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Biological aspects of *Barbonymus gonionotus* (Bleeker, 1849) in the Padma River, Bangladesh

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Abstract

The present study describe the biological aspects of *Barbonymus gonionotus* including- sex ratio, ovarian maturity, spawning season and fecundity from the Padma River, Bangladesh. Sampling was done, using traditional fishing gears i.e., cast net, square lift net and gill net during January 2011 to December 2012. For each individual total length was measured to the nearest 0.1 cm using digital slide calipers and whole body weight and gonadal weight were taken using an electronic balance with 0.01 g accuracy. A total of 1440 specimens of *B. gonionotus* were collected, of which 634 were males and 806 were females and sex ratio was recorded as 1:1.27. The number of females was higher than that of males. During the study a total 5 gonadal stages were examined for both males and females. Spawning season ranged from April to July and peak spawning season was June for *B. gonionotus* in the Padma River. The fecundity of *B. gonionotus* varied from 13192 to 98325 with a mean value of 58660 ± 29288 . The results of this study would be very beneficial for fishery biologists and may effective for sustainable management and conservation of this fish species in the Padma River of Bangladesh and surrounding ecosystems.

Keywords: *Barbonymus gonionotus*, Gonadal maturation, spawning season, fecundity

1. Introduction

The Silver barb, *Barbonymus gonionotus* (Bleeker, 1849) is a fish of the family Cyprinidae. It is distributed in Asian countries including-Bangladesh, China, India, Indonesia, Malaysia, Myanmar and Thailand [1]. This fish species is a major source of animal protein and macronutrients in the diet of people and use as food fish [2, 3]. This species an important target species for small- and large- scale fishers, who use various types of traditional fishing gears [4]. However, the natural population of this species is declining due to reckless fishing, habitat destruction, and other ecological changes to their habitat [5-7].

Reproduction is a physiological process by which species are perpetuated and play an important role to ensure their survivability [8-11].

The reproductive process of fish involves sexual maturity, ovarian maturation, spawning period, mating, spawning and fecundity [12]. Reproduction is prejudiced by several factors i.e., differentiations in genetic combination, rainfall, day light, temperature, turbidity, water depth and availability of food [13, 14].

Only a few studies on length-weight relationship [15, 16], stocking density and survivability [17], for this species has been conducted. Even though a few studies have been done on sex ratio, length frequency distribution [18, 19], length-weight relationships, condition and form factor of several fish species from the region [20-24], but there are no detailed and sound studies on biological aspects of *B. gonionotus* from Bangladesh. Therefore, the aim of this study is to report on reproductive biology of *B. gonionotus* from the Padma River of Bangladesh for sustainable management and conservation in the natural water body.

2. Materials and Methods

2.1 Study site

This study was conducted in the Padma River (Lat. 24°22'; Long. 88° 35') northwestern Bangladesh. This river is considered an important feeding and spawning ground for freshwater fish species of northwestern Bangladesh [25, 26].

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2.2 Sampling and laboratory analysis

A total of 1440 individuals of *B. gonionotus* were collected from the commercial fishers catch in different part of the River in Rajshahi region during January 2011 to December 2012. Fishes were caught using different types of traditional fishing gears including cast, square lift and gill nets. The fresh samples were immediately chilled in ice upon capture, and then preserved in 10% buffered formalin solution in the laboratory. Fish were sexed by observing their gonads under a microscope. Individual lengths including total length (TL) was measured to the nearest 0.1 cm using digital slide calipers and whole body weight (BW) and gonadal weight (GW) were measured using an electronic balance with 0.01 g accuracy. Stages of ovarian maturity were examined by the method of visual examination based on color, texture, size, shape and extent of occupancy of gonads. Spawning season was calculated based on monthly variations of gravid female and gonadosomatic index (GSI). The GSI was calculated by the following formula-

$$GSI (\%) = \frac{100 \times GW}{BW}$$

Where

GW = Gonad weight

BW = Body weight

For the estimation of fecundity, the ovary was firstly weighted. Then three sub-samples were taken from the front, mid and rear-section of the ovary and weighed. The total number of eggs in each sub-sample was counted. This value was proportional to the total ovary weight; the number of eggs (F₁) for the sub-sample was estimated by using the following equation [27].

$$F_1 = \frac{\text{Gonadweight} \times \text{number of egg sin the sub-sample}}{\text{sub-sample weight}}$$

Later, by taking the mean number of three sub-samples (F₁, F₂ and F₃), the individual fecundity for each female fish was calculated by the following equation:

$$Fe = \frac{F_1 + F_2 + F_3}{3}$$

2.3 Statistical analysis

Statistical analyses were performed using Graph Pad Prism 6.5 software. All statistical analyses were considered significant at 5% (p<0.05).

3. Results

In the present study a total of 1440 specimens of *B. gonionotus*, were sampled, where 634 were males and 806 were females and sex ratio was recorded as 1:1.27. The number of females was higher than that of males. Monthly variation of sex ratio indicated that both male and female was highest in number in the month of June (Figure 1).

A sum of 250 mature males and 350 gravid females were studied to determine the different stages of testis and ovaries. During the study a total of 5 stages (immature, maturing-I, maturing-II, mature and ripe) were examined for both male and female *B. gonionotus* and shown in Figure 2.

In the present study, both gravid female and GSI was highest in the month of April to July. On the basis of percentages of gravid females and monthly variations of GSI, the spawning season was ranged from April to July and peak spawning season was June for *B. gonionotus* in the Padma River (Figure 3 and 4). The mean value of GSI was highest (13.67 ± 0.77) in the month of June and lowest (2.14 ± 0.11) in December (Figure 4).

Total 350 gravid female was used for the estimation of fecundity for *B. gonionotus* in the Padma River. The fecundity for this species varied from 13192 to 98325. However, the smallest female (total length 16 cm and body weight 13 gm) had 13192 eggs and the largest female (total length 43 cm and body weight 757 gm) was carrying 98325 eggs. The mean fecundity was 58660 ± 29288. The relationship between fecundity and total body weight is presented in Figure 5. The figure indicates that maximum fecund fishes were within the limit of 250-500 g body weight and fecundity increases with increasing the body weight.

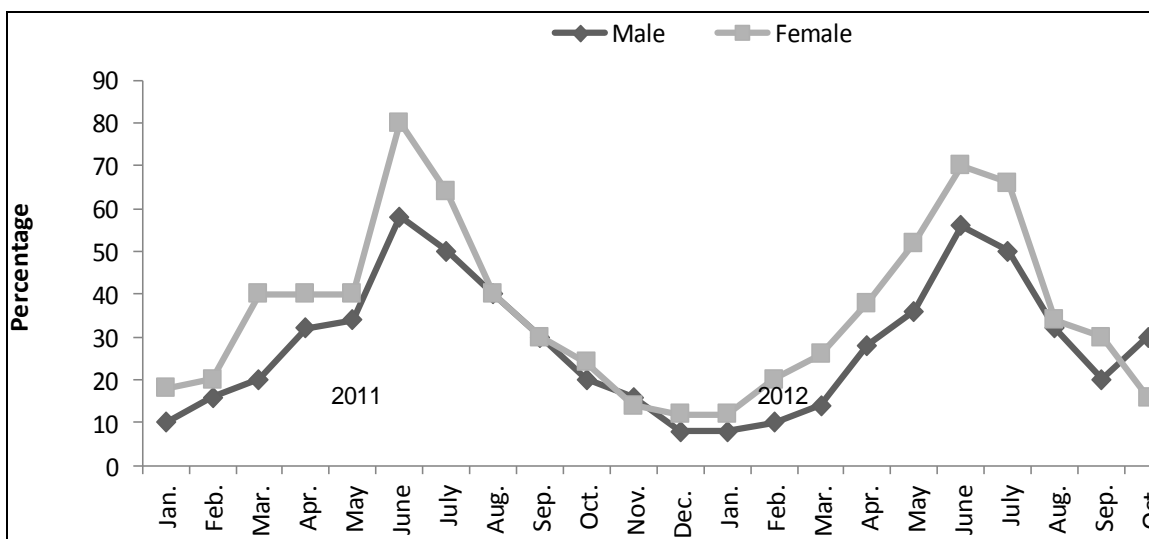


Fig 1: Monthly variations of sex ratio of *Barbonymus gonionotus* in the Padma River, Bangladesh

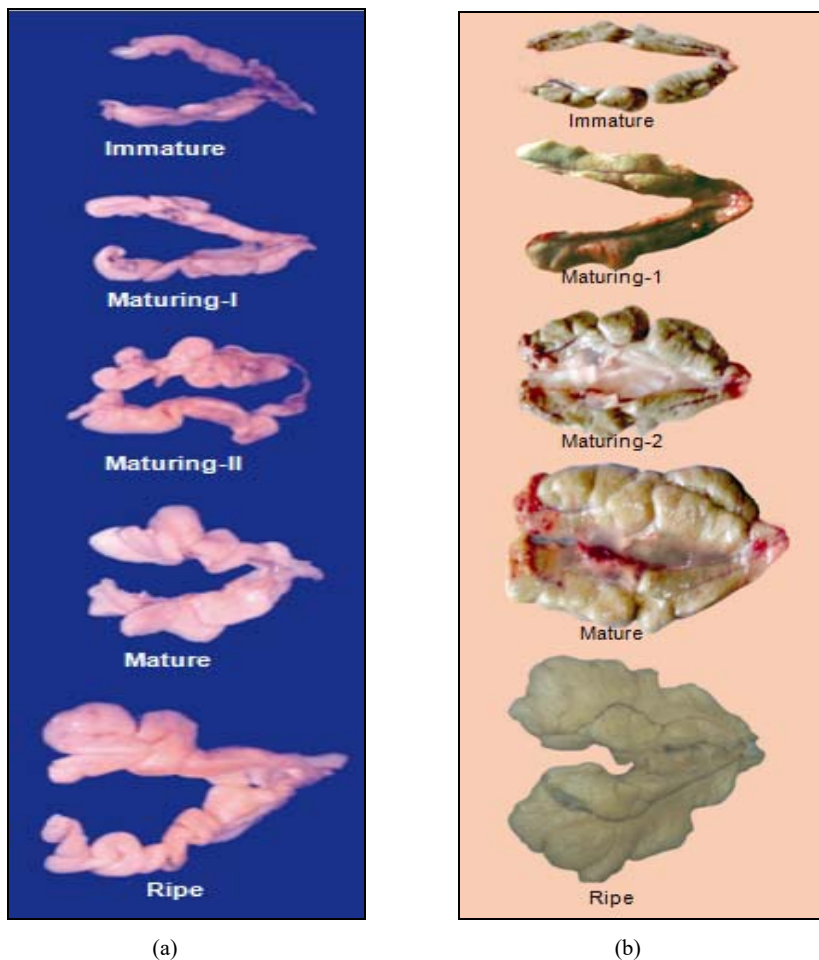


Fig 2: (a) Maturation stages of male testis and (b) maturation stages for female ovaries of *Barbonymus gonionotus* in the Padma River, Bangladesh

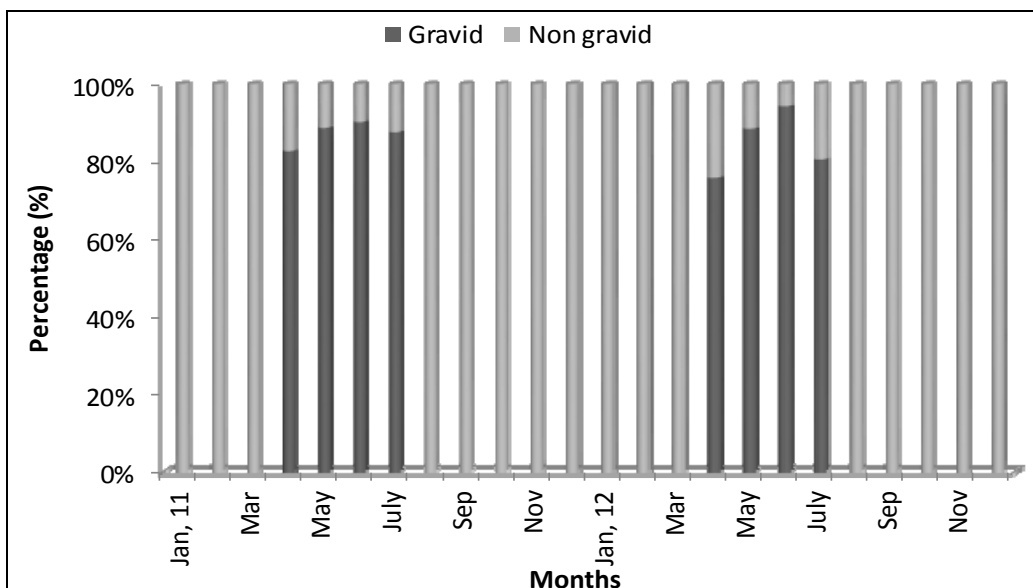


Fig 3: Monthly variations of gravid female (in percentage) of *Barbonymus gonionotus* in the Padma River, Bangladesh

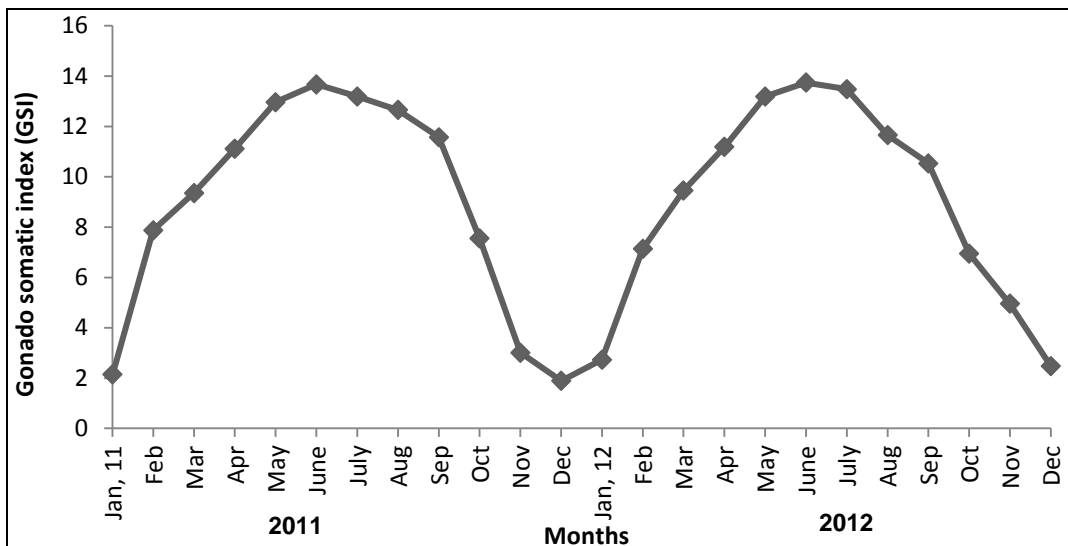


Fig 4: Showing the monthly changes of mean Gonado somatic index (GSI) of female *Barbonymus gonionotus* in the Padma River, Bangladesh

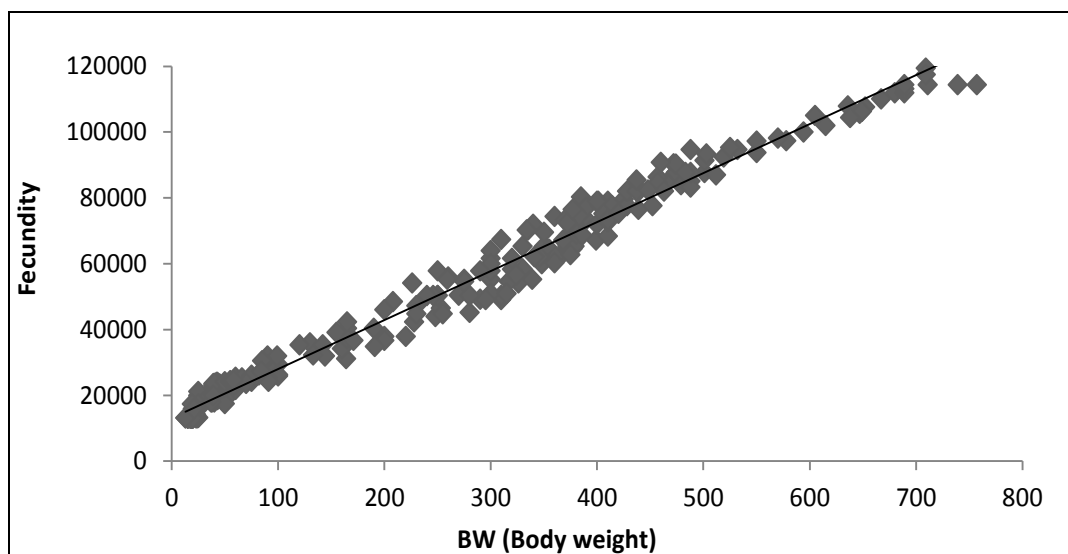


Fig 5: Relationships between fecundity and body weight for *Barbonymus gonionotus* from the Padma River, Bangladesh

4. Discussion

Difference from 1:1 sex ratio is not anticipated for most aquatic species, although some finfish may show a strong bias [28]. In our study the sex ratio was 1:1.27 (male: female) and due to lack of available literature on sex ratio, it was not possible to compare with our findings.

In the present work the spawning season was ranged from April to July and peak spawning season was June for *B. gonionotus* in the Padma River. According to [29] the spawning season varied from March to June and was not similar with our findings.

During the study, the fecundity of *B. gonionotus* in the Padma River varied from 13192 to 98325 with a mean value of 58660 ± 29288. Also, there was a positive relationship between fecundity and total body weight. There is no previous study on fecundity for this species, which restrains to compare with our findings.

5. Conclusion

The present study describes the biological aspects for *B. gonionotus* including sex ratio, gonadal maturation, spawning season and fecundity from the Padma River, Bangladesh. The

findings of this study would be an effective tool for fishery managers, biologists, and conservationists to initiate sustainable management strategies and regulations for proper management of the remaining stocks of this species in the Padma River and adjoining ecosystems. Also this study will be used as baseline for further study.

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