

OVARIAN DEVELOPMENT, FECUNDITY AND REPRODUCTIVE CYCLE IN SECURICULA GORA (HAMILTON, 1822)

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ABSTRACT

Securicula gora is a commercially important SIS (small indigenous species) fish of Bangladesh. The ovary of the species passes four maturation stages viz. Immature (mean ova diameter 0.581 ± 0.11 mm), Maturing (mean ova diameter 0.645 ± 0.16 mm), Mature (mean ova diameter 2.232 ± 0.11 mm) and Ripe stage (mean ova diameter 3.263 ± 0.09 mm) up to maturity. The fish is moderately fecund having reproductive potentiality as 23860.12 ± 4980.21 eggs in average. The relationship among fecundity and six important variables viz. total length, standard length; body depth, total weight, gonadal length and gonadal weight were found positively correlated. The gravid females are only observed from April to August. The ranges of GLI and GSI values are found highest (GLI, 28.45 to 38.19 and GSI, 10.63 to 14.44) from April to August. The mean ranges of higher values of ova diameter (2.608 ± 0.12 to 3.624 ± 0.12 mm) are also observed in the same months. All four methods used to determine the reproductive cycle of *S. gora* focused that the fish breeds in April to August and during this single spawning time the fish spawns for more than once, as mature, ripe and immature ovaries were found in the same size group of females. The results of the study will play a vital role for the proper management and conservation of the species.

KEY WORDS: fecundity, ovary, reproductive cycle, *Securicula*

INTRODUCTION

Research in fish biology, both in the marine and freshwater is becoming prominent all over the world. In recent years climate change has become recognized as the foremost environmental problem of the twenty-first century, and a subject of considerable debate (Cowie, 2007). The global climate change seriously has been affecting both the terrestrial and aquatic organisms. Fisheries biologists are therefore increasingly turning their eyes to the biological research of fishes to ensure proper management of this sector. There are 260 freshwater fish species in Bangladesh of which SIS (small indigenous species) are playing a vital role in the economy and nutrition of the nation. *Securicula gora* is one of them which is commonly known as “Ghora Chela” are available in the rivers, canals and beels of northern part of the country (Rahman, 2005). Information on the biology of *S. gora* is scanty, only Das *et al.* (2002) reported on the monthly size frequency distribution and length-weight relationship; and Ahsan *et al.* (2004) reported only on the fecundity of the species. Proper management of this species can play more effective role in supplying protein and employment to the people. So, study on the reproductive biology of *S. gora* is found to be essential in the sense that it may provide information and clues for its proper management and conservation.

MATERIALS AND METHODS

Random sampling was done to collect adult *S. gora* at a regular interval of one week from different fish landing centres of Rajshahi, Bangladesh since January to December 2010. A total of 194 specimens were collected during day time and precautions were taken to save from spoilage or any damage. After collection, the specimens were washed well, confirmed to the species level and then tagged and preserve by date with 10% formalin. Finally, a total of 108 females were used for the present study. Total length (TL) and total weight (TW) of the individuals were recorded. The ovaries were dissected out and excess moisture of the ovaries was removed by using blotting papers. Length and weight of the ovaries were measured in standard accuracy. Colour of the ovaries was noted. Five to ten ova from each anterior, middle and posterior portions of each ovary were taken out, and diameter of these ova was measured with the help of an ocular micrometer. Gravimetric method was followed according to Lagler (1956) to estimate the fecundity.

The reproductive cycle was determined based on the following methods:

- (i) Monthly percentage distribution of gravid females,
- (ii) Gonadal Length Index (GLI),
- (iii) Gonado-Somatic Index (GSI); and
- (iv) Variation in ova diameter.

The GLI and GSI were calculated according to the formula described by Welcomme (1985) and Wootton (1990) as follows:

$$GSI = \frac{\text{weight of the gonad}}{\text{weight of the fish}} \times 100, \quad GLI = \frac{\text{Length of the gonad}}{\text{Length of the fish}} \times 100$$

RESULTS AND DISCUSSION

Ovarian development: The maturation of oocytes in the ovaries of *S. gora* undergoes four major stages, which can be detected by ovary size and colour before spawning. The maturation stages are repeated in cyclic order, in which the ovarian development continues and the fish get ready to breed again. Including the resting or spent ovary, the following stages of oocytes are observed in the ovaries of *S. gora* (Table 1):

Stage-I Immature: The ovary was difficult to clearly define without a microscope. The ovary was irregular in shape and transparent ova are nearly round shaped with central nucleus. Ova diameter was ranged from 0.11 to 0.89 mm with the mean of 0.581 ± 0.11 mm.

Stage-II Maturing: The ovary became slight opaque due to the deposition of yolk at the central part. The nucleus was not clearly visible. The ovarian wall was still irregular. Diameter of the ova ranged from 0.39 to 1.90 mm with the mean of 0.645 ± 0.16 mm.

Stage-III Mature: The ovary became enlarged and spherical. The nucleus was invisible due to heavy deposition of yolk and the colour of the ovary became yellowish. Ova diameter ranged from 1.8 to 3.10 mm with the mean of 2.232 ± 0.11 mm.

Stage-IV Ripe: The ovary became deep yellow and grew in size. A single oil globule was noticed in each ovum when examined through a microscope. The mean diameter of ova was found 3.263 ± 0.09 mm ranged from 1.95 to 3.21 mm.

Stage-V Spent: The ovary became whitish-yellow in colour and seemed to be a loose sac. The ova were of different size, mostly immature ones, with a few ripe ones. The mean diameter of ova was found 0.527 ± 0.05 mm.

Workers like Hossain *et al.*, 1991; Nargis and Hossain, 1992; Azadi *et al.*, 1995; Nabi and Hossain, 1996; Sultana *et al.*, 2001; Hossain *et al.*, 2002; Lenhardt and Cakic 2002; Rahman *et al.*, 2002; Grabowska, 2005; and Ferriz *et al.*, 2007 have studied these stages in different freshwater fishes of Bangladesh and some other countries.

Table 1: Variation in ova diameter in different stages of maturity with distinguishing colour.

Developmental stages of ova	Ova diameter (mm)			Colour
	Minimum	Maximum	Mean \pm SE	
Immature	0.11	0.89	0.581 ± 0.11	Transparent
Maturing	0.39	1.90	0.645 ± 0.16	Opaque
Mature	1.80	3.10	2.232 ± 0.11	Yellowish
Ripe	1.95	3.21	3.263 ± 0.09	Deep Yellow
Spent	0.12	0.84	0.527 ± 0.05	Whitish Yellow

Table 2: Relationships between fecundity (F) and total length (TL), standard length (SL), body depth (BD), total weight (TW), gonadal length (GL) and gonadal weight (GW) of *S. gora* (N=108).

Relationships		Value of 'a'	Value of 'b'	Value of 'r'
Ordinate (Mean \pm SE)	Abscissa (Mean \pm SE)			
F= (23860.12 \pm 4980.21)	TL (127.32 \pm 37.47) mm	- 2987.5	210.87	0.774
	SL (104.96 \pm 32.98) mm	- 909.21	235.98	0.751
	BD (56.45 \pm 19.18) mm	- 550.84	432.45	0.853
	TW (18.47 \pm 7.38) g	16832	380.49	0.619
	GL (48.59 \pm 17.82) mm	2875.20	431.82	0.735
	GW (1.85 \pm 0.50) g	16152	4645.80	0.742

Fecundity: Fecundity is one of the important factors of the biology and population dynamics of fish. The fecundity of *S. gora* varied from 11,213 (fish having TL 89 mm and TW 4.2g) to 35,782 (fish having TL 208 mm and TW 61.3g). The mean fecundity was estimated as 23860.12 \pm 4980.21 (Table 2) which revealed that *S. gora* is a moderately fecund fish. The fecundity of a species is not a constant number, it fluctuates within a certain range and species specific (Shafi *et al.*, 1978; Afroze and Hossain, 1983; Hossain *et al.*, 1992; Rahman *et al.*, 2002). This variation is very common among the same species of fish depending on their size, age and environmental conditions (Lagler *et al.*, 1977). The relationship among fecundity and six important variables *viz.* total length, standard length, body depth, total weight, gonadal length and gonadal weight were established and descriptive statistics of these variables are presented in Table 2. The relationships were found significant and determined to be positively correlated as described by Bagenal, 1978.

Reproductive cycle: The time and season when a species normally breed is termed as the "breeding" or "spawning" season of that species. The breeding season repeats in cyclic order, in which the organism undergoes maturation changes and thereby gets ready to breed again. This repeated phenomenon is known as reproductive cycle (Milton and Arthington, 1983). The reproductive act in some fishes occurs only once in a very short lifetime, while in other fishes, it occurs once in a moderately long life span. Several other species spawn more than once in a year more or less continually (Lagler *et al.*, 1977).

Figure 1: Variation in GLI, GSI and percentage of gravid females of *S. gora* in different months showing reproductive cycle (N=108).

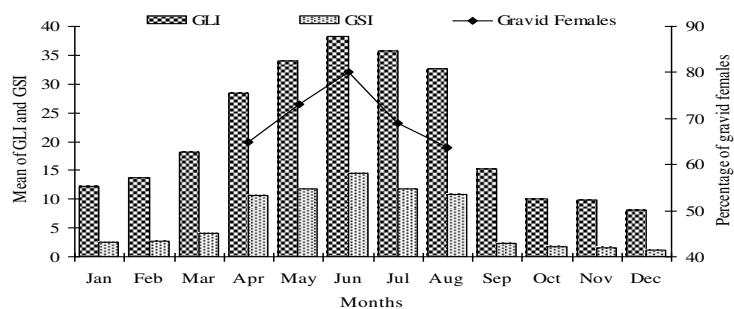


Table 3: Variation in ova diameter of *S. gora* in different months showing reproductive cycle (N=108).

Months	Ova diameter (mm)		
	Minimum	Maximum	Mean±SE
January	0.39	0.94	0.607±0.05
February	0.52	1.01	0.886±0.07
March	0.95	1.90	1.730±0.11
April	1.80	2.70	2.608±0.12
May	1.90	3.10	2.855±0.10
June	1.95	3.15	3.089±0.13
July	1.50	3.09	3.077±0.11
August	1.09	3.21	3.624±0.12
September	0.12	0.84	0.527±0.05
October	0.11	0.70	0.389±0.05
November	0.23	0.75	0.563±0.03
December	0.39	0.89	0.792±0.06

Note: The highlighted months indicate the breeding season

In the present investigation, the gravid females are only observed from April to August. The ranges of GLI and GSI values are found remarkably highest (GLI, 28.45 to 38.19 and GSI, 10.63 to 14.44) from April to August in comparison to other months (GLI, 8.09 to 18.22 and GSI, 1.25 to 4.14). The mean ranges of higher values of ova diameter (2.608±0.12 to 3.624±0.12 mm) are also observed in the same months (Figure 1 and Table 3). All the four methods used to determine the reproductive cycle of *S. gora* focused that the fish breeds in April to August. During this single spawning time the fish spawns for more than once, as mature, ripe and immature ovaries were found in the same size group of females. Most of the freshwater fishes of Bangladesh breed during the monsoon and post-monsoon. The same and similar results have been obtained in different fishes by researchers *viz.* Hossain *et al.* (1992) in *O. pabda*; Nargis and Hossain (1992) in *A. testudineus*; Parween *et al.* (1993) in *E. danricus*; Fatema *et al.* (1997) in *O. bacaila*; Islam *et al.*, (2001) in *S. phasa*; Koc *et al.* (2007) in *L. cephalus*; and Dadzie *et al.* (2008) in *P. niger*. Several dissimilarities were also reported by Hossain *et al.* 2002 in *G. manminna* (January to June); Lorenzo *et al.*, 2002 in *L. mormyrus* (June to December); Fazli *et al.*, 2008 in *L. aurata* (October to December); and Mazlan and Rohaya, 2008 in *P. schlosseri* (June to October) both in marine and freshwater fishes of the world.

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