



Research Paper

Length – weight relationship and condition factor of *Labeo rohita* (Ham.) fish in Barnoo reservoir, Jabalpur, Madhya Pradesh, India

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Abstract: Attempts have been made to determine length – weight relationship and condition factor of *Labeo rohita* (Ham.) fish in Barnoo reservoir, Jabalpur (M.P.). The present study indicates that the fish did not follow the cube law ($W = a L^n$) because the value of 'n' is a shade lower than three, and is deviated from cube law. The parabolic equation for the statistical relationship between the length and weight was recorded; $W = 0.000429 L^{1.78568}$ and $W = 0.000226 L^{1.74549}$. The condition factors (K) were also estimated for to determine the wellbeing of fishes and was found satisfactory growth of *Rohu* fish at Barnoo reservoir. The values of condition factor (K) of *Labeo rohita* was also computed and found that the species performed well. The maximum of 'K' value was found 1.3932 in *Labeo rohita*. Observed condition factor of *Labeo rohita* reported that the fish were in well condition during the study period.

Keywords: *Labeo rohita*, Length-weight relationship, Condition-factor, Barnoo reservoir

INTRODUCTION:

Studies on length – weight relationship of fishes in fisheries research have two objectives (i) to determine the type of mathematical relationship between two variables and (ii) to know the wellbeing of the fishes (Annapaswamy *et al.*, 2004). Furthermore the study allow (i) estimation of average weight of the fish for a given length group (Beyer, 1987) (ii) conservation of length – growth equation to corresponding weight – growth equivalents (iii) assessing the wellbeing of fish population (Bolgar and Connolly, 1989) and determination of condition factor (Mitra, 2001)

The present work is an attempt to assess the potential of Barnoo reservoir through the

study of length – weight relationship and condition factor of the fish. Both the tools usually employed for fish growth determination. The determination of the weight of a fish directly from length may become necessary some times and prove to be useful (Rose *et al.*, 2006).

MATERIALS AND METHODS:

Barnoo reservoir: Location and Topography: It is a small irrigation reservoir in Sihora tehsil of Jabalpur district (M.P.), located at 80° 07' 10" E Longitude and 23° 20' 50" N Latitude . The reservoir is about 40 years old and was created by constructing an earthen dam of 322.50m. long and was completed during the year 1966-67. It was impounded on the rainy river Barnae, with a view to irrigate 2137ha. land of 15 villages of Sihora block . Total water spread area of the reservoir is 75.6 ha. at FRL , with a catchments area of 32.8 sq. km. the maximum and minimum depth of the reservoir is 72 feet and 22 feet respectively. Barnoo reservoir was adopted for fisheries purpose in 1980. For fishing it had been divided into 10-beats. The water remains only in 2- beats round the year (5-7m) while the remaining dry up in summer. The perennial region of the reservoir have uneven bottom and submerged trees (Mandloi *et al*, 2003; Ojha, 2004).

Rohu fishes for the present work were collected during the study period from December 2001 to December 2002 and January 2003 to Oct. 2003 from Barnoo reservoir. Altogether 628 specimen of size ranging from 22 to 51.5 cm. in total length

were collected in different months. Live specimen was collected with the help of fishermen through gill nets, cast net and some time drag net. Fish specimens were weighed on the pan balance and measured for the length up to the nearest millimeter.

Fishes grow three dimensionally and they normally retain the same shape or outline of the body. So the shape and specific gravity of fish remain constant throughout their life. Length – weight relationship was estimated using the following formula-

$$W = a L^n \text{ (Le Cren, 1953):}$$

Where as - W= Weight of the fish,

L= Length of the fish,

‘a’ and ‘b’ = Constant or it can be linearly represented as-

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

The value of the constant ‘a’ or the proportionately constant (Mitra, 2001) and the exponent ‘b’ or the regression slope (Vinch and Nair, 1974) are calculated by the formula given by Leglar (1952). Condition factor ‘K’ was calculated by the

$$\text{formula- } K = \frac{W}{L^3} \times 100$$

RESULTS AND DISCUSSION:

Monthly average growth and average weight of stocked *Rohu* fishes were observed and noted during two consecutive period of after two month from the stocking. In first year i.e. year Dec. 2001 to Dec. 2002 *Rohu* attain their weight from 120 gm to 1600 gm with the total length from 22 cm to 51.5 cm (Table-1).

Table-1. Length – weight relationship and condition factor of *Labeo rohita* (Ham.) in Barnoo reservoir (year- Dec. 2001 to Dec. 2002)

Month of Collection	Number of fish examined	Average length (cm)	Log length Log L	Average weight(gm)	Log weight Log W	Calculated Log 'a'	Calculated Log 'n'	Condition factor (k)
December	35	22	1.34224	120	2.07918	-0.000429	1.78568	1.1270
January	27	24.6	1.39094	175	2.24304	-0.000429	1.78568	1.1755
February	35	27.5	1.43933	250	2.39794	-0.000429	1.78568	1.2021
March	25	32.2	1.50786	400	2.60206	-0.000429	1.78568	1.1981
April	34	36	1.55030	650	2.81291	-0.000429	1.78568	1.3932
May	25	40	1.60206	800	2.90309	-0.000429	1.78568	1.2500
June	20	41.5	1.61805	900	2.95424	-0.000429	1.78568	1.2592
July	21	42.5	1.62839	1050	3.02119	-0.000429	1.78568	1.3678
August	18	46	1.66276	1250	3.09691	-0.000429	1.78568	1.2842
September	19	48	1.68124	1400	3.14613	-0.000429	1.78568	1.2659
October	28	49	1.69020	1450	3.16137	-0.000429	1.78568	1.2325
November	40	50	1.69897	1500	3.17609	-0.000429	1.78568	1.2050
December	20	51.5	1.71181	1600	3.20412	-0.000429	1.78568	1.1734
	N=347		Σ20.52415		Σ36.79827			

The value of Correlation co-efficient (observed length and calculated weight) $r = 0.9990$ ($P \leq 0.01$).

In 2nd year i.e. year Jan. 2003 to Oct. 2003, *Rohu* attain their weight from 140 gm to 1000 gm, with the total length from 23.5 cm to 42.5 cm (Table-2).

Table-2. Length – weight relationship and condition factor of *Labeo rohita* (Ham.) in Barnoo Reservoir (year- Jan. 2003 to Oct. 2003).

Month of Collection	Number of fish examined	Average length (cm)	Log length Log L	Average weight(gm)	Log weight Log W	Calculated Log 'a'	Calculated Log 'n'	Condition factor (k)
January	40	23.5	1.37107	140	2.14613	-0.000226	1.74595	1.0785
February	30	26	1.41497	220	2.34242	-0.000226	1.74595	1.2517
March	25	30	1.47712	350	2.54407	-0.000226	1.74595	1.2963
April	39	32.1	1.50650	400	2.60206	-0.000226	1.74595	1.2592
May	26	32.8	1.51587	450	2.65321	-0.000226	1.74595	1.2752
June	21	36.7	1.56467	55	2.74036	-0.000226	1.74595	1.1127
July	20	38.5	1.58546	700	2.84510	-0.000226	1.74595	1.2266
August	20	40.8	1.61066	850	2.92942	-0.000226	1.74595	1.2515
September	35	41.5	1.61805	900	2.95424	-0.000226	1.74595	1.2592
October	25	42.5	1.62839	1000	3.0000	-0.000226	1.74595	1.3027
	N=281		Σ15.29276		Σ26.75701			

The value of Correlation co-efficient (observed length and calculated weight) $r = 0.999$ ($P \leq 0.01$).

Length-weight relationship of *Rohu* fish was calculated. In first year (i.e. Dec. 2001 to Dec. 2002) the calculated values of log 'a' were – 0.000429 and 'n' were 1.78568. In 2nd year (i.e. January 2003 to Oct. 2003) the calculated values of log 'a' 0.000226 and 'n' were 1.74595. The length-weight

relationship of *Rohu* is given in Table -1 & 2. The parabolic equation obtained for total length and weight data comes to –
Labeo rohita (Ist year) –
 $W = -0.000429 L^{1.78568}$
Labeo rohita (IInd year) –
 $W = -0.000226 L^{1.74596}$

The correlation co-efficient (r) between log of total length and that of body weight was 0.9990 in first year (Dec. 2001 to Dec. 2002) and 0.9995 in second year (Jan. 03 to Oct. 03). The values of 'K' (condition factor) were given in Table-1 & 2 (Fig. 1 and 2.); against the different size classes for the fish. In first year the primary maximum value of 'K' for Rohu fish was at 51.5 cm. length which is 1.1734 and minimum value of 'K' was at 22cm length which is 1.1270. In second year the maximum value of 'K' for Rohu fish was at 42.5 cm length which is 1.3027 and minimum was at 23.5 cm length which is 1.0785.

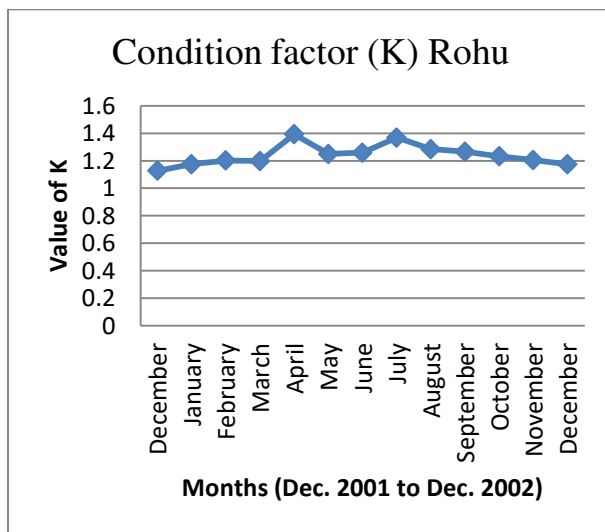


Figure 1. Condition Factor (K) of *Labeo rohita* (Dec.2001 to Dec.. 2002)

Length – weight relationship of the fishes indicates that it is not follows cube law ($w = a L^3$) because the value of 'n' is a shade higher than 3. Higher values for 'n' have been reported for *Hilsa* of the Ganga River (Mathur, 1964, Pillay 1958a, De, 1980, 1936 and Martin, 1949). Le Cren (1951) stated that the value of 'n' may vary for fishes inhabiting different localities and even in different sexes and life stages. The value of

$K > 1$ points towards good health of the fish and < 1 opposite (Le Cren, 1951).

In the present study value of 'K' was estimated and indicating good health of the fish stock. However, amongst fishes of

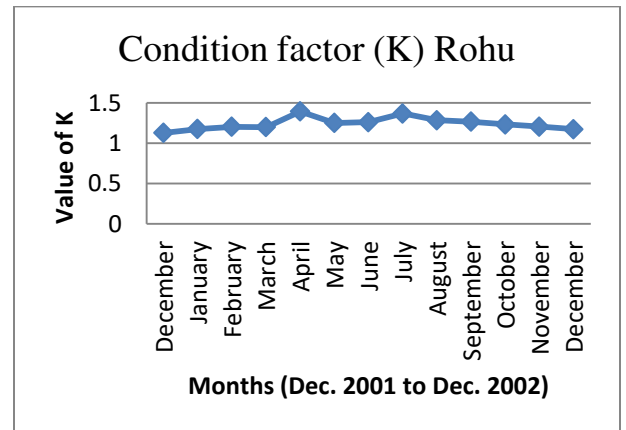


Figure 2. Condition Factor (K) of *Labeo rohita* (Jan.2003 to Oct. 2003)

different size groups the 'K' factor fluctuated in a very narrow range in different fish species. De (1980) also observed highest value of 'K' (1.120) amongst fishes in size range of 260 – 479 mm. Pillay (1958a) stated that curve of 'K' for females showed a steady increase from July onwards reaching the maximum in November thereafter registered a sudden fall.

The determination of 'K' helps in defining the seasonal variation in the condition of the fish in relation to age and sex of the fish. It also helps in finding the differences between the conditions of the same species in different water which might also serve as an index of the productivity of the water mass. During the study such rapid change and recovery is generally associated with the attainment of sexual maturity. Pantulu (1961) and Rao (1967) observed a similar

change in relative condition factor in *Mystus gulio* and *Labeo fimbriatus*.

Bhatnagar (1963) stated that the monthly variation in 'K' values of *Puntius kolus* indicated the spawning season of the fish. Menon (1950) stated that the 'K' values denoted the beginning of spawning as the downward trend may be due to increased metabolic strain.

While working on four Indian major carps of river Brahmaputra found that in *Labeo rohita* the 'K' value was high during August and low during January (Choudhari *et al.* 1982). The high value in June may be due to the presence of mature gonads and subsequent fall in July and August probably due to spawning. Such observation was also seen in the present study in Length-weight relationship of Rohu fish in Barnoo reservoir i.e. 'K' value was high during April and October and low during December and January months. While studying on the fish Catla and Mrigala we observed such findings (Ojha *et al.* 2007; 2018). Gairola *et al.* (1990) showed that the peak 'K' value was smaller (< 8.0 cm), providing evidence of intensive feeding and rapid growth in *P. ticto*.

Condition factor is believed to be an indicator of the physiological state involving maturity, spawning, environmental conditions and availability of food. It has also been established that noticeable variation can occur in the 'K' values during the life span of the fish.

CONCLUSION:

Extrinsic factors such as space, competition for food, enemies and changes in physico-chemical characteristics of water and intrinsic factors such as genetic makeup; reproductive state and endocrine balance etc. influence the growth rate of fish. The length-weight relationship of selected fishes were clearly indicates that the total weight of the

fish increases as an exponential function of its total length. Length-weight relationship of any fish is depending upon various environmental factors besides body shape, outline and the contour. Nikolsky (1963) is of the opinion that growth has its specific characteristics in different age groups. In the present study growth rate was not found similar in all length groups. This can be seen by the slight curvilinear in the calculated values of the weight (Fig. 1 & 2.).

It has been observed during the study that the condition factor 'K' follows a pattern of seasonal cycles related to feeding intensity, spawning activity and well being of fishes. Monthly variation in 'K' values synchronies with the feeding intensity and influenced by the maturation cycle of the fish. The value of co-efficient of correlation (r) estimated for the observed species of fishes were found always less than one, which indicated that the relationship between length and weight of the Rohu fish was highly significant in Barnoo reservoir and well-being of fish.

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