



## Length-weight relationship, condition factor and gonado-somatic index of *Labeo calbasu* (Hamilton, 1822)

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### Abstract

An attempt was made to study dynamics of length-weight relationship (LWR), relative condition factor ( $K_n$ ) and gonado-somatic index (GSI) of *Labeo calbasu* from the wetlands of South 24 Parganas district of West Bengal, India. A total of 275 fish specimens (130 to 430 mm) were examined over nine months from December 2006 to August 2007. Specimens were categorized into two groups based on the size at first maturity of 260 mm. The LWR was recorded  $W = 0.007269 L^{3.181}$  for Group A (<260 mm) and  $W = 0.007367 L^{3.031}$  for Group B ( $\geq 260$  mm). The individuals exhibited isometric growth. The monthly mean  $K_n$  values varied from 0.924 to 1.141 with an average value of 1.059. The mean monthly values of GSI varied from 0.544 to 3.301 for male and 0.560 to 9.649 for female. There was significant variation ( $P < 0.05$ ) in the mean values of GSI in different months between sexes.

**Keywords:** *Labeo calbasu*; length-weight relationship; relative condition factor; gonado-somatic index

## 1 | INTRODUCTION

*Labeo calbasu* (Hamilton 1822) commonly called as Kalbasu or Black rohu supports an important commercial fishery in ponds, lakes, rivers, and reservoirs of India. It occurs frequently in the commercial catch in rivers of Narmada, Godavari, Yamuna and Ganga rivers. It is also an important candidate species in culture ponds due to its compatibility with other major carps (Borah *et al.* 2014). This species is distributed throughout India, Pakistan, Bangladesh, Burma and Nepal (Chondar 1999) and com-

mon in natural waters (e.g. Mohsin *et al.* 2013; Chaki *et al.* 2014; Galib *et al.* 2009–2018). Kalbasu was once dominant species in Indian waters till the 1980s but now it is considered a locally threatened species (Ramasamy and Rajangam 2016) and categorized as Vulnerable in West Bengal (Das *et al.* 2006). A range of studies have been carried out on *L. calbasu* (Alam *et al.* 2000; Haroon *et al.* 2002; Khan *et al.* 2007) but these lack representation of individuals from wetlands that has been described in this paper. The condition of a fish is influenced by seasonal changes of gonads and also by the feeding intensity

(Sarkar *et al.* 2017a and 2017b). Studies on the reproductive biology of any species are essential in evaluating the commercial potential of the stocks. Gonado-somatic index (GSI) value gives a clear idea regarding spawning season of any species which enable to set seasonal closures during the reproductive season as per need. In majority of the fishes the number of eggs does not change significantly as the season progress but the gonad weight increases due to an increase in water content or organic matter derived from food or organic matter transferred from somatic tissues (Bagenal 1978). Sporadic works have been done on the length-weight relationship, condition factor and GSI of *L. calbasu* (Alam *et al.* 2000) but work on *L. calbasu* from wetlands is scant. So, an attempt was made to study different biological indices of *L. calbasu* in the wetlands of South 24 Parganas district of West Bengal to bridge the gap.

## 2 | METHODOLOGY

The sample constituted 275 specimens of *L. calbasu* with size ranged from 130 to 430 mm in total length collected from various wetlands (Bhara Haripota Bheri, Trees Bigha and Bees Bigha) of South 24 Parganas district of West Bengal during the period of investigation of nine months from December 2006 to August 2007 (Figure 1). About 30 specimens were collected each month during morning hours (0600 – 0700 hours) from wetlands. The specimens were caught by cast net (mesh 25–30 mm) and drag net (mesh 5–30 mm). The specimens were brought to the laboratory of Department of Fisheries Resource Management, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata, West Bengal.



**FIGURE 1** Study area of wetlands of South 24 Parganas district of West Bengal (source: Google)

The total length of fish was measured with a millimetre scale to the nearest millimetre and body weights were measured by mono-pan balance to the nearest gram. The fishes were categorized into two groups *i.e.* Group A (<260 mm) and Group B ( $\geq$ 260 mm) for convenience of interpretation. Le Cren (1951) proposed a non-linear equation in the form of  $W = aL^b$ , which explains the rela-

tionship between length (L) and weight (W) of fish. Isometry in growth was tested by employing student t-test. The relative condition factor ( $K_n$ ) was calculated by using the Froese (2006) formula  $K_n = W_o/\hat{W}$ , where  $W_o$  is observed weight and  $\hat{W}$  is calculated weight. The GSI was calculated according to Strum (1978) as follows:  $GSI = \text{weight of gonad}/\text{weight of fish} \times 100$ .

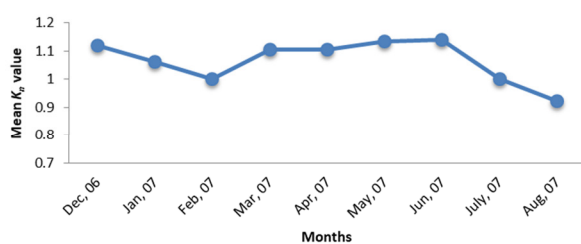
## 3 | RESULTS AND DISCUSSION

A total sample of 275 fish with size ranged from 130 to 430 mm in total length was examined for their bioindices during nine months of study. It was found that the length at first maturity was 260 mm. The numbers of sample specimens were 119 and 156 for Group A (<260 mm) and Group B respectively. The length-weight relationship recorded for corresponding groups were  $W = 0.007269 L^{3.181}$  ( $\text{Log } W = -2.138 + 3.181 \text{ Log } L$ ) and  $W = 0.007367 L^{3.031}$  ( $\text{Log } W = -2.133 + 3.031 \text{ Log } L$ ). The  $b$  value did not vary significantly from 3 indicating isometric growth in the present study. It bears resemblance with earlier works on *L. calbasu* which was being 3.105 in Bhavanisagar reservoir (Natarajan 1971), 3.00 in Loni Reservoir of Madhya Pradesh (Pathak 1975), 3.105 in immature males in Nagarjunasagar Reservoir (Vinci and Sugunan 1981), 3.109 in fish of size 16 to 46 cm in Sylhet basin, Bangladesh (Alam *et al.* 2000). Sani *et al.* (2010) reported  $b$  value of 2.94 of *L. calbasu* from the Betwa (Yamuna River tributary) and Gomti (Ganga River tributary) rivers. Froese (2006) mentioned the value of regression coefficients  $b$  of family Cyprinidae is ranged from 2.5 to 3.5. In the present study, the  $b$  value resemble with earlier works and the smaller size group (Group A) exhibited relatively higher  $b$  value compared to the larger fishes (Group B) indicating more growth rate which bears similarity with earlier works in *Liza tade* (Das 2004) and in *Chelon planiceps* (Pramanick *et al.* 2017). Several researchers (Chatterji *et al.* 1980; Haroon *et al.* 2002; Rizvi *et al.* 2012) have reported allometric growth but Pathak (1975) and Khan (1988) have reported isometric growth pattern in *L. calbasu*.

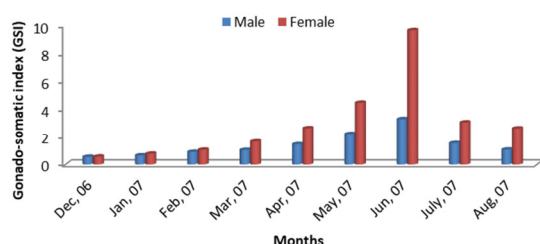
The monthly mean pooled relative condition factor ( $K_n$ ) values varied from 0.924 (August) to 1.141 (June) (Figure 2). The condition factor provides ideas on important aspects of feeding, spawning and other aspects related to the well-being of the fish. A high  $K_n$  value from April to June corresponds to the maturity of gonads and fall of the value from July to August might be due to spawning.

Rao and Rao (1972) and Choudhary *et al.* (1982) observed high  $K_n$  values of *L. calbasu* from the Godavari River and Brahmaputra River which might be due to high feeding tendency of the fishes. The condition factor ( $K$ ) for *L. calbasu* varied from 0.79 –  $1.81 \pm 0.150$  from the River Chenab of Punjab in Pakistan (Naeem *et al.* 2012). In the pre-

sent study the  $K_n$  value found to be higher in smaller size fishes which might be due to relatively more growth and it is in agreement with the earlier workers (Das 2004; Pramanick *et al.* 2017)). Condition factor in fishes generally influenced by several factors like food abundance and physicochemical characters of the environment (Ranganathan and Natarajan 1970), age and sex of fish (Everhart *et al.* 1975), spawning (De Silva and Silva 1979), sex and maturity (Gowda *et al.* 1987), environmental condition, breeding, feeding (Dhanze and Dhanze 1997) and pollution (Sandhya and Shameem 2003; Rao *et al.* 2005).



**FIGURE 2** Monthly mean variations of pooled relative condition factor ( $K_n$ )



**FIGURE 3** Monthly mean variations in gonado-somatic index of *Labeo calbasu*

The monthly mean values of GSI for the male varied from a minimum of 0.544 during the month of December to maximum of 3.301 during June. In case of females, the corresponding values were 0.560 and 9.649 (Figure 3). An increasing trend of GSI values was noticed from December towards June in both sexes. There was significant variation ( $P < 0.05$ ) in the mean values of GSI in different months as well as in both sexes which were due to gonadal maturity. Rao and Rao (1972) found that the peak breeding season of *L. calbasu* was observed in the month of June in Godavari River. But Pathak (1975) and Vinci and Sugunan (1981) reported July as the peak breeding season of *L. calbasu* in the Loni and Nagarjunasagar reservoirs respectively. In the present study, the peak spawning season was observed during the month of June and July which is in agreement with earlier studies. However, the dynamics of increasing gonad weight in proportion to body weight may change from year to year depending on environmental factors such as food availability and temperature (Delahunty and de Vlaming 1980).

#### 4 | CONCLUSION

The length-weight relationship was found to be isometric and  $K_n$  value indicated that *L. calbasu* exhibits healthy and robust conditions, showing good compatibility with the studied wetlands. Knowing of stock assessment of certain species is prerequisite for sustainable management of the fishery in a region. This data will provide some important information for the carp species that are present in the wetlands to improve the management strategies in natural habitats.

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