LENGTH-LENGTH RELATIONSHIPS OF ELONGATE GLASS PERCHLET, *Chanda nama* (HAMILTON, 1822) FROM THE OLD BRAHMAPUTRA RIVER, BANGLADESH

Nelufa Aktar, Zoarder Faruque Ahmed and Mst. Kaniz Fatema*

Department of Fisheries Management, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

*Corresponding author: Dr. Mst. Kaniz Fatema; E-mail: kanizfatemafm@bau.edu.bd

ARTICLE INFO	A B S T R A C T
	The generalized length-length relationships of *Chanda nama* ((Hamilton, 1822) belongs to Ambassidae were studied separately for a period of a calendar year collected from the Old Brahmaputra River, Mymensingh, Bangladesh for male, female and combined populations. A total of 1170 specimens were examined where 599 were male and 571 were female. The standard length, fork length and total length of male ranged from 19 to 79 mm, from 23 to 90 mm, and 28 to 100 mm respectively. The standard length, fork length and total length of female were found from 15 to 81 mm, 24 to 89 mm, and from 29 to 100 mm respectively. The generalized relationships of standard length and fork length, fork length and total length, and standard length and total length of male, female and combined populations were FL = 1.08 SL+1.41, TL = 1.11 FL + 1.54 and TL = 1.20 SL+2.81; FL = 1.09 SL+1.23, TL = 1.12 FL+1.04 and TL = 1.22 SL+2.22; and FL = 1.09 SL+1.20, TL = 1.11 FL+1.27 and TL = 1.22 SL+2.38 respectively. The coefficient of determination (R^2) revealed high values in all regression analyses. In length–length relationships, the coefficient of determination (R^2) ranged from 0.973-0.990. The present findings of this study will be helpful for a well-organized and significant exploitation and regulation of the *Chanda nama* fishery in the Old Brahmaputra River and surrounding ecosystems.

INTRODUCTION

A member of the family Ambassidae, *Chanda nama* (Hamilton, 1822), is commonly known as elongate glass-perchlet (Talwar and Jhingran, 1991) is one of the important small indigenous fish species and popular food fish having good consumer preference in Bangladesh. *Chanda nama* is a carnivorous, brackish water fish in the Asiatic glassfish family Ambassidae. The species is known by "perchlet" and is well known as a Small Indigenous Species (SIS) of fish of Bangladesh. *Chanda nama* is found in running and standing fresh and brackish water throughout the Indian sub-continent including Pakistan, India, Nepal, Bangladesh, and Myanmar. This fish is abundantly found from the marginal area of the jute and paddy fields during in the rainy season (Bhuiyan, 1964; Rahman, 2005). Biology of elongate glassy perchlet such as growth design, reproduction, length–length relationships, length-weight relationship etc. are obligatory to fit out appropriate information for the formulation of fisheries management policies (Everhart et al., 1975). Information of length-length relationship disclose the index of well-being of fishes, growth dynamics, impression of first maturity, timing of reproduction, stock variation etc. Information on length-length relationships are still scarce for most tropical and sub-tropical fish species (Martin-Smith 1996, Harrison 2001, Ecoutin et al. 2005) thus length-length relationships of this species using a calendar year data sets are clearly a prim need to broaden the understanding about *C. nama*. The data on length-length relationship is considered to be insufficient for this species in the Old Brahmaputra River; therefore, the present study was conducted to widen the observation of length-length relationships of an important small indigenous species *C. nama* of Bangladesh.

MATERIALS and METHODS

Study area and fish sample collection

Monthly samples were collected from the Old Brahmaputra River near Bangladesh Agricultural University, Mymensingh (24º75´N, 90º43´E) for a period of one year. The samples were collected using a combination of fine-meshed (< 2 mm) cast and seine nets by the help of local fishermen. A total of 100 fish individuals were collected randomly for every sampling occasion. All specimens at each sampling were preserved with 10% formalin to avoid decomposition of fish and transferred to the laboratory for further analysis.

Recording of lengths

Linear dimension of fish as linear distance of body length which is measured by scale. To carry out present research two linear dimensions of standard length, total length and fork length were considered. Standard length was measured from the tip of the snout (mouth closed) to the last vertebrae, total length from the tip of the snout to the end of caudal fin and fork length from tip of the snout to the fork of the caudal fin. All lengths were taken to the nearest cm with the help of a measuring board. Data were input on the spreadsheet of the computer software, Microsoft Excel.

Gender determination

The body cavity of a fish was cut open carefully by scissors, and gonads were extracted with forceps carefully. Fishes were sexed as male and female observing the gonads with naked eye.

Estimation of length-length relationship

A linear relationship between standard length (SL) and total length (TL) was estimated using the equation: TL= a+bSL where 'a' and 'b' are constants as intercept and slope respectively. Estimates of 'a' and 'b', and their 95% confidence limits were computed statistically.

RESULTS

Fish size

The investigation dealt with a total of 1170 elongate glass perchlet individuals. Among them 599 were male and 571were female. The standard length, fork length and total length of male ranged from 19 to 79 mm, from 23 to 90 mm,

340

Res. Agric. Livest. Fish.   **Vol. 8, No. 3, December 2021: 339-347.**

and 28 to 100 mm respectively. The standard length, fork length and total length of female measured from 15-81 mm, from 24 to 89 mm, and from 29 to 100 mm, respectively (Table 1).

Size relationships

Length-length relationships
Linear regression (Y = a+bX) analyses were used to establish the relationship between standard length and fork length; fork and total length; and standard length and total length. Generalized length-length relationships were fitted with the pooled data of all monthly samples for male, female and combined populations separately.

Table 1. Details for monthly samples of *Chanda nama* population collected from the Old Brahmaputra River (Obs, observation; SL, standard length; TL, total length; FL, fork length)

Month	Male				Female			
	Obs.	SL (mm)	TL (mm)	FL (mm)	Obs.	SL (mm)	TL (mm)	FL (mm)
January	56	21-51	45-71	41-62	44	15-67	29-86	24-76
February	50	23-65	28-75	26-65	50	25-66	33-87	28-76
March	66	26-64	30-80	25-89	34	25-69	34-85	28-76
April	54	22-52	29-70	25-58	46	23-62	29-84	25-75
May	56	21-81	32-100	28-90	44	26-81	33-98	30-88
June	61	24-71	30-86	4.4-76	39	23-78	36-100	31-87
July	45	19-59	30-76	3.0-67	55	23-68	10-88	29-81
August	43	26-76	33-95	7.0-84	57	26-81	34-96	6-88
September	39	31-79	40-100	34-88	42	37-80	48-100	41-89
October	47	22-61	30-80	26-70	53	24-75	34-100	29-89
November	32	27-66	34-84	30-73	56	27-78	28-96	32-82
December	50	27-54	34-68	30-60	50	28-74	35-89	30-79

Male population
Linear regression of pooled data of standard length vs. fork length from all monthly samples of male *Chanda nama* over the study period from January to December is shown in Figure.1. The equation revealed that the intercept "a" and the slope "b" were 1.41 and 1.08 respectively. The value of "b" was found 1.08, which indicated the pattern of allometric growth. The coefficient of determination was 0.978 respectively. The high correlation coefficient (0.978) indicated that there was a high degree of association between standard length and fork length of male pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 97.8% of the variation in fork length was due to variation in standard length.

Linear regression of pooled data of fork length vs. total length from all monthly samples of male *Chanda nama* over the study period from January to December is shown in Figure 1. The equation revealed that the intercept "a" and the slope "b" were 1.54 and 1.11 respectively. The value of "b" was found 1.11, which indicated the pattern of allometric growth. The coefficient of determination was 0.983. The high correlation coefficient (0.983) indicated that there was a high degree of association between fork length and total length of male pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 98.3% of the variation in total length was due to variation in fork length.

Linear regression of pooled data of standard length vs. total length from all monthly samples of male *Chanda nama* over the study period from January to December is shown in Figure 1. The coefficient of determination was 0.973. The high correlation coefficient (0.973) indicated that there was a high degree of association between standard length and total length of male pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 97.3% of the variation in total length was due to variation in standard length.

Among the above length-length relationships of male population, the lowest value of "a" was 1.41 found between the standard length and fork length relationship and the highest value was 2.81 obtained between the standard length and total length relationship. The minimum value "b" was 1.08 found between the standard length and fork length relationship and the maximum value was 1.20 obtained between the standard length and total length relationship. The highest value of

"R^2" was 0.983 found between the fork length and total length relationship and the lowest value of "R^2" was 0.973 found between the standard length and fork length relationship (Table 2).
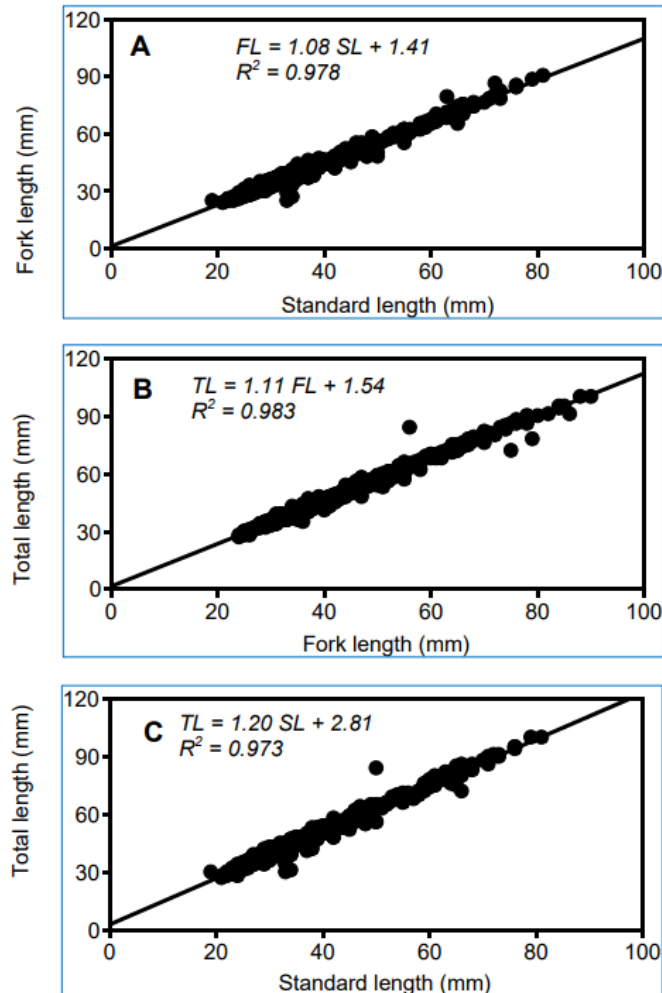

Figure 1. Generalized length-length relationships of male population (A) between standard length and fork length; (B) between fork length and total length; (C) between standard length and total length.

Female population

    Linear regression of pooled data of standard length vs. fork length from all monthly samples of female *Chanda nama* over the study period from January to December is shown in Figure 2. The equation revealed that the intercept "a" and the slope "b" were 1.23 and 1.09 respectively. The value of "b" was found 1.09, which indicated the pattern of allometric growth. The coefficient of determination was 0.987. The high correlation coefficient (0.987) indicated that there was a high degree of association between standard length and fork length of female pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 98.7% of the variation in fork length was due to variation in standard length.

    Linear regression of pooled data of fork length vs. total length from all monthly samples of female *Chanda nama* over the study period from January to December is shown in Figure 2. The equation revealed that the intercept "a" and the slope "b" were 1.04 and 1.12 respectively. The value of "b" was found 1.12, which indicated the pattern of allometric growth. The coefficient of determination was 0.990. The high correlation coefficient (0.990) indicated that there was a high degree of association between fork length and total length of female pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 99.0% of the variation in total

length was due to variation in fork length. Linear regression of pooled data of fork length vs. total length from all monthly samples of female *Chanda nama* over the study period from January to December is shown in Figure 2.

The equation revealed that the intercept "a" and the slope "b" were 2.22 and 1.22 respectively. The value of "b" was found 1.22, which indicated the pattern of allometric growth. The coefficient of determination was 0.984. The high correlation coefficient (0.984) indicated that there was a high degree of association between fork length and total length of female pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 98.4% of the variation in total length was due to variation in fork length.

Among the above length-length relationships of female population, the lowest value of "a" was 1.04 found between the fork length and total length relationship and the highest value was 2.22 obtained between the standard length and total length relationship. The minimum value "b" was 1.09 found between the standard length and fork length relationship and the maximum value was 1.22 obtained between the standard length and total length relationship. The highest value of "R^2" was 0.990 found between the fork length and total length relationship and the lowest value of "R^2" was 0.978 found between the standard length and fork length relationship (Table 2).
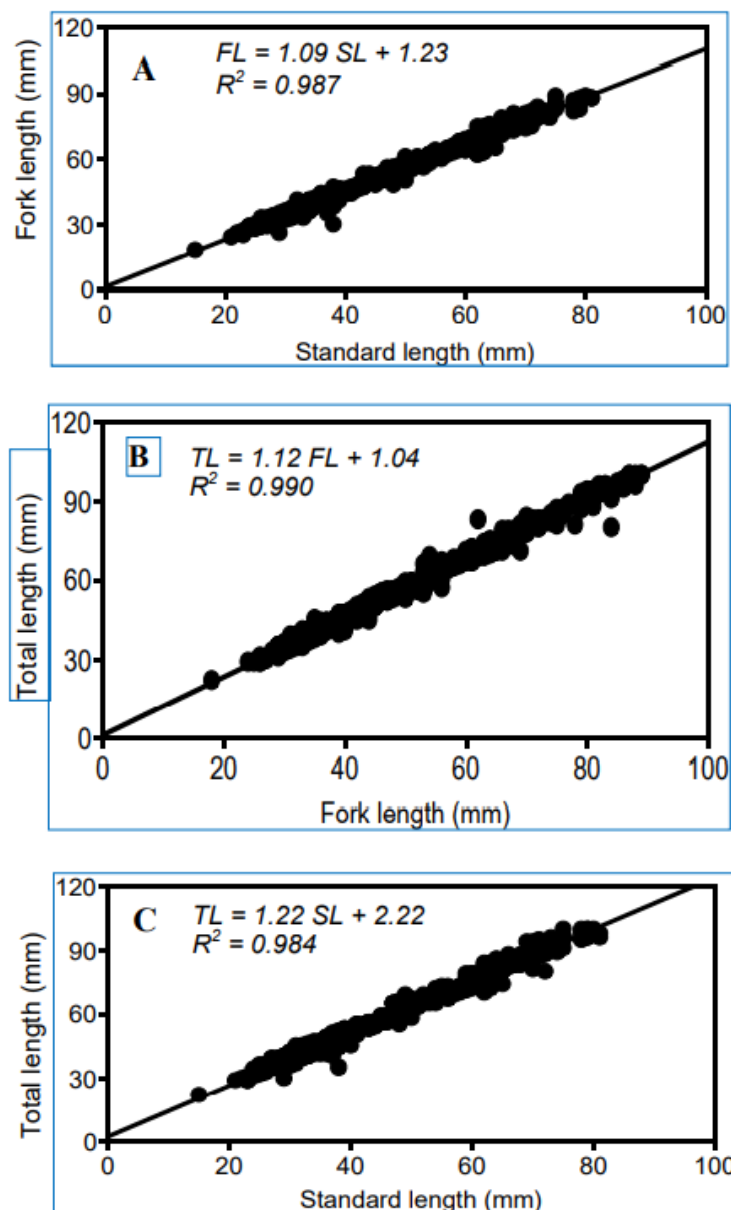
Figure 2. Generalized length-length relationships of female population (A) between standard length and fork length; (B) between fork length and total length; (C) between standard length and total length

Combined population

Linear regression of pooled data of standard length vs. fork length from all monthly samples of Combined *Chanda nama* over the study period from January to December is shown in Figure 4. The equation revealed that the intercept "a" and the slope "b" were 1.20 and 1.09 respectively. The value of "b" was found 1.09, which indicated the pattern of allometric growth. The coefficient of determination was 0.984. The high correlation coefficient (0.984) indicated that there was a high degree of association between standard length and fork length of combined pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 98.4% of the variation in fork length was due to variation in standard length.
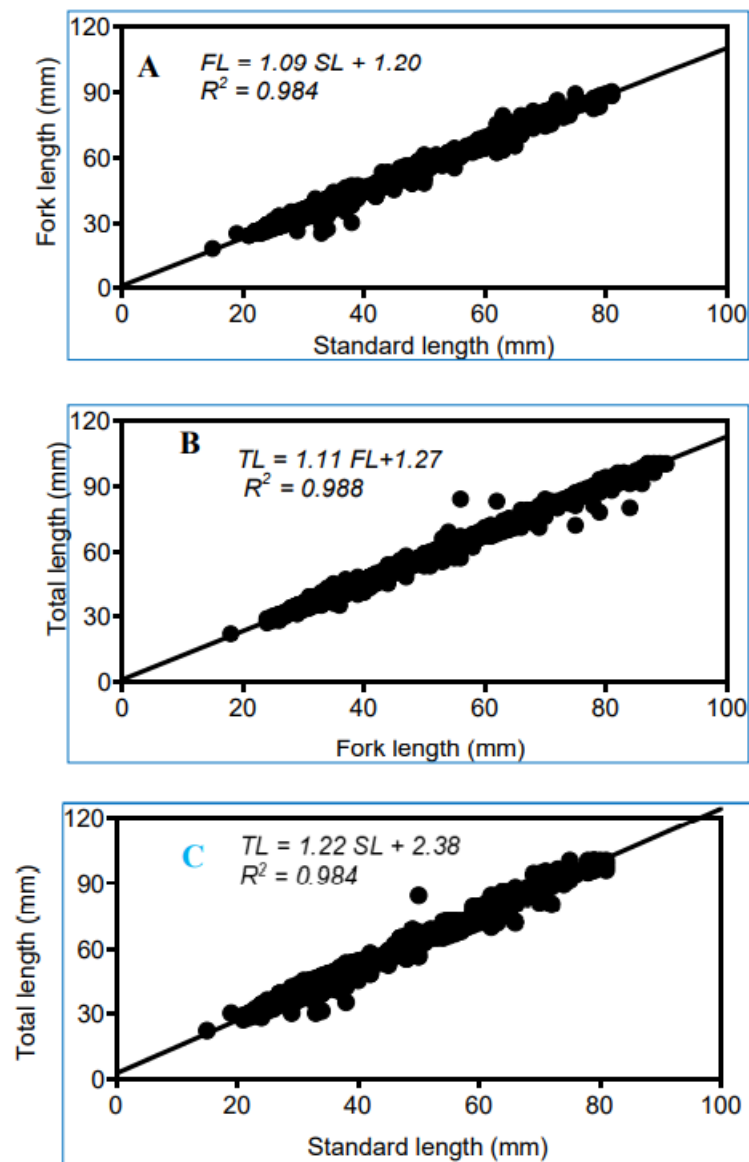

Figure 3. Generalized length-length relationships of combined sex population (A) between standard length and fork length; (B) between fork length and total length; (C) between standard length and total length

344

Res. Agric. Livest. Fish.   **Vol. 8, No. 3, December 2021: 339-347.**

Linear regression of pooled data of fork length vs. total length from all monthly samples of combined *Chanda nama* over the study period from January to December is shown in Figure 3. The equation revealed that the intercept "a" and the slope "b" were 1.27 and 1.11 respectively. The value of "b" was found 1.11, which indicated the pattern of allometric growth. The correlation coefficient and the coefficient of determination were 0.988. The high correlation coefficient (0.988) indicated that there was a high degree of association between fork length and total length of unsexed pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 98.8% of the variation in total length was due to variation in fork length.

Linear regression of pooled data of standard length vs. total length from all monthly samples of combined *Chanda nama* over the study period January to December is shown in Figure 3. The equation revealed that the intercept "a" and the slope "b" were 2.38 and 1.22, respectively. The value of "b" was found 1.22, which indicated the pattern of allometric growth. The coefficient of determination was 0.984.

The high correlation coefficient (0.940) indicated that there was a high degree of association between standard length and total length of unsexed pooled data since it was close to 1, and its positive value reflected that the slope is positive. The coefficient of determination suggested that 98.4% of the variation in total length was due to variation in standard length.

Among the above length-length relationships of combined population, the lowest value of "a" was 1.20 found between the standard length and fork length relationship and the highest value was 2.38 obtained between the standard length and total length relationship. The minimum value "b" was 1.09 found between the standard length and fork length relationship and the maximum value was 1.22 obtained between the standard length and total length relationship. The highest value of "R^2" was 0.988 found between the fork length and total length relationship and the value of "R^2" was similar (0.984) which found between the standard length and fork length, and the standard length and total length relationship (Table 2).

Table 2. Parameters of general equations fitted to pooled length-length data collected over the study period with population growth inference (TL, total length; FL, fork length; SL, standard length; M, male; F, female; C, combined; a and b, parameters of equation (Y = a+bX); r, correlation coefficient; df, degree of freedom)

Relationships	Equation	Sex	n	A	b	R^2
SL vs. FL	FL = a + bSL	M	599	1.41	1.08	0.978
		F	571	1.23	1.09	0.987
		C	1170	1.20	1.09	0.984
FL vs. TL	TL = a + bFL	M	599	1.54	1.11	0.983
		F	571	1.04	1.12	0.990
		C	1170	1.27	1.11	0.988
SL vs. TL	TL = a + bSL	M	599	2.81	1.20	0.973
		F	571	2.22	1.22	0.984
		C	1170	2.38	1.22	0.984

DISCUSSION

Studies on construction of length-length relationships, and growth deductions based on interrelationships of linear dimensions were insufficient across literature. Present study recorded the standard length, fork length and total length of male ranged from 19 to 79 mm, 23 to 90 mm, and 28 to 100 mm, respectively. The standard length, fork length and total length of female measured from 15-81 mm, 24 to 89 mm, and 29 to 100 mm, respectively. *Gudusia godanahiae* ranged from 47 to 167 mm in total length (Subba et al., 2009) whereas total lengths of *Lithognathus mormynus* ranged between 14.4 and 26.4 cm for males and 14.3 and 27.4 cm for females, respectively (Emre et al., 2008). The total length of *Oreochromis niloticus* ranged between 7.97 cm to 19.50 cm.

The generalized relationships of standard length and fork length, fork length and total length, and standard length and total length of male, female and combined sex of *Chanda nama* were FL = 1.08 SL+1.41, TL = 1.11 FL + 1.54 and TL =

345

Res. Agric. Livest. Fish.   **Vol. 8, No. 3, December 2021: 339-347.**

1.20 SL+2.81; FL = 1.09 SL+1.23, TL = 1.12 FL+1.04 and TL = 1.22 SL+2.22; and FL = 1.09 SL+1.20, TL = 1.11 FL+1.27 and TL = 1.22 SL+2.38, respectively. The value of "a" and "b" varied due to age and sex of the fish, wet and dry seasons, environmental condition and water bodies. The value of regression coefficient (b) is usually close to 3.0 (Beverton and Holt, 1975). For isometric pattern of growth, the value of the "b" would have been equal to 3.0. When the growth is isometric, the form and specific gravity of the fish do not change at all during the lifetime of the species (Doha, 1970). A value less than 3.0 indicated that fish becomes lighter (negative allometric) and greater than 3.0 as heavier (positive allometric) for a particular length as it increases in size (Wootton, 1990). However, the values of "b" were not equal to 3.0 in all relationships; this indicates allometric growth of *Chanda nama*. Similar findings (allometric pattern of growth) in *Glossogobius giuris* were also found by Das and Dewen (1989). Thus, the growth of *Chanda nama* can be said to be nearly isometric in the present study. Male, female and combined sex of *Chanda nama* exhibited both positive and negative allometric growth in present study. But only negative allometric growth was found in male, female and combined sex *Oreochromis niloticus* (Adeyemi et al., 2009). In the present study, the high values of coefficient of determination (R^2) were revealed in all regression analyses. In length–length relationships that (R^2) ranged from 0.973-0.990. The values of coefficient of determination (R^2) were very close to 1. This indicates that the length-length (LLR) relationships of *Chanda nama* were highly correlated. Thus, the present study given valuable details on the length-length relationships of *C. nama*, which will be helpful to construct conservation and management plan of this species in aquatic ecosystem of Bangladesh.

ACKNOWLEDGEMENTS

CONFLICT OF INTEREST

The author declares that they have no any conflict of research interest.

REFERENCES

1. Adeyemi S O, Bankole N O and Adikwu A I, 2009. The length-weight, length-length relationship and condition factor of *Oreochromis niloticus*in Gbedikere lake, Bassa, Kogi state. Continental Journal Fisheries and Aquatic Science, 3: 1-7.
2. Beverton R J H and Holt S O, 1957. On the dynamics of exploted fish. Investment Services, II, 19: 533.
3. Bhuiyan A L, 1964. Fishes of Dacca, Asiat. Soc. Pakistan, Pub. 1, No. 13, Dacca. 1-148.
4. Das M and Dewan S, 1989. The length-weight relationship and condition of some small fishes in a fish pond. Bangladesh Journal of Agricultural Science, 16(2): 261-264.
5. Doha S, 1970. Length-weight relationship and condition factor in male and female shrimp, *Palaemon malcolmsonii* (Palaemonidae, Decapoda, Crustacea). Pakistan Journal of. Zoology, 2(2): 185-193.
6. Ecoutin J M, J J Albaret and S Trape, 2005. Length-weight relationships for fish populations of a relatively undistributed tropical estuary the Gambia. Fisheries Resources, 72: 347–351.
7. Emre Y, Balik I, Sumer C, Oskay D A, and H O Yesilcimen, 2008. Age, growth, length-weight relationship and reproduction of the striped seabream (*Lithognathus mormyrus* L., 1758) in the Beymelek lagoon (Antalya, Turkey). Turkish Journal of Zoolology, 34: 93-100.
8. Everhart W H, Eiper A W and Youngs W D, 1975. Principles of Fishery Science. Cornell University Press, New York, pp 228.
9. Hamilton F, (Buchanan), 1822. An account of the fishes found in the river Ganges and its branches. Edinburgh & London. Fishes Ganges. pp.1 - 405.
10. Harrison T D, 2001. Length–weight relationships of fishes from South African estuaries. Journal of Applied Ichthyology, 17: 46-48.
11. Martin-Smith K M, 1996. Length-weight relationships of fishes in a diverse tropical freshwater community, Sabah, Malaysia. Journal of Fisheries Biology, 49: 731-734

12. Rahman A K A, 2005. Freshwater Fishes of Bangladesh. 2nd ed. Zoological Society of Bangladesh. Department of Zoology. University of Dhaka. Bangladesh. 394 pp.
13. Subba B R, Bhagat R K and Adhikaree S, 2009. Studies on length-weight and length-length relationship of a freshwater fish *Gudusia godanahiae* from Biratnagar, Nepal. Our N. 7: 218-221.
14. Talwar P K, Jhingran A G, 1991. Inland fishes of India and adjacent countries. vol 1, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi-Calcutta. pp: 152- 541.
15. Wootton R J, 1990. Ecology of telecast fishes. Chapman and Hall, London. 405 pp.

347

Res. Agric. Livest. Fish.   Vol. 8, No. 3, December 2021: 339-347.