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## Research Article

# LENGTH-WEIGHT RELATIONSHIP AND RELATIVE CONDITION FACTOR OF *PACHYPTERUS ATHERINOIDES* (BLOCH, 1794) OF LACHIA RIVER OF DHEMAJI DISTRICT OF ASSAM, INDIA

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### ABSTRACT

*Pachypterus atherinoides* (Bloch, 1794) an indigenous cat fish locally known as *Bordoia* in upper Assam (India) belongs to the order Siluriformes and family Schilbidae, Bleeker 1858.

The Length-weight relationship and relative condition factor of *Pachypterus atherinoides* was studied for male, female and combined (male & female) of Lachia river of Dhemaji District of Assam, India. The growth coefficient value 'b' in male, female and combined was found to be 1.90, 3.04 and 2.91 respectively. The value of Correlation coefficient 'r' between total length (TL) and body weight (BW) in male, female and combined has shown highly positive significant correlation ship. The value of relative condition factor (Kn) in male, female and combined varied from 0.81 – 1.21, 0.81–1.21 and 0.80–1.27 respectively. The finding of this study will help farmers for commercial cultivation and artificial breeding of this species in near future.

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## INTRODUCTION

Growth is the inherit characters and an integral part of every living organism with reference to time in nature. Length-weight relationship (LWR) of any fish species is a basic tools for studying like well being of fish in relation to habitat, its status of stock variation, assessment of growth rate, appearance of first maturity and time of spawning (Le-Cren, 1951). Length-weight of any fish has a direct or indirect proportional relationship with the habitat. Many factors has influence in the growth of a fish such as geographical location, geographical niche, physio-chemical parameters of water and soil, limited or same food source, age, size and sexual maturity of the fish. In ideal environmental condition of any natural habitat, the growth pattern in fishes follow the cube-law ( $W=L^3$ ) where fish grows isometrically. However, in actual practice in natural environment in any water bodies, due to various environmental factors, the length and weight may deviate from the cube-law. Therefore, to overcome the cube law, Le-Cren, 1951 used a more satisfactory formula as  $W=aL^b$  for estimating the length-weight relationship throughout the life history stages of fishes. According to Morey *et al.* (2003) three different values of 'b' (growth coefficient) are used to express the growth dynamics of the fish (if  $b=3$ , an isometric growth;  $b>3$ , the positive

allometric growth and  $b<3$ , the negative allometric growth). Relative condition factor (Kn) also express information like well being of fish in various natural aqua-habitat.

The species *Pachypterus atherinoides* (Bloch, 1794) belongs to the order Siluriformes and family Schilbidae, Bleeker 1858 is one of the most delicious and having good market demand in Assam (India). People preferred this fish as it is scale less and not easily damaged. *Pachypterus atherinoides* is locally known as *Bordoia* in upper Assam (India) and it is also famous for its taste in Assamese dishes. Exploitation of this fish is increasing day by day due to high price in the market (used for both sundry and smoke dry for preservation for long duration). The colour of the fish is silvery grey, dark brown longitudinal stripe along lateral line, fins light brown and caudal base with black markings. The species has a wide distribution across India (except West Coast and Eastern Himalaya), Bangladesh, Nepal and Pakistan (Pathak, 2015). Published information on the length-weight relationship and relative condition factor of *Pachypterus atherinoides* is very limited or no previous literature is available in India especially in Assam. This may be the first report on growth dynamics of *Pachypterus atherinoides* in Indian sub-continent particularly in Assam. Therefore, present study is aimed to study growth dynamics

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through length-weight relationship and relative condition factor of *Pachypterus atherinoides* of adult's males, females and both combined in Lachia river in Dhemaji District of Assam (India).

## MATERIALS AND METHODS

A total number of 100 adults samples having size ranges 5.9 – 7.5 cm in length and 1.13 – 2.58 g in weight were collected during November, 2016 to May, 2017 from landing station of Lachia river (latitudes 27°5'27" N and longitudes 94°12'18" E), a small tributary of Brahmaputra River basin situated at Dhemaji District of Assam (India) for studying Length-weight relation (LWR) and relative condition factor (Kn). The samples were washed with clean water and moisture of the fishes was absorbed with the help of tissue paper before weight was taken. Total length of the fresh fish samples were measured from tip of the snout to tip of the caudal fin nearest to 0.01 mm by digital vernier caliper and body weight were measured nearest to 0.01 g by digital balance (Systronic Make) individually. After weighing, the fish samples were preserved in 5% formaldehyde for further study. To identify male and female, fishes were dissected and identified the sex based on gonadal structures following Mackie and Lewis, 2001.

Since the cube law does not satisfy the result throughout the life history stages of fishes, a satisfactory formula was used to express the relationship by following Le Cren, 1951 as

$$W = a L^b$$

Where, W = total weight of fish,  
a = initial growth constant,  
b = exponent (Growth coefficient)  
L = total length of fish,

Le Cren (1951) expressed this formula in logarithmic form as  
 $\text{Log } W = \text{Log } a + b \text{ Log } L$

Where, 'a' is constant being initial growth and 'b' is the growth coefficient. The values of 'a' and 'b' were calculated by the method of least square technique.

$$\text{Log } a = \frac{\sum \text{Log } W \cdot \sum (\text{Log } L)^2 - \sum \text{Log } L \cdot \sum (\text{Log } L \cdot \text{Log } W)}{N \cdot \sum (\text{Log } L)^2 - (\sum \text{Log } L)^2}$$

$$\text{Log } b = \frac{\sum \text{Log } W - N \cdot \text{Log } a}{\sum \text{Log } L}$$

The relative condition factor 'Kn' had been calculated in both the sexes by using Le Cren, 1951 formula as stated below:

$$Kn = W/w$$

Where, W = Total observed body weight  
w = Calculated weight of fish (Expected weight)

The Correlation coefficient between body weight and total length was done with the help of SPSS software (version-16) and standard deviation, mean, min, max and graph was done with the help of Microsoft Office Excel (version-7).

## RESULTS

In the present study, the size and body weight of the adult males, adult females and combined (male and female) have ranged between 6.1 to 7 cm (6.46±0.2 cm); 5.9 to 7.5 cm

(6.8±0.33 cm) and 5.9 to 7.5 cm (6.67±0.34 cm) in length while 1.24 to 2.08 g (1.67±0.18 g); 1.13 to 2.58 g (2.07±0.31 g) and 1.13 to 2.58 g (1.87±0.32 g) in weight respectively (Table-1). The value of growth coefficient 'b' of the adult males, adult females and combined were 1.90, 3.04 and 2.91 respectively and the Correlation coefficient 'r' of the adult males, adult females and combined were 0.48, 0.85 and 0.83 respectively (Table-2). And the value of relative condition factor of the adult males, adult females and combined have ranged between 0.81 – 1.21 (1.00±0.09), 0.81 – 1.21 (1.00±0.08) and 0.80 – 1.27 (1.01±0.09) respectively (Table-2). The regression graph of LWR and relative condition factor (Kn) are depicted in the Figure-1 and Figure-2.

The result of length-weight relationship (logarithmic) for the sex groups and combined of *Pachypterus atherinoides* studied under the present study in Lachia river of Dhemaji District of Assam (India) are recorded as follows:

Male Adults	– Log W	=	–1.32 + 1.90 Log L
Female Adults	– Log W	=	– 2.24 + 3.04 Log L
Combined	– Log W	=	– 2.13 + 2.91 Log L

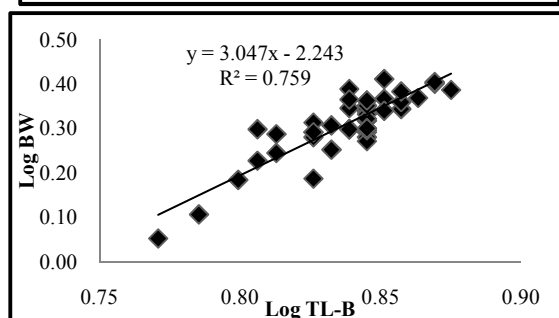
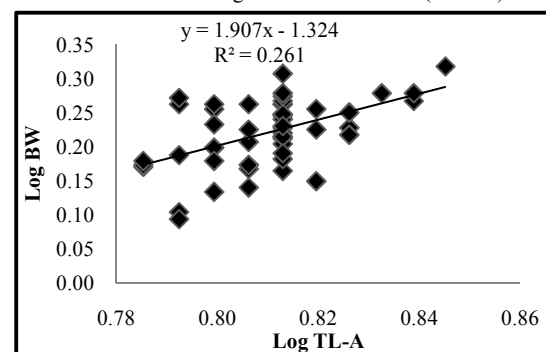
**Table 1** Mean± standard deviation (SD) of Body weight (BW) and Total length (TL), value 'a' and 'b'

Sex	Weight range (g)	Size range(cm)	Mean±SD BW (g)	Mean±SD TL (cm)	Value of 'a'	Value of 'b'
Male N=50	1.24–2.08	6.1–7	1.67±0.18	6.46±0.2	–1.32	1.90
Female N=50	1.13–2.58	5.9–7.5	2.07±0.31	6.8±0.33	–2.24	3.04
Combined N=100	1.13–2.58	5.9–7.5	1.87±0.32	6.67±0.34	–2.13	2.91

**Table 2** Value of Correlation coefficient 'r', value of Kn range and mean±SD of Kn.

Sex	Value of 'r'	Kn range	Mean±SD of Kn
Male	0.48**	0.81–1.21	1.00±0.09
Female	0.85**	0.81–1.21	1.00±0.08
Combined	0.83**	0.80–1.27	1.01±0.9

\*\*Correlation coefficient is significant at 0.01 level (2-tailed)



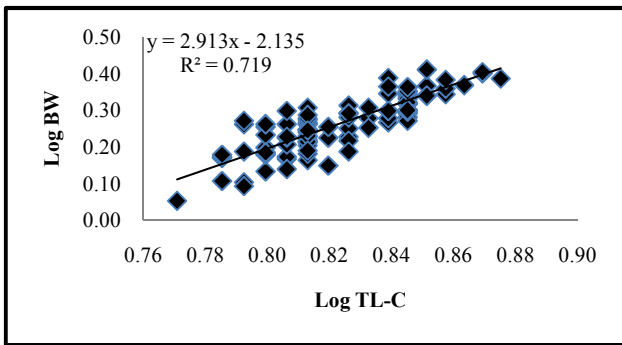


Figure 1 Relationship between Log TL (cm) and Log BW (g) of *Pachypterus atherinoides* (A-Male, B-Female and C- Combined).

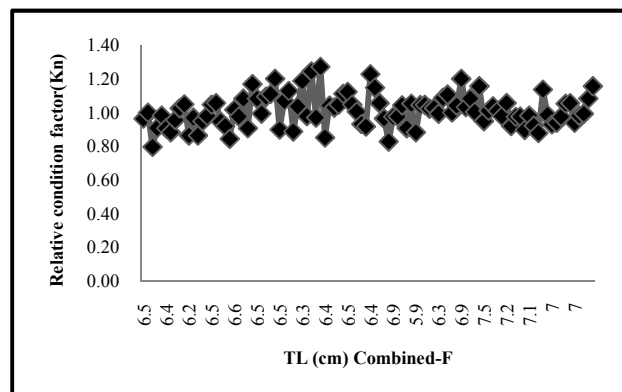
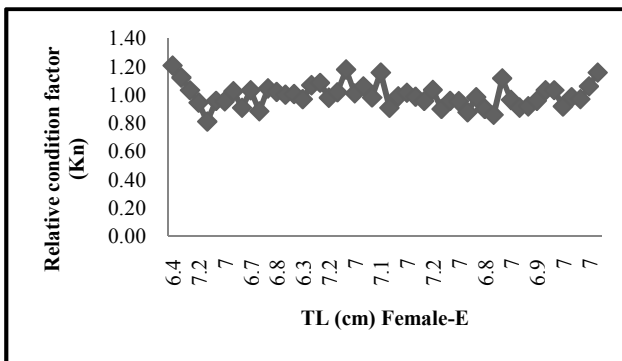
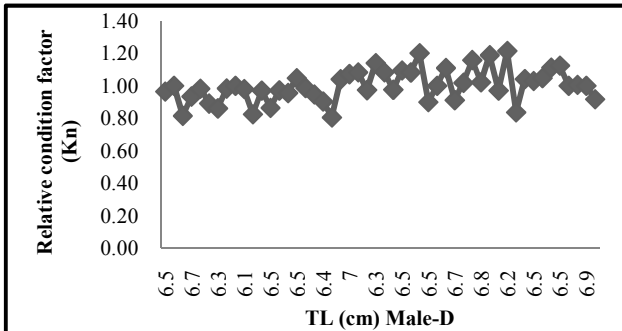


Figure 2 Relative condition factor (Kn) in relation to different length of *Pachypterus atherinoides* (D- Male, E- Female and F- Combined).

## DISCUSSION

The present investigation reveals that the value of ‘b’ (growth coefficient) of the adult females is the highest (3.01) to show positive allometric growth, which is followed by combined (2.91) with almost isometric growth and adult males (b=1.9) showing negative allometric growth. However, Correlation coefficient ‘r’ in female adults is the highest (0.85, p<0.01) followed by combined (0.83, p<0.01) and adult males (0.48,

p<0.01) shows highly significant value in all cases as shown in the Table-2. The value of ‘b’ indicates from the present finding that in case adult females, the weight of the female increase simultaneously with the increase of length, while in case of adult males, the weight of the male decrease with the increase of length or vice versa in that natural environment (Lachia river). However, the value of ‘b’ for combined (male & female) shows more or less isometric growth pattern (2.91) in that environment. As the fish samples were collected during the pre breeding and breeding season (November, 2016 – May, 2017) from the present study, it reveals that females increase in weight with increase in length due to development of gonad preparing for breeding which was also supported in the earlier finding in different fishes (Dhakal and Subba, 2003; Buragohain and Deka, 2017). Indeed the value of ‘b’ for males is less which may be due to loss of energy for development of gonads rather than development of somatic body (Buragohain and Goswami, 2013; Das *et al.*, 2015; Buragohain and Deka, 2017). The degree of variation of ‘b’ value takes place with sex (Hile and Jobes, 1940), state of maturity (Frost, 1945), feeding (Le-Cren, 1951), different population of a species (Jhingran, 1968), depending on sex, stage of maturity and food habits (Qasim, 1973 and Bal & Rao, 1984) and developmental stages of the gonad, especially the ovary affect the weight (Hile, 1936 and Weatherly, 1972). The value of relative condition factor (Kn) also determine the well-being of fishes. According to Le-Cren (1951), the value of ‘Kn’ greater than 1 indicated good general condition of fishes. In the present investigation, the mean value of ‘Kn’ for all cases is within the range of 1.00 indicating the healthy well-being of the fishes. From the present study, it also reveals that *Pachypterus atherinoides* inhabits in naturally rich and better healthy natural environment (Lachia river) in Dhemaji district of Assam (India). The finding of this study will benefit fish farming community for pond cultivation, artificial breeding, and commercialization and also will provide livelihoods and employment generation in the country.

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