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SOME ASPECTS OF BIOLOGY OF THE WHITE-SPOTTED SPINE-FOOT, *SIGANUS CANALICULATUS* (PARK, 1797) FROM THE GULF OF MANNAR

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ABSTRACT

The regression coefficients of length-weight relationships of males and females of *S. canaliculatus* are not significantly different and therefore a common regression is recommended. The regression coefficient does not significantly depart from 3. The spawning season is from November to February in the Gulf of Mannar. The female attains first maturity at about 177 mm length. Fecundity varies from 33,711 to 284,516 and bears good correlation with ovary weight.

INTRODUCTION

Siganids are excellent food fishes having great mariculture potential and some information on the biology of this group is available (Lam, 1974; Hasse *et al.*, 1977). Works on siganids from Indian waters are scanty, being restricted to that of traditional trap fishery (Mohan, 1985), food and feeding (Balasubramanyam and Natarajan, 1980), taxonomy (Pius, 1984) and length-weight relationship (Lazarus and Reddy, 1986-'87). The present study deals with length-weight relationship, maturation and spawning of *S. canaliculatus* from Keelakarai (Gulf of Mannar).

MATERIAL AND METHODS

Samples of *S. canaliculatus* were collected from the 'disco net' catches at Keelakarai landing centre, Ramnad district from November, 1987 to October, 1988. The study is based on 51 males ranging in length from 126 to 238 mm and 78 females of length range 146-250 mm. Total length (from tip of snout to tip of upper caudal lobe, in mm) and weight (nearest to 0.1 g) of both sexes were taken separately.

The length-weight relationship was calculated by the method of least squares using the formula, log W = log a + b log L, where W = weight in g, L = total length in mm and 'a' and 'b' are constants. Using Analysis of Covariance (Snedecor and Cochran, 1967), the significance at 5% level between the regression coefficients of the sexes were tested. 't' test was conducted to see whether the regression coefficient departs significantly from 3.

Ovaries were preserved in 5% formalin. Three ovaries each from stage II to stage VII were selected for ova diameter studies. Ova diameter measurements were made with an ocular micrometer, each division being equal to 0.0167 mm. Fecundity studies were carried out by weighing the entire ovary and then by weighing a small portion (both nearest to 1 mg) sampled from middle of the right ovary. All mature ova

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from the sample were counted and fecundity was determined by raising this value by the ratio of total weight of ovaries to the sample weight.

Results and Discussion

Length-weight relationship

The logarithmic values of observed length and weight of both sexes were plotted (Figs. 1 & 2) and the regression lines fitted to the data indicated straight line relationship. The logarithmic length-weight equations obtained were :

Males: log W = -4.5709+2.8732 log L;
r = 0.9856

Females:log W = -4.2712+2.7486 log L;
r = 0.9389

The ANOCOVA test revealed that there is no significant difference in the regression coefficients of the sexes (Table 1). Hence the data on sexes were pooled (Fig. 3) and common equation was calculated as follows :

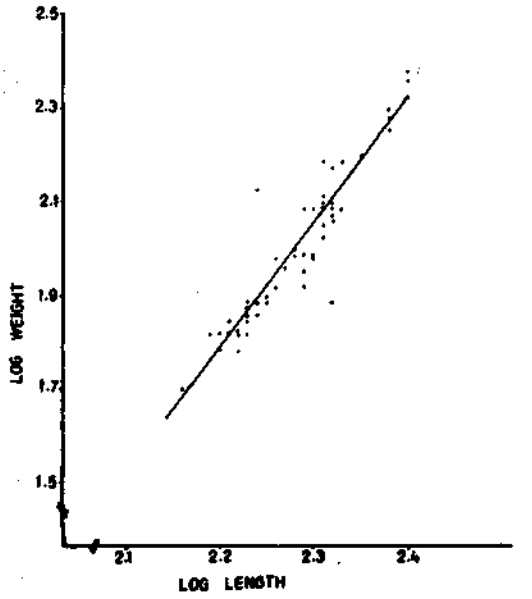

Fig. 1. Length-weight relationship in the male *Siganus canliculatus*.

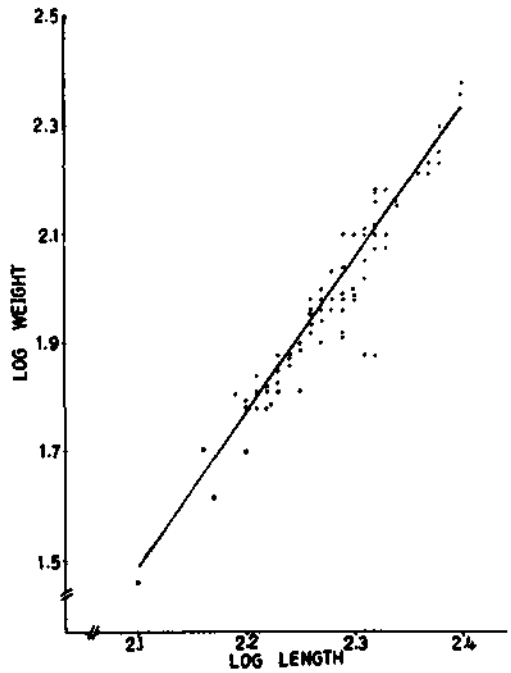

Fig. 2. Length-weight relationship in the female *Siganus canaliculatus*.

log W = -4.4389 + 2.8193 log L;
r = 0.9589

The 't' value (1.52; d. f = 127) showed that the regression coefficient is not significantly deviating from 3, agreeing with the 'cube-law'. In *Siganus javus* and *S. canaliculatus* , Lazarus and Reddy (1986-'87) found that the regression coefficients of their length-weight relationships departed significantly from 3, which is contrary to the present results.

Maturity stages

Seven maturity stages have been identified in female *S. canaliculatus* and are presented in Table 2.

TABLE 1. *Analysis of Covariance for testing differences in regression coefficients between males and females of* Siganus canaliculatus

Source of variation	Degrees of freedom	Sum of squares	Mean square
Within			
Male	49	0.04182	0.000853
Female	76	0.23451	0.003086
Total	125	0.27633	0.002211
Pooled within (W)	126	0.27788	0.002211
Difference between slopes*	1	0.00155	0.001550
Within + Between	127	0.28633	0.002255
Difference between adjusted means**	1	0.00845	0.008450

* Difference between S. No. 4 & 3.
** Difference between S. No. 6 & 4.

For comparison of slopes:

$F = \frac{0.001550}{0.002211} = 0.701040$ (df=1,125) - not significant i . e., the slopes of males and females are not significantly different.

For comparison of elevations:

$F = \frac{0.008450}{0.002211} = 3.8218$ (df=1,126)-not significant i.e., elevations are not significantly different.

Development of ova to maturity

Fig. 4 shows that the immature ova in stage II ovary, forming a mode at 0.18 mm, develop to maturing condition at a mode 0.35 mm in stage III. The size of the maturing ova further advances in stage IV, showing a mode at 0.42 mm, and the ova attain maturity at 0.48 mm in stage V. At stage VI, the ovary contains large and transparent eggs in ripe condition, which form a mode at 0.62 mm with a size range of 0.53 to 0.70 mm. The spent (stage VII) ovary contains maturing eggs at mode 0.35 mm, in addition to the immature stock of eggs.

The presence of single and distinctly separate mode of mature ova in stage VI is indicative of a short and definite spawning period in *S. canaliculatus*. Females in stages VI and VII were available only during November to February. Hence it may be inferred that *S. canaliculatus* spawns during November to February in the Gulf of Mannar.

The main spawning season of *Siganus canaliculatus* in Singapore and Philippine waters has been reported to be from January to April (Lam, 1974; Manacop, 1937). In Palau, *S. canaliculatus* spawns mainly during March to May (Hasse *et al.*, 1977). Occurrence of juveniles of *S. canaliculatus* in quantity during February through May in the Gulf of Mannar (Mohan, 1985) is corroborative of the present observation that the spawning

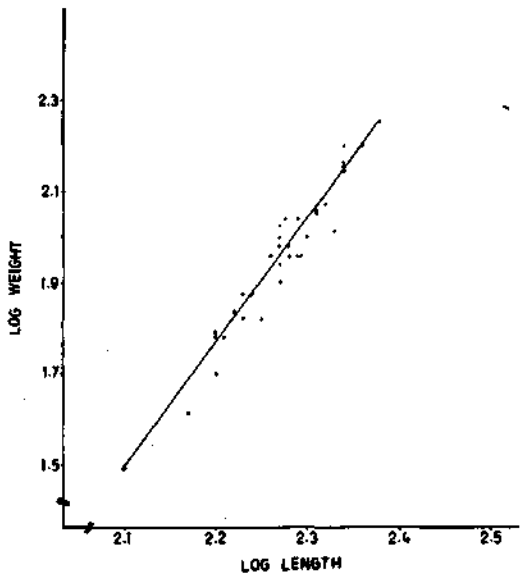

Fig. 3. Length-weight relationship (both sexes combined) in *Siganus canaliculatus*.

season of the species extends from November to February.

Length at first maturity

To determine the length at first maturity, 78 females were grouped into 10 mm size groups and the percentage occurrence of fish at the different maturity stages in each size group was calculated (Fig. 5). All the fish upto 149 mm were immature. About 43% were mature in 170-179 mm size group and 63% in 180-189 mm size group. The data suggest that female *S. canaliculatus* attains first maturity at about 177 mm total length.

In Singapore waters, Lam (1974) noticed mature females of *S. canaliculatus* in the size range of 13 -21 cm. The present results tend to agree with this observation.

Fecundity

Fecundity in *S. canaliculatus* varied from 33,711 to 284,516 in 20 individuals

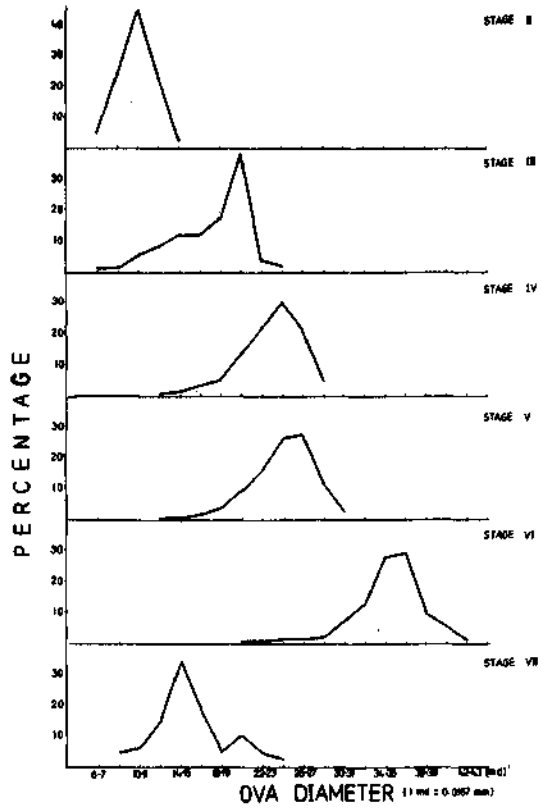

Fig. 4. Ova diameter frequency polygons of *Siganus canaliculatus*.

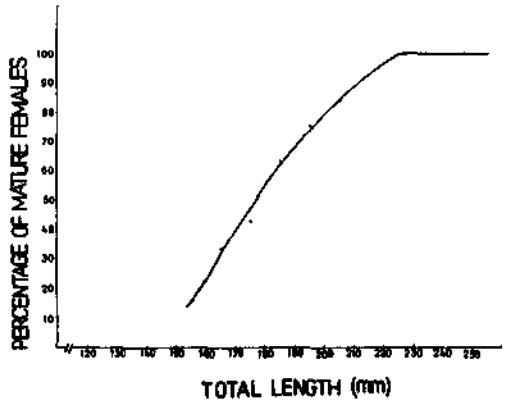

Fig. 5. Percentage frequency distribution of mature females of *Siganus canliculaus*.

TABLE 2. *Maturity stages of* Siganus canaliculatus

Maturity stage	Description of ovary	Range in ova diameter (mm)
I - Immature virgin	Ovaries narrow and small, colourless and generally translucent	0.02 - 0.10
II - Developing virgin	Ovaries more rounded, the ovarian wall is thick and opaque; ova creamy white and opaque	0.12 - 0.20
III - Developing	Ovaries increase in size, the ovarian wall becoming thinner and translucent	0. 22 - 0. 37
IV - Maturing	Ovaries occupy over half of the body cavity and ova appear opaque and yellow	0. 39 - 0. 45
V - Mature	Ovaries occupy most of the body cavity, the ovarian wall is very thin and translucent; ova are large and yellow, tending to become translucent	0. 47 - 0.52
VI - Ripe	Ovaries distend the body cavity; ova large, translucent and lemon coloured and can be extruded by slight pressure to the abdominal wall	0.53 - 0.70
VII - Spent	Ovaries flattened and irregular in shape and ovarian wall becomes opaque. Few large, deshaped residual ova visible.	—

measuring from 164 to 250 mm (Table 3), with an average of 115,401. It was observed that the fecundity varied irrespective of the length or body weight of the fish and increased with ovary weight. The logarithmic relationships of fecundity with length, body weight and ovary weight are as follows :

$\log F = 4.4464 + 0.2179 \log L;$

$r = 0.0289$: not significant

TABLE : 3 *Fecundity of* Siganus canaliculatus

Total length (mm)	Body weight (g)	Ovary weight (mg)	Observed fecundity
164	66.5	6,118	106,398
165	62.2	1,973	38,565
173	75.2	4,080	92,200
183	90.0	1,858	40,094
188	100.0	1,852	43,956
191	99.5	7,862	227,196
192	101.7	7,250	191,799
197	104.7	11,266	284,516
199	100.7	10,580	264,500
201	118.4	8,914	236,050
202	113.0	2,756	41,640
203	122.9	5,716	100,110
205	123.3	1,715	40,704
206	129.4	6,315	109,800
209	117.7	1,398	33,711
209	132.0	3,428	51,814
212	135.6	4,476	96,061
214	123.8	2,568	38,800
224	156.8	7,580	200,500
250	235.0	3,974	69,601

$\log F = 4.7529 + 0.0950 \log W$;

$r = 0.0373$: not significant

$\log F = 0.9614 + 1.1001 \log w$;

$r = 0.9636$: significant

A higher range in fecundity of this species, i.e., 300,000-500,000 has been reported (Lam, 1974) from Singapore waters.

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