite satisfactory. Four species of *Clarias batrachus*, *Oreochromis* sp., *Glossogobius giurius* and *Channa harcourtbutleri* were found negative allometric growth but only one species of *Parambasis ranga* was recorded isometric growth. The coefficient of determination (R^2) ranged from 0.9042 to 0.9764 and the condition factor (K) values ranged from 0.6853 to 1.6837.

Keywords: Length-weight relationship, condition factor, fishes.

Introduction

The length-weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group and in assessing the relative wellbeing of a fish population (Bolger and Connoly, 1989).

Length-weight relationship is of prime importance in parameterizing fish yield equations and stock assessments. Length-weight relationship enables the estimation of biomass from commercial processing data. Length-weight relationship as an empirical relationship is helpful in studying the natural history of fishes. For example, it allows prediction of the weight of a fish from a given length in yield assessment (Le Cren, 1951; Petrakis and Stergious, 1995).

In fishes, generally the growth pattern follows the cube law (Lagler *et al.*, 1962). The length-weight relationship provides means for finding out the "condition factor" or "coefficient of condition" to investigate seasonal and habitat differences in "condition" or "general wellbeing" of the fish. It is now generally accepted that the length frequency analysis represents the most promising avenue for future assessment work (Pauly, 1983).

Condition factor has been used as an indicator of health in fishing biology studies since the beginning of the 20th century, such as growth and feeding intensity. The condition factor provides information on the variation of fish physiological status and may be used for comparing populations living in certain feeding, climate and other conditions. Therefore, condition factor can be used to determine the feeding activity of a species to determine whether it is making good use of its feeding source. Thus, condition factor is important in understanding the life cycle of fish species and it contributes to adequate management of these species, hence, maintaining the equilibrium in the ecosystem (Imam *et al*., 2010).

A detailed knowledge of growth rates of different fish stocks is important for more specific fishery management. Many authors discussed the method of estimation of condition factor. Noteworthy among them are that of Le Cren (1951), Weatherly (1972) and Gill (1987).

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Since Myanmar is a country of abundant freshwater areas in the form of rivers, streams, lakes and ponds, both natural and man made, adequate habitats can be afforded for freshwater fishes (Khin Maung Soe, 2008).

The fisheries sector plays a vital role in the culture and socio-economic life of Myanmar. Myanmar people prefer freshwater fish to marine fish. The fisheries sector is the fourth largest source of foreign exchange earnings after timber, mineral, and rice in Myanmar. Fishes are keystone species, which determined the distribution and abundance of other organisms in the ecosystem they live in and are good indicator of the water quality and the health of ecosystem (FAO, 2005).

The fish species belonging to the order Siluriformes and Perciformes are the most delicious and fleshy food fish for common people. Many people prefer these fishes.

Therefore healthy fish condition of length-weight relationship and condition factor in Meiktila Lake were checked

- to assess the general wellbeing of selected fish species in the study area.

Materials and Methods

Study area

The study area of the present work is Northern part of Meiktila Lake, Meiktila Township, Mandalay Region. It is located at 20° 54' 26.43" N Latitudes and 95° 53' 17.03" E Longitudes (Fig. 1).

Fig. 1 Location map of study area

(Source: Google Earth, 2020)

Study period

The present study was conducted from December, 2019 to September 2020. Data collection had to be put on ice for two months (April and May, 2020) because of the pandemic of corona virus disease 2019 (COVID-19).

Collection of the specimens

Fishes were collected monthly from Northern part of Meiktila Lake, Meiktila Township, Mandalay Region. Fishes were collected from local fishermen and fishmongers. The distinct colour patterns of specimens were instantly recorded and taken photographs soon after collection. Morphological characteristics and measurement of species were taken according to the method of Lagler *et al*., (1962).

Identification of the specimens

At least ten specimens of each species of *Clarias batrachus*, *Parambasis ranga*, *Oreochromis* sp., *Glossogobius giurius* and *Channa harcourtbutleri* were studied (Plate 1). The vernacular names of the fishes were recorded as mentioned by the local fisherman and fishmongers. Identification and classification of the specimens were made according to Lagler *et al*., (1962), Talwar and Jhingran (1991), FAO (2005) and Jayaram (2013).

Measurement of the specimens

Fresh fish specimens were measured as total length with measuring tape in centimeters. The total length (TL) of the fish was measured from the tip of the anterior part of the mouth to the caudal fin. Each was measured to the nearest 0.1 centimeter. Fresh wet weight was measured to the nearest 0.01 gram with an electric digital balance.

Statistical analysis

Length-weight relationships were determined by the following equation:

$$\text{Log } W = \log a + b \log L \text{ (Zar, 1996)}$$

Where W = weight of fish in grams (g)

L = total length of fish in centimeters (cm)

a = constant (intercept)

b = the length exponents (slope)

The condition factor was calculated using length and weight data of fish samples by using the formula below:

$$K = W/L^3 \times 100 \text{ (Pauly, 1983)}$$

Where K = condition factor

W = weight of fish in grams (g)

L = total length of fish in centimeters (cm)

The length-weight relationship was calculated by using Microsoft Excel 2010.

Results

During the present study, Length weight relation and condition factor of five species belonging to five different families and under two orders were studied.

Length-weight relationship of the species studied

The total number of 510 individual of fish, represented with species of *Clarias batrachus*, *Parambasis ranga*, *Oreochromis* sp., *Glossogobius giurius* and *Channa harcourtbutleri* from Northern part of Meiktila Lake, Meiktila Township were observed and calculated.

In the present study, the total length of *Clarias batrachus* ranged from 17.6 - 35.9 cm and body weight from 45.9 - 367.7g and the equation for length-weight relationship is y = 2.9146x - 2.0465 (Table 2 and Fig. 2).

The total length of *Parambasis ranga* ranged from 4.6 - 10.2 and body weight from 1.0 - 14.4 g and the equation for length-weight relationship is y = 3.0666x - 1.9500 (Table 2 and Fig. 3).

The total length of *Oreochromis* sp. ranged from 9.6 - 22.9 cm and body weight from 14.7 - 217.3 g and the equation for length-weight relationship is y = 2.9930x - 1.7671 (Table 2 and Fig. 4).

The total length of *Glossogobius giurius* ranged from 6.5 - 12.5 cm and body weight from 2.6 - 15.7g and the equation for length-weight relationship is y = 2.8971x - 1.9773 (Table 2 and Fig. 5).

The total length of *Channa harcourtbutleri* ranged from 8.7 - 42.5 cm and body weight from 6.5 - 562.8 g and the equation for length-weight relationship is y = 2.8675x - 1.9128 (Table 2 and Fig. 6).

The regression analysis of length weight relationship for studied fishes is shown in Table 2. Length-weight parameters "a", "b" and coefficient of determination (R^2) are given in Table 3. According to the results, the length-weight relationship, showed that *Clarias batrachus* (R^2 = 0.9042), *Parambasis ranga* (R^2 = 0.9558), *Oreochromis* sp. (R^2 = 0.9764), *Glossogobius giurius* (R^2 = 0.9311) and *Channa harcourtbutleri* (R^2 = 0.9706) are significantly correlated between length and weight (Table 3 and Fig 2, 3, 4, 5, 6).

The growth "b" values are 2.9146 (negative allometric growth) for *Clarias batrachus*, 2.8971 (negative allometric) for *Glossogobius giurius*, 2.8657 (negative allometric) for *Channa harcourtbutleri*, 3.0666 (isometric growth) for *Parambasis ranga* 2.9930 (negative allometric growth) for *Oreochromis* sp. (Table 3 and Fig. 7).

Condition factors of the species studied

The values of mean condition factors are described in Table 3 and Fig. 7. The maximum value of mean condition factor was found in *Oerochromis* sp. 1.6837 and the minimum value 0.6853 was found in *Clarias batrachus.*

Table 1 List of fish species recorded from the study area

Order	Family	Species	Common name	Vernacular name
Siluriformes	Clariidae	*Clarias batrachus*	Spotted catfish	Nga-khu
Perciformes	Ambassidae	*Parambasis ranga*	Indian glassy fish	Nga-zin-sat
	Cichilidae	*Oreochromis* sp.	Nile Tilapia	Tilapia
	Gobiidae	*Glossogobius giurius*	Tank-goby	Naing-lon-nga
	Channidae	*Channa harcourtbutleri*	Dwarf snakehead	Nga-yant-gaung-to

Table 2 Measurements of Length-weight relationship of fish species studied

Species	No. of fishes	Total length (cm)		Body weight (g)		Length-weight relationship
		Min	Max	Min	Max	
Clarias batrachus	60	17.6	35.9	45.9	367.7	2.9146x-2.0465
Parambasis ranga	120	4.6	10.2	1.0	14.4	3.0666x-1.9500
Oreochromis sp.	120	9.6	22.9	14.7	217.3	2.9930x-1.7671
Glossogobius giurius	120	6.5	12.5	2.6	15.7	2.8971x-1.9773
Channa harcourtbutleri	90	8.7	42.5	6.5	562.8	2.8657x-1.9128

Min = Minimum
Max = Maximum

Table 3 Regression parameters, condition factors and growth patterns of fish species studied

Species	Regression		Condition factor (K)	Growth pattern
	b	R^2		
Clarias batrachus	2.9146	0.9042	0.6853	Negative allometric
Parambasis ranga	3.0666	0.9558	1.2802	Isometric
Oreochromis sp.	2.9930	0.9764	1.6837	Negative allometric
Glossogobius giurius	2.8971	0.9311	0.8426	Negative allometric
Channa harcourtbutleri	2.8657	0.9706	0.8565	Negative allometric

b = Regression coefficient
R^2= Coefficient of determination
K = Condition factor

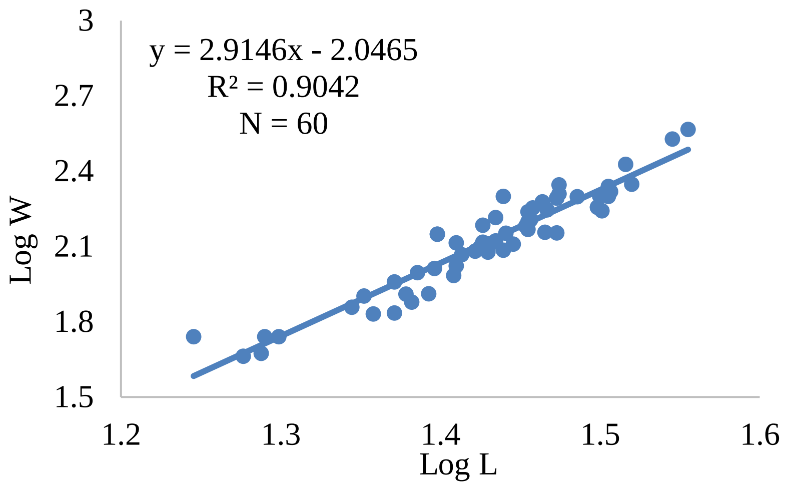

Fig. 2 Logarithmic relationship between length and weight of *Clarias batrachus*

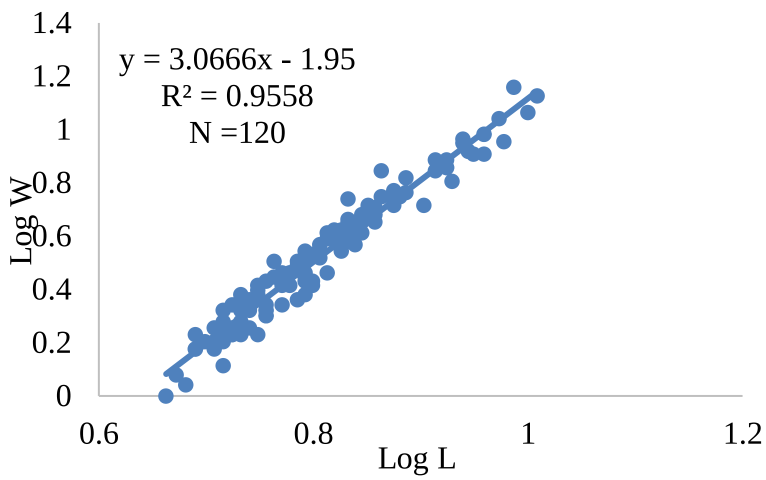

Fig. 3 Logarithmic relationship between length and weight of *Parambasis ranga*

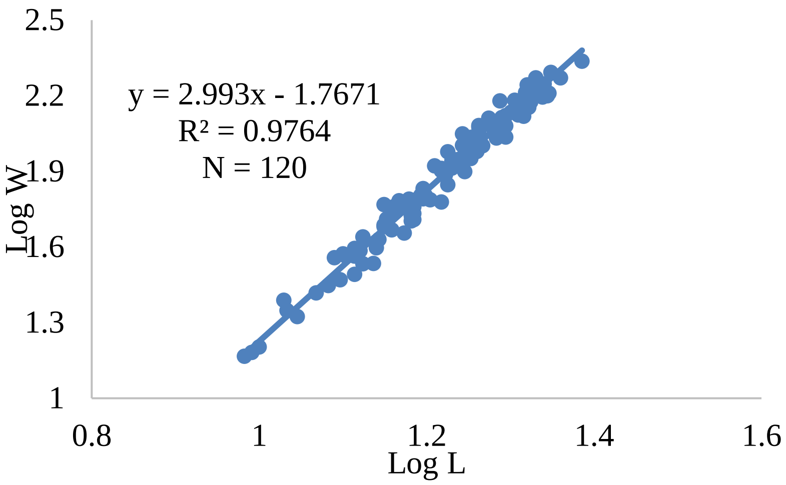

Fig. 4 Logarithmic relationship between length and weight of *Oreochromis* sp.

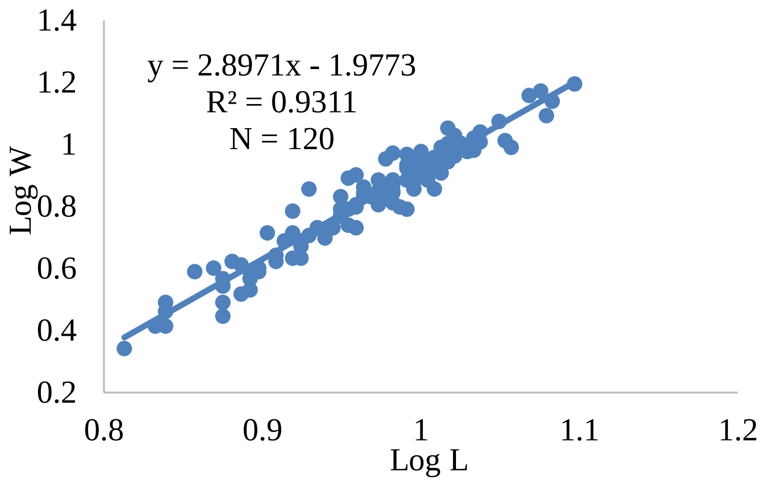

Fig. 5 Logarithmic relationship between Length and weight of *Glossogobius giurius*

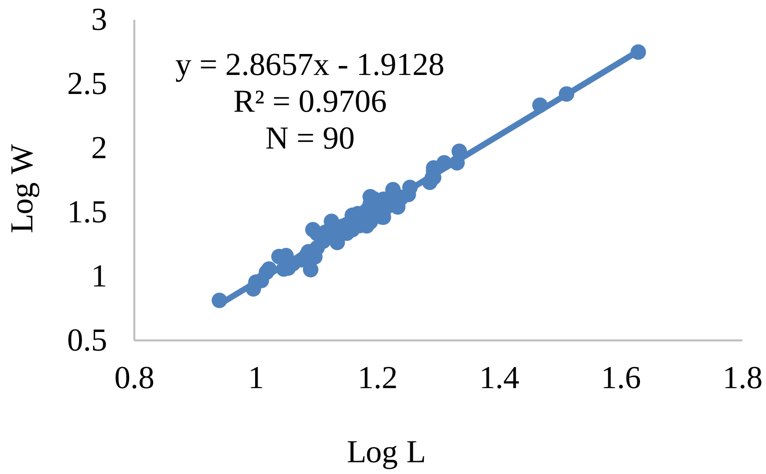

Fig. 6 Logarithmic relationship between length and weight of *Channa harcourtbutleri*

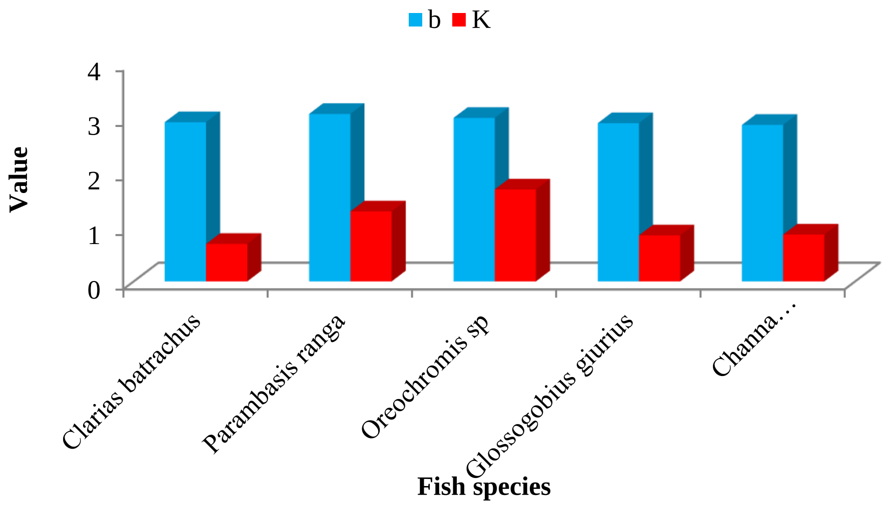

Fig. 7 Comparative b value and K value of fish species studied

(A) *Clarias batrachus*

(B) *Parambasis ranga*

(C) *Oreochromis* sp.

(D) *Glossogobius giurius*

(E) *Channa harcourtbutleri*

Plate 1 Fish species recorded in the present study

Discussion

The present study was conducted on length-weight relationship and condition factor of five selected fish species: *Clarias batrachus*, *Parambasis ranga*, *Oreochromis* sp., *Glossogobius giurius* and *Channa harcourtbutleri* were studied during December 2019 to September 2020.

The length-weight data were considered to establish the growth patterns of the fish species. The value of "b" was calculated to find out whether the fish is growing allometrically or isometrically. If the "b" value is 3.0, the growth is isometric. If the value of "b" becomes greater than 3 as the fish become fatter, or when the "b" value is lower than 3, the fish is slimmer (Veeramani *et al*., 2010).

In the present finding, the "b" value of the five selected fish species ranged from 2.8657 to 3.0666. Among these selected species, *Clarias batrachus*, *Orechromis* sp., *Glossogobius giurius* and *Channa harcourtbutleri* had the "b" value, 2.9146, 2.9930, 2.8971 and 2.8657 respectively, indicating the negative allometric growth. *Parambasis ranga* had the "b" value, 3.0666, indicating the isometic growth pattern. In *C. batrachus*, which is similar with Sittaung river section near Phyu, Taungoo district (Nilar Than *et al*., 2017), they stated the "b" value 2.631 for *C. batrachus*. In *Oreochromis* sp., which does not agree with Pauk In, Pakokku Township (Hnin Nwe Hlaing, 2015), they also reported the "b" values 2.545.

In the present study, the "b" value 3.0666 for *Parambasis ranga* is not similar with Mahapatra *et al.,* 2014 who stated the "b" value 2.67. May Thingyan, 2019 stated the "b" value 3.1720 for *Glossogobius giurius*, which is similar with present study and the "b" value 3.38 for *Channa,* which is not similar with present study.

Coefficient of determination "R^2" for LWR is significant $R^2 > 0.900$ in all five species (*Clarias batrachus*, 0.9042; *Parambasis ranga*, 0.9558; *Oreochromis* sp., 0.9764; *Glossogobius giurius*, 0.9311; and *Channa harcourtbutleri*, 0.9706) respectively which indicate that the weight increases together with the increase of length. The reason behind may be that the observed specimens were the inhabitants of quite good environment.

The difference may be due to the availability of food, habitat, stomach fullness and gonadal maturity. It may be suggested that variation of R^2 was due to the habitat and difference in the observed length ranges of the five selected fish species.

Condition factor is an index reflecting interaction between biotic and abiotic factors in the physiological condition of fish. Therefore, the condition factor may vary among fish species in different locations. Condition factor of greater than or equal to 1 indicates a good level of feeding and proper environmental conditions (Ujjania *et al*., 2012).

Based on the results, it was < 1 for *Clarias batrachus,* (0.6853), *Glossogobius giurius* (0.8426) and *Channa harcourtbutleri* (0.8565) showing no proper environmental conditions of habitat for these species whereas the highest value of "K" > 1 for *Parambasis ranga* (1.2802) and *Oreochromis* sp. (1.6837), showed the perfect condition.

Conclusion

In conclusion, considering the above mentioned statement, it can be concluded that the contribution presented in this research would be useful reference for fishery biologists and in future studies on the population assessment of the other species inhabiting the Meiktila Lake, Meiktila Township, Mandalay Region.

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