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Maturation and Spawning in the Pearl Spot *Etroplus suratensis* (Bloch)

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The gonads of *Etroplus suratensis* (Bloch) have been classified into five stages of maturity. The fish spawns twice in a year in the Veli lake, Trivandrum. The first period is short, lasting for two months during June and July and the second is apparently prolonged, being about five months from November to March, with a peak in January. This is confirmed by the examination of intraovarian eggs and the cyclic changes in the maturation and depletion of gonads. The gonadosomatic index of both the sexes shows the highest values in May and October. The size at first maturity for males and females has been fixed at 140 mm and 144 mm respectively. Males are generally larger than females.

Key Words: **Maturation, Spawning,** *Etroplus suratensis*

Introduction

The pearl spot, *Etroplus suratensis* (Bloch) is a well known indigenous cichlid esteemed locally as a delicious food fish which can be cultured economically for commercial purposes. Despite its economic importance and wide distribution all along the brackish and freshwater systems along the South-West Coast, no attempt has, hitherto been made to study the detailed reproductive biology. Brief reports on some preliminary observations on the breeding habits of *E. suratensis* are available (Panikkar 1920, 1924, Ward & Wymann 1977). Nevertheless, detailed information on the various aspects of its reproductive biology is lacking except for some general observations (Bhaskaran 1946, Job et al. 1947, Alikunhi 1957, Menon et al. 1959, Prasadam 1971). The present study, therefore, attempts to furnish the needed information on the maturity stages of the gonads, growth of ova from immature to mature stages, spawning season, spawning frequency, gonado-somatic index and size at first maturity of this cichlid inhabiting the Veli lake, a brackish water habitat near Trivandrum.

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Materials and Methods

Regular fortnightly samples were collected for a period of one year (March 1977 to February 1978). 360 females and 320 males ranging from 55 to 224 mm in total length, were examined through various months for the total length, weight, state of maturity and the length and weight of the gonad. The maturity stages of the females were determined based on the colour, shape, size and the microscopic structure of the fresh ovary.

Test measurements of ova from different regions of the ovary showed no difference in their relative size and hence about 400 ova from the middle portion of each ovary were found to be sufficient to represent all stages. Ova diameter frequency polygons were drawn after grouping the ova into 100 μ micron class intervals.

Results

Maturity Stages

Classification of maturity stages based on the ICES Scale (Wood 1930) as reproduced by James (1967), Kagwade (1968) and Rangarajan (1971) for marine fishes and as applied to several freshwater fishes by Qayyum and Qasim (1964 a, b, c) and Bhatt (1968, 1970, 1971 a, b), was found to be applicable for *E. suratensis.*

Immature, Stage I

Ovaries appear as small, elongated, somewhat cylindrical and translucent structures with a reddish yellow hue and occupy less than a third of the body cavity. Ova are not distinct to the naked eye. The length of the ovary ranges from 15 to 25 mm and the mode of the largest group of maturing ova falls at 300 μ.

The testes are long and thread-like, light pinkish in hue and translucent, measuring about 20–23 mm in length.

Maturing, Stage II

The ovaries are slightly larger, occupying about one-third of the body cavity. They are pale yellow in colour containing spherical and partly opaque ova owing to the commencement of yolk deposition. The ovary now measures about 21–30 mm in length. The diameters of the maturing ova range from 51 to 850 μ with the mode of the largest group of maturing ova at 600 μ.

Testes slightly more enlarged than Stage I, flesh-coloured and opaque, measuring about 25–35 mm in length.

Ripening, Stage III

The ovaries are yellowish brown in colour occupying approximately half of the body cavity. The ova are distinct and the ovaries contain large yolk laden eggs with the ovarian wall highly distended and semi-transparent. The length of the ovary is 27–35 mm with the mode of the largest group of ova at 1300 μ.

Testes creamy white in colour, opaque and measure between 30 and 42 mm in length.

Ripe, Stage IV

The ovaries are much broader and distended, occupying more than half of the body cavity. Brownish in hue with a close ramification of blood vessels, the ovary has an envelope which is distended, thin, delicate and easily rupturable. Each ovary is about 30–52 mm in length and the mode of the largest group of ova falls at 2000 μ.

Testes dull pinkish in hue and measure about 32–48 mm in length. With gentle pressure, the milt oozes out.

Spent, Stage V

The ovaries appear quite shrunken and flaccid, with a few scattered blood patches in the fresh condition. The ovary is about 28–38 mm in length and yellowish-brown in colour, the mode of the largest group of ova falling at 1000 μ.

Testes shrunken and dull reddish in colour having a length ranging between 28 and 40mm.

Growth of ova from immature to mature stages

Ova diameter frequency polygons of different maturity stages arrived at by taking the diameter measurements of ovaries representing all stages of maturity and classifying them into 100 μ intervals are illustrated in figure 1. The curves represent average frequencies from samples of specimens representing the same stage of maturity. In the Stage I ovary, the measurements show a mode at 300 μ; the ova which measure between 51 μ and 450 μ constitute the general immature stock. In Stage II, the first batch of ova get separated from the general immature stock with a mode at 600 μ (mode 'a' in figure 1); a second batch of immature ova could be distinguished at this stage with a mode at 300 μ (mode 'b' in figure 1). As the ovary passes from Stage II to Stage III, the maturing group of ova, observed at Stage II, shows a further increase in size with a mode at 1300 μ (mode 'a' in figure 1). The second batch of maturing ova gets separated from the original immature stock at this stage with a mode at 600 μ (mode 'b' in figure 1). In Stage IV, two distinct modes are discernible, the major one at 2000 μ (mode 'a') comprising about 20.75% of the total ova. This represents the first batch of eggs separated from the immature stock and forms the first batch of ripe eggs ready to be laid in the ensuing

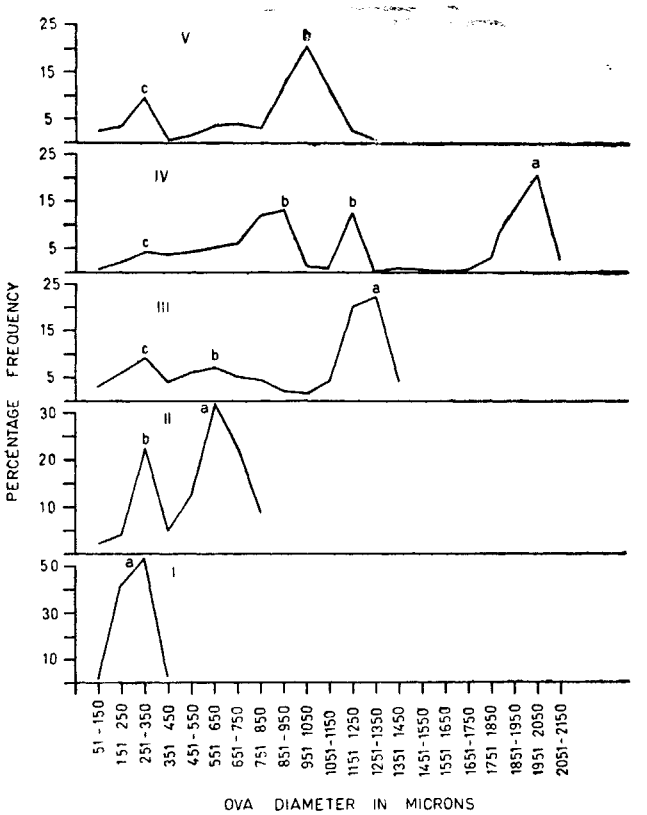

Figure 1 Ova diameter frequency polygons of the ovaries in different stages of maturity of *E. suratensis*

spawning season. The other major modes are seen at 900 μ and 1100 μ. This corresponds to the mode 'b' seen at Stage III.

Thus, the nature of growth of both batches of eggs could be traced. The first batch has a slower growth from Stage I to Stage II but growth is rapid from Stage II to IV. The second batch of eggs is separable from the immature egg stock at Stage III. Since the second batch of eggs is distinctly differentiated from the first batch of eggs, the two modes are quite distinguishable in Stage IV. But in Stage V, after the first spawning and release of ripe ova of mode 'a', a mode at 1000 μ could be regarded as mode 'b' itself. This batch has a much slower rate of growth relatively when compared to the 'a' mode group. It may be because of this slow rate of growth of the 'b' mode group that the second spawning season is quite prolonged.

Spawning season

The percentage occurrence of fish with gonads in different stages of maturity during different months were determined to delineate the spawning season. The percentages of each stage of maturity of females and males during different months are shown in table-1.

The ovaries show regular seasonal changes in the stages of maturity. Immature virgins (Stage I) occur throughout the year. The maturing (Stage II) ovaries are also present during all the months, with a high percentage from July to September. The ripening stage (Stage III) appears in February, continues to increase and becomes dominant in March and April. However, after April there is a sudden fall in Stage III and a complete absence of this stage in June and July. Stage III again appears in August and increases in number, reaching a peak in September with a minimum in November.

Ripe ovaries (Stage IV) first appear in April and their number increases, attaining a maximum in May and then declining to a minimum in July. The ripe females appear for the second time after August. From September onwards the females show a preponderance of ripe ovaries with a maximum in October. The high incidence of the ripe ovaries persist for a period of three months and after November it gradually declines. This indicates the attainment of peak maturity and the onset of spawning.

The spent females (Stage V) show a brief period of abundance in June and July which indicates a short spawning season of two months. From November, spent fish begin to appear for a second time and their number increases with high values in December, January and February. The preponderance of spent females from November to March clearly suggests a second longer spawning season.

In the case of the males, the immature (Stage I) and maturing (Stage II) ones are found all through the year. There is a peak of ripening specimens in March—May and August-October. Ripe fish occur in increasing numbers from April to May and again from September to December, their peak being in May and in October–November. Spent males appear in abundance in June and July indicating the first spawning season. The maximum number of spent males occur during December, January, February and March coinciding with the second larger spawning season.

Frequency of spawning

Following the method adopted by Clark (1934), Hickling and Rutenberg (1936), de Jong (1939) and Prabhu (1956), measurement of 1000 ova was found necessary to delineate the probable error in the representation of various groups of ova. Accordingly, 1000 ova from the ripe ovary were measured for studies on the spawning periodicity.

Table 1 *Percentage of* Etroplus suratensis *at each of the five maturity stages in each month*

Months	No. of females	Maturity stages of females					No. of males	Maturity stages of males				
		I	II	III	IV	V		I	II	III	IV	V
March 1977	22	18.18	18.18	36.36	—	27.28	19	10.53	10.53	47.36	—	31.58
April	26	11.54	19.23	38.46	30.77	—	22	9.10	18.20	45.40	27.30	—
May	24	16.66	12.50	20.84	50.00	—	21	9.53	4.77	23.80	61.90	—
June	23	13.00	24.00	—	30.42	43.58	19	10.53	10.53	—	26.31	52.63
July	25	20.00	24.00	—	4.00	52.00	18	11.11	16.67	—	11.11	61.11
August	22	31.82	45.45	22.73	—	—	19	31.58	47.37	21.05	—	—
September	25	24.00	28.00	44.00	4.00	—	20	20.00	30.00	50.00	20.00	—
October	28	3.58	7.14	32.14	57.14	—	23	13.04	8.70	34.78	43.48	—
November	25	16.00	8.00	12.00	48.00	16.00	24	20.83	4.14	16.68	41.67	16.68
December	24	16.67	4.17	—	33.33	45.83	24	12.50	8.33	—	29.17	50.00
January 1978	23	8.69	8.69	—	17.40	65.22	20	15.00	5.00	—	15.00	65.00
February	28	8.00	8.00	12.00	8.00	64.00	17	5.88	5.88	5.88	5.88	76.48

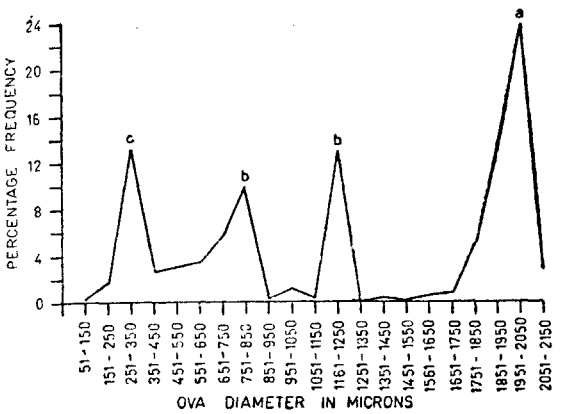

Figure 2 Ova diameter frequency polygon of 1000 ova from a ripe ovary of *E. suratensis*

The % size frequency distribution of eggs is shown in figure 2. Three distinct groups of eggs are discernible. The first mode 'c' is represented by the minute, transparent, immature stock while the last mode 'a' is comprised of the largest ripe eggs which are to be spawned immediately. This mode 'a' is well separated from the second mode 'b'. This clear separation of the ripe eggs from the rest suggests that spawning occurs more than once in a year. The mode 'b' is sharply distinguishable from the immature stock. This indicates that this batch of eggs would be spawned only during the next spawning season and there is no possibility of these eggs getting resorbed. Since this batch of eggs has advanced nearly half of the process of maturation and the gonado-somatic index values for females show a bimodal curve with the two modes distinctly differentiated from each other, it is evident that *E. suratensis* spawns twice in a year.

Seasonal changes in gonad weight

The gonado-somatic indices of *E. suratensis* of both the sexes are shown in figure 3. The gonads register a rapid increase in weight from April onward and reach a maximum by May. A sudden fall in weight of both the sexes occurs by June and continues till July, indicating the first spawning season. A slow recovery in the gonad weight occurs from August. This is followed by a steady and rapid increase attaining a peak by October, coinciding with the abundance of ripe ovaries. Hence the ovaries register the second peak of maturity by October showing the predominance of ripe ovaries. In November, there is again a sharp fall in gonad weight, suggesting a second spawning during the same year. This decline in weight of the gonads is continued till March when the minimum weight of the gonads is found.

Size at first maturity

With a view to determining the minimum size for the attainment of maturity in *E. suratensis*, the fish collected were grouped into 10 mm interval length groups and the data are shown separately for females and males in figures 4 and 5 respectively. It is evident from these that all female specimens measuring 124 mm and less are in the immature stage while the

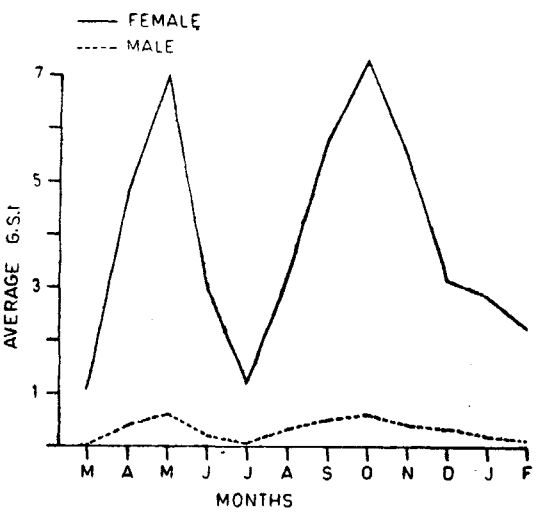

Figure 3 Monthly average gonado-somatic index of male and female *E. suratensis*

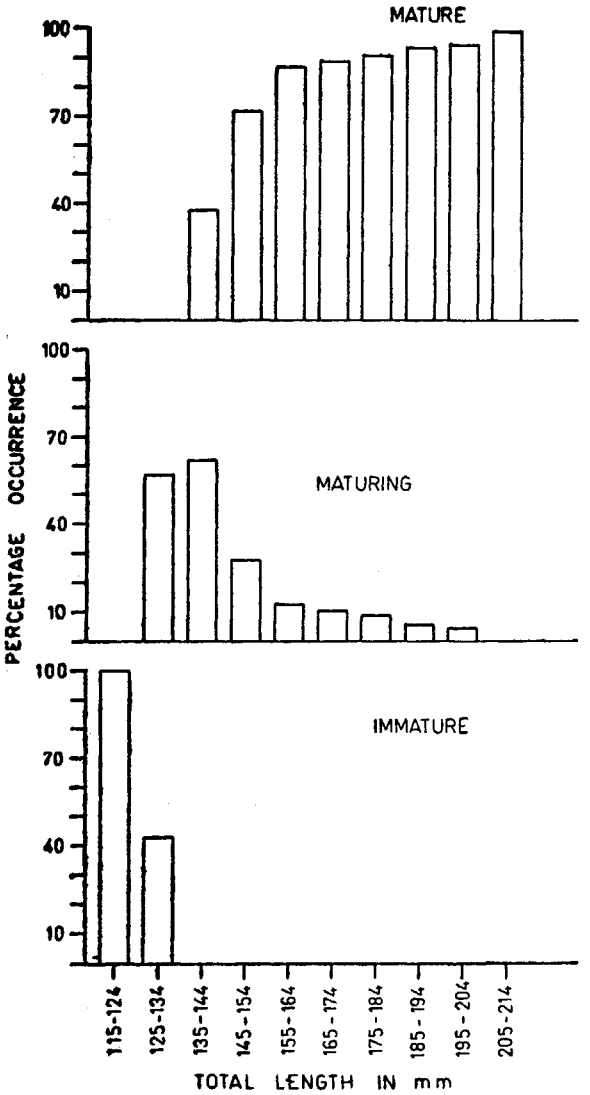

Figure 4 Percentage of *E. suratensis* males in each of the five maturity stages in each month

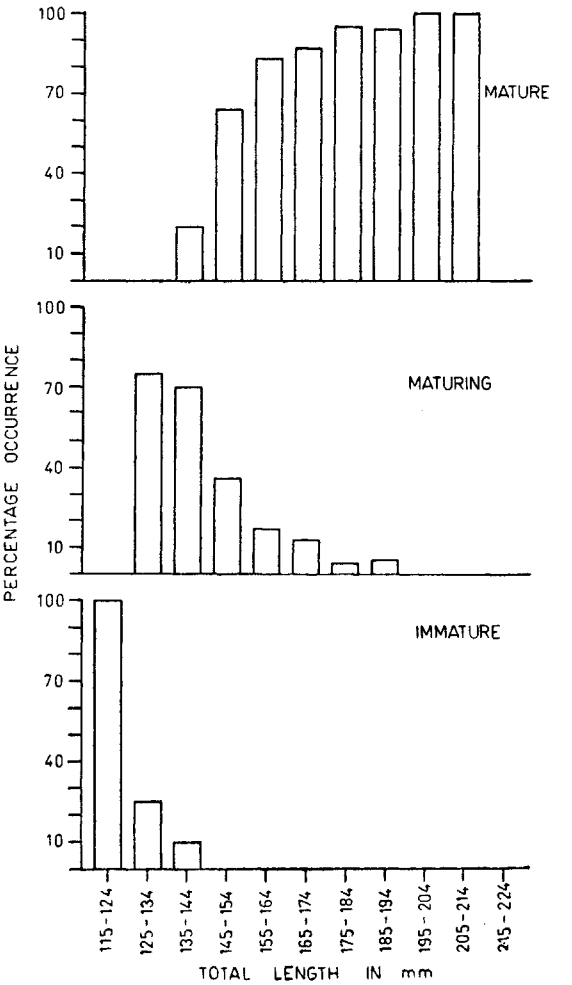

Figure 5 Percentage of *E. suratensis* females in each of the five maturity stages in each month

125–131 mm length group consists of 25% immature and 75% maturing specimens. Mature females first appear from the 135–144 mm length group onwards. Fish of the 175–184 mm and 185–194 mm length groups include 95.35% and 93.94% mature fish respectively while those 195–204 mm and above in total length are all in mature condition. The smallest mature female fish observed was 144 mm in total length.

With respect to males, specimens in the 125–134 mm length group include 57.15% maturing and 42.85% immature fish. The smallest mature male fish was recorded in the 135–144 mm length group and measured 140 mm in total length. So females

and males attain maturity when they reach a length of 144 mm and 140 mm respectively, males attaining maturity at a smaller size than females.

Discussion

The present investigation on the breeding biology of *E. suratensis* has shown that this species spawns twice in a year, once in June–July and a second time in November–March. The multiplicity of modes in the percentage frequency curves of ova diameter (figure 1) suggest that individuals of *E. suratensis* spawn more than once during a year. The occurrence of Stage IV individuals in large numbers during the months of April–May and October–November (table 1) coupled with the high values of the GSI (figure 3) in the same months show that peak maturity is attained during these months. The high incidence of spent specimens in the subsequent months indicate that spawning in *E. suratensis* will be over for the first time during the months of June–July and again between November and March. It must also be presumed that all fish do not spawn at the same time because of the occurrence of spent fish in these months. It is seen (figure 2) that in Stage IV, the presence of two distinct groups of ova sharply separated from each other in addition to the general immature egg stock suggests that the fish spawns at least twice in a year. The periodicity of spawning is also confirmed by making direct observations from a pond selected for the study. Also no resorption or degeneration of the maturing group of ova in the ovary was noticed (Ritakumari & Padmanabhan 1976); the presence of these two groups of ova confirms that *E. suratensis* spawns at least twice in a year. Thus this fish belongs to category 'c' of Prabhu (1956), and Karekar and Bal (1960) or Category II of Qasim and Qayyum (1961).

It will be of interest to note that the spawning seasons of *E. suratensis* more or less correspond to the two monsoons experienced along the south-west coast in a year. In southern India, the south-west monsoon generally breaks in June and continues until August. The north-east monsoon commences by October and lasts up to January. The intense spawning of *E. suratensis* also takes place during these months. It can be seen that (figures 4 & 5) females and males attain maturity when they reach a length of 144 mm and 140 mm respectively. Males mature earlier than females and the males are also larger in size than the females.

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