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# Length-Weight Relationships of *Xenentodon cancila* (Hamilton, 1822) and *Hyporhamphus limbatus* (Valenciennes, 1847) from Bhima River of Maharashtra, India

**Ranjit, M.M.[1*], Jiwan, P.S.[2], Monika, B.G.[2] and Shubhada, S.R.[2]**

[1]*Department of Zoology, Modern College of Arts, Science and Commerce, Ganeshkhind, Pune – 411 053, Maharashtra, India.*
[2]*Department of Zoology, Arts, Science and Commerce College, Indapur – 413 106, Maharashtra, India.*
**Email: zoologistranjit@gmail.com*

## Abstract

Two fish species, *Xenentodon cancila* (Hamilton, 1822) and *Hyporhamphus limbatus* (Valenciennes, 1847) sampled from the Bhima river of Maharashtra state of India were investigated for studying the length-weight relationships. Total 124 specimens were collected on a monthly basis from September 2019 to November 2019 for analysis of their length–weight relationships (LWRs). The intercept (a value) for *X. cancila* and *H. limbatus* was found to be 0.0043 and 0.0013 whereas the slope (b value) for both species was 2.9538 and 3.2755 respectively. The LWRs analysis of both the species revealed that *X. cancila* has b value is less than 3 indicating negative allometry and *H. limbatus* has b value more than 3 indicating positive allometry and these values in expected range (2.5 to 3.5). The $R^2$ value in the present study was found to be greater than 0.9 for both the species, which indicates the proper fitness of the model for growth and good health status.

**Keywords:** *Xenentodon cancila*, *Hyporhamphus limbatus*, Length weight relationship, Bhima river, Conservation

## 1. Introduction

The Western Ghats of India is rich in ichthyofauna and most of the species are endemic (Shaji *et al*., 2000; Dahanukar *et al*., 2004). There are about 1030 Indian freshwater fish species (Froese and Pauly, 2019) has been reported so far from Indian waters of which 216 in the state of Maharashtra (Karmakar *et al*., 2012). Bhima river, the tributary of river Krishna is one of the important river of Maharashtra. The Ujani dam is situated on the Bhima river is constructed as a irrigation project which has shallow expense of water and largest freshwater fishing co-operative in Maharashtra (Yazdani and Singh, 2002; Karmakar *et al*., 2012; Joshi and Shahapure, 2020). The ichthyo-faunal diversity of the Bhima river consists of 60 fish species belonging to 6 orders, 15 families and 36 genera (Sarwade and Khillare, 2009). Among them, the species *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Oreochromis mossambica* are found to be common in fisher's catch. The freshwater garfish, *Xenentodon cancila* (Hamilton, 1822) and Congaturi halfbeak, *Hyporhamphus limbatus* (Valenciennes, 1847) are the two important fish species sometimes considered as trash fish in certain areas. The species *Xenentodon cancila* (Beloniformes: Belonidae) is a fresh to brackish water species also found in marine-waters (Froese and Pauly, 2019). It is native to Asian countries and commonly known as Kokila in India (Hossain *et al*., 2013). *Hyporhamphus limbatus* (Beloniformes: Hemirhamphidae) is a coastal surface dwelling species, found in the tidal freshwaters and brackish estuaries. Length weight relationship (LWR) is an important parameter in fish biology commonly used to convert length data from the field studies into weight data because fish weight measurement is time-consuming and difficult often in the field (Pauly, 1993; Goncalves *et al*., 1996; Panda *et al*., 2016; Karna *et al*., 2017a; Sahoo *et al*., 2020). Further, LWRs and conditional factors are important indices for the aquaculture studies and establishment of a relationship between length and weight, which is essential for calculating the production of biomass in fish population (Safran, 1992; Petrakis and Stergious, 1995). In view of the importance of length and weight parameters and lack of fisheries study from the Bhima river, we attempted to report LWR for two fish species (*X. cancila* and *H. limbatus*) which has never been attempted earlier from this ecosystem.

## 2. Materials and Methods

In total 124 specimens (59 for *X. canxila* and 65 for *H. limbatus*) were collected from September 2019 to November 2019 from local fish market of Bhigwan, Pune, Maharashtra (18.29$^0$N, 74.76$^0$E) which receives the fish supply from nearby Bhima river. After collection, specimens were preserved in 10% formalin solution and brought to the research laboratory for identification and measurements. Fishes were identified based on Jayaram (1981) and Fricke *et al*. (2018). Measurements of total length (TL) were done by using digital calliper (Mitutoyo, Japan) to the nearest 0.1cm and body weight (W) were measured using weighing machine closest 0.01 gm (CONTECH – CB Series).

Length weight relationships was estimated by the common formula: $W = aL^b$ (Froese 2006), where, 'L' is the total length (cm), 'W' is the body weight (g), 'a' is the intercept and 'b' is the slope of the log-transformed linear regression, $r^2$ is the coefficient of determination to estimate the goodness of fit. Some outliers from the length-weight plots were identified and removed.

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## 3. Results and Discussion

Summery of the analysis: sample size (n), maximum and minimum value of length and weight for each species, estimates of the LWRs parameters (a, b, $r^2$) are presented in table 1. The sizes of *X. cancila* specimens were much bigger than the *H. limbatus* specimen. Maximum total length and weight for the *X. cancila* were estimated to be 27.6 cm and 61.30 g respectively. Similarly, maximum total length and weight for the *H. limbatus* were estimated to be 20 cm and 24.07 g respectively. The intercept (a value) for *X. cancila* and *H. limbatus* was found to be 0.0043 and 0.0013 whereas the slope (b value) for both species was 2.9538 and 3.2755 respectively. The b value exponent for both species is significantly lying within the recommended value of 2.5 – 3.5 (Carlander, 1969; Froese, 2006).

For *X. cancila*, the b value observed in the present estimation was found to be lowered than the previous reports: 2.999 from Atrai river, Bangladesh (Islam *et al*., 2017), 3.490 from Chi river of Thailand (Satrawaha and Pilasamorn, 2009) and 3.180 from Hirakud reservoir of India (Karna *et al*., 2018). Similarly, the a value of the present finding was higher than the all three discussed reports. For *H. limbatus*, both *a* and *b* value found in this analysis was much higher than the previous study from Chilika lake, India by Karna *et al*. (2017b). The a value and b value for Chilika sample was reported as -2.484 and 2.945 respectively. Moreover, the sample size and length range used for Chilika fish was much robust than the current analysis.

Variation in the "b" value of fishes could be caused by factors like fishing pressure, mesh size, geographical and environmental factor, sampling gear, sampling season, length range used, gonadal maturity, sex, diet, stomach fullness (Ogunola *et al*., 2018, Pise *et al*., 2018) which were not considered in this study. The observed b value for *H. limbatus* is 3.28 and for *X. cancila* is 2.95. The b value <3 indicates the negative allometries, b value >3 indicates positive allometries while (b = 3) indicates the isometric growth pattern (Torres *et al*. 2012). Present investigations indicate that *H. limbatus* has positive allometric value while *X. cancila* has negative allometric value.

**Table 1.** Length weight relations parameters of two fish from Bhima river (N: No. of sample; TL: Total length; SL: Standard length; BW: Body weight; Min: Minimum; Max: Maximum; a: Intercept; b: Slope; $r^2$: coefficient of determination)

| Parameters | *Xenentodon cancila* | *Hyporhamphus limbatus* |
|---|---|---|
| N | 59 | 65 |
| TL range (cm) | 17.9-27.6 | 8.6-20.0 |
| TL (mean±SD) | 23.3±2.27 | 11.1±2.40 |
| W range (g) | 12.64-61.30 | 1.46-24.07 |
| W (mean±SD) | 32.14±9.86 | 4.26±4.33 |
| a value | 0.0043 | 0.0013 |
| 95 % CI of a | 0.0028-0.0013 | 0.0010-0.0017 |
| SE of a | 0.4001 | 0.1372 |
| b value | 2.9538 | 3.2755 |
| 95 % CI of b | 2.6992-3.2084 | 3.1612-3.3898 |
| SE of b | 0.1272 | 0.0572 |
| $r^2$ | 0.904 | 0.981 |

LWRs for each species were highly significant with coefficient of determination ($r^2$) value > 0.90. According to Hanif *et al*. (2017), fish with ideal growth shows the $r^2$ value between 0.9 and <1.0 which indicates the proper fitness of the model for growth good health status of investigated fish species. With this data we conclude that this study provides the baseline information on the LWRs of the studied fishes. These freshwater fish species would be important for monitoring their populations and operative implementation of protection of species and another conservation policies.

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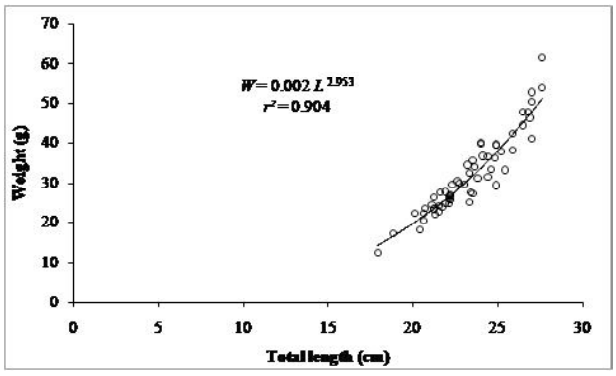


**Fig. 1.** Scattered plot for LWR of *Xenentodon cancila*

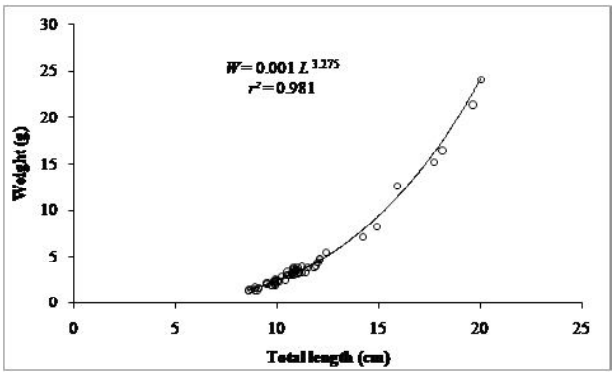


**Fig. 2.** Scattered plot for LWR of *Hyporhamphus limbatus*

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