Uttar Pradesh J. Zool. 30(3) : 353-357, 2010 ISSN 0256-971X

SEX RATIO OF FRESHWATER CATFISH *NOTOPTERUS NOTOPTERUS* (HAMILTON) FROM BHIMA RIVER, MAHARASHTRA

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Sex ratio of a freshwater catfish, *Notopterus notopterus* (Hamilton) from Bhima river near Bhigwan, Pune District, Maharashtra has been studied. The overall sex ratio males to females were 1.18:1.0. Males outnumbered females, although the sex ratio showed no significant deviation in the population. Males outnumbered females before spawning (May – June). During peak spawning (August – September) females outnumbered males. Males outnumbered females from 210-259 mm, whereas females outnumbered males from 260- 289 mm. In larger length groups 290- 329 mm only females were recorded. Males were not recorded above 289mm length.

Key words : Sex ratio, *Notopterus notopterus*, spawning, Bhima river.

INTRODUCTION

Sex ratio indicates the proportion of males to females in a population. In nature, the ratio is expected to be 1 : 1. The study on sex ratio throws light on aspects such as sex viability and segregation or aggregation of sexes according to breeding behavior. A knowledge of sex ratio in population of fishes is essential in the management of fishery since it is essential to derive means of ensuring a proportional fishing of the two sexes (Pillay, 1954). Earlier studies on these lines were made by Kumthekar (1988), Anantha *et al.* (1995), Sharma *et al.* (1996), Raje (2003), Pawar & Mane (2006) and Shendge *et al.* (2007).

Notopterus notopterus is one of the commonest catfishes of Western India and abundant in different types of freshwaters. The literature on the age, growth and sex ratio of catfishes of the Indian subcontinent is scares (Nair, 1949; Radhakrishnan, 1954; Qasim & Bhatt, 1964; Reddy, 1981). Therefore, an attempt has been made to investigate the sex ratio of *Notopterus notopterus* of the river Bhima a tributary of river Godavari, Maharashtra.

MATERIALS AND METHODS

Fresh and healthy samples of *Notopterus notopterus* were collected from catches of fishermen involved in traditional fishery in Bhima river (Latitude 18^0 17' N and Longitude 74^0 45' E), near Bhigwan, Pune District, Maharashtra, during April 2008 to March 2009.

The collected samples were brought to the laboratory and biological details such as length, sex and stage of maturity were determined. Length was measured to the nearest mm. In the present study a total of 168 specimens comprising 91 males and 77 females were examined covering a wide range of sizes. In the present study the sex was

ascertained by examining the gonads, since *Notopterus notopterus* does not exhibit external sexual differences. The number of males and females collected monthly were recorded over a period of 12 months. The data were then pooled monthwise and lengthwise with a view to study the distribution of sexes according to season and size of the fish. The strength of males and females were then calculated for each month as well as for each length group of 10 mm size interval. In order to find out whether the males and females were equally represented in the population, the difference between the observed ratio and the expected ratio was ascertained by the chi-square test. The data are given in the Tables I and II.

RESULTS AND DISCUSSION

The sex ratio was calculated for various months and for different length groups (Table I & II). The sex ratio for each month showed that in many months, the number of males exceeded the number of females. During May and June the males outnumbered females. It was also observed that during non-breeding season (March, October and November) males outnumbered females. This might be to differential sex mortality or other physiological factors. The proportion of males was highest during May, June, October and November. The observation could be attributed to active movements of males for spawning. On the contrary, the proportion of females was higher during July, December and January which could be due to possibility that spent males must have left the spawning ground before the females, hence reduction in their relative number. Similar observations were earlier reported by Menezes (1980) in *Pseudorhombus arsius*; Surendra Babu & Neelakantan (1983) in *Liza parsia*; Shamsul Hoda (1995) in *Acentrogobius viridipunctatus*; Raje (2003) in *Tachysurus caelatus* and *Tachysurus tenuispinis* and Shendge *et al.* (2007) in *Oreochromis mossambicus*. It was interesting to note that the sex ratio was 1:1 in April and almost 1:1 in August and September. This may indicate that the sex ratio of 1:1 ensures the success of spawning. Similar findings were reported by Sharma *et al.* (1996) in *Mystus cavasius*, Raje (2003) in *Tachysurus caelatus* and *Tachysurus tenuispinis* and Sarma *et al.* (2007) in *Puntius gelius*.

During the present study it was found that, out of 168 specimens, 91 (54.17%) were males and 77 (45.83%) were females. The percentage showed that the two sexes were not present in equal proportion and there was a preponderance of males over females by about 8.34%. The overall sex ratio of males to females was 1.18:1.0 and it was not significantly different from expected 1:1 ratio. This coincides with the earlier findings of Menezes (1980) in *Psettodes erumei* and *Pseudorhombus arsius* from Goa region. Raje (2003) reported a sex ratio of 1.37 males : 1.0 females in *Tachysurus caelatus* and 1.18 males to 1.0 females in *Tachysurus tenuispinis* from Veraval, Gujrat. The chi-square test showed that the observed ratio for the total catch was non-significant and hence the hypothetical value was 1:1.

The variations in the ratios occurred before July and after December. After the peak spawning period (*i.e.* in August and January) more females than males were caught. Cooper (1983) observed that the metabolic strain of spawning being greater in older males than in older females there may be greater mortality among males which mature earlier than the females. Since more males of *Notopterus notopterus* remained in breeding longer than females, the metabolic strain of spawning and consequent mortality

Table I : Sex Ratio of *Notopterus notopterus* in different months.

Month & Year	Total	Male	Female	Ratio (M:F)	Expected no. in each sex	Chi-square values	Remarks
Apr., 2008	10	5	5	1.0:1.0			
		18	8		13	3.846	NS
May	16	13	3	4.3:1.0			
June	19	15	4	3.75:1	9.5	6.3684	NS
July	14	4	10	2.5:1.0	7.0	2.5714	NS
Aug	15	7	8	1.0:1.4	7.5	0.0666	NS
Sept	15	7	8	1.0:1.4	7.5	0.0666	NS
Oct	15	9	6	1.5:1.0	7.5	0.6000	NS
Nov	14	9	5	1.0:1.8	7.0	1.1428	NS
Dec	15	6	9	1.0:1.5	7.5	0.6000	NS
Jan., 2009	12	5	7	1.0:1.4	6.0	0.3333	NS
Feb	10	3	7	1.0:2.3			
		11	12		11.5	0.043	NS
March	13	8	5	1.6:1.0			
Total	**168**	**91**	**77**	**1.18:1**	**84.0**	**15.6386**	

NS = Non-significant
Sum of 10 Chi-square = 15.6386
Chi-square χ^2 Table value Chi-square n-1, 5%
= χ^2 9, 0.05% = 16.919, Non-significant.

Table II : Sex Ratio of *Notopterus notopterus* in relation to various length groups.

Length group (mm)	Total	Male	Female	Expected no. in each sex	Chi-square values	Remarks
210-219	7	7	0			
		15	3	9	8.0000	NS
220-229	11	8	3			
230-239	13	3	4	6.5	1.9230	NS
240-249	28	20	8	14.0	5.1728	NS
250-259	22	17	5	11.0	6.5454	NS
260-269	30	13	17	15.0	0.5333	NS
270-279	20	8	12	10.0	0.8000	NS
280-289	16	7	9	8.0	0.2500	NS
290-299	10	0	10			
300-309	6	0	6	21		Sig
310-319	2	0	2	10.5	21.0000	
320-329	3	0	3			
Total	**168**	**91**	**77**	**84.0**	**44.1945**	

NS = Non-significant, Sig = Significant
Sum of 8 Chi-square = 44.1945
Chi-square χ^2 Table value Chi-square n-1, 5%
= χ^2 7, 0.05% = 14.057, Significant

in older males may be greater than that in older females. This may explain the preponderance of females over males during August, September, January and February.

The data on sex ratio in relation to length (Table II) showed that the males outnumbered the females from 210-259 mm length groups. However, the chi-square test showed that the difference in their numbers was not significant. From 260-329 mm length group the proportionate number of females increased with the increasing length and in the last four length groups, there were only females. Males were not recorded above 259 mm in the river, presumably due to greater mortalities among mature males. Similar works based on the analysis of sex ratio with respect to size have also reported the dominance of females over males in the population of *Mystus cavasius* (Sharma *et al.*, 1996), *Macrones bleekeri* (Pawar & Mane, 2006) and *Puntius gelius* (Sarma *et al.*, 2007).

Information on sex ratio of *Notopterus notopterus* from Bhima river presents a true picture of sex ratio. Males outnumbered females before spawning whereas females outnumbered males after spawning. In smaller length groups only males were recorded, whereas in larger length groups only females were recorded. The sex ratio changes in *Notopterus notopterus* may be utilized in describing the population characteristics, possible catch size at a given time and locality and ensuring a proportional fishing of the two sexes.

ACKNOWLEDGEMENT

The authors are thankful to the Principal, T.C. College, Baramati-413 102, Dist. Pune, Maharashtra for providing the necessary facilities. Author ANS is thankful to BCUD University, Pune for sanctioning research project for 2008-09.

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