

Length-weight relationship, Condition factor and Relative condition factor of *Gymnostomus fulungee* (Sykes, 1839) from Krishna River, Maharashtra, India

Abstract

Gymnostomus fulungee (Sykes, 1839) is a cyprinid freshwater fish reported from Deccan plateau and widely distributed in Western Ghats of India. Western Ghats is known for its higher fish species richness and endemism. *Gymnostomus fulungee* is inhabitant of Krishna River, Maharashtra with abundant population. The abundance, length-weight relationship (LWR), and reproductive behavior of this species have not been studied in this region. The present study aims to investigate length-weight relationship, growth patterns and condition factor of the *Gymnostomus fulungee*. Assessments of these parameters were done by using specimens of combined sexes. Fishes were collected from 3 different collection sites of Krishna River namely Ramling bet, Bahe (17.11813 °N, 74.26524°E), Khodshi (17.30968°N, 74.16739°E) and Karad (17.28961 °N, 74.18243 °E), Maharashtra, India. Study was conducted during the period of June-2021 to May 2022. Total 235 specimens were collected and total length (TL) observed from minimum 8.9 to maximum 18.2 cm. Weight (W) ranges were varied between 6.353 to 60.185 g. LWR was estimated by linear regression equation [$\ln W = \ln (a) + b \ln (L)$]. Overall estimated value of 'a'= 0.009 and the value of 'b'= 3.019 found in normal range. Significant variation was seen during winter and summer for value of 'b' with 3.310 and 3.098 respectively. The value of b=3 indicates isometric growth of species and above 3 indicates positive allometric growth. The condition factor (K) ranged between 0.7 and 1.5 which was analysed seasonally. Relative Condition factor (Kn) is equal or close to 1. It was revealed that

Gymnostomus fulungee was in a good physical state with aquatic environment providing proper conditions for fish growth.

Keywords: *Gymnostomus fulungee*, length-weight relationship, Krishna River, condition factor.

1. Introduction:

Morphometric characters dependent indices are globally used to assess feeding potential and growth conditions of fish. LWRs of fish changes with fish condition in its ecosystem and helpful in predicting the average weight of the fish of a given length group (Mir et al., 2012). Assessing Length–weight relationship (LWR) is playing vital role in fisheries research and development with contribution involved in fish species conservation assessment. The data available in LWR can be efficiently used in estimation and monitoring fish biomass (Guo et al., 2020) It also helpful in determination of fish length based on its weight and vice-versa in a particular environmental condition of habitat (Froese, 2006). LWR is extensively used in fisheries as tool to get insights on condition and fish growth patterns in its habitat. Furthermore, species composition, relative abundance, and frequency of occurrence have long been considered as key indicators in assessing biological communities. LWR parameters namely slope (b) and intercept (a) value have vital applications in fisheries study and management for assessment of weight of fish for its length and knowing condition factors for better understanding of fish life (Sani et al., 2010).

Length–weight relationships (LWRs) have vital significance in assessment of growth and stock of fishes and also for estimating the biomass (Petrakis and Stergiou, 1995; Jobling, 2002; Valset et al., 2007). However, fish length can be practically more accurately measured than weight and easily converted to weight (Chu et al., 2011). Condition factor and relative weight are commonly used morphometric indices that are based on external measures of length–weight relationships. With applications based on general assumption that fish having more weight for given length has better physical condition in habitat (Bolger and Connolly, 1989). Majority of Indian Peninsular River backwater passes tropical and sub-tropical regions carrying abundant fish fauna (Oberdorff et al., 1995). Krishna river is the second largest peninsular river of India next after Godavari with area of 268,786 km². It originates in Mahabaleshwar hills of the Western Ghats in Maharashtra. Most of river flow areas belong to Karnataka (42.4%) followed by Andhra Pradesh (31.8%) and Maharashtra (25.8%). It flows

about 1400 km from west to east before reaching to the Bay of Bengal (Das et al., 2017). It is one of biodiversity rich rivers in India.

Gymnostomus fulungee is accepted synonym of *Cirrhinus fulungee* (Froese and Pauly, 2025). It is a freshwater teleost belonging to Cypriniformes order. Its geographical distribution confined to India with Maharashtra and Karnataka showing wide distribution range. It forms significant part of food of rural as well as urban population in Maharashtra. It is abundantly found in Krishna River. LWRs and Condition factor of this fish have been not evaluated from this region. Present work was done to investigate morphometric analysis of this fish.

2. Materials and Methods:

2.1 Fish Sample Collection: *Gymnostomus fulungee* fish samples were collected from 3 different collection sites of Krishna River namely Ramling bet, Bahe (17.11813 °N, 74.26524°E), Khodshi (17.30968°N, 74.16739°E) and Karad (17.28961 °N, 74.18243 °E), Maharashtra, India during the period of June-2021 to May 2022. Total 235 specimens were collected and investigated during this study.

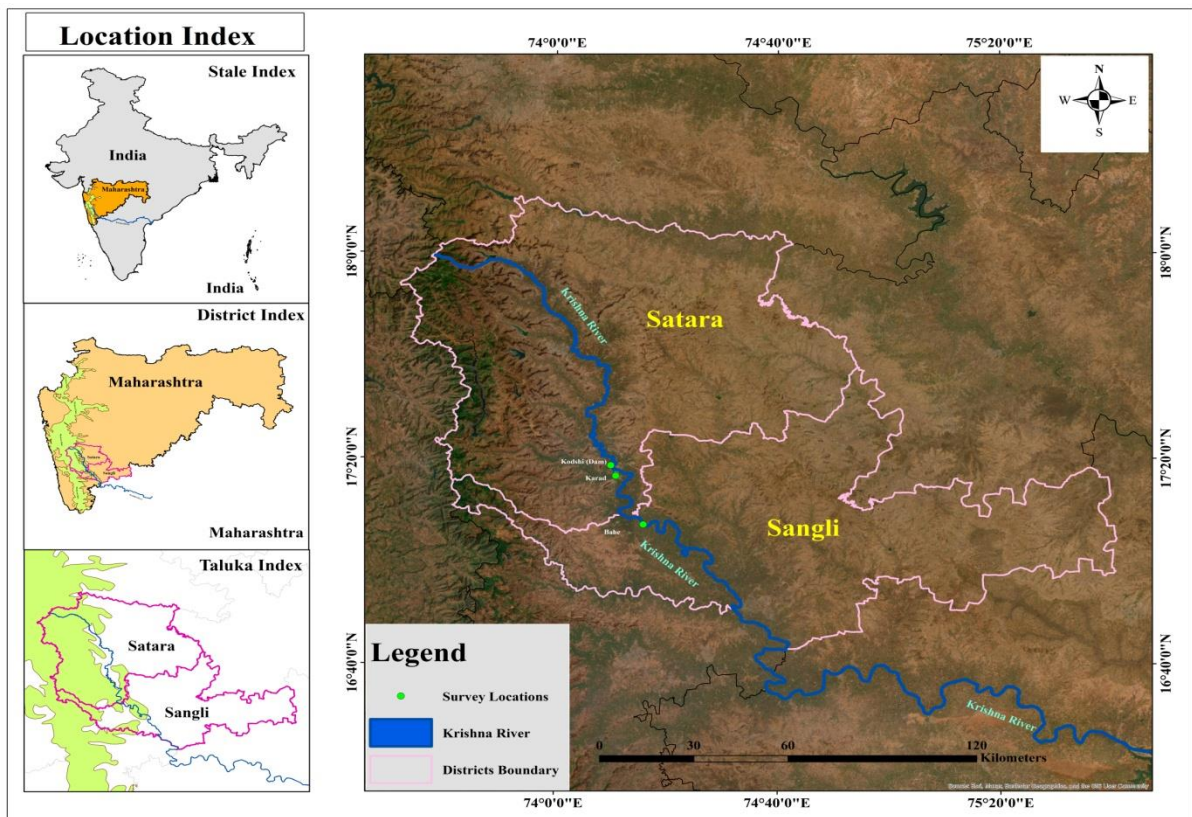


Figure 1: Map of study area showing fish collection sites.

2.2 Sample Preservation: Collected samples then preserved in 10% formalin solution and brought to the laboratory for identification and measurements.

2.3 Fish Identification: Fishes were identified based on various morphometrics characters by using literature of Jayaram, 1981; Talwar and Jhingran, 1991.

2.4 Length and weight measurements: Measurements of length (L) were taken by using digital caliper to the nearest 0.01cm and body weight (W) was measured using weighing balance to nearest 0.01 gm (CONTECH – CB Series). Length weight relationships were estimated by formula:

$W = aL^b$, 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. Length- length relationships were determined by using total length and body weight in MS-Excel software.

2.5 Fulton's Condition Factor (K)

Fulton's condition factor (Fulton, 1904) was calculated for each specimen as: $K = 100 \times W / TL^3$

A value of $K \approx 1.0$ is generally considered indicative of average condition for a well-nourished fish; values consistently below 1.0 indicate poor nutritional state (Bagenal & Tesch, 1978). Seasonal differences in K were tested by one-way analysis of variance (ANOVA), followed by pairwise Student t-tests with Bonferroni correction to identify which seasonal pairs differed significantly

2.6 Relative Condition Factor (Kn)

The relative condition factor (Kn) was calculated for each fish specimen following the method described by Le Cren (1951):

$Kn = W/w$ Where W = observed (actual) body weight of the fish (g), w = predicted (expected) weight calculated from the length-weight relationship. The predicted weight (w) was estimated using the equation: $w = aL^b$ Where L = total length (cm), a = intercept of the length-weight regression, b = slope of the length-weight regression

3. Results and Discussion:

The current study comprising LWRs of *Gymnostomus fulungee* provides the first-hand information for growth pattern and condition factor from Krishna river. The findings of study showing different length-weight parameters were given in table 1.

Table 1: Length weight relationship parameters and results observed during study.

Parameters	Results
N	235
Min. TL (cm)	8.90
Max. TL (cm)	18.20
TL (Mean±SD)	13.39 ±1.77
Min. weight (g)	6.353
Max. weight (g)	60.185
Weight (Mean±SD)	24.337±10.55
'a' value	0.009
'b' value	3.019
r ² (Coefficient of determination)	0.914
Min. condition factor (K)	0.7
Max. condition factor	1.5
Condition factor(K) (Mean±SD)	0.96±0.12
Relative condition factor (Kn) (Mean±SD)	1.02±1.0

Total length (TL) of samples used for study was ranged between 8.90 cm to 18.20 cm. Body weight found in range of 6.353 to 60.185 g. The relationship between total length and body weight was shown in Fig. 1. During present study 'a' value (intercept) was 0.009. Maximum values of 'a' has range of 0.001 to 0.05 (Froese, 2006). 'a' value lower than present study was recorded for *Parambassis ranga* (0.0070), *Ompok Pabda* (0.0076); concordant value observed for *Nandus nandus* (0.0094) and higher value observed for *Trichogaster lalius* (0.0274) during study on freshwater fish species from Gandak River, India (Baitha et al., 2018). Similar value of 'a' 0.0091 was observed for *Coilia dussumieri* from Tetulia River, Bangladesh (Hossain et al., 2015). *Terapon puta* (0.009) and *Aplocheilus panchax* (0.009) also had similar values from Chilika lagoon, India. Slope value (b value) for *Gymnostomus fulungee* in present study was 3.019. This value was found in normal range of parameter b range of 2.5–3.5 (Hile

1936; Froese 2006). The present study b value equal to 3.0 indicates isometric growth pattern in fish. It showed that body form of such fish remains constant at different lengths (Allen 1938). Almost similar values were observed for *Pristolepis fasciata* (3.072), *Hampala macrolepidota* (3.019) and *Osteochilus hasseltii* (3.038) from Temengor Reservoir, Malaysia (Sekitar et al., 2015). Lower ‘b’ values were observed in *Anabas testudineus* (2.90), *Coilia dussumieri* (2.64), *Otolithoides biauritus* (2.55) and *Setipinna taty* (2.51) and higher values observed in *Pethia conchonius* (3.33), *Polynemus paradiseus* (3.23) and *Sillaginopsis panijus* (3.30) from Tetulia River, Bangladesh (Hossain et al., 2015)

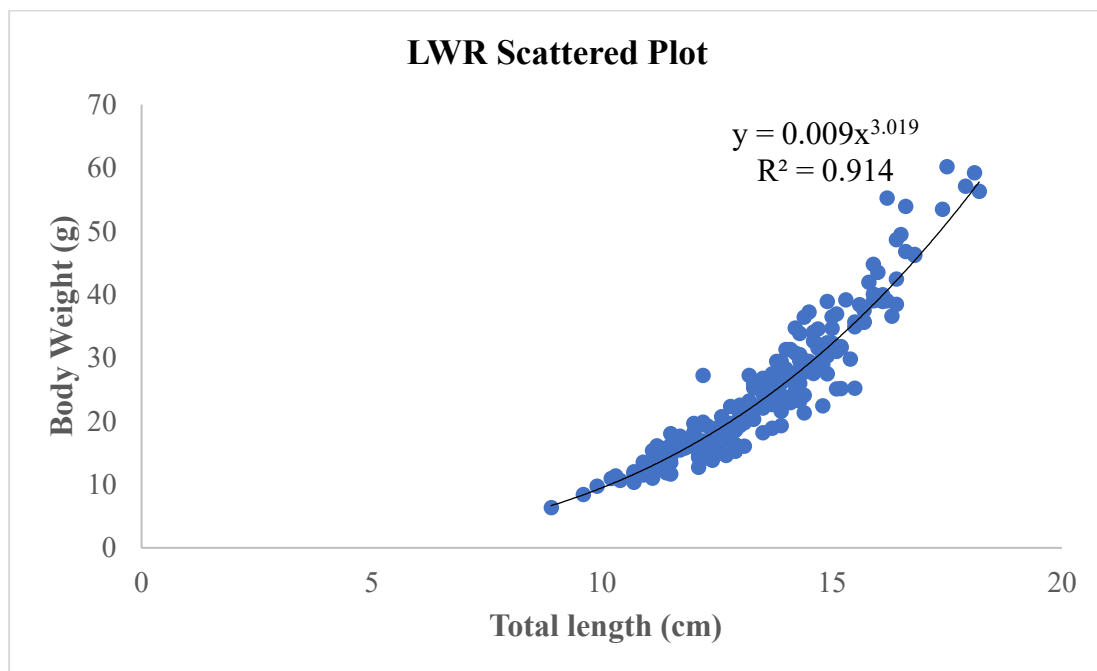


Figure 2: Scattered plot showing length- weight relationship of *Gymnostomus fulungee*

A variation in the ‘b’ value attributed to multiple factors such as conditions at habitat, season of collection, degree of stomach fullness at the time fish capture, gonad maturity and health of fish, preservation techniques and differences in the fish length (Wootton, 1990; Tesch, 1971; Weatherly and Gill, 1987; Hossain et al., 2014). Isometric growth pattern and condition factor close to 1.0 reflected on favorable conditions in environment and niche (Froese, 2006). r^2 describes coefficient of determination for goodness of fit. The value estimated in present study was 0.914. It is within normal range of 0 to 1.0 (Kuriakose, 2017).

Condition factor of fishes calculated during present study was found in range 0.7 to 1.5. The average condition factor was 0.96 ± 0.12 . The relative condition factor (K_n) value observed during study was 1.02. overall fitness for fish species is assumed when K_n values are equal or close to 1 (Jisr,2018). Condition factor value close to 1.0 means that most of the fishes were

in good physical conditions in habitat. Condition factor (K) reveals about physical and biological conditions of fish. It may fluctuate with feeding habits and in case of parasitic infections (Le Cren, 1951). The biotic and abiotic environmental conditions significantly influence the condition factor of fish and hence it can be used to assess the status of the aquatic ecosystem (Anene, 2005).

4. Conclusion:

The findings and result obtained during this study revealed that fishes exhibited isometric growth in habitat. Condition factor (K) average value was close to 1.0 indicated that fishes were in good physical form in habitat. Relative condition factor (Kn) value during study 1.02 revealed overall goodness of species in habitat. Morphometric indices studied in present work showed suitability of environmental conditions to fishes in study area.

Competing Interests

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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