DOI: 10.2478/cjf-2023-0013

CODEN RIBAEG ISSN 1330-061X (print)
1848-0586 (online)

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LIFE HISTORY TRAITS OF GANGETIC AILIA *Ailia coila* (Hamilton 1822) IN THE TETULIA RIVER, SOUTHERN BANGLADESH

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ARTICLE INFO

Received: 16 February 2023
Accepted: 15 March 2023

Keywords:
Growth pattern
Population biology
Natural mortality
Sexual maturity

ABSTRACT

The near-threatened *Ailia coila*, commonly referred to as Gangetic ailia, is a catfish species in the Ailiidae family that is indigenous to Bangladesh, Pakistan, Nepal, and India. This study describes the comprehensive explanation of life-history traits of *Ailia coila*, including length-frequency distribution (*LFD*), growth pattern (length-weight relationships, *LWRs* and length-length relationship, *LLR*), form factor ($a_{3.0}$), condition factors (allometric, K_A; Fulton's, K_F; relative, K_R and relative weight, W_R), size at first sexual maturity (L_m), optimum catchable length (L_{opt}) and natural mortality (M_w) from the Tetulia River in southern Bangladesh. Additionally, L_α, $a_{3.0}$, L_m, M_w and L_{opt} from various water bodies worldwide using the existing literature were calculated in this study. A total of 316 samples were randomly collected occasionally using traditional gear for a year from July 2021 to June 2022. With an accuracy of 0.01 cm and 0.01 g, each fish's total length (TL), standard length (SL), and body weight (BW) were measured. The group from 10.00 to 10.99 cm TL was numerically leading and the *b* values of *LWRs* indicate positive allometric growth. The $a_{3.0}$ was 0.005 and K_F was the best for assessing the well-being of *A. coila*. Additionally, W_R indicates that the habitat was imbalanced with higher predators. The calculated L_m, L_{opt} and M_w were 9.19 (~ 9.2 cm TL), 10.7 cm TL and 1.37 year^{-1} for *A. coila* in the Tetulia River, respectively. These insights are vital for future research and recommending suitable management strategies for *A. coila* in the Tetulia River and neighboring basins.

How to Cite

Saha, N., Roy, P., Utsha, S. T., Nag, K. S., Kaushik, G., Hossain, M. Y. (2023): Life history traits of Gangetic ailia *Ailia coila* (Hamilton 1822) in the Tetulia River, southern Bangladesh. Croatian Journal of Fisheries, 81, 115-126. DOI: 10.2478/cjf-2023-0013.

INTRODUCTION

Gangetic ailia *Ailia coila* (Hamilton 1822) is a tropical freshwater catfish species of the family Ailiidae (Romero, 2002) distributed in Asia, especially Bangladesh, India, Pakistan and Nepal (Rahman, 1989; Talwar and Jhingran, 1991; Shrestha, 1994; Froese and Pauly, 2022). This egg-laying species (Breder and Rosen, 1966) stays in shoals from the surface to the middle of the waters (Talwar and Jhingran, 1991). Although this fish is small, it is predominantly rich in proteins, fats, carbohydrates, and various minerals needed for both infant and adult nutrition (Bogard et al., 2015). This fish is classified as near threatened (NT) by IUCN (2022-1) because its numbers are declining rapidly due to a lack of suitable environmental conditions (Ng and Dahanukar, 2011).

Several studies have been conducted on this fish. Nair (1938) studied the changes in the internal structures of the air bladders of this fish during growth. Later, Haider and Sathyanesn (1972) studied the hypothalamic neurosecretory system of this catfish in situ. Sinha (1991) made a comparative study of the olfactory organs of this fish. Hossain et al. (2009) and Hossain (2010) studied the length-weight and length-length ratio of the fish. Later, the morphometric differentiation and stock structure of this small native fish were studied by Bhutia et al. (2019a, b). A biometric study of the fish was carried out by Gogoi et al. (2019) from the Brahmaputra River in Assam. In molecular biology, the complete mitochondrial genome of this fish was studied by Alam et al. (2019). Later, Gogoi et al. (2021) studied the age, growth and mortality parameters of this fish from the Brahmaputra River. Recently, Khan et al. (2022) studied the relationship between the length, otolith size, and weight of this fish from the Ganges River in Uttar Pradesh, India.

The current study was conducted in the Tetulia River. The river is considered one of the largest river ecosystems and supports the fishing community in southern Bangladesh (Hossain et al., 2018). The river also plays an important role in the economic well-being of the people and in alleviating poverty by creating employment opportunities (Hossen et al., 2018). There is no report on the study of the nutrient-rich *A. coila* from the Tetulia River, although some scientific studies on length-weight relationship, condition factor, biometric analysis and mortality parameters (Hossain et al., 2009; Hossain, 2010; Mortuza and Al-Misned, 2015; Deori et al., 2017; Mahapatra et al., 2018; Gogoi et al., 2019; Mortuzaet al., 2020; Sandhya et al., 2020; Gogoi et al., 2021) have been conducted on this species. However, there are still no detailed scientific studies on the whole life history with a special focus on this species, which attracted our attention. Considering the innumerable outstanding aspects of *A. coila*, the present work aimed to investigate the life history characteristics of Gangetic ailia *A. coila* from the Tetulia River in Bangladesh.

MATERIALS AND METHODS

The present study was conducted in the Tetulia River (location: 90.523E, 22.652N) (Fig. 1) in the Barisal District of southern Bangladesh, which is associated with the marine ecosystem. Fish samples were collected between July 2021 and June 2022 at different sites of the Tetulia River, using different conventional fishing techniques such as jhaki jal (cast net, 1.0-2.0 cm mesh size), tar jal (square lifting net, > 0.5 cm mesh size), and dughair (conical fish trap). Collected fresh specimens were immediately preserved with ice in the sampling areas and later fixed in 10% buffered formalin upon arrival at the laboratory for further analysis. For each specimen, total length (TL) and standard length (SL) were determined to the nearest 0.1 cm using a measuring scale, and body weight (BW) was measured to the nearest 0.01 g using a digital scale.

For *A. coila*, length frequency distribution (*LFD*) was measured using 1.0 cm of class intervals of total length (TL).

The formalin-preserved fish were rinsed with running tap water and allowed to dry for about half an hour at room temperature. Length-weight relationships were measured by the following equation (Le Cren, 1951):

$$W = a \times L^b$$

where W = whole body weight (g); L = total length (cm); a = intercept; and b = regression parameters.

Previous formula's regression variables a and b will be evaluated for *LWR* using the linear regression analysis below (Froese, 2006; Hossain et al., 2016a,b):

$$ln(W) = ln(a) + bln(L)$$

Utmost deviations were expelled according to Froese (2006). A t-test was applied to assess significant variations from the isometric value (for *LWR,* b = 3; for *LLR,* b = 1) (Sokal and Rohlf, 1987). Deviation of the b value from the theoretical isometric value indicates positive (b > isometric value) or negative (b < isometric value) allometric growth. To test the significant differences in slopes and intercepts among the relationships, the analysis of covariance (ANCOVA) (Zar, 1989) was used. Moreover, the *LLR* (SL-TL) was analyzed using a linear regression model (Hossain et al., 2016b).

To calculate the form factor ($a_{3.0}$), the following equation was used (Froese, 2006):

$$a_{3.0} = 10^{loga-s\,(b-3)}$$

where a indicates intercept and b indicates the slope of *LWRs* (TL vs. BW), and s indicates the regression slope of log a vs. b. The average slope, $s = -1.358$ was used for calculating the form factor because information on *LWRs* is not available for this studied species.

Tesch's (1968) equation was used to determine the allometric condition factor *(K_A)*: $K_A = W / L^b$, where W is the BW in g, L is the TL in cm, and b is the *LWR* parameter. The condition factor (K_F) was calculated using Fulton's formula (Fulton, 1904): $K_F = 100\ (W / L^3)$, where W is the

body weight in g and *L* is the TL in cm. A scaling factor of 100 was used to get the K_F close to the unit (Froese, 2006). Moreover, the relative condition factor (K_R) was evaluated through the following formula of Le Cren (1951): $K_R = W / (a \times L^b)$, where *W* is the body weight (g), *L* is the total length (cm), and *a* and *b* are the *LWR* parameters. The equation was used to assess relative weight (W_R): $W_R = (W / W_S) \times 100$ according to Froese (2006), where *W* is the weight of a single species and W_S is the expected normal weight as intended by $W_S = a \times L_b$ (here the values of *a* and *b* are calculated from the equation of TL vs. BW).

The size at first sexual maturity (L_m) of *A. coila* was calculated using the following equation (Binohlan and Froese, 2009):

$$log(L_m) = -0.1189 + 0.9157 \times log(L_{max})$$

where L_m = size at first maturity in TL, L_{max} = maximum length (TL) of *A. coila* for this study. Additionally, L_{opt} was assessed by the model of Beverton (1992): $L_{opt} = L_\infty [3 / (3 + M / K)]$, where L_∞ = asymptotic length as projected by $\log (L_\infty) = 0.044 + 0.9841 \times \log(L_{max})$ (Froese and Binohlan, 2000); *M* = natural mortality and *K* = growth coefficient $K = 3 / t_{max}$ (Pauly and Munro, 1984).

The M_w of *A. coila* was assessed through the following model proposed by Peterson and Wroblewski (1984):

$$M_w = 1.92\ year^{-1} \times (W)^{-0.25}$$

where M_w indicates natural mortality (at mass *W*) and $W = a \times TL^b$, with *a* and *b* values obtained from *LWRs* (TL vs. BW).

Graph Pad Prism 8.0 and Microsoft Excel (version 2019) were used for statistical analysis and data processing.

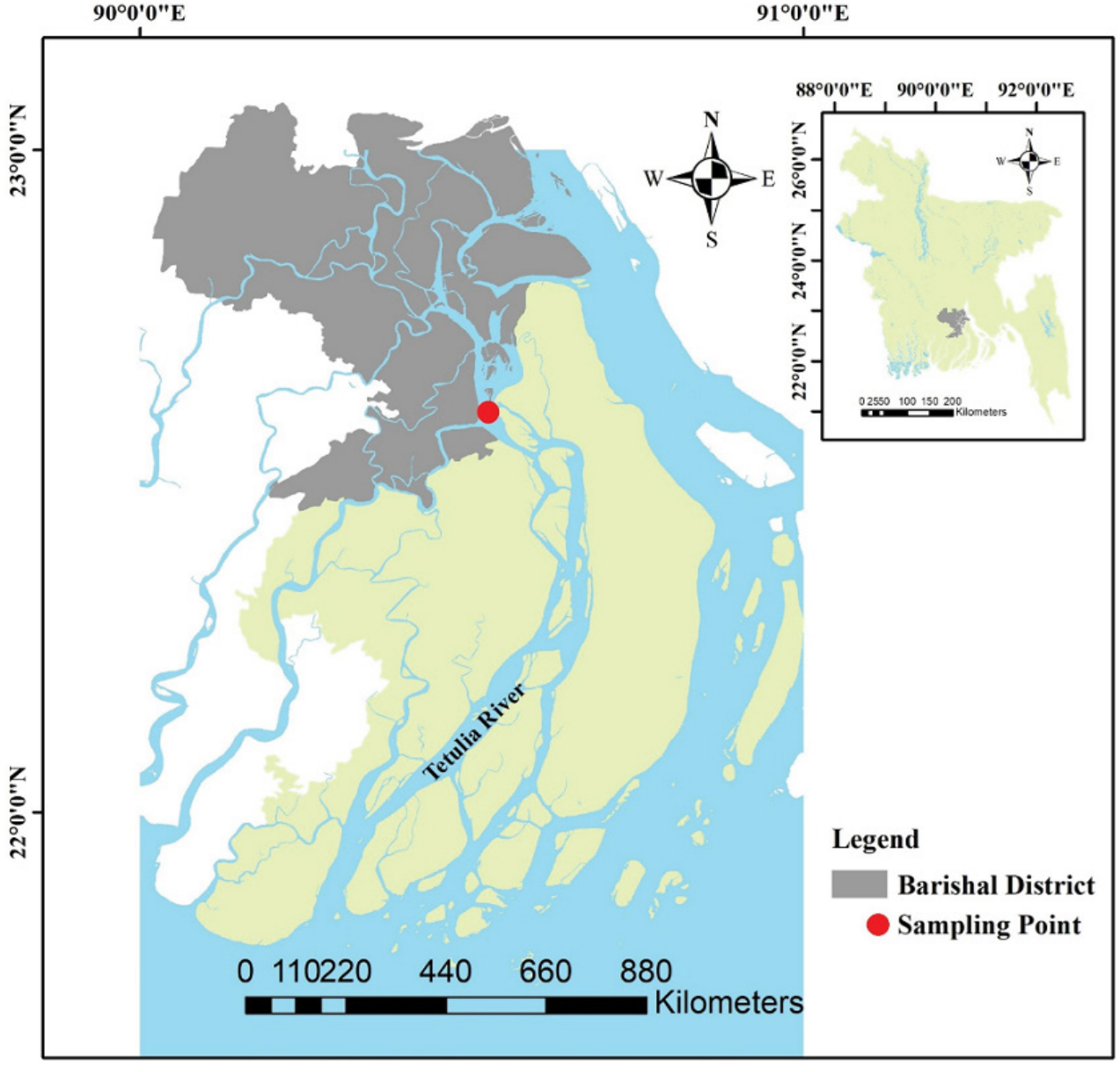

Fig 1. Location of the study area of *A. coila* in the Tetulia River, southern Bangladesh

To determine the relationship of the condition factor with TL and BW, the Spearman rank correlation test was applied. To differentiate the total relative weight (W_R) from 100, the Wilcoxon signed-rank test was used (Anderson and Neumann, 1996). The statistical analysis was done at a 5% level of significance ($P < 0.05$).

RESULTS

A total of 316 specimens of *A. coila* were collected from the Tetulia River, southern Bangladesh. Descriptive statistics of maximum and minimum length and body weight measurement, with their 95% confidence interval (CI) of *A. coila* are illustrated in Table 1. The *LFDs* of *A. coila* exposed that the range of TL was 5.6 to 15.2 cm, whereas BW ranged from 0.76 to 16.40 g.

The maximum population is in the size group from 10.00 to 10.99 cm TL and constituted 24.37% of the total population in the Tetulia River (Fig. 2). Based on the Shapiro-Wilk normality test, the *LFDs* were normally distributed ($P = 0.1676$ for TL and $P < 0.0001$ for BW) in the Tetulia River.

Table 2 shows the regression parameters *a* and *b* at 95% confidence interval (CI), coefficient of determination (r^2), value and growth type (GT) of *A. coila*. In this study, the measured allometric coefficient (b) of TL vs. BW and SL vs. BW indicate positive allometric growth where *b* values were 3.18 and 3.14, respectively.

All *LWRs* were highly significant and most of the coefficient of determination values were $r^2 \geq 983$. The positive value of the coefficient of determination indicated that body weight is increasing with the increase of lengths (Fig. 3a).

Table 1. Length (cm) and weight (g) measurements of combined sexes of *A. coila* from the Tetulia River, southern Bangladesh

Measurement	*n*	Maximum	Minimum	Mean ± SD
Total length (TL)	316	15.20	5.60	10.19 ± 1.99
Standard length (SL)		13.00	4.90	8.39 ± 1.69
Fork length (FL)		14.00	5.10	8.90 ± 1.84
Body weight (BW)		16.40	0.76	4.91 ± 3.21

Here, *n*, Sample size; and SD, Standard deviation.

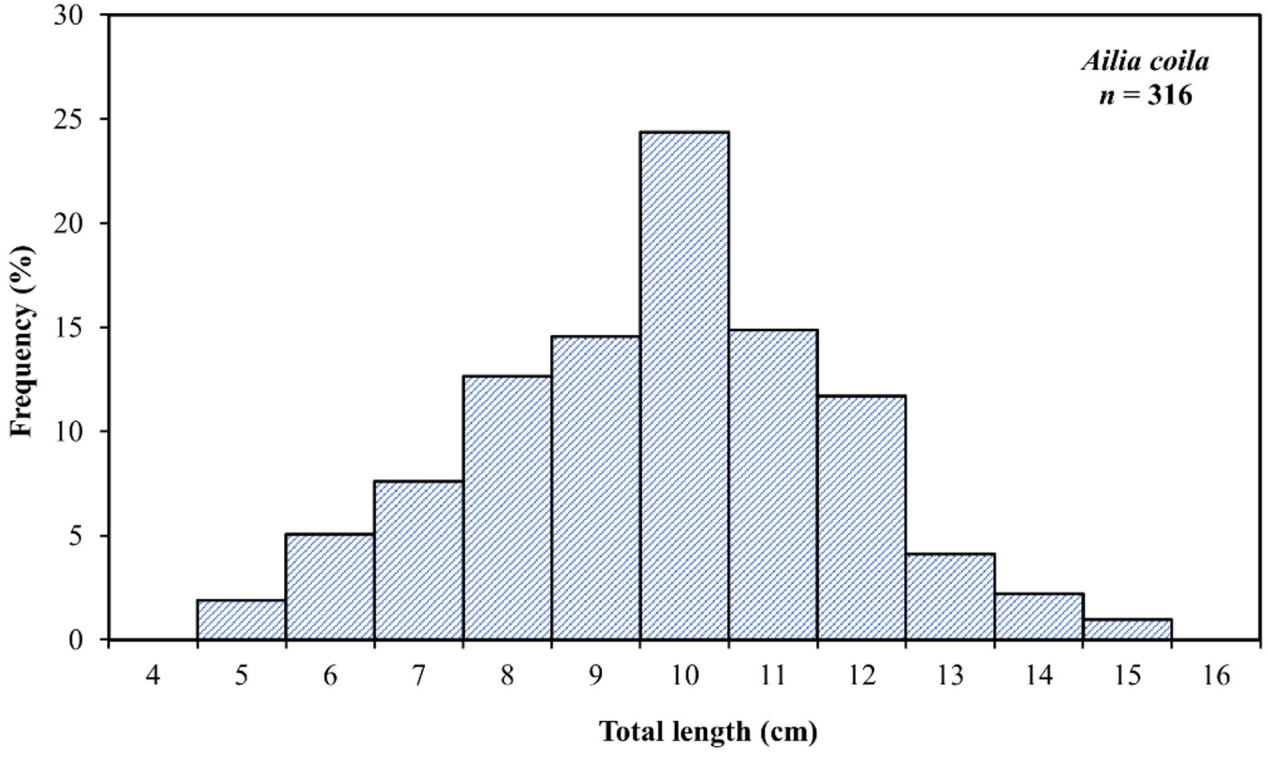

Fig 2. Length-frequency distribution of *A. coila* in the Tetulia River, southern Bangladesh

Table 2. Descriptive statistics of length-weight and length-length relationships of *A. coila* from the Tetulia River, southern Bangladesh

Equations	*n*	Regression parameters		95% CI of *a*	95% CI of *b*	r^2	GT
		a	*b*				
$BW = a \times TL^b$	316	0.0027	3.18	0.0024 to 0.0030	3.1320 to 3.2200	0.985	A+
$BW = a \times SL^b$		0.0053	3.14	0.0048 to 0.0059	3.0990 to 3.1900	0.983	A+
$TL = a + b \times SL$		0.3061	1.18	0.2100 to 0.4020	1.1670 to 1.1890	0.993	A+

Here, *n*, Sample size; TL, Total length; SL, Standard length; BW, Body weight; *a*, Intercept; *b*, Slope; CI, Confidence interval; r^2, Coefficient of determination; GT, Growth type; A+, Positive allometric growth

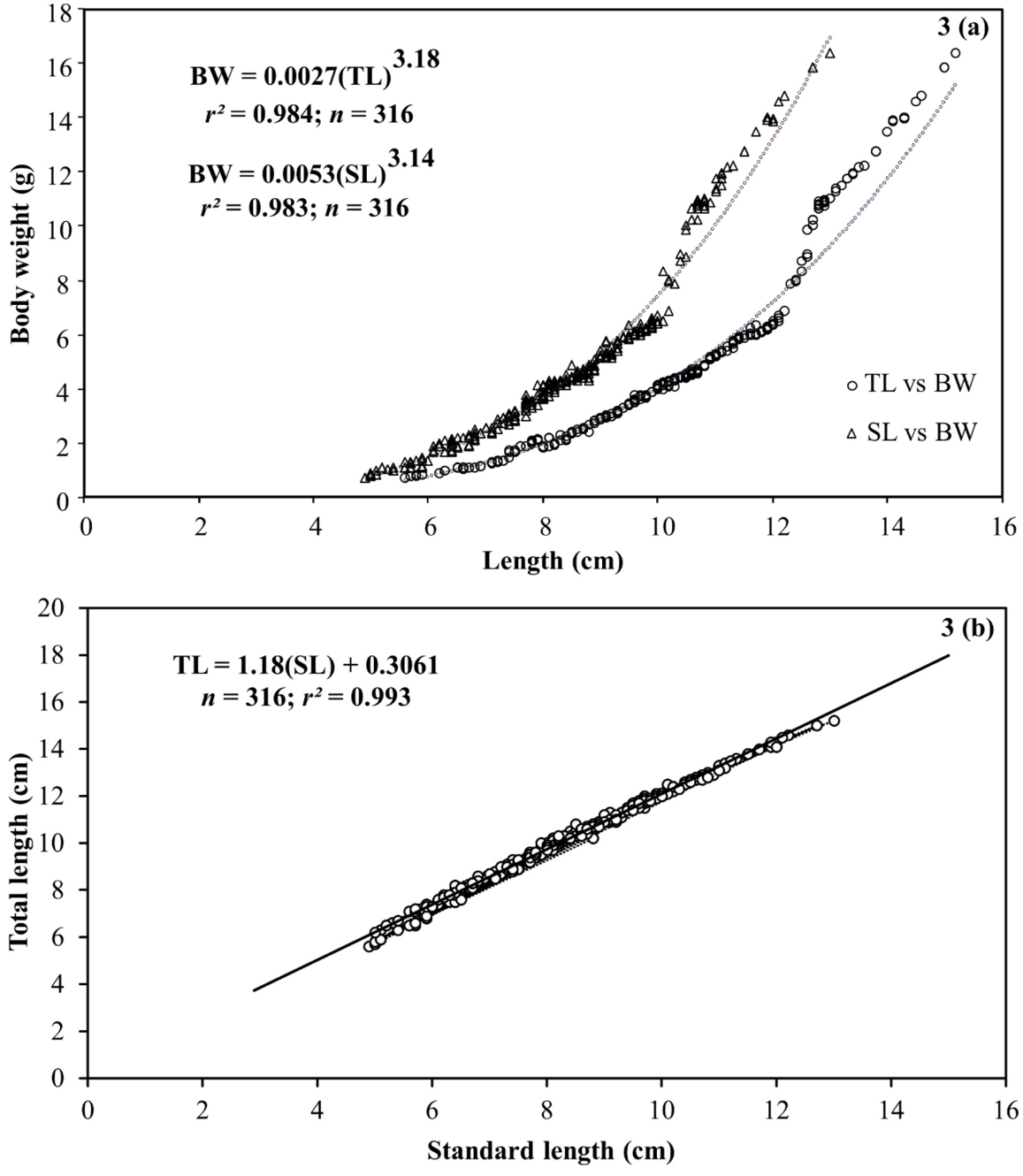

Fig 3. (a) Relationships between total length (TL) vs. body weight (BW), and (b) standard length (SL) vs. total length (TL) of *A. coila* in the Tetulia River, southern Bangladesh

Further, the *b* value of *LLR* (SL vs. TL) indicates the same growth pattern ($b > 1$), as represented in Fig. 3b. The *LLR* was extremely significant ($P < 0.001$) with a coefficient of determination (r^2) of 0.993.

The $a_{3.0}$ was calculated as 0.005 for the combined sex of *A. coila* in the Tetulia River, southern Bangladesh, and this value signifies that this fish is elongated in body shape. Furthermore, the researchers used the remaining literature to calculate the $a_{3.0}$ of *A. coila* from waters around the world in Table 4.

The values of four types of condition factors (K_A, K_F, K_R, and W_R) are displayed in Table 3. According to the Spearman rank correlation test, there were highly significant ($P < 0.001$) co-relationships of K_F with TL and BW (Table 3). Based on Wilcoxon signed-rank test analysis, W_R demonstrated very significant differences from 100 ($P < 0.001$) for *A. coila*. The relationships of condition factors (K_A, K_F, K_R, and W_R) with total length (TL) and body weight (BW) are embodied in Table 3; whereas the relationship between TL and W_R is exposed in Fig. 4.

Table 3. Descriptive statistics on condition factor measurements with their 95% CI; and estimation of correlation for condition factors with total length (TL, cm) and body weight (BW, g) of *A. coila* from the Tetulia River, southern Bangladesh

Condition factors	Minimum	Maximum	Mean ± SD	95% CI
K_A	0.0023	0.0033	0.0027 ± 0.0002	0.0027 to 0.0027
K_F	0.3467	0.5196	0.4050 ± 0.0383	0.4007 to 0.4092
K_R	0.8679	1.2160	0.9905 ± 0.0832	0.9813 to 0.9997
W_R	86.79	121.60	99.05 ± 8.32	98.13 to 99.97
Relationships	**r_s values**	**95% CI of r_s**	***P* value**	**Significance level**
TL vs. K_A	- 0.1026	- 0.2137 to 0.0111	0.0685	NS
BW vs. K_A	- 0.0825	- 0.1942 to 0.0314	0.1434	NS
TL vs. K_F	0.1869	0.0749 to 0.2942	0.0008	***
BW vs. K_F	0.2107	0.0995 to 0.3167	0.0002	***
TL vs. K_R	- 0.1025	- 0.2136 to 0.0112	0.0689	NS
BW vs. K_R	- 0.08235	- 0.1941 to 0.0315	0.1441	NS
TL vs. W_R	- 0.1025	- 0.2136 to 0.0112	0.0689	NS
BW vs. W_R	- 0.08235	- 0.1941 to 0.0315	0.1441	NS

Here, TL, Total length; BW, Body weight; CI, Confidence interval; r_s, Coefficient of Spearman rank correlation test values; *P*, Exhibitions of the intensity of significance; NS, Non-significant; and ***Extremely significant

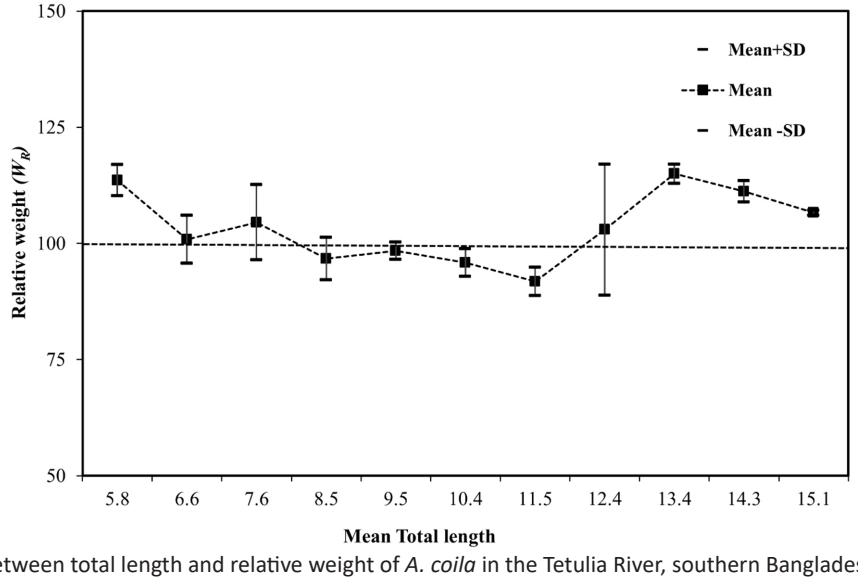

Fig 4. Relationship between total length and relative weight of *A. coila* in the Tetulia River, southern Bangladesh

The L_m value of *A. coila* was estimated as 9.19 (~ 9.2) cm TL in the Tetulia River, southern Bangladesh. The estimated optimum catchable length (L_{opt}) for *A. coila* was 10.74 cm TL in the Tetulia River, southern Bangladesh (Fig. 5). Besides, using available literature, L_m and L_{opt} of *A. coila* acquired from numerous worldwide waters were calculated and represented in Table 4.

M_w for *A. coila* in this study was calculated as 1.37 year^{-1} in the Tetulia River in southern Bangladesh (Fig. 6). The calculated M_w for *A. coila* from various water bodies globally is revealed in Table 4.

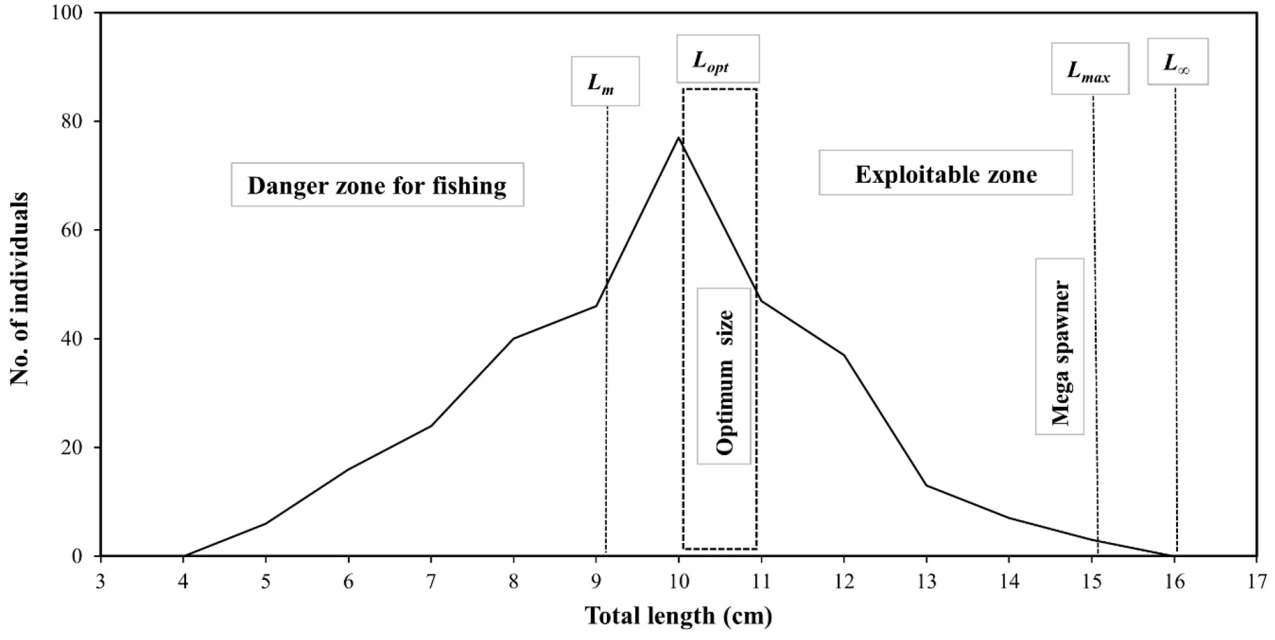

Fig 5. Optimum catchable length of *A. coila* in the Tetulia River (L_m - size at first sexual maturity, L_{opt} - optimum catchable length, L_∞ - asymptotic length)

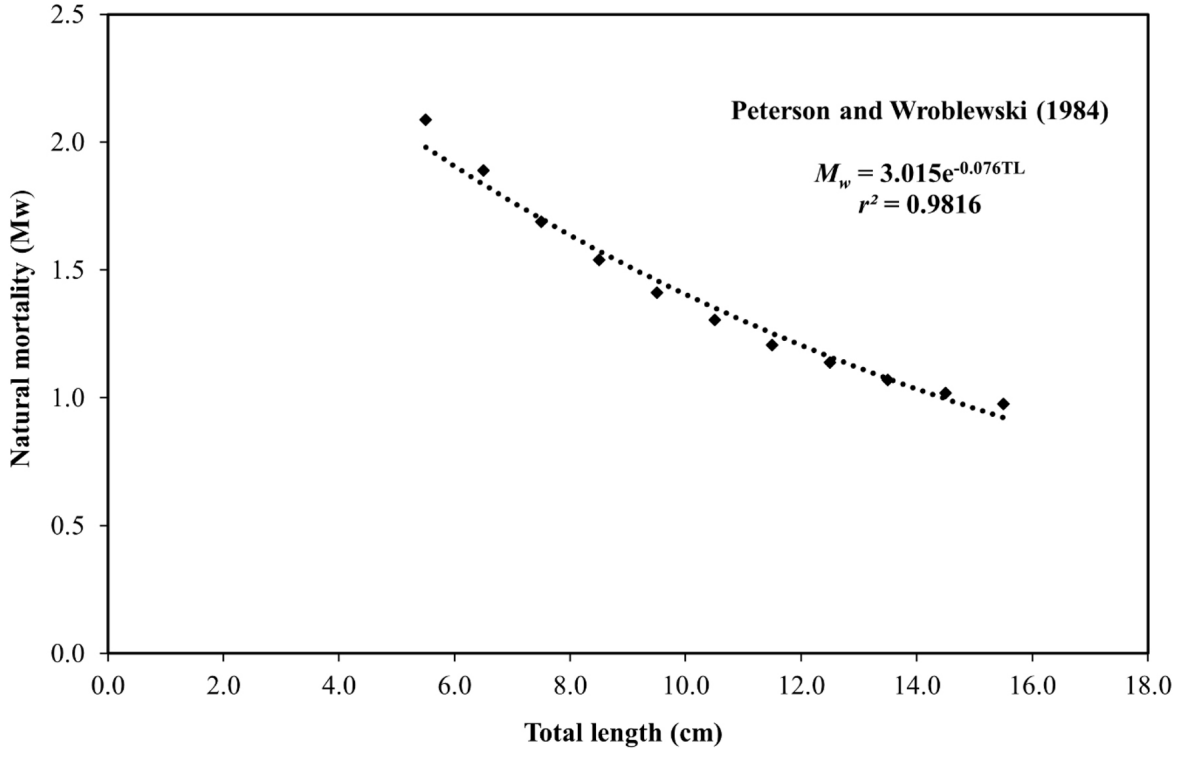

Fig 6. Natural mortality of *A. coila* in the Tetulia River, southern Bangladesh

Table 4. Calculated form factor, size at first sexual maturity, natural mortality, asymptotic length, and optimum catchable length of *A. coila* obtained from different water bodies around the world

Water body	Sex	Regression parameters *a*	*b*	L_{max} (cm)	L_α	$a_{3.0}$	L_m (cm)	M_w (year^{-1})	L_{opt}	References
Brahmaputra River, Assam, India	M	0.0028	3.19	15.40	16.32	0.005	9.30	0.94	10.87	Gogoi et al. (2019)
	F	0.0058	2.86	16.10	17.05	0.004	9.69	0.95	11.36	
Ganges basin, Jharkhand, India	C	0.0012	3.43	15.80	16.73	0.005	9.52	0.96	11.15	Sandhya et al. (2020)
Ganges River, Bangladesh	C	0.0080	3.01	13.00	13.81	0.008	7.96	0.93	9.20	Hossain et al. (2009)
Padma River, Northwestern Bangladesh	C	0.0890	3.07	15.60	16.53	0.114	9.41	0.42	11.01	Hossain (2010)
Ganges River, Varanasi	C	0.0009	3.65	17.50	18.50	0.007	10.46	0.81	12.33	Mahapatra et al. (2018)
Padma River, Bangladesh	C	0.8315	3.06	17.00	17.98	1.018	10.18	0.23	11.98	Mortuza et al. (2020)
Brahmaputra River, Assam, India	C	-	-	-	26.80	-	-	1.63	17.85	Gogoi et al. (2021)
Tetulia River, Southern Bangladesh	C	0.0027	3.18	15.20	16.11	0.005	9.19	1.37	10.74	Present study

Here, M, Male; F, Female; C; Combined; *a* and *b* are length-weight relationship parameters; L_{max}, Maximum length; L_α, Asymptotic length, $a_{3.0}$, Form factor; L_m, Size at first sexual maturity; CL, Confidence limit for mean value; M_w, Natural mortality; and L_{opt}, Optimum catchable length

DISCUSSION

Present studied work on the life history traits of *A. coila* still appears to be infrequent in Bangladesh and the world literature. This study focuses on population parameters of *A. coila*, such as *LFD*, growth pattern (*LWRs* and *LLR*), $a_{3.0}$, condition factors (K_A, K_F, K_R and W_R), L_m, L_{opt} and M_w of *A. coila*, using a suitable number of specimens of multiple lengths from the Tetulia River, southern Bangladesh.

Throughout the study period, it was not possible to select individuals of *A. coila* smaller than 5.6 cm TL. This limitation was most likely triggered by a lack of small fish in the fishing areas (Hossain et al., 2012b, 2012c, 2017a, 2017b, 2018; Khatun et al., 2019; Saha et al., 2021c), by the tendency of fishermen to reject smaller fish (Hossain et al., 2012a; Saha et al., 2021a; Rahman et al., 2018; Nadia et al., 2023) or by the impossibility to reach the exact area where smaller size fish are located (Hossain et al., 2012a; Azad et al., 2018; Khatun et al., 2018). In addition, the maximum total length of *A. coila* measured in the Tetulia River in southern Bangladesh was 15.2 cm, slightly lower than the highest documented estimate of 18.0 cm (Froese and Pauly, 2022). This variation could be attributed to gear selectivity (Hossain et al., 2019; Sabbir et al., 2020). In addition, these growth differences may be attributed to different environmental factors, particularly water temperature and food availability (Ahmed et al., 2012).

In the ongoing study, the allometric co-efficient *b* values for *A. coila* ranging from 3.14 (SL vs. BW) to 3.18 (TL vs. BW) were assessed to be comparable with the anticipated ranges of 2.0 to 4.0 (Tesch, 1971) and 2.50 to 3.50 (Froese, 2006). In spite of the differences in fish conformation between species, *b* is usually close to 3, indicating that the fish grows isometrically, and values that deviate significantly from 3.0 indicate allometric growth (where > 3 positive allometry and < 3 negative allometry) (Tesch, 1968). In this scenario, the estimated *b* value of the *LWRs* (TL vs. BW) was 3.18, indicating that the population precisely follows the growth in a positive allometric pattern. Parallel research findings (*b* = 3.42) were observed from Panchet Reservoir in the Ganges basin, Jharkhand, India (Sandhya et al., 2020), from the Brahmaputra River, Assam, India (*b* value was 3.19 for males) (Gogoi et al., 2019) and ponds along the Ganges Varanasi (*b* = 3.65) (Mahapatra et al., 2018). An isometric growth pattern was observed (*b* = 3.07) in the Padma River in northeastern Bangladesh (Hossain, 2010). In contrast, a negative allometric growth pattern was reported on a seasonal basis in the Brahmaputra River near Dibrugarh, Assam, India (Deori et al., 2017). The length-weight relationship parameters (*a* and *b*) are influenced by a series of factors including season, gonad maturity, habitat, sex, stomach fullness, diet, the health of the individuals in their natural habitats as well as the treatment of specimens and preservation techniques after sampling (Tesch, 1971; Bagenal and Tesch, 1978;

Saha et al., 2021b). Moreover, fish tend to exhibit great plasticity in their morphological characteristics because of variations in diet, temperature, and other environmental factors (Allendorf and Phelps, 1980; Allendorf et al., 1987; Swain et al., 1991).

However, there are almost no references in the literature concerned with the length-length relationship for this species except for Hossain et al. (2009) and Hossain (2010). In this study, the estimated *b* values of the *LLRs* (SL vs TL) indicated positive allometric growth (b = 1.18) for the specimen, which was equivalent to the study (b = 1.18) conducted from the Ganges, Bangladesh (Hossain et al., 2009). For future scientific investigation, the anticipated length-length relationships of this species may offer valuable insights. Moreover, it might serve as an excellent framework for new research on this population. The application of the form factor ($a_{3.0}$) can be used to identify whether the body shape of individuals in a given population is notably diverse from others (Froese, 2006). The $a_{3.0}$ for *A. coila* was 0.005, indicating that this fish is elongated in body shape in the Tetulia River, southern Bangladesh. There was almost no reference dealing with the form factor of this species, thus it may be the first study on *A. coila* which can serve as a framework for ulterior studies.

Although most of the studies deal with a single condition factor, however, the current study has worked with four condition factors (K_A, K_F, K_R and W_R) to assess the health and habitat condition of *A. coila* in the Tetulia River. This study postulates that the K_F is the best biometric index for assessing the well-being of this species in the study area. In terms of size (TL in cm), in the present study the K_F values of *A. coila* for combined sexes were recorded from 0.38 to 0.51, which was almost identical (0.42-0.55) to another scientific study from the Padma River, northwestern Bangladesh (Hossain, 2010). Additionally, the W_R was significantly different from 100 ($P < 0.05$), indicating an imbalanced habitat with food availability relative to the presence of predators for *A. coila* in the Tetulia River.

For fish stock assessment, the size at first sexual maturity (L_m) works as an indicator to estimate the minimum permitted capture size (Lucifora et al., 1999; Hossain et al., 2019; Khatun et al., 2019). In this case, the size at first sexual maturity for the combined sex of *A. coila* was estimated as 9.19 (~ 9.2) cm TL. As there are almost no references in the literature concerned with the size at first sexual maturity for this species, hence the current findings provide a crucial foundation for future assessments.

L_{opt} assists in selecting mesh sizes of fishing gear and avoiding the capture of fish underneath the catchable size for the desired fish species (Mawa et al., 2021). L_{opt} was found to be 10.7 cm, suggesting the size range where the optimum yield might be acquired; accordingly, fish sizes greater than 10.7 cm in TL are suggested for exploitation (Fig. 5). Since this is also the first work on this biological aspect, no comparison can be made.

The M_w for the entire population of *A. coila* was estimated to be 1.37 year^{-1} in the Tetulia River, which was lower than the recent result (1.63 year^{-1}) obtained from the Brahmaputra River system of Assam (Gogoi et al., 2021), which may be attributed due to geographical variation. Furthermore, the M_w value was particularly high for those which are comparatively smaller, but it reduced as body size increased. Because they are more susceptible to attack by predators, they have lower disease resistance and have not developed enough to adapt to the adverse environment.

CONCLUSION

The present study represents an essential baseline study on the *LFDs, LLRs, LWRs*, $a_{3.0}$, condition factors (K_F), L_m, and natural mortality (M_w) of *A. coila* (Ailiidae) from the Tetulia River, southern Bangladesh. For *A. coila*, the size group from 10.00 to 10.99 cm was numerically dominant and K_F indicates that this species is not in better condition in the Tetulia River. Additionally, *A. coila* is a near-threatened species and there are very few studies on the life history traits of this fish. So, this is the first ever inclusive study on the life history traits of *A. coila* and our findings represent the exact condition of this species. In addition, the findings of this study provide vital information for the FishBase online database and offer an important baseline for further studies. Thus, they are an effective tool for fishery managers, fish biologists and conservationists to initiate early management strategies and regulations for a more sustainable conservation of the remaining stocks of this species in the Tetulia River. Moreover, further detailed studies (considering monthly sampling throughout the year) on the spawning frequency and some other biological aspects, i.e. histology, growth, and abundance, are still necessary for the future management of this species.

BIOLOŠKA OBILJEŽJA GANGETSKE AILIJE, *Ailia coila* (Hamilton, 1822.) IZ RIJEKE TETULIA, JUŽNI BANGLADEŠ

SAŽETAK

Gotovo ugrožena gangetska ailia (*Ailia coila*) vrsta je soma iz obitelji Ailiidae koja je autohtona u Bangladešu, Pakistanu, Nepalu i Indiji. Ovaj rad opisuje biološka obilježja vrste *Ailia coila*, uključujući distribuciju duljine i frekvencije (*LFD*), obrasce rasta (dužinsko-masene odnose i odnose duljina-dužina), faktor oblika ($a_{3.0}$), faktore kondicije (alometrijski, K_A; Fultonov, K_F; relativni, K_R i relativnu težinu, W_R), veličinu pri prvoj spolnoj zrelosti (L_m), optimalnu lovnu duljinu (L_{opt}) i prirodnu smrtnost (M_w) iz rijeke Tetulia u južnom Bangladešu. Nadalje, L_α, $a_{3.0}$, L_m, M_w i L_{opt} iz raznih otvorenih voda iz cijelog

svijeta izračunati su u ovoj studiji pomoću postojeće literature. Ukupno 316 uzoraka nasumično je prikupljeno povremenim korištenjem tradicionalnih alata tijekom godine od srpnja 2021. do lipnja 2022. S točnošću od 0,01 cm i 0,01 g, ukupna duljina (TL), standardna duljina (SL) i tjelesna težina (BW) svake pojedinačne ribe su izmjereni. TL od 10,00 do 10,99 cm bila je brojčano vodeća skupina, a b vrijednosti *LWR*-a ukazuju na pozitivan alometrijski rast. $a_{3.0}$ je 0,005, a K_F je najbolji za procjenu dobrobiti *A. coila*. Osim toga, W_R pokazuje da je stanište bilo neuravnoteženo s višim udjelom grabežljivaca. Izračunati L_m, L_{opt} i M_w bili su 9,19 (~ 9,2 cm TL), 10,7 cm TL i 1,37 godina^{-1} za *A. coila* u rijeci Tetulia. Ovi će uvidi biti od vitalnog značaja za buduća istraživanja i preporuku prikladnih strategija upravljanja za *A. coila* u rijeci Tetulia i susjednim vodama.

Ključne riječi: obrazac rasta, populacijska biologija, prirodna smrtnost, spolna zrelost

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