



STUDIES ON THE MATURITY AND SPAWNING OF *MACRONES BLEEKERI* FROM VISAPUR RESERVOIR, AHMEDNAGAR, MAHARASHTRA

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ABSTRACT

Maturation and spawning biological study of a fresh water catfish *Macrones bleekeri* from Visapur reservoir revealed that, there are three distinct stages of ova viz, immature, maturing and matured, respectively with ova diameters of stage I and II oocytes 3.891 ± 0.3723 to $6.9233 \pm 0.2877 \mu\text{m}$, maturing primary oocytes (stage III) 4.675 ± 0.5187 to $8.580 \pm 0.5389 \mu\text{m}$, secondary oocytes (stage IV) 6.5725 ± 0.6490 to $10.3984 \pm 0.9189 \mu\text{m}$, and matured stage V oocytes 51.7333 ± 3.017 to $58.933 \pm 3.4089 \mu\text{m}$, stage VI oocytes showed 57.8667 ± 3.1213 to $87.4667 \pm 6.6398 \mu\text{m}$. Running gonads indicated a peak spawning during June- August. Females were abundant during peak spawning period (June- August). Size at first sexual maturity is 100 mm. in males and 105 mm in females, respectively.

KEY WORDS: Maturity, spawning, *M. bleekeri*, Visapur reservoir.

INTRODUCTION

Knowledge of the gonadal cycles and their functional mechanisms in fishes is of importance in the successful management of fisheries (Bhatti and Al- Daham, 1978). The study of gonad maturation in teleosts has been directed mainly at species occurring in temperate regions of the world and there have been few detailed investigation of tropical species (Cyrus and Blaber, 1984). Structural and histological changes in the gonads have been recorded for some species. From the available literature it is apparent that no work on the reproductive cycle has so far been carried out on *Macrones bleekeri*. It was therefore, decided to study the histomorphology and annual cyclical changes in the ovarian activity of *Macrones bleekeri*. Knowledge of the minimum size at first sexual maturity is beneficial in adjusting mesh size of fishing gear in order to ensure that smaller fish which have not spawned even once may have an opportunity to escape (Usha and Nair, 1994). *Macrones bleekeri* is a small sized teleost fish and to introduce in aquaculture, it was felt very essential to determine the size at first sexual maturity.

MATERIALS & METHOD

Fresh specimens were collected from Visapur reservoir. In the study period, a total of 480 fishes (120-130mm in length) were collected and brought to the laboratory. The paired ovaries of each fish were dissected and middle piece was drawn and fixed in Bouin's fluid for histological studies. The total length and weight of the specimens were recorded to the nearest cm. and g, respectively. The wet weight of dissected ovaries was obtained and their total length was measured to the nearest mm. In situ, maturity stages were determined visually, based on size, colour, texture and vascularization (Vazzoler, 1996), prior to

fixing the ovaries in fixative. For microscopic determinations of maturity stages, cross-sections of the ovaries, embedded in paraffin blocks, cut to 7 μm thickness, and stained with Mallory's triple stain and were analyzed. For the study of size at first sexual maturity, 20 fishes (70-150 mm.) were collected at each sampling, composed of males and females. The gonad of these fishes was immediately processed for routine histological study as above.

RESULTS & DISCUSSION

Macroscopic / Morphological characterization of the gonads:- The ovaries of *M. bleekeri* are paired, elongated tubular located above the intestine and ventral to the swimbladder. Ovaries occupy nearly half of the abdominal cavity and are attached by thin mesenteries, the mesovarium to the viscera and swimbladder. The two ovaries are joined at their base by short oviduct. Immature ovaries are smooth pinkish transparent organs, but when matured they turn yellowish with a granular surface and are nearly round. Both the lobes of the ovary are almost similar in size, but in some case the right one being slightly longer than the left (about 8 to 10mm longer).

Histological stages of development

Six microscopic histological stages were distinguished among the gonads (Table. 1).

Stage-I: (Gametogenic)-Ovary contained oogonia and a large number of early and late perinucleolar oocytes.

Stage-II: (Maturing) - Ovary contained reserve fund oocytes, yolk vesicle oocytes and some yolk granule oocytes.

Stage-III: (Mature) Ovary contained reserve fund oocytes, early yolk granule oocytes, late yolk granule oocytes and some yolk vesicle oocytes were also present.

Stage-IV: (Spawning)- There were only early and late yolk granule oocytes and some degenerating oocytes were also seen.

Stage-V: (Recovery)- Ovary contained only germ cells and some oogonia.

Stage-I: (Gametogenic)- Ovaries thin and light pink in colour. Ovaries consist of germ cells in different phases of development, germinal epithelium, connective tissue, stroma cells and blood vessels. The matrix of the ovary has a number of fingers like folds, the ovigerous lamellae, containing germ cells. The lamellae project into the lumen of the ovary. The germ cells ranged from 1.79 ± 0.17 to 2.29 ± 0.20 μm . and were of larger size in December and January compare to those formed in August and November. Germ cells were not seen from February to July and during September and October.

In stage I, the oogonia arise from the germinal epithelium. Each oogonium is rounded and contains very little cytoplasm and a prominent nucleus with one or two nucleoli. Both the cytoplasm and the nucleus are chromophobic. The diameter of the oogonia ranged from 2.86 ± 0.41 to 4.06 ± 0.58 μm and nuclear diameter ranged from 1.49 ± 0.17 to 2.01 ± 0.19 μm (Table.1).

As the development proceeds the nucleus subsequently enlarges and contains more nucleoli close to the nuclear membrane. This is early perinuclear stage (stage II). This stage is characterised by a clear zonation of cytoplasm (outer light and inner dense region).

In the late perinuclear stage i.e. stage III, oocytes become more regular in shape. Oocytes contain small vacuoles in the cytoplasm. The immature oocytes of stage II and III are small, and ranged from 3.89 ± 0.37 to 6.92 ± 0.29 μm in diameter. Early and late perinuclear oocytes were small from September to November and their size increased from December to August. Over all, the size was comparatively larger during March to August. Similar variation in nuclear diameter was observed. The nuclei of immature oocytes ranged from 1.76 ± 0.19 to 3.22 ± 0.45 μm in diameter.

Stage-II: (Maturing)- As the ovaries mature they become opaque and light yellow and ova are visible to the naked eye through the ovarian wall. In stage IV, three groups of ova – Reserve fund, Yolk vesicle oocytes (mature ova completely opaque with heavy deposition of yolk) and yolk granule oocytes are observed.

The diameter of maturing oocytes of stage IV ranged from 4.68 ± 0.52 to 8.58 ± 0.54 μm and the diameter of secondary oocytes ranged from 6.57 ± 0.65 to 10.40 ± 0.92 μm . The nucleus of primary oocytes measures 2.26 ± 0.30 to 4.3 ± 0.41 μm and the nuclear diameter of secondary oocytes ranged from 3.22 ± 0.38 to 6.63 ± 0.24 μm , respectively. Stage IV oocytes showed maximum diameter on December, March and July. In general the diameter was maximum from May to August then the rest of the period. In September and October oocytes were smaller in size.

Stage-III: (Mature) Ovaries yellow, occupying half of the body cavity. Ova visible to naked eye through ovarian wall. Four groups of ova – immature, maturing, early and late mature.

The maturing oocytes transforms in to mature ovum. Stage V and stage VI, early yolk granule and late yolk granule, respectively, by attaining characters like formation of yolk

granules, yolk vesicles with the advancement of yolk granule stage, in some cases the yolk granules appears to coalesce to form larger, tightly packed granules. The follicular cells undergo hypertrophy. Deposition of both the types of yolk is completed. Ooplasm of the mature ovum becomes acidophilic. The diameter of stage V oocytes ranged from 51.73 ± 3.02 to 58.93 ± 3.41 μm and stage VI oocytes showed diameter from 57.87 ± 3.12 to 87.47 ± 6.64 μm .

Almost uniform cell diameter of stage V oocytes was observed from February to April. Vacuoles diameter in these cells was larger in April than in February and March. Yolk granules in some oocytes of stage V were also observed in March and April. Stage VI oocytes which dominated the entire ovaries during May, June and July showed largest diameter in May and smallest in July. No vacuoles were seen and yolk granules diameter was almost uniform.

Stage-IV: (Spawning) Ovaries flabby and collapsed, occupy varying amount of space in the body cavity. The lamellar organization continued to diminish, as did the intercellular lumen. The most important feature of this stage was the presence of some postovulatory follicles. This stage showed some early and late yolk granule oocytes to be spawned later; some degenerating oocytes were also seen. A large number of atretias were observed. Atretia was found in both the oocytes i.e. early and late yolk granule oocytes. Because some of the ova are extruded, the remaining ova are not as closely packed together. The follicular cells associated with the extruded ova begin to hypertrophy and to fill the emptied space.

Stage-V: (Recovery)-Ovaries completely collapsed shrunken, occupying little space of the body cavity. Ovary contained only germ cells and some oogonia.

The overall study showed that by September the ovary contained large number of stage I, II and III oocytes. In October the oocytes in stage IV and V started to appear while from March onwards stage VI began to appears in the fishes sampled. Overall stage IV, V and VI were mostly common during March to July. This indicated commencement of vitellogenesis from March onwards with the appearance of many yolk vesicle stage oocytes. In May, percentage of yolky oocytes rose. However, indication of spawning was observed in fishes sampled during June and July. Yolky oocytes showed abrupt decrease in these months. Atretic oocytes of various stages also observed from August till December.

From above study it can be concluded that *M. bleekeri* spawned in June, July and August, and as the mature oocytes are released batches of immature ova were produced during rest of the period.

Size at first sexual maturity – The percentage occurrence of mature males and females in each size group was calculated for different stages of maturity (Fig. 1). The minimum size at which *M. bleekeri* attains maturity was determined for both males and females. The percentage occurrence of mature male and female increased steadily with length. 22.5 % males were mature at 85 mm, 39 % at 95 mm, 50 % at 100 mm, 62.6 % at 115 mm, 74 % at 125 mm, 87.3 % at 130 mm and all the males were matured at 150 mm. Similarly 24.3 % females were matured at 85 mm, 40.6 % at 95 mm, 50% at 105 mm, 65.4 % at 120

mm, 78 % at 130 mm, 93 % at 145 mm and all the females mature at 150 mm. Since 50 % of the specimens were matured at 100 mm and 105 mm in males and females, respectively, it can be stated that first sexual maturity is attained at the length of 100 mm and 105 mm in males and females, respectively. When compared with females, males matured at a smaller length (100 mm). Similar observations have been made by many authors that males have been found to mature at a smaller length than females (Royce, 1972, N. Veerappan et al., 1997). However, some authors have claimed that females mature earlier than males (Singh, 1989 and C.S. Anantha et.al., 1995).

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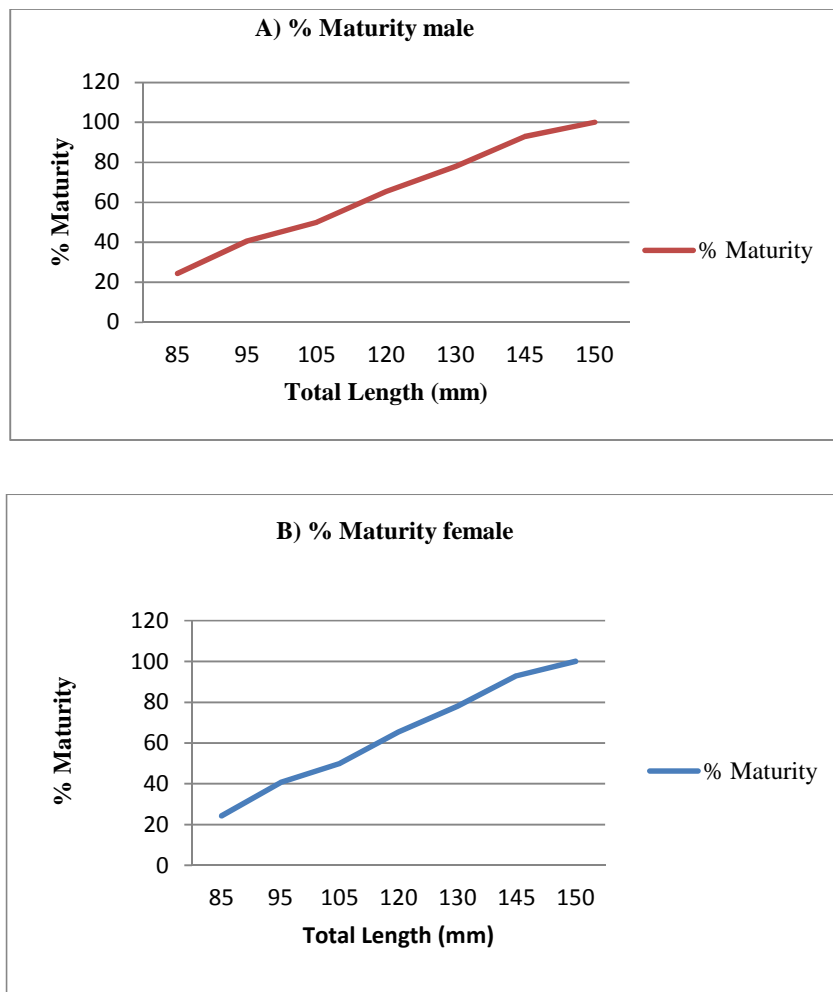


FIGURE 1: Size at first sexual maturity A) Male B) Female

TABLE I: Showing measurements of the reproducing cells from female gonad of *M.bleakeri*. (Values are in μm ; X \pm S.D:n=6).

Month	Germ cell diameter	Oogonia		Oocytes Stage-I and II		Stage-III Oocyte	
		Cell diameter	Nuclear diameter	Cell diameter	Nuclear diameter	Cell diameter	Nuclear diameter
Nov	1.7953 \pm 0.1721	3.4925 \pm 0.3564	1.7325 \pm 0.3553	3.8913 \pm 0.3723	1.8142 \pm 0.2481	6.9575 \pm 0.3356	3.6163 \pm 0.2807
Dec	2.1355 \pm 0.1202	3.85 \pm 0.4152	1.7825 \pm 0.2265	5.28 \pm 0.3854	2.255 \pm 0.1959	8.4149 \pm 0.5493	3.8354 \pm 0.4342
Jan	2.2916 \pm 0.2030	3.91 \pm 0.2537	2.0075 \pm 0.1912	4.2213 \pm 0.3188	1.8013 \pm 0.1778	6.7925 \pm 0.5924	2.9838 \pm 0.3755
Feb	-	3.8225 \pm 0.3860	1.7325 \pm 0.3265	5.115 \pm 0.5491	2.365 \pm 0.5422	5.7475 \pm 0.4988	3.4925 \pm 0.4063
Mar	-	3.795 \pm 0.3159	1.65 \pm 0.2694	6.325 \pm 0.4177	3.2175 \pm 0.4506	8.1115 \pm 0.5251	3.8913 \pm 0.3371
Apr	-	3.795 \pm 0.3159	1.76 \pm 0.1556	6.9233 \pm 0.2877	1.76 \pm 0.1959	8.580 \pm 0.5389	3.4375 \pm 0.6204
May	-	3.74 \pm 0.3648	1.815 \pm 0.1650	6.3533 \pm 0.7118	2.7767 \pm 0.2015	5.7458 \pm 0.6139	2.8333 \pm 0.2753
June	-	-	-	-	-	-	-
July	-	-	-	5.72 \pm 0.5275	3.1083 \pm 0.4088	6.5717 \pm 0.6639	4.3183 \pm 0.4097
Aug	1.9274 \pm 0.1659	4.0563 \pm 0.5788	1.5125 \pm 0.3773	6.1604 \pm 0.4331	3.1488 \pm 0.3831	6.9025 \pm 0.4499	3.6025 \pm 0.4094
Sept	-	2.86 \pm 0.4116	1.485 \pm 0.1650	3.905 \pm 0.5189	1.925 \pm 0.2962	4.675 \pm 0.5187	2.255 \pm 0.2962
Oct	-	3.245 \pm 0.0518	1.595 \pm 0.4434	4.1525 \pm 0.2413	2.31 \pm 0.2694	5.445 \pm 0.3689	3.3 \pm 0.3810

Stage-IV Oocyte	Cell diameter	Nuclear diameter	Cell diameter	Stage-V and VI Oocyte	
				Vacuoles diameter	Yolk granule diameter
	8.2363 \pm 0.3391	4.4825 \pm 0.3897	-	-	-
	10.3984 \pm 0.9189	4.2487 \pm 0.2701	-	-	-
	8.69 \pm 0.6037	4.6616 \pm 0.3778	-	-	-
	8.58 \pm 0.5892	4.1113 \pm 0.3854	*51.7333 \pm 3.0170	0.4733 \pm 0.1041	-
	10.01 \pm 0.5609	4.9225 \pm 0.2002	*57.8666 \pm 8.0378	0.4872 \pm 0.1078	1.002 \pm 0.2156
	-	-	*58.9333 \pm 3.4089	1.0438 \pm 0.1526	1.3083 \pm 0.2857
	9.075 \pm 0.5636	6.6283 \pm 0.2407	87.4667 \pm 6.6398	-	1.336 \pm 0.2156
	9.2399 \pm 0.4260	4.7575 \pm 0.3357	61.3333 \pm 2.3851	-	1.3082 \pm 0.3532
	10.395 \pm 0.5636	4.125 \pm 0.3690	57.8667 \pm 3.1213	-	1.4052 \pm 0.2649
	9.5975 \pm 0.5032	5.6106 \pm 0.1655	-	-	-
	6.5725 \pm 0.6490	3.218 \pm 0.3781	-	-	-
	6.6 \pm 0.1905	4.098 \pm 0.2764	-	-	-

*=Oocytes stage V

=Oocytes stage VI