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-Short Communication

MORPHOMETRIC CHARACTERS OF FRESHWATER FISH *XENENTODON CANCILA* COLLECTED FROM RAJSHAHI CITY, BANGLADESH

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Biological research of fish species is essential for the assessment of probability of culture in water bodies. The morphometric analysis of fish is an important key in the study of biology of fish. In many fishes, changes in the relative growth of the various body parts are known to occur at different stages of development and particularly at sexual maturity (Bhuiyan and Islam 1990). Growth of the body parts is proportional to the growth of the total length. So, morphometric measurement of fishes and the study of statistical relationship among them are essential for taxonomic study of a species (Tandon *et al.*1993).

Length measurements can be obtained quicker and under a large range of circumstances than weight measurements, therefore a limited number of weight observations are often used to construct a length-weight relationship (Gerritsen and MacGrath 2007). This relationship can be used to convert length distribution into weights for biomass estimates. Further, length-weight relationships of fish are often used to estimate the biomass of length distribution or to obtain indices of condition (Gerritsen and MacGrath 2007). Length-weight relationships are needed to estimate weight from length because direct weight measurements can be time consuming in the field (Martin-Smith 1996, Koutrakis and Tsikliras 2003, Sinoveic *et al.* 2004). These parameters are important in fish biology and can give information on stock condition (Bagenal and Tesch 1978, Gonzalez *et al.* 2004). Knowledge of the length-weight relationship of a fish is essential for stock assessment modeling and when evaluating the relative condition of fish among populations (Lai and Helser 2004). Further length-weight relationships are useful in fishery management for both applied and basic use (Pitcher and Hart 1982, Moutopoulos and Stergiou 2002).

Condition factor is a quantitative parameter of the state of well being of the fish that will determine present and future population success by its influence on growth, reproduction and survival. The condition of a fish reflects recent physical and biological circumstances and fluctuates by interaction among feeding conditions, parasitic infection and physiological factors (Le-Cren 1951). It is a numerical index by which weight and length in particular samples are usually compared under standard conditions (Ricker 1975), and to detect seasonal variations in the condition of fish which may vary with food abundance and average reproductive stage of the stock (King 1995).

X. cancila is a wild fish and available in beels, ponds, rivers and flooded field of the country throughout the year. From the view of local consumption, this fish is rather economically important one. But there is little information about different aspects of the fish (Bhuiyan 1964, Rahman 2005). Remembering these overall importance of size frequency distribution, meristic analysis, length-length relationship, length-weight relationship, condition factor, relative condition factor along with other biological studies for successful farming and economic exploitation of any economically important species or delicious food fishes, the present work has been planned and analyzed critically to every possible aspects of size frequency distribution, length-length relationship, length-weight relationship, condition factor, relative condition factor of *X. cancila.*

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A total of 568 specimens of *X. cancila* were collected from September, 2010 to August, 2011, from Shaheb Bazar, Laxmipur Bazar, Shalbagan Bazar, Rajshahi, Bangladesh and some fish culture ponds of Rajshahi City. After collection the specimens were washed and preserved in 10% formalin in individual plastic jars. The specimens were divided into 12 size groups of 10 mm class intervals for morphometric studies. Measurements and weight of the collected fishes were taken with the help of a measuring board fitted with a meter scale and a sensitive pan balance respectively in the laboratory the Department of Fisheries, University of Rajshahi, Bangladesh.

The length-length relationships with total length among different body lengths were determined by the method of least squares to fit a simple linear regression based on one year data using the formula- Y = a + bX (Le-Cren 1951).

Where, Y = various body lengths, X = total length, a = Proportionality constant and b = Regression coefficient.

For studying the length-weight relationship the following well known formula was used -
$W = aL^n$ or (Log w= log c + n Log L) (Le-Cren1951).

Where, W = Weight, L = Length, a = constant equivalent to c, n = another constant to be calculated empirically.

The values of constant 'a' and 'n' are determined empirically from data, as the coefficient of condition. These values may change with age, sex, seasons and system of measurement. In fisheries practice, knowledge of length - weight relationship is very useful.

Different organs of body or even different organs have different rates of growth. Theoretically, it is expressed by the formula (cube law) as: $W = KL^3$ (Le-Cren 1951).

Where, W = weight of fish, L = Length of fish, K = constant [for the fish showing symmetrical or isometric growth throughout].

For finding out the condition factor the formula for observed value (K_o) and calculated value (K_c) is, K_o or K_c = $\frac{TW \times 10^5}{TL^3}$

Where, TW = total weight (grams), TL = total length (mm) and k = factor for proportion, using the formula the condition factor (for observed value and for calculated values) of the males, females and combined sexes were determined.

Relative condition factor was determined by using the formula $K_n = \frac{TW}{aL^n}$ or, $K_n = \frac{TW}{\overline{TW}}$

Where, TW = Observed total weight and $\overline{TW}$ = Calculated total weight.
During the study all sorts of calculations were done by using computer software SPSS Version 11.5.

A total of 568 species were sexed (295 males and 273 females) and grouped into 12 size groups. The size frequency distribution of *X. cancila* in the present study revealed that 121-130, 131-140 and 141-150 mm size groups of the males were dominant. In case of females 121-130, 131-140, 141-150 and 151-160 mm size groups mostly dominated (Table 1).

Table 1. Total size frequency distribution in males and females of *X. cancila*

Size group	No. of male fish (%)	No. of female fish (%)	Total no. of fish (N=568)
101-110	15 (65.22)	8 (34.78)	23
111-120	26 (59.09)	18 (40.91)	44
121-130	60 (62.50)	36 (37.50)	96
131-140	68 (66.67)	34 (33.33)	102
141-150	65 (59.09)	45 (40.91)	110
151-160	28 (38.89)	44 (61.11)	72
161-170	17 (36.96)	29 (63.04)	46
171-180	7 (26.92)	19 (73.08)	26
181-190	5 (19.23)	21 (80.77)	26
191-200	2 (13.33)	13 (86.67)	15
201-210	2 (40.00)	3 (60.00)	5
211-220	0 (0.00)	3 (100)	3

Size frequency method is based on the assumption that size of individual of the same group in a population of fish approximate has normal distribution (Hoque and Hossain 1992, Afroze *et al*.1992, Alam *et al*.1994).

The relationship among total length (TL), standard length (SL), dorsal length (DL), pectoral length (PL), anal length (AL) and pelvic length (PvL) are shown in Table 2, for males, females and combined sexes, along with the values of correlation co-efficient. In all the three cases the values of co-efficient of correlation have been found highly significant.

Table 2. Relation between total length and other body lengths of males, females and combined sexes. The values of intercepts (a), regression co-efficient (b) and co-efficient of correlation (r) of *X. cancila* (P<0.01)

Relation between x	Relation between y	Sex	Mean±SD 'x'	Mean±SD 'y'	Value of 'a'	Value of 'b'	Value of 'r'	% with TL
		Male	159.94±35.39	144.37±30.98	4.5321	0.8743	0.999**	90.27
TL	SL	Female	160.33±35.44	144.72±31.05	4.4334	0.875	0.999**	90.26
		Combined	160.02±35.36	144.50±30.96	4.5912	0.8743	0.999**	90.30
		Male	159.94±35.39	117.66±25.40	3.08	0.7164	0.998**	73.57
TL	DL	Female	160.33±35.44	117.44±25.11	3.932	0.708	0.999**	73.25
		Combined	160.02±35.36	117.39±25.01	4.2888	0.7068	0.999**	73.36
		Male	159.94±35.39	58.64±11.04	9.1782	0.3092	0.991**	36.66
TL	PL	Female	160.33±35.44	58.95±11.14	8.7643	0.313	0.996**	36.77
		Combined	160.02±35.36	58.79±11.03	8.9684	0.3113	0.998**	36.74
		Male	159.94±35.39	117.74±26.05	0.1992	0.7349	0.998**	73.62
TL	AL	Female	160.33±35.44	117.52±25.84	0.7621	0.7282	0.999**	73.30
		Combined	160.02±35.36	117.50±25.69	1.3206	0.726	0.999**	73.43
		Male	159.94±35.39	94.20±16.53	20.252	0.4623	0.990**	58.90
TL	PvL	Female	160.33±35.44	95.16±15.82	26.644	0.4273	0.958**	59.35
		Combined	160.02±35.36	94.48±16.16	22.368	0.4506	0.986**	59.04

TL= Total Length, SL = Standard Length, DL =Dorsal Length, AL = Anal Length, PL = Pectoral Length, PvL = Pelvic Length

When the total weights (TW) of the fishes were plotted against their total length, smooth growth curve was obtained. The relation between TL and TW was competent logarithmically both for individual and combined sexes and the equation obtained as

LogTW = - 6.0789 + 3.163 TL (Males)

LogTW = - 5.844 + 3.0547 TL (Females)

LogTW = - 5.9695 + 3.1123 TL (Combined sexes)

Hile (1936) and Martin (1949) observed that the value of the regression co-efficient 'n' usually lies between 2.5 and 3.0 only and ideal fish maintains the shape n = 3. In the vast majority of instances, it was being found that the cube law is not obeyed n = 3 (Le-Cern 1951). The value of regression co-efficient in the present analysis found as little above 3 and therefore, *X. cancila* does follow the cube law. However, individual variation in total weight in both sexes (*X. cancila*) of the same size range have been observed as due to several factors like food, age, spawning condition of the females.

In the present study, it was found that the weight of smaller fishes increase rapidly but in case of bigger fish it is a slow process. Allen (1938) and Ricker (1963) said that the value of 'n' will be exactly 3.0 when the growth is isometric. The authors also said that the volume of similarly shaped bodies of the same specific gravity vary directly as the cube of the corresponding dimension (cube law). Huxlley (1932) and Frost (1945) observed that the length weight relationship may change due to metamorphosis, stomach contents or on the stage of maturity.

The condition factor or ponderal index or co-efficient of correlation expresses the condition of a fish, *i.e.* such as the degree of well being, relative robustness, plumpness or fatness in numerical terms. The condition factor was determined from observed total weight and calculated weights. In male the K_o (observed) values ranged from 0.17 to 0.25 with mean value 0.20 ± 0.02. The values of K_o in females ranged from 0.17 to 0.22 with the mean of 0.19 ± 0.01. For the specimens of males and females combinedly the mean of K_o 0.19 ±0.02 with a range of 0.17 to 0.24 (Table 3).

The value of K_c (calculated) showed a mean as 0.20 ± 0.01, 0.19 ± 0.01 and 0.20 ± 0.02 in male, female and combined sexes of *X. cancila* respectively. The range was 0.145 ± 0.250, 0.140 to 0.245 and 0.150 to 0.250 for male, female and combined sexes respectively. From the observation it is found that there remains a fluctuation in the values. Such variation was reported by several workers like Rao (1963), Doha and Dewan (1967), Bhuiyan and Biswas (1982), Mortuza and Rahman (2006), Khatun *et al*. (2008) and Begum *et al*. (2010). From these references it is apparent that these changes are due to spawning and rebuilding of reproductive system of the species.

The relative condition factor K_n was calculated and the mean value obtained as 0.98 ± 0.02, 0.97 ± 0.02, 0.97 ± 0.02 for the males, females and combined sexes of *X. cancila* respectively (Table 3). These are due to the seasonal variation in feeding and the gonadal condition of the fishes. Similar K_n values were also observed by Doha and Dewan (1967), Shafi and Quddus (1974, 1975), Rahman *et al*. (1975), Mortuza and Rahman (2006), Khatun *et al*. (2008) and Begum *et al*. (2010).

Table 3. Mean values of K_o, K_c and K_n in different size groups in males, females and combined sexes of *X. cancilla*

Size groups	K_o			K_c			K_n		
	Male	Female	Combined	Male	Female	Combined	Male	Female	Combined
101-110	0.19	0.20	0.20	0.145	0.14	0.20	0.95	0.96	0.98
111-120	0.19	0.19	0.19	0.15	0.15	0.20	0.96	0.93	0.93
121-130	0.17	0.18	0.17	0.16	0.155	0.18	0.98	0.95	0.97
131-140	0.17	0.17	0.17	0.175	0.17	0.17	0.97	0.99	0.97
141-150	0.19	0.17	0.18	0.19	0.18	0.18	0.98	0.97	0.99
151-160	0.20	0.19	0.19	0.20	0.19	0.20	0.99	0.99	0.95
161-170	0.19	0.20	0.19	0.21	0.20	0.20	0.98	1.00	0.98
171-180	0.18	0.19	0.19	0.215	0.204	0.20	0.99	0.98	0.95
181-190	0.22	0.20	0.21	0.22	0.21	0.21	0.99	0.98	0.98
191-200	0.22	0.22	0.22	0.225	0.22	0.23	0.99	0.99	0.97
201-210	0.21	0.20	0.21	0.235	0.23	0.21	1.00	0.97	0.99
211-220	0.25	0.18	0.20	0.25	0.245	0.20	0.99	0.99	0.99
Mean± SD	0.20 ±0.02	0.19 ±0.01	0.19 ±0.02	0.20 ±0.01	0.19 ±0.01	0.20 ±0.02	0.98 ±0.02	0.97 ±0.02	0.97 ±0.02

The present study deals with some biological aspects of *X. cancila.* Length-weight relationships were found highly significant. The values of condition factor K_o, K_c and K_n showed fluctuation among males, females and combined sexes. Results of the research work will play important role in the management and conservation of *X. cancila.*

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