MATURITY AND SPAWNING OF *JOHNIUS (JOHNIEOPS) SINA* (CUVIER) AT CALICUT DURING 1969-72

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ABSTRACT

The percentage occurrence of mature fish and ova-diameter frequency in *Johnius (Johnieops) sina* (Cuvier) indicated prolonged spawning of the species. The minimum size at first maturity has been found to be at an average size of 115 mm for females. The condition factor had the minimum value at a length of 115 mm for females and 125 mm for males, when they are considered to be mature for the first time. Sexes appeared in equal proportion in most of the months. Dominance of females in the population was noticed at 115mm total length and upwards. Fecundity has been found to vary from 12,774 to 1,51,697 in specimens of the size range 124-174 mm.

INTRODUCTION

Johnius (Johnieops) sina is one of the most common species among the small sciaenids contributing to the sciaenid fishery of the Malabar coast. Although the biology of some species of sciaenids has been studied by earlier workers (John 1951, Karamchandani and Motwani 1954, Pantulu and Jones 1954, Annigeri 1963, Rao, K. V. 1963, Rao, T. A. 1964, and Devadoss 1969) there seems to be no detailed information on the biology of *J. sina* except on its food by Venkataraman (1957) and George et al. (1964). Therefore a study on the various aspects of the biology of the species was initiated at Calicut from July 1969 and the present account relates to its maturity and spawning.

MATERIAL AND METHODS

Random samples were collected every week from commercial catches landed by trawl nets, *Ayila chala vala* (mackerel gill nets) and *pattenkolli vala* (boat-seine) at Vellayil fish landing centre between July 1969 and June 1972. Specimens were also obtained from the catches made by weekly experimental fishing operation by the departmental *paithu vala* (boat-seine).

In each sample the total length, weight, sex and stage of maturity were noted in fresh condition. The different stages of maturity were classified according to the I. C. E. S. scale and the ovaries were preserved in 5% formalin. A

total of 14 ovaries, two to three in each stage of maturity, were selected for ova-diameter studies. As there was no significant difference in the distribution pattern of ova in different parts of the overies, the material for ova-diameter study was always taken from the middle portiton of the ovary and measurements made with an ocular micrometer with each division giving 0.0147 mm. Only ova measuring 5 m.d. and above were measured.

OBSERVATIONS

Distribution of ova in the ovary

In order to test the distribution of ova in different parts of the ovary three specimens measuring 133, 159 and 169 mm in total length in stage V of maturity were examined by taking ova-diameter measurments from the anterior, middle and posterior region of the ovary. Since the pattern of distribution of ova in the right and left ovary was found to be uniform, samples from both the right and the left ovaries were pooled together and are plotted in figure 1. The frequency polygons from the three regions of the ovary showed a similar pattern of distribution of ova of different sizes, in all the specimens examined. However, to eliminate any difference between different parts of ovary all further ova-diameter studies were made on a sample taken from the middle region of the right ovary.

Ova-diameter frequency

Figure 2 gives the ova-diameter-frequency polygon of ova in different stages of maturity. From the figure it can be seen that batches of eggs are continuously being withdrawn from the general egg stock, resulting in a series of modes which are not sharply separated from each other.

In the ovary of stage III, in addition to the immature egg stock, two batches of eggs represented by a small mode at 11-12 m.d. and a prominent one at 21-22 m.d. are distinguishable. In stage IV the diameter of mature eggs has shifted to 25-26 m.d. in addition to probable fresh batches of eggs at 21-22 and 11-12 m.d. Further development of eggs is seen in stage V, with modes at 29-30 m.d. besides the presence of batches of eggs at 13-14 and 21-22 m.d. In stage VI the frequency polygons showed apart from the immature egg stock modes 11-12, 21-22, 31-32, 35-36 and 39-40 m.d. The batches of ova above 21-32 m.d. are expected to be spawned out within a short time, as they were not represented in spawned individuals. (Stage VII). In stage VII maturing eggs predominated with modes at 15-16 and 21-22 m.d.

Analysing the data in the light of Hickling and Rutenberg's (1936) and Prabhu's (1956) remarks, *J. sina* belongs to the type in which the spawning is prolonged. The different batches of eggs are not sharply differentiated from one another thereby indicating that the passing of one batch of eggs into the next stage is a continuous process.

Spawning season

A total of 228 fish during 1969-70, 560 fish during 1970-71 and 511 fish during 1971-72 were examined to study the percentage of occurrence of different stages of maturity. The females alone were considered for this study and the results are plotted in figure 3.

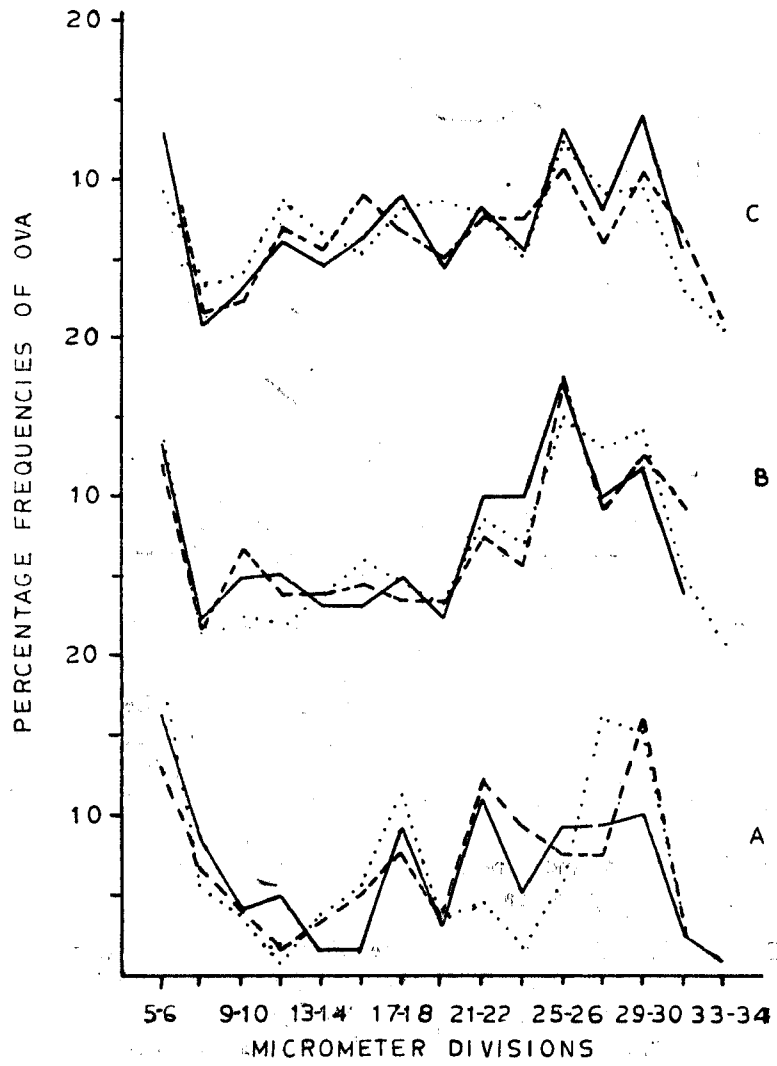

FIG. 1. Ova-diameter-frequency polygon of the anterior, middle and posterior regions of mature ovaries of *J. sina* of A-139, B-169 and C-159 mm in total length.
——Anterior region ----- Middle region ..... Posterior region.

During 1969-70 fishes in advanced stage of maturity (stage IV and V) were observed in almost all the months of observation, the percentage occurrence of which was high from November to February. Immature specimens occurred in small percentages in February, April and May. Stage II fishes occurred in October, and January to May, while stage III specimens were recorded during October to December and March to May.

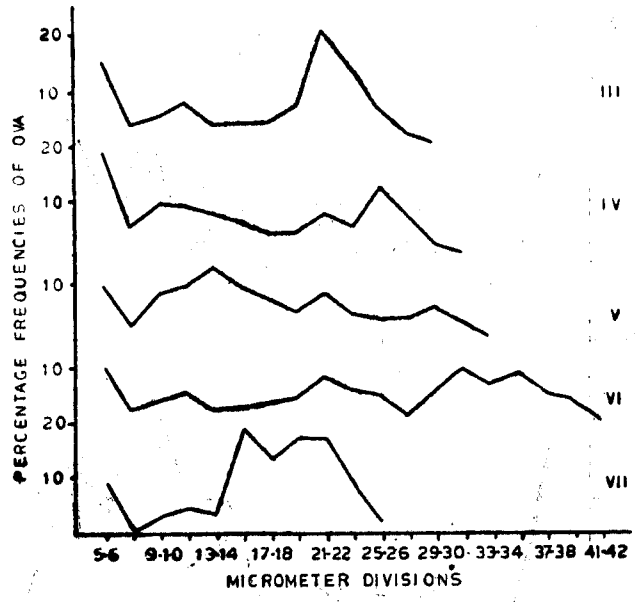

FIG. 2. Ova-diameter frequency of *J. sina* from stages III to VII.

During 1970-71 mature specimens occurred in all the months with the peak occurrence during October to February as in the previous season. Spawning individuals (stage VI) were seen during October to May, with a high percentage of occurrence during December to February, and May. Spent specimens (stage VII) were met with during December to February, April and May, with their dominance in January and April. Immature specimens occurred from July to September and January to May.

During 1971-72 the predominance of stage IV and V was seen in September, October, December, and February to May. Spawning individuals were observed in September, and November to May. Spent specimens were recorded in July, November, December, January and May. Immature and maturing specimens occurred in most of the months.

Thus the examination of the percentage occurrence of *J. sina* in different stages of maturity showed that fishes in all stages of maturity occurred almost

through out the year. Though the occurrence of specimens in stage V and VI were seen in most of the months, stage VI specimens (running) appeared in greater proportion during November to February, and May. Spent individuals (stage VII) had a high percentage of occurrence in November to February, and May. From the above it may be inferred that the population of *J. sina* breeds all the year round, with the peak spawning periods corresponding to the months of high percentage of occurrence of running and spent individuals. The length-frequency studies (Nair, K. V. Somasekharan 1974) also supported the prolonged spawning of the species, as was evidenced by the continued recruitment of juveniles.

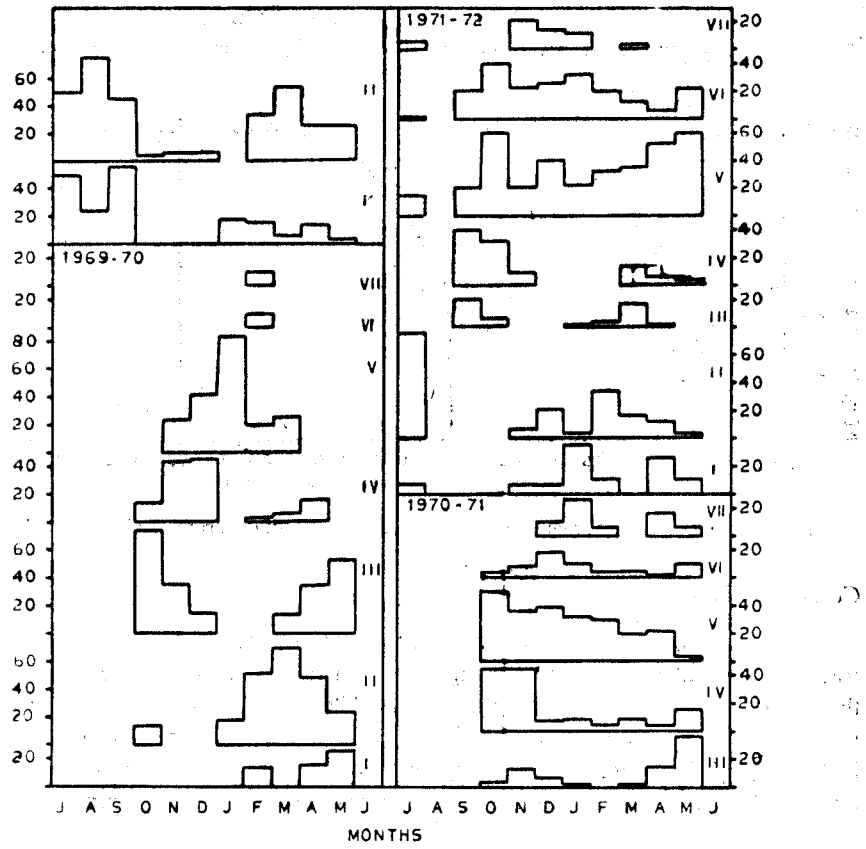

FIG. 3. Percentage occurrence of *J. sina* in different stages of maturity during 1969-70 to 1971-72.

Size at first maturity

During the course of this investigation a total of 1311 females were examined for studying the size at first maturity. The percentage of occurrence

of *J. sina* in different stages of maturity was calculated for each 10 mm interval for each year and are plotted in figure 4. All the specimens above stage III were considered as mature.

It is seen that in 1969-70 the mature fish appeared first at 115 mm and 50% of the fish were found to be mature at 125 mm. In 1970-71 the 50% level of maturity was at 115 mm, whereas the mature fish appeared for the first time at 105 mm. In 1971-72 also the mature fish occurred for the first time at 105 mm, with the 50% level of maturity at 115 mm as in the previous season. In all the years there was a sudden increase in the percentage of mature fish above 115 mm and at about 165 mm all the fish were found to be mature. The size at which 50% of the fish was found mature, 115 mm in the present instance, may be considered as the size at which sexual maturity is attained.

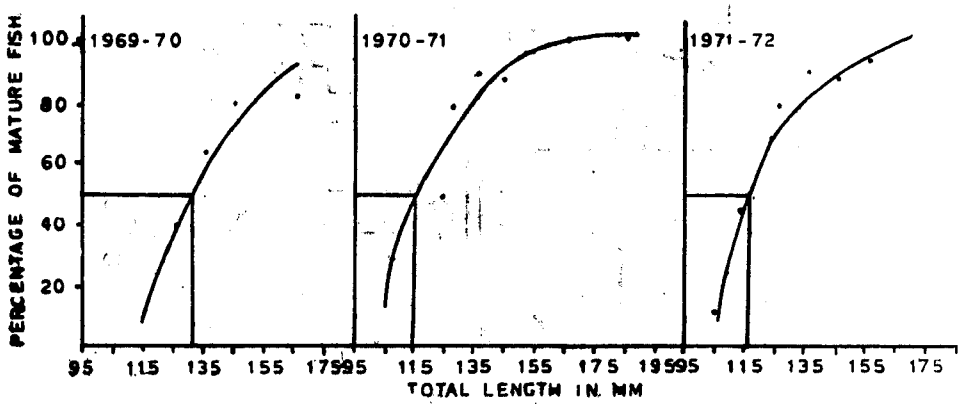

FIG. 4. Size at first maturity of females of *J. sina* during 1969-70 to 1971-72.

Condition factor

The length-weight data were analysed for determining the condition factor. The average length and weight for each size group were caculated, after the males and females were grouped at 10mm-class intervals. The average 'K' was caculated seaparately for the two sexes by employing the formula $K = 100W/L3$, where W = average weight, L = average length and K = average condition and are plotted against respective length in figure 5.

Hart (1946) observed that the point of inflexion on a curve showing the diminution of K with increasing length is an approximate indication of the size at first maturity, the lower level of condition being due to the strain of spawning. Based on this it can be said that the size at first maturity for females is at 115 mm and the males at 125 mm. The size at first maturity as based on the percentage of occurrence of gonads for females is also at 115 mm, a value which agrees with the results obtained here.

Sex ratio

The record of analysis of 454 specimens collected during 1969-70, 949 specimens during 1970-71 and 986 specimens during 1971-72 is presented here. The fish were classified according to the month of capture and length group of 10mm-class intervals for each season. The observed ratios were tested against an expected 1:1 ratio by the method of Chi-square.

In table 1 is presented the monthwise data for the three seasons. It can be seen that x^2 values of high significance occurred only in October, November and December 1970 and March, May, July and September 1971 with a preponderance of females. The data for all other months appear to satisfy the null hypothesis. So it can generally be concluded that the sexes were almost of equal distribution in most of the months.

TABLE 1. *Chi-sqare test for* J. sina *obtained in different months*

Months	Females (1969-70)	Males	x^2	D.F.	Females (1970-71)	Males	x^2	D.F.	Females (1971-72)	Males	x^2	D.F.
July	..	..	..	..	4	10	2.580	1	14	3	..	1
August	..	..	..	..	4	6	04.00	1	..	..	..	..
September	..	..	..	..	16	15	0.032	1	5	..	5.000*	1
October	16	11	0.926	1	44	26	4.628*	1	31	26	0.438	1
November	45	34	1.532	1	56	30	7.860*	1	48	44	0.172	1
December	19	22	0.220	1	25	50	5.040*	1	66	62	0.126	1
January	19	18	0.028	1	79	58	3.218	1	121	124	0.036	1
February	40	46	0.041	1	71	52	2.934	1	85	75	0.624	1
March	60	57	0.076	1	86	52	8.378*	1	71	58	1.310	1
April	16	17	0.030	1	62	50	1.286	1	34	32	0.060	1
May	13	8	1.190	1	63	40	5.136*	1	36	51	2.585	1
June	..	..	..	..	..	..	..	..	..	..	..	..
Pooled	228	213	0.510	1	510	389	16.286*	1	511	475	1.314	1

* Significant at 5% level.

From table 2 it is observed that the proportion in which the two sexes appeared in the catches varied with the length of the fish and also between different seasons. Significant x^2 values with dominance of females were noted at 115 mm and above 155 mm in 1969-70, at 115, 125 and above 145 mm in 1970-71 and at 135 and above 155 mm in 1971-72. The dominance of females in the population occurred at 115 mm, i.e., the size at first maturity for females.

TABLE 2. *Chi-sqare test for* J. sina *of different size groups*

Size groups n mm.	Females (1969-70)	Males	x^2	D.F.	Females (1970-71)	Males	x^2	D.F.	Females (1971-72)	Males	x^2	D.F.
75	9	15	1.500	1	17	9	2.460	1	13	17	0.532	1
85	17	33	5.124*	1	31	46	2.922	1	41	41	0.000	1
95	36	37	0.014	1	53	55	0.038	1	19	37	5.784*	1
105	23	25	0.084	1	59	68	0.638	1	27	78	24.770*	1
115	23	8	7.258*	1	106	74	5.688*	1	71	88	1.816	1
125	15	25	2.500	1	104	69	7.080*	1	97	80	1.632	1
135	31	28	0.152	1	69	54	1.828	1	102	65	14.070*	1
145	31	31	0.000	1	59	30	9.448	1	48	39	0.932	1
155	28	6	14.234*	1	36	11	13.296*	1	47	21	9.942*	1
165	13	2	8.642*	1	15	5	5.000*	1	29	12	7.048*	1
175	5	..	5.000*	1	10	1	7.362*	1	13	1	10.286*	1
185	..	..	..	..	9	1	6.400*	1	4	1	1.800	1
Pooled	231	210	1.000	1	568	423	21.216*	1	511	480	0.970	1

* Significant at 5% level.

Fecundity

Since *J. sina* spawns more than once in a season an accurate estimate of the fecundity cannot be made from the number of ripe eggs in the ovary at a time. Instead, the ripe eggs along with the eggs in which the disposition of yolk was complete was taken into account in estimating the fecundity. The figure thus obtained indicates the potemtial stock of eggs irrespective of the number of batches each of them would have already spawned.

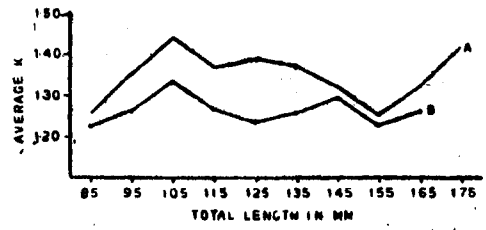

FIG. 5. The average ponderal index 'K' at different lengths of *J. sina*. A: males. B: females.

Fecundity was estimated first by weighing the ovary and then by weighing a small portion from the middle of the right ovary. The number of mature eggs in the ovary was calculated from the sample, the number of ova in the

sample and the total weight of the ovary. In the present study, fecundity was determined from the examination of 25 specimens ranging in size from 124 to 174 mm in total length and fecundity was found to vary from 12,744 to 1,51,697.

Relation between fecundity and length of fish

The number of mature eggs produced by individuals of *J. sina* are plotted against the length of the fish in a scatter diagram (Figure 6). It was found that fecundity of individual fish of the same length varied considerably, showing that no direct relationship existed between fecundity and length of fish.

Relation between fecundity and weight of fish

The relationship was tested by plotting the observed values of fecundity against the weight of fish in a scatter diagram (Figure 6). It was found that the two sets of data do not show any relationship.

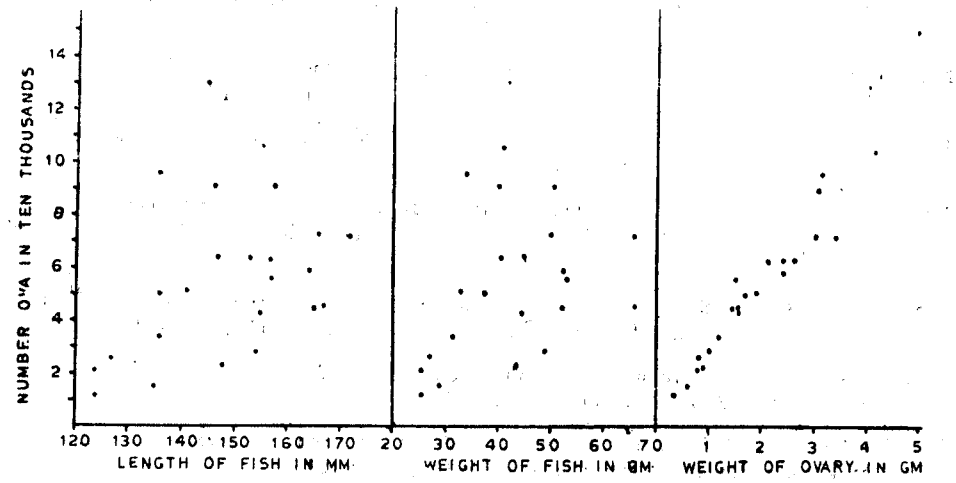

FIG. 6. Relation between fecundity and length and weight of fish and weight of ovary.

Relation between fecundity and weight of ovary

The number of eggs are plotted against the weight of ovary in figure 6. It was found that the fecundity generally increased with increase in weight of the ovary.

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