Breeding biology of a carangid fish *Selaroides leptolepis* Cuv. (Perciformes) along Tuticorin, southeast coast of India

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Studies on ova diameter frequency, seasonal occurrence of maturity stages, gonado-somatic indices and relative condition factor (Kn) revealed that *S. leptolepis* was a prolonged breeder and the individuals spawned once in a year. The spawning period for *S. leptolepis* was from August to March with two peaks, one in January to February and the other in September to October. Length at first maturity in *S. leptolepis* was 113.8 mm (TL) for both the sexes. Fecundity studies showed a direct and significant correlation with total length and body weight. Sex ratio conformed to the expected 1:1 ratio in all the months of the year.

Studies on breeding biology of carangid fishes from India are limited\(^1\) - \(^5\). Reports by Tandon\(^2\) - \(^3\) dealing with maturity and spawning and Prabhu\(^4\) dealing with ova diameter studies are the only works on the breeding biology of *S. leptolepis*. The present study pertains to the breeding of *Selaroides leptolepis* from Tuticorin waters (east coast of India).

Materials and Methods

Fishes were obtained every week for 1 year (January-December 1993) from the commercial catches at Tuticorin (lat. 8° 50' N; and long. 78° 06'E). Specimens collected from different gears (trawlnets and gillnets) were weighed and measured the total length. The extension of gonads in the body cavity, their general appearance and weight were noted and the stage of maturity was recognized using ICES scale\(^6\) with modifications. The ovaries were treated with modified Gilson's fluid\(^7\). Ova diameter measurements were taken from ovaries of different stages of maturity to study the maturation of ova following the methods adopted elsewhere\(^8\) - \(^10\). Ova taken from anterior, middle and posterior regions of few ovaries from different stages of maturity indicated a more or less uniform pattern of distribution. Hence 400 to 500 ova were measured using an ocular micrometer from ovaries irrespective of regions, in different stages of maturity and results expressed in micrometer divisions.

The spawning period was assessed from the percentage occurrence of various maturity stages of gonads, gonado-somatic indices (GSI) and relative condition factor (Kn) during different months. Spawning periodicity was determined by ova diameter studies. The sex ratios were calculated and to test the homogeneity in the distribution of males and females the chi-square test was performed. For calculating fecundity, the method described by Polder & Zijlstra\(^11\) was employed and for this ovaries of stages IV and V were used\(^12\).

By suitably modifying the ICES scale the ovaries and testes were classified into 7 and 4 stages respectively which are as follows: Ovary stages : I = immature, II & III = maturing, IV = mature, V = fully matured, VI = fully matured and oozing and VII = spent; testis stages: I = immature, II = maturing, III = mature and IV = spent.

Results and Discussion

For this study, 30 ovaries were utilized for each maturity stage to assess the intra ovarian periodicity and frequency of spawning. The immature ova (1-6 micro. div.) outnumbered the maturing ova in all stages of maturity and so ova measuring > 7 micro div. were taken into consideration from stage III onwards. The ova diameter frequencies were grouped, based on the micro divisions of the ova as 1-3, 4-6, 7-9, 10-12 etc. and plotted (Fig. 1). The results indicate that in stage VI ova were seen in fully matured condition with a single oil globule in each ovum. The ova diameter frequency polygon of mature ovaries in stage VI presented a well differentiated batch of ova with two modes, one at 34-36 micro div. (mode 'a') and another at 28-30 micro div. (mode 'b'), comprising 30% and 20% of the total ova respectively. In spent, percentage of maturing ova forming a mode 7-9 micro div. with few matured ova undergoing resorption.
The percentage occurrence of maturity stages of ovary and testis during different months (1993) is given in Fig. 2. Fully matured ovaries (stage V) and testes (stage III) were recorded from August to March with two peaks one in January-February and another in September-October. The spent specimens were recorded from September to April with two peaks one in October to November and another in February to March. This indicates that the spawning period of this species was prolonged one, since specimens with matured ovaries could be recorded for 8 months in a year, and majority of individuals spawn twice in a year with two peaks (September-October and January-February).

Gonado-somatic indices and relative condition factor ("Kn") are presented in Figs. 3 and 4. Higher values of GSI and 'Kn' were registered in September-October and in January-February. Steep fall of GSI and Kn value in March and November was due to the discharge of gametes and during these months higher percentages of spent specimens were encountered. Monthly fluctuations in GSI and 'Kn' in both the sexes of *S. leptolepis* strengthens the inference about their extended breeding season. Rise in GSI and 'Kn' values with a peak and its steep fall coincide with peak spawning months.

The cumulative percentage occurrence of mature fishes of different size classes (3 mm interval) of both sexes of *S. leptolepis* is shown in Fig. 5. The percentage of mature males and females increased with the length of the fish and 100% maturity was found in size groups above 130-133 mm. The 50% level in maturity curves which may be taken to represent the mean lengths at which maturity was attained was 113.8 mm (TL) for both males and females.

Fecundity in *S. leptolepis* was studied in 15 ovaries with ova ranging from 13, 429-35, 514 in size group 123-158 mm in (TL). The number of ova increased with increasing length of fish and body weight (Fig. 6). The correlation coefficient (r) between fecundity and length was 0.9705 and that between fecundity and body weight was 0.9737. The r values were significant (P < 0.001).

No secondary sexual characters are known which might help in distinguishing the sexes. Sex ratio calculated for 1 year does not deviate from the expected 1:1 ratio (Table 1). The sex ratio conformed with expected 1:1 ratio for all months (based on
chi-square values). The chi-square value for the year was 2.5329 ($P > 0.05$).

Tandon\textsuperscript{2,3} observed that *Scleroides leptolepis* from Mandapam waters spawns twice in a year during January-March and July-October with single peak in February and September. The present study shows it has a prolonged spawning period from August to March with two peak spawning seasons, one in
September-October and the other in January-February. Eggs and postlarvae of this species were collected during these months and were abundant in plankton during the two peak spawning seasons which also confirms the breeding season of this species.

The spawning frequency as determined from the ova diameter studies shows that in advance stage of maturity two mature modes were well separated from the immature stock and there was no mode being formed at maturing stock. Hence it can be safely inferred that the individual fish of this species spawns once in a year but the population as a whole showed an extended breeding period as the mature mode (Fig. 1) was found to be wide based. This is also confirmed by the seasonal occurrence of maturity stages GSI and 'Kn' values. Extended or year round spawning has been noticed in other carangid fishes by earlier workers. Variations in condition have been attributed to different factors in different fishes. Presently rise in 'Kn' values was probably due to the peak spawning season as has been observed in other teleostean fishes.

Prabhu recorded the size at first maturity in S. leptolepis as 139 mm (TL) in Mandapam waters and in the present observation both the sexes attain maturity at 113.8 mm (TL). This species spawns at the 2nd year of their life. This observation also supports the view that majority of marine fishes in tropical waters mature early and start spawning either in the first or second year of life. Fecundity estimates showed that the number of eggs are more in lower length groups compared to the estimate made by Tandon from Mandapam waters.

References
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