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# Length-weight relationship of 10 freshwater fish species from Mahi Bajaj Sagar Reservoir (Gemon Pool), Banswara, Rajasthan.

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***Abstract***

This study delineates the length-weight (LWR) connection of the Gemon Pool backwater in the Mahi Bajaj Sagar reservoir in Banswara. Samples were collected from the Gemon Pool from March 2020 to February 2021. One hundred specimens were tested to determine the length-weight connection of ten distinct fish species from various families, and a descriptive study was accompanied by them. A descriptive analysis of the length-weight connection among 10 distinct fish species from various families was conducted, involving a total sample of 100 specimens. The regression parameters (a and b) for the length-weight relationship, along with the coefficients of determination ($r^2$) for significant freshwater fish species, including *Channa striata, Labeo calbasu, Tilapia mossambica, Chitala chitala, Ompok pabda, Catla catla, Labeo rohita, Cirrhinus mrigala, Heteropneustes fossilis*, and *Pangasianodon hypophthalmus*, are presented in Table 1. This is apparent from figures (a) and (j), depicting the coefficients of determination ($r^2$) for all 10 species. The b' value in this study varied from 0.46204 (lowest; *Pangasianodon hypophthalmus*) to 4.433752 (highest; *Tilapia mossambica*).



**Keywords:** ***length-weight relationship, Gemon pool, Banswara, freshwater fishes, coefficient of determination.***

## Introduction

Fish growth is generally evaluated by measuring the increase in length and weight, as these are the primary metrics utilised to monitor population growth [1]. Lightweight Regression (LWRs) can be employed to detect potential discrepancies among different unit stocks of the same species, provided that all units are assessed using the same completely standardised sampling methodology [2]. Furthermore, they can provide insights into the status of the stock [3, 4]. Data regarding LWRs for numerous tropical and subtropical fish species is scarce. Recent research has concentrated on the length-weight correlations (LWRs) of indigenous freshwater fish species in Indian waters [5, 6]. Data concerning the length-weight correlations (LWRs) of fish species in Gemon Pool, Banswara, Rajasthan, India, is insufficient. The present study sought to determine Length-Weight Ratios (LWRs) for ten fish species inhabiting the Gemon Pool. No prior documentation of the length-weight correlations (LWRs) for 10 fish species was found in FishBase. New maximum total length measurements have been documented for eleven species from Gemon Pool.

Length-weight relationships (LWR) can estimate the weights and lengths of fish species based on a single known value. Biometric measurements like weight and length are commonly collected in research that tracks animal populations [7]. Despite the diverse array of fish species in the Yangtze River, there is a paucity of data regarding length-weight relationships (LWRs). Length-weight relationships (LWRs) for six species were obtained from FishBase for comparative analysis, as referenced in [8]. The Length-Weight Relationship (LWR) data for freshwater fish is essential due to the difficulties and inaccuracies associated with getting precise weight measurements in the field for freshwater fish in developed areas [9]. The length-weight association of Indian major carp has been studied by numerous researchers across various regions of India, including [10, 11, 12, 13, 14, 15]. [16, 17, 18, 19] have investigated the length-weight connection of freshwater fish from several water bodies in Rajasthan.

## MATERIALS AND METHODS

### Study site

The research was conducted in the Gemon Pool backwater of the Mahi Bajaj Sagar reservoir in Banswara. Gemon Pool is located on the Mahi River, adjacent to the Danpur-Ratlam main road, 16 km from Banswara city. The Mahi River offers a conducive habitat for freshwater species, mainly freshwater fish.

### Collection of fish samples

Samples were collected from the Gemon Pool from March 2020 to February 2021 using various standard fishing apparatus, including cast nets (mesh size 1.0 to 2.0 cm), seine nets (mesh size 1.5 to 2.5 cm), and square lift nets (mesh size about 1.0 cm). During fish collection, efforts were undertaken to guarantee a proportional representation of individuals from all size categories within each population in the sample. The specimens were immediately refrigerated in ice post-collection and thereafter stored in 10% formalin upon arrival at the laboratory to avert degradation. Specimens were extracted from the formalin solution and positioned on a plastic tray. The fish was rinsed under running water for 30 minutes to eliminate debris, formalin odour, and excess moisture. The fish were allowed to air dry at ambient temperature. The specimens were identified in accordance [20, 21].

### Data analysis

The variables that constitute the basis of length-weight relationships were determined using the following equation [22, 23, 24]:

**$W = a\ Lb$**

Where

W = weight of the fish in grams

L = total length in centimetres

a = constant

b = the length exponent

Coefficients of regression The parameters 'a' and 'b' in the length-weight correlations were ascertained by linear regression utilising the equation Log TW = log a + b log TL, following the logarithmic transformation of the weight and length data. Statistical significance, 95% confidence intervals for 'a' and 'b', and the coefficient of determination ($r^2$) were computed. The data were evaluated statistically with Microsoft Office Excel 365, Graphpad 8, and SPSS 20.

### Result and Discussion

100 specimens were analysed to calculate the length-weight relationship of 10 different fish species belonging to different families, along with a descriptive analysis. The length-weight relationship of 10 different fish species belonging to different families was shown along with the descriptive analysis, and for this purpose, a total of 100 specimens were sampled. The regression parameters (a and b) of the length-weight relationship, coefficients of determination ($r^2$) of important freshwater fish species *Channa Straita, Labeo calbasu, Tilapia mossambica, Chitala chitala, Ompok pabda, Catla catla, Labeo rohita, Cirrhinusmrigala, Heteteroneustus fossilis, Pangasianodon hypophthalmus* are given in table 1. This is evident from figures (a) to (j) of the coefficients of determination ($r^2$) for all ten species. In the present study, the b' value ranged from 0.46204 (minimum; *Pangasianodon hypophthalmus*) to 4.433752 (maximum; *Tilapia mossambica*) in 2020-21.

During the year 2020-21, average length and weight were observed for the fishes *Channa Straita* (TL=27.09cm, TW=401.33g), *Labeo calbasu* (TL=40.1cm, TW=1134.66g), *Tilapia mossambica* (TL=31.86cm, TW=1770.41g), *Chitala chitala* (TL=33.95cm, TW=394.25g), *Ompok pabda* (TL=21.87cm, TW=359g), *Catla catla* (TL=25.125cm, TW=866.35g), *Labeo rohita* (TL=26.02cm, TW=709.58g), *Cirrhinus mrigala* (TL=23.81cm, TW=330.51g), *Heteteroneustus fossilis* (TL=21.41cm, TW=174.16g), *Pangasianodon hypophthalmus* (TL=32.16cm, TW=344.41g).

**Table 1 - Monthly variations of length and weight of fishes at Gemon Pool, Banswara**

| Fish Species | Length (TL) | Weight (TW) | log10 (Total length) | log10 (Total weight) | a | b | SE | $R^2$ |
|---|---|---|---|---|---|---|---|---|
| ***Channa Straita*** | 27.09 | 401.33 | 1.432836 | 2.603505 | 0.903762 | 1.170257 | 0.153043 | 0.31 |
| ***Labeo calbasu*** | 40.1 | 1134.66 | 1.603235 | 3.054868 | -2.32348 | 3.334607 | 0.164592 | 0.369 |
| ***Tilapia mossammbica*** | 31.86 | 1770.41 | 1.503337 | 3.248075 | -2.04589 | 3.490984 | 0.200698 | 0.447 |
| ***Chitala chitala*** | 33.95 | 394.25 | 1.53084 | 2.595772 | 0.910265 | 1.095939 | 0.089394 | 0.362 |
| ***Ompok pabda*** | 21.87 | 359 | 1.339948 | 2.555094 | 1.73913 | 0.602792 | 0.096987 | 0.134 |
| ***Catla catla*** | 25.125 | 866.35 | 1.400106 | 2.937698 | -1.97373 | 3.444519 | 0.279547 | 0.315 |
| ***Labeo rohita*** | 26.02 | 709.58 | 1.415391 | 2.851003 | -3.41452 | 4.3118 | 0.339344 | 0.437 |
| ***Cirrhinusmrigala*** | 23.81 | 330.51 | 1.376881 | 2.519193 | -2.26532 | 3.341055 | 0.232803 | 0.679 |
| ***Heteteroneustus fossilis*** | 21.41 | 174.16 | 1.330752 | 2.240965 | 0.824593 | 1.028159 | 0.264387 | 0.156 |
| ***Pangasianodon hypophthalmus*** | 32.16 | 344.41 | 1.507406 | 2.537084 | 1.835824 | 0.46204 | 0.081819 | 0.155 |

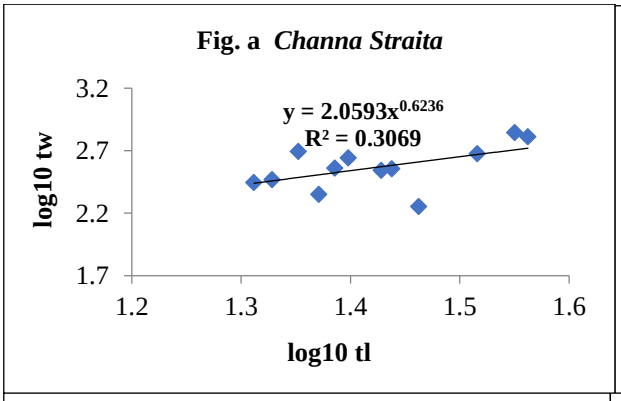



**Fig. a *Channa Straita***

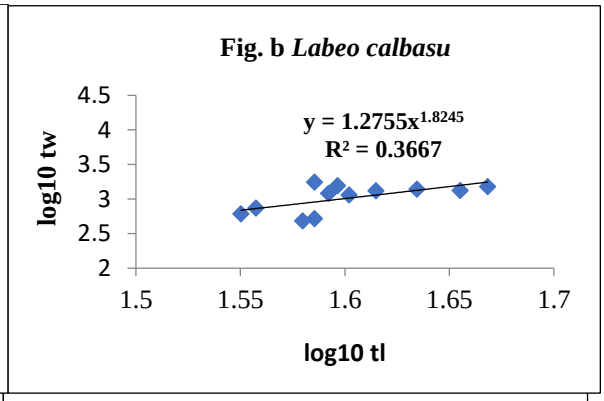



**Fig. b *Labeo calbasu***

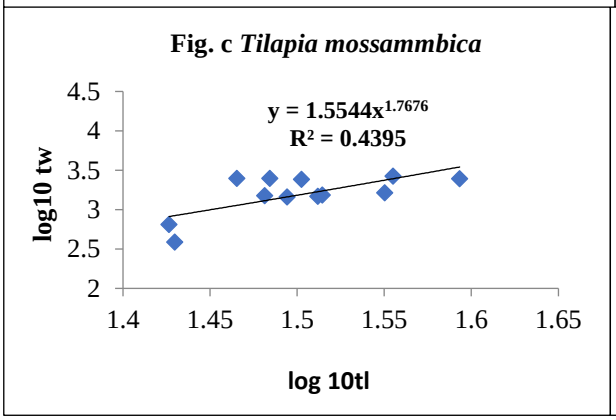



**Fig. c *Tilapia mossammbica***

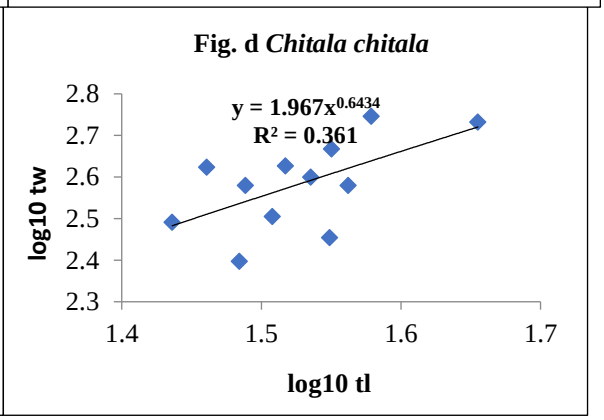
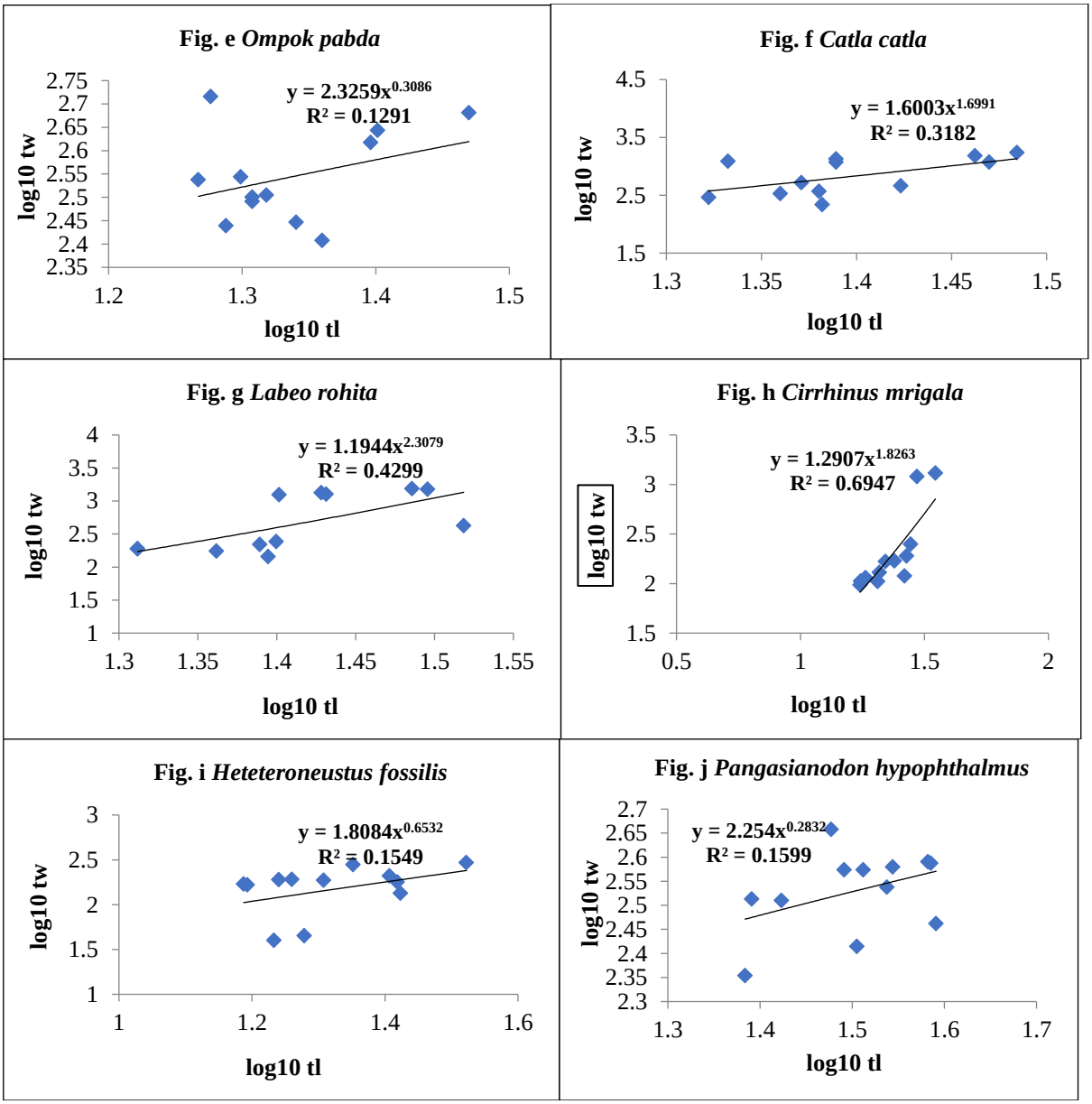



**Fig. d *Chitala chitala***




[25] proposed that samples from Sone Beel indicate a strong correlation between length and weight in *L. rohita* and *L. gonius*. The fish strictly follow the cube law, as evidenced by samples from various locations with different environmental conditions, all showing a weight increase proportional to the cube of their length. The conditions at the collecting location and habitat exhibit an essentially isometric growth pattern, promoting feeding and optimal growth for the fish.

[26] found that the exponent value for *Cyprinus carpio* in a tropical lake was 3.75, while for *catla* in Mysure Lake, it ranged from 1.5 to 2.17. [27, 28] reported a regression coefficient of 3.0 from Lake Nainital in India. [29] found regression coefficients ranging from 2.97 to 3.13 in *rohu* fish from various water bodies in southern Rajasthan. An inverse relationship in growth rate has been noted in *C. reba* fish species from Lower Anicut, Tamil Nadu, with a 'b' value of 2.363 [30].

[31] documented a 'b' value of 2.9 for *Labeo rohita* at Govindgarh Lake, Rewa (M.P.). The study indicated that the 'b' value fell within the expected range of 2.5-3.5. Diverse factors such as environment, maturation stage, sex, nutrition, growth phase, and stomach fullness can influence this variation [24].

Many fish species demonstrated a negative allometric growth trend (b<3) in this research. *Labeo calbasu, Tilapia mossambica, Catla catla, Cirrhinus mrigala, Labeo rohita, and Cirrhinus reba* had a 'b' value, signifying positive allometric growth. The R2 value in this study is within the anticipated range, indicating that the model is appropriate for evaluating the growth and health status of the species being examined. New data on these freshwater fish species is essential for monitoring their populations and efficiently executing management strategies, regulating invasive species, using inland/artisanal fisheries, or conserving at-risk species.

[32] indicated that *Labeo rohita* at Daya reservoir, Rajasthan, exhibited n' values between 2.861 and 3.215, whilst *Catla catla* displayed values ranging from 2.713 to 3.292. The research identified a significant positive link between total body length and body weight in length groups A (24-29 cm) and C (36-41 cm) of *rohu-catla* hybrid fish in Lake Udaisagar, Udaipur, Rajasthan. The correlation was substantial, with r values of 0.803 and 0.748, respectively ($P < 0.01$) [18]. In groups A, B, and D, the *rohu-catla* hybrid had negative allometric growth, transitioning to positive allometric growth in group C. This pertains to the findings presented by [17].

**References**


1. Jobling, M. 2002. Environmental factors and rates of development and growth. In P. J. B. Hart, & J. D. Reynolds (Eds.), Handbook of fish biology and fisheries, Vol. 1 (pp. 107–109). Oxford: Blackwell Publishing.
2. King, M. 2007. Fisheries biology, assessment and management, 2nd ed. (pp. 189–194). Oxford: Blackwell Publishing.
3. Bagenal, T.B. & F.W. Tesch. 1978. Age and growth. In T. Bagenal (Ed.), Methods for assessment of fish production in fresh waters, 3rd ed. (pp. 101–136). IBP Handbook No. 3. Oxford: Blackwell Science Publications.
4. Gonzalez Acosta, A.F., G. De La Cruz Aguero, & J. De La Cruz Aguero. 2004. Length–weight relationships of fish species caught in a mangrove swamp in the Gulf of California (Mexico). Journal of Applied Ichthyology, 20: 154–155.
5. Borah, S., B.K. Bhattacharjya, B.J. Saud, A.K. Yadav, D. Debnath, S. Yengkokpam, P. Das, N. Sharma, N.S. Singh & K.K. Sarma. 2017. Length–weight relationship of six indigenous fish species from Deepor beel, a Ramsar site in Assam, India. Journal of Applied Ichthyology, 33: 655–657.
6. Sandhya, K.M., M.A. Hassan, S. Kumari, P. Mishal, L. Lianthuamluaia, V. Kumar, M. Aftabuddin, & D.K. Meena. 2016. Length–weight relationships of four indigenous freshwater fish species from Khalsi wetland in lower Ganga basin, West Bengal, India. Journal of Applied Ichthyology, 32: 505–506.
7. Zuchi, N., C. Röpke, A. Shibuya, T. Farago, M. Carmona, J. Zuanon & S. Amadio. 2020. Length-weight relationship of fish species from Central Amazon floodplain. Journal of Applied Ichthyology, 36(6): 837–841. https://doi.org/10.1111/jai.14082.
8. Froese, R. & D. Pauly. 2021. FishBase. World Wide Web electronic publication. Retrieved from https://www.fishbase.org.
9. Alberto, A., A.F. Camargo, J.R. Verani, O.F. Costa & M.N. Fernandes. 2005. Health variables and gill morphology in the tropical fish Astyanax fasciatus from a sewage-contaminated river. Ecotoxicology and Environmental Safety, 61: 247–255. https://doi.org/10.1016/j. ecoenv.2004.08.009
10. Mahapatra, B.K., M. Pal, S. Bhattacharjee & W.S. Lakra. 2014. Length-weight relationship and condition factor of an indigenous ornamental fish, Pseudambassis ranga (Hamilton, 1822) from East Kolkata Wetland. International Journal of Fisheries and Aquatic Studies, 2: 173–176.
11. Baitha, R., A. Sinha, S.K. Koushlesh, T.N. Chanu, K. Kumari, P. Gogoi, M.H. Ramteke, S. Borah & B.K. Das. 2018. Length-weight relationship of ten indigenous freshwater fish species from Gandak River, Bihar, India. J. Appl. Ichthyol., 34:233–236. https://doi.org/10.1111/jai.13555.
12. Pise, M., P.A. Gorule, S. Kharat, S.D. Tapkir, C. Verma, P. Kumkar & S.M. Gosavi. 2018. Length-weight relationships of four freshwater fishes from northern Western Ghats of India. Journal of Applied Ichthyology, 34(6): 1394-1396.. https://doi.org/10.1111/jai.13820.
13. Gorule, P.A., M. Pise, S.S. Kharat, S.D. Tapkir, P. Londhe, S. Sarkar & S.M. Gosavi. 2019. Length–weight relationships of nine freshwater fishes from five rivers of the Western Ghats of India. J Appl Ichthyol., 35:1044–1046. https://doi.org/10.1111/jai.13887.
14. Ramulu, D., J. Paulraj, J.K. Natarajan & S. Chandran. 2022. A note on length-weight relationship and relative condition factor of freshwater fish species inhabiting Thamirabarani River, Eastern Slope of Western Ghats, Southern Tamil Nadu, India, Journal of Entomology and Zoology Studies, 10(4): 101-104
15. Johal, M.S. & J.S. Kingra. 1992. Length-weight relationship of three Indian major carps from Jaisamand Lake, Udaipur, Rajasthan, India. Bioved., 3(1): 55-56.
16. Ujjania, N.C. 2012. Comparative age and growth of Indian major carp (catla catla ham. 1822) in Selected water bodies of Southern Rajasthan, India, Research Journal of Recent Sciences, ISSN 2277 – 2502, 1: 17-22.
17. Gokhale, G.S., S.K. Sharma, B.K. Sharma & B. Upadhyay. 2015. Length-weight relationship and condition factor of rohucatla hybrid in Lake Udaisagar, Udaipur, Rajasthan. Int. J. Fauna Biol. Stud., 2(5): 1-5.

18. Balai, V.K., L.L. Sharma & N.C. Ujjania. 2017. International Journal of Fisheries and Aquatic Studies, 5(1): 1-4.
19. Fischer, W. & G. Bianchi. 1984. FAO Species identification sheets for fishery purposes. Western Indian Ocean (Fishing Area 51), Rome: Food and Agricultural Organization of the United Nations, II.
20. Talwar, P.K. & R.K. Kacker. 1984. Commercial Sea fishes of India, Edited by Director, Zoological Survey of India, Calcutta-700016, 997.
21. Le Cren, E.D. 1951. The length-weight relationships and seasonal cycle in gonad weight and condition in the perch (Perca fluviatilis). Journal of Animal Ecology, 20: 201-219.
22. Pauly, D. 1983. Some simple methods for the assessment of tropical fish stocks. FAO. Fisheries Technical Pap. FAO, Rome, 234.
23. Froese, R. 2006. Cube law, condition factor and weight–length relationships: history, meta-analysis and recommendations. Journal of Applied Ichthyology, 22: 241-253.
24. Das, B.K., R.K. Ngasepam, B. Dutta & D. Kar. 2014. Length - Weight Relationship of Labeo rohita and Labeo gonius (Hamilton-Buchanan) from Sone Beel, The Biggest Wetland of Assam, India. J. Environ. Res. Develop., 8(3).
25. Sachidanandmurthy, K.L., B.N. Madhuranath & B.K. Chethan. 2013. Length-weight relationship and condition factor of two carp species in Shettikere Lake of Mysore. India. Poll. Res., 32(1): 21-24.
26. Negi, R.K. & T. Negi. 2009. Length-weight relationships of Puntius conchonius from lakes of Kumaon Himalaya Uttarakhand State, India. Pb. Univ. Res. J. (Sci.)., 59: 71-75.
27. Negi, R.K. 2013. Length-weight relationship and condition factor of Labeo rohita from Bhagwanpur fish pond Roorkee Uttarakhand, India. Biolife., 1(4): 170-171.
28. Ujjania, N.C., L.L. Sharma, V.K. Balai. 2013. Length-weight relationship and condition factor of Indian major carp (Labeo rohita Ham., 1822) from southern Rajasthan, India. App. Biol. Res., 15(2): 1-5.
29. Mathialagan, R., R. Sivakumar, N. Rajasekaran & S. Chandrasekar. 2014. Length-frequency distribution and length-weight relationship of reba carp Cirrhinus reba (Hamilton, 1822 Cypriniformes: Cyprinidae) from Lower Anicut, Tamil Nadu, India. International Journal of Fisheries and Aquatic Studies, 2(2): 115-125.
30. Prasad, U., S. Patel, D.P. Patel & D. Patel. 2012. Length-weight relationship and condition factor of L. rohita in Govindgarh Lake, Rewa (M.P.). Indian Journal of Research, 1(12): 185-187.
31. Rajkumar. 2015. Studies on some aspects of fish biology and fisheries potential in relation to current water quality status of Daya reservoir, Udaipur, Rajasthan. Ph.D. Thesis. Maharana Pratap University of Agriculture and Technology, Udaipur.