



Condition and Length-weight relationship of mountain carps *Labeo Diplostomus* and *Labeo Dyocheilus* from Khirthar torrent Nai Gaj, Sindh, Pakistan

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Abstract: The paper presents first report on length-weight relationship and condition of *Labeo diplostomus* and *Labeo dyocheilus* from Nai Gaj, mountain torrent, Sindh. The fish species in genus *Labeo* are considered important due to their nutritional value and as aquaculture species. Both of these species are considered the substitute of Rahu in the hilly areas of Indian sub-continent. Sampling was carried out from January to December 2016. In total 74 specimen of *L. dyocheilus*, and 80 specimen of *L. diplostomus*, were examined in the laboratory of FWB and Fisheries, University of Sindh, Jamshoro for length (cm) and weight (g). That data was utilized to generate the length-weight equations, Relative condition factor (*Kn*) and Fultons condition factor (*KF*). Total length of *L. diplostomus* ranged between (13-26.5 cm) and that of *L. dyocheilus* ranged between (15-27.1 cm). The length-weight analysis gave highly significant values of R^2 for both species (> 90 ; 0.001). The values of *b* of *L. diplostomus* and *L. dyocheilus* were 2.90 and 2.16, respectively, indicating the negative allometric growth, however within the suggested range (2.5-3.5). This paper presents first report on any aspect of *L. diplostomus* and *L. dyocheilus*, which will be helpful for fisheries management of these species after the construction and functioning of Nai Gaj dam.

Keywords: Hill stream carps, *Labeo diplostomus*, *Labeo dyocheilus*, Length-weight relations ship.

1. INTRODUCTION

Labeo diplostomus is commonly called as mountain rahu, this species was previously named as *Labeo microphthalmus* or *Labeo sindensis*, however these two species are synonymies of *Labeo diplostomus* due to slight morphological changes induced by habitat differences (Mirza, 2004; Mirza 1991). Its distribution is reported from Pakistan, India, Myanmar, Bangladesh and eastern parts of china (Mirza, 2004). *Labeo dyocheilus* is less studied species, its presence is documented from Afghanistan, Bangladesh, Bhutan, Cambodia, India, Laos, Myanmar, Nepal, Pakistan, and Sri Lanka (Talwar and Jhingran; 199; Froese and Pauly (2018). In mountain area both of these species are preferred as substitute of *Labeo rohita* due to the test of meat (Mirza, 2004).

Nai Gaj is situated in taluka Johi District dadu quadrate latitude :26°56'20.44"N, longitude 67° 9'35.34" point latitude 26°52'33.75"N, longitude 67°19'11.09"E. Nai Gaj is the largest mountain torrent in Sindh, that makes second largest flow in Southern Province Sindh after River Indus. However higher intensities of the Nai Gaj flow is observed in a decade or two (i.e. 1995; 2020 floods). This water flow is mainly fed by rain water in Khirthar range and its vicinity from Baluchistan (Khuzdar District), whereas at base of Khirthar range large number of permanent

depressions can be seen throughout the year, these are deeper and connected with the mountain base. Those depressions are locally known as "Kumbh". Fishing was carried out by using different nets, from the various permanent and perennial depressions of Nai Gaj.

Length-weight relationship estimations are regression measurements to predict the well being of fish and its environment health, this study also reveals the production and biomass of fish species (Dulcic and Kraljevic, 1996; Soomro *et al.* 2015). This tool is also used to estimate the status of populations of same species in different environments. In fisheries science weight of the fish can be predicted from Length using length weight relationship equation $W = aL^b$ (Froese *et al.* 2014). Condition factor is parameter to quantify the fish health which can help to estimate the population success in present and future (Hossain *et al.* 2006).

Labeo dyocheilus or Kali rohu is a commercially vital food fish in upland waters (Hill streams, Torrents) of India. Study aims to present the first report on length-weight relations ship condition of *L.* and *Labeo diplostomus* from Nai Gaj. The study can useful for future studies on aquaculture of the species. The study aims to conduct the first comprehensive description for Length-weight relationship and condition factor of both of these species.

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2. MATERIALS AND METHODS

Monthly samples were collected by fixing gill net and sein net from January 2016 to December 2016. Specimens preserved in ice box were brought to laboratory of Department of FWB and Fisheries, University of Sindh, Jamshoro. Fish were identified using the taxonomic keys (Talwar and Jhingran, 1991; Mirza, 2004). Fish were measured for Total length (cm) and Weight at nearest 0.01 (g). Length-weight relationship was calculated by the Le Cren, 1951.

$$W = a L^b$$

Following formula was used for estimating the condition factor (Kn)

$$Kn = W / a L^b \text{ (Le Cren, 1951).}$$

The The Fulton's condition factor (K) estimations were done by following equation.

$$KF = 100 \times (W/L^3).$$

Microsoft Excel Add-in DDXL was used for statistical analysis. The statistical significance level of R^2 were tested by simple t-test

3. RESULTS AND DISCUSSION

Both of these species belong to order cypriniformes and family cyprinidae and are commonly called as mountain or hill stream carps. In total 74 specimen of *L. dyocheilus*, and 80 specimen of *L. diplostomus*, were examined for the study. Total Length (cm) and Weight (g) of *L. dyocheilus* ranged between 15-27.1 cm and 25-116 g, respectively, while length and weight of *L. diplostomus* ranged between 13.5-26.5 cm and 17-119 g, respectively. Samples of both of the species were lacking the smaller sized individuals, hence smallest length of *L. dyocheilus* and *L. diplostomus* were 15 and 13.5 cm, respectively. Absence of smaller individuals of both species can mainly be attributed to difficult habitat for fishing. The water body is specialized and away from the wet lands and river, therefore this can be assumed that smaller individuals were present but could not be fished, either due to peculiarity of water body or fishing techniques.

According to Talwar and Jhingran, 1991 of *L. dyocheilus* attains maximum length 90 cm, however in present study maximum length recorded was 27.1, such difference can be attributed to sampling techniques and habitat type. The permanent "Kunbh" depression of Nai Gaj are deeper and connected to the base of Khirthar mountains through cave connectivity, these features of habitat are supportive for hiding of larger fishes.

Sample size (number), and various regression parameters are also given in (Table 2), Length-weight relationship for both of these species generated following equations.

$$L. dyocheilus: \quad \text{Log } W = -2.50 + 2.16 \text{ Log } L$$

$$L. diplostomus: \quad \text{Log } W = -2.66 + 2.90 \text{ Log } L$$

Values of b for *L. dyocheilus* and *L. diplostomus* were calculated 2.16 and 2.9, respectively, suggesting the negative allometric growth in both of these hill stream species.

Previously value of b for *L. dyocheilus* from Indus river was recorded 2.5 (Muhammad *et al.* 2016), which is also negative allometric. However, to the best of our knowledge no such study is conducted for *L. diplostomus* in Pakistan or elsewhere. Despite the negative allometric growth ($b < 3$) were within the range 2.5-3.5 given by Froese (2006) and Dars *et al.*, (2010). The value of b out of the range (2.5-3.5) could be seen as inaccurate (Pauly and Gayanilo, 1997; Jatoi *et al.* 2013). The values of co-efficient of determination (R^2) are given in table 2 and Figure 1, which are > 90 and highly significant (< 0.001).

The mean value of Kn of *L. dyocheilus* and *L. diplostomus* were recorded 1.44 ± 0.30 and 1.05 ± 0.37 , respectively (Table 3). The mean value of relative condition factor of both of the species were observed > 1 , indicating the good health of fish (Jamali *et al.* 2018). The KF values for *L. dyocheilus* and *L. diplostomus* were calculated 0.72 ± 0.12 and 0.71 ± 0.16 , respectively. Results of fultons condition factor (KF) and relative condition factor (Kn) indicating good growth in both of the species, however the growth of *L. dyocheilus* comparatively better than that of *L. diplostomus*. Condition factor is tool to depict the wellbeing of fish and through its variation. Relative condition factor Kn gives insight for the wellbeing of different population of same species, habitat differences availability of food and climatic conditions can affect the condition of fish, when comparing two populations living in different feeding regime, density, climate, and other conditions (Weatherley, 1972; Lizama, and Ambrosio, 2002).

Current study established some growth parameters of two hill stream carp species from Nai Gaj. Nevertheless, the study is first from this habitat and will be supportive for the conservation and aquaculture of both of these species.

Table 1. Descriptive statistics of length and weight of hill stream carps *L. dyocheilus* and *L. diplostomus* from Nai Gaj mountain torrent, Khirthar range, Sindh

Species	No	Length (cm)		Weight (g)	
		Min-Max	Mean±STD	Min-Max	Mean±STD
<i>Labeo dyocheilus</i>	74	15-27.1	19.3±3.86	25-116	58.3±21.35
<i>Labeo diplostomus</i>	80	13.5-26.5	18.38±3.13	17-119	53.82±25.28

No. Number; STD. Standard deviation; Min. = Minimum; Max: Maximum

Table 2. Descriptive statistics of regression parameters a, b and R^2 (co-efficient of determination) of hill stream carps *L. dyocheilus* and *L. diplostomus* from Nai Gaj mountain torrent, Khirthar range, Sindh.

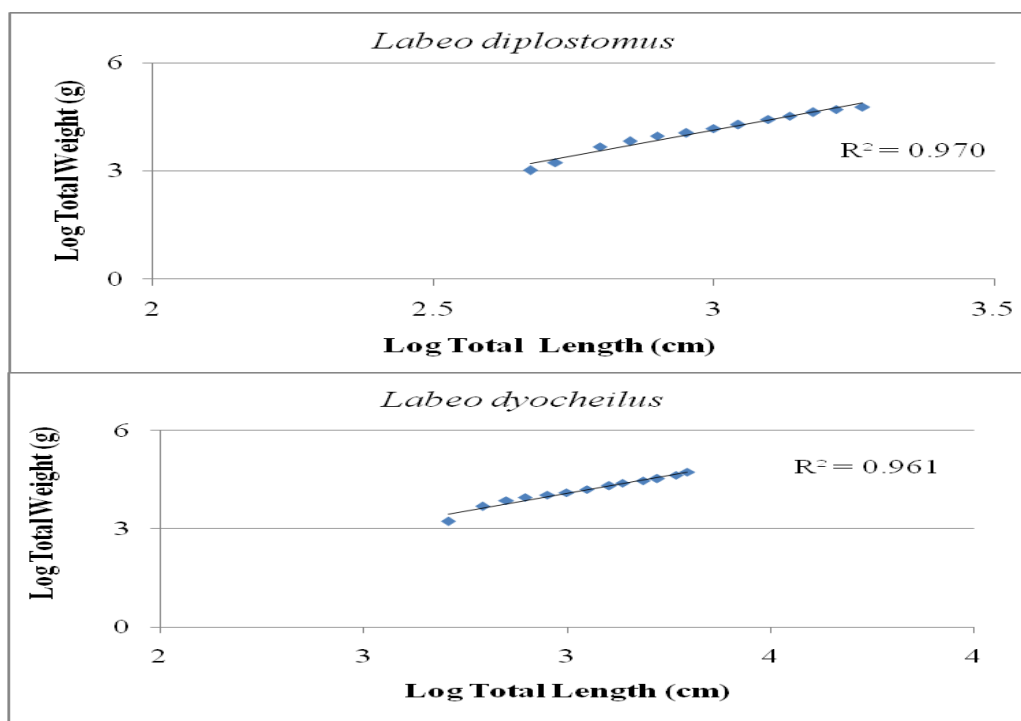
Species	Regression Parameters						R ²
	a	95% CI a		b	95% CI b		
		Lower	Upper		Lower	Upper	
<i>Labeo dyocheilus</i>	-2.50	-3.3	-1.61	2.16	1.90	2.4	0.96*
<i>Labeo diplostomus</i>	-2.66	-3.41	-1.91	2.9	2.61	3.1	0.97*

*Significant

Table 3. Descriptive statistics of relative condition factor and Fultons condition factor of hill stream carps *L. dyocheilus* and *L. diplostomus* from Nai Gaj mountain torrent, Khirthar range, Sindh

Species	Relative condition factor			Fulton's Conditions factor		
	Min	Max	Mean±STD	Min	Max	Mean±STD
<i>Labeo dyocheilus</i>	0.76	1.92	1.44±0.30	0.56	0.9	0.72±0.12
<i>Labeo diplostomus</i>	0.44	1.55	1.05±0.37	0.41	1.1	0.71±0.16

STD. Standard deviation; Min. = Minimum; Max: Maximum

**Fig. 1.** Length-weight relationships of two mountain carps from Khirthar torrent Nai Gaj, Sindh, Pakistan

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