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# Length-weight relationship and condition factor of *Catla catla* in reservoir Udaisagar (Udaipur, Rajasthan)

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**Abstract**
The commercially important fish species of Udaisagar reservoir *Catla catla* was selected for their biological study. Present study which include the length-weight relationship and condition factor of *Catla catla*. The exponent values of total length and weight varied from 0.138 to 0.280. On the basis of exponent value of length-weight relation, it could be concluded that *Catla catla* attains more weight per unit of length in the Udaisagar reservoir. The values of condition factor (K) of *Catla catla* was also computed and found that the species performed well. The maximum of 'K' value was found 1.917 in *Catla catla* (group A). Observed condition factor of *Catla catla* reported that the fish were in well condition during the study period. On the basis of length-weight data, the regression equations of body weight on total body length were calculated. The higher values of 'n' could be attributed to high rate of weight increase with per unit increase in length. The correlation co-efficient 'r' between total length and weight were found to be significant for all the length groups of *Catla catla*.

**Keywords:** *Catla catla,* Length weight, Condition factor (K), exponent value etc

## 1. Introduction
Indian major carps *viz., Catla catla, Labeo rohita* and *Cirrhinus mrigala* dominate the fishery wealth from Indian reservoirs. Though Indian major carps dominate the whole reservoir fishery of North India, during the recent years their population in the total catch is drastically reduced in comparison to their production potential.

Inspite of favourable conditions for high fish growth rate in the state of Rajasthan, fish culture has yet not gained required popularity. It is mainly due to inadequate knowledge about growth performance and other related information on Indian major carps in the specific climate of southern Rajasthan in different types of water bodies except few notable studies by Durve (1976) [4], Sharma *et al.* (1986) [13], Johal and Tandon (1987) [6], Sinha *et al.* (1991) [14], Sugunan (1995) [16], Kohli *et al.* (1998) [9] Ujjania (2003) [17], Raj kumar (2005) [12] and Vijay kumar (2007) [18].

The condition factor is an important biological aspect which indicates the well being of a specific fish in a water body. It is an index of species average size and its value depends on the physiological features like maturity, spawning, environmental factors and food availability in a water body. Therefore, the study of condition factor is a mirror for the evaluation of the well being of the fish in relation to its biotic and abiotic environments.

In view of the above, the present study on Length- weight relationship and condition factor of *Catla catla* in reservoir Udaisagar (Udaipur, Rajasthan) has been designed and conducted.

## 2. Materials and methods
The present study was carried out during Sept. 2008 to Sept. 2009 with a view to investigate the biology of *Catla* catla of Udaisagar reservoir. For this purpose, laboratory studies were conducted in the College of Fisheries, Udaipur while field studies were conducted at Udaisagar reservoir.

### A. Study area
The Udaisagar reservoir, under investigation is situated 18 km away from Udaipur (Rajasthan) near the village Bichari. This reservoir originates from Berach river near the village Bichari. River Berach covering a distance of 3 km from Hindustan Zinc Colony, Debari, Udaipur. The catchment area of Udaisagar reservoir is semi-hilly and rocky.

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## B. Sample Collection
### Fishery Biological Study
In order to study the biology of commercially important fish Catla, samples of fish *Catla catla* were collected from the commercial catches during fishing year 2008 at landing centre of Udaisagar reservoir.

## A. Length-weight relationship
About 500 specimens, of *Catla catla*, were collected during the fishing year 2008 from Udaisagar reservoir for the length-weight relationship. The total length and weight of fish samples were measured in centimetre and gram, respectively. The samples collected for *Catla catla* were divided into four length groups i.e. 40.0-50.0, 50.0-60.0, 60.0-70.0 and 70.0-80.0 cm and named as A, B, C and D, respectively. After grouping, the relationship (correlation and regression) between body weight and total body length for each group was calculated using following formula of Le Cren (1951) [11]:

$W = aL^n$

Where,

W = Weight of the fish in g
L = Total length in cm
a & n = Constants

## B. Condition factor or ponderal index (K)
The condition factor or ponderal index (K) was determined using length and weight data of fish samples. The condition factor was calculated as per the standard method of Le Cren (1951) [11].

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

Where,

W = Observed weight of fish in g
L = Total length of fish in cm

## C. Statistical analysis
The data collected during the present investigation were processed for statistical analysis. The analysis of correlation coefficient and regression was done as per the method described by Snedecor and Cochran (1981) [15]. The length-weight relationship was established using the linear equation of the form Log W = Log a + b Log L.

## 3. Result
### Biological Studies
Biological studies in fishes encompass fairly wider aspects of fish body functions and in a research, it is impossible to touch all aspects in details. As such, only the following aspects of the fish biology of *Catla catla* have been dealt with below:
(A) Length-weight relationship
(B) Condition factor or ponderal index

## (A) Length-weight relationship
For the purpose, the fishes selected for the study were grouped into 4 length groups i.e., A-40.0 to 50.0 cm, B-50.0 to 60.0 cm, C-60.0 to 70.0 cm and D-70.0 to 80.0 cm. It would be seen from Table 1.1 and Fig.1.1 that *Catla catla* from Udaisagar reservoir was primarily dominated by C length-group (50.46%) while the other length group *viz*., D, A and B followed in the same sequential order, with percentage of 36.4%, 7.2% and 6.0% respectively.
The statistical relationships of body-weight with total body-length in the case of *Catla catla* were highly significant as seen by significant correlation coefficients (r value) indicated in the Table 1.1 for all the length groups. It may be noted here that the highest 'r' value (0.775) was in C length-group followed by length-groups D (0.741), A (0.648) and B (0.557).Table 1.1 also depicts that *Catla catla* deviated from Cube law at all the length groups. The exponent 'n' values for body-weight and total body-length ranged between 0.138 and 0.280. The above highest and lowest values of 'n' were observed in length groups D and B, respectively. For other length-groups i.e. A and C, the exponent values were 0.197 and 0.228, respectively.
The values of 'a' constant for different length-groups ranged between -3.810 and -14.741 (Table 1.1) This value was the highest in the length-group D (-14.741) followed by length-group C (-10.137), A (-7.271) and B (-3.810). Fig-1 shows the graphical representation of relationship between logs of total body-weight with log of total body length.

## (B) Condition factor/Ponderal index (K)
The mean values of condition factor (K) for all the length-groups of *Catla catla and Labeo rohita* are shown in (Table.1.2). The 'K' values of *Catla catla* ranged between 1.484 and 2.278. The highest being recorded from the length-group B. The highest 'K' value of B group was subsequently followed by those of A, C and D groups in the order of 1.917, 1.705 and 1.484 respectively.

## 4. Discussion
Length weight relationship for any fish species gives its performance and well being in relation to habitat and helps in monitoring the status of fish stock for obtaining optimum yield. The length-weight relationship of Indian major carps has been discussed by Choudhary *et al.* (1982) [1], Johal and Tandon (1987) [6], and Kumar *et.al.* (2007) [10] from different localities of India.
Studies on length-weight relationship have widely attracted the attention of fishery biologists. However, on Rajasthan waters such reservoirs are comparatively meagre. In the present study on length-weight relationship and exponent values for the carps, *Catla catla* and *Labeo rohita* from Udaisagar reservoir, Udaipur Rajasthan have been computed.
The observations on *Catla catla* clearly indicate that in all these fish morpho-metric parameters of the species showed the relationship between total body length and body weight were highly significant (Table 1.1 and 1.2). The results shown in the Tables 1.1 and 1.2 and Fig 1.1 point out a highly significant relationship between total body length and body weight of the fish. Coefficient of correlation (r) in respect of various parameters (Table 1.1 and 1.2) further indicated that relationship for morpho-metrical parameters were highly significant.
In the present study, the exponent value 'n' was found to be deviated from 'cube law' i.e. the values was 0.228. Such deviations from 'cube law' were also observed by earlier workers. Desai and Shrivastava (1990) [3] observed an exponent value of 2.9143 for Cirrhinus mrigala from Rihand reservoir. Johal and Kingra (1992b) [8] reported exponent values varying between 2.752 to 3.545 in three Indian major carps.
In Rajasthan Jain (2000) [5] reported a high variations in 'cube law' for *Catla catla, Labeo rohita* and *Cirrhinus mrigala* from Siliserh reservoir, and observed that availability of living space and food could strongly influence the values of exponent. Ujjania (2003) [17] attempted to workout length

weight relationship in three Indian major carps namely, *Catla catla, Labeo rohita* and *Cirrhinus mrigala* and reported a highly positive significant relationship between standard body length and body weight. He also reported the variations in the exponent value (n) of *Catla catla* at different length-weight groups from 3.160 to 3.805, 2.734 to 4.452 and 3.013 to 4.004 from Mahi Bajaj Sagar, Surwania dam and Aasan pond, respectively from southern Rajasthan. Further, the same author reported the exponent value 'n' to vary from 2.770 to 4.574, 2.853 to 4.056 and 2.685 to 4.455 in Three length-groups of rohu from the above stated three reservoirs in respective order.

From above discussion it may be seen that the exponent values obtained in the present study in respect of *Catla catla* of Udaisagar reservoir are comparable to those reported by Johal and Kingra (1992a) [7], Jain (2000) [5] and Ujjania (2003) [17].

Condition factor or ponderal index is a physiological indicator of the well being of any fish living in a giving environment. Low values of condition factor or K, as it is normally referred

to in a fishery language, is a definite sign of non-allometric fish growth probably owing to the competition for the food and space within the different fish communities in a water body. In the present study, the K values of Catla varied between 1.273 and 1.484. The nearness of K value to 1.0 in the species clearly indicates the environmental suitability of the reservoir Udaisagar for good growth of fish.

Further, the high value of condition factor (K) in the present study is an indicator of higher increase in weight in relation to length. The higher 'K' value for catla supported by Choudhary *et al*. (1991) [2]. He reported that the oscillation of 'K' value in the case of *L. calbasu* between 1.15 and 1.26. In this connection, the observation of Jain (2000) [4] in respect of IMC in Seliserh reservoir are comparable and supportive. Ujjania (2003) [17] observed that the condition factors varying from 2.788-3.225 for catla, 2.053-2.339 for rohu and 1.779-1.965 for mrigal. He also reported that such values of 'K' are indicative of the suitability of the water body for good fish growth. All the above studies support the presently made observations in catla and rohu of Udaisagar reservoir.
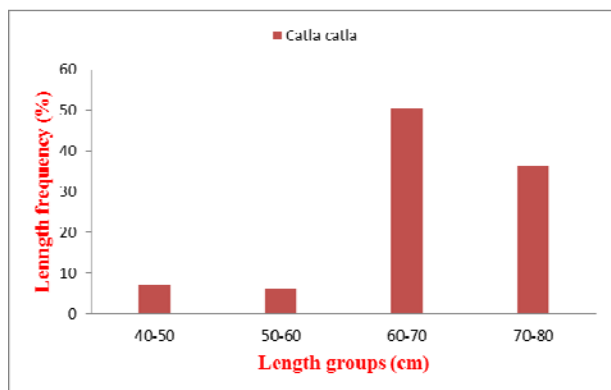
**Table 1.1:** Correlation of total body length (cm) with body weight (kg) of *Catla catla* at different length groups

| S. No. | Length | Group | Total No of Observation | Frequency (%) | Mean L±SD | Mean W ±SD | a' Value | n' value | r' value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 40-50 | A | 36 | 7.2 | 47.194±3.097 | 2.015±0.940 | -7.271 | 0.197 | 0.648** |
| 2 | 50-60 | B | 30 | 6 | 54.867±3.627 | 3.363±0.899 | -3.81 | 0.138 | 0.557** |
| 3 | 60-70 | C | 252 | 50.4 | 66.259±3.583 | 4.961±1.053 | -10.137 | 0.228 | 0.775** |
| 4 | 70-80 | D | 182 | 36.4 | 75.372±3.240 | 6.357±1.218 | -14.741 | 0.28 | 0.741** |

** Significant at 1 % Level of significance

**Table 1.2:** Condition factor of *Catla catla*

| S. No. | Length groups (cm) | Condition Factor (K) |
|---|---|---|
| 1 | 40-50 | 1.9172 |
| 2 | 50-60 | 2.2785 |
| 3 | 60-70 | 1.7055 |
| 4 | 70-80 | 1.4846 |



**Fig 1:** Length frequency distribution of Catla catla of Udaisagar Reservoir

### 5. Acknowledgement

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