

## Short Communication

# Length Weight Relationship of Five Cyprinidae Fish Species from Ranikot Lotic Water Body in Sindh, Pakistan

Wakeela Gul Mughal<sup>1</sup>, Muhammad Younis Laghari<sup>2\*</sup>, Zameer Ali Palh<sup>2</sup>, Summaiya Rajput<sup>2</sup>, Ikram Hussain<sup>3</sup>, Punhal Khan Lashari<sup>2</sup> and Maryam Sheikh<sup>2</sup>

<sup>1</sup>Department of Zoology, University of Sindh, Jamshoro

<sup>2</sup>Department of Freshwater Biology and Fisheries, University of Sindh, Jamshoro

<sup>3</sup>Directorate of Fisheries, Gilgit Baltistan

## ABSTRACT

The length-weight relationship (LWR) is the most important parameter; those are applied for the assessment of fish health and growth. The present study was carried out to know the gap and provide useful information for fish management and conservation in the Ranikot lotic water body. Five Cyprinidae fish species (*Labeo bata*, *L. pangusia*, *L. barbus*, *L. potail*, and *L. porcellus*) were collected from the lotic water body to calculate the LWR in order to assess the population status of the lotic water body. All of the five species showed significant positive correlation ( $r^2 > 0.5$ ) between length and weight. The values of the growth exponent 'b' in the LWR ranged from 2.089 to 3.193. LWR indicated an isometric pattern of growth for *L. barbus* ( $b=2.959$ ) and *L. potail* ( $b=2.718$ ), while a little positive allometric growth ( $b=3.193$ ) was observed in *L. pangusia*. Furthermore, the negative allometric growth was observed for *Labeo bata* ( $b=2.337$ ) and *L. porcellus* ( $b=2.089$ ). While, the regression value shows median correlation ( $r^2 < 0.8$ ) except *L. barbus* ( $r^2=0.852$ ) for all other four species. The present investigation is likely to be useful for application in fish biology and fisheries management.

## Article Information

Received 06 April 2023

Revised 05 May 2023

Accepted 24 May 2023

Available online 26 July 2023  
(early access)

## Authors' Contribution

MYL designed the experiment and guided authors from sampling to final draft of the article. WGM, SR and IH collected the samples and measured the traits of fishes. ZAP and MS assisted the authors for statistical analysis and graph development. WGM, PKL and MYL wrote the article and finalized for publication.

## Key words

Length-weight relationships, Cyprinidae Fish, Stream water, Ranikoat, Sindh

Fish is a vital dietary constituent as of its high protein value. Fish body length and body weight are two functional experimental procedures in stock estimation and more commonly in different aspects of fields such as population ecology, community and ecosystem ecology studies (Giarrizzo *et al.*, 2015; Baitha *et al.*, 2018). Fish growth is generally calculated through the increase of length and weight, which are used to conclude population development. The length-weight relationship (LWR) is a mathematic form that allocates for the exchange of length for weight and weight for length in reserve assessment models, as well as the assessment of biomass from the length distribution (Oscoz *et al.*, 2005). The LWR is used to conclude feasible variation among separate stock units of a species or within a species, supplied all units are studied

with the similar fully standardized sampling method (Dieb-Magalhães *et al.*, 2015; Baitha *et al.*, 2018). LWR is as well used for approximation the condition factor of fish, which is utilized to evaluate the fitness of fish populations. A high condition factor points out that a fish is heavier, comparatively than a fish of the similar length with a lower condition factor, and consequently all time passes on to a difference from the average LWR for a population (Le Cren, 1951; Froese, 2006; Freitas *et al.*, 2017). The analysis of LWR and condition factors of fish populations are imperative tools to maintain the normal management of fishing reserves and can facilitate in the completion of public policies (Dieb-Magalhães *et al.*, 2015; Giarrizzo *et al.*, 2015; Silva *et al.*, 2015; Baitha *et al.*, 2018). In biometric studies, it is essential to conclude the growth individuality associated with the weight and length of the fish (Morato *et al.*, 2001). Furthermore, to the condition of health of the species controlled by many biological as well as environmental factors. The value of determining LWRs in fish has been accentuated by several studies. It gives information regarding the growth pattern, general health, habitat situation, life record, fish size, and condition, as well as morphological characteristics of the fish (Schneider *et al.*, 2000; Froese, 2006). LWRs are

\* Corresponding author: laghariyounis@yahoo.com  
0030-9923/2023/0001-0001 \$ 9.00/0



Copyright 2023 by the authors. Licensee Zoological Society of Pakistan.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

elucidated in a formula, which allocates the assessment of the fish weight (W) to a particular length (L), and may be affected by the development of gonads, feeding speed along with the condition of maturity (Beyer, 1987). In addition, the length-length relationships are also significant in fisheries management and conservation (Moutopoulos and Stergiou, 2002; Hossain *et al.*, 2006). The formula for allometric growth was first intended by Huxley (1924) and explained the relationship between length and weight. Condition factors and LWRs are important tools in fish biology, physiology, ecology, fisheries assessment, and conservation. Condition factors are used for comparing the condition, fitness, or well-being of fish.

The present study was designed to investigate the population status of Ranikoat water body. The mountain stream of Ranikot is situated at around 30km south west of Sann Railway Station, 124 km from Hyderabad, Sindh, Pakistan. The site territory goes under Khirther Range which falls under the Sahara-Sindhian area (Ali and Qaiser, 1986). The small stream goes through the focal point of the post from the west to the east of Ranikot fort. It flows throughout the median region of the fort. The local community is fully dependant on this water source for both drinking and agriculture purposes. The water flow and size of the stream vary in this valley depend upon the season.

#### Materials and methods

The fish samples were collected from the Ranikot lotic water body, 25°45'N - 26°00'N long, 67°45'E - 68°00'E, from Jan 2021-Dec2021 (Supplementary Fig. 1). The samples were collected by using hand and drag nets.

A total of 860 specimens of *Labeo bata*, *L. barbuis*, *L. pangusia*, *L. porcellus*, and *L. potail* were selected for LWR and condition factor study. Fish were measured for total length (cm) and body weight (g) for determination of LWR. Weight of fish was weighed by using a digital electronic balance. For each specimen, length and weight were measured to the nearest 0.1 centimeter and gram, respectively.

The data of LWR was calculated by the formula following Le Cren (1951) as  $W = a L^b$ , Where 'W' is the weight of fish in grams, 'L' is the length of fish in millimeters, while 'a' and 'b' are constants.

The data on total length and weight were statistically treated by the method of least squares using the equation of Le Cren (1951) as  $\text{Log } W = \log a + b \log L$ .

#### Results and discussion

The LWR of five cyprinidae fish species belonging to the family Cyprinidae were calculated and analyzed in the present study (Table I, Supplementary Fig. 2). In the result, the length and weight show significantly positive

correlation ( $r^2 \geq 0.5$ ) in the all species. The value of 'b', the growth exponent resulted 2.089-3.193 for the LWR. A little positive allometric growth ( $b=3.193$ ) was observed in *L. pangusia*, while LWR indicated isometric pattern of growth in *L. barbuis* ( $b=2.959$ ) and *L. potail* ( $b=2.718$ ) and negative allometric growth was observed in *Labeo bata* ( $b=2.337$ ) and *L. porcellus* ( $b=2.089$ ). Furthermore, the regression value shows median correlation ( $r^2 < 0.8$ ) except *L. barbuis* ( $r^2=0.852$ ) for all other four species.

**Table I. Descriptive statistics and parameters of LWR for five freshwater fish species belonging to the family Cyprinidae, collected from Ranikot lotic water body in Sindh, Pakistan.**

Species	N	TL range (cm)	W range (g)	b	a	r <sup>2</sup>
<i>Labeo bata</i>	200	21.0-25.6	11.6-29.8	2.337	0.337	0.688
<i>L. pangusia</i>	180	10.2-21.2	23.0-99.7	3.193	0.874	0.771
<i>L. barbuis</i>	170	4.1-23.2	2.5-128	2.959	0.848	0.852
<i>L. potail</i>	160	10.9-22.3	32.0-80.9	2.718	0.776	0.629
<i>L. porcellus</i>	150	10.0-19.1	23.0-60.7	2.089	0.721	0.663

TL, Total length; W, weight; N, number of specimens; a, intercept; b, regression slope; r<sup>2</sup>, coefficient of determination.

The present findings may also support the Froese (2006), whereas *Trachelyopterus galeatus* and *Triporthetus angulatus* showed positive allometric growth. Furthermore, *Aequidens tetramerus* and *A. nuchalis* which presented 'a' and 'b' coefficient <2.5, and *T. galeatus*  $b \geq 3.5$ .

The growth pattern of fish species is changeable; depending on the season, food availability, population, sex, or physiology (Silva *et al.*, 2015; Giarrizzo *et al.*, 2015; Dieb-Magalhães *et al.*, 2015; Freitas *et al.*, 2017). Hence, the LWR in fishes is affected by a number of factors including season, habitat, population, gonad maturity, sex, diet, stomach fullness, health, sample size, preservation techniques and locality (Esmaeili, 2001; Froese, 2006), differences in the LWRs could potentially be attributed to the combination of one or more of the factors given above.

In the present investigation, it is proved that the growth of fishes is not ideal. There might be various reasons, as discussed above. Furthermore, a detailed study is required to investigate the major reasons. The present outcomes can serve as baseline data for species with no earlier information concerning length-weight relationships and for association in future studies of Ranikot water body. However, these species might be cultured or develop techniques to improve the health of species in this stream water. Furthermore, our results contribute to assess and evaluate the improvement of fisheries in the

stream reservoir. This site is ideal for sport fishing as well as for aquaculture purposes. If some positive efforts would be taken in interest, then the government and local communities might earn much more.

#### Acknowledgement

Authors are grateful to the Department of Freshwater Biology and Fisheries for providing laboratory facilities for completing the experiment.

#### Funding

The study received no external funds.

#### IRB approval and ethics statement

The authors declare that the experiment was approved and conducted following the recommendation of the Institutional Ethic Board (IEB) for Care and Use of Animals for Scientific Purposes and Academic Ethics Committee of University of Sindh, Jamshoro.

#### Supplementary material

There is supplementary material associated with this article. Access the material online at: <https://dx.doi.org/10.17582/journal.pjz/20230406090440>

#### Statement of conflict of interest

The authors have declared no conflict of interests.

#### References

- Ali, S.I. and Qaiser, M., 1986. *Proc. R. Soc. Edinb.*, **89**(B): 89-101. <https://doi.org/10.1017/S0269727000008939>
- Baitha, R., Sinha, A., Koushlesh, S.K., Chanu, T.N., Kumari, K., Gogoi, P., Ramteke, M.H., Borah, S. and Das, B.K., 2018. *J. appl. Ichthyol.*, **34**: 233-236. <https://doi.org/10.1111/jai.13555>
- Beyer, J.E., 1987. *Fishbyte*, **5**: 11-13. <https://doi.org/10.1111/j.1747-1567.1987.tb00406.x>
- Dieb-Magalhães L., Florentino, A.C. and Soares, M.G.M., 2015. *J. appl. Ichthyol.*, **31**: 1182-1184. <https://doi.org/10.1111/jai.12919>
- Esmaeili, H.R., 2001. *Biology of an exotic fish, silver carp, Hypophthalmichthys molitrix, from Gobindsagar reservoir, India*. PhD. thesis, Department of Zoology, Punjab University, India. pp. 290.
- Freitas, S.R., Panetta, J., Longo, K.M., Rodrigues, L.F., Moreira, D.S., Rosário, N.E., Silva Dias, P.L., Silva Dias, M.A.F., Souza, E.P., Freitas, E.D., Longo, M., Frassoni, A., Fazenda, A.L., Santos e Silva, C.M., Pavani, C.A.B., Eiras, D., França, D.A., Massaru, D., Silva, F.B., Santos, F.C., Pereira, G., Camponogara, G., Ferrada, G.A., Campos Velho, H.F., Menezes, I., Freire, J.L., Alonso, M.F., Gácita, M.S., Zarzur, M., Fonseca, R.M., Lima, R.S., Siqueira, R.A., Braz, R., Tomita, S., Oliveira, V. and Martins, L.D., 2017. *Geosci. Model Dev.*, **10**: 189-222. <https://doi.org/10.5194/gmd-10-189-2017>
- Froese, R., 2006. *J. appl. Ichthyol.*, **22**: 241–253. <https://doi.org/10.1111/j.1439-0426.2006.00805.x>
- Giarrizzo, T., Oliveira, R.R.S., Andrade, M.C., Gonçalves, A.P., Barbosa, T.A.P., Martins, A.R., Marques, D.K., Santos, J.L.B., Frois, R.P.S., Albuquerque, T.P.O., Montag, L.F.A., Camargo, M. and Sousa, L.M., 2015. *J. appl. Ichthyol.*, **31**: 514-424. <https://doi.org/10.1111/jai.12677>
- Hossain, M.Y., Ahmed, Z.F., Leunda, P.M., Islam, A.K.M.R., Jasmine, S., Oscoz, J., Miranda, R. and Ohtomi, J., 2006. *J. appl. Ichthyol.*, **22**: 301-303. <https://doi.org/10.1111/j.1439-0426.2006.00801.x>
- Huxley, J.S., 1924. *Nature*, **114**: 895–896. <https://doi.org/10.1038/114895a0>
- Le Cren, C.D., 1951. *J. Anim. Ecol.*, **20**: 201-219. <https://doi.org/10.2307/1540>
- Morato, T., Afonso, P., Loirinho, P., Barreiros, J.P., Santos, R.S. and Nash, R.D.M., 2001. *Fish. Res.*, **50**: 297-302. [https://doi.org/10.1016/S0165-7836\(00\)00215-0](https://doi.org/10.1016/S0165-7836(00)00215-0)
- Moutopoulos, D.K. and Stergiou, K.I., 2002. *J. appl. Ichthyol.*, **18**: 200-203. <https://doi.org/10.1046/j.1439-0426.2002.00281.x>
- Oscoz, J., Campos, F. and Escala, M.C., 2005. *J. appl. Ichthyol.*, **21**: 73–74. <https://doi.org/10.1111/j.1439-0426.2004.00587.x>
- Schneider, J.C., Laarman, P.W. and Gowing, H., 2000. Length-weight relationships. Chapter 17. In: *Manual of fisheries survey methods II: With periodic updates, michigan department of natural resources, fisheries special report 25* (eds. Ed. J.C. Schneider). *Annls Arbor.*, **2000**: 1-18.
- Silva, L.M.A., Oliveira, M.S.B., Florentino, A.C. and Tavares-Dias, M., 2015. *J. appl. Ichthyol.*, **31**: 816-817. <https://doi.org/10.1111/jai.12791>



## Supplementary Material

# Length Weight Relationship of Five Cyprinidae Fish Species from Ranikot Lotic Water Body in Sindh, Pakistan

Wakeela Gul Mughal<sup>1</sup>, Muhammad Younis Laghari<sup>2\*</sup>, Zameer Ali Palh<sup>2</sup>, Summaiya Rajput<sup>2</sup>, Ikram Hussain<sup>3</sup>, Punhal Khan Lashari<sup>2</sup> and Maryam Sheikh<sup>2</sup>

<sup>1</sup>Department of Zoology, University of Sindh, Jamshoro

<sup>2</sup>Department of Freshwater Biology and Fisheries, University of Sindh, Jamshoro

<sup>3</sup>Directorate of Fisheries, Gilgit Baltistan




Supplementary Fig. 1. Collection sites of Ranikot steam.

\* Corresponding author: [laghariyounis@yahoo.com](mailto:laghariyounis@yahoo.com)  
0030-9923/2023/0001-0001 \$ 9.00/0



Copyright 2023 by the authors. Licensee Zoological Society of Pakistan.

This article is an open access  article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).



Supplementary Fig. 2. Five cyprinidae fish species, used for LWR, collected from Ranikoat stream-Sindh. 1, *Labeo bata*; 2, *L. pangusia*; 3, *L. barbus*; 4, *L. potail*, and 5, *L. porcellus*.