Length-weight relationship, condition factor and sex-ratio of the spiny eel, *Mastacembelus pancalus* (Hamilton)

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Mastacembelus pancalus (Hamilton) is a freshwater spiny eel of Bangladesh, commonly known as Guchi Baim (Rahman, 2005). This fish is available in rivers, ponds and beels, but their population is more in the floodplain areas. This species is also distributed in India and Pakistan (Talwar and Jhingran, 1991). The fish is commercially important and palatable as a table fish. It is the most beautiful species among the spiny eels. The smaller size of this species has an ornamental value as an indigenous aquarium fish. Published report on the length-weight relationship is important for the studies on biology, population and management of fish species and their fisheries (LeCren, 1951; Islam and Hossain, 1991; Mortuza and Rahman, 2006.). Among the freshwater fishes the length-weight relationship was reported especially on *Tilapia mossambica* (Doha and Dewan, 1967), *Puntius stigma* (Islam and Hossain, 1991), *Lepidocephalus guntea* (Hossain *et al.*, 1991), *Mystus vittatus* (Hoque and Hossain, 1991-1992), *Amblypharyngodon mola* (Afroze *et al.*, 1991-1992), *Ailia coila* (Alam *et al.*, 1994), *Chanda nama* and *Chanda ranga* (Iqbal *et al.*, 1995-1996), *Rhinomugil corsula* (Mortuza and Rahman, 2006). Therefore, this study provides baseline information on *M. pancalus*, which may serve as a tool for management and conservation practices. The present investigation is concerned with the study of length-weight relationship, condition factor, relative condition factor and sex-ratio of *M. pancalus*.

A total of 1410 specimens were collected during the period from January 2010 to December 2010 on weekly sampling basis from the different fish landing centres of Rajshahi, Bangladesh (Rajshahi, Naohata and Puthia). Just after collection, the specimens were washed and preserved in 10% formalin in separate jars on monthly basis for the study of morphometric characters. The total length (TL) and the total weight (TW) of the preserved specimens were measured with the help of a meter scale (in mm) and a pan balance (in g) respectively.

Length-weight relationships

For studying the length-weight relationship the following well known curvilinear formula was used

$W = aL^n$ or   (Log TW = log c +n Log TL) (Le-Cren, 1951)
where,
W = Weight
   L = Length
   a = Constant equivalent to C
and   n = regression coefficient.

Condition factor

The condition factor can be determined by two ways either from the observed values or from the calculated values of total weight. The general formula of condition factor (K_O for observed value and K_c for calculated value) is,

$$TW = KTL^3$$
which can be written as,
$$K_o \text{ or } K_c = \frac{TW}{TL^3}$$

where, TW is the total weight in g. TL is the total length in mm and k for constant (for the fish showing symmetrical or isometric growth throughout), the formula can also be written as,

$$K = \frac{TW \times 10^5}{TL^3}.$$

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

Relative condition factor was determined by using the formula

$$K_n = \frac{TW}{\overline{TW}}$$

Where,   TW = Observed total weight ,
$\overline{TW}$ = Calculated total weight

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Sex-ratio

The sex-ratio were tested whether the observed deviations from the ratio of 1:1 of the sexes on the null hypothesis are significant by the chi-square tests or not.

A total of 1410 specimens of *M. pancalus* (681 males and 729 females) were sexed and grouped into 11 size groups of 10mm class intervals. The males were found to be ranged from 77 to 172 mm (mean 124.95±28.79 mm) in total length. The total weights were found to be ranged from 1.97 to 24.38 g (mean 10.43±7.19 g). In females, the range of total length was 78 to 177 mm (mean 128.17±30.18 mm) and weight was 2.2 to 29.3 g (mean 11.88±8.24 g).

The length-weight relationships of *M. pancalus* were determined as follows:

LogTW = -5.950+3.284 log TL (male)
LogTW = -5.932+3.283 log TL (female)
LogTW = -5.441+3.043 log TL (combined sex)

Hile (1936) and Martin (1949) observed that the value of regression coefficient "n" usually lies between 2.5 to 4.0 and ideal fish maintains the shape n = 3. The values of regression coefficient for male (3.284), female (3.283) and combined sex (3.043) found in the present analysis are very much closed to 3.0 and therefore growth of *M. pancalus* does follow the cube law.

The condition factor or Ponderal index, or co-efficient of correlation expresses the condition of a fish, 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 total weight of the fish. For the observed weights the condition factor (K_o) ranged from 0.388 to 0.520 with mean 0.441±0.037 (male). In female 0.394-0.539 with a mean of 0.463±0.038 and in combined sexes it ranged from 0.391 to 0.526 with a mean of 0.446±0.035. The mean calculated condition factor (K_c) was 0.441±0.029 with a range of 0.386 to 0.485 for male. For female, the mean calculated condition factor was 0.462±0.032 with a range from 0.405 to 0.510. In case of combined sex, the mean K_c 0.445±0.004 with ranged 0.437 to 0.453. The above observation reveal that there are marked fluctuation in the "K_o" and "K_c" values between the sexes as well as in different size groups (Table 1). Such variation in the K_o and K_c values were also recorded by various workers, like Doha and Dewan (1967), Hossain *et al*. (1991), Hoque and Hossain (1991-1992), Afroze *et al*. (1991-1992), Mortuza and Rahman (2006), Khatun *et al*. (2008) etc.

The relative condition factor (K_n) was calculated for both sexes individually and combined sexes. The K_n values ranged from 0.920 to 1.116 (mean 1.002±0.054) in male, 0.937 to 1.102 (mean 1.001±0.038) in female and 0.889 to 1.161 (mean 1.000±0.006) in combined sexes. The values of K_n showed fluctuation between the sexes and different size groups (Table 1). The fluctuation of K_n values may be due to several reasons such as feeding intensity, gonadal condition of the female fishes. Similar fluctuations in K_n values were also observed by Shafi and Quddus (1974), Mortuza and Rahman (2006), Khatun *et al*. (2008) etc.

Table 1. Month-wise distribution of male and female *M. pancalus*

Month	Male	Female	Total	Sex-ratio (Male:Female)	Chi-square (χ^2)value
Jan	69	51	120	1:0.739	2.700[NS]
Feb	63	57	120	1:0.905	0.300[NS]
Mar	61	59	120	1:0.967	0.033[NS]
Apr	56	64	120	1:1.143	0.533[NS]
May	45	65	110	1:1.444	3.636[*]
Jun	40	80	120	1:2.000	13.333[***]
Jul	31	79	110	1:2.548	20.945[***]
Aug	39	71	110	1:1.820	11.309[***]
Sep	65	55	120	1:0.846	0.833[NS]
Oct	70	50	120	1:0.714	3.333[*]
Nov	68	52	120	1:0.765	2.133[NS]
Dec	74	46	120	1:0.622	6.533[*]
Total	**681**	**729**	**1410**	**1:1.070**	**1.634[NS]**

NS, Not significant; ***, P<0.001; **, P<0.01; *, P<0.05

Table 2. Values of K_o, K_c and K_n in different size groups in males, females and combined sexes of *M. pancalus*

Size groups	K_o			K_c			K_n		
	Male	Female	Combined	Male	Female	Combined	Male	Female	Combined
75-80	0.431	0.419	0.411	**0.386**	**0.405**	**0.437**	**1.116**	1.035	0.942
80-85	0.422	0.411	0.421	0.393	0.411	0.437	1.074	0.992	0.963
85-90	0.414	**0.394**	**0.391**	0.400	0.420	0.439	1.036	**0.937**	**0.889**
90-95	**0.388**	0.439	0.414	0.408	0.425	0.440	0.951	1.030	0.940
95-100	0.399	0.418	0.410	0.412	0.430	0.441	0.968	0.972	0.929
100-105	0.397	0.450	0.425	0.419	0.437	0.442	0.948	1.031	0.962
105-110	0.391	0.433	0.411	0.424	0.442	0.443	**0.920**	0.978	0.928
110-115	0.414	0.430	0.422	0.431	0.448	0.444	0.960	0.959	0.952
115-120	0.425	0.446	0.435	0.436	0.454	0.444	0.979	0.982	0.979
120-125	0.433	0.463	0.426	0.441	0.459	0.445	0.980	1.006	0.957
125-130	0.462	0.482	0.437	0.445	0.464	0.446	1.038	1.038	0.980
130-135	0.440	0.446	0.443	0.453	0.469	0.447	0.976	0.949	0.991
135-140	0.437	0.490	0.440	0.455	0.474	0.447	0.961	1.033	0.983
140-145	0.443	0.460	0.452	0.460	0.479	0.448	0.961	0.960	1.008
145-150	0.453	0.489	0.466	0.464	0.484	0.449	0.977	1.009	1.039
150-155	0.503	**0.539**	0.498	0.469	0.489	0.449	1.071	**1.102**	1.108
155-160	0.501	0.495	0.481	0.473	0.494	0.450	1.059	1.000	1.067
160-165	**0.520**	0.509	0.491	0.478	0.499	0.451	1.088	1.020	1.090
165-170	0.467	0.483	0.468	0.481	0.502	**0.453**	0.970	0.961	1.036
170-175	0.483	0.489	**0.526**	**0.485**	**0.510**	0.452	0.995	0.996	**1.161**

The total male and female ratio of 1410 fishes studied over a period of 12 months was found as 1:1.037 (Table 2). Chi-square test indicates that the male and female distribution in natural population was highly significantly different at 0.001% level of significance in the month of June, July and August. That suggests the females were more abundant in the breeding period (Table 2).

Acknowledgement

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