

Breeding Biology of the Grey Mullet, *Valamugil cunnesius* from the Ashtamudi Estuary, Southwest Coast of India

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Breeding biology of *Valamugil cunnesius* (Val.), inhabiting the Ashtamudi estuary along the southwest coast of India, was studied in detail. Six maturity stages viz., immature, maturing-I, maturing-II, mature, oozing and spent were identified. Relatively higher Gonado-somatic indices were observed during July to December. Results revealed that *V. cunnesius* in the Ashtamudi waters has a prolonged spawning season which extends from July to December. The size at first maturity for males is around 139 mm and for females around 148 mm (total length). The sex-ratio of males to females was 1:1.5.

Key words : *Valamugil cunnesius*, grey mullet, breeding biology, India - southwest.

Mulletts are of great economic value and importance from the point of view of aquaculture, but details of their biological aspects from the southwest coast of India are still incomplete. Ashtamudi, the second largest estuarine system in Kerala contributes considerably to the mullet fishery. Studies have revealed that *Valamugil cunnesius* (Val.) is a common species in this estuarine system (Krishnakumar, 1992). Available works on the biological aspects of this species are those of Sarojini (1958) from the Bengal waters and Sathyashree (1981) from the Porto Novo area. Hence an attempt is made in the present paper to study the breeding biology of *V. cunnesius* inhabiting the Ashtamudi estuary (8°53' - 9°02' N lat., 76°31' - 76°41' E long).

Materials and Methods

Fortnightly samples of *V. cunnesius* were collected for a period of one year (September 1980 - August 1981) from the Ashtamudi estuary. Sampling could not be done during second fortnight of June and first fortnight of July. Total length, weight, sex and stage of maturity of each fish were recorded. Ova diameter was measured with an ocular micrometer having a magnification of 15.26 μ to each micrometer division (MD). Ova measuring 3 MD and above only were taken into consideration for drawing percentage frequencies. Ova diameter frequencies were classified into 2 MD groups. Size at first maturity was determined by tabulating the percentage occurrence of mature and immature specimens in different length groups. Stages I & II were treated as immature. To

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delineate the spawning season, the monthly percentage occurrence of fish in different stages of maturity was recorded. Applying the method of June (1953) and Yuen (1955), gonado-somatic indices (GSI) were calculated.

Results and Discussion

Six maturity stages were identified on the basis of the colour, shape and size of the gonads (Table 1).

Table 1. Maturity stages of *Valamugil cunnesius*

Stage I (Immature) :

Ovary dull brownish, occupying 1/3 to 1/2 body cavity, Ova irregular and transparent. Testes whitish, thread like occupying 1/2 body cavity.

Stage II (Maturing I) :

Ovary dull brownish, occupying 1/2 to 2/3 body cavity. Ova round, partially yolk laden. Testes whitish occupying 1/2 to 2/3 body cavity.

Stage III (Maturing II) :

Ovary yellowish occupying 1/3 to 3/4 body cavity. Ova round and fully laden with yolk. Testes whitish occupying 2/3 to 3/4 body cavity.

Stage IV (Mature) :

Ovary yellowish extending almost the entire body cavity with some ova visible to the exterior. Yolk vacuolated, peri-vitelline space present. Testes creamy white occupying 3/4 of the body cavity.

Stage V (Oozing) :

Ovary yellowish occupying the entire body cavity; testes creamy white in the oozing stage.

Stage VI (Spent) :

Ovary flaccid with blood vessels prominent over the surface, occupying about 1/2 the body cavity. A few degenerating ova often occur. Testes flaccid occupying about 1/2 body cavity.

Percentage frequencies of ova diameter measurements at different maturity stages are presented in Fig. 1. In stage I, there are only immature ova and majority of them measured 3-4 MD. The largest ova measured 14 MD. In stage II, the size of ova ranged between 3-22 MD. There are

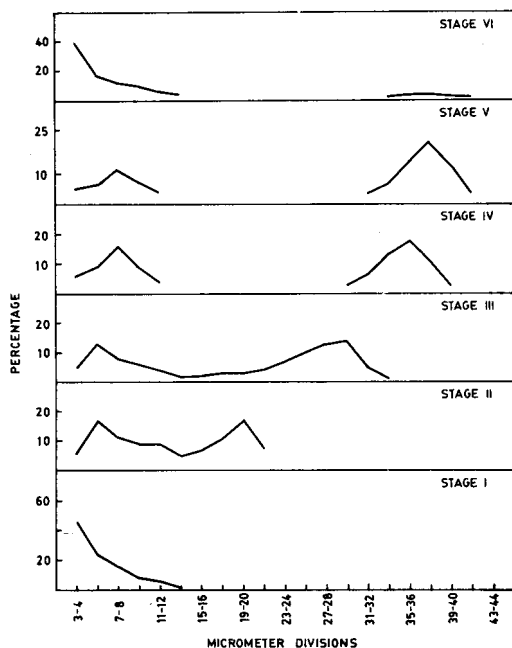


Fig. 1. Ova diameter percentage frequency of different maturity stages of *Valamugil cunnesius*.

2 distinct batches of ova at this stage, the first representing the immature general stock with a mode at 5-6 MD and the second of developing ova with a mode at 19-20 MD. In stage III, the smallest ova measured 3 MD and the largest 34 MD. At this stage the maturing batch of ova was distinct from the immature stock with a mode at 29-30 MD. In stage IV, the mature ova get separated completely from the general stock and have a mode at 35-36 MD. The maximum size of ova attained in this stage is 40 MD. Stage V was the most advanced stage of ova development. The mature batch of ova is well differentiated from the general stock with a mode at 37-38 MD. The largest ova measured 42 MD. In stage VI further development of the ova was not evident.

The month-wise percentage occurrence of different maturity stages of

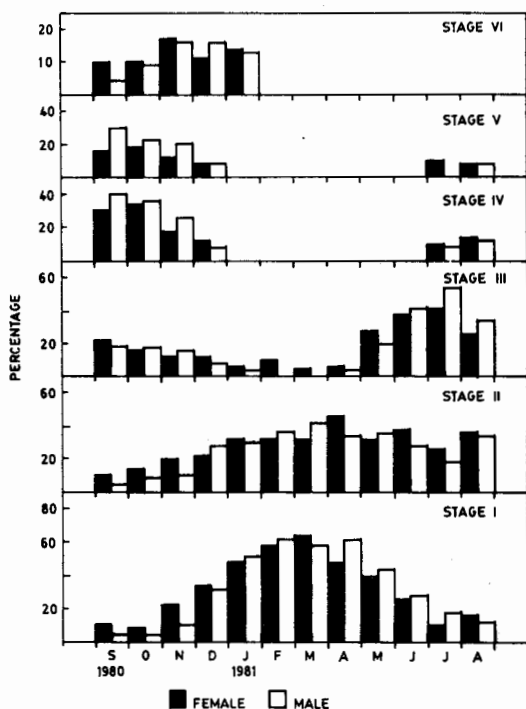


Fig. 2. Monthly percentage occurrence of different stages of maturity of males and females in *Valamugil cunnesius*.

V. cunnesius is shown in Fig. 2. Occurrence of ripe and oozing stages (stage IV and V) can be considered as an indication of spawning. In the present study ripe and oozing stages occurred during July - December with a peak during September - November. Monthly variations in the GSI values of males and females are illustrated in Fig. 3. The lowest GSI value for the males was recorded in February and that for females in March. Peak values were observed during September and October in males and females, respectively. In general, values were low during January to April in both sexes and picked up from May onwards. Relatively higher GSI values were observed during July to December. Low GSI values encountered during January to April were due to the

occurrence of large number of immature and spent females and higher values observed during July to December were due to the presence of ripe gonads. Presence of ripe and oozing stages of gonads and higher GSI values during July to December clearly indicated that *V. cunnesius* in the Ashtamudi waters has a prolonged spawning season which extends from July to December. Sarojini (1958) who studied the biology of this species from the Bengal waters concluded that the spawning season lasts from May-June to July-August. However, in Porto Novo waters along the southeast coast of India this species breeds during January to May (Sathyashree, 1981).

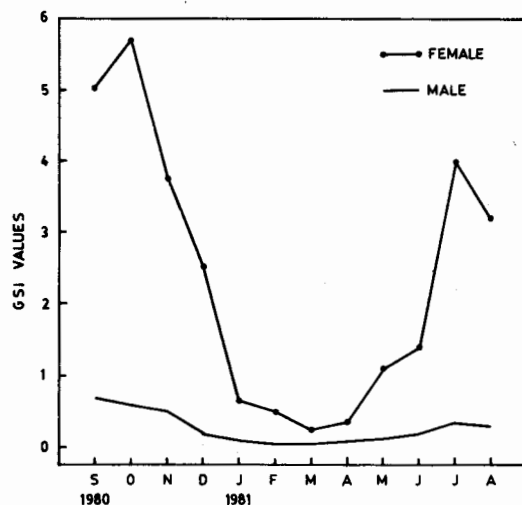


Fig. 3. Gonado-somatic indices of males and females of *Valamugil cunnesius*.

Percentage occurrence of mature males and females in different size groups (total length; 10 mm intervals) is presented in Fig. 4. The mature males first appeared in 131-140 mm length group and the percentage of mature males increased up to 181-190 mm length group when all the males examined were mature. Mature females first appeared in 141-150 mm length group and the percentage increased with length

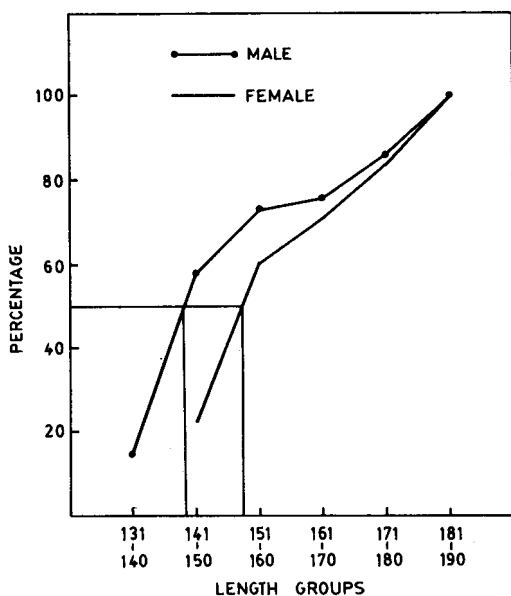


Fig. 4. Length at first maturity (total length) in males and females of *Valamugil cunnesius*.

up to 181-190 mm when all females were found to be mature. The length at which 50% of the fish attain maturity is regarded as the length at first maturity (Kagwade, 1968). The 50% maturity is plotted in the

Table 2. Sex-ratio of *Valamugil cunnesius* from September 1980 to August 1981 and Chi-square values

Months	Males	Females	Ratio	Chi-square value
September 1980	23	37	1:1.6	1.63
October	22	38	1:1.7	2.13
November	19	41	1:2.2	4.03*
December	25	35	1:1.4	0.83
January 1981	23	37	1:1.6	1.63
February	27	31	1:1.1	0.14
March	24	34	1:1.4	0.86
April	29	31	1:1.1	0.03
May	25	35	1:1.4	0.83
June	14	16	1:1.1	0.06
July	11	19	1:1.7	1.07
August	24	36	1:1.5	1.20
Total	266	390	1:1.5	11.72*

* Significant at 5% level

figure and it is observed that the size at first maturity (total length) for males is around 139 mm and for females around 148 mm. The males attained maturity earlier than the females - an observation similar to the findings of Sathyashree (1981), Das (1978), Natarajan & Reddy (1980) and Kurup & Samuel (1983). Sathyashree (1981) observed the size at first maturity (total length) as 137 mm for males and 151 mm for females in Porto Novo waters. In Bengal waters the smallest maturing fish obtained was 130 mm long (Sarojini, 1958).

Monthly sex-ratio of *V. cunnesius* is given in Table 2 along with results of Chi-square analysis. Of the 656 specimens examined, 390 were females and 266 males. It was found that in all the months, the females outnumbered the males. Chi-square analysis has shown that sex-ratio was significantly different ($p < 0.5$) in the month of November. The sex-ratio of males to females for the entire period was found to be 1:1.5 and the difference was significant at 0.05 level. Similar observations of female dominance was also reported by Sathyashree (1981) who noticed a ratio of 1:1.17 in *V. cunnesius*.

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