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***Research Article** (Open Access)*

BIOMETRICS OF THE MULLET, *RHINOMUGIL CORSULA* (HAMILTON, 1822) FROM LOWER REACHES OF BRAHMAPUTRA RIVER, ASSAM

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ABSTRACT
This study presents the first assessment of biometrics for *Rhinomugil corsula* (Hamilton, 1822) from the Brahmaputra River in Assam, India. Total length (TL) of the species ranged from 9.5–21.5 cm (Mean 12.53 ± 2.15), while body weight ranged from 6.97–84.43 g (Mean 16.12 ± 3.58). For all length measurements, growth type was negative (-ve) allometric (b<3). Co-efficient of determination (r^2) was found as 2.695, 2.757 and 2.787 for Total Length (TL), Standard Length (SL) and Fork Length (FL) respectively. Total length-body weight relationship was observed as $BW=0.016TL^{2.695}$, Standard length-body weight relationship as $BW=0.024SL^{2.757}$ and Fork length-body weight as $BW=0.015FL^{2.787}$. The correlation co-efficient are recorded between 0.633 and 0.995. There was a positive relationship observed between all the length parameters. The findings will help the fishery biologists, managers and conservationists to initiate management strategies and regulations for the sustainable conservation of this species in Brahmaputra River ecosystem.

Keywords: *Length-Weight Relationship, Rhinomugil corsula, Brahmaputra River, Assam*

INTRODUCTION
Rhinomugil corsula (Hamilton, 1822) (Mugiliformes: Mugilidae) is a commercially important Mullet species locally known as *Khorsula* or *Kursa* or *Uporsakua* in Assam. It is widely distributed in the rivers and estuaries throughout the Indian sub-continent including Bangladesh, India, Nepal and Myanmar (Froese and Pauly, 2025). It attains a maximum total length of 45 cm. *R. corsula* is an important species in the Brahmaputra River and is widely preferred by the consumers in India. The fish is considered as a least concern under the family Mugilidae and has high demand as food fish in Asian countries (Ara *et al*., 2024). Natural population of this fish has declined to an alarming condition due to over-exploitation and various ecological changes in its natural habitats and deserves high conservation importance (Hossain *et al*., 2013).

Biometric studies have often been recommended by the researchers to conserve and manage fishery resources because it can provide an accurate assessment of fish biomass in a particular habitat (Hasan *et al*., 2021). The length-weight relationship (LWR) is a handy tool in fishery assessment which helps in predicting weight from length required in yield assessment and in the calculation of the standing crop biomass (Martin-Smith, 1996). Estimations of LWRs allow fisheries scientists to convert growth-in-length equations to growth-in-weight in stock assessment models, calculate fish condition, compare life history and morphological aspects of populations inhabiting different regions and estimate biomass from length frequency distributions (Famoofo and Abdul, 2020).

There is limited information available on the biometrics of *R. corsula* in different river systems of the world. Reports on LWRs and condition factor of this species is available from the Sitakunda coast of the Bay of Bengal, Bangladesh (Ara *et al.* (2021). Hossain *et al.* (2013) investigated the biometrics of the *R. corsula* (Hamilton, 1822), including length-weight relationships (LWRs), condition factors and sex ratio and length-frequency distributions in the Padma River in Northwestern Bangladesh. In India, Length-Weight Relationship and Condition Factor of *R. corsula* (Hamilton, 1822) has been studied by Bhatt *et al*.

(2021) in four major estuaries of Gujarat. No study has been conducted so far on biometrics of *R. corsula* in the Brahmaputra River system in Assam, India. This study therefore presents the first reference on biometrics for this species in the Brahmaputra River in Assam, India.

MATERIALS AND METHODS

The study area covers the lower reaches of the Brahmaputra River (25°50′–26°20′ N; 90°10′–91°05′ E) in Assam, India. Brahmaputra is the main river in Assam and is believed to be an important spawning and feeding ground for many riverine fish species**.** The samples were collected monthly both in the morning hours (6:00–9:00) and evening hours (5:00–6:00) from commercial catches landed at local fish market between January, 2025 and December, 2025. Fishes were caught by the professional fishermen using traditional fishing gears including *dheki jaal* (lift net) and *ber jaal* (wall net). Collected specimens were immediately fixed in 10% buffered formalin solution and taken to the laboratory for identification. Identification was done following the taxonomic keys (Talwar and Jhingran, 1991; Jayaram, 2012).

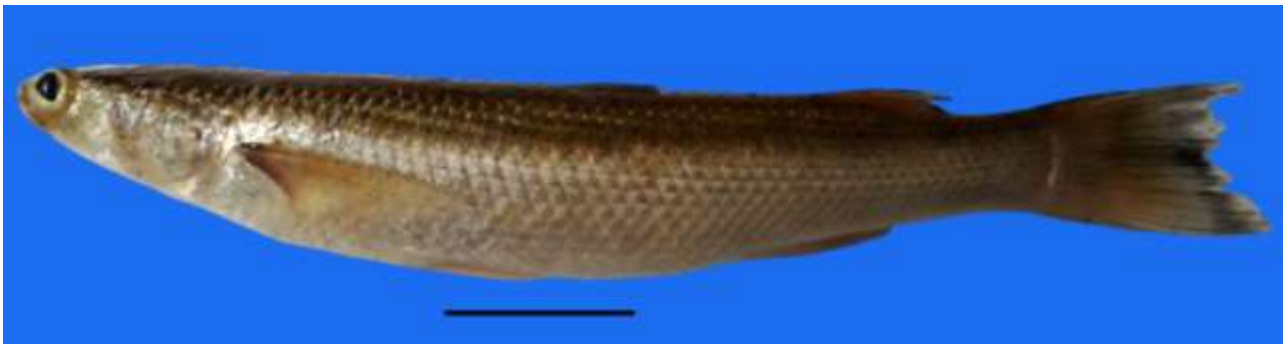

Figure 1: A specimen of *Rhinomugil corsula* (Hamilton, 1822) (bar indicates 2 cm).

For each individual, various length (TL, SL, FL, DF_1L, DF_2L, PcFL, PvFL, AFL) was measured to the nearest 0.01 cm using digital slide calipers and wet body weight (BW) was taken on a digital balance (Shimadzu, BL-220H) with 0.01 g accuracy. The LWR was estimated using the equation: $W=a\times L^b$, Where W stands for body weight (g), L for length (cm), a is the intercept (constant) and b the exponent. The coefficient of determination r^2 was also calculated. Growth type of the species is presented as positive (+ve) allometric or negative (-ve) allometric ($b>3$ or $b<3$). Statistical analysis was conducted using Microsoft Excel 2007 and XLSTAT software version 2025.1.

RESULTS AND DISCUSSION

The descriptive statistics of the various biometric measurements are presented in the table 1. The results are based on 114 specimens of *R. corsula* collected from the lower reaches of Brahmaputra River in Assam. To the best of the knowledge, this study provides the first information on the LWR of *R. corsula* in this river. A total of eight length measurements and body weight are taken for calculation of LWR equations. Total length (TL) of the species was observed between the range of 9.5 cm and 21.5 cm (Mean, 12.53 ± 2.15), while body weight (BW) ranged from 6.97 g to 84.43 g (Mean, 16.12 ± 3.58). Bhatt *et al*. (2021) reported total length (TL) of *R. corsula* within the range of 11.5 to 24.5 cm and total weight within 12.38 to 144.56 g. The asymptotic smaller body size of the fish species in the present study might be due to changes in environmental conditions, such as salinity, temperature, and food availability (Ben-Hasan *et al*., 2024). Though this can be attributed to biological reasons but are more likely owing to technical reasons such as different sample sizes, different gear selectivity and/ or shrinkage in body size of the formalin preserved specimens (Hossain *et al.*, 2012). This also suggests differences in their growth (Frontal *et al*., 2004).

Table 1: Descriptive statistics of *R. corsula* from lower reaches of Brahmaputra River

n	Measurements	Minimum	Maximum	Mean ± SD	$CL_{95\%}$
114	TL	9.5	21.5	12.53±2.15	12.53±0.40
	SL	7.2	18.7	10.39±1.89	10.39±0.35
	FL	9.0	20.9	11.95±1.98	11.95±0.36
	DF_1L	2.9	21.6	10.42±3.20	10.42±0.59
	DF_2L	7.05	32.52	14.24±3.67	14.24±0.68
	PcFL	9.23	33.27	20.72±4.39	20.72±0.81
	PvFL	6.57	24.77	13.57±3.28	13.57±0.61
	AFL	8.53	27.72	16.12±3.58	16.12±0.66
	BW	6.97	84.43	16.12±3.58	16.12±0.66

Table 2: LWRs of *R. corsula* along with co-efficient of determination (r^2)

	n	Regression parameters		r^2	Growth type
LWR equation		*a*	*b*		
$BW = 0.016TL^{2.695}$	114	0.016	2.695	0.869	- ve allometric
$BW = 0.024SL^{2.757}$	114	0.024	2.757	0.867	- ve allometric
$BW = 0.015FL^{2.787}$	114	0.015	2.787	0.876	- ve allometric

Table 3: Correlation matrix of various length-length measurements of *R. corsula*

	TL	**SL**	**FL**	**DF_1L**	**DF_2L**	**PcFL**	**PvFL**	**AFL**
TL	1.000	0.994	0.995	0.963	0.964	0.653	0.860	0.842
SL		1.000	0.989	0.961	0.960	0.633	0.855	0.834
FL			1.000	0.965	0.972	0.659	0.855	0.838
DF_1L				1.000	0.980	0.689	0.907	0.890
DF_2L					1.000	0.691	0.887	0.868
PcFL						1.000	0.797	0.787
PvFL							1.000	0.917
AFL								1.000

***TL-** Total Length, **SL-** Standard Length, **FL-** Fork Length, **DF_1L-** Dorsal Fin_1 Length, **DF2L-** Dorsal Fin 2 Length, **PcFL-** Pectoral Fin Length, **PvFL-** Pelvic Fin Length, **AFL-** Anal Fin Length.*

Length-weight relationship (LWR) of *R. corsula* for total length (TL), standard length (SL) and fork length (FL) are presented in the table 2. In all cases, LWRs were calculated irrespective of sex (male or female). Total length-body weight relationship was observed as $BW=0.016TL^{2.695}$, Standard length-body weight relationship as $BW=0.024SL^{2.757}$ and Fork length-body weight as $BW=0.015FL^{2.787}$ respectively. The regression parameter '*a*' is observed within the range from 0.015 to 0.02, which is within the normal range of 0.001-0.05 as proposed by Froese (2006), though there was significant variation among different length measurements. The slope (*b*) value ranged from 2.695 to 2.787 for all types of length measurements. The LWRs with '*b*' values significantly different from 3.0 is often associated with narrow size ranges of the specimens examined (Torres *et al*., 2017). Ranganathan and Natarajan (1969) reported an overall '*b*' value 3.002 and 3.175 for *R. corsula* from Sathnur Reservoir and Krisnagiri Reservoir (India). Mortuza and Rahman (2006) observed the regression coefficient combined sexes in *R. corsula* as (2.984) very much closed to 3.0. Present finding also shows the similar trend following the cubic law.

The value of '*b'* may deviate from the ideal value of 3 that represents an isometric growth because of certain environmental circumstances or the condition of the fish themselves (Jisr *et al*., 2018). The growth coefficient (*b*) value of the length–weight relationship obtained in the present study is less than 3 indicating the negative (-ve) allometric (b<3) growth type. Similar pattern of negative allometric growth was also reported in the *R. corsula* population as a whole (b = 2.761) in the Padma River of northwest Bangladesh (Hossain *et al*., 2013). In the present study, '*b*' values were within the limits (2.5–3.5) as reported by Froese (2006) for most fishes. The differences in '*b*' values can be attributed to the combination of one or more factors including habitat, area, seasonal effect, degree of stomach fullness, gonad maturity, sex, health, preservation techniques etc. (Gonzalez-Acosta *et al.,* 2004). Most fish species often deviate from isometric growth as the shape of their bodies change with growth (Thomas *et al*., 2003). However, there is no existing theory that says the *b*-value must be negatively or positively allometric (Pauly, 1983).

Co-efficient of determination was found as 0.869, 0.867 and 0.876 for Total Length (TL), Standard Length (SL) and Fork Length (FL) respectively indicating good fits ($p < 0.01$). According to Hmoud *et al*. (2003), deviation in value of growth coefficient may be affected by various factors such as difference in ecological conditions of the habitat, variation in physio-chemical conditions of the environment, seasonal fluctuation, food and space availability, competition with indigenous species, presence of immature fishes in the samples and reproductive stages. TL-BW, SL-BW and FL-BW relationships are also presented in the form of regression curve (Figure 2 to 4). Linear relationship was observed in arithmetic expression of length-weight relationship for all the length measurements. Similar relationships between length and weight were reported by Ara *et al.* (2021) for *R. corsula* collected from the coast of Bay of Bengal (Bangladesh).

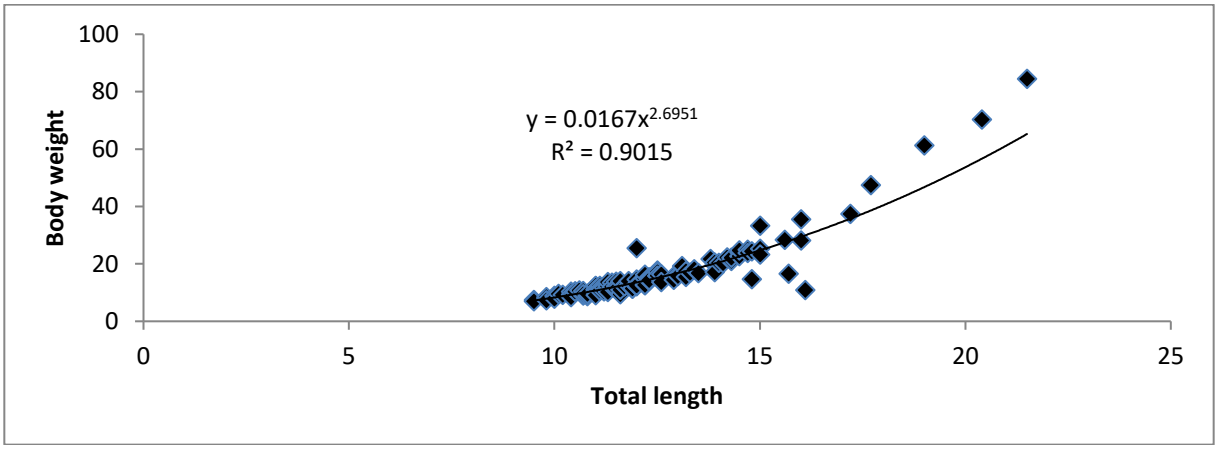

Figure 2: Body weight-total length relationship of *R. corsula*

The correlation co-efficient for the various length-length measurements are presented in the form of correlation matrix (Table 3). The values of correlation co-efficient are observed between the range of 0.633 and 0.995. The findings show positive relationship between all the length parameters, which indicates the healthy condition of this species in its habitat. In a study, Ara *et al*. (2021) observed coefficient of correlation within the range of 0.990 to 0.998 for *R. corsula* collected from Brackish water system.

Thus, the Brahmaputra River system can be considered as a suitable habitat for *R. corsula*. The findings of the present study will provide valuable baseline information for fishery biologists, resource managers and conservationists to develop effective management strategies and regulatory measures for sustainable conservation of this species within the Brahmaputra River ecosystem. The study further emphasizes the need for additional research on the potential for freshwater culture of *R. corsula* in the region.

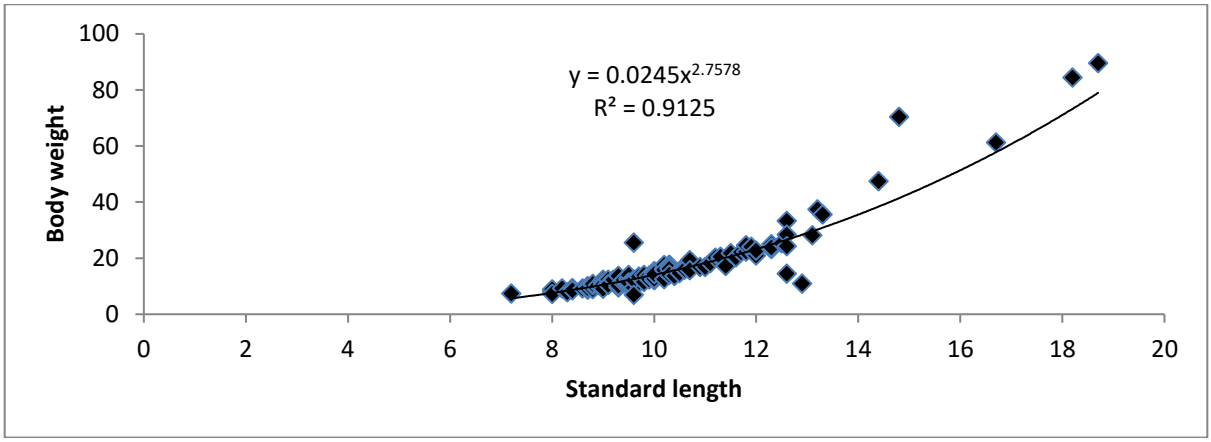

Figure 3: Body weight-standard length relationship of *R. corsula*

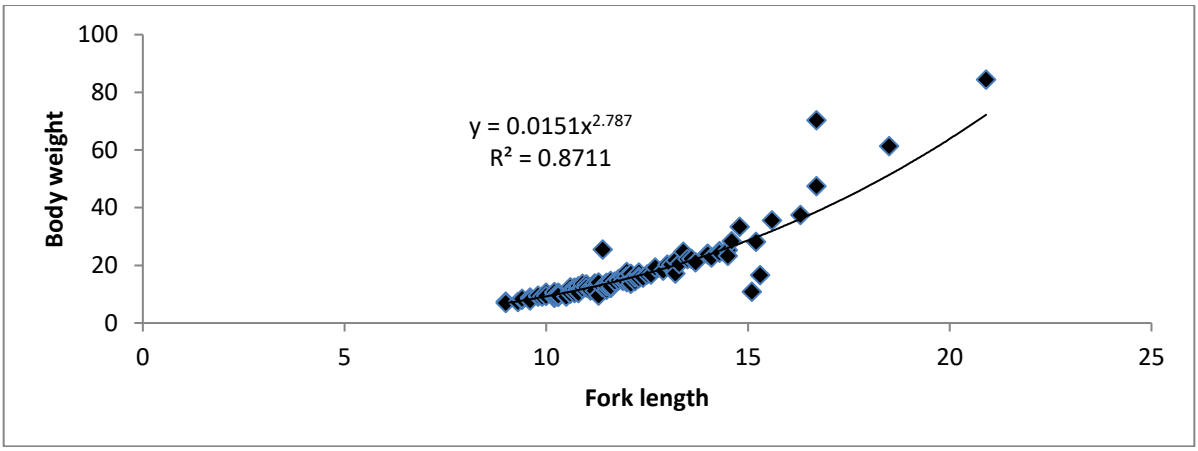

Figure 4: Body weight-fork length relationship of *R. corsula*

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