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Length-weight relationship and relative condition factor of *Channa gachua* (Hamilton, 1822) of Garjan Beel (wetland) of Assam, India

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Abstract
The present study reveals the length-weight relationship of *Channa gachua* (Hamilton, 1822) of Garjan Beel of Assam. The present finding indicates that the correlation coefficient 'r' exhibits strong positive correlation between total length and body weight, with coefficient correlation 'r' approaching almost towards +1, although the growth performances exhibits negative allometric correlation which may be due to lower feeding proficiencies and/or may be due to environmental and/or seasonal incompatibility for proper growth of fishes. In this investigation the value of 'b' in *Channa gachua* is 2.76 and the Kn value ranged from 0.52-1.94 with an average of 0.71 ± 0.17.

Keywords: Length-Weight relationship, relative condition factor, Channa gachua, Garjan Beel

1. Introduction
Growth is the fundamental and unique characteristic for all living beings and is a function of length and weight. During the growth, both length and weight of organisms increases simultaneously as both the parameters being positively correlated with each other. Study of length-weight relationship has good significance in fishery science since it acts as significant parameter that helps in assessing growth rate, general well-being, appearance of first maturity, onset of spawning, status of stock variation etc. of fishes.
In general, when fishes grow isometrically, the Cube law ($W=L^3$) (Brody, 1945; Lagler, 1952) is followed. However, there is every chance of departure of expected length-weight relationship from Cube's law due to various factors prevailing in the environment; that changes the whole characteristics of water, where fishes inhabit. Thus, Le Cren in 1951 modified Cube's law as $W = aL^b$ which finally gives an acutely precise result for easy calculation of length - weight relationship for the entire life history stages of fishes.
Channa gachua (Dwarf Snakehead) is an attractive hardy fish with small size and pretty coloration, often kept in aquaria. It is a thrust predator possessing supplementary breathing apparatus and thus capable of breathing atmospheric oxygen and surviving in hypoxic conditions. It is commonly distributed almost in all the Beels (wetlands) of Assam.

2. Materials and Methods
For evaluation of length-weight relationship 98 live samples of *Channa gachua* of various age groups were randomly collected from Garjan Beel (located at $91^0 30' 41'' - 91^0 35' 40''$ East longitude and $26^0 13' 5''$ to $26^0 18' 5''$ North latitude) from Febraury 2016 to April, 2016. Total length and weight of fishes were measured individually. For computing total length, fishes were measured with digital slide caliper from tip of the snout to the tip of the longest ray of caudal fin and body weight were measured nearest to 0.01 g with the help of standard digital balance individually after blot drying. The length – weight relationships were estimated by following the formula $W = aL^b$ (Le Cren, 1951) and this formula is expressed logarithmically as Log W = Log a + b Log L
Where, W is body weight of the fish; L is total length of the fish; 'a' is a constant showing the initial growth index and 'b' is growth coefficient. Parameter 'a' and 'b' were calculated by method of least square regression:

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

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

Relative condition factor (Kn) were estimated by following Le Cren (1951) formula and is expressed as follows:

$$Kn = \frac{W}{\hat{W}}$$

Where
W = Observed weight
^W = Calculated weight derived from length-weight relationship.

The mean, standard deviation and correlation coefficient of total length and body weight were calculated with the help of SPSS software (version-16) and Microsoft Office 7.

3. Results
In this investigation total length and body weight of *Channa gachua* ranged from 5.5-16.1 cm in length and 2.72- 39.84 g in weight. The value of a, b, mean ±SD of total length and body weight for *Channa gachua* are given in the Table-1. The value of 'r' and mean±SD of Kn are given in the Table-2. Interestingly, the Kn value ranged widely from 0.52 to 1.94 with an average of 0.71±0.17. The regression graph of length-weight relationship

and relative condition factor (Kn) are depicted in Figure-1 and Figure-2 respectively. The result of logarithmic length-weight relationship for *Channa gachua* under the present study is as follows during the period of investigation in Garjan Beel.
Channa gachua (Fishes under various age groups) –
Log W = -1.77+ 2.76 Log L

Table 1: Mean ± Standard deviation of Body weight (BW) and Total length (TL), value of 'a' and 'b'.

Fish Species	Total no. of fish sample	Weight Range (g)	Size Range (cm)	Mean ± SD BW (g)	Mean ± SD TL (cm)	Value of 'a'	Value of 'b'
Channa gachua	98	2.72-39.84	5.5-16.1	14.88 ± 6.65	11.36 ± 1.8	-1.77	2.76

Table 2: Value of Correlation coefficient 'r', Kn range and Mean ± Standard deviation of condition factor 'Kn'.

Fish Species	Total no. of fish sample	Value of 'r'	Kn range	Mean ± SD of Kn
Channagachua	98	0.95	0.52-1.94	0.71±0.17

**.Correlation is significant at the 0.01 level (2-tailed).

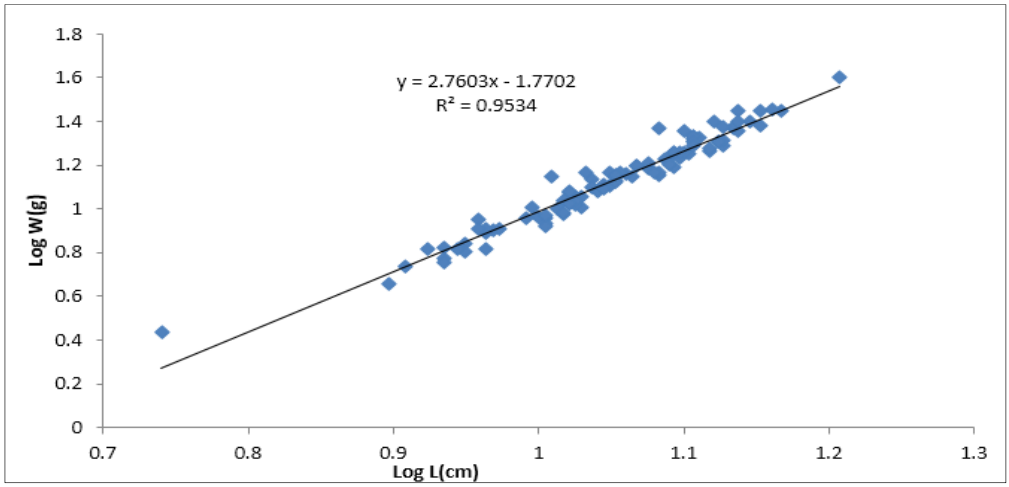

Fig 1: Relation between Log Total Length (cm) and Log Body Weight (g) of Channa gachua

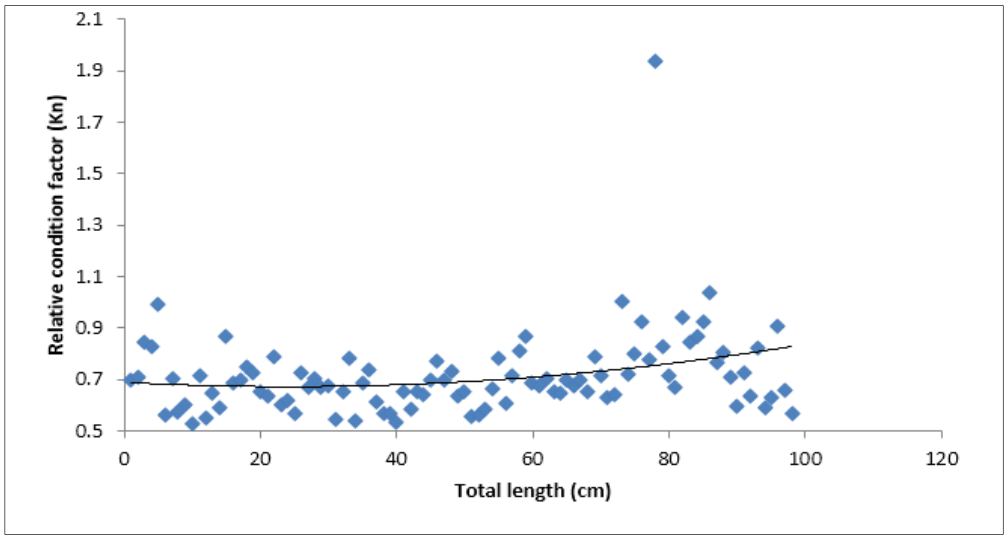

Fig 2: Relative condition factor (Kn) in relation to total length (cm) of Channa gachua

4. Discussion

The present study reveals that the growth performance in *Channa gachua* was quite high since the correlation coefficient 'r' exhibits strong positive correlation between the length-weight relationships, although the growth being negative allometric which may be due to lower feeding proficiencies and/or unsuitable environmental condition and/or inappropriateness of physico-chemical parameters and/or the season of experiment is not suitable for proper growth of fishes (Das *et al.*, 2015 [6]. Das *et al.*, 2015 [7]. Kalita *et al.* 2016). However, Soni, Kathal, 1953; Kaur 1981; Saikia *et al.* 2011; Bura Gohain, Goswami, 2013 [4]. Deka, Bura Gohain, 2015 [8]. Das *et al.*, 2015 [5]. Rahman *et al.* 2015 observed the effect of availability of food, higher proficiencies in feeding and many

other related factors responsible for positive allometric growth. Degree of variation of exponential value of length-weight relationship indicated by 'b' value in *Channa gachua* is 2.76. Thus 'b' value is found to be in normal range between 2.5 and 4.0, as suggested by Hile, 1936 [11] and Martin, 1949 and between 2.5 and 3.5 as reported by Froese, 2006 for most fishes. Variation in 'b' value may be due to feeding (Le Cren, 1951), sex (Hile, Jobes, 1940) [12] developmental stages of gonads (Weatherly,1972 and Hile 1936) specially the ovary affect the weight and state of maturity (Frost, 1945) etc. As the 'b' value is deviated from 3 in this investigation, it shows the growth is not isometric indicating the fish gets thinner as it grows larger.

Kn is an index to monitor feeding intensity and growth rate of fish (Oni *et al.*, 1983) [18] is based on hypothesis that heavier fish for a given length are in better condition (Bagenal, Tesch, 1978) [1]. Fish with high value of Kn are heavy for its length, while with low 'Kn' are lighter (Bagenal, Tesch, 1978) [1]. Kn value greater than 1 indicates better condition of fish (Le Cren, 1951). In the present study on *Channa gachua*, Kn value is ranged from 0.52-1.94 with an average 0f 0.71±0.17. Kn value for most of the fishes were less than 1 which indicates that the fishes were not in a better condition. However, the relative condition factor is observed to decrease slightly from lighter to heavier fish first to attain minimum in medium sized fish samples and increase sharply to attain maximum near to the heaviest fish (Figure-2) which does not corroborate with the result of Bhatta and Goswami, 2014 [2] who noticed reverse phenomenon in their study where peak Kn value is recorded in medium sized fishes of *Channa aurantimaculata.* However, Rahman *et al.* 2015 in female *Anabas testudineus* and Das *et al.* 2015 [7] in male *Heteropneustes fossilis* also recorded more or less similar trend where Kn decrease from lower sized fish exhibiting the lowest value at medium fish and thereafter steadily increase to get the highest value in bigger fishes.

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