



## Length-weight relationship and relative condition factor of Indian river shad *Gudusia chapra* (Hamilton, 1822) in oxbow lakes of Bangladesh

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### Abstract

Length-weight relationships (LWRs) and the relative condition factor are crucial parameters in fisheries stock assessment studies. In this study, LWRs and the condition factor of the Indian river shad *Gudusia chapra* (Hamilton, 1822) were examined from three oxbow lakes (locally known as baor; 42–166 mm, 0.76–24.93 g) in Bangladesh. A total of 924 specimens were collected from Baluhar ( $n = 316$ ), Purapara ( $n = 287$ ) and Khushna ( $n = 321$ ) oxbow lakes across three seasons (pre-monsoon, monsoon and post-monsoon) during March–December 2022 using standardized fishing nets. In Baluhar Baor, the lowest (2.588) and highest (3.017)  $b$  values were recorded in the post-monsoon and monsoon seasons, respectively. In Purapara and Khushna oxbow lakes, these values ranged from 2.893 (post-monsoon) to 2.972 (monsoon) and from 2.748 (post-monsoon) to 2.883 (monsoon), respectively. The coefficient of correlation ( $r$ ) exhibited a consistent trend across all length categories as well as between seasons (all  $r^2 > 0.96$ ). The present study will contribute to the development of future strategies for the sustainable management of *G. chapra* in the oxbow lakes of Bangladesh and similar aquatic ecosystems.

**Keywords:** condition factor; *Gudusia chapra*; Indian river shad; LWR; oxbow lake; SIS

### 1 | INTRODUCTION

Fisheries in Bangladesh, a nation rich in diverse aquatic resources, play a vital role in human nutrition, employment generation, and foreign exchange earnings (Mredul *et al.* 2021). An oxbow lake (locally known as baor) typically resembles a saucer-shaped depression, common in the southwestern region of Bangladesh and compared to

wetlands (locally called beel), oxbow lakes are more stagnant and retain water throughout the year. Oxbow lakes are considered very important wetlands in the country, supporting a wide variety of aquatic plants and animals (Mohsin *et al.* 2009). Study of length-length and length-weight relationships (LWRs) provides insights into fish population dynamics (Yin *et al.* 2022). For many tropical

and subtropical fish species, the length–length relationship (LLR) is used to compare population growth patterns and inform aquaculture management strategies (Alam *et al.* 2012). Yield equations, harvest estimation, and comparisons of fish populations across time and space all depend on these relationships (Chanchal *et al.* 1978; Yin *et al.* 2022).

The association between length and weight was calculated using the equation  $W = aL^b$ , where  $a$  and  $b$  represent the intercept and slope, respectively, of the linear regression equation based on the relationship between body weight and length (Froese 2006). Numerous studies have emphasized the importance of establishing LWRs in fish, as they provide insights into physical traits, growth patterns, overall health and well-being, onset of maturity, initiation of spawning, stock variation, habitat conditions, life history, and fatness (Le Cren 1951; Froese 2006). To identify specific variations in fish length and weight—either individually or in groups—as indicators of condition, health, productivity, and physiological status, LWRs have been widely studied (Pramesthy *et al.* 2022).

The condition factor ( $K$ ), derived from a fish’s length and weight, provides numerical indicators of physiological state and feeding behavior within a given niche (Ali *et al.* 2014; Arafat and Bakhtiyar 2022). The  $K$  measures deviations from the average weight in a sample to assess whether a particular aquatic environment is suitable for fish growth and development (Arafat and Bakhtiyar 2022). Furthermore, physiologically significant indices such as LWRs, allometric condition factors (KA), relative condition factors (KR), and Fulton’s condition factor (KF) can be employed to evaluate the health of fish populations and the status of fish stocks (Islam *et al.* 2021).

Additionally, relative weight (WR) has been utilized in Bangladesh to evaluate freshwater fishes, and it has been one of the most widely used indicators. According to Esenowo *et al.* (2016), the coefficient values of the LWR are products of the condition factor and provide a key to understanding a fish’s life cycle, which may be influenced by both biotic and abiotic environmental variables (Anene 2005). *Gudusia chapra* is a small indigenous fish species in Bangladesh, commonly found in freshwater habitats (Rahman 2005; Galib *et al.* 2018; Parvez *et al.* 2023). Because biometric studies can provide an accurate picture of freshwater fish biomass in a particular habitat, researchers frequently employ them to manage and safeguard fisheries resources (Islam *et al.* 2021). Habitat specific information on the different aspects of biology of any fish might provide important information that can be useful for the sustainable management of the species. However, despite wider availability in the country, only a limited number of studies have been published on the LLR, LWR and condition factor of *G. chapra* in Bangladesh (Mondal *et al.* 2019). This study is therefore an attempt to investigate the relationship between length and weight in

this species.

## 2 | METHODOLOGY

### 2.1 Study area

This study examines the lentic interactions of three oxbow lakes in Kotchandpur and Mohespur Upazilla of Jhenaida District, Bangladesh. These oxbow lakes include Baluhar, Porapara and Khushna. The total areas of Baluhar and Khushna oxbow lakes are 260.9 ha and 19.4 ha, respectively, with GPS coordinates of 23°24’N, 89°1’E and 23°44’N, 89°02.8’E (Figure 1). Both oxbow lakes were once part of the Kapotaksha River. Another oxbow lake in Jhenaidah, Puropara, covers 91.3 ha and is located at 23°33’N, 88°82’E (Figure 1).

### 2.2 Fish sampling

Between March 2022 and December 2022, fishermen used cast nets (mesh: 1–2 cm), gill nets (mesh: 1.5–2.5 cm), and square lift nets (mesh: 1 cm) to catch and identify fish. Specimens of *G. chapra* were collected from professional fishermen in pre-monsoon (March–May), monsoon (June–August) and post-monsoon (September–November) seasons. A total of 924 specimens of *G. chapra* were collected from professional fishermen in three study oxbow lakes (316 from Baluhor, 287 from Porapara, and 321 from Khushna).

After collection, the fish specimens were taken to the laboratory for further analysis, wrapped in polythene containers, cooled and transported in iceboxes. On-site samples were immediately refrigerated on ice, and upon arrival at the lab, they were preserved in 10% buffered formalin.

**TABLE 1** Sampling details of *Gudusia chapra* from three freshwater oxbow lakes in Jhenaidah District of Bangladesh.

Oxbow lakes	$n$	Length (mm)	Weight (g)
Baluhor	316	57.62–166.00	2.44–24.93
Khushna	286	42.00–157.00	0.76–12.25
Poropara	309	55.00–156.00	1.64–15.61

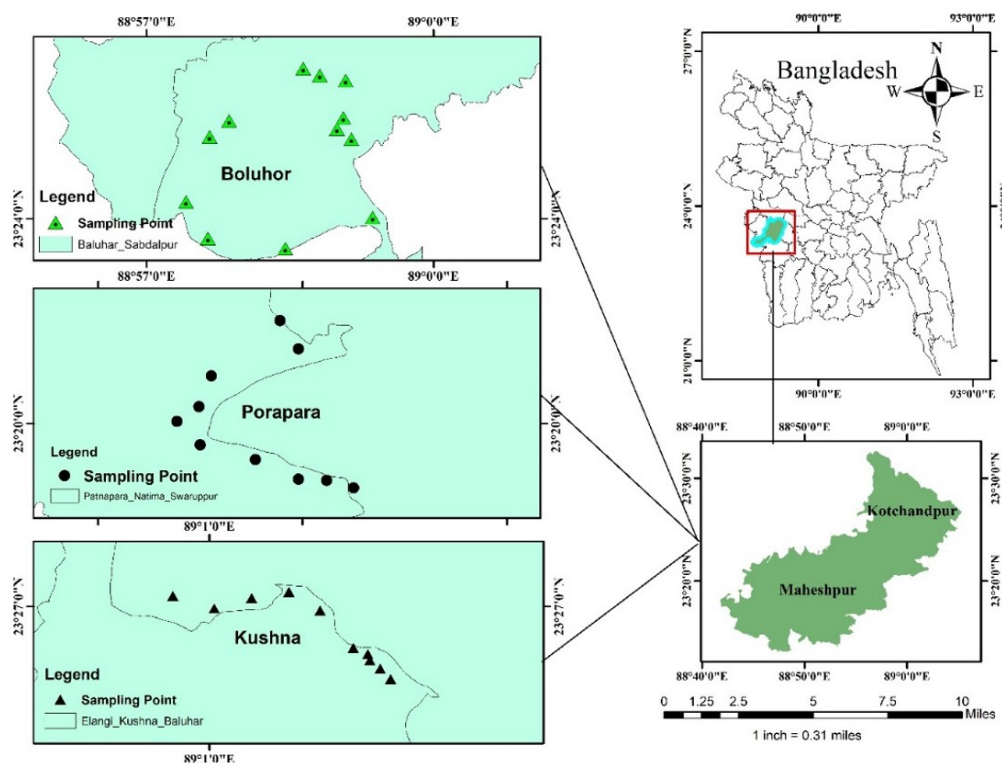
### 2.3 Growth Pattern

LWRs used the formula  $W = aL^b$  to determine the growth pattern. The equation  $\ln(W) = \ln(a) + b \ln(L)$  was applied to calculate the regression coefficients  $a$  and  $b$ . To test whether the value of  $b$  (where  $b = 3$ ) differed significantly from the isometric value, a  $t$ -test was conducted. The 95% confidence limits of  $a$  and  $b$ , as well as the coefficient of determination ( $r^2$ ), were also calculated. Severe outliers were removed from the analysis in accordance with Froese (2006).

Although most studies include only one condition factor, four condition variables (KA, KF, KR, and WR) were evaluated in the present study to assess the health and habitat status of *G. chapra*. Condition factors, expressed

numerically, represent the plumpness or overall condition of the fish, reflecting its physical potential to survive and reproduce (Desrita *et al.* 2021). A *t*-test was again applied

to determine significant differences from the isometric value of  $b = 3$ , thereby characterizing growth patterns as either isometric or allometric (+/-).



**FIGURE 1** Map showing the location of three study oxbow lakes (Boluhor, Khushna and Porapara) in Jhenaidah District of Bangladesh.

Each fish specimen was measured for biometric parameters as follows: using digital slide calipers, the total length (TL) was measured from the tip of the anterior portion of the mouth to the caudal fin. Fish sizes were recorded to the nearest mm. The total lengths ranged from 44 mm to 166 mm. After blot-drying with a clean hand towel, the weight of each fish was determined using an electronic balance, recorded to the nearest gram. Minimum and maximum fish weights were 1.96 g and 16.85 g, respectively. Measurements were taken with an accuracy of 0.01 cm for length and 0.01 g for weight. The length–weight relationship for *G. chapra* was calculated using the equation

$W = aL^b$ , which was log-transformed into the linear regression equation  $\ln(W) = \ln(a) + b \ln(L)$ . Here,  $a$  and  $b$  represent the body form and growth type of the fish, respectively, with  $W$  denoting weight and  $L$  denoting length (Froese 2006).

Furthermore, general linear relationships between different length parameters were determined using consolidated data. The coefficient of determination ( $r^2$ ) and the regression slope ( $b$ ) were calculated with 95% confidence intervals. Fulton’s condition factor (FK) and the relative condition factor (KR) were calculated to assess the reproductive physiology and health condition of *G.*

*chapra* as follows:

$K = (BW / SL^3) \times 100$ , and  $KR = Wo/Wc$ , where  $BW$  is body weight,  $SL$  is standard length,  $Wo$  is observed weight, and  $Wc$  ( $W = aL^b$ ) is calculated weight (Jisir *et al.* 2018).

All sampling, slaughtering, measurement, and other standard procedures were conducted in accordance with ethical approval granted by the Agricultural Research Institute (ARI) ethics committee, established by the Bangladesh Fisheries Research Institute (BFRI).

### 3 | RESULTS AND DISCUSSION

#### 3.1 Length–weight relationship (LWR)

The LWR was estimated for a total of 924 individuals of *G. chapra* (Table 2 and 3, Figure 2–4). For each oxbow lake, three seasonal groups were created from the collected specimens: pre-monsoon, monsoon, and post-monsoon. Fishing cages that target fish within these size ranges have been commonly used by local fishermen. Therefore, the LWRs reported in the present study should be applied within the observed length ranges.

Fish varied in total length (TL) from 42 mm to 166 mm, with the Boluhor oxbow lake producing the longest specimen (166 mm) and the Khushna oxbow lake in Jhenaidah district producing the shortest (42 mm). Table

2 indicates that TL was generally greater before the monsoon and lower during other seasons. At Kaptai Lake in Rangamati, Bangladesh, pooled TL ranged from 65 to 128 mm, which was lower than that observed in Boluhor oxbow lake (Paul *et al.* 2021). Similarly, in Dalani Beel (wetland) in Assam, India, TL ranged within comparable limits

(Kumari *et al.* 2019). According to Sheikh *et al.* (2017), the TL of adult and subadult *G. chapra* ranged from 7.1 to 12.95 cm and 1.42 to 3.52 cm, respectively. Knowledge of maximum length is essential for estimating growth parameters such as the growth coefficient, which is critical for sustainable fisheries management (Kaka *et al.* 2019).

**TABLE 2** Length–weight relationships of *Gudusia chapra* and related statistics of seasonal variation in the studied oxbow lakes.

Periods	Oxbow lake	n	Total Length (mm)			Body weight (g; range)	Parameter of the Relationship			
			Mean	S. E	Range		a	b	S.E(b)	r <sup>2</sup>
Pre-Monsoon	Boluhor	106	89.88	±0.044	57-162	3.12-24.93	0.0181	2.6805	±0.047	0.97
	Porapara	95	85.87	±0.032	60-154	2.1-15.61	0.0082	2.9019	±0.037	0.98
	Khushna	107	76.04	±0.034	48-154	1.21-10.06	0.0089	2.8499	±0.038	0.98
Monsoon	Boluhor	105	97.03	±0.036	62-166	3.35-24.93	0.0067	3.0173	±0.035	0.99
	Porapara	96	82.26	±0.031	55-150	1.59-13.46	0.0072	2.9722	±0.037	0.99
	Khushna	107	76.08	±0.027	42-148	0.76-11.49	0.0088	2.883	±0.028	0.99
Post-monsoon	Boluhor	105	94.01	±0.053	43-147	2.44-24.35	0.0155	2.588	±0.054	0.96
	Porapara	96	85.09	±0.029	56-151	1.64-14.59	0.0083	2.893	±0.033	0.99
	Khushna	107	77.3	±0.033	51-157	1.43-12.25	0.0084	2.748	±0.037	0.98

N sample size, length (L) in mm, weight (W) in g relationship for the species found across seasons, presented here during the pre-monsoon, monsoon and post-monsoon based on  $\log(W) = \log a + b \log(L)$  (a: intercept and b: slope of the equation). SE(b): standard error of b; r<sup>2</sup>: correlation coefficient of the regression.

**TABLE 3** Dimensions of length-weight relationships in *Gudusia chapra* (n = 924) and growth pattern in different seasons in the studied oxbow lakes.

Season	Water Body	n	Length (mm, range)	Weight (g, range)	b	95% CI of b (range)	r <sup>2</sup>	Growth type
Pre-monsoon	Boluhor	106	57-162	3.12-24.93	2.680	2.48-2.69	0.969	A-
	Porapara	95	60-154	2.1-15.61	2.901	2.83-2.97	0.984	A-
	Khushna	107	48-154	1.21-10.06	2.849	2.77-2.92	0.981	A-
Monsoon	Boluhor	105	62-166	3.35-24.93	3.017	2.94-3.08	0.985	A+
	Porapara	96	55-150	1.59-13.46	2.972	2.89-3.04	0.985	A-
	Khushna	107	42-148	0.76-11.49	2.883	2.82-2.93	0.989	A-
Post-monsoon	Boluhor	105	43-147	2.44-24.35	2.587	2.58-2.77	0.956	A-
	Porapara	96	56-151	1.64-14.59	2.893	2.83-2.82	0.987	A-
	Khushna	107	51-157	1.43-12.25	2.747	2.67-2.82	0.981	A-

A+ = positive growth; A- = negative growth; r<sup>2</sup> = coefficient of determination

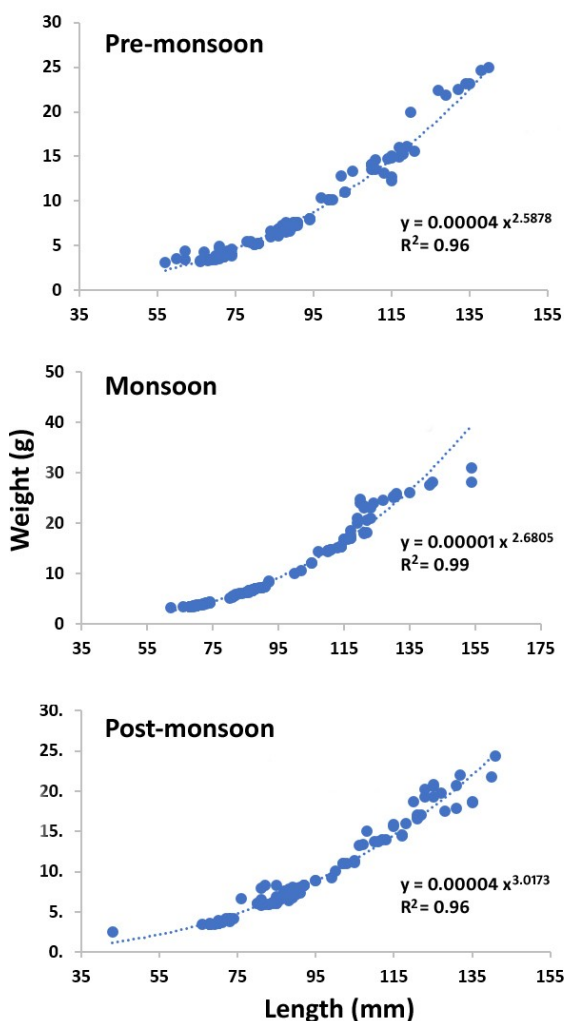
Due to the use of different fishing gears with varying mesh sizes, the number of specimens examined, and the methods of sample preservation, the b value of the same species may vary from study to study. These differences may also arise from ecosystem conditions, as well as seasonal, sexual, and physiological factors of the fish (Froese 2006). The most significant differences in LWR allometric coefficient (b) values are observed between 2.5 and 3.5, though they can range from 2.0 to 4.0 (Froese 2006; Paul *et al.* 2019). The b value generally reflects variation in fish weight and growth (Paul *et al.* 2019). For instance, a b value of 3 indicates isometric growth, meaning the species is growing proportionally in length and weight (Jobling 2008). In contrast, the current study's b value was less than 3, suggesting negative allometric growth (slower

growth rate and reduced body weight) or fluctuations in environmental factors such as physico-chemical parameters (Das *et al.* 2015; Paul *et al.* 2019).

In Boluhor oxbow lake, a higher regression coefficient (b>3) was observed during the monsoon, indicating increased allometric growth. However, before and after the monsoon, all oxbow lakes reported lower regression coefficients (b<3). Paul *et al.* (2019) similarly reported that in Kaptai Lake, Rangamati, Bangladesh, *Gudusia chapra* exhibited b values ranging from 2.51 to 2.93, indicating a tendency toward negative allometric growth.

Other studies reported comparable findings: Kumari *et al.* (2019) observed b values of 2.73 in Panchet Reservoir, Jharkhand, while Sheikh *et al.* (2017) reported values ranging from 0.92 to 2.81 in Dalani Beel (wetland), India.

In Bangladesh, females of *G. chapra* in several environments exhibited both positive and negative allometric growth.



**FIGURE 2** The length-weight relationship of *Gudusia chapra* from Boluhor oxbow lake.

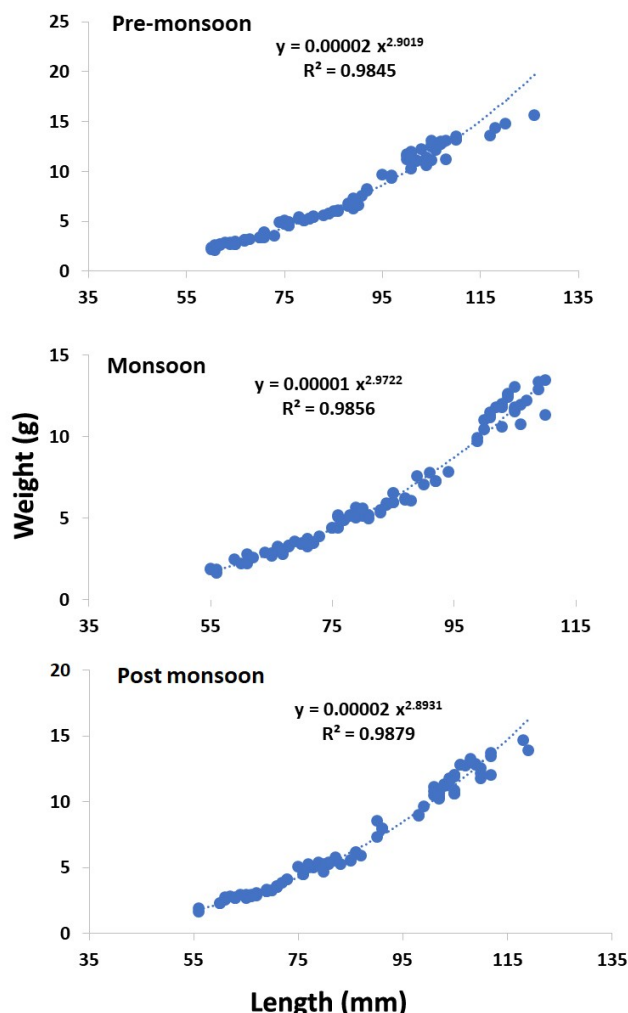
In the present study, the combined-sex *b* value (2.85) was consistent with the findings of Kumari *et al.* (2019). It is evident that multiple factors—including habitat, season, gut content, nutrition, sex, size range, health, and overall fish condition—influence the relationship between fish length and weight (Paul *et al.* 2021).

A strong positive association between length and weight indicate that *G. chapra* exhibits strong growth performance, as its length and weight are highly positively correlated, as reflected by the high correlation coefficient.

### 3.2 The relative condition factor (KR)

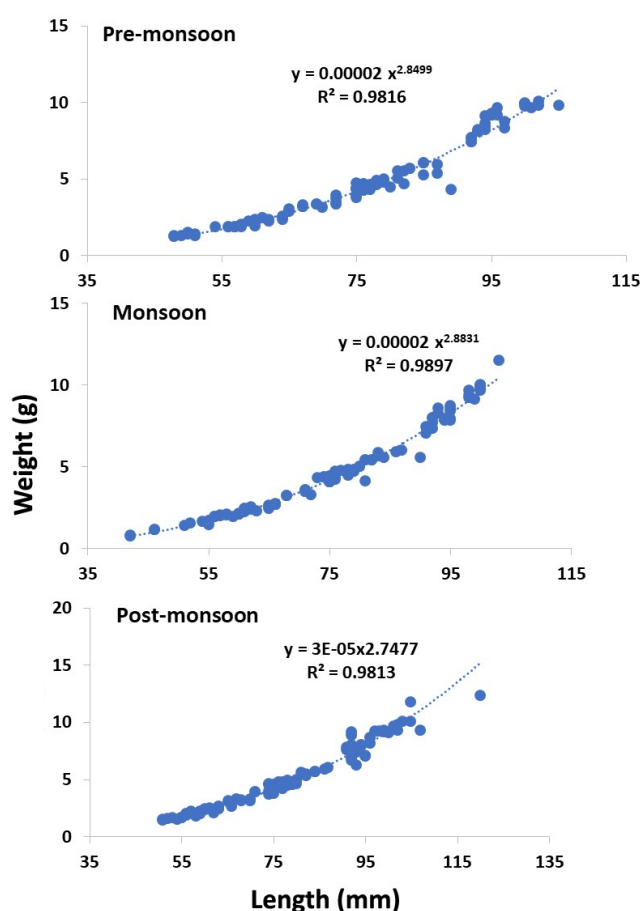
The KR values for the species in the current study ranged from 0.09 to 1.93 (mean±SD = 0.537±0.205). These values indicate that the species under examination were generally in a healthy state. Fish condition is influenced by vari-

ous factors, including food availability, reproductive cycles, habitat, and environmental conditions (Morato *et al.* 2001). A divergence of KR from 1 provides insights into the effects of physicochemical characteristics on fish life cycles as well as changes in food availability (Le Cren 1951). KR values for the three selected oxbow lakes are presented in Table 4, divided into pre-monsoon, monsoon, and post-monsoon periods.



**FIGURE 3** The length-weight relationship of *Gudusia chapra* from Porapara oxbow lake.

There was a significant difference in mean KR values across periods ( $p < 0.05$ ), indicating that this species was more fit during the monsoon season (Table 4). The increase in feeding intensity during the post-monsoon period (KR = 1.93) may explain the high KR values observed. In fact, higher KR often reflects greater food availability or increased feeding activity in the post-monsoon season, when temperatures are optimal (De Giosa *et al.* 2014). Moreover, it is well known that during spawning, fish reduce feeding activity and rely on lipid reserves, which results in a decline in condition (Lizama and Ambrósio 2002).



**FIGURE 4** The length-weight relationship of *Gudusia chapra* from Khushna oxbow lake.

Given that *G. chapra* typically spawns in June or July (Rahman 2005), when reproductive activity peaks, the decline in feeding activity may also account for the reduced KR levels observed during this time. It should be

noted that previous research has shown that gut fullness is not necessarily related to condition factor; therefore, gut fullness was not examined prior to analysis (Hanjavanit *et al.* 2013). In practice, KR values greater than 1 correspond to optimal developmental conditions, reflecting adequate food intake for growth. However, even if a fish is consuming sufficient food for survival and development in the aquatic ecosystem, its gut may be empty at the time of collection (Jisir *et al.* 2018).

### 3.3 Fulton's condition factor (KF)

Table 4 presents the monthly and size-class variations in KF for studied oxbow lakes. The KF ranged from 0.48 (post-monsoon) in Porapara to 1.29 (post-monsoon) in Boluhor (mean  $\pm$  SD = 0.671 $\pm$ 0.33). Compared to Khushna in the pre-monsoon period, the lowest KF value was observed in the post-monsoon season. The highest KF values during post-monsoon were recorded in Boluhor and Khushna. Overall, post-monsoon KF values were consistently higher than those observed during the monsoon.

The condition factor of *G. chapra* was prominent at the onset of the monsoon season, when more mature eggs were present, and gradually declined throughout the extended spawning cycle. This indicates that KF is influenced by gonad weight. Variations in the condition factor may also result from limited food availability, flooding, extreme heat, temperature fluctuations, or water contamination (Hasan *et al.* 2021).

According to Le Cren (1951), KF > 1 suggests that the lake environment is favourable for fish growth. The KF indicated positive growth (KF > 1) for *G. chapra* in all lakes except post-monsoon Boluhor. The relatively lower KF values in the lakes may be attributed to indiscriminate exploitation of the species (Paul *et al.* 2021).

**TABLE 4** The condition factors and relative weight of *Gudusia chapra* from studied oxbow lakes.

Oxbow lakes	Periods	Condition factors (CF)						Relative weight (g)	
		Fulton CF (KF)		Relative CF (KR)		Allometric CF (KA)		Mean	SD
		Mean	SD	Mean	SD	Mean	SD		
Boluhor	Pre-Monsoon	0.67	$\pm$ 0.33	0.76	$\pm$ 0.296	0.01	$\pm$ 0.005	76.14	$\pm$ 29.67
	Monsoon	0.68	$\pm$ 0.33	0.98	$\pm$ 0.31	0.01	$\pm$ 0.005	97.73	$\pm$ 31.5
	Post-monsoon	1.29	$\pm$ 0.78	1.93	$\pm$ 0.848	0.03	$\pm$ 0.01	194.7	$\pm$ 85.294
Khushna	Pre-Monsoon	0.57	$\pm$ 0.31	0.09	$\pm$ 0.022	0.01	$\pm$ 0.005	87.04	$\pm$ 22.11
	Monsoon	0.59	$\pm$ 0.22	0.09	$\pm$ 0.022	0.01	$\pm$ 0.005	153	$\pm$ 42.49
	Post-monsoon	0.61	$\pm$ 0.23	0.09	$\pm$ 0.03	0.16	$\pm$ 0.015	9.278	$\pm$ 2.73
Porapara	Pre-Monsoon	0.51	$\pm$ 0.22	0.79	$\pm$ 0.25	0.007	$\pm$ 0.0029	79.3	$\pm$ 32.21
	Monsoon	0.64	$\pm$ 0.31	0.09	$\pm$ 0.03	0.01	$\pm$ 0.005	104	$\pm$ 31.03
	Post-monsoon	0.48	$\pm$ 0.21	0.1	$\pm$ 0.04	0.01	$\pm$ 0.005	22.71	$\pm$ 9.135
Overall		0.671	$\pm$ 0.25	0.537	$\pm$ 0.205	0.029	$\pm$ 0.006	91.54	$\pm$ 31

### 3.4 Allometric condition factor (KA)

When KF > 1, the lake environment is considered ideal for fish development (Le Cren 1951). In this study, KF for *G.*

*chapra* showed positive development (KF > 1) only in post-monsoon Boluhor (Table 4). KA values of the species fluctuated between 0.007 and 0.03 (mean $\pm$ SD =

0.029±0.006), as shown in Table 3. The lower KF values observed in the lakes may be attributed to indiscriminate harvesting of the species (Paul *et al.* 2021).

From this perspective, it can be inferred that variation in the condition factor should correspond with changes in body weight, since individuals within a sample do not exhibit statistically distinct lengths. Three different condition criteria were employed to assess the overall performance and well-being of *G. chapra* in the oxbow lakes during the study period. The condition factor serves as a metric to evaluate the interaction between biotic and abiotic influences on fish physiological status (Lizama and Ambrosio 2002; Jisr *et al.* 2018).

### 3.5 Relative weight (WR)

In this study, the WR of *G. chapra* ranged from 9.27 to 194.7 (mean±SD = 91.54±7.76) (Table 4). The lowest WR value was recorded in Khushna during the post-monsoon, while Boluhor showed the lowest WR in the pre-monsoon. The findings revealed that mean WR varied across different life history stages.

The mean WR of pooled sexes did not deviate significantly from the benchmark value of 100. However, the results indicate that the *G. chapra* ecosystem in Boluhor oxbow lake is gradually degrading, with juvenile stages of *G. chapra* being particularly vulnerable. Seasonal variations in natural food composition may explain the fluctuations in WR observed in the present study. Correlation analysis demonstrated the direction and strength of relationships between variables (Table 5). In some cases, correlation coefficients may suggest cause-and-effect relationships between them.

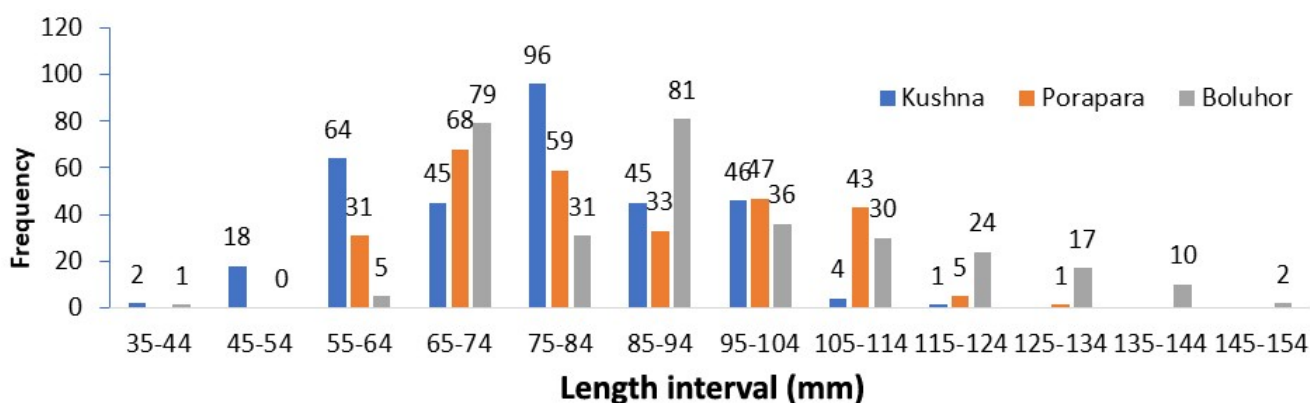
### 3.6 Length frequency distributions (LFDs)

In the Khushna Oxbow Lake, 96 fish were caught in the class interval of 75–84 mm, 81 fish in the class interval of 85–94 mm, and only one fish in the class intervals of 35–44 mm and 145–154 mm (Figure 5). Due to variations in fishing gear size, the nets used, and the water population, the number of fish decreases as the class interval increases (Rambe *et al.* 2021).

**TABLE 5** Spearman correlations among length and condition factors of *Gudusia chapra* in three studied oxbow lakes of Bangladesh.

	TL	BW	WR	KF	KR	KA
TL	1					
BW	0.4223225*	1				
WR	-0.029814	-0.0203432	1			
KF	0.0094545	-0.3824314	0.7111124*	1		
KR	-0.027078	-0.130702	0.599468*	0.8382973*	1	
KA	-0.367793	-0.4598736	-0.446718	0.0384065	-0.164061	1

TL = Total length; BW = body weight; WR = relative weight; KF = Fulton’s condition factor; KR = relative condition factor; KA = allometric condition factor. Values represent Spearman correlation coefficient (two tailed). \* represents the significant level at  $p < 0.05$ .



**FIGURE 5** Length frequency distribution of *Gudusia chapra* in three studied oxbow lakes of Bangladesh.

Additionally, migration, mortality, and changes in water conditions contributed to these variations. Gill nets with a mesh size of 1.25 inches are relatively small and do not capture mature fish in the study oxbow lake. Both

internal and external factors may influence the number of fish caught (Hossain *et al.* 2024, 2025). External factors include climate and diet, while internal factors include genetics, sex, age, parasites, and disease.

#### 4 | CONCLUSIONS

In the current study, the length–weight correlations and the condition factor were found to be highly associated. Therefore, any modification in one of these characteristics will affect the other parameters examined. It should be noted, however, that the *b* coefficient may be calculated independently for each sub-sample to determine the length–weight relationship parameters for individuals, since the purpose of a study may differ depending on whether the condition of individuals is being analysed.

Negative allometry was observed in the growth pattern of *G. chapra* in the oxbow lakes, accompanied by changes in fish length and weight over time. The growth rate of *G. chapra* from Boluhor, Khushna and Porapara oxbow lakes was relatively low, according to the present investigation of length–weight relationships and relative condition factors. This research provides important baseline data on *G. chapra*'s LWRs, condition indices, form factors, and size distribution in southwestern Bangladesh.

In conclusion, the study revealed fundamental insights into the length–length relationship, length–weight relationship, and condition factor of *G. chapra*. Negative growth conditions were evident in the lakes. Fish allometric growth was negative in almost all LWRs, which may be linked to environmental factors or to physical traits unique to the species. The results of this study will assist managers, environmentalists, and fisheries biologists in developing management strategies and guidelines for the long-term preservation of surviving populations of this species in the oxbow lake ecosystem.

#### CONFLICT OF INTEREST

The author declares no conflict of interest.

#### AUTHORS' CONTRIBUTION

Moumita Choudhury: Conceptualization, data analysis, Supervision. Md. Aktarul Islam: Data collection. Md. Anisur Rahman: Critical review of the manuscript. Md. Monjurul Islam: Data collection. Md. Abdul Baten: Critical review of the manuscript. Anusree Biswas: Critical review of the manuscript. Nadia S. Kashmi: Data analysis, draft manuscript writing, Critical review of the manuscript.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on a reasonable request from the corresponding author.

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