Uttar Pradesh J. Zool. 35(1) : 15-20, 2015 ISSN 0256-971X

STUDY OF EXTERNAL SEXUAL CHARACTERISTICS AND GONADO-SOMATIC INDEX FOR DETERMINING THE BREEDING SEASON OF *ANABAS TESTUDINEUS*

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The present study attempts to understand the breeding season of *Anabas testudineus* (Bloch) collected from natural environment of Mohanpur in West Bengal. The fishes were length range of 100 to 160 mm and in the weight range of 15 to 62 gm. The total length of male *Anabas* was 107.6 ± 6.8 to 132.0 ± 8 mm and in female was 109.4 ± 5.68 to 154.5 ± 3.41 mm. The weight of the male fish was 13.6 ± 4.15 to 33.75 ± 4.67 gm and in female was 27.6 ± 7.16 to 64.0 ± 2.5 gm. The length of the testes was found different and which was varying from 12.06 ± 0.95 mm to 22 7 ± 1.70 mm. The weight of the testes was increasing from 0.134 ± 0.04 gm in March to 1.52 ± 0.64 gm in June. The length of the ovary in different body size varied from 13.6 ± 2.04 mm to 35.5 ± 2.38 mm. The weight of the ovary increased from 0.81 ± 0.81 in March to 4.72 ± 0.40 gm in June. The Gonado Sornatic Index (GnSI) showed increasing with the approach of breeding season *i.e.* 0.16 ± 0.05 to 2.518 ± 0.21. During the spawning period, length and weight of fish, length of the gonad, weight of the gonad and the GnSI were found gradually increasing upto peak breeding season (May and June).

Key words : *Anabas testudineus,* length, weight, gonad, ovary and Gonado Sornatic Index.

INTRODUCTION

The air breathing teleosts comprise a moderate catch constituting nearly 15% of the total marketable Inland fisheries in India (Prasad *et al.,* 1988) from total India' s Population, the state of West Bengal has 8% population and have less than 3% of land mass. The state of West Bengal has rich water resources which include sewage fed fishery of 4, 083 ha, reservoir fishery of 16,739 ha. The fishery of beels and boars comprises around 41,782 ha (Roy, 1994).

In many cases, captive females failed not only to spawn, but also to complete vitellogenesis and oocyte maturation (Micale & Perdichizzi, 1994). Many commercial and productive fish species are adversely affected in modern times, due to severe fast and undesirable changes detrimental to their surroundings survival and viability. Gradually they are becoming threatened (Roy, 1994). Hence, its need conservation arid proper management for future generation. Therefore, the commercially important threatened species are to be managed, conserved and exploited accordingly (Menon, 1994). For the proper management of the threatened species, the fundamental knowledge on various aspects of biology, reproduction and breeding behaviour are very much necessary. Comparatively more emphasis has been laid on the ovarian aspects than the testes (Agarwal, 1996).

In West Bengal *Anabas* is considered as a lucrative fishery due to it high and regular demand (Roy, 1994). Its price in the market of West Bengal range between Rs. 180 to 200 per kg as carp fetches only Rs. 40 to 60 per kg. *Anabas* sp. is not only a lucrative fishery in the West Bengal but also in the states of North Eastern region. It is highly priced fish range between Rs. 100 to 200 per kg (Roy, 1994). According to Saha (1970), the fish contains high value of physiologically available iron and copper, which are essentially needed for haemoglobin synthesis. In addition, it also contains easily digestible fat of very low melting point and many of essential amino acids. So *Anabas* is considered as valuable item of diet for sick and convalescent with high market demand.

Current investigation was carried out on study of external sexual characteristics and gonado-somatic index for determining the breeding season of *Anabas testudineus* and Morphometry features of the fish like length, weight, gonads length-weight and gonado samatic index during breeding season.

MATERIALS AND METHODS

The study was confined to the laboratory investigation for the breeding season from the natural environment was conducted during January to June 2005 in the Department of Fisheries Resource Management, West Bengal University of Animal and Fishery Sciences, West Bengal.

Collection and Sampling of the Fish Species : Live adults of *A. testudineus* were collected from Mohanpur, Nadia, West Bengal, for study. Sampling was done in the 3rd week of every month in every sampling; four to five male and four to five female fishes were studied in detail *i.e.* Morphometric features like length and weight of the fish, gonads length-weight and gonado samatic index.

Morphological study of the fish : The weight (w/w) of the fishes was measured by balance and standard length of fishes was measured by millimetre scale. Total weight was measured with a monopan balance for individual fish in grams. The length and weight were estimated by millimetre scale and electric balance method respectively. The lobular size, volume and transparency of the gonads were observed keenly.

Gonado Somatic Index ($G_n si$) : Gonado somatic index values were used as indicator of degree of gonadal development. It was found out by employing the following formula.

$$GnSI = \frac{weight\ of\ the\ gonad}{total\ weight\ of\ the\ fish} \times 100$$

Statistical Analysis : The Mean and Standard error statistical methods were used in the present study.

RESULTS AND DISCUSSION

External Morphometry and Morphology for Sex Identification

In the present study, *A. testudineus* was observed from January to June 2005 to understand the changes in the morphometric characters like length and weight of fish as well as length of weight of gonad were studied.

Morphometry of Body

Morphometrical study of *Anabas* showed that irrespective to season the male *Anabas* is smaller in length and weight in comparison to female fish (Table. 1). From this study it can be concluded that the size of the fish is an important criteria for identification of sex.

During the study from January to June, the total length of male *Anabas* was 107.6 ± 6.8 to 132.0 ± 8 mm (Table I) and in female was 109.4 ± 5.68 to 154.5 ± 3.41 mm (Table II). The weight of the male fish was 13.6 ± 4.15 to 33.75 ± 4.67 gm (Table I) and in female was 27.6 ± 7.16 to 64.0 ± 2.5 gm (Table II).

During January and February, the bulginess of belly was found slightly in both the sexes. During breeding season, bulginess of belly was increasing gradually upto the peak breeding season (*i.e.* May to June). Because during breeding season the gonads (*i.e.* males = testes and female = ovary) were maturing by increasing their gonadal material (sperm and egg). So that, both the sexes were increasing the volume of the gonads which in turn increases the size of the belly. But the bulginess of belly was comparatively more in case of female than the male. During this period, the GnSI of female was found more than that of the male. Based on this observation, it was found that there was a bulginess of belly during breeding and non breeding season in both the sexes. But during breeding season the female can be identified based on their bulged belly than that of male. This is agreed with the observation of Mookherjee & Mazumdar (1946) and Das (2002).

Testicular Morphometry

The testes of *A. testudineus* were dissected out and found paired and elongated in the Coelomic Cavity. The length of the testes was found different and which was varying from 12.06±0.95 mm to 22.7±1.70 mm. The weight of the testes was increasing from 0.134±0.04

Table I : Morphometry of body and testes of male *Anabas testudineus.*

Month	Weight of fish (gm)	Length of fish (mm)	Weight of testes (gm)	Length of testes (mm)	GnSI (%)
January	13.6 ±4.15	107.6 ± 6.80	0.0252 ± 0.955	12.06±0.955	0.168±0.05
February	21.00 ± 4.18	111.7 ± 7.87	0.138 ± 0.03	13.0 ± 1.58	0.21 ± 0.05
March	30.60 ± 3.78	118.8 ± 5.70	0.134 ± 0.04	15.2 ± 2.91	0.46 ± 0.10
April	31.25 ± 8.55	122.7 ± 4.43	0.892 ± 0.08	17.5 ± 2.08	0.791 ± 0.12
May	32.50 ± 8.66	124.3 ± 11.5	1.38 ± 0.49	19.5 ± 2.29	1.77 ± 072
June	33.75 ± 4.76	132.0 ± 8.04	1.52 ± 0.64	22.7 ± 1.70	2.518 ± 0.21

Table II : Morphometry of body and testes of female *Anabas testudineus*

Month	Weight of fish (gm)	Length of fish (mm)	Weight of testes (gm)	Length of testes (mm)	GnSI (%)
January	27.6 ± 7.16	109.4 ± 5.68	0.216 ± 0.16	13.6 ± 2.07	072 ± 0.41
February	35.0 ± 7.07	118.8 ± 1.89	026 ± 0.04	17.5 ± 1.29	0.077 ± 0.09
March	40.4 ± 12.74	127.8 ± 5.93	0.81 ± 0.81	22.4 ± 1.51	1.72 ± 1.3
April	47.4 ± 5.02	137.8 ± 2.58	1.47 ± 2.40	26.75 ± 1.30	3.06 ± 1.05
May	58.25 ± 3.30	142.7 ± 5.65	3.50 ± 0.30	29.75 ± 1.5	5.94 ± 1.12
June	64.0 ± 2.58	154.5 ± 3.41	4.72 ± 0.40	35.5 ± 2.83	7.32 ± 0.35

Table III : Relationship between total length and ovary weight and ovary length of female *Anabas testudineus.*

Total length of fish		No. of fish examined	Ovary weight		Ovary length	
Range	Average		Range	Average	Range	Average
100-110	105	4	0.10-0.19	0.145	12-15	13.5
110-120	115	5	0.22-0.513	0.366	16-19	17.5
120-130	125	4	0.15-0.80	0.485	20-23	21.5
130-140	135	5	0.912-2.17	1.54	24-27	25.5
140-150	145	4	2.19-4.10	3.145	28-31	29.5
150-160	155	5	4.2-5.21	4.705	32-37	34.5

gm in March to 1.52 ± 0.64 gm in June (Table I). The gonado sornatic Index (GnSI) showed increasing with the approach of breeding season *i.e.* 0.16 ± 0.05 to 2.518 ± 0.21. The details of testicular morphometery are presented in Table I. In the present study, it was observed that there is an increasing trend in weight and length of testes with respect to the increase of fish length and weight (Table 1).

In teleosts, the paired testes may vary in their morphology and histology. The testes in different species of teleosts may be either fused along the entire length (Khanna & *Pant,* 1966) or completely separated (Dixit & Agarwal, 1974a). Sometimes it is found to be fused at the posterior region reported by Pandey & Misra (1981). In the present study, the testes of *Anabas testudineus* was found separated throughout their length and both the lobes are also equal in size. The colour of the testes was varied from reddish white to creamy white or pinkish hue due to the enhanced of blood circulation. During breeding season, sperm could be oozing out by pressing on the belly. Length and weight of testes was maximum during breeding season (March to June). This study can be corroborated with Dehadrai *et al.* (1973). The colouration of the testes during the study period was varied from reddish white to creamy white or pinkish hue due to the enhanced blood circulation. This observation can be corroborated with the study of Pandey (1987) and Besra (1997). In the present study, the colour of the testes was changing according to the maturation of testes with onset of seasonal rhythm. Due to the release of sperm after breeding season the length, weight and GnSI of the testes were also found reduced. During this period, the (testes is influence by hormones secreted by pituitary gland to go for spermatogenesis for the further breeding season as these was observed by Swarup (1958) in *Gastresteus aculeatus.*

Ovarian Morphometry

The length of the ovary in different body size varied from 13.6 ± 2.04 mm to 35.5 ± 2.38 mm. The weight of the ovary showed increasing trend with the onset of the breeding season (March to June). The weight of the ovary increased from 0.81 ± 0.81 in March to 4.72 ± 0.40 gm in June. The Gonado Somatic Index also showed increasing with the approach of the breeding season, it was 1.72 ±1.3 in March and it increases 7.32 ± 0.35 in June (Table II).

There is one pair of ovary in female. During the breeding period, the Gonado Somatic Index raises much. There is an increase in ova diameter. The reproductive activities in fishes are rhythmic and the breeding phase is restricted to a particular season of the year. However, the morphological structures of ovary are also changes according to the change

in the ovarian cycle, which is influenced by the season. In the present study, the colour of the ovary became less bright during January and February because of the empty lobulation of the ovary. However, from March onwards, the ovary weight, length and GSI are increases gradually (Table.II) This study can be corroborated with the study of Munkittrick *et. al.* (1984), in *Carassius auratus* and Azad (1990) in *A. testudineus.*

Gonado Somatic Index (GnSI):

Gonad somatic index first used in fish by Meien (1927) has been used widely to monitor seasonal or experimental fluctuations in gonadal state of a variety of teleost species. The index assumes a constant arithmetic relationship between gonad and body weights. However, identification of maturity stage and spawning period by using GnSI is of great significance in the life of fish. In the present study, GnSI value of *Anabas* both male and female revealed increasing trend with the onset of the breeding season (Table I & II).

In male the value was 0.168±0.05 in January and it increases gradually upto 2.518±0.21 in June. However in female, it was 0.72±0.41 in January and increases upto 7.32±0.35 in June. There was progressive increase from March to June. This increasing trend in GnSI value indicated that the spawning season of *A. testudineus* in between March to June which is resemble with the observation of Mookherjee & Mazumdar (1946). Based on GnSI, several authors reported the spawning season of different fishes. Belsare (1962) studied the GnSI of *O. punctatus in* the Saugar Lake and found the breeding season starts from March and ends in June, who is corroborated, with the present study. Das (2002) has reported the breeding season of *A. testudineus* starts from June to August. The GnSI reached peak value during the spawning period of the fish, which are useful and sensitive parameters to monitor the gonad maturation. Based on the study, it is concluded that *Anabas* has preparatory phase (January and February) and spawning phase (March to June).

ACKNOWLEDGEMENT

The authors would wish to thank the West Bengal University of Animal and Fishery Sciences (WBUAFS) for providing laboratory facilities and financial support to carry out this experiment in the Laboratory of Fisheries Resource Management.

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(Manuscript Received : March 2015)