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Research Article

Integrated Assessment of Biometric Indices and Life-history Traits of *Anabas testudineus* in Baluhor Oxbow Lake

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ABSTRACT

The freshwater climbing perch (*Anabas testudineus*) is highly valued in Bangladesh for economic significance and food source. Understanding the life-history traits of *A. testudineus* is crucial for developing effective long-term conservation and management. The present study provides a comprehensive analysis of life-history traits and biometric indices such as length-weight and length-length relationships (LWRs), and length-frequency distribution. A total of 102 specimens were collected between May and July 2025 using traditional fishing gears. Total length (TL), standard length (SL) and body weight (BW) were measured using digital slide calipers and an electronic balance. Total length of the specimens ranged from 6.96-13.49 cm and body weight varied from 9.59-35.07 g. The estimated '*b*' values revealed a pattern of negative allometric growth (*b*<3.0). The LWR was highly significant ($p<0.05$) with r^2 value 0.8632. The determined form factor, $a_{3.0}$ was 0.00861, and L_m was 8.2383 (~8.30) cm in TL. According to the findings of the study, the natural mortality, M_w was 1.26 $year^{-1}$, with optimum age was 2.60 years and maximum life span, t_{max} was 9.65 years. The results will contribute to sustainable conservation and effective management of *A. testudineus* in Southwestern Bangladesh.

Introduction

An Oxbow Lake, formed from an abandoned river channel in the moribund delta, is commonly known as a *baor*, which typically exhibits a saucer-shaped geomorphological structure. More than 600 *baors* are distributed across the southwestern region of Bangladesh, collectively covering an area of approximately 5,488 hectares (Mondal et al. 2025). The majority of these *baors* are distributed across notable districts including Jashore, Kushtia, and Faridpur, with Jashore containing the maximum number (DoF, 2024; Islam et al. 2025). A significant portion of the local community solely depends on the *baor* fishery for their livelihood, and the area is rich in diverse fisheries resources (Jamil et al. 2022). The *baors* function as important breeding grounds for small indigenous fish species. However, most *baor* fisheries have declined in productivity due to overfishing, destructive fishing practices (Gain et al. 2017; Azad et al. 2020), habitat loss and degradation (Sarower-E-Mahfuj et al. 2017, 2019), natural siltation, and pollution from industrial and agricultural activities such as pesticides (Amin et al., 2026a) and heavy metals (Amin et al., 2026b).

Anabas testudineus, belongs to the family of Anabantidae under the order Perciformes and is widely distributed across Asia, including Bangladesh. This fish inhabits in both freshwater and brackish water environments, irrigation channels, impoundments, marshes, swamplands, and brackish lagoons (Manon et al. 2023). This species holds commercial significance due to its considerable demand in the Southeast Asian region as a popular and edible fish. This indigenous species holds significant economic value and serves as a key source of livelihood (Khatun et al. 2019). According to DoF (2024), *A. testudineus* contributed 79,913 metric tons, accounting for 1.82% of the country's total inland fish production. The use of illegal fishing gear, water pollution, indiscriminate fishing, habitat destruction and alteration, and other environmental changes have

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impacted their habitats, leading to a decline in wild populations (IUCN 2015).

Understanding insight into the biological and life-cycle characteristics of fish is essential for developing effective management strategies aimed at conserving commercially valuable species such as *A. testudineus*. Moreover, the abovementioned data facilitate comparisons of fish habitat quality and overall condition (Hossain et al. 2015a Samad et al. 2023). The study of length–weight relationships is crucial in fisheries science because it provides insights into growth patterns, condition factors, and energy allocation strategies of fish populations, thereby supporting effective stock assessment and management. Key biological parameters, including size at sexual maturity (Hossain et al. 2015b; Hossen et al. 2020), condition factors (Islam et al. 2021), length-weight relationships, length-frequency distributions (Asadujjaman et al. 2022; Hanif et al. 2022), and form factors (Khan et al. 2023; Sabbir et al. 2023) for various fish species across different ecosystems are well documented. However, knowledge of life-history traits of *A. testudineus* in Oxbow Lakes remains scarce. Only a limited number of studies have examined about the biometric and life history traits of this species in other ecosystems such as in Gajner *beel* (Pabna, Bangladesh) (Khatun et al. 2019), Basurabad *beel* (Khulna, Bangladesh) (Manon et al. 2023), several islands (Indonesia) (Damora et al. 2025), Huai Kho Reservoir (Thailand) (Khowhit et al. 2024), wetland habitat (Indonesia) (Ndobe et al. 2024). Comprehensive information on the biological characteristics of these species is essential for their effective fisheries management and to support biodiversity conservation in the Oxbow Lakes of Southwest Bangladesh. Therefore, this study focused on examining the length-frequency distributions (LFDs), length–weight relationships (LWRs), condition factors, form factor ($a_{3.0}$), and life-history traits such as, size at first sexual maturity (L_m), optimum catchable limit (L_{opt}), and natural mortality (M_W) of *A. testudineus* from the Baluhor Oxbow Lake in southwestern Bangladesh.

Materials and methods

Fish sampling

A total of 102 specimens of *A. testudineus* were collected from Baluhor Baor using traditional fishing gear from May to July. The specimens were preserved in 8% formalin and transported to the Department of Fisheries and Marine Bioscience Laboratory at Jashore University of Science and Technology, Bangladesh, for further analysis.

Biometric measurements

The total length (TL), standard length (SL) and body weight (BW) of each specimen were recorded with a precision of 0.01 cm and 0.01 g, respectively, using precision calipers (Model: 500-196-30, Japan) and a digital balance. The TL, SL, and BW measurements were processed using Microsoft Excel, where the Solver add-in was employed to perform advanced optimization and statistical validation, thereby ensuring greater analytical precision and enhancing the overall robustness of the data interpretation.

Length-frequency distribution (LFD)

The total length (TL) of *A. testudineus* ranged from 6.96 to 13.49 cm, with a mean value of 9.61 ± 1.19 cm. The length-frequency distribution (LFD) of *A. testudineus* was constructed using 0.50 cm total-length class intervals in PAST software (Hammer et al. 2001), with a normal curve fitted to the TL distribution. Employing the normal curve allowed for a clear depiction of central tendency and variability, facilitated comparisons across samples, and supported statistical inferences essential for evaluating population structure.

Growth pattern

Growth analysis was conducted using the length–weight relationship expressed as $BW = a \times TL^b$. Using fish TL and BW data, the log-transformed linear regression model $\ln(BW) = \ln(a) + b \times \ln(TL)$ was applied to estimate the regression parameters, including the intercept (a) and slope (b). In addition, the coefficient of determination (r^2) and the 95% confidence intervals for parameters *a* and *b* were calculated. To detect outliers, log–log plots of TL and BW were examined prior to conducting the regression analysis of log (BW) against log (TL) (Froese, 2006), and extreme outliers were excluded before final regression analysis. Data transformation into logarithmic form (Log TL and Log BW) is necessary to linearize the inherently allometric relationship, stabilize variance, and improve the accuracy of parameter estimation in regression analysis.

Condition factors and form factor

The allometric condition factor (K_a) was calculated following the model proposed by Samad et al. (2022) utilizing the equation $K_a = W / L^b$, where W represents BW, L denotes TL, and *b* is the length–weight relationship (LWR) parameter.

Size at sexual maturity and natural mortality

Length at first maturity (L_m) was estimated following the method of Binohlan and Froese (2009) using the equation: $\log(L_m) = -0.1189 + 0.9157 \times \log(L_{max})$. Natural mortality ($M_W$) was examined utilizing the Peterson and Wroblewski (1984) model: M_W =

1.92 year^{-1} × W$^{-0.25}$, where W = a × L^b represents body weight, and '*a*' and '*b*' are the LWR parameters.

Optimum catchable length (L_{opt})

The optimal harvest length (L_{opt}), which represents the size at which the greatest number of individuals can be sustainably caught (Froese et al. 2018), was estimated utilizing the model of Binohlan and Froese (2009): log (L_{opt}) = 1.0421 × log(L_α) − 0.2742, where L_α represents the asymptotic length.

Statistical analyses

Prior to statistical analyses, data normality was verified using the Shapiro–Wilk test to ensure the appropriateness of parametric procedures. Subsequent analyses were conducted in PAST, R, and SPSS version 25, employing a 5% significance threshold and incorporating regression modeling, correlation assessments.

Results

Population structure

In Table 1, the weight and morphometric data showed significant variation among the specimens. Total length (TL) showed a consistent size distribution, ranging from 6.96 to 13.49 cm, with a mean of 9.61 ± 1.19 cm and a narrow confidence interval ($CI_{95\%}$: 9.37–9.84 cm). The standard length (SL) showed homogeneity in length trends, ranging from 5.91 to 10.88 cm, with an average of 7.81 ± 0.97 cm ($CI_{95\%}$: 7.62–7.99 cm). With a mean of 17.73 ± 4.91 g ($CI_{95\%}$: 16.76–18.69 g) and a dispersion of 9.59–35.07 g, body weight (BW) demonstrated larger variability in mass relative to length. The narrow confidence intervals between values highlight the dependability of the information and offer a solid basis for population structural interpretations.

Table 1. Descriptive statistics of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh.

Measurements	n	Minimum	Maximum	Mean ± SD	$CI_{95\%}$ (Lower-Upper)
Total Length (TL)	102	6.96	13.49	9.61 ± 1.19	9.37 - 9.84
Standard Length (SL)		5.91	10.88	7.81 ± 0.97	7.62 -7.99
Body Weight (BW)		9.59	35.07	17.73 ± 4.91	16.76 – 18.69

A histogram of the distribution of total length (cm) is shown in Figure 1, with frequencies peaking about 9.0 cm. The probability distribution is shown by a superimposed density curve that rises quickly to a high of about 9.0 cm before progressively dropping. The density curve and histogram together show a unimodal distribution, suggesting that the majority of specimens were grouped around a constant size range.

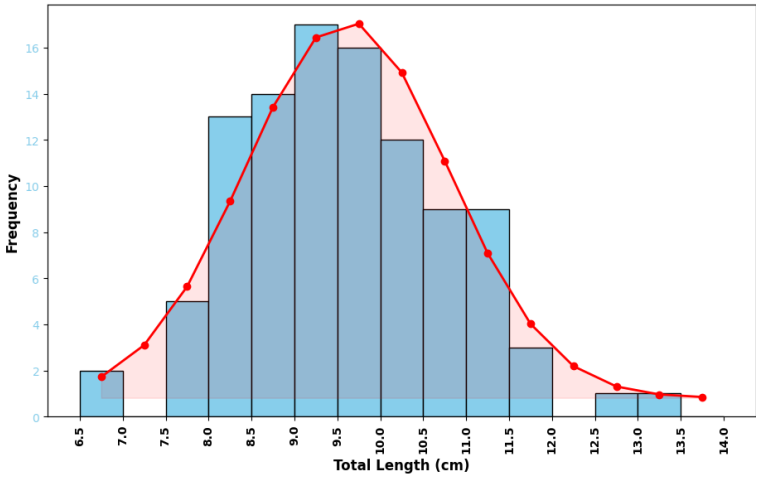

Figure 1. Length-frequency distribution of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh.

Growth pattern

The LWRs of *A. testudineus* in Baluhor Oxbow Lake, southwest Bangladesh, are summarized in Table 2 and Figure 2. The noteworthy coefficients of determination (r^2 = 0.8632 and 0.8117, respectively) of the regression analysis showed highly substantial relationships between body weight (BW) and both total length (TL) and standard length (SL). The regression parameters demonstrated that BW = 0.1676 × TL$^{2.0508}$ and BW = 0.2786 × SL$^{2.0101}$, with 95% confidence intervals for 'a' ranging from 0.1162–0.2416 (TL) and 0.1879–0.4131 (SL), and for 'b' ranging from 1.8888–2.2128 (TL) and 1.8180–2.2021 (SL). These values suggest that growth patterns in both models followed negative allometry (GP = A–), meaning that weight increased at a slower

rate relative to length. The sample t-test values (t_s = 25.1210 for TL and 20.7674 for SL) further confirmed the statistical robustness of the regression models. The relatively high r^2 values underscore the reliability of the fitted equations in explaining the variance in body weight. Importantly, the negative allometric growth pattern indicates that the species tends to allocate more energy toward linear growth than mass accumulation under the prevailing ecological conditions. These findings provide a strong quantitative basis for understanding the morphometric and growth dynamics of *A. testudineus* in Oxbow Lake ecosystems. This information is crucial for fisheries management and aquaculture practices, as it highlights the species' adaptive responses to environmental constraints.

Table 2. Descriptive data of length–weight relationships of *Anabas testudineus* in Baluhor Oxbow Lake, Bangladesh.

Formula	Regression parameters a	b	a (±95% CI)	b (±95% CI)	r^2	t_s	GP
BW = a x TL^b	0.1676	2.0509	0.1162 - 0.2416	1.8888 - 2.2128	0.8632*	25.1210	A-
BW = a x SL^b	0.2786	2.0101	0.1879 - 0.4131	1.8180 - 2.2021	0.8118*	20.7674	A-

Abbreviations: CI, Confidence interval for mean values; TL, total length; BW, body weight; r^2, co-efficient of determination, t_s, sample t-test value; GP, growth pattern; A–, Negative allometry; *, Significant correlations.

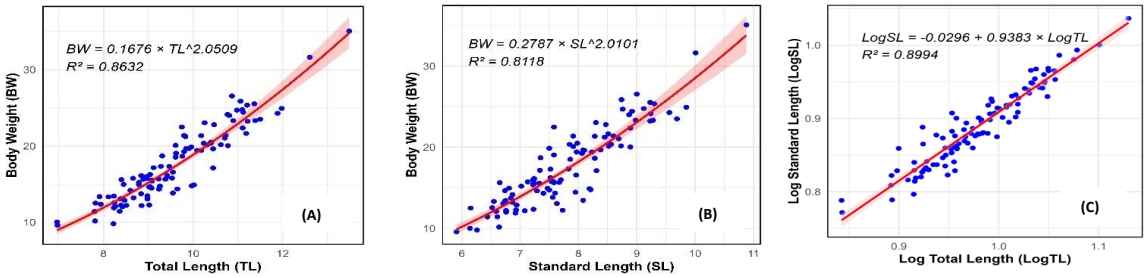

Figure 2. Relationships between total length and standard length and body weight of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh.

Condition factor and form factor

Table 3 presents the descriptive statistics of condition indices for *A. testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh. The allometric condition factor (K_A) ranged between 0.1304 and 0.2106, with a mean of 0.1684 ± 0.0166, and a narrow confidence interval (CI95%: 0.1651–0.1717), indicating stable body proportionality. The Fulton's condition factor (K_F) varied from 1.4285 to 2.9719, averaging 1.9954 ± 0.3111 ($CI_{95\%}$: 1.9343–2.0565), reflecting moderate variability in overall body robustness. Relative condition factor (K_R) values spanned 0.7781–1.2570, with a mean of 1.0050 ± 0.0992 ($CI_{95\%}$: 0.9855–1.0245), suggesting that most individuals maintained near-ideal physiological condition. Finally, the relative weight (W_R) ranged from 77.8187 to 125.7088, with a mean of 100.5029 ± 9.9227 ($CI_{95\%}$: 98.5539–102.4519), underscoring balanced energy allocation and favorable ecological fitness within the population.

Table 3. Descriptive data of condition indices of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh.

Condition indices	Minimum	Maximum	Mean ± SD	CI95% (Lower-Upper)
K_A	0.1304	0.2106	0.1684 ± 0.0166	0.1651 - 0.1717
K_F	1.4285	2.9719	1.9954 ± 0.3111	1.9343 - 2.0565
K_R	0.7781	1.2570	1.0050 ± 0.0992	0.9855 - 1.0245
W_R	77.8187	125.7088	100.5029 ± 9.9227	98.5539 - 102.4519

Figure 3 presents the Pearson correlation coefficient analyses between body lengths and condition indices of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh. The results demonstrate strong negative correlations between total length (TL) and Fulton's condition factor (K_F) (r = –0.71), as well as between standard length (SL) and K_F (r = –0.65). Body weight (BW) also showed a moderate negative correlation with K_F (r = –0.41). Conversely, K_F displayed moderate positive correlations with the allometric condition factor (K_A), relative condition factor (K_R), and relative weight (W_R), highlighting interrelated physiological indices. These findings collectively suggest that morphometric traits and condition indices are

intricately linked, with trade-offs between growth dimensions and body condition reflecting adaptive ecological strategies.

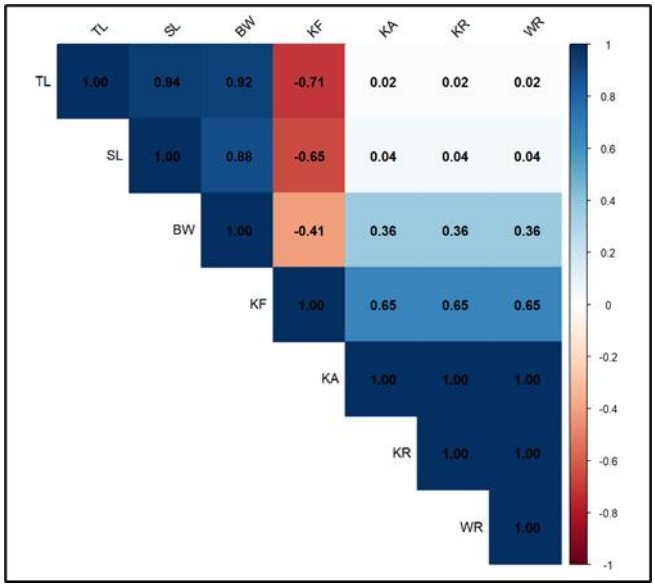

Figure 3. Pearson correlation coefficient analyses of body lengths and condition indices of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh.

Figure 4 depicts the relationship between total length (TL) and relative weight (WR) of *A. testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh. The analysis shows that WR declines from approximately 110 at smaller lengths (~7 cm) to around 95 near 9 cm, before gradually increasing and stabilizing close to the reference value of 100 as TL extends from 10 to 13 cm. This pattern suggests that smaller individuals initially exhibit higher relative weight, but as fish grow, W_R stabilizes near the target benchmark, reflecting balanced energy allocation and ecological fitness across size classes.

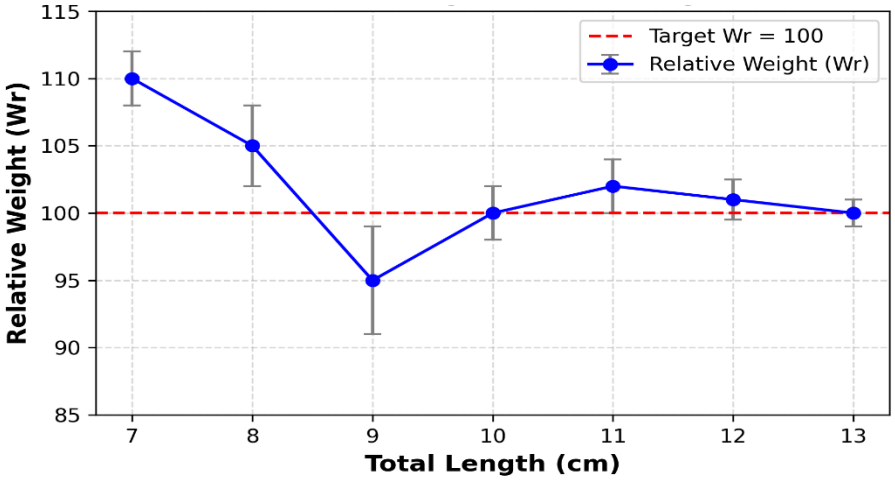

Figure 4. Analysis of the relationship between total length and relative weight (W_R) of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh.

Life -history traits

In table 4, the life-history traits of *A. testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh, provide valuable insights into its growth and reproductive strategies. The optimum catchable limit (L_{opt}) was estimated at 8.5188 cm, which closely aligns with the length at first sexual maturity (L_m = 8.2383 cm), suggesting that harvesting practices should be carefully managed to avoid recruitment overfishing. The asymptotic length (L_α) reached 14.3192 cm, while the

asymptotic weight (W_α) was 39.3502 g, reflecting the species' maximum growth potential under natural conditions. The age at first sexual maturity (t_m) was 2.8490 years, whereas the theoretical age at zero length (t_0) was 0.093 years, indicating early growth initiation. The optimum age for maximum biomass was calculated at 2.6032 years, highlighting the critical period for population productivity. The estimated life span (t_{max}) of 9.65 years underscores the species' relatively long-lived nature compared to other small-bodied freshwater fishes. The form factor ($a_{3.0}$ = 0.00861) and growth performance index (Φ = 1.8043) further confirm moderate growth efficiency and adaptability to Oxbow Lake environments. Natural mortality (M_w) was estimated at 1.26 year^{-1}, suggesting a moderate level of population turnover. These parameters emphasize the ecological resilience of *A. testudineus*, while also underscoring the importance of sustainable management practices to maintain stock viability.

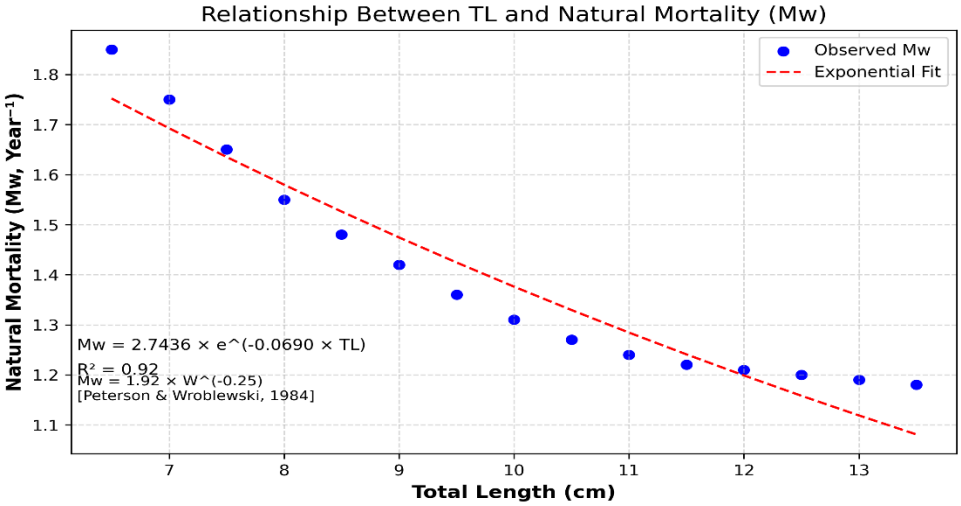

Figure 5. Natural mortality of of *Anabas testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh.

Figure 5 illustrates the relationship between total length (TL) and natural mortality (Mw) of *A. testudineus* in Baluhor Oxbow Lake, southwestern Bangladesh. The analysis revealed a clear exponential decline in Mw with increasing TL, as described by the fitted equation $M_w = 2.7436 \times e^{(-0.0690 \times TL)}$, with a high coefficient of determination (R^2 = 0.932), indicating strong predictive accuracy. This pattern suggests that smaller individuals experience higher natural mortality rates, whereas larger fish exhibit reduced vulnerability, consistent with ecological theory. Collectively, these findings highlight the size-dependent mortality dynamics of the population, providing critical insights for stock assessment and sustainable management.

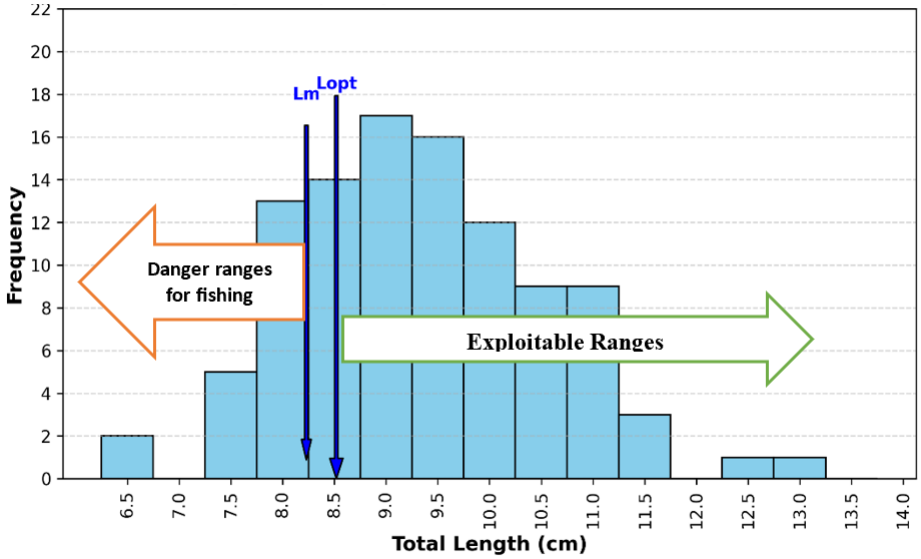

Figure 6. Histogram of total length (TL, cm) distribution of *Anabas testudineus* from Baluhor Oxbow Lake, indicating L_m (≈8.2323 cm), L_{opt} (≈8.5188 cm), danger ranges for undersized fishing, and exploitable ranges for sustainable harvest.

Figure 6, the histogram shows that most individuals were concentrated between 8.0 and 9.0 cm, with vertical markers identifying the length at first sexual maturity (L_m = 8.2383 cm) and the optimum catchable limit (L_{opt} = 8.5188 cm). The graphical annotations highlight that harvesting fish below these thresholds falls within the 'danger ranges for fishing', which could jeopardize stock sustainability. Conversely, individuals exceeding L_{opt} are categorized within the 'exploitable ranges', representing sizes suitable for sustainable capture. This visualization underscores the importance of aligning fishing practices with biological reference points to ensure long-term population viability.

Discussion

The present study provides a comprehensive account of the population structure, growth dynamics, condition status, and life-history characteristics of *A. testudineus* inhabiting Baluhor Oxbow Lake, southwestern Bangladesh. The morphometric and weight data show considerable variation between specimens; body weight (BW) exhibits greater variability, while total length (TL) shows a consistent size distribution and narrow confidence intervals. During sampling of fish individuals below 6.96 cm in TL most likely indicates bias or insufficiency, which could result from fishermen purposefully avoiding environments where smaller fish were concentrated or from the selective nature of the fishing gear (Hossain et al. 2012; 2016, Azad et al. 2018; Khatun et al. 2018), or absence of small fish in the fishing grounds (Khatun et al. 2019), or the discarding of smaller fish by fishermen (Rahman et al. 2018). The maximum length of *A. testudineus* within the Baluhor Oxbow Lake was 13.49 cm in TL. Satrawaha and Pilasamorn (2009) documented a maximum total length of 16.50 cm for *A. testudineus* from the Chi River in northeastern Thailand. Likewise, Hossain et al. (2015b) reported a maximum TL of 16.10 cm in the Tetulia River, Bangladesh, while Jumawan and Seronay (2017) recorded 17.0 cm TL from Agusan Marsh in the Philippines. Furthermore, Khatun et al. (2019) observed a maximum length of 14.50 cm TL in Gajner Beel, Pabna, Bangladesh. These reported lengths are all greater than the maximum length recorded in the present study. Maximum length serves as a key biological metric in fisheries management for estimating growth metrics including growth coefficient and asymptotic length (Nawer et al. 2017).

In the current study, the estimated *b* values for *Anabas testudineus* ranged from 1.8888 to 2.2128 in Baluhor Oxbow Lake, which are lower than the typical range (2.5–3.5) reported for most fish species (Froese 2006). Values of 'b' close to 3 indicate isometric growth in fish, whereas values greater than 3 represent positive allometric growth, and values less than 3 denote negative allometric growth (Khatun et al. 2019). In this study, the 'b' values of the length–weight relationships were less than 3, indicating negative allometric growth of *A. testudineus* in Baluhor Oxbow Lake. However, several studies in Asia have also reported negative allometric growth for *A. testudineus*: Jumawan and Seronay (2017) recorded (b = 2.86) in Agusan Marsh, Philippines; Hossain et al. (2015b) reported (b = 2.91) from the Tetulia River, Bangladesh; and Kumar et al. (2013) found (b = 2.77) in ponds at Kausalyaganga, India. Such variations may be attributed to differences in length classes sampled, preservation techniques, fish condition, stomach fullness, sex, seasonal factors, gonadal maturity, or geographic origin (Hossain et al., 2017, Khatun et al., 2019), which were beyond the scope of the current study.

The current study estimated four condition factors (K_A, K_F, K_R, and W_R) to determine the physiological condition and natural environment of *A. testudineus*, in contrast to most studies that typically consider only one condition factor. The condition factor (K_F) of *A. testudineus* was observed to range from 1.4285 to 2.9719. The K_F value greater than 1 indicates that the fish are in good or optimal condition, whereas a value less than 1 suggests that the fish are not in a healthy or satisfactory condition (Manon et al., 2023). Thus, K_F appears to be the most reliable parameter for evaluating the physiological condition of *A. testudineus*, as it showed significant correlations with body weight compared to the other condition factors. The W_R is a valuable metric for assessing population good health and fitness, in addition to detecting potential disturbances in the ecosystem. A fish with a greater W_R possesses greater stores of energy, supporting routine activities, growth, and reproduction. The W_R below 80 is classified as very lean, around 90 is considered normal, and above 100 indicates obesity. W_R is a commonly used indicator of fish condition in fisheries research and management. Standard weight equations should ideally encompass the species' full geographic range and be applied for comparison rather than exclusively for management purposes. W_R values above 100 for an individual, size group, or population may indicate low prey availability or high predation pressure, whereas values below 100 suggest a prey surplus or reduced predation pressure. In the present study, *A. testudineus* exhibited a mean W_R of 100, suggesting that the species is healthy, well-conditioned, and likely capable of successful reproduction. The findings of this study align with those of Manon et al. (2023), Hossain et al. (2014), Rahman et al. (2012), and Richter (2007). The condition factors K_A, K_R, and W_R were significantly correlated with body weight, highlighting their usefulness in evaluating the health status of *A. testudineus* in Baluhor Oxbow Lake. In a similar study, Khatun et al. (2019) identified

K_F as a key condition index for *A. testudineus* in Gajner Beel.

According to Froese (2006), the form factor ($a_{3.0}$) serves as a useful tool for comparing body shapes among different populations or species. For *A. testudineus* in Baluhor Oxbow Lake, the form factor ($a_{3.0}$) was 0.00861, indicating a moderately robust and deep-bodied morphology characteristic of the species. Khatun et al. (2019) reported a form factor ($a_{3.0}$) of 0.021 for *A. testudineus* in Gajner Beel, whereas Hossain et al. (2015b) recorded $a_{3.0}$ = 0.0161 for the species in the Tetulia River, reflecting some variation in body shape among different populations.

The size at first sexual maturity can serve as a basis for establishing the minimum legal capture size and for conducting stock assessments (Lucifora et al. 1999). The size at first sexual maturity (L_m) of *A. testudineus* in Baluhor Oxbow Lake was estimated to be 8.2383 cm. Similar findings have been reported in other studies: Khatun et al. (2019) estimated the size at first sexual maturity (L_m) of *A. testudineus* as 8.41 cm in Gajner Beel; Hossain et al. (2015b) reported 9.26 cm in the Tetulia River, Bangladesh; Garcia (2010) recorded 6.90 cm in the Pampanga River, Philippines; Jumawan and Seronay (2017) reported 9.74 cm in Agusan Marsh, Philippines; and Kumary and Raj (2016) documented 10.48 cm in Kuttanad, Kerala. These values provide a baseline for future studies on environmental factors influencing L_m and the spawning season of *A. testudineus* in Baluhor Oxbow Lake.

For *A. testudineus* in Baluhor Oxbow Lake, the natural mortality (M_w) was calculated as 1.26 year^{-1}. Comparable findings have been reported in other regions: Khatun et al. (2019) estimated the natural mortality (M_w) of *A. testudineus* as 1.05 year^{-1} in Gajner Beel; Hossain et al. (2015b) reported 0.89 year^{-1} in the Tetulia River, Bangladesh; Garcia (2010) recorded 1.14 year^{-1} in the Pampanga River, Philippines; Jumawan and Seronay (2017) reported 0.57 year^{-1} in the –Philippines; and Kumary and Raj (2016) documented 0.96 year^{-1} in Kerala, India.

Anabas testudineus exhibited an optimum catchable length (L_{opt}) of 8.52 cm, reaching first sexual maturity at 2.85 years with a maximum lifespan of 9.65 years. The growth performance index (Φ) was 1.8043, and the theoretical age at zero length (t_o) was 0.093 year, with maximum biomass attained at 2.60 years.

Conclusion

This study provides a comprehensive assessment of the life-history features of *Anabas testudineus* in Baluhor Oxbow Lake, including length-frequency distribution, length–weight and length–length relationships, condition factors (allometric, Fulton's, and relative), relative weight, form factor, size at first sexual maturity, and natural mortality. The findings offer critical insights into the growth, health, and reproductive status of the species, serving as a valuable reference for fisheries managers, ecologists, and conservationists. Overall, these results can inform proactive management strategies and regulatory measures aimed at ensuring the sustainable utilization and long-term conservation of *A. testudineus* population in the Baluhor Oxbow Lake.

Author's Contribution

Md Imtiaz Ahamed: Writing - original draft; Sarower Mahfuj: Conceptualization, Methodology, Writing - original draft, Writing - review and editing, Data curation, Formal analysis, Investigation, Supervision, Software, Validation, Visualization, Resource; Sk. Mohibulla Islam: Data curation; Mst. Sabrin Akter: Data curation. Md. Abdus Samad: Software.

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