

**OBSERVATIONS ON THE SPAWNING BEHAVIOUR OF THE INDIAN  
OIL SARDINE, *SARDINELLA LONGICEPS VALENCIENNES*,  
DETERMINED BY OVA DIAMETER STUDIES**

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INTRODUCTION

Studies on the spawning habits of fishes form an integral part of fishery biological investigations. Nair (1959) published a detailed account on the spawning habits and early life history of oil sardine, *Sardinella longiceps Valenciennes*. Brief references on the spawning habits of oil sardine have also been made by Hornell and Nayudu (1924) and Chidambaram (1950). These authors have drawn the conclusion that oil sardine have a prolonged spawning season. During the course of investigations carried out on the biology of oil sardine, observations were made on the occurrence of fish in various degrees of spent condition and this indicated the possibility of oil sardine releasing eggs in batches. So far there has been no published account to support this assumption. In search of further support for this assumption studies on ova diameter were conducted during the years 1960-62 at Mangalore, and the results obtained thereon have been presented in this paper together with the minimum size at first maturity.

MATERIAL AND METHODS

Oil sardine samples from various gears were collected from fishing centres between Malpe in the North and Kasargod in the South. After recording the maturity stages\* the ovaries were preserved in 5% Formaldehyde. For measuring the diameter of intra-ovarian eggs, the method suggested by Hickling and Rutenberg (1936) was employed. From each ovary samples from anterior, posterior and middle regions were taken and teased together on a slide for further examination. 500 eggs from each ovary were measured and were grouped at a size interval of two ocular divisions and their frequencies expressed in percentages. Ova measuring less than 5 ocular divisions were not taken into consideration. It has to be mentioned here that oil sardine in oozing condition were not available during the course of this study.

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\*The stages of maturity referred to in this paper correspond to the maturity scale given by the International Council for the Exploration of the sea.

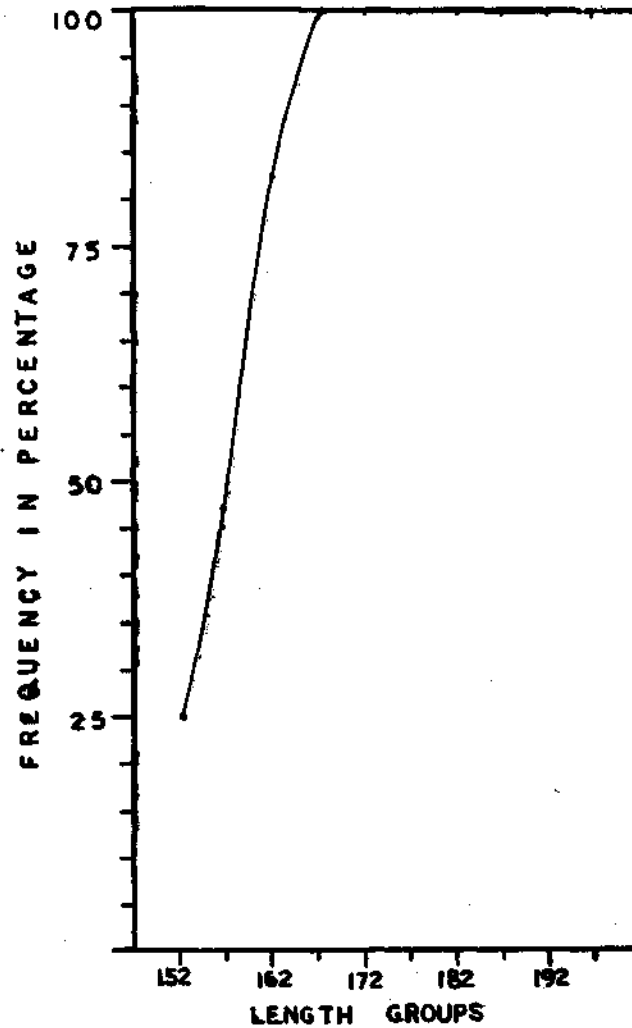


FIG. 1. Size at first maturity of *Sardinella longiceps*

#### MINIMUM SIZE AT FIRST MATURITY

For purposes of this study, specimens in maturity stages III, IV and V totalling 743 were examined for their gonad conditions. It could be seen from Fig. 1 that percentages of mature fish in size groups 150-154 mm. (total length), 155-159 mm., and 160-164 mm., were 25, 47 and 78 respectively. All fish above 165-169 mm. group were mature. The last group indicates the minimum size at first maturity for oil sardine.

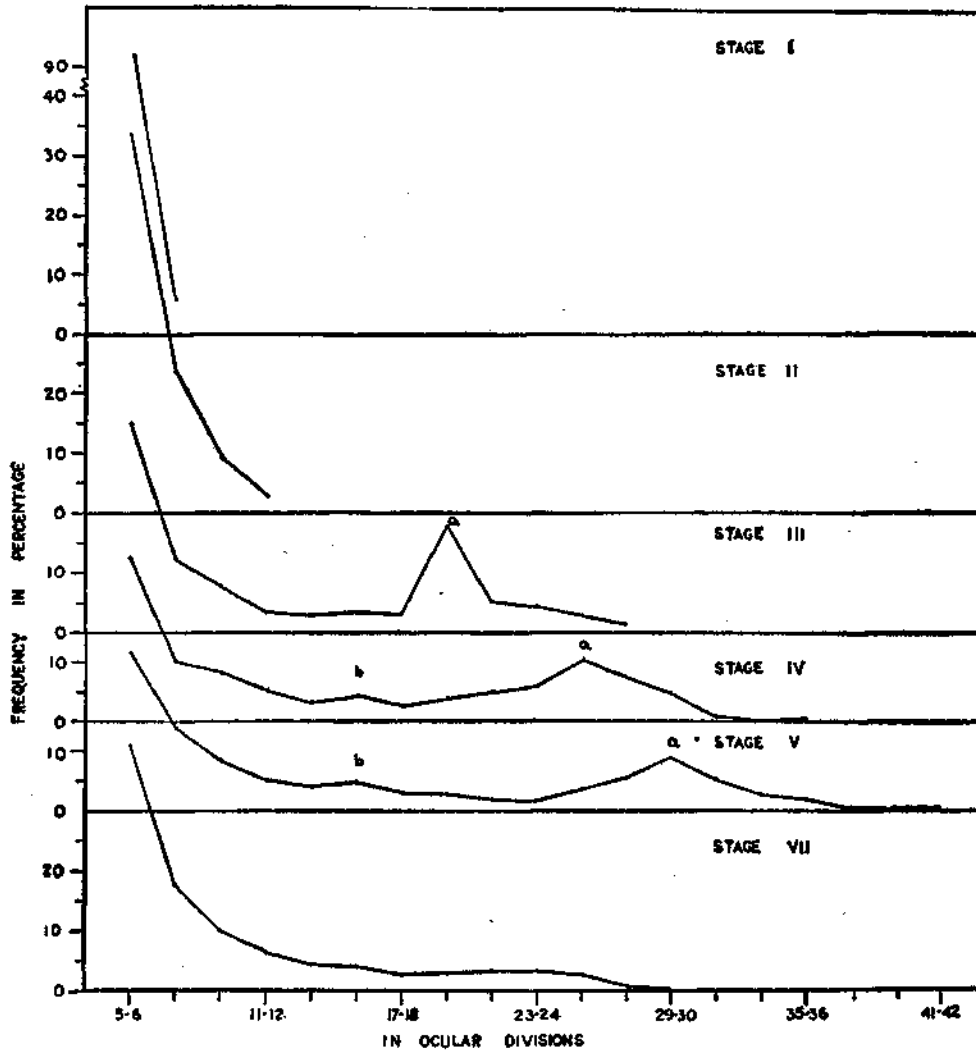


FIG. 2. Frequency of ova diameter of *Sardinella longiceps* in different stages of maturity.

#### OVA DIAMETER STUDIES

In Fig. 2 various maturity stages of oil sardine have been shown. In stage I about 94.5% of ova measure 5-6 ocular divisions (one ocular division = 0.019 mm.) whereas in stage II the immature ova are getting differentiated from the general stock. In stage III the eggs are visible to the naked eyes and progressive growth of eggs can be made out. A distinct mode "a" at 10-20 ocular divisions (0.36 to 0.38 mm.) comprising mature eggs is conspicuous. However, stage IV has two distinct and widely separated modes "a" and "b" at 25-26 and 15-16 ocular divisions respectively. The former mode alone is comprised of mature eggs. In stage V the mode "a" has shifted to 29-30 ocular divisions but the

mode "b" is static. From the progression of modes it can be inferred that the mature eggs constituting the mode "a" alone in the ensuing season partake in the spawning activity.

Oil sardine in maturity stage I dominate the catches made from September to December and in stage II from November to February. During March and April maturing (stage III) and in May-July period mature (stage IV & V) oil sardine contribute to the bulk of the catches. During July-September period

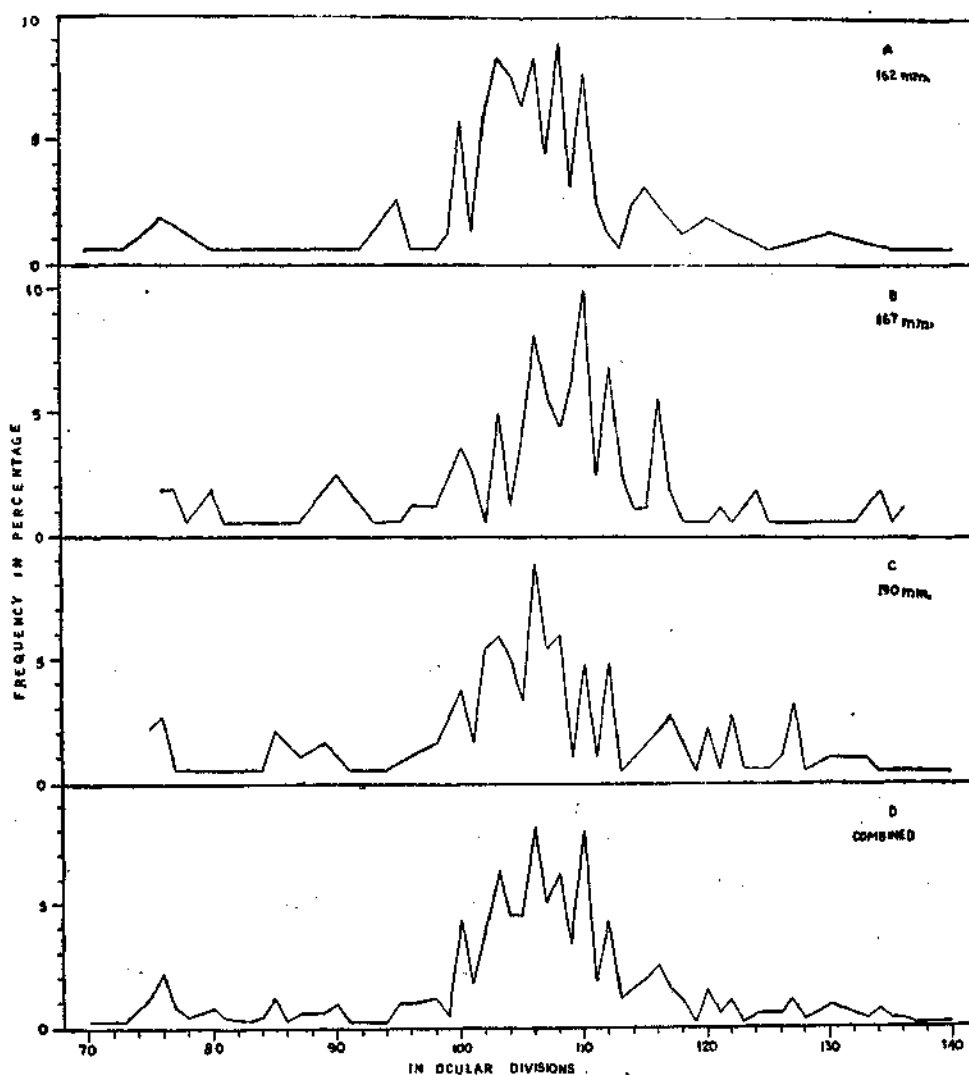


FIG. 3. Frequency of ova diameter (under higher magnification) of *Sardinella longiceps*.

fish in various degrees of spent condition are caught in large numbers and in lesser numbers till December.

From Fig. 2 it is seen that mature eggs measuring in diameter between 23 to 42 ocular divisions in various stages of ripeness are involved in the act of spawning. However, the range of ova diameters is too wide to suggest that these eggs will be released in one batch only. To examine whether different modal sizes, if any, exist within the above mentioned range, the method adopted by Vijayaraghavan (1962) was employed in this study, *i.e.*, the diameter of eggs were measured under a greater magnification (one ocular division = 0.0045 mm.) and plotted in one ocular division interval which brought out more clearly the variations in the diameter of eggs. In Fig. 3 ova diameter of three specimens A, B and C measuring 162, 167 and 190 mm., respectively (in total length) and the pooled frequencies (D) have been shown. It is apparent that the graph is of polymodal nature. The three ovaries further show more or less the same pattern of development of eggs. The modes falling within the range 100-115 ocular divisions are clear and sharp. Although the eggs falling in the above mentioned range show different modes, perhaps all the eggs within this range may get ripened and released at one time only. Further the graph indicates that the eggs do get ripened in distinct groups and are obviously released in batches. Perhaps eggs measuring between 120-140, 100-119 and 70-99 ocular division may get ripened in succession and extruded in a number of batches. It can be inferred from the figure that 3 to 4 batches of eggs may be released during the spawning season.

In stage VII it is seen that almost all the eggs have already been released and few remaining ones perhaps are going to be absorbed.

Nair (*op. cit.*) states that only one batch of eggs is spawned during the spawning season. But from the foregoing account it can be seen that oil sardine release eggs not in one batch but in a number of successive batches. Sekharan and Dhulkhed (in press) have reported from Mangalore the recruitment of different broods of oil sardine to the coastal fishery during August-October period. While this is a typical characteristic of a population with a protracted spawning where different members of the population may spawn at different times, the fact that an individual fish itself releases eggs in intermittent batches is yet another reason for the occurrence of a number of broods which enter the fishery. Occurrence of oil sardine in various degrees of spent condition during July-September period lends further support to the above conclusion. This also indicates that the spawning period of oil sardine is from June to September coinciding with the south-west monsoon period when the hydrological conditions *viz.*, temperature and salinity of the inshore waters are low due to the influx of flood waters.

## SUMMARY

The minimum size group at first maturity is when oil sardine measure 165-169 mm. Studies on the ova diameter revealed that the eggs are released in a number of successive batches.

## ACKNOWLEDGEMENT

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