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B.K. Mahapatra
ICAR-Central Institute of Fisheries Education, Salt Lake City, Kolkata-700091, India

M. Pal
ICAR-Central Institute of Fisheries Education, Salt Lake City, Kolkata-700091, India

S. Bhattacharjee
ICAR-Central Institute of Fisheries Education, Salt Lake City, Kolkata-700091, India

W. S. Lakra
ICAR-Central Institute of Fisheries Education, Versova, Mumbai- 400 061, India

Correspondence:
B.K. Mahapatra
ICAR-Central Institute of Fisheries Education, Salt Lake City, Kolkata-700091, India

Length-Weight relationship and condition factor of an indigenous ornamental fish, *Pseudambassis ranga* (Hamilton, 1822) from East Kolkata Wetland

B.K. Mahapatra, M. Pal, S. Bhattacharjee and W. S. Lakra

Abstract
The Indian Glass fish, *Pseudambassis ranga* (*P. ranga*) (Hamilton, 1822) is popular Indian aquarium fish both locally and globally. The length-weight relationship and condition factor of *P. ranga* were carried out from East Kolkata Wetland during June 2013 to May 2014. This paper spots the light on the growth coefficient (b) and condition factor. Length-weight relationship and condition factor for a sample size of 595 specimens were calculated. The 'b' value was 2.70, 2.63 and 2.67 in case of male, female and combined sex respectively. Length-weight relationship of *P. ranga* indicates negative allometric growth and found to be significantly different at 1% level. The scatter diagram showed the linear relationship between the Log length and Log weight of the fish in all cases. The fish does not follow the cube law strictly. The functional form of Length-weight relationship of the species is fitted as Log W= -4.39+ 2.67Log L for combined sex, Log W= -4.43+ 2.70Log L for male and Log W= -4.33+ 2.63Log L for female. The value of the condition factor (K) of the fish is 0.0014 which indicates the poor condition of the fish. The study on the sex ratio showed 1 male: 1.26 female.

Keywords: Aquarium fish, *Pseudambassis ranga*, Length-weight relationship, Condition factor.

1. Introduction
Length weight relationships as well as the condition factors are considered to be useful parameters for assessing the well-being of the individuals and for determining possible differences among different stocks of the same species [18]. In fisheries science, the condition factor is used in order to compare the "condition", "fatness" or wellbeing of fish. It is based on the hypothesis that heavier fish of a particular length are in a better physiological condition [4]. Several works on the length-weight relationship on different fishes were done by various workers [1, 5, 7, 8, 12, 13, 16, 17, 21, 25, 26, 29]. Among the indigenous aquarium fish species, Indian glass fish, *Pseudambassis ranga* is very popular aquarium fish in the hobby world due to its striking transparent body revealing its bones and internal organs [11, 22]. The good nutritional value also highlighted [26]. *Pseudambassis ranga* is a species of fresh water fish in the Asiatic glassfish family Ambassidae of order Perciformes. *P. ranga* is categorised as threatened species by IUCN [32]. Length- weight relationship was done on the Painted Indian glass fish, *Pseudambassis ranga* in Bangladesh [15] and no such study done in Indian condition especially in East Kolkata Wetlands (EKW). The wetlands are used to treat Kolkata's sewage, and the nutrients contained in the waste water sustain fish farms and agriculture [14]. EKW is a unique example of innovative resource reuse system through productive activities. EKW confirms its suitability for conservation of diverse elements of flora and fauna [19]. The Ranga Chanda or Lal Chanda is a common inhabitant in EKW. The present study is an attempt to supply the information on the length-weight relationship and condition factor of *P. ranga* from East Kolkata Wetlands. The present study has two main objectives; the first is to establish a mathematic relationship between the length and weight and while the second is to know the variations from expected weight for various length groups of *Pseudambassis ranga.*

2. Materials and Methods
2.1 Fish collection
A total 595 nos. specimens of *P. ranga* belonging to all available size classes, both male (263) and female (332) were collected from East Kolkata Wetlands (22°25' to 22°40' N and

88°20' to 88°35' E) during June 2013–May 2014. The collected specimens were preserved in 4% formalin. The specimen length was measured to the nearest mm by using an accurate scale and weighted to the nearest gm by using an electrical balance. The L-W data were analysed according to the method mentioned by [20].

2.2 Statistical analysis

The equation of the parabolic relationship of the form $\mathbf{W = aL^b}$ was used where W represents weight of the fish in gram; L being the total length in millimetre; 'a' the constant and 'b' an exponent to which L can be raised. The equation expressed in logarithmic form becomes: **Log W = Log a + b Log L**. The equation was calculated for male, female and combined sex sample and a linear relationship between the logarithm length and logarithm weight was found from the examination of scatter diagram. The coefficient of correlation and the regression line was calculated and drawn from the formula given by [31]. To test the regression coefficient, 't' test was done according to the method given by [30]. All data were analysed by using internationally reputed Software Statistical Package for Social Sciences (SPSS-16.0) and MS Excel. Condition Factor was calculated by using the following formula $K=100W/L^3$ as given by [4]. Where 'W' denotes weight of the fish in grams and 'L' denotes total length of the fish in mm.

3. Result and Discussion

The descriptive statistics of male, female and combined sex of length weight data were presented in Table 1. The length range of male is 21 to 44 mm and that of female is 20 to 52 mm. The weight range of male and female were 0.19 to 1.01 g and 0.09 to 1.39 g respectively. The average total length and weight of the fishes are 31.87 mm 0.44 g respectively.

Table 1: The descriptive statistics of length weight characteristics of male, female and combined sex of *P. ranga*

Sex	Total Length (TL) (mm)			Weight (W) (gm)		
	Max	Min	Average	Max	Min	Average
Male	44.00	21.00	30.61	1.01	0.19	0.39
Female	52.00	20.00	32.87	1.39	0.09	0.48
Combined sex	52.00	20.00	31.87	1.39	0.09	0.44

The L-W data was presented in the form of scatter diagram (Fig.1, 2 and 3). From the scatter diagram we see that the relationship is linear in all cases.

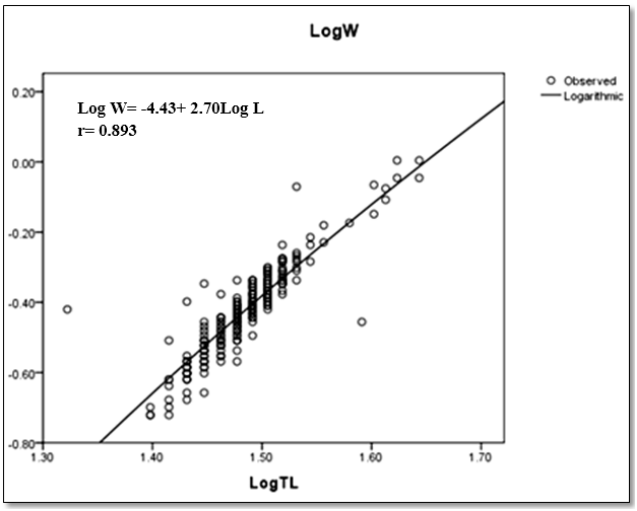

Fig 1: Scatter diagram shows L-W Relationship of *P. ranga* (logarithmic scale) for male

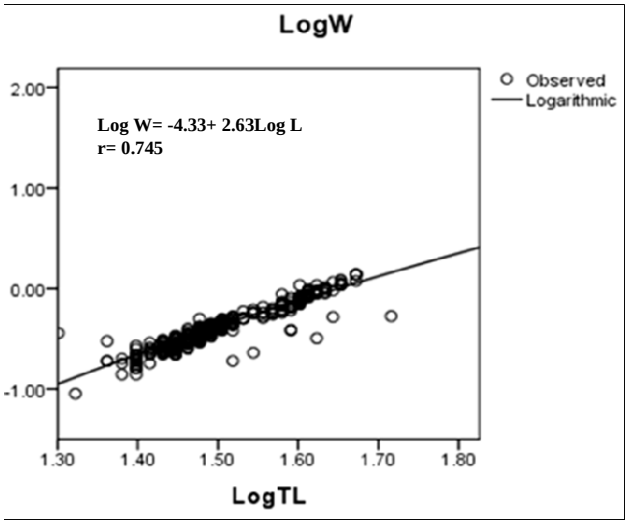

Fig 2: Scatter diagram shows L-W Relationship of *P. ranga* (logarithmic scale) for female

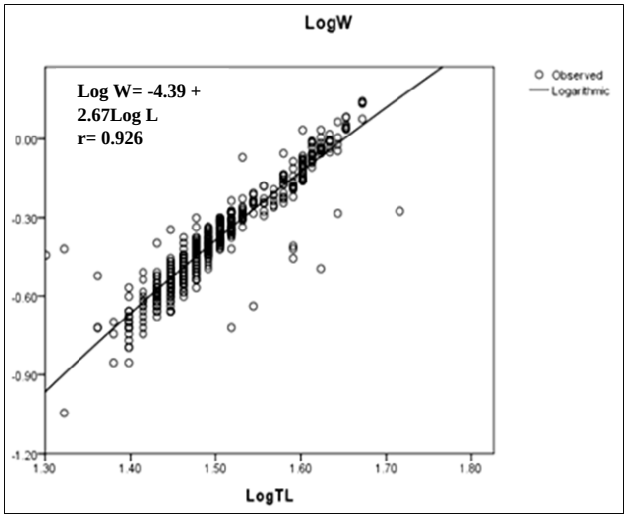

Fig 3: Scatter diagram shows L-W Relationship of *P. ranga* (logarithmic scale) for combined sex

Table 2: Calculation of coefficient of correlation along with r^2, adjusted $r^2$and Std. Error

Sex	r	r^2	Adjusted	Std. Error of the
Male	0.893[a]	0.797	0.796	0.05630
Female	0.745[a]	0.555	0.554	0.17577
Combined	0.926[a]	0.857	0.857	0.06915

Calculation of coefficient of correlation (r) along with coefficient of determination (r^2), adjusted $r^2$and Standard Error of the estimate were presented in the Table 2. The r^2 was used as an indicator of the quality of the linear regressions [28]. In the Table 2 showing a high degree of correlation between r and r^2 parameters. That justified the fact that there was a strong significant relationship between length and weight.

Analysis of variance of regression coefficient (ANOVA[b]) for testing regression coefficient of length and weight of *P. ranga* were presented in the table 3.

Table 3: ANOVA[b]

	Model								
	Regression			Residual			Total		
	Male	Female	Combined sex	Male	Female	Combined sex	Male	Female	Combined
Sum of Sq.	3.23	12.72	16.99	0.82	10.19	2.83	4.058	22.92	19.82
df	1	1	1	260	330	592	261	331	593
Mean Sq.	3.23	12.72	16.99	0.003	0.031	0.005			
F.	1.02	411.76	3.553						
Sig.	0.000[a]	0.000[a]	0.000[a]						

[a. Predictors: (Constant), LogL b. Dependent Variable: LogW]

The significant of calculated regression was tested through ANOVA which was represented in Table 4. We found that this regression co-efficient (b) was highly significant. In the present study 'b' value (b=2.70 for male, 2.63 for female and 2.67 for combined sex) was more than 2.5 which was within the limits 2.5-3.5 for most fishes as mentioned [10]. In this study 'b' was found to be highly significant as evidenced from't' test presented in that Table 4. Here the calculated value of 't' is found to be much higher from the tabulated value of 't' justifying that the regression co-efficient calculated based on L-W data of *P. ranga* is significant. The regression equation represented as:

Male **: Log W= -4.43+ 2.70Log L**
Female **: Log W= -4.33+ 2.63Log L**
Combined sex **: Log W= -4.39+ 2.67Log L**

The exponential value of all cases was tested against '3' and was found to be significantly different (t = 31.944 for male, 20.292 for female and 59.607 for combined sex) at the 1% level.

Table 4: Testing of constant and regression coefficient (a= Dependent Variable: LogW)

Sex	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
Male	(Constant)	-4.428	0.125		-35.332	0.000
	Log L	2.697	0.084	0.893	31.944	0.000
Female	(Constant)	-4.329	0.196		-22.084	0.000
	Log L	2.630	0.130	0.745	20.292	0.000
Combined sex	(Constant)	-4.393	0.067		-65.417	0.000
	Log L	2.668	0.045	0.926	59.607	0.000

The variation of condition factor reflects information on the physiological state of the fish. The mean K value was calculated as 0.0014 in both cases of male and female indicating a very poor body condition. A characteristic of length-weight relationship of fishes is that when the value of the exponent (b) is 3 then growth is said to be isometric. If 'b' value is different from 3, growth is said to be allometric. The 'b' value 3 is not confined for all fishes because growth causes for the change of their shapes [2]. In the present study lower regression coefficient (b<3) were recorded for both the sexes and combined sex and it was an indication of negative allometric growth. In the present study the regression coefficient (b) of both sexes is more all less same. The fish does not follow the cube law (b=3) strictly. The correlation coefficient (r) values suggested that the length and weight of male (0.893) are slightly better correlated than the male (0.745). Biotic and abiotic environmental factors highly influenced the condition factor and the index can be used to assess the status of the aquatic ecosystem in which fish live [3]. The variation in 'b' value is due to environmental factors, season, food availability, sex, life stage and other physiological factors [20]. An overview of literature reveals that the length –weight relationship of fish differs from one species to another. The difference in the length –weight relationship of intra- specific populations inhabiting the same water body [23]. Several biological factors like sex [25], size of fish [9], physiological condition and gonadal maturity [6, 20, 27] and fatness have significant influence over length-weight relationship of fishes. The study on the sex ratio showed 1 male: 1.26 female. The male develops a dark edge to the dorsal fin. The result of the study will be useful for future researchers and policy planners and also helpful for the fishery managers to implement adequate adaptation-centric regulation for sustainable fishery management.

4. Conclusion

The above results high lightened to the knowledge about the length-weight of *Pseudambassis ranga* from East Kolkata Wetlands. It was concluded that the negative allometric and poor growth of the fish which indicates the bad condition of the wetlands area.

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