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Length-weight relationship (LWR) of fish, *Labeo rohita* (Hamilton) from pond near Kalayat, Kaithal, Haryana India

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Abstract
The present study have been carried on the thirty one specimens of the rohu, *Labeo rohita* (Hamilton) collected from the pond near the Kalayat in Kaithal, Haryana, India. The total fish length ranged between 24.6-40.3 cm and the total weight of the fish varies between 190-455 gms. The present studies on *Labeo rohita* (Hamilton) from the pond near Kalayat in Kaithal, Haryana, shows a negative allometric growth pattern with 'b' value 2.263.

Keywords: *Labeo rohita,* length-weight relationship, negative allometric growth, Kalayat, Haryana

Introduction
Length-weight relationship (LWR) is of great importance in fishery (Haimovici and Velasco, 2000) [4]. Fish length weight relationship (LWR), are useful for converting length observations into weight estimates to provide some measure of biomass (Froese, 1998) [3]. Length weight relationships have been used to estimates weight from length because direct weight measurements can be time consuming in the field (Sinovcic *et al*., 2004) [14]. Length weight relationship of the fish are vital in fishery science (Lizama and Ambrosio, 2001; Ahmed *et al*., 2003) [9].
Labeo rohita or rohu (Hamilton) is a species of fish of the carp family, and extensively used in aquaculture. It is in silver- colored fish of typical cyprinid shape, with a conspicuously arched head. Adults can reach a maximum weight of 45 kg and maximum length of 2 m. The species is omnivore with specific food preferences at different life stages. During the early stages of its lifecycle, it eats mainly zooplankton, but as it grows, it eats more and more phytoplankton, and as juvenile or adult is an herbivorous column feeder. *Labeo rohita* (Hamilton) reach sexual maturity between two and five years of age. They generally spawn during the monsoon season.

Methodology
31 specimens of the rohu, *Labeo rohita* (Hamilton) collected from the pond near the Kalayat in Kaithal, Haryana, India. The length-weight assessment is of great importance in fishery assessments. The parameters of the length-weight relationships were calculated by the following equation:

$W = aL^b$ (Le Cren, 1951; Ricker, 1973; Pauly, 1983) [8, 13, 12].

Whereas,
W: Weight of the fish in grams (gm)
L: Total length of the fish (cm)
a: Constant (intercept)
b: the length exponent (slope)

The length-weight pairs were plotted initially in order to identify and delete the possible outliers. The "b" is an exponent with value ranging between 2.5-3.5 demonstrating normal growth dimensions or the interpretation of relative well-being (Bagenal, 1978; King, 1996a, b). Linear transformation was made by using the natural logarithm at the observed lengths and weights proposed by Zar (1984).

The expression of the equation is represented by the following formula:

$$\log W = b \log L + \log a$$

A graph of the log W against log L forms a straight line with slope of "b" and a Y-axis (log w) intercept of log a. Invariably, "b" is close to 3.0 for all species. In the previous versions and in much of the fishery literature, the regression constant is represented by "c" rather than "a" and the regression slope is represented by "n" rather than "b". Equations in the form of natural logarithms (base e) and power functions are commonly used instead of log 10 (Schneider *et al*., 2000). All the above statistical calculations were done using the software SPSS (Version 25) and then the graphs were plotted using the observed values and log of observed values.

Result and Discussion

The present studies have been carried on the thirty one specimens of the rohu, *Labeo rohita* (Hamilton) collected from the pond near the Kalayat in Kaithal, Haryana, India. The total fish length ranged between 24.6-40.3 cm and the total weight of the fish varies between 190-455 gms.

On the analysis of the data, it has been observed that the length-weight shows a significant correlation between these two parameters and the value of the correlation has been found to be 0.881**

All the observed values are plotted on graph with length on the X-axis and weight on Y-axis. It has also been observed that when the observed values of total length and the weight are plotted on X and Y axis respectively, a curvilinear relationship has been obtained which is very much evident in the graph (Fig.1). To calculate the length-weight relationship, these values have been converted into logarithmic values so as to obtain a straight line relationship (Fig.2). Therefore all the calculations of the length weight relationship are based on log values not on the original values. The value of correlation coefficient is on very high side 0.881 and value of "b" is 2.263 indicating negative allometric growth.

In Table 1, the regression equation based on logarithmic values are given for the extrapolation of results. For extrapolation the log total length value is used which gives log weight and by calculating antilog of the log weight, it gives the calculated weight of fish. In practice there is always a difference between the calculated and observed weight

Table 1: Correlation coefficient "r", value of constant "a" and "b", regression equation of *Labeo rohita* (Hamilton)

Total Length (cm)	N	Weight (gms)	Correlation Coefficient	Value of "a"	Value of "b"	Regression equation	$W=aL^n$
24.6-40.3	31	Less than 1Kg	0.881**	-.858	2.263	= -.858+2.263logTL	$0.1386L^{2.21}$

N= number of specimens ** correlation significant at 0.01 level.

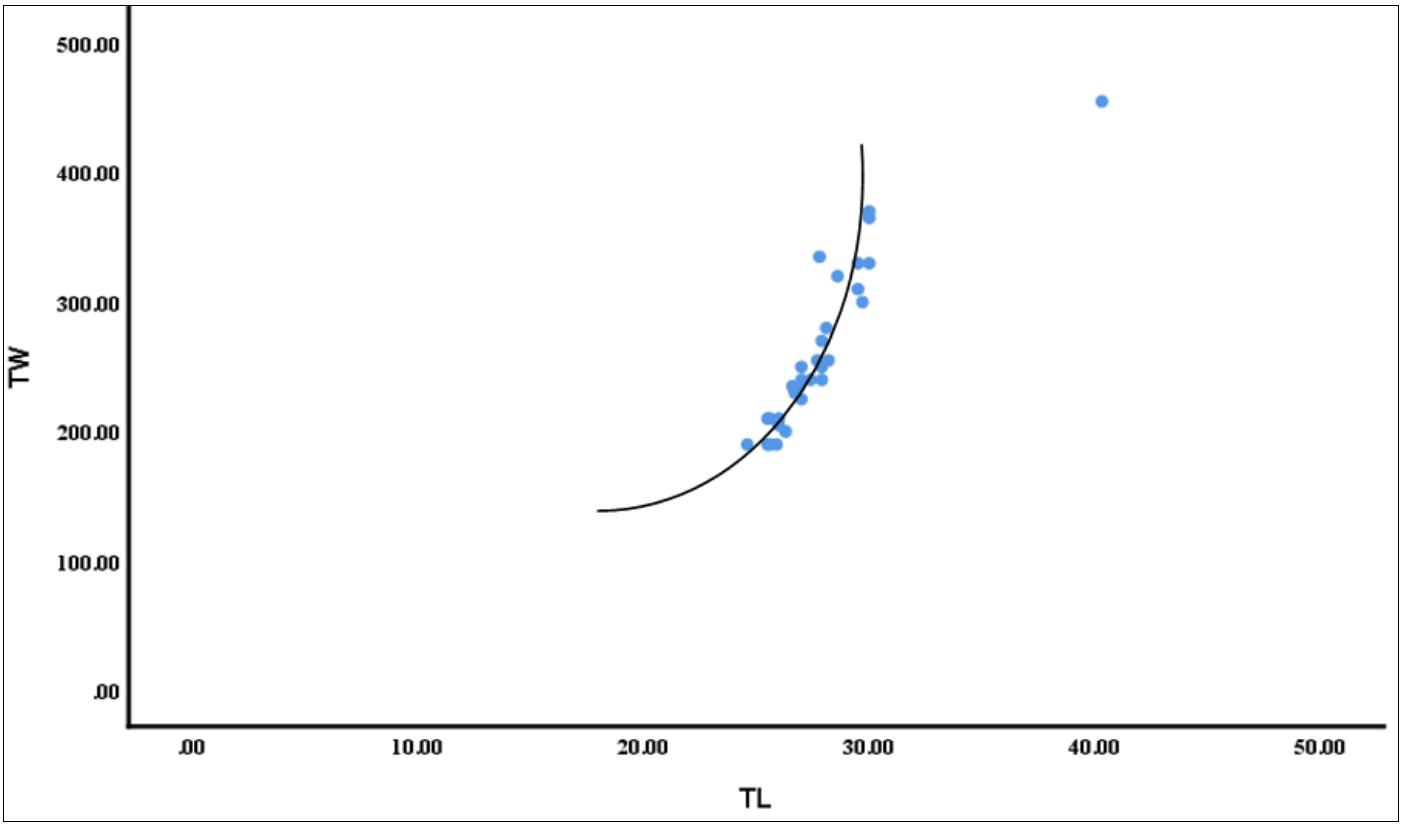

Fig 1: Curvilinear relationship between Total Length (cm) and Total Weight (gm) of *Labeo rohita* (Hamilton) from the pond near Kalayat in Kaithal, Haryana.

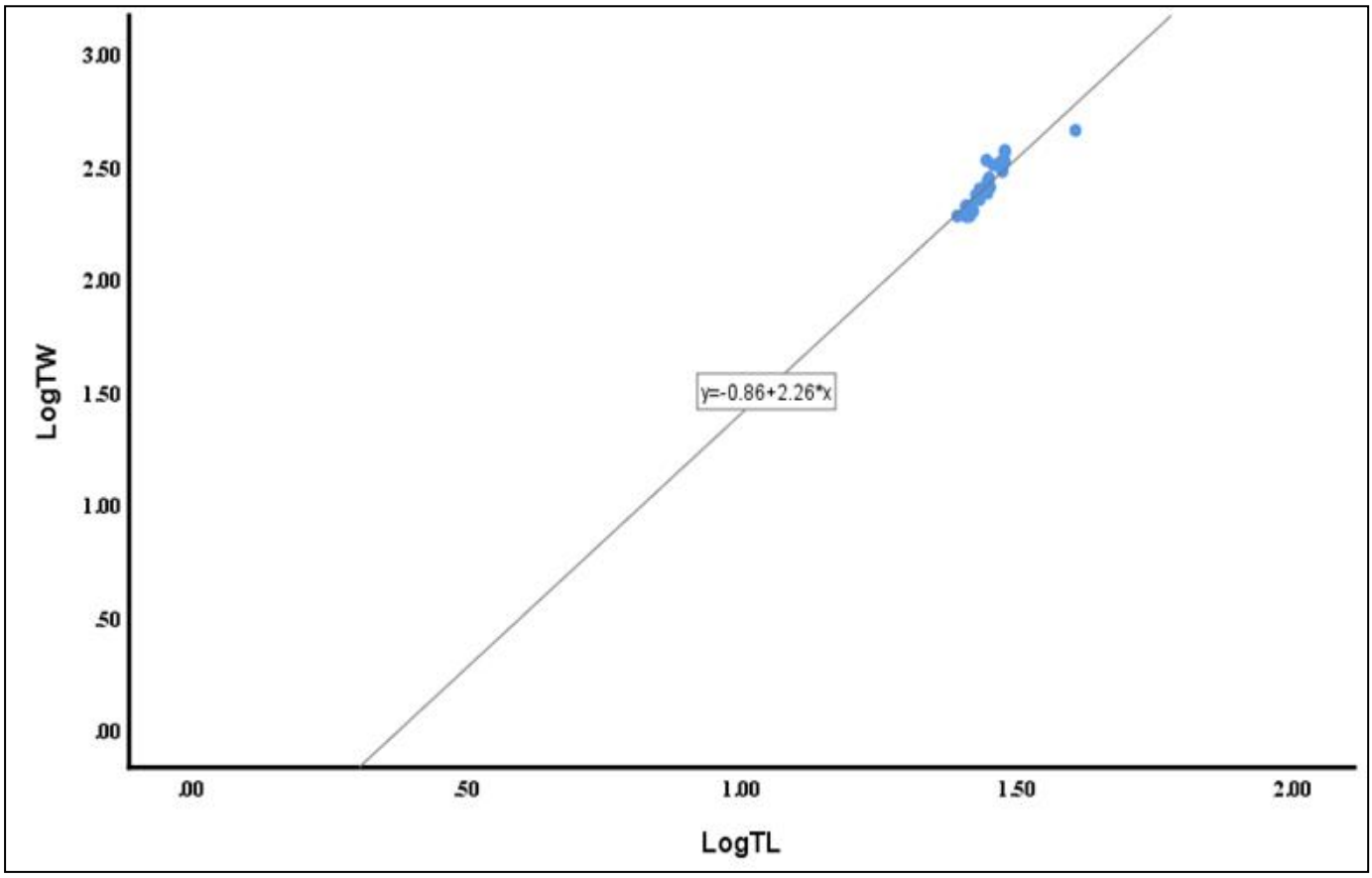

Fig 2: Graph between Log TL and Log TW of *Labeo rohita* (Hamilton) from the pond near Kalayat in Kaithal, Haryana.

The length-weight relationship studies of fish proves to be an important tool for studying the growth, gonadal development of fish population (LeCren, 1951: Pauly, 1993 and Nagesh *et al.*, 2004) [8, 12, 10]. The length- weight relationship is the most important aspect in biological studies of fishes. The 'b' value less than 3 shows that fish become lighter (negative allometric) for a particular length. According to LeCren (1951) [8] fishes may not remain the same shape or body outline throughout their life span. The value of 'b' gives information about the growth and wellbeing of fish.

The present study revealed that the fish species did not follow the cube law completely with the value of exponent 'b' recorded as 2.263 thus revealing negative allometric growth (b<3). Can *et al*. (2002) [2] found similar negative allometric value with 'b' 2.90 which may be due to various factors like food availability, environmental changes, season, sex and many other physiological factors.

Similar results were obtained by Haq *et al.* (2012) [5] for *Epinephelus malabaricus*; Ndiaye *et al.* (2015) [11] for white grouper (*Epinephelus aeneus*,); Jumawan and Seronay (2017) [6-7] for *C. striata* which shows a negative allometric growth pattern. Padmavathi *et al.* (2015) while studying length-weight relationship of puffer fishes (*Arothron immaculatus*) and (*Lagocephalus lagocephalus*) found value of 'b' less than less than 3 i.e. 2.813 and 2.705 respectively. Joy and Jumawan (2017) [6-7] found the 'b' value ranges between 2.476-2.830 for *Barbodes binotatus* and *Trichopodus trichopodus*.

Conclusion

The present studies provide the first hand information about the growth pattern and condition of *Labeo rohita* (Hamilton) from pond near Kalayat in Kaithal, Haryana. This study will help for better conservation techniques and proper management and production methods for the *Labeo rohita* (Hamilton).

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