Study on the fecundity indices of two indigenous fish species from the Padma River

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Abstract: Aspects on the fecundity indices of *Gudusia chapra* and *Mystus vittatus* of the Padma River were studied during March to August 2006. A total of 660 specimens, representing two species off two families used for the study were caught by traditional fishing gear. For the estimation of fecundity the gravimetric method was used. The mean total fecundity of *G. chapra* was 20160 ± 6545 and *M. vittatus* was 12180 ± 5812. However in August the total fecundity, standard length (SL) and body weight (BW) was greater than in March. The relationships between fecundity and morphometric measurements indicated that the body weight and fecundity was related isometrically with female body size.

Keywords: Fecundity, *Gudusia chapra*, *Mystus vittatus*, Padma River

Introduction

The fecundity of a fish is defined as the number of eggs that are likely to be laid during a spawning season (Chondar, 1977). Knowledge about fecundity of a fish is essential for evaluating the potentialities of its stocks, life histories, practical culture and actual management of the fishery (Lagler, 1956; Das, 1977). Assessment of fecundity has paramount importance in fisheries management as it provides knowledge about the number of offspring produced in a season and the reproductive capacity of the species (Qasim and Qayyum, 1963). The fecundity and its relation to the size of a fish make it possible to estimate the number of eggs likely to be liberated (Chondar, 1977). However, there is no previous information on the fecundity of *Gudusia chapra* and *Mystus vittatus* from the Padma River in Bangladesh, although few studies have been conducted on sexual maturity and fecundity of these species from the Indian sub-continent (Jhingran and Verma, 1967; Chondar, 1977; Rao and Sharma, 1984; Quddus *et al.*, 1990). Considering the availability and importance to the common people, the present work was undertaken with a view to determine the fecundity of these species from Padma River.

Materials and Methods

Sampling and Laboratory Analysis

The present study was conducted in the Padma River at Rajshahi. This study on fecundity of *G. chapra* and *M. vittatus* were conducted using samples collected during day time from the fishermen catch landed at the Rajshahi city, Rajshahi, Bangladesh from March to August 2006. These fishes were caught by means of traditional fishing gear jhaki jal (cast net), tar jal (square lift net), and dughair (conical trap) (Kibria and Ahmed, 2005). The sample was immediately preserved with ice in the fish market and fixed with 5% formalin on arrival in the laboratory. All specimens were sexed by gonad observation under a binocular microscope and only female specimens were used for this study.

For each individual, standard length (SL) was measured, and whole body weight (BW) was taken on a digital balance with 0.01g accuracy. Whole gonad was removed from each female fish and weighed (GW) with balance to an accuracy of 0.001g and was preserved by 10% formalin.

Estimation of Fecundity

The specimen larger than first size at sexual maturity was used for the estimation of fecundity during this study. For the estimation of fecundity, the ovaries were weighed; three sub-samples were taken from the front, mid and rear-section of each ovary and weighed. The total number of eggs in each sub-sample ovary was calculated. This value was proportional to the total ovary weight; the number of eggs (F_1) for the sub-sample was estimated by using the following equation:

$$F_1 = \frac{(Gonad\,weight \times number\,of\,egg\,\sin\,the\,sub-sample)}{sub-sample\,weight}$$

(Yelden and Avsar, 2000).

Later, by taking the mean number of three sub-sample fecundities (F_1, F_2 and F_3), the individual fecundity for each female fish was calculated by the following equation:

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

The relationship between fecundity and some morphometric measurements were determined by relating total fecundity (F_e) data to standard length (SL) and total weight (BW) using the following formulae:

In $F_e = \ln m + n \times \ln SL$; $F_e = m \times SL^n$

In $F_e = \ln m + n \times \ln BW$; $F_e = m \times BW^n$

Here, m and n are constant parameter in the linear regression analysis and ln is the natural logarithm.

Results and Discussion

Gudusia chapra:

A total of 250 female specimens for *G. chapra* were collected from Padma River, Rajshahi, Bangladesh to select 40 female specimens for this study. The results showed that SL of *G. chapra* ranged from 3.60 to 13.70 cm, with mean tandard deviation (Mean±SD) calculated as 8.80 ± 2.93 mm while body weight varied from 1.00g to 43.60g with calculated 16.56 ± 11.96 g. The mean fecundity of the sampled population of *G. chapra* was 20160 ± 6545 eggs per fish, positively correlated with the standard length 11.02 cm ($R^2 = 0.881$) and body weight 25.77g ($R^2 = 0.684$). It was

observed that the fecundity of the *G. chapra* in proportion to the 2.659 power of SL and 0.769 power of BW. Positive relationships between fecundity and body weight have been reported in a number of fishes which support the present findings (Khan and Jhingran, 1975; Raina and Bali, 1982). The total estimated fecundity of this species is comparable with that of the Indian sub-continent (Quddus *et al*., 1990; Jhingran and Verma, 1967). Quddus *et al.* (1990) reported that the fecundity of this species varied from 694 eggs (7.38 cm Total length, weight 5.5 g) to 2235 eggs (13.5 cm TL and weight 25.0 g). They also observed that the mean number of eggs was 1394 for a fish with a mean total length of 9.71 cm and a mean weight of 11.32 g.

Jhingran and Verma (1967) reported that the fecundity of this species varied from 485 to 2030. The average fecundity value of the different length groups showed a direct proportionate increase from 18252 to 36712 with the increase of the mean standard length from 8.50 to 16.50 cm in this species in the Keetham Lake and the Ganges River System, India (Chondar, 1977). In the present study, the fecundity of *G. chapra* in Padma River was relatively high when compared to the same species in different geographical regions. Total fecundity (number of eggs per ovary) at different standard length and body weight of the fish are given in Table 1 and 2.

Table 1 Fecundity (average number of eggs) on different standard length classes of *Gudusia chapra* collected from the River Padma during March to August 2006

SL Class (cm)	Mean SL (cm)	No. of fish examined	No. of eggs in each SL class		
			Minimum	Maximum	Average
09.00-09.99	09.50	8	10888	12500	11997
10.00-10.99	10.50	11	14666	18000	16108
11.00-11.99	11.50	7	20200	22944	22142
12.00-12.99	12.50	9	24000	24900	24238
13.00-13.99	13.50	5	26000	36200	32020

Table 2 Fecundity (average number of eggs) on different body weight classes of *Gudusia chapra* collected from the River Padma during March to August 2006

BW of fish range (g)	Mean BW (g)	No. of fish examined	No. of eggs in each BW class		
			Minimum	Maximum	Average
15.00-19.99	18.00	19	10888	22944	15600
20.00-24.99	20.65	4	16000	21800	19952
25.00-29.99	25.80	3	14723	22440	21296
30.00-34.99	33.10	2	24000	24200	24100
35.00-39.99	36.52	7	24000	24900	24249
40.00-44.99	41.65	5	26000	36200	32017

Mystus vittatus:

For *M. vittatus*, a total of 410 female specimens were collected from the study site during this study. Among these a total number of 40 female specimens were used for the estimation of fecundity. The result showed that SL of *M. vittatus* ranged from 4.50 to 10.30 cm, with mean standard deviation (Mean±SD) calculated a 7.08±1.02 mm while body weight varied from 1.70 to 24.90 g with calculated 8.73±4.12 g. Female of the species *M. vittatus* with different type of maturity stage

were collected during the study period. A total number of 40 female specimens larger than the size at first sexual maturity (5.9 cm in SL) were used for the estimation of fecundity. Total fecundity (number of egg per ovary at different standard length and body weight of the fish are given in Table 3 and 4. Fecundity was estimated on 40 matured female of *M. vittatus* belonging to different size classes. The mean total fecundity a 12180±5812 and ranged from 5200 to 23900, i.e. positively correlated with the total length

7.76 cm ($R^2 = 0.818$) and body weight 11.89 g ($R^2 = 0.770$). In this study, the fecundity of the *M. vittatus* increased in proportion to the 2.889 power of SL, and 0.901 power of BW. Positive relationships between fecundity and body weight have been reported in a number of fishes and these supports to the present findings (Khan and Jhingran, 1975; Raina and Bail, 1982). The total estimated fecundity of this species is comparable with the similar species from the Indian sub-continent (Rao and Sharma 1984). In general, the total fecundity increased with increasing the size and weight of fish and also with the gonad weight. The estimated relationship between fecundity and total length and fecundity and body weight in sample from Aligrah, India was given by ln F_e= 5.451 ln TL+1.6556 and ln F_e= 1.681 ln BW+2.0477 (Qasim and Qayyum, 19630). In Jammu division, India, these relationships were ln F_e = 3.0225 ln TL+0.7469 and ln F_e= 1.3594 ln BW+2.2935 (Malhotra *et al.,* 1979). The result of the present study revealed that the fecundity of *M. vittatus* is comparatively higher than the other water bodies. The ovary from the smallest mature female weighted 0.068 g and it total fecundity was 5200. The highest total fecundity was 23900 eggs with a body length and totals weight 10.30 cm SL and 24.90 g respectively. Variation of fecundity among the population may result largely from selectivity different environmental factors, of which temperature is considered the most probable selective factor (Jonsson and Jonsson, 1999). However, fecundity of fishes varies from species to species, also within the same species due to different factors such as age, size, body and gonad weight, ecological conditions of the water body, etc (Lagler, 1956).

Table 3 Fecundity (average number of eggs) on different standard length classes of *Mystus vittatus* collected from the River Padma during March to August 2006

SL Class (cm)	Mean SL (cm)	No. of fish examined	No. of eggs in each SL class		
			Minimum	Maximum	Average
6.00-6.99	6.50	11	5200	9000	6361
7.00-7.99	7.35	5	9000	14000	10750
8.00-8.99	8.61	14	11300	21306	15472
9.00-9.99	9.05	9	14007	21652	18121
10.00-10.99	10.30	1	239000	23900	23900

Table 4 Fecundity (average number of eggs) on different body weight classes of *Mystus vittatus* collected from the River Padma during March to August 2006

BW of fish range (g)	Mean BW (g)	No. of fish examined	No. of eggs in each BW class		
			Minimum	Maximum	Average
3.00-7.99	6.03	10	6068	7000	6086
8.00-12.99	9.04	7	9700	14000	9700
13.00-17.99	15.91	16	15328	21306	15328
18.00-22.99	18.30	6	21652	21652	21209
23.00-27.99	24.90	1	23900	23900	23900

The study has provided some basic information on the size at sexual maturity and fecundity for *G. chapra* and *M. vittatus* that will be helpful to evaluate reproductive potential of individual fish species in similar studies. Further, it would be useful for fishery biologist/manager to impose adequate regulation for sustainable fishery management for the control of exploiting fishing of young individuals and when associated with other information aids in evaluation and prediction of fish stock in the Padma River and nearby areas of Bangladesh.

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