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Length-weight relationship and condition factor of fresh water fish from Himalayan state

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ABSTRACT

Length and weight relationship and Fulton's condition factor may be used for understanding the growth pattern of a particular fish. These two parameters provide fundamental information regarding the growth parameters for sustainable fishery management in the natural as well as man-made reservoirs. The length (L) and weight (W) relationship was calculated for *Catla catla* found in Nanak Sagar reservoir, which is the largest one with the total water surface area of 4600 ha in Himalayan state Uttarakhand. The calculation of b for the length and weight relationship ($W=aL^b$) was recorded as 2.990 for G_1, 2.889 for G_2, 3.108 for G_3 and 2.790 for overall sample. The average allometric coefficient 'b' of the length-weight relationship was found (2.361) is a negative allometric growth pattern. Further results showed highly correlated LWR (r^2 = 0.932) of fish whereas, Fulton's condition factor (K) ranged between 2.943-3.263 (average 3.089).

Keywords: Freshwater fish, LWR, condition factor, reservoir

1. INTRODUCTION

For effective and efficient fisheries development, proper understanding of the aquatic ecosystem of water bodies is mandatory. Natural water bodies are utilized for various purposes as irrigation, drinking water supply and fish production. Himalayan state Uttarakhand is bestowed with rich freshwater resources as rivers, lakes, reservoirs etc. The Tarai area of this state has several sized water bodies named Dhaura, Tumaria, Baigul, Baur and Nanak Sagar, theses water bodies holds and support rich fish diversity (Sugunan, 1995). Nanak sagar is the largest reservoir among earlier mentioned water bodies, with total surface area of 4600 hec. (Anon, 1992). Nanak Sagar reservoir is situated near the Sitarganj town at the river Deoha, at 280, 57', 20'' N latitude and 790, 50', 34'' E, longitude, altitude of the reservoir is 200 meters. Selected fish, *Catla catla* belongs to Cyprinidae family and highly valuable for commercial purposes. This fresh water fish inhabits in freshwater ponds, reservoirs, lakes and rivers. *Catla catla* is considered as the fastest growing fish among major carps (Mitra, 1942). To maintain a healthy commercial stock, extensive study of growth and length is most important. The appropriate growth rate monitoring of fish may be performed by estimation of age, weight and length, these parameters may be useful to accumulate the information of stock composition, life span, growth, maturity and production. Length-weight (LWR) parameters may be used for monitoring purpose on fish health and growth factors, for maintain healthy and productive stock of fish species.

Length-weight relationship (LWR) and condition factor, are very efficient tools in fishery biology in imposing effective guidelines for sustainable fishery management in natural water sources. Considering above, present study was planned to assess the length-weight relationship and condition factor of *Catla catla* fish in Nanak Sagar reservoir.

2. MATERIALS AND METHODS

Total 56 specimen were collected (total length range 15.6-30.6 cm, standard length range 13.18-27.6 cm, weight range 94.7-543.4 gm) with the help of local fishermen, during the month of February, 2018. Total catch was segregated in three groups (G1, G2, G3) on the basis of total length. Fish moisture was removed before body weight and measurement. Specimen were measured for total length (TL) and standard length (SL) and average weight (g) using millimeter scale to the nearest 1 mm, while body weight (g) was determined with a digital balance to the nearest 0.01 g. The length weight relationship between the total length and weight was calculated by applying the formula as suggested by (Le Cren, 1951) $W = aL^b$

Where,

W =Total weight of fish (gm).

L = Total length of fish (cm)

b = is the regression coefficient (slope)

a= is the intercept in the *y*-axis,

The general parabolic equation $W = aL^b$ can be written as LogW = Log a + b Log L. Total length of all specimens was used in order to calculate the length weight relationship (LWR) which was calculated by log transformed data log: W= log a+b log L (Ricker, 1975). Fulton's condition factor (*K*) was calculated using the equation $K = (BW/SL^3) \times 100$ (Bagenal and Tesch, 1978).

3. RESULTS & DISCUSSION

In present study, specimen of *Catla catla* were collected and examined. Length and weight relationship and Fulton's condition factor of *Catla catla* procured from Nanak Sagar Reservoir (Table 1).

Value of 'b' and its deviations fishes may be classified into three categories:

(i) **b=3,** Isometric growth (where the body form of fish remains constant at different length)

(ii) **b< 3** Positive allometric growth (when fish becomes more slender as the length increases)

(iii) **b > 3** Negative allometric (when fish grows more stouter with increase in length)

The exponent b often has a value close to 3 but varies between 2 and 4 (Tesch, 1971). According to table 1 the value of b for G1 was recorded (2.990), for G2 (2.889), for G3 (3.108) and for overall catch (2.790). The length- weight relationship in fresh water fishes may be affected by various factors including climate, habitat, reproductive maturity, diet, appetite pattern, overall health and annual alteration in environment (Bagenal and Tesch, 1978). Indeed the change in the value of b depends majorly on the shape and size of the species, still various factors may play role in the alteration in parameters of the LWR among seasons, such as climate temperature, available food, sex and reproductive maturity (Ricker,1973). Goncalves *et al.,* (1997) discussed about the parameter 'b' value may fluctuate seasonally or even on daily basis, variations may also reported due to change in habitats, reproductive maturity and on population size. In present study regression values were recorded more significant (except G2) with coefficient of determination in the range of 0.805 in G1 group, 0.480 in G2 group, 0.851 in G3 group and 0.932 in overall catch similar with the findings of study of Huo, *et al.,* (2011) (Fig. 1-4). The value of condition factor of any population may fluctuate due to the age and sex ratio but climatic and environmental factors and seasonal variations may play crucial role (Pravdin, 1966). The Fulton's Condition factor (K) of *Catla catla* showed various values and these reported values may furnish the current information that will be available to compare data with present research (Isa, *et al.,* 2010). Fulton's condition factor (K) was determined as 3.2637 in G1, 2.9434 in G2, 2.9982 in G3 and 3.089 in overall catch. Although the values for different groups varied insignificantly, hence condition factor (K) was recorded ($P<0.01$) significant. Minimum (K) value was observed in G2 group (2.9434) whereas maximum (K) value (3.2637) was noted in G1 group. Although (K) value calculated for *Catla catla* reported slightly lower than the previous research. Such tendency of (K) value may have been recorded due to climatic conditions, feeding pattern and seasonal variations (Mir *et al*., 2012).

Table 1. Length-weight relationship and condition factor of *Catla catla* in the Nanak Sagar Reservoir. India

Group (cm)	**TL (cm)**±SD	**Weight (gm)**±SD	**Log L**±SD	**Log W**±SD	**b**	**r^2**	**SL (cm)**±SD	**K**±SD
G_1 (15.0-20.9)	18.91±1.62	160.38±47.71	1.275±0.03	2.186±0.12	2.990	0.805	16.86±1.45	3.2637±0.40
G_2 (21.0-24.9)	22.37±0.96	236.95±41.80	1.349±0.01	2.368±0.07	2.889	0.480	20.01±0.79	2.9434±0.39
G_3 (25.0-30.9)	27.70±1.73	427.28±87.88	1.441±0.02	2.621±0.09	3.108	0.851	24.16±1.70	2.9982±0.27
Overall	22.38±3.85	256.48±123.96	1.343±0.07	2.361±0.20	2.790	0.932	19.83±3.25	3.089±0.39

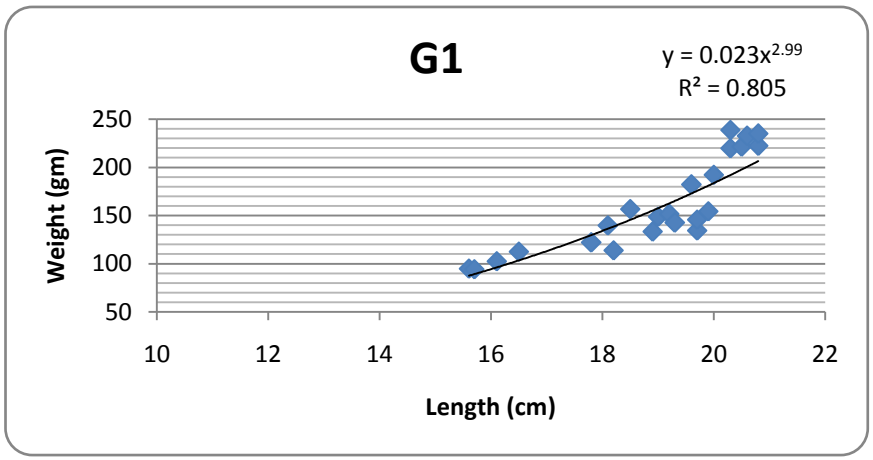

Figure 1. Length-weight relationship of G1 (15.0-20.9 cm) group

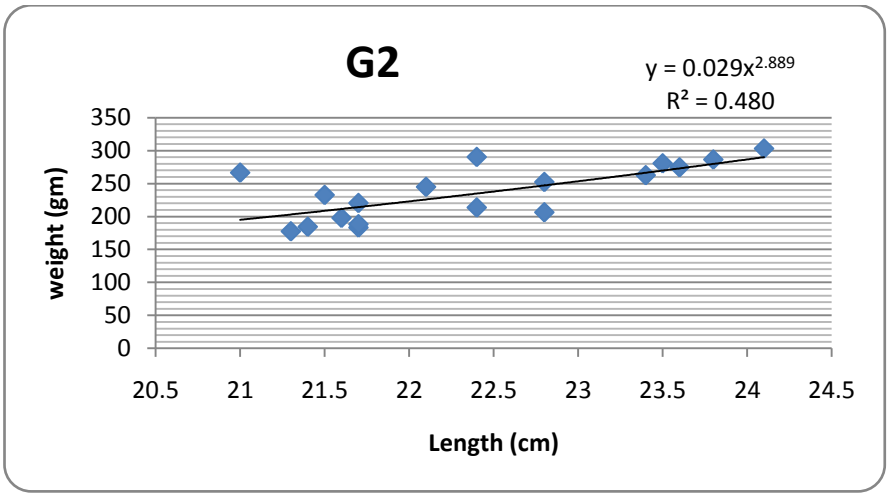

Figure 2. Length-weight relationship of G2 (21.0-24.9 cm) group

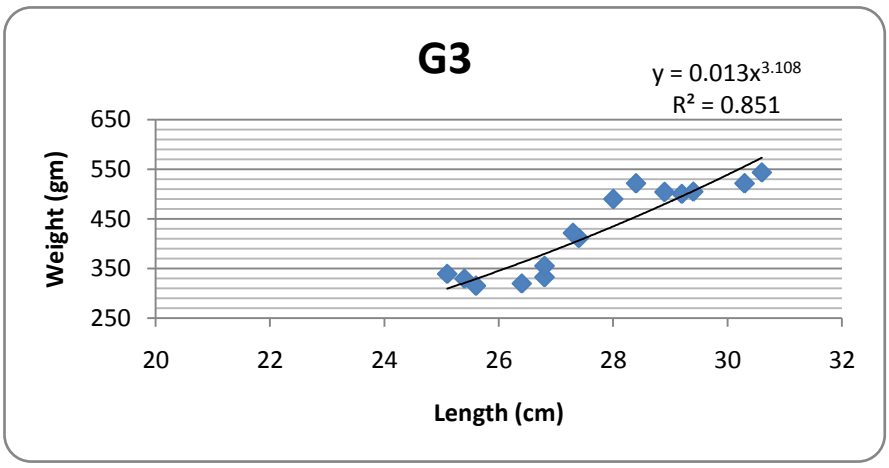

Figure 3. Length-weight relationship of G3 (25.0-30.9 cm) group

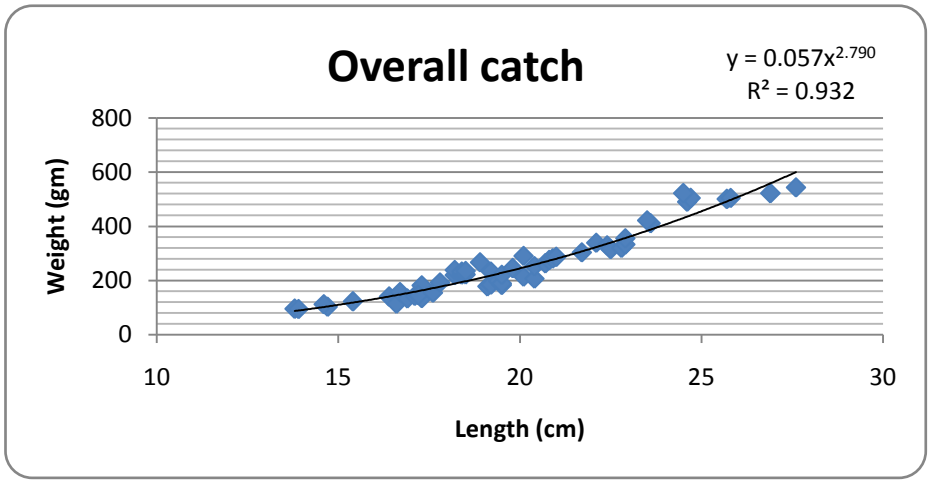

Figure 4. Length-weight relationship of total catch

4. CONCLUSIONS

The normal values of b usually remain between 2.5 and 4.0, in present study value of b ranged between 2.990 to 3.108 in different groups, where as overall population showed 2.790 value for b. On the basis of the present study, it may be concluded that weight and length relationship of *Catla catla* from Nanak Sagar Reservoir depict allometric growth pattern.

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6. ACKNOWLEDGEMENTS

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