



## Dynamics of bioindices in mud crab *Scylla serrata* (Forsskål, 1775) occurring in Hooghly-Matlah Estuary of West Bengal, India


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### Abstract

Dynamics of some bio indices (carapace width [CW] and body weight [W] relationship, relative condition factor [ $K_n$ ]) of mud crab *Scylla serrata* (Forsskål, 1775), collected from the Hooghly-Matlah Estuary of West Bengal, were studied for a period of one year. A total of 325 specimens were collected (CW 44 – 120 mm, W 20 – 210 g) and studied. The CW and W relationship was found as  $W = 0.0006 CW^{2.665}$  for male and  $W = 0.001 CW^{2.561}$  for female. The  $b$  value was found relatively higher in male indicating better growth rate compared to females. Moreover, the growth pattern was allometric. The monthly mean  $K_n$  was 0.968 to 1.058 for males and 0.962 to 1.054 for females that significant varied ( $P < 0.05$ ) among sampling months.

**Keywords:** *Scylla serrata*; mud crab; biotic index; relative condition factor; Hooghly-Matlah Estuary

## 1 | INTRODUCTION

The mud crab *Scylla serrata* (Forsskål, 1775) is one of the largest Portunids under order Decapoda and is widely distributed throughout the coastal Indo-Pacific region (Barnes *et al.* 2002). The species forms a highly potential fishery of Hooghly-Matlah estuarine system due to its well-known export trade, delicacy, medicinal value and local consumer preference. The length-weight relationship (LWR) is a prerequisite to know the population structure and implements management measures of respective species. It is also useful in estimating and comparing the population status and general wellbeing of aquatic species with high commercial value (Mohapatra *et al.*

2010). In crabs, the study of carapace width and body weight relationship is widely used to know the growth patterns during their developmental stages (e.g. Prasad *et al.* 1989, Khan and Alam 1991, Poovachiranon 1991, Knuckey 1996, Nandi *et al.* 1996, Sukumaran and Neelakantan 1997).

However, very limited studies were done on this issue from the Hooghly-Matlah estuarine system. So, the present work was conducted to find out dynamics of bioindices of mud crab which will be a useful reference for biological management of fisheries, especially in India and adjacent countries.

## 2 | METHODOLOGY

The mud crab *S. serrata* is the largest crab species found in near shore and brackish water habitats and formed lucrative fishery at Hooghly-Matlah estuarine system. The present work on carapace width and body weight relationship was conducted for a period of 12 months from September 2007 to August 2008. The samples were collected from Sagar Island, Bokkhali and Kakdwip landing sites of Hooghly-Matlah Estuary. The collected specimen was caught by fishing lines, locally known as 'haarsuti' or 'doan', 'gultasuti' or 'thupasuti', 'chhankanjal', 'kancha', 'ganjia' and 'kanpi'. During the period of study, a total of 325 specimens, 181 male and 144 female individuals, were procured and examined with size ranged from 44 to 120 mm carapace width and 20 to 210 g of body weight. The carapace width (CW) was measured with a standard ruler (to the nearest mm) and body weight (W) was measured by a mono-pan balance (to the nearest g).

Le Cren (1951) proposed a nonlinear equation in the form of  $W = aL^b$ , which explains the relationship between length (L) and weight (W). A student 't' test was employed to test the variation among 'b' values. The relative condition factor ( $K_n$ ) was calculated by using the formula  $K_n = W_o / \hat{W}$ , where  $W_o$  is the observed weight and  $\hat{W}$  is the calculated weight.  $K_n$  value was observed for male and female separately in different months. Significant difference among mean values of different biological parameters was tested employing by a Student's 't' test and analysis of variance (ANOVA) technique (Snedecor and Cochran 1967). Data were checked to meet the assumptions for a parametric test and necessary transformation was made where needed.

## 3 | RESULTS AND DISCUSSION

It was observed that there was a high positive significant correlation between CW and W of mud crab ( $r = 0.98$  for male,  $r = 0.97$  for female). The nonlinear equation was found as  $W = 0.0006 CW^{2.665}$  for male and  $W = 0.001 CW^{2.561}$  for female crabs. It bears similarity with earlier works where CW and W relationships of mud crab *S. serrata* were  $W = 0.0423 CW^{2.726}$  (male) and  $W = 0.3357 CW^{2.6265}$  (female), with male exhibiting more growth rate compared to female in Queensland (Lee 1992). A significantly high growth rate of male mud crabs than female was reported ( $W = 0.0423 CW^{3.726}$  for male and  $W = 0.3357 CW^{2.7285}$  for female) in the Andaman sea (Poovachiranon *et al.* 1991).

The growth was found allometric for both the male ( $t = 9.265$ ,  $df = 180$ ,  $P < 0.05$ ) and female ( $t = 7.845$ ,  $df = 143$ ,

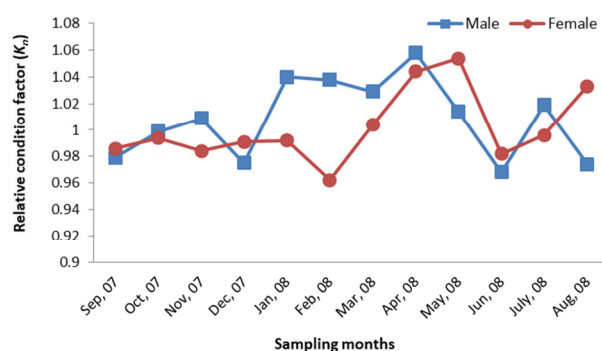
$P < 0.05$ ) crabs and  $b$  values of male were comparatively higher than female that indicates a relatively better growth rate in male. Mohapatra *et al.* (2010) reported  $b$  value of 3.21 – 3.22 for male and 2.75 – 2.92 for female *S. serrata* and 3.01 – 3.11 (for male) and 2.72 – 2.89 (for female) of *S. tranquebarica*, similar to present findings. However, the results obtained in this study differ from Gayathre *et al.* (2016) who reported isometric growth pattern in *S. serrata* with pooled  $b$  value of 2.915 from Pulicat Lake of Tamil Nadu. In another study  $b$  values of 2.240 to 3.549 in *S. serrata* was reported from the coastal waters of Western Seram, Maluku, Indonesia (Siahainenia *et al.* 2016). Higher  $b$  values in male compared to female *S. serrata* were also reported from the Sunderbans mangrove ecosystem and other areas of Bangladesh (Khan and Alam 1991; Zafar *et al.* 2006) and mangrove ecosystem in the Andaman Sea (Poovachiranon *et al.* 1991). Higher  $b$  values of two marine Portunids were also reported (3.10 for males and 2.96 for females of adult *Portunus sanguinolentus*; 3.62 for males and 3.25 for females of *P. pelagicus*) from Karnataka Coast (Sukumaran and Neelakantan 1997). It was reported that length-weight relationship can vary among same population depending on the life stages (Ricker 1975). Chakrabarti (1981) mentioned relationships between CW and W can be influenced by food habits, maturity and spawning of *S. serrata*.

Relative condition factor ( $K_n$ ) is an indicator of physiological state and general well-being of fishes. It is influenced by maturity, spawning, environmental conditions and availability of food (Brown 1957). The monthly average  $K_n$  value for the male crab was ranged from 0.975 (December) to 1.058 (April) and for female it varied between 0.962 (February) and 1.054 (May) (Figure 1). The  $K_n$  values varied significantly ( $F = 2.8463$ ,  $df = 11.11$ ,  $P < 0.05$ ) among months. However,  $K_n$  did not vary significantly between the sexes ( $P > 0.05$ ). The  $K_n$  values ranged from 1.41 to 1.53 (male) and 1.0 to 1.04 (female) *S. serrata* of Sundarbans mangrove ecosystem Bangladesh (Ali *et al.* 2004). Mohapatra *et al.* (2010) reported  $K_n$  values of *S. serrata* of Chilika Lagoon and it varied from  $0.83 \pm 0.12$  to  $1.21 \pm 0.16$  (male) and  $0.84 \pm 0.15$  to  $1.13 \pm 0.24$  (female). A mean condition factor of 1.02 to 1.04 was reported in *S. serrata* in the coastal waters of Western Seram, Maluku, Indonesia (Siahainenia *et al.* 2016).

## 4 | CONCLUSION

The carapace width and body weight relationship was found to be allometric for both males and females of mud crab. Relative condition factors indicate that the species

exhibits healthy and robust conditions in the in the study area and males shows a better condition than females. The present findings will be useful for proper assessment and management of the mud crab fishery in the Hooghly-Matlah estuarine system.



**FIGURE 1** Monthly variation of relative condition factor of males and female of mud crab *Scylla serrata* in the Hooghly-Matlah Estuary

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#### CONTRIBUTION OF THE AUTHORS

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**MAK** primary data collection; **DB** data analysis and manuscript preparation; **SKD** research supervision



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