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Note

Biological parameters of the revalidated cyprinid *Osteobrama dayi*, endemic to the Godavari River, India

Rejani Chandran, Kantharajan Ganesan, Rajeev Kumar Singh*, Lalit Kumar Tyagi, Achal Singh, Uttam Kumar Sarkar

ICAR-National Bureau of Fish Genetic Resources, Lucknow – 226 002, Uttar Pradesh, India

Abstract

The length-weight relationship is of great importance in fishery assessments. In the present study, we estimated the length-weight relationship (LWR) of a recently re-validated endemic cyprinid, *Osteobrama dayi*, which is endemic to the Godavari River. The specimens were collected from their natural habitat between 2021 and 2023. The "b" value ranged from 3.29 to 3.50 between pre-monsoon and monsoon season, whereas the "a" value ranged between 0.0056 and 0.0029, respectively. This study provides the first report on LWR for *O. dayi* and records the maximum standard length (26.4 cm) and total weight (728 g), recorded for this species from the wild, along with the condition factor (K). The baseline information on LWR and K for *O. dayi* will be useful in further studies on the stock management of this endemic species.

*Correspondence e-mail:
rajeevsingh1@yahoo.com

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The length-weight relationship (LWR) is of significant importance in fishery research, as it is used for age and growth studies, weight prediction from length measurements, stock assessment studies, and biomass estimation (Nazek *et al*., 2018). LWR studies also play a vital role in predicting feeding intensity, metamorphosis, comparing interspecific and interpopulation morphometric composition across fish species, and assessing the general well-being of fish populations (Hajjej *et al*., 2011). Altered feed availability, parasite infestations, and other factors affect fish physically and biologically, which is reflected in their condition factor (Le Cren, 1951). The condition factor is an estimate of fish well-being that compares robustness and provides information on food abundance and breeding duration (Ao *et al*., 2017). This information is vital to culture systems as it provides insight into the specific conditions under which organisms develop (Araneda *et al*., 2008).

The genus *Osteobrama* belongs to the family Cyprinidae and includes 10 species. These species are highly nutrient-rich, small indigenous fishes with great culture potential. Hora and Misra (1940) described *Osteobrama dayi* from the Godavari River, but Menon (1999) synonymised this species with *O. vigorsii*. Shangningam *et al.* (2020) validated *O. dayi* by carrying out a comparative analysis and documenting distinct, distinguishable characters between *O. dayi* and *O. vigorsii*. The present study aims to document the length-weight relationship, condition factor, maximum length, and maximum weight (in the wild) of this important endemic species. As the species has been revalidated after six decades, proactive measures must be taken to document its biological attributes as a step towards its conservation and management. The present study provides estimates of LWR and the extent of general well-being for sustainable management and protection of this important species.

A total of 68 specimens of *O. dayi* were collected from July 2021 to May 2023 from fish landing centres/markets from Rajamahendravaram, Andhra Pradesh (Lat: 16.99° N; Lon: 81.75° E) (Fig. 1). The taxonomic identification of the collected specimens was done based on keys illustrated by Talwar and Jhingran (1991), Jayaram (1999), and the re-description given by Shangningam *et al.* (2020).

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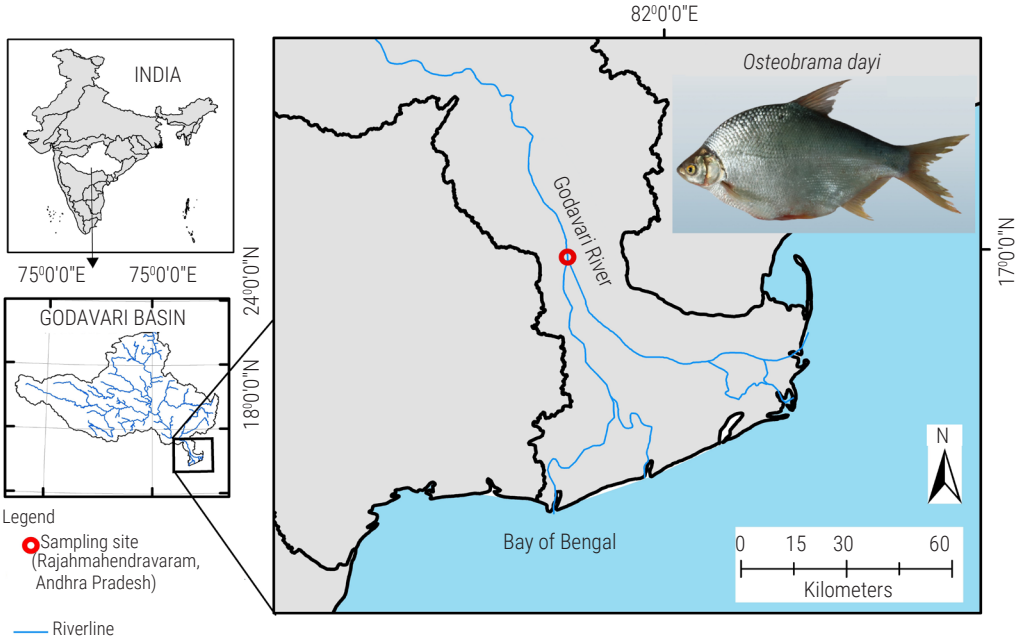

Fig. 1. Sampling location of *O. dayi* in Godavari River, India

The total length (TL), measured from the snout tip to the caudal fin tip, and standard length (SL), measured from the snout tip to the posterior end of the last vertebra, were measured using a digital vernier calliper (Mititoyo Make) with 0.01 cm accuracy. The total wet body weight (W) was measured by an electronic weighing balance (Sartorius Make) with 0.01 g accuracy. Though the specimens were collected from commercial catches and were already dead, the protocols for the current study were approved by the Institutional Animal Ethical Committee (IAEC), ICAR-National Bureau of Fish Genetic Resources (ICAR-NBFGR), Lucknow, India, vide No. NBFGR/IAEC/2020/039.

The length-weight relationship (LWR) was calculated using the formula given by Le Cren (1951), $W = a L^b$, where W = body weight (g), L = total length (cm); "a" is the intercept, "b" is the slope of the relationship. The logarithmic form is ln W = ln a + b ln L. The growth parameters "a" and "b" were estimated using the least square regression method, and the coefficient of determination (R^2) was analysed to test the robustness of the fit. The condition factor was determined by the coefficient of condition factor (K) (Fulton, 1904) using the equation, $K = 100W/L^b$, where K = condition factor; W = weight of fish (g); L = total length of the fish (cm) and b = value obtained from the length-weight equation. The relative condition factor (Kn) (Le Cren, 1951) was estimated using the equation Kn = Wo/Wc, where Kn = relative condition factor, Wo = observed weight and Wc = calculated weight. The analysis involved basic statistical computations and regression model fitting, which were conducted using the standard analytical tools available in MS Excel.

The present study used seasonal sampling to assess length-weight relationships in *O. dayi*. A total of 44 specimens were collected during the monsoon season, while 24 specimens were collected during the pre-monsoon season. The total length and weight of *O. dayi* specimens ranged from 14.2 to 34.7 cm and 22 to 728 g, respectively. The largest specimen (Total length = 34.7 cm) was deposited in the National Fish Museum and Repository (Accession Code: CYPODAY.1), at the ICAR-NBFGR, Lucknow, India. A comparative assessment of inter-seasonal LWR was made for *O. dayi*. Regression coefficient "b" was calculated as 3.50 (R^2=0.97) during the monsoon, while 3.29 (R^2=0.80) during the pre-monsoon season (Table 1). The overall regression coefficient for the species was found to be 3.48 (R^2=0.95) (Fig. 2). The outlier observation indicated in the figure corresponds to the largest specimen collected during the monsoon season. When this specimen was excluded, the regression coefficient was 3.47 (R^2 = 0.93), indicating no appreciable change in the regression

Table 1. Estimated parameters of length-weight relationships of *O. dayi*

Season	N	Regression parameters					Condition factor (K)	Relative condition factor (Kn)
		a	95% CL of a	"b"	95% CL of "b"	R^2		
Monsoon	44	0.0029	0.0016- 0.0054	3.50	3.30-3.71	0.97	1.28	1.00
Pre-monsoon	24	0.0056	0.00063- 0.0489	3.29	2.56-4.01	0.80	1.33	1.01
Total	68	0.0031	0.0017- 0.0056	3.48	3.28-3.68	0.95	1.30	1.01

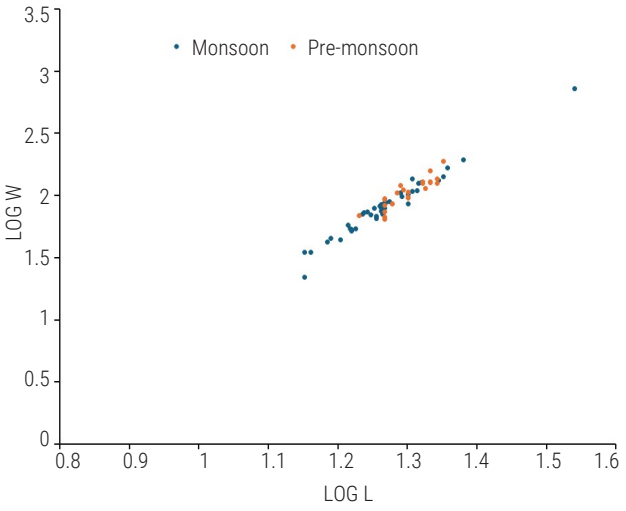

Fig. 2. Regression of Log L against Log W of *O. dayi*

analysis. The condition factor was 1.30, while the relative condition factor was 1.01. Over the course of 2 years, only 68 samples could be collected owing to the species' endemic status and limited availability in the wild. All length and weight measurements of the 68 specimens were log-transformed to normalise the distributions, after which the regression equation was fitted. Despite the limited sample size, the regression coefficients were highly significant (based on p values), with small standard errors and good 95% confidence intervals. However, sex-wise seasonal analyses were not performed, which is a limitation of the present study.

The present study documents the maximum recorded length (34.7 cm) and body weight (728 g) of *O. dayi*. The highest standard length recorded in the present study (26.4 cm) is higher than that reported by Hora and Mishra (1940) (12.75 cm). This study also substantiates previously unavailable biological information. The results of LWR in the present study confirm Le Cren's (1951) hypothesis that, in nature, fishes depart significantly from the cube law and do not retain the same shape or body outline throughout their lifespans. The "b" value (3.48) for *O. dayi* exceeded 3, indicating positive allometric growth (Froese, 2006), with weight increasing more than the cube of length consistently across seasons. Such growth patterns reflect favourable habitat conditions and overall physiological fitness, including gonadal development and reproductive potential. Positive allometric growth is also widely recognised as a biological indicator of good stock health and habitat quality and provides critical input for stock assessment, fisheries management, and conservation planning.

A variation in the "b" value might have been due to the single or combined effects of several factors such as habitat, season, degree of stomach fullness, gonad maturity, sex, health, preservation techniques, sample size, and observed length range differences of the specimens (Wootton, 1990; Chandran *et al*., 2023). Considering that, apart from physiological factors, the LWR might vary over seasons and at times on a daily basis (Giosa *et al*., 2024) The current investigation also assessed the extent of variation in LWR and condition factor during monsoon and pre-monsoon samplings. The growth coefficient "b" was higher during the monsoon, possibly due to the abundance of plankton, which might be its preferred food, like all fishes of the genus *Osteobrama*, in the water body, owing to the surface runoff. Given the endemic nature of *O. dayi*, the present findings aassume added conservation significance. The Godavari River is experiencing increasing anthropogenic pressures, including flow regulation, pollution, and habitat fragmentation, that threaten the endemic fish populations (Kantharajan *et al*., 2026). In this context, observed growth patterns provide essential baseline data for evaluating population health. Regular monitoring using growth and condition indices is critical for early detection of population declines, supporting IUCN-based assessments, and guiding effective conservation and management of this endemic species within the basin.

This study provides the first reference on the length-weight relationship of this re-described valid species from Indian waters, for which no such record exists in FishBase (Froese and Pauly, 2023). Given the unknown population trends and the ongoing global decline in freshwater biodiversity (Tickner *et al*., 2020), documenting its distribution and conservation status in line with IUCN criteria is essential. The present findings offer essential baseline data for estimating growth and other biological parameters, thereby supporting informed conservation planning and sustainable management of this endemic fish species.

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