Indian Journal of Ecology (2022) 49(3): 869-872
DOI: https://doi.org/10.55362/IJE/2022/3608

Manuscript Number: 3608
NAAS Rating: 5.79

Length Weight Relationship and Condition Factor of *Labeo rohita* (Ham.) Collected from Domesticated and Riverine Habitats

Vedika Masram, Prabjeet Singh, S.N. Datta and Grishma Tewari

Department of Fisheries Resource Management, College of Fisheries
Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141 004, India
E-mail: prabjeet29255@yahoo.co.in

***Abstract*:** The length weight relationship and condition factor of *Labeo rohita* individuals collected from two different habitats and four sites i.e S-1 (River Sutlej at Ropar Headworks), S-2 (Harike Pattan at the meeting point of Sutlej and Beas) , S-3 (Instructional fish farm of College of Fisheries, GADVASU, Ludhiana), S-4 (Aquaculture ponds from nearby farms of district Ludhiana) was estimated. A total 134 individuals of *L. rohita* comprising males and females of varying sizes were collected and the length weigh parameters were recorded. The mean average length ranged from 32.9–51.54 cm with corresponding mean weight from 431-1926 g at all the selected sites. The length and weight parameters of Rohu collected from all the sites showed a linear relationship as is evident from the correlation coefficient values ranging from 0.90 to 0.94 from S1-S4. The species showed negative allometric growth at all the four sites as depicted by exponent (b) values ranging from 2.70-2.93. The condition factor values ranged from 1.11-1.54 at all the selected sites. The condition factor values of 1.11 at the domesticated sites suggested that the habitat was more conducive in terms of optimum physicochemical factors and more availability of natural as well as the artificial feed leading to optimum growth and well-being of the fish.

***Keywords*:** Rohu, Allometric growth, Condition factor, b-values

The study of length-weight relationship (LWR) has a vast significance in fish biology studies as it helps to comprehend growth form, maturity, reproductive status and overall well-being of the fish (LeCren 1951). LWR can be a useful tool for biomass estimation as well as assessment of stock. LWR can simultaneously be used to assess intra species variation on the basis of body form of fish specimen collected from different habitats or varied geographical locations (Moutopoulos and Stergious 2002). The growth rate of fish species vary as per their genetic makeup, availability of food and the existing ecological conditions. Under such conditions, the cube law is used as one of the important measure to determine the growth of fish. For such estimates length and weight is used as an important indices since it elucidates that the fish weight increases thrice as compared to length. Condition factor (K) is a significant biological index which depicts how conducive water body is for fish growth. Condition factor (K) indicates the well-being of a fish with respect to its sexual maturity, availability and utilisation of food by fish. It is also useful in assessing even age and sex of some species (Anibeze 2000). Naeem et al (2010) has described the Length weight relationship and condition factor of *Catla catla* and *L. rohita* and stated that condition factor is greatly influenced by the availability of the food. Similarly, LWR and K of *L. rohita* were evaluated by Prasad et al (2012) from Govindgarh Lake. Rizvi et al (2012) described growth of *Labeo calbasu* in terms of length as a function of weight. Ujjania (2012) and Ujjania et al (2012) described condition factor and LWR of Indian major carps in their study from Rajasthan, lake. Present study examined the length-weight relationship and condition factor of Rohu collected from domesticated (private fish farms) and natural (River Sutlej) habitats of Punjab with an aim to see the effects of habitats, prevailing environment condition and availability of food on the well-being of the fishes.

MATERIAL AND METHODS

Study area: The River Sutlej is one of the major sources of capture fisheries in Northern India. It originates southwest of the Tibetan lakes of Rakasthal and Mansarover, enters the plains of Punjab at Ropar, flowing via the industrial city of Ludhiana, and finally meets with river Beas at Harike-Pattan. Besides this,the fish farming in Punjab is mainly based on carp polyculture. For the present study, the fish was collected from following four sites.

Site-1: River Sutlej at Ropar Headworks at the entry point of Sutlej in Punjab (30°59'09.7"N 76°31'13.4"E).

Site-2: Harike Pattan at the meeting point of Sutlej and Beas (31°08'33.6"N 74°56'55.2"E).

Site-3: Sample collection from Domesticated habitat. Instructional fish farm at College of Fisheries, GADVASU, Ludhiana (30°54'19.2"N 75°48'04.9"E)

Site-4: Aquaculture ponds from nearby farms of district Ludhiana.

Sample collection: Samples were collected from the above-designated sites from November, 2020-September, 2021. *Labeo rohita* was selected for the study due to its commercial importance, consumer preference and greater contribution towards the faunal diversity of river Sutlej besides being the main candidate species of carp culture. A total of 134 *L. rohita* individuals comprising males and females of varying in sizes were collected and the length weight parameters were recorded.

Length weight relationship: The total length (TL) was estimated as a distance from tip of snout upto the end of caudal fin (corrected up to 0.5 cm) with the help of measuring scale, while fish weight was recorded with the help of a digital balance (corrected up to 1.0 g) after eliminating water and mucus from the fish body. For any biological organism the Length-Weight relationship is generally non-linear and expressed in the form of parabolic equation

$W = a L^b$

where weight (W) is proportional to a certain power (b) of the length (L) and 'a' is the intercept. Values of the exponent 'b' provide information on fish growth. When 'b'=3, increase in weight is isometric. When the value of 'b' is other than 3, weight increase is allometric (positive if 'b' >3, negative if 'b' <3) (Berhan et al 2019).Relationship between these two variables were adjusted by transforming them into linear regression (Ricker 1975)

Condition factor: The Condition factor (K) generally, used for determining the physiological state of a fish, including reproductive capacity. The heavier the fish for a length, the higher its condition factor (K). It is calculated by using the formula by (Fulton 1904):

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

where K is the condition factor, W is the body weight of fish in grams, and L is the total length in centimetres (Bagenal et al 1978).

RESULTS AND DISCUSSION

The mean average length ranged from 32.9-51.54 cm with corresponding mean weight from 431-1926 g at the selected sites. During the present study, 'b' values ranged from 2.70-2.93 with corresponding 'r' values as 0.90-0.94 at the selected sites. *L. rohita* individuals showed negative allometric growth at all the selected sites.During the present study the values of b<3 clearly indicate that fishes are becoming slimmer with increase in length i.e the weight of fish is lower than cube of its length. Similar finding for *L. rohita* have been reported by several others researchers like Ujjania et al (2012) who stated that negative allometric growth patterns are characterised by fish becoming slimmer with increase in length. Many other workers have reported similar findings in cold water cyprinids where fish is becoming slimmer with increase in weight (Dar et al 2012). The values of correlation coefficient depicted a strong positive correlation between length and weight indicating an increase in length with corresponding increase in weight.

The values of condition factor (K) ranged from 1.11 to 1.54 with maximum and minimum values at S1and S4, respectively. K values greater than 1 reveal that the

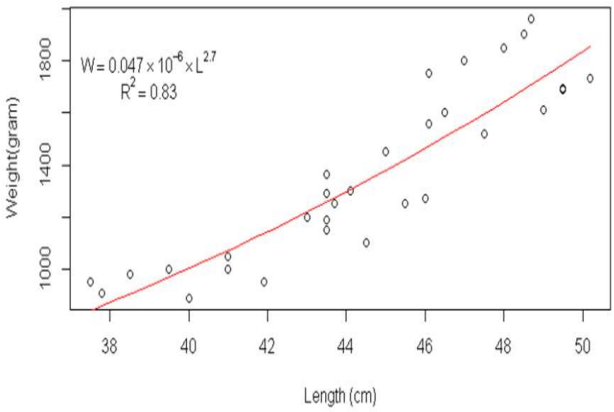

Fig. 1. Length-weight relationship of *L. rohita* from Site-1

Table 1. Length-weight relationship and condition factor (K) of *L. rohita* from four different habitats

Parameters	Sampling sites			
	Natural population		Domesticated population	
	Site- 1	Site- 2	Site-3	Site-4
Mean length (cm)	44.5	51.54	32.9	33.8
Mean weight (g)	1361.75	1926.74	394.7	431.91
Growth coefficient 'b'	2.70	2.81	2.93	2.75
Correlation coefficient 'r'	0.91	0.94	0.92	0.90
Coefficient of determination 'R^2'	0.83	0.85	0.84	0.81
Condition factor 'K'	1.54	1.40	1.11	1.11
Growth type	Negative allometric growth	Negative allometric growth	Negative allometric growth	Negative allometric growth

environment of the selected habitats were conducive for the growth and survival of the candidate fish species, however the domesticated fish species were getting more conducive environment as revealed by the condition factor value equaling near to 1.Present study indicated that the growth of *L. rohita* from domesticated as well as the natural habitats is satisfactory and same results have been recorded by Saxena et al (2013) for Rohu (1.03-1.46) from Raipur reservoir

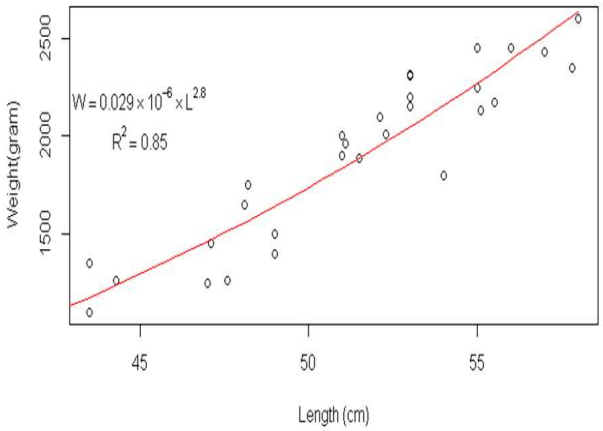

Fig. 2. Length-weight relationship of *L. rohita* from Site-2

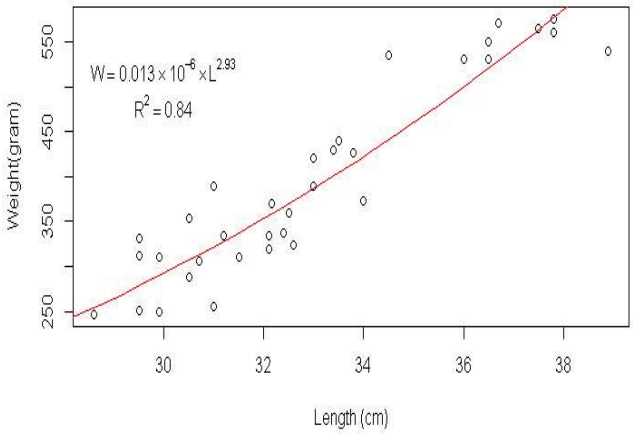

Fig. 3. Length-weight relationship of *L. rohita* from Site-3

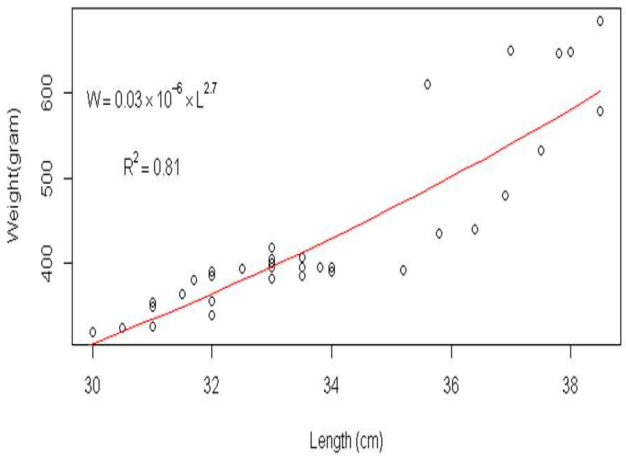

Fig. 4. Length-weight relationship of *L. rohita* from Site-4

Gwalior. Kaur and Singh (2017) have reported condition factor in the range of 1.33 to 1.36 for *C. catla* from river Sutlej Punjab.

CONCLUSION

The length and weight parameters of Rohu collected from all the sites showed a linear relationship as is evident from the correlation coefficient values. The species showed negative allometric growth at all the four sites as depicted by exponent values. The condition factor values recorded in the present study clearly revealed that the environment at all the habitats was conducive for the well-being of the fish but comparatively it was more conducive at the domesticated habitats when compared to riverine environment. The domesticated habitats are well managed since fishes are cultured under semi-intensive conditions with all the inputs like balanced ration is being supplemented externally, thus making a more favorable environment for fish growth and reproduction. The present study is of paramount importance since it proves information on pattern of fish growth, its general well-being and can be of helpful for fishery managers in fish stock assessment and devising management plans for sustainable resource conservation.

ACKNOWLEDGEMENT

The authors are highly thankful to Indian Council of Agricultural Research (ICAR) for providing NTS scholarship during the study. The financial support and research facilities provided by GADVASU to carry out this study are duly acknowledged.

REFERENCES

Anibeze CIP 2000. Length-weight relationship and relative condition factor of *Heterobranchus longifilis* (Valencienness) from Idodo River, Nigeria. NAGA, the *ICLARM Quarterly* **23**: 34-35.

Bagenal T 1978. *Methods for assessment of fish production in fresh waters* (No. 597.052632 M4 1978).

Berhan A , Birhanu B, Misikire T and Abraham A 2019. Length-weight relationships and condition factor of Nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758) (Cichlidae) in Koka Reservoir, Ethiopia. *International Journal of Fisheries and Aquatic Research* **4**(1): 47-51.

Dar SA, Najar AM, Balkhi MH, Rather MA and Sharma R 2012. Length weight relationship and relative condition factor of *Schizopyge esocinus* (Heckel, 1838) from Jhelum River, Kashmir. *International Journal of Aquatic Science* **3**(1): 29-36.

Fulton TW 1904. The rate of growth of fishes. *22nd Annual Report of the Fishery Board of Scotland* **3**: 41-241.

Kaur N and Singh P 2017. Gonadosomatic Index (GSI), Gastrosomatic Index (GaSI), Hepatosomatic Index (HSI) and Condition Factor (K) of Selected Cyprinid Fishes of River Sutlej in Response to Pollution. *Research Journal of Agricultural Sciences* **8**(2): 294-299.

LeCren ED 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *Journal of Animal Ecology* **20**: 219-223.

Moutopoulos DK and Stergious KI 2002. Length-weight and length-length relationships of fish and species from Aegean Sea

(Greece). *Journal of Applied Ichthyology* **18**: 200-203

Naeem M, Salam A, Ishtiaq A and Shafique S 2010. Length weight and condition factor relationship of farmed hybrid (*Catla catla* x *Labeo rohita*) from Multan, Pakistan. *Sindh University Research Journal Science Series* **42**(2): 35-38.

Prasad US, Prasad PD and Amitabh P 2012. Length weight relationship and condition factor of *Labeo rohita* in Govindgarh Lake, Rewa (M.P.). *Indian Journal of Research* **1**(12): 185-187.

Ricker WE 1975. Computation and interpretation of biological statistics of fish populations. *Bulletin Fisheries Research Board of Canada* **191**: 1-382.

Rizvi AF, Amitabh CD and Singh KP 2012. Growth pattern of *Labeo calbasu* affected by socio-geographical condition of the riverine habitat. *Current Research Journal of Biological Science* **4**(3): 250-257.

Saxena M and Saksena DN 2013**.** Growth of Indian major carps and a Chinesecarps in extensive culture system in Raipur Reservoir, Gwalior, M.P. India. *Journal of Fisheries and Aquaculture* **4**(1): 75-81.

Ujjania NC 2012. Comparative age and growth of Indian majors carp (*Catla catla*) in selected water bodies of Southern Rajasthan. *Research Journal of Recent Sciences* **1**: 17-22.

Ujjania NC, Kohli MPS and Sharma LL 2012. Length weight relationship and condition factor of Indian major carp (*C. catla*, *L. rohita*, *C. Mrigala*) in Mahi Bajaj Sagar, India. *Research Journal of Biology* **2**(1): 30-36.

Received 07 January, 2022; Accepted 22 April, 2022