

# Length-weight relationship of five minor carps from Western Himalaya (H.P), India

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The parameters 'a' and 'b' of the length-weight relationship for five species from the Western Himalaya of India were analyzed. The fish samples used during study period were collected from different sub-tributaries of Beas. The power 'b' was analyzed whether they deviated significantly from the expected cubic value using t test. An isometric growth pattern was found in *Barilius bendelisis* and *Gara gotyla* and non-isometric in case of *Devario devario*, *Pethia ticto* and *Crossocheilus latius*.

## Introduction

The minor carps are all those cyprinids which do not grow larger than a foot even in the adult stage. Such small minor carps have contributed substantially on the livelihood of fisheries especially in the hilly region where bigger fishes are not captured adequately. In the present contest of unconventional fishing pressure, conservation of minor carps is highly desirable, even though recent IUCN Red List has considered the status of *Barilius bendelisis*, *Pethia ticto*, *Crossocheilus latius*, *Devario devario* and *Garra gotyla* under Least Concern (Dahanukar 2010; Rayamajhi & Jha 2010; Singh 2010; Vishwanath 2010a; 2010b).

In fish, size is generally more biologically relevant than the age, mainly because several ecological and physiological factors are mainly size dependent than age. The relationship between body length and weight (LWR) is of great importance in fishery biology as it helps to estimate growth rates, age structure and various aspects of fish populations. However, the length-weight parameters of the same species may be different in the population because of feeding, reproduction activities and fishing etc. Therefore, data on LWR ( $W = aL^b$ ) of fish species is important for fish stock assessment and parameters 'a' (normalization constant) as well as 'b' (exponent) can be used for length-weight conversion. Thus, the present study has been conducted, considering the economic importance and conservation status of these minor carps.

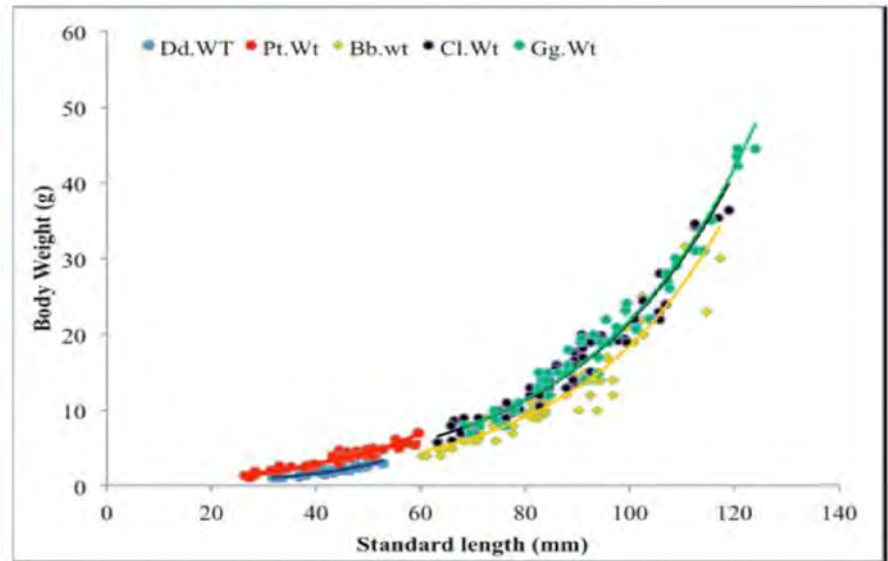


Figure 1. Length Weight Relationship of *D. devario*, *P. ticto*, *B. bendelisis*, *C. latius* and *G. gotyla* (Dd, Pt, Bd, Cl and Gg).

## Material and Methods

Altogether 282 specimens of minor carps (*Devario devario*, *Pethia ticto*, *Barilius bendelisis*, *Crossocheilus latius* and *Gara gotyla*) were collected from different sub-tributaries and tributaries of river Beas (Mole near Saralu Tanda, Rajpur, Bhoda Palampur, Binwa near Chobu Baijnath, Neugal near Nagni Thural) during the period of September 2009 to July 2011. The collection was done by using different types of gears like hooks and lines, cast net, hand net and local fishing traps. Prior to fixing in 10% formalin, standard length (from the tip of snout to the end of the caudal peduncle) and total weight of the fish specimens were recorded up to nearest 1 mm and 0.1 g respectively. The length-weight relationship was estimated using formula,  $W = aL^b$  LeCren (1951), where 'W' is the weight of the fish, 'L' is the standard length, 'a' is normalization constant and 'b' is exponent. The above equation can be transformed into linear equation by taking the logarithm of the variables,  $\log W = \log a + b \log L$ . In order to find out the significance of regression coefficient (b) t-test (Snedecor & Cochran, 1967) was applied. The t-test was applied to find out whether the b-value for different species was significantly different from '3' using the formula:  $t = b-3/sb$ , where 'sb' is the standard error of 'b'.

## Result and Discussion

The sample size (n), length and weight (range), regression equations, correlation coefficient (r), coefficient of determination ( $R^2$ ) and t-value of five minor carps are summarized in Table 1. The t-test, conducted to check the isometry of the minor carps revealed that *B. bendelisis* and *G. gotyla* had no significant difference from the expected value of '3', but significant differences were noticed in *D. devario*, *P. ticto* and *C. latius*. Hence it was concluded that the growth is isometric in case of *B. bendelisis* and *G. gotyla* and non-isometric in *D. devario*, *P. ticto* and *C. latius*. Pandey & Lal (1994) also reported isometric growth in *B. bendelisis* from Garhwal Himalaya. In *Crossocheilus oblongous* and *P. ticto* isometric growth pattern has been reported by Isa *et al.* (2010) & Hossain (2009). But Gairola *et al.* (1990) reported significant departures from the isometric growth values in the investigation on *P. ticto* while Hossain *et al.* (2009) had reported negative allometric growth. In the present study non-isometric growth was found which could be attributed to the fact that the general well-being, growth, spawning, gonad development and

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**Table 1. The results of regression analysis, 't' test and correlation of minor carps**

Sr.	n	Range		Regression equation		r	R <sup>2</sup>	Sb	t value	95% CI of 'b'
		Length (mm)	Weight (g)	Log W=Log a + b Log L						
				a	b					
1.	39	30-60	1.00-2.70	-4.227	2.751	0.989	0.978	0.0811	3.0702	2.909-2.592
2.	53	20-60	1.00-7.10	-4.222	2.817	0.972	0.944	0.0826	2.215	2.978-2.655
3.	79	60-120	4.00-31.60	-4.679	2.971	0.963	0.928	0.0938	0.298	3.155-2.787
4.	59	60-120	6.00-36.40	-4.302	2.820	0.974	0.949	0.0858	2.085	2.988-2.652
5.	52	60-130	7.00-44.50	-4.753	3.053	0.980	0.961	0.0867	0.611	3.223-2.883

**1. *D. devario*, 2. *P. ticto*, 3. *B. bendelisis*, 4. *C. latius* and 5. *G. gotyla*, 'n' is no of fish, 'r' is correlation coefficient, 'R<sup>2</sup>' is coefficient of determination, 'Sb' is standard error of b, and '95% CI of 'b' is 95% confidence limit or interval of 'b'.**

maturity of the fish are related to their environment and availability of food in their browsing habitat.

The plot of standard length and body weight were fitted with the power function for each fish and a high degree of positive correlation between length and weight were indicated by the correlation coefficient (r) in all the five species (Figure 1). The regression analysis explained 97.8%, 94.4%, 92.8%, 94.9% and 96.1% of the total variation in the data of length weight of *D. devario*, *P. ticto*, *B. bendelisis*, *C. latius* and *G. gotyla* respectively. It is well known that the theoretical value of 'b' (regression coefficient) in length-weight relationship is reported as 3.0, when the body form of the fish remains constant at different lengths. This type of relationship is found in fishes, which maintain a constant body shape (Anna Mercy *et al.*, 2002). Mitra *et al.* (2005) reported that in *Puntius sophore* only female fish showed isometric growth while male exhibited allometric growth.

Similar findings were also presented by Reddy & Rao (1992). In the present study all the correlations were highly significant (p<0.05), and the coefficient of determination were ranging from 0.928 to 0.978. While the b value of regression ranged between 2.751 to 3.053 and those having low b value showed non-isometric growth. The present work intends to find out some baseline information (LWR) regarding these five fish species from the Western Himalaya (H.P) and will add to understand their growth, well being and stock assessments for the betterment of fisheries management in Himachal Pradesh.

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