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Length-Weight relationship and condition factor of *Botia dario* (Hamilton-Buchanan) from Sivasagar district

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Abstract
The length-weight relationship and condition factor of *Botia dario* were carried out from wetland of Sivasagar District of Assam between March'2012 and February'2014. This paper throws light on the changes in the growth coefficient (b) seasonally and condition factor. Length-weight relationship and condition factor for a sample size of 300 specimens were calculated on seasonal basis. A wide fluctuation was observed in growth coefficient. The 'b' value ranged from 3.06 in male and 3.128 in female length-wise. Seasonally, 'b' value for male is 2.02 to 3.45 and for female is 2.4 to 3.17.

Keywords: Length-weight relationship, *Botia dario*, Condition factor.

1. Introduction
Length-weight relationship is of great considerable importance in fishery research especially for study of fish population dynamics and stock condition [7, 14, 17]. According to [21], this relationship is useful to estimate the relative condition factor to assess the general well being of the fish or type of somatic growth whether isometric or allometric. These studies are mainly directed towards two objectives; first to establish a mathematical relationship between two variables; length and weight and secondly to know the variations from expected weight for various length groups [25]. Very little works were done by [9, 4, 8, 23].
Condition factor reflects the fluctuations by interaction among feeding conditions, parasitic infection and physiological factors and recent physical and biological circumstances [21]. The study of condition assumes that heavier organisms of a given length are in better physical state, therefore, condition indices are used in fishery sciences as indicators of the length-weight-relationship of a population. Condition factor also helps to reflect the feeding conditions of the species. The condition factor, in fisheries science, is used in order to compare the "condition", "fitness" or well being of fish. It is based on the hypothesis that heavier fish of a particular length are in a better physiological condition [7].
Botia dario (Hamilton) is a small sized (maximum recorded length 10cm) loach found in streams with sandy bottom as well as in wetlands. It is one of the highly priced aquarium fish of the Brahmaputra basin. It naturally breeds in monsoon season [10]. The present communication deals with the length-weight relationship and condition factor of *Botia dario* from Sivasagar, Assam.

2. Material and Methods
Samples were collected from the selected wetlands of Sivasagar district between March'2012 and February'2014. The collected specimens were preserved in 5% formalin. The specimens' length were measured to the nearest cm and weighted to the nearest gm. The length-weight relationship was based on 250 specimens collected during study period.

Length-weight relationship was estimated by using the equation $W=aL^b$ (LeCren, 1951), where W=weight, L=length. 'a' and 'b' are initial growth and growth coefficient respectively. The values of constant 'a' and 'b' were estimated from coefficient of regression equation. The correlation coefficient (r) was estimated to determine the degree of linear

relationship between the length and weight samples. Condition factor or ponderal index was calculated by using formula $K=100W/L^3$ [6] to estimate the general wellbeing of the fish.

3. Result and Discussion

The average total length of male is 6.5 cm. and that of female is 8.7 cm. The average total weight for male and female are 3.8 and 8.9 respectively. The length-weight relationship obtained for the males and females of *Botia dario* in different seasons have been shown in Table 1. A linear relationship between the length and weight as well as condition factor was established. The regression equation represented for male and female are as follows:

Males: LogW=Log 0.663 + 3.06 LogL

Females: LogW=Log -2.076 + 3.28LogL

Table 1: Seasonal variation of length-weight relationship and condition factor of *Botia dario*

Season	Sex	Length Mean ± SD	Weight Mean ± SD	b	r	LogW=log a+b logL	k
Pre-Monsoon	M	8.7 ± 1.84	8.4 ± 4.4	3.45	0.99	log -2.4 + 3.45logL	1.11
	F	8.3 ± 1.3	7.2 ± 2.8	3.17	0.96	log -2.09 + 3.17logL	1.18
Monsoon	M	6.16 ± 2.05	2.9 ± 2	3.09	0.88	log -2.03 + 3.09logL	1.05
	F	11.45 ± 1.83	19.9 ± 8.13	3.01	0.98	log -1.92 + 3.01logL	1.25
Post-Monsoon	M	5.5 ± 1.15	2.1 ± 1.6	2.5	0.87	log -1.6 + 2.5logL	1.03
	F	7.34 ± 0.85	4.3 ± 1.5	2.5	0.86	log -1.64 + 2.5logL	1.1
Winter	M	5.64 ± 0.95	2.1 ± 1.16	2.02	0.83	log -1.2 + 2.02logL	1.085
	F	7.7 ± 1.00	4.3 ± 1.5	2.4	0.9	log -1.5 + 2.4logL	0.96

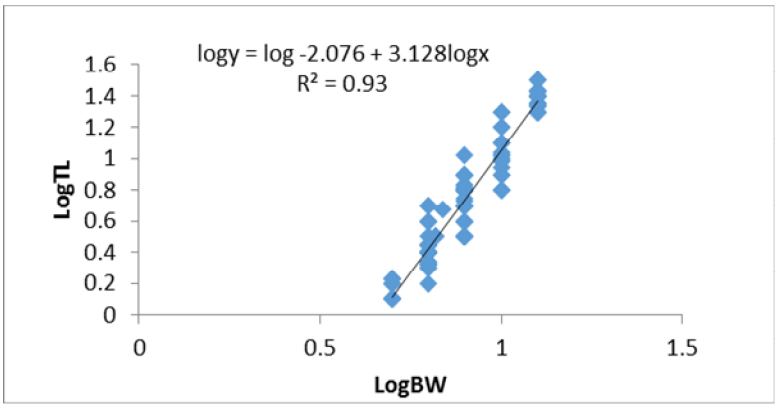

Fig 1: Length-weight relationship in *B. dario* (female)

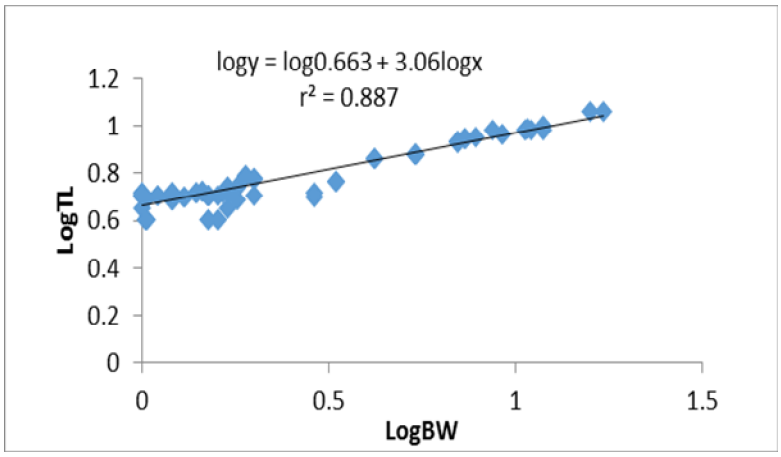

Fig 2: Length-weight relationship in *B. dario* (male)

The length-weight relationship was calculated for different seasons to see seasonal fluctuation. Four seasons viz., winter (Dec-Feb), pre monsoon (Mar-May), monsoon (Jun-Aug) and post monsoon (Sept-Nov) have been taken into consideration. In *Botia dario* the growth coefficient (coefficient for regression) for different seasons was found within the range of 2.02 (winter) to 3.45 (pre-monsoon) for male and from 2.4 (winter) to 3.17 (pre-monsoon) for female. The coefficient of correlation for different seasons was found to range from 0.83 to 0.99 for male and from 0.86 to 0.98 for female.

According to [21], the variation in 'b' value is due to

environmental factors, seasons, food availability, sex, life stage and other physiological factors. It is evident from the results that the value of regression coefficient 'b' of *Botia dario* tends to be higher during pre-monsoon and lower during winter. The 'b' value may change seasonally and even daily and also between habitats [7, 16]. A characteristic length-weight relationship for fishes is that the value of exponent (b) is 3 when growth is said to be isometric. If 'b' value is different from 3, growth is said to allometric. The variation in fish sizes indicate that the fish population ranged from immature specimens to fully matured ones. This also suggest differences in their growth [13]. The b value 3 is not confined for all fishes because growth causes for the change of their shapes [2]. In the preset study higher regression coefficient (b>3) was observed for both the sexes indicating a positive allometric growth during pre-monsoon and monsoon. However, lower value of regression coefficient (b<3) were recorded in post-monsoon and winter season was an indication of negative allometric growth. The fish did not follow the cube law (b=3) strictly. The regression coefficient (b) of female was higher than that of the males. Higher regression value in female was also obtained by [5] in *Labeo bata* from Bangladesh; [12] reported the same in *Lepidocephalichthys guntea* from Morang District, Assam; [22] in case of *Puntius sophore* from flood plain wetland in West Bengal; [18] in *Rasbora daniconius* from Karnataka; [24] in *Puntius filamentous* from Chalakudy River, Kerala; [8] in *Amblypharyngodon mola* in Garjan beel of Assam; [15] in *Amblypharyngodon mola* from Assam;.

The correlation coefficient (r) values suggested that the length and weight of female (0.93) are slightly better correlated than the male (0.89). As a whole, the maximum and minimum value of 'r' in female of *B. dario* was recorded in monsoon and post-monsoon, while in male the maximum and minimum values were recorded in pre-monsoon and winter respectively. In fish, the weight is considered to be a function of length [27]. Further, [28] viewed that exact length-weight relationship differs among fish species according to their inherited body shape and within a species according to the condition of individuals, availability of food and prior to sampling growth within the weeks.

The condition factor of *B. dario* was found to range from 1.03 to 1.11 in males and 0.96 to 1.25 in females seasonally. The highest condition value was observed during monsoon for female and pre-monsoon for males. It has been observed that females were found to be slightly in better condition than the male. Similar observation have also been reported by many workers [1, 19, 11, 23]. 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]. Through the variation of condition factor, it reflects information on physiological state of the fish on its welfare [20]. K also gives information when comparing two populations living in certain feeding, density, climate and other conditions; when determining the period of gonad maturation; and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source [26].

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