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Biological aspects of the mola carplet *Amblypharyngodon mola* (Cyprinidae) in the Payra River, Southern Bangladesh

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Abstract

Biological aspects including size at sexual maturity, breeding season and condition factor of *Amblypharyngodon mola* was studied in the Payra River, southern Bangladesh during February 2016-January 2017. All specimens were sexed and standard length (SL), body weight (BW) and gonad weight (GW) were measured. The gonadosomatic index (GSI) increased with the body size, however; the GSI rose sharply at 4.1 cm SL indicating the size at sexual maturity of *A. mola*. Monthly GSI was higher (average value > 8.0) during April to July with a peak in May, indicating this was the main breeding season. Fulton's condition factor by months and SLs varied in both sexes and was attributed to variations in GSI with maturity. The findings of this study will be useful for the management and conservation of this important fishery in Bangladesh and neighboring countries.

Keywords: standard length; gonadosomatic index; sexual maturity; *Amblypharyngodon mola*

1. Introduction

Amblypharyngodon mola is a small indigenous freshwater fish species that inhabits ponds, rivers, floodplain lakes, canals, paddy fields and many other small water bodies in the Indian subcontinent. The species is widely distributed in Indian South Asian countries including Bangladesh, Pakistan, India, Myanmar and Afghanistan [1, 2]. This is an important species for the artisanal fisheries of the Indian sub-continent and is an important source of livelihood for many of the subsistence and artisanal fisher folks [2, 3, 4]. This is a popular food fish mainly in Indian sub-continent due to its good taste and high nutrient value [5, 6] with high protein, vitamin, mineral, Fe, Zn and Ca content [7-10]. In Bangladesh, this species has been reported as a vital source of micronutrients essential to prevent malnutrition for the rural people, particularly women and children [11]. The species is also important as ornamental fish having moderate demand and availability in the ornamental fish markets [12].

Several studies have been conducted on the biology of *A. mola* including reproduction [6, 13-21], feeding ecology [22-28] and length-weight relationships [29-32]. However, no studies were conducted on any of the biological aspects of this species from the Payra River. Therefore, the present study aimed to provide information on the biological aspects including size at sexual maturity, breeding season and condition factor of *A. mola* in the Payra River, southern Bangladesh.

2. Materials and methods

The present study was conducted in the Payra River running through Patuakhali, a southern district of Bangladesh (straddling 22° 35' N and 90° 26' E). The river originated from the Tetulia River via the Karkhana River and finally falls into the Bay of Bengal by the name of Burishwar River.

Monthly samples were collected from the small-scale fisher of set bagnet fishery in the Payra River during February 2016-January 2017. Set bagnet is a traditional fishing gear widely used by the small-scale fishers in the Payra River similar to trawl net having larger mesh size at mouth and wing, however; the mesh size gradually decreases to <2 mm and sometimes mosquito net at the codend. All collected specimens were preserved in 10% formalin and transferred to the laboratory for analysis.

The standard length (SL) of all individuals was measured to the nearest 0.1 cm using a measuring scale, while weight body weight (BW) was recorded using a digital balance to 0.01 g accuracy. Sex determination was done by incision of the abdomen of each individual and visual inspection of the gonad by naked eye. All fat, connective tissue and blood vessels were carefully removed from the gonads and were weighed to the nearest 0.001 g. All fat, connective tissue and blood vessels were carefully removed from the gonads and were weighed to the nearest 0.001 g accuracy.

The gonadosomatic index (GSI) was calculated for each female individual as: $GSI (\%) = (GW / BW) \times 100$. The size at sexual maturity was estimated by the relationship between the GSI and SL. Breeding season was estimated based on the monthly variations of GSI. Fulton's condition factor (K) was estimated using the equation: $K = (BW / L^3) \times 100$ for both monthly and in terms of size (SL cm) class.

3. Results

The relationship between SL and GSI of female *A. mola* is shown in Fig. 1. The lowest and highest GSI recorded during this study was 0.18 and 17.18 respectively. The GSI of females <4.0 cm SL was low (~ 4.0). However, the GSI rose sharply at around 4.1 cm SL. Therefore, the size at sexual maturity of *A. mola* was considered to be 4.1 cm SL.

The monthly variations of mean GSI of female *A. mola* were plotted in Fig. 2. The mean GSI varied from 1.90 in November to 10.67 in May. The GSI value began to increase drastically from March and remained high during April to July with a peak in May. The GSI then began decreasing in August and remained low in the subsequent months. The estimated breeding season of *A. mola* was considered to be from April to July, since the mean GSI was high during this period.

The Fulton's condition factors (K) varied monthly showing almost similar pattern for both sexes (Fig. 3). The monthly K ranged from 0.88 to 1.07 in males and from 0.87 to 1.12 in females. The lowest K was found in December, while the K was highest in June for both sexes. In majority of the months, K in females was higher than that in males except in August and December. The K with regard to length class is presented in Fig. 4. Both males and females recorded minimum K values at 2.5 cm and maximum at 6.0 cm, while the maximum K values for males and females were at 6.0 cm and 4.5 cm respectively. The K for females was higher than that for males at each length classes. The K tended to be higher after 4.0 cm for both sexes.

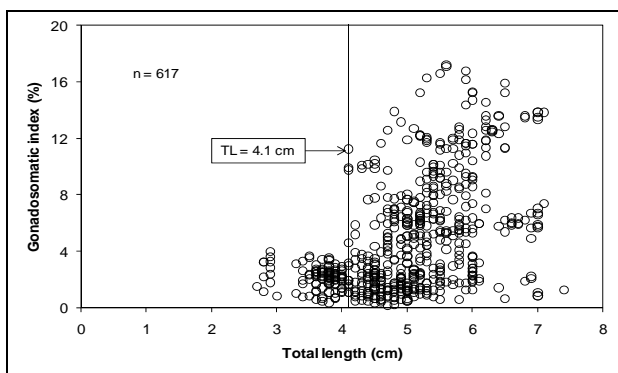


Fig 1: Relationship between gonadosomatic index and standard length (cm) for female *Amblypharyngodon mola* in the Payra River, southern Bangladesh.

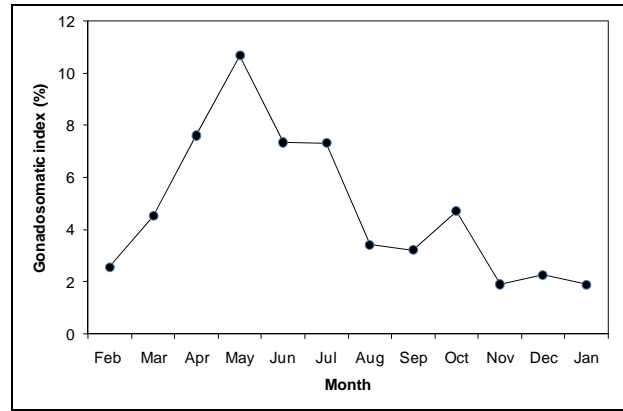


Fig 2: Monthly changes in the mean gonadosomatic index (GSI) for females *Amblypharyngodon mola* in the Payra River, southern Bangladesh.

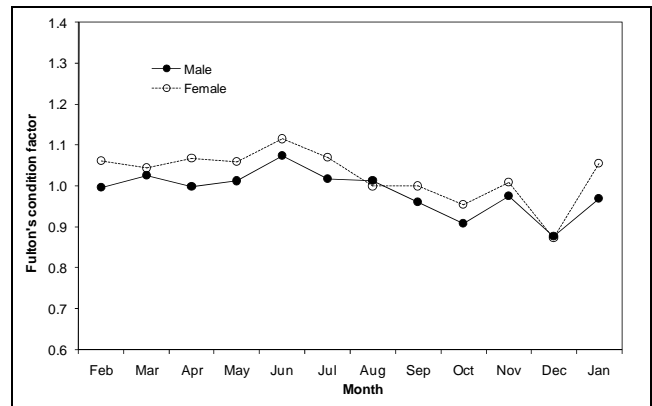


Fig 3: Monthly changes of Fulton's condition factor for both male and female *Amblypharyngodon mola* in Payra River, southern Bangladesh.

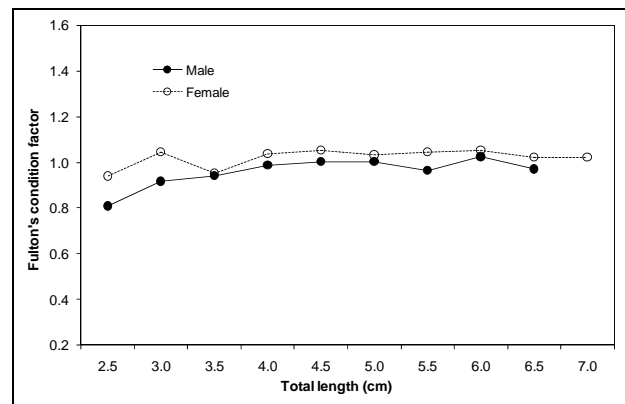


Fig 4: Fulton's condition factor with regard to standard length (cm) class for both male and female *Amblypharyngodon mola* in the Payra River, southern Bangladesh.

4. Discussion

The present study represents the size at sexual maturity, breeding season and condition factor of *A. mola*. Determining the size at sexual maturity of a particular species is very important in fisheries management and is widely used as an indicator for minimum permissible capture size [33-38]. In the present study, the size at sexual maturity of female *A. mola* was estimated as 4.1 cm SL on the basis of the relationship between SL and GSI. This result was similar to the study by Suresh *et al.*, 2007 [18] who reported that the size at sexual

maturity for female *A. mola* in the floodplain wetland, West Bengal was 3.9-4.4 cm SL. A number of studies on sexual maturity of *A. mola* have also been reported with various results from different water bodies. For example, Hoque and Rahman, 2008^[19] reported the size at sexual maturity of female *A. mola* in the floodplain, northern Bangladesh as 5.5 cm SL; Gupta and Banerjee, 2013a^[20] reported the size at sexual maturity of female *A. mola* in the floodplain wetland, West Bengal as 5.5-6.0 cm SL; and Mondal and Kaviraj, 2013^[21] reported the size at sexual maturity of female *A. mola* from two floodplain lakes of India as 4.9 cm SL. These differences in the size at first sexual maturity may be influenced by the abundance and seasonal availability of food, temperature, photoperiod and other environmental factors in different geographical regions^[34-39].

Monthly variations of GSI indicated the breeding season of *A. mola* in the Payra River from April to July with a peak in May. Numerous studies have been conducted on the breeding season of *A. mola* at different habitats of Bangladesh, including Parveen, 1984^[40] who reported that the breeding season of *A. mola* is from June to October/November; Rahman, 1989^[41] reported the breeding season from May to October; Afroze and Hossain, 1990^[42] reported the breeding season in August; Kohinoor *et al.*, 2005^[17] reported the breeding season from May to October; Azadi and Mamun, 2004^[16] reported the breeding season from March to October; Hoque and Rahman, 2008^[19] reported the breeding season from April to October; and Saha *et al.*, 2009^[9] reported the breeding season from March to August. On the other hand, several studies have been conducted in Indian waters, including Piska and Waghay, 1986^[15] who reported the breeding season of *A. mola* in Andhra Pradesh from February to July; Suresh *et al.*, 2007^[18] reported the breeding season in West Bengal from April to October while Gupta and Banerjee, 2013a^[20] reported the breeding season from April to December; and Mondal and Kaviraj, 2013^[21] have documented July as the spawning month for this fish species in West Bengal. These variations in breeding season might be attributed to the difference of geographical location particularly temperature.

In the present study, the K values of *A. mola* were lowest in December, whilst the highest in June for both sexes. Condition factor is correlated with the changes of GSI^[37, 43]; it used to increase with increasing gonad weight and reach maximum just before the spawning period. After that it decreases due to loss of gonadal products and thereafter again it start to increase gradually. The present study indicated that the K values for both sexes started to increase rapidly in January and remained high from April to July, thereafter started to decrease in the subsequent months. Therefore, the condition factor values supporting the above conclusion made on reproductive period of *A. mola* based on monthly fluctuation of GSI values. With regard to length class the K values start to increase after 4.0 cm for both sexes, which might be attributed to the start of sexual maturation, as indicated in the present study the size at sexual maturity of *A. mola* was 4.1 cm.

5. Conclusions

In conclusion, this is the first study on some biological aspects of *A. mola* in the Payra River, southern Bangladesh. The findings of this study would be useful for fishery biologists/managers to impose adequate regulations for conservation of this important fishery in Bangladesh and

neighboring countries.

6. Acknowledgements

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