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Some morphometric traits of *Rita rita* from Southern Punjab, Pakistan

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Abstract
In this research work, fifty (50) specimens of *Rita rita* inhabiting River Chenab, one of the five rivers of the Punjab Province, were evaluated to observe morphometric and proximate composition of the fish specimens. To analyze the influence of biological factors, condition factor was determined based on body constituents using regression equations. Various morphometric characters i.e. total length (TL), standard length (SL), fork length (FL), head length (HL), head width (HW), body girth (BG), body depth (BD), dorsal fin length (DFL), pectoral fin length (PtFL), pelvic fin length (PvFL), anal fin length (AFL), dorsal fin base (DFB), anal fin base (AFB), caudal fin length (CFL), and caudal fin width (CFW) were measured to know their correlation with the size and types of growth pattern. Morphometric analysis showed isometric growth pattern of the fish in the current study.

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Introduction

In aquaculture, change in size and tissue composition of fish is a key component (Assan et al., 2021). Fish weight and length are crucial factors in fish evaluations (Kuriakose, 2017; Ankita et al., 2023). During development, organisms generally gain weight and length. Traits such as age, size, sexual maturity, water temperature, oxygen, number of fish using same food sou--rce, and food availability affect fish growth (Kuriakose, 2017). Understanding fish food and feeding behavior is crucial for fish culture (Assan et al., 2021). Fish size, behavior, size, temperature, stocking density, and food concentration can impact the amount of food they eat (Bassmann et al., 2023).

Morphological research on fish and other aquatic animals is crucial for understanding behavior, ecology, conservation, evolution, and the management of water resources (Başusta et al., 2014; Kalhoro, 2015; Amin and Borzee, 2024). In fish biology, for examining the patterns in the life cycle of a fish, morphometric data is essential (Ferdaushy and Alam, 2015; Tripathy, 2020). Fisheries biologists (Mustafa and Brooks, 2008; El_Aiatt et al., 2021) and taxonomists (Simon et al., 2010; Ulain et al., 2016) respect statistical relationships among fish morphometric measurements. Practical and objective statistical model equations for fish growth represent growth pattern data and estimate fish weight (Nielsen et al., 2014). Fish farming management requires accurate biomass estimates to feed fish. Relationship equations for length and weight allow stock assessment models to convert growth-in-length to growth-in-weight to evaluate fish morphology and condition (Stergiou and Moutopolous, 2001; Jisr et al., 2018).

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Researchers often employ biometric relations to convert field data into indices (Mendes et al., 2004; Ankita et al., 2023; Rahman et al., 2024). The most common biomass estimation methods in fisheries management are length-weight relationships (L-W-R) and length-length relationships (L-L-R) (Adarsh and James, 2016). Fisheries scientists use the link between weight and length of fish to estimate mean stock weight by known group length (Gupta and Banerjee, 2015).

Rita rita, an omnivorous catfish, occurs widely in rivers and estuaries of the South Asian countries, however, its growth in terms of body weight and length varies in different environments (Ankita et al., 2023). In the Punjab Province five rivers differ in terms of composition of water, so River Chenab presents a specific habitat. Thus, it was naïve to expect that the catfish inhabiting in Chenab might have different growth pattern compared with that of the fish inhabiting other contemporary rivers. So, the primary objective of the current study was to measure a number of morphometric traits of the fish and relate them to its growth and productivity.

Materials and Methods

Fifty (50) samples of *Rita rita* were collected from Head Muhammad Wala, Multan, Punjab, Pakistan, for the analysis of complete morphometric characters and proximate body composition. The fish samples were then transported to the Fish Research Lab. The samples were weighed using an electric balance once any trash and extra water had been removed to the nearest 0.01 g. A hardwood measuring tray with a mm scale was embedded into it and a Vernier caliper that measures body length precisely to the nearest 0.01 cm, was used for the measurements. Total length was measured with the lobes flattened along the midline, between the tip of the snout and the longer caudal fin lobe. The measurement of length was done along a straight line rather than across the body's curvature by the measurement board. Standard length was taken from the nose tip to the back of its final vertebra or to the back of its mid-lateral section of the hypural plate by a wooden measurement board. For measuring fork length (FL) a wooden measurement box was used to determine the total length. Starting at the tip of the fish's snout, the shortest median fin ray of the tail was employed for determining this length. For estimating head length, a scale was used; it is the length of the opercula bone measured from the beginning of the mouth to its posterior end. Pre-orbital length was noted by applying a Vernier caliper. This was taken from the tip of the snout of the fish to the interior hard margin of the orbit. Eye was taken using a Vernier caliper. Dorsal, pectoral, pelvic, caudal, and anal fin lengths were recorded with a Vernier caliper. Dorsal, pectoral, pelvic, caudal, and anal fin bases were measured also by using a Vernier caliper. For measuring pre-dorsal and post-dorsal lengths a Vernier caliper was used. Pre-pelvic length was taken using a Vernier caliper starting from the tip of the snout to the starting point of the pelvic fin.

Fulton condition factor (CF) was calculated using the following equation: CF = [Weight/Length 3] X 100

Statistical analysis

One-way analysis of variance was employed to statistically analyze the percentages of different body contents collected in order to ascertain the impacts on the fish's body composition. The Multiple Range Test was used to assess differences between the treatment means at the $P < 0.05$ significance level. A multiple regression analysis was also computed to compare different variables.

Results

Overall, 50 specimens of *Rita rita* were captured for analysis of external morphometric parameters. The correlation and regression analyses of some important morphological features with total length, wet weight and condition factor were carried out. The mean values ± S.D and the ranges for maximum and minimum measurements for some important morphological features, e.g., standard length, head width, anal fin length, body girth, condition factor, pelvic fin length, head length, dorsal fin length, tail fin length, tail fin width, total length, body depth, and pectoral fin length were measured for *Rita rita* collected from River Chenab. The mean value and standard deviation of total length (TL) was 19.82 ± 0.92 cm and the range had been from 17.1 to 22 cm. For wet weight (WW) mean value was 82.08 ± 12.89 g and the range from 52 to 126 g.

The value of condition factor (K) had been 1.047 ± 0.074, ranging from 0.877 to 1.225; Standard length (SL) 16.034 ± 0.83 cm with a range from 14.4 to 18.7 cm; mean value of forklength (FL) was 16.67 ± 1.09 cm with a range from 13.8 to 19.6 cm; Head length (HL) mean value had been documented as 4.456 ± 0.298 cm, ranging from 3.80 to 5.10 cm; Head width (HW) was noted as 2.360 ± 0.717 cm with a 1.80-4.90 cm range. The mean body depth (BD) was 4.184 ± 0.592 cm with a range 3.0-5.70 cm; body girth (BG) was on an average 8.368 ± 1.184 cm with a range from 6.00 to 11.40 cm. Dorsal fin length

(DFL) was documented as 5.078 ± 0.626 cm with a range being 4.0 to 6.40 cm. Dorsal fin base (DFB) was found to be 2.242 ± 0.289 cm varying from 1.80 to 2.80 cm. Pectoral fin length (PeFL) had been 4.014 ± 0.404 cm with a range being 3.10 to 5.00 cm. Pelvic fin length (PvFL) was documented as 2.366 ± 0.591 cm ranging from 1.60 to 5.00 cm. Anal fin length (AFL) was recorded as 2.562 ± 0.336 cm with a range from 1.60 to 3.40 cm; anal fin base (AFB) had been 1.814 ± 0.174 cm with a range from 1.40 to 2.20 cm. Caudal fin length (CFL) had been 4.164 ± 0.365 cm with values ranging from 3.40 to 5.30 cm; caudal fin width (CFW) was noted as 1.968 ± 0.178 cm with a range from 1.60 to 2.40 cm and eye diameter (ED) being 0.444 ± 0.064 cm ranging from 0.30 to 0.60 cm as shown in Table 1.

Table 1. Mean values and ranges of different external morphological traits of *Rita rita*

Parameter	Mean	±	S.D.	Range		
WW (g)	82.080	±	12.889	52.000	-	126.000
TL (cm)	19.822	±	0.924	17.100	-	22.000
Condition factor	1.047	±	0.074	0.877	-	1.225
SL (cm)	16.034	±	0.830	14.400	-	18.700
FL (cm)	16.676	±	1.092	13.800	-	19.600
HL (cm)	4.456	±	0.298	3.800	-	5.100
HW (cm)	2.360	±	0.717	1.800	-	4.900
BD (cm)	4.184	±	0.592	3.000	-	5.700
BG (cm)	8.368	±	1.184	6.000	-	11.400
DFL (cm)	5.078	±	0.626	4.000	-	6.400
DFB (cm)	2.242	±	0.289	1.800	-	2.800
PtFL(cm)	4.014	±	0.404	3.100	-	5.000
PvFL (cm)	2.366	±	0.591	1.600	-	5.000
AFL (cm)	2.562	±	0.336	1.600	-	3.400
AFB (cm)	1.814	±	0.174	1.400	-	2.200
CFL (cm)	4.164	±	0.365	3.400	-	5.300
CFW (cm)	1.968	±	0.178	1.600	-	2.400
PeFB (cm)	0.802	±	0.280	0.400	-	1.300
PvFB (cm)	0.622	±	0.082	0.500	-	0.900
ED (cm)	0.444	±	0.064	0.300	-	0.600

WW, Wet weight; TL, Total length; SL, Standard length; FL, Fork length; HL, Head length; HW, Head weight; BD, Body depth; BG, Body girth; DFL, Dorsal fin length; DFB, Dorsal fin base; PtFL, Pectoral fin length; PvFL, Pelvic fin length; AFL, Anal fin length; AFB, Anal fin base; CFL, Caudal fin length; CFW, Caudal fin width; PeFB, Pectoral fin base; PvFB, Pelvic fin base; ED, Eye diameter

The regression results of fish length with other morphometric traits of *Rita rita* are presented in Table 2. The correlation coefficient of fish length with wet weight had been ('*R*' value) 0.885, with head length 0.542, with standard length 0.912, and with dorsal fin base 0.462; all these *R* values were highly significant ($P < 0.001$). A significant correlation of fish length was observed with anal, dorsal and pelvic fin bases with *R* values being 0.420, 0.334 and 0.462, respectively. However, least significant correlation of fish length was recorded with caudal width, pelvic fin base and eye diameter reflecting *R* values 0.296, 0.296 and 0.333, respectively. Non-significant correlation of fish length was recorded with the remaining parameters (Table 2).

Table 2. Descriptive statistical analysis of total length (TL, cm) with various morphometric attributes of *Rita rita*

Equation	a	b	S.E (b)	*R*	r^2
W= a+bTL	-162.720	12.350	0.936	0.885***	0.784
K = a+bTL	1.069	-0.001	0.012	$-0.013^{n.s}$	0.000
SL= a+bTL	-0.210	0.819	0.053	0.912***	0.832
FL= a+bTL	13.892	0.140	0.169	$0.119^{n.s}$	0.014
HL= a+bTL	0.985	0.175	0.039	0.542***	0.294
HW = a+bTL	3.765	-0.071	0.112	$-0.091^{n.s}$	0.008
BD= a+bTL	4.242	-0.003	0.092	$-0.005^{n.s}$	0.000
BG= a+bTL	8.484	-0.006	0.185	$-0.005^{n.s}$	0.000
DFL= a+bTL	-0.641	0.289	0.088	0.426**	0.181
DFB= a+bTL	-0.626	0.145	0.040	0.462***	0.214
PeFL= a+bTL	1.975	0.103	0.061	$0.236^{n.s}$	0.055
PvFL= a+bTL	1.287	0.054	0.092	$0.085^{n.s}$	0.007
AFL= a+bTL	0.486	0.105	0.050	0.288*	0.083
AFB= a+bTL	0.249	0.079	0.025	0.420**	0.176
CFL = a+bTL	4.088	0.004	0.057	$0.010^{n.s}$	0.000
CW = a+bTL	0.838	0.057	0.027	0.296*	0.088
PeFB= a+bTL	-1.201	0.101	0.041	0.334**	0.112
PvFB = a+bTL	0.838	0.057	0.027	0.296*	0.088
ED= a+bTL	-0.016	0.023	0.009	0.333*	0.111

*, **, *** = significant at 5%, 1%, and 0.1% probability levels. n.s = non-significant

The results of the regression analysis of log total length (TL) with other log transformed morphometric traits for *Rita rita* are given in Table 3. The regression analysis of log total length with all other log transformed parameters such as *R* of log wet weight had been 0.794, that of log fish length with log head width being 0.541, that with log standard length as 0.909; these all values were highly significant. The *R* value of log fish length with log anal fin base had been 0.389, with log pelvic fin base 0.445, and with log eye diameter 0.344; these values had significant correlation values. Moreover, the R value of log fish length with log pelvic fin base had been noted as 0.338, with log pectoral fin base 0.294, and with log anal fin length 0.280; all these values were least significant. However, the *R* value of log fish length with the remaining parameters as listed in Table 3 had been non-significant.

Table 3. Descriptive regression analysis of log total length (TL, cm) with various morphometric attributes of *Rita rita*

Equation	a	b	S.E (b)	*R*	r^2	t-value (b=1)
LogW=a+bLogTL	-1.958	2.982	0.219	0.891***	0.794	-1.585
LogK=a+bLogTL	0.042	-0.018	0.219	$-0.012^{n.s}$	0.000	-4.585
LogSL=a+bLogTL	-0.084	0.994	0.066	0.909***	0.826	-14.204
LogFL=a+bLogTL	1.003	0.168	0.201	$0.120^{n.s}$	0.014	-4.812
LogHL=a+bLogTL	-0.356	0.774	0.174	0.541***	0.293	-4.984
LogHW=a+bLogTL	0.822	-0.357	0.704	$-0.073^{n.s}$	0.005	-1.776
LogBD=a+bLogTL	0.659	-0.032	0.434	$-0.011^{n.s}$	0.000	-2.338
LogBG=a+bLogTL	0.960	-0.032	0.434	$-0.011^{n.s}$	0.000	-2.338
LogDFL=a+bLogTL	-0.760	1.128	0.341	$0.431^{n.s}$	0.185	-1.803
LogDFB=a+bLogTL	-1.215	1.205	0.357	$82.189^{n.s}$	0.192	-1.600
LogPeFL=a+bLogTL	-0.109	0.548	0.299	$0.256^{n.s}$	0.065	-2.796
LogPvFL=a+bLogTL	-0.385	0.578	0.616	$0.134^{n.s}$	0.018	-1.045
LogAFL=a+bLogTL	-0.633	0.800	0.397	0.280*	0.078	-1.722
LogAFB=a+bLogTL	-0.782	0.801	0.274	0.389**	0.151	-2.849
LogCFL=a+bLogTL	0.624	-0.005	0.262	$-0.003^{n.s}$	0.000	-3.824
LogCW=a+bLogTL	-0.434	0.560	0.263	0.294*	0.086	-3.239
LogPeFB=a+bLogTL	-3.601	2.681	1.077	0.338*	0.114	1.753
LogPvFB=a+bLogTL	-1.721	1.165	0.338	0.445**	0.198	-1.790
LogED=a+bLogTL	-1.697	1.033	0.407	0.344**	0.118	-1.421

*, **, *** = significant at 5%, 1%, and 0.1% probability levels. n.s = non-significant

Table 4 displays the findings of the regression-based analysis of wet weight with various morphometrics traits of *Rita rita*. The *R* value of wet weight with standard length had been 0.885, with head length 0.597, and with total length 0.885. The *R* values of wet weight with dorsal fin base and length were calculated to be 0.443 and 0.440, respectively. However, non-significant *R* value (0.269) was noted of wet weight with pectoral fin length. The remaining parameters showed least significant or non-significant correlations with wet weight (Table 4).

Table 4. Descriptive statistical analysis of wet weight (W, g) with various morphometric attributes of *Rita rita*

			Correlation coefficient		
Equation	a	b	S.E (b)	*R*	r^2
TL= a+bWW	14.611	0.063	0.005	0.885***	0.784
K = a+bWW	0.838	0.003	0.001	0.442**	0.195
SL= a+bWW	11.355	0.057	0.004	0.885***	0.783
FL= a+bWW	16.252	0.005	0.012	$0.061^{n.s}$	0.004
HL= a+bWW	3.321	0.014	0.003	0.597***	0.357
HW = a+bWW	2.220	0.002	0.008	$0.031^{n.s}$	0.001
BD= a+bWW	3.798	0.005	0.007	$0.103^{n.s}$	0.011
BG= a+bWW	7.595	0.009	0.013	$0.103^{n.s}$	0.011
DFL= a+bWW	3.313	0.022	0.006	0.443**	0.196
DFB= a+bWW	1.432	0.010	0.003	0.440**	0.193
PeFL= a+bWW	3.323	0.008	0.004	$0.269^{n.s}$	0.072
PvFL= a+bWW	1.565	0.010	0.006	$0.213^{n.s}$	0.045
AFL= a+bWW	1.950	0.007	0.004	$0.286^{n.s}$	0.082
AFB= a+bWW	1.355	0.006	0.002	0.414**	0.172
CFL = a+bWW	3.889	0.003	0.004	$0.119^{n.s}$	0.172
CW = a+bWW	1.513	0.006	0.002	0.402**	0.172
PeFB= a+bWW	0.232	0.007	0.003	0.320*	0.102
PvFB = a+bWW	0.351	0.003	0.001	0.521***	0.172
ED= a+bWW	0.238	0.003	0.001	0.503***	0.253

*, **, *** = significant at 5%, 1%, and 0.1% probability levels. n.s = non-significant

The results of the regression-based analysis of log total length (TL) with other log-transformed morphometric traits of *Rita rita* are given in Table 5. The *R* value of log wet weight with log total length had been 0.891, with log standard length 0. 872, with log head length 0.573, and with log pelvic fin base and eye diameter as 0.473 and 0.510, respectively; all these values were highly significant ($P < 0.001$). A significant *R* value (0.443) was recorded of log wet weight with condition factor, with dorsal fin length 0.452, with dorsal fin base 0.394, with anal fin base 0.396, and with caudal fin width 0.388. However, the remaining parameters showed non-significant correlations with log wet weight (Table 5).

Table 5. Descriptive regression analysis of log wet weight (W, g) with different morphometric traits of *Rita rita*

				Correlation coefficient		
Equation	**a**	**b**	**S.E (b)**	***R***	r^2	**t-value (b=3)**
LogTL=a+blogW	0.788	0.266	0.020	0.891***	0.794	-16.602
LogK=a+blogW	-0.364	0.201	0.059	0.443**	0.196	-5.422
LogSL=a+blogW	0.661	0.285	0.023	0.872***	0.760	-14.000
LogFL=a+blogW	1.157	0.034	0.060	$0.080^{n.s}$	0.006	-5.443
LogHL=a+blogW	0.180	0.245	0.051	0.573***	0.328	-6.279
LogHW=a+blogW	0.187	0.091	0.211	$0.062^{n.s}$	0.004	-1.476
LogBD=a+blogW	0.464	0.080	0.129	$0.090^{n.s}$	0.008	-2.476
LogBG=a+blogW	0.765	143.37	143.37	$0.090^{n.s}$	143.371	143.368
LogDFL=a+blogW	0.027	0.354	0.101	0.452**	0.205	-2.921
LogDFB=a+blogW	-0.271	0.324	0.109	0.394**	0.155	-2.704
LogPeFL=a+blogW	0.263	127.52	127.52	$0.277^{n.s}$	127.523	127.520
LogPvFL=a+blogW	-0.302	0.349	0.179	$0.271^{n.s}$	0.073	-1.495
LogAFL=a+blogW	-0.006	0.215	0.119	$0.252^{n.s}$	0.063	-2.547
LogAFB=a+blogW	-0.208	0.244	0.082	0.396**	0.156	-3.799
LogCFL=a+blogW	0.541	0.040	0.078	$0.074^{n.s}$	0.006	-4.188
LogCW=a+blogW	-0.130	0.221	0.076	0.388**	0.151	-4.129
LogPeFB=a+blogW	-1.669	0.810	0.322	0.342*	0.117	-0.217
LogPvFB=a+blogW	-0.916	0.370	0.099	0.473***	0.224	-2.946
LogED=a+blogW	-1.231	0.458	0.112	0.510***	0.260	-2.499

*, **, *** = significant at 5%, 1%, and 0.1% probability levels. n.s = non-significant

The results of the regression analysis of condition factor (K) with other morphometric traits of *Rita rita* are displayed in Table 6. The *R* value of K with wet weight was recorded as 0.442**, that with head weight 0.292*, with pelvic fin length 0.331*, and with eye diameter 0.436**. However, the correlation of condition factor with other parameters had been non-significant (Table 6).

Table 6. Descriptive statistical analysis of condition factor (K) with various morphometric traits of *Rita rita*

Equation	**a**	**b**	**S.E (b)**	***R***	r^2
TL= a+bK	19.997	-0.167	1.791	-0.013	0.000
W = a+bK	1.990	76.476	22.412	0.442**	0.195
SL= a+bK	14.539	1.428	1.596	$0.128^{n.s}$	0.016
FL= a+bK	17.654	-0.934	2.113	$-0.064^{n.s}$	0.004
HL= a+bK	3.566	0.850	0.565	$0.212^{n.s}$	0.045
HW = a+bK	-0.587	2.814	1.329	0.292*	0.085
BD= a+bK	2.222	1.874	1.115	$0.236^{n.s}$	0.056
BG= a+bK	4.443	3.748	2.230	$0.236^{n.s}$	0.056
DFL= a+bK	3.814	1.207	1.201	$0.144^{n.s}$	0.021
DFB= a+bK	2.163	0.075	0.561	$0.019^{n.s}$	0.000
PeFL= a+bK	3.308	0.674	0.776	$0.124^{n.s}$	0.015
PvFL= a+bK	-0.389	2.630	1.081	0.331*	0.110
AFL= a+bK	2.387	0.167	0.650	$0.037^{n.s}$	0.001
AFB= a+bK	1.596	0.208	0.336	$0.089^{n.s}$	0.008
CFL = a+bK	3.142	0.976	0.693	$0.199^{n.s}$	0.040
CW = a+bK	1.273	0.664	0.331	$0.278^{n.s}$	0.077
PeFB= a+bK	0.528	0.261	0.541	$0.070^{n.s}$	0.005
PvFB = a+bK	0.409	0.204	0.155	$0.186^{n.s}$	0.035
ED= a+bK	0.049	0.377	0.112	0.436**	0.190

*, ** = significant at *P* 5% and *P* 1%. n.s = non-significant

Discussion

The primary objective of this study was to determine the relationship of *Rita rita* weight and length with other fish growth parameters. The correlation between length-weight relationship (LWR) in fishes is important for morphological studies. It is commonly used to determine fish growth pattern. Morphometry allows the assessment of fish body weight, profit estimation, and the identification of achievable dissimilarity among stocks of similar fish species (King, 2007; Traverso et al., 2024).

In the research or management of fishes, LWR is an important attribute. The body weight of fish is calculated using the L-W regression (Li et al., 2023), because it may take longer in the field to measure weight directly (Sinovcic et al., 2004). The current study's findings demonstrate that fish development was isometric. It demonstrates that not all fish develop or increase the same way. When the length of fish is increasing, the body of fish becomes slim and lean. In LWR regression, the value of "b" helps us to find out different patterns of growth in fishes. The growth is isometric when "b" is equivalent to 3 (Ragheb, 2023). It means that when length increases, fish attains size and becomes strong (Li et al., 2023).

Cube law stated that if there is an increase in one unit of length then there is an increase of three units of mass, because mass increases in different dimensions and length increases in one dimension only at any age of fish (Ikpewe et al., 2021). Mass of fish can be compared with cube of length. Therefore, the ideal "b" value for isometric growth of mass with respect to length is measured as 3; when "b" is greater than 3 the growth of fish is positively allometric. It means that fish will become heavier as compared to length with passage of time. Thus, fish growth is not equal in different dimensions. When b is less than 3 fish will become lighter as compared to its length (Ragheb, 2023).

In the present study, the weight-length relationship of *Rita rita* followed the Cube law. The value of "b" was found to be 2.982 that is almost close to 3. So, *Rita rita* in the present study showed the isometric growth. The L-W correlation was highly significant ($^{***}P < 0.001$). Relative growth of an organ or parts with respect to total length was classified as negative allometric growth when "b" value obtained from the regression analysis is less than 1 ($b < 1$). It shows positive allometric growth when "b" value is greater than 1 ($b > 1$). When "b" value is equal to 1 or not significantly different from one, then growth is isometric (Xie et al., 2024).

Correlation co-efficient analysis showed a highly significant relationship ($n = 50$) among L (length) of external body parameters to total length both on logarithmic and arithmetic scales. All the parameters, i.e., standard length (b = 0.818), head weight (b = 0.340), head length (b = 0.260), body girth (b = 0.306), dorsal fin length (b = 0.170), pelvic fin length (b = 0.201), anal fin base (b =0.550), fork length (b = 1.006), caudal fin length (b = 0.181), body depth (b = 0.144), tail width (b = 0.122), dorsal fin base (b = 0.518), pelvic fin length (b =0.601) showed negative allometric growth except fork length (b = 1.006) which indicates positive allometric growth. In the regression equation if b value was not different from the ideal value (b = 0.33) that represented the isometric growth between log length of external parts and wet body weight. If b value is significantly different from the ideal value (b = 0.33) then it represents allometric growth, i.e., if b value is greater than 0.33, the growth is positive allometric, and if b value is less than 0.33, the growth is negatively allometric (Hossain et al., 2006; Xie et al., 2024).

Conclusion

The present work provides an important information on the morphometric correlation and proximate body composition relationships of *Rita rita* under natural conditions. This information will be helpful for future management of this particular fish. Moreover, further studies on length-weight relationship could provide more comprehensive picture of the growth of this species under river waters.

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Contribution of authors
Conceptualized and designed the study: SuR, NB, MAR, HMI. Conducted research and wrote up the first draft of the manuscript: SuR. Data analysis: SuR, NB, MAR. Reviewed and edited the manuscript: SuR, NB, MAR, HMI.

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Handling of bio-hazardous materials
The authors certify that all experimental materials were handled with care during collection and experimental procedures. After completion of the experiment, all materials were properly discarded to minimize/eliminate any types of bio-contamination(s).

Availability of primary data and materials
As per editorial policy, experimental materials, primary data, or software codes are not submitted to the publisher. These are available with the corresponding author and/or with other author(s) as declared by the corresponding author of this manuscript.

Authors' consent
All authors contributed in designing and writing the entire review article. All contributors have critically read this manuscript and agreed to publish in IJAaEB.

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It is declared that we the authors did not use any AI tools or AI-assisted services in the preparation, analysis, or creation of this manuscript submitted for publication in the International Journal of Applied and Experimental Biology (IJAaEB).

References
Adarsh, S., James, R.A. (2016). Morphometric role on length-length and length weight relationship of sulphur goatfish (*Upeneus sulphureus*, Cuvier, 1829) from Mandapam Coast, Southern India. *International Journal of Advanced Research* 4(1):825- 839.

Amin, H. Borzée, A. (2024). Understanding the distribution, behavioural ecology, and conservation status of Asian *Pelophylax*. *Diversity* 16:259. https://doi.org/10.3390/d16050259

Ankita, A., Khan, M.A., Khan, S. (2023). Age and growth assessment of the near-threatened fish *Rita rita* (Siluriformes: Bagridae) in the Ganges basin. *Revista de Biología Tropical* 71(1):e51374. https://dx.doi.org/10.15517/rev.biol.trop..v71i1.51734

Assan, D., Huang, Y., Mustapha, U.F., Addah, M.N., Li, G. et al. (2021). Fish feed intake, feeding behavior, and the physiological response of Apelin to fasting and refeeding. *Frontiers in Endocrinology* 12:798903. https://doi.org/10.3389/fendo.2021.798903

Bassmann, B., Hahn, L., Rebl, A., Wenzel, L.C., Hildebrand, M.-C. et al. (2023). Effects of stocking density, size, and external stress on growth and welfare of African catfish (*Clarias gariepinus* Burchell, 1822) in a commercial RAS. *Fishes* 8:74. https://doi.org/10.3390/fishes8020074

Başusta, A., Özer, E.I., Girgin, H., Serdar, O., Başusta, N. (2014). Length-weight relationship and condition factor of *Hippocampus hippocampus* and *Hippocampus guttulatus* inhabiting Eastern Black Sea. *Pakistan Journal of Zoology* 46:447- 450.

El-Aiatt, A.O. (2021). Length-weight relationship and condition factor of white grouper *Epinephelus aeneus* (Geoffroy Saint Hilaire, 1817) in the Mediterranean coast of Sinai, Egypt. *Egyptian Journal of Aquatic Biology and Fisheries* 25(4):573–586.

Ferdaushy, M.H., Alam, M.M. (2015). Length-length and length-weight relationships and condition factor of nine freshwater fish species of Nageshwari, Bangladesh. *International Journal of Aquatic Biology*, 3(3):149-154.

Gupta, S., Banerjee, S. (2015). Length-weight relationship of *Mystus tengara* (Ham.-Buch., 1822), a freshwater catfish of Indian subcontinent. *International Journal of Aquatic Biology* 3(2):114-118.

Hossain, M.Y., Ahmed, Z.F., Leunda, P.M., Islam, A.K.M.R., Jasmine, S. et al. (2006). Length-weight and length-length relationships of some small indigenous fish species from the Mathabhanga River, Southwestern Bangladesh. *Journal of Applied Ichthyology* 22(4):301-303.

Ikpewe, I.E., Baudron, A.R., Ponchon, A., Fernandes, P.G. (2021). Bigger juveniles and smaller adults: Changes in fish size correlate with warming seas. *Journal of Applied Ecology* 58:847–856. https://doi.org/10.1111/1365-2664.13807

Jisr, N., Younes, G., Sukhn, C., El-Dakdouki, M.H. (2018). Length-weight relationships and relative condition factor of fish inhabiting the marine area of the Eastern Mediterranean city, Tripoli-Lebanon. *Egyptian Journal of Aquatic Research* 44(4):299-305.

Kalhoro, M.A., Liu, Q., Valinassab, T., Waryani, B., Abbasi, A.R. et al. (2015). Population dynamics of greater lizard fish, *Saurida tumbil* from Pakistani waters. *Pakistan Journal of Zoology* 47:921-931.

King, M. (2007). "Fisheries Biology, Assessment and Management". Blackwell Publishing Ltd. https://doi.org/10.1002/9781118688038.ch6

Kuriakose, S. (2017). Estimation of length weight relationship in fishes. *In* "Summer School on Advanced Methods for Fish Stock Assessment and Fisheries Management". Lecture Note Series No. 2/2017. CMFRI; Kochi, Kochi, pp. 215-220.

Li, Y., Feng, M., Huang, L., Zhang, P., Wang, H. et al. (2023). Weight-length relationship analysis revealing impacts of multiple factors on body shape of fish in China. *Fishes 8:269*. https://doi.org/10.3390/fishes8050269

Mendes, B., Fonseca, P., Campos, A. (2004). Weight–length relationships for 46 fish species of the Portuguese west coast. *Journal of Applied Ichthyology* 20 (5):355–361.

Mustafa, M.G., Brooks, A.C. (2008). Status of fisheries resource and management approach in the open Beels of Bangladesh: a comparative case study. *Asian Fisheries Science* 21:189- 203.

Nielsen, J.R., Kasper, K., Peter, L., Francois, B. (2014). A statistical model for estimation of fish density including correlation in size, space, time and between species from research survey data. *PloS one* 9:e99151. https://doi.org/10.1371/journal.pone.0099151

Ragheb, E. (2023). Length-weight relationship and well-being factors of 33 fish species caught by gillnets from the Egyptian Mediterranean waters off Alexandria. *Egyptian Journal of Aquatic Research* 49(3):361-367.

Rahman, M.K., Shahinur Rahman, B.M., Lima, R.A., Ali, A., Mahmud, Y. (2024). Biometric indices of eight fish species from the catchment area of Kaptai lake, Bangladesh. *Ecological Frontiers* 2024: https://doi.org/10.1016/j.ecofro.2024.05.007

Simon, K.D., Mazlan, A.G., Samat, A., Zaidi, C.C., Aziz, A. (2010). Size, growth and age of two congeneric archer fishes (*Toxotes jaculatrix* Pallas,1767 and *Toxotes chatareus* Hamilton, 1822) inhabiting Malaysian coastal waters. *Sains Malaysiana* 39(5):697–704.

Sinovcic, G., Franicevic, M., Zorica, B., Ciles-Kec, V. (2004). Length-weight and length-length relationships for 10 pelagic fish species from the Adriatic Sea (Crotia). *Journal of Applied Ichthyology* 20:156-158.

Traverso, F., Aicardi, S., Bozzo, M., Zinni, M., Amaroli, A. et al. (2024). New insights into geometric morphometry applied to fish scales for species identification. *Animals: an open access journal from MDPI* 14(7):1090. https://doi.org/10.3390/ani14071090

Tripathy, S.K. (2020). Significance of traditional and advanced morphometry to fishery science. *Journal of Human, Earth, and Future* 1:153-166.

Ulain, M., Farooq, R., Saleem, B. (2016). Implication of role of statistics in fish taxonomy. *International Journal of Biology and Biotechnology* 13:257-260.

Xie, M., Wang, P., Deng, Q., Liu, S., Zhang, Z. et al. (2024). Allometric growth pattern and hunger tolerance of *Hemibarbus maculatus* Bleeker larvae. *Biology* 13:164. https://doi.org/10.3390/biology13030164