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Length-weight relationship and relative condition factor of *Lepidocephalichthys Guntea* (Hamilton, 1822) of Ghati *Beel* of Dhemaji district of Assam, India

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Abstract

The Length-weight relationship and relative condition factor of *Lepidocephalichthys guntea* (Hamilton, 1822) was studied for male, female and male & female combined (combined) of Ghati *beel* of Dhemaji District of Assam, India. The growth coefficient value 'b' in female is the highest (3.76) followed by combined (3.02) and the lowest in male (2.66). The negative allometric growth interestingly observed in male may be due to loss of energy during breeding behavior of the present study. The value of Correlation coefficient 'r' in male, female and combined was estimated at 0.92, 0.93 and 0.91 respectively. The value of relative condition factor (Kn) in male, female and combined varied from 0.78–1.25, 0.75–1.21 and 0.76–1.34 respectively which show good general condition of the fish.

Keywords: Length-weight relationship, relative condition factor, *Lepidocephalichthys guntea*, Ghati *beel*

1. Introduction

Growth of an organism is nothing but a change in weight or length or together which is an integral part of their life history with reference to time. Weight of a fish is expressed as a function of length. Length-weight relationship (LWR) of any fish species is a significant biological parameter in studying its growth dynamics, production, stocking density, productivity of the habitat and maturity etc. LWR and relative condition factor (Kn) also gives various information 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) [1]. Weight of any fish may be considered as function of the length and as such the relationship exists between its body weights (BW) and total length (TL). In an ideal environment of any habitat, growth pattern follows the 'cube-law' where fish grows isometrically. However, in natural environment, due to various environmental factors and non-identical growth pattern of different species, the mathematical expression does not follow the simple cube law during different life history stages of a species. According to Morey *et al.*, 2003, three different values of 'b' (growth coefficient) are convincingly put forward to express the growth situation of the fish (If $b=3$ an isometric growth; $b>3$, the positive allometric growth and $b<3$, the negative allometric growth [2].

The species *Lepidocephalichthys guntea* (Hamilton, 1822) [3] belongs to the order Cypriniformes and family Cobitidae is one of the most delicious and fleshy food fish for common people. Many people preferred this fish as it possess minute scale in their body and not easily damaged. *Lepidocephalichthys guntea* is locally known as *Bali botia* in upper Assam (India) and it also famous for its food and Ornamental value. The colour of the fish is charcoal brown, a series of dark blotches along mid lateral, ventral white, dorsal fin and caudal light brown and small dark spots over the body. The common name in English are *Peppered loach*, *Guntea loach* and *Scavenger loach* (www.iucnred.list) [4]. The species has a wide distribution across the northern parts of South Asia, especially in Pakistan, central and northern India, Nepal and Bangladesh and also have records from Myanmar and Thailand (www.iucnred.list) [4]. It is found in flowing and clean standing waters. Published information on the length-weight relationship and relative condition factor is scanty on *Lepidocephalichthys guntea* in Assam (India).

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The Present study is aimed to study growth dynamics through length-weight relationship and relative condition factor of *Lepidocephalichthys guntea* of adult males and females and both combined in Ghati *beel* in Dhemaji District of Assam.

2. Materials and Methods

A total number of 90 adults samples having size ranges 5 – 8 cm in length and 1.08- 4.22 g in weight were collected from March, 2016 to August, 2016 from landing station of Ghati *Beel* latitudes 27°5'27" N and longitudes 94°12'18" E), a small tribute of Brahmaputra River basin situated at Dhemaji District of Assam (India) for studying Length-weight relation (LWR). Body weight of the fresh fish samples were measured nearest to 0.01 g by digital balance (Systronic Make) and total length were measured from tip of the snout to tip of the caudal fin nearest to 0.01 mm by digital vernier caliper individually. After weighing, the samples were washed with clean water and preserved in 5% formaldehyde for further study. Since the adult specimens could not distinguished by secondary sexual characters, fishes were dissected and identified the sex based on gonadal structures following Mackie and Lewis, 2001 [5]. Since the cube law does not satisfy the result in throughout the life history stages of fishes, a satisfactory formula was used to express the relationship by following Le Cren, 1951 [1] as

$$W = a L^b$$

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

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.

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

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

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.

3. Results

In the present study the size and body weight of the adult males, adult females and male and female combined have ranged between 1.08 and 2.71 cm; 1.08 and 4.22 cm and 1.08 and 4.22 cm in length while 5.2 and 7.51 g; 5.2 and 8 g and 5.2 and 8 g in weight respectively. The value of initial growth constant 'a', growth coefficient 'b', Correlation coefficient 'r', mean±SD of TL, BW and Kn for adult males, adult females and combined were given in the Table 1 and 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 of *Lepidocephalichthys guntea* studied under the present study in Ghati *beel* of Dhemaji District of Assam (India) are recorded as follows:
 Male Adults – $\text{Log } W = -1.90 + 2.66 \text{ Log } L$
 Female Adults – $\text{Log } W = -2.76 + 3.76 \text{ Log } L$
 Combined – $\text{Log } W = -2.17 + 3.02 \text{ Log } L$

Table 1: Mean± standard deviation (SD) of Body weight (BW) and Total length (TL), value of '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=60	1.08-2.71	5.2-7.51	1.66±0.42	6.22±0.53	-1.90	2.66
Female N=30	1.08-4.22	5.5-8.0	1.86±0.75	6.31±0.57	-2.76	3.76
Both Male &Female N=90	1.08-4.22	5.2-8.0	1.73±0.55	6.25±0.55	-2.17	3.02

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	0.92**	0.78 -1.25	1.00±0.09
Female	0.93**	0.75 -1.21	1.00±0.12
Combined	0.91**	0.76 -1.34	1.00±0.11

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

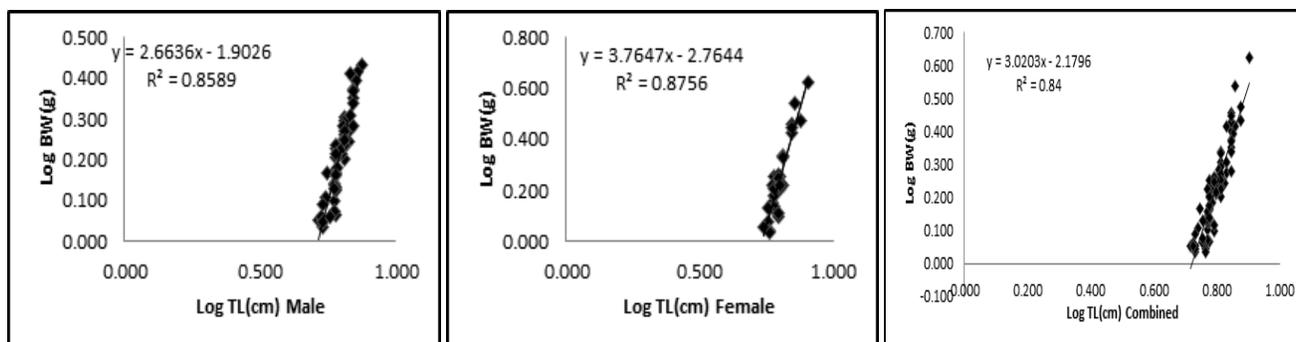


Fig 1: Relationship between Log TL (cm) and Log BW (g) of *Lepidocephalichthys guntea* (A-Male, B-Female and C- Combined)

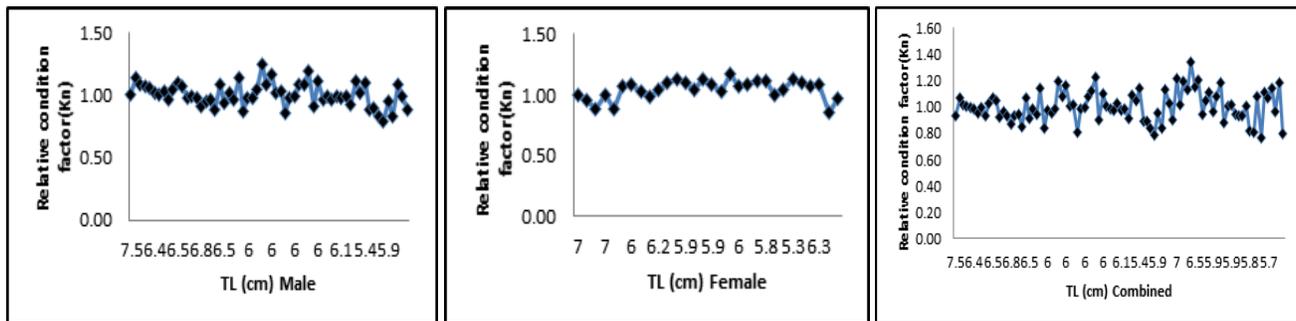


Fig 2: Relative condition factor (Kn) in relation to different length of *Lepidocephalichthys guntea* (D- Male, E- Female and F- Combined).

4. Discussion

From the present finding of Correlation coefficient between TL and BW of male ($r=0.92$, $p<0.01$), female ($r=0.93$, $p<0.01$) and combined ($r=0.91$, $p<0.01$) shows highly significant value in all cases as shown in the Table-2. The Present study reveals that the value of 'b' for female is the highest (3.76) to show positive allometric growth, which is followed by combined (3.02) with almost isometric growth pattern and males (2.66) interestingly showing negative allometric growth. The value of 'b' indicates from the present finding that weight increases more than with the increase of length in case of female and weight decreases along with the increase of length in case of male. However, the value of 'b' for combined (male & female) shows more or less isometric growth pattern (3.02) in that environment. As the samples were collected during the Pre-monsoon and Monsoon season (March – August, 2016) from the present investigation, it reveals that female increase in weight in contrast to increase in length due to enormous development of gonads which was also supported in the earlier finding (Dhakal and Subba, 2003) [6]. 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 (Bura gohain and Goswami, 2013) [7]. The negative allometric growth interestingly observed in male may be due to loss of energy during breeding behavior of the present study (Das *et al.*, 2015) [8]. The most of the Indian freshwater teleosts attain maturity and breeding during monsoon season (Encina and Lorenzo, 1997) [9]. Similar value of 'b' was also reported on *Lepidocephalichthys guntea* for female ($b=3.18$), male ($b=2.68$) and combined ($b=3.48$) by Dhakal and Subba, 2003 in India [6] and Rahman *et al.*, 1997 reported value of b on *Lepidocephalichthys guntea* for male (3.32), female (3.23) and combined (3.27) in Bangladesh [10]. Several authors also reported different value of 'b' on this species, namely Hossain *et al.*, 2009 ($b=3.25$), Hossain, 2010 ($b=3.64$) and Ferdoushy and Alam, 2015 ($b=2.84$) in Bangladesh [11, 12, 13]. The degree of variation of 'b' value takes place with sex (Hile and Jobes, 1940) [14], feeding (Le Cren, 1951) [1], developmental stages of the gonad, especially the ovary affect the weight (Weatherly, 1972 and Hile, 1936) [15, 16] different population of a species (Jhingran, 1968) [17] and state of maturity (Frost, 1945) [18]. The value of 'a' and 'b' differed within the same species depending on sex, stage of maturity and food habits (Qasim, 1973 and Bal and Rao, 1984) [19, 20]. In any natural aqua-habitat, the value of relative condition factor (Kn) also determine the well-being of fish. According to Le Cren (1951), the value of 'Kn' greater than 1 indicated good general condition of fish. In the present study, the mean value of relative condition factor (Kn) for all cases is within the optimal range of 1.0 determining the healthy well-being of

fish. From the present study it indicates that *Lepidocephalichthys guntea* inhabitat in suitable and better healthy natural environment (Ghati beel) in Dhemaji district of Assam.

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