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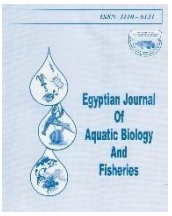

Length-weight and length-length Relationships of Six Cyprinid fish species from Sulaeman Mountain Range, Dera Ghazi Khan Region, Pakistan

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ABSTRACT

The current research aims to report length-weight relationships (LWRs) and length-length relationships (LLRs) parameters of 460 specimens from six freshwater fish species (*Garra gotyla*, *Cyprinion watsoni*, *Labeo diplostomus*, *Labeo dyocheilus pakistanicus*, *Tor macrolepis*, and *Schizothorax plagiostomus*) of the family Cyprinidae with some updated information on maximum total length. Fish growth was optimized for the species under study, as indicated by the LWR and LLR regression coefficient (*b*) values.This research presents the first documents of LWRs for these species from the Suleman Mountain Range in the District of Dera Ghazi Khan in Punjab, Pakistan.

INTRODUCTION

It is important to understand the length-weight relationships (LWRs) and length-length relationships (LLRs) of fish species because they provide information on the fish community, growth level, and health status **(Pauly, 1983; Moutopoulosand Stergiou, 2002; Okgerman, 2005; Froese, 2006)**. Pakistan's freshwater fishing potential has made a significant contribution to the country's food supply, economic growth, and environmental conservation **(Ministry of Food, Agriculture and Livestock, Pakistan, 2006)**. *Tor* spp., *Schizothorax* spp., and *Labeo* spp. (cyprinid species) are some of Pakistan's most valuable fish species for cultivation.

There is insufficient knowledge about the fish species examined in terms of food, habitat, and reproduction. These species were noted from pools, streams, ponds, and small

rivers, of hilly areas of Pakistan. Moreover, Numerous of species have also been documented from other countries i.e., *Gara gotyla* and *Labeo diplostomus* from Bangladesh, India, Myanmar, Nepal; *Schizothorax plagiostomus* from India, Nepal, Afghanistan; *Cyprinion watsoni* from Iran; *Tor macrolepis* from India (Himachal Pardesh) **(Mirza, 2004)**.

According to **Rafique and Khan (2012)**, five of the studied species such as *Garragotyla*, *Cyprinion watsoni*, *Labeo diplostomus*, *Tor macrolepis*, and *Schizothorax plagiostomus*, are indigenous to Pakistan, but *Labeo dyocheilus pakistanicus* is endemic. *Schizothorax plagiostomus* is listed in vulnerable category, while *Labeo dyocheilus pakistanicus*, *Labeo diplostomus*, and *Garra gotyla* have been rated as least concern **(Rafique and Khan,2012)**. Tor *macrolepis*' IUCN red list status is still not assessed, while *Cyprinion watsoni's* status has now been declared as of least concern **(IUCN, 2020)**.

Current research aims to determine the LWRs and LLRs of fish in the Sulaeman Mountain Range of Punjab's District Dera Ghazi Khan. FishBase does not contain any information on the LWRs and LLRs of these fishes from the study area (Sulaeman Mountain Range) **(Froese and Pauly, 2020)**. These endemic and indigenous fish species' LWRs and LLRs have never been documented before, so this study serves as the first source for that information. Using this data as a baseline, we can compare the same species from different locations.

MATERIALS AND METHODS

From 2011 to 2013, fish specimens were gathered with the help of some fishing gears (cast net, hand net, etc.) from various Hill Torrents (usually known as Nallahs) of Sulaeman Mountain Range of District Dera Ghazi Khan site (28^o 28′- 31^o 18′N to 69^o 20′- 70^o 55′E), Punjab, Pakistan.

Water comes in the form of seasonal rains and springs, which are the region's main sources of water supply. In plastic containers, samples were transferred to the laboratory for analysis. A top-pan digital balance was used to weigh the fish after they had been lightly anaesthetized and blotted dry with paper towels. Different body length measurements such as total length (TL), Fork length (FL) and standard length (SL) were achieved to the nearest 0.1 cm with the help of Perspex measuring tray. Standard taxonomic key was used for fish identification **(Mirza and Sharif, 2003)**.

The LWRs and LLRs were calculated for 460 specimens of six freshwater fish species. Using $W = aL^b$ formula, the LWR was calculated **(Ricker, 1975)**, here, W indicates the total weight in grams; (a) indicates a coefficient related to body form; L indicates the total length in centimeters; and 'b' indicates an exponent demonstrating isometric growth when equal to 3. The parameters (a)and (b) has been assessed using linear regression on the transformed equation: $\log W = \log a + b \log L$. Log–log plots of length and weight values had been achieved for removal of obvious out liers before regression analysis

(Froese, 2006). All statisticalanalyses have carried out using Microsoft Excel 2019, and SPSS 21.

RESULTS

LWRs analyses showed that total length against weight relationships for the studied species were significant (P< 0.001, r^2> 0.91). Likewise, LLRs values for determination of coefficient were also significant (P< 0.001, r^2> 0.91))(Table 1).

Table 1. Statistical analysis and assessed parameters of length-weight and length- length relationships of six cyprinid fish species from Sulaeman Mountain Range of District Dera Ghazi Khan, Pakistan.

Scientific name (Common name)	N	TL (cm)	BW (g)	Relation	*a*	95% CL of *a*	*b*	95% CL of *b*	r^2
Cyprinion watsoni	65	8.0 –**14.3**	5.3–28	TL-W	0.025	0.015-0.040	2.653	2.452-2.855	0.917
(Day, 1872)				TL-FL	0.995	0.860-1.148	0.947	0.886-1.008	0.939
(Sabzak)				TL-SL	0.931	0.807-0.928	0.912	0.851-0.973	0.934
[a]*Garra gotyla*	12	9.0 –14.1	8.6 –39.3	TL-W	0.010	0.003-0.023	3.123	2.728-3.481	0.971
(Gray, 1830)				TL-FL	0.820	0.653-1.028	1.040	0.945-1.135	0.983
(Pathar Chat)				TL-SL	0.763	0.591-0.981	1.002	0.896-1.108	0.978
[a]*Labeo dyocheilus pakistanicus*	70	10.9 – **22.5**	12.7–86.6	TL-W	0.026	0.015-0.041	2.712	2.452-2.791	0.933
(Mirza & Awan, 1976)				TL-FL	0.887	0.767-1.025	0.984	0.933-1.035	0.956
(Torki)				TL-SL	0.796	0.669-0.944	0.969	0.918-1.029	0.937
[a]*Labeo diplostomus**	84	9.3 – **22.0**	8.5–97.0	TL-W	0.010	0.008-0.014	2.965	2.854-3.076	0.972
(Hamilton, 1822)				TL-FL	0.938	0.229-1.019	0.970	0.935-0.999	0.978
(Pahari rohu)				TL-SL	0.817	0.748-0.889	0.964	0.930-0.997	0.976
[a]*Schizothorax plagiostomus*	84	8.08 – 17.2	7.05–58.6	TL-W	0.015	0.008-0.024	2.873	2.681-3.066	0.915
(Heckel, 1838)				TL-FL	1.016	0.807-1.276	0.959	0.872-1.046	0.855
(Swati)				TL-SL	0.697	0.590-0.822	1.047	0.984-1.109	0.931
Tor macrolepis	145	7.6 – **29.0**	4.6–208.6	TL-W	0.013	0.009-0.015	2.851	2.803-2.983	0.983
(Heckel, 1838)				TL-FL	0.734	0.209-0.735	1.042	1.008-1.066	0.962
(Sonahri mahseer)				TL-SL	0.682	0.627-0.736	1.051	1.013-1.082	0.961

N: Number of specimens; BW: body weight; TL: total length; W: Weight; FL: Fork length; SL: Standardlength; *a*: intercept; *b:* regression coefficient; CL: Confidence limits; r^2: Coefficient of determination.

*: The fish has some synonyms; *Banganadiplostoma* is in current use **(Froese & Pauly, 2020)**.

Bold font indicates new data about new maximum length

[a]: Data exhibited has no earlier reporting of length-weight relationships from Pakistan **(Froese & Pauly, 2020)**.

DISCUSSION

Only *Tor macrolepis* has been reported from the Indus River before **(Pervaiz *et al.*, 2012)**, as in FishBase **(Froese and Pauly, 2020)**. These are the first records of LWRs for these species not only from this area, but also from Pakistan **(Hussain *et al.*, 2016)**. In present study, regression coefficient (b) ranged from 2.712 (*Labeo*

dyocheiluspakistanicus) to 3.123 (*Garragotyla*) **(Table 1)**. Therefore, the regression coefficient (b) values existed within the range of acceptance from 2.5 to 3.5 **(Froese, 2006)**. Isometric growth was shown when the regression coefficient (b) was near 3 **(Wootton, 1990; Moutopoulos and Stergiou, 2002)**. LWR is influenced by a number of factors in fish, including food competition, gonad maturity, stomach fullness, health, preservation methods and season **(LeCren, 1951; Bagenaland Tesch, 1978; Froese, 2006)**. These factors, however, were not considered in the current study.

CONCLUSION

The current study delivers basic information on LWRs and LLRs for these fish species of the mountainous areas. As far as we know, this is the first study of its kind to be conducted in the area. It will serve as a starting point for fishery biologists and conservationists in Pakistan's Sulaeman Mountain Range, Dera Ghazi Khan Region, in their efforts to manage and conserve the region's fisheries sustainably.

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Statement of conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this article.

REFERENCES

Bagenal, T.B. and Tesch, F.W. (1978). Age and Growth. In: Methods for assessment offish production in freshwaters, 3rd ed. T. Bagenal (Ed.), IBP Handbook No. 3. Blackwell Scientific Publications, Oxford, UK, pp.: 101-136.

Froese, R. (2006). Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. J. Appl. Ichthyol., 22(4): 241-253 doi: 10.1111/j.1439-0426.2006.00805.x

Froese, R. and Pauly, D.(2020). FishBase. World Wide Web electronic Publication. Available at: http://www.fishbase.org (accessed on 19December 2020).

IUCN. (2020). IUCN Red List of Threatened Species. Version 2020-2. (accessed on19 December, 2020).

Le Cren, E.D. (1951). The length-weight relationships and seasonal cycle in gonad weight and condition in the perch (*Percafluviatilis*). J. Ani. Ecol., 20: 201-219.

Ministry of Food, Agriculture and Livestock, Government of Pakistan. (2006). National policy and strategy for fisheries and aquaculture development in Pakistan. Part-I.

Mirza, M.R. (2004). *Freshwater fishes of Pakistan* (Urdu) Vol. 2, Urdu Science Board. pp:1-243.

Mirza, M.R. and Sharif, H.M. (2003).*A key to fishes of Punjab*. Ilmi kitab Khana, Lahore (Pakistan).

Moutopoulos, D.K. and Stergiou, K.I. (2002). Length–weight and length–length relationships of fish species from the Aegean Sea (Greece). J. App. Ichthol., 18: 200–203 doi:10.1046/j.1439-0426.2002.00281.x.

Okgerman, H. (2005). Seasonal variation of the length weight and condition factor of rudd (*Scardiniuserythropthalmus L*.) in Spanca Lake. Intern. J. Zool. *Res*., 1: 6-10 doi: 10.3923/ijzr.2005.6.10.

Pauly, D. (1983). Some simple methods for the assessment of tropical fish stocks. FAO. Fisheries Technical Pap, (234): 52.

Pervaiz, K.; Iqbal, Z.; Mirza, M.R.; Javed, M.N.; Naeem, M. and Ishtiaq, A. (2012). Length-weight, length-length relationships and feeding habits of wild Indus Mahseer, *Tor macrolepis*, from Attock, Pakistan. J. Appl. Ichthyol., 1-4. 10.1111/j.1439-0426.2012.01953.x

Rafique, M. and Khan, N.H. (2012). Distribution and status of significant freshwater fishes of Pakistan.Rec. Zoologic. Sur. Pakistan, 21: 90-95.

Ricker, W.E. (1975). Computation and interpretation of biological statistics of fish populations. *Bull. Fisher.* Res. Board Canada,191: 1-382. 10.1080/ 10454438. 2012.652027.

Hussain, S., Hussain, M. Z., Iqbal, R., Latif, A., & Ali, M. (2016). Morphometric Analysis of the Wild Ompok pabda (Hamilton-Buchanan, 1822) from Suleman Mountain Range, Dera Ghazi Khan Region, Pakistan. Sindh University Research Journal-SURJ (Science Series), 48(1).

Wootton, R.J. (1990). *Ecology of teleost fishes*. Chapman & Hall, London, 404pp.