

LARVAE OF *RASTRELLIGER* (MACKEREL) FROM THE INDIAN OCEAN

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Three early larval stages of mackerel, probably *Rastrelliger kanagurta* collected during the International Indian Ocean Expedition, have been described and illustrated. These records of larvae of such early stages from the Indian Ocean are made for the first time. The area and time of capture of larvae throw some light on their possible breeding season and spawning grounds.

INTRODUCTION

Mackerel belonging to the genus *Rastrelliger* is very widely distributed in the Indian Ocean, and the mackerel fishery of India is constituted very largely by *R. kanagurta*. But very little is known about its spawning and early larval stages. The published records of young specimens are only of a few juvenile stages. Larvae described by Delsman (1926) as *Rastrelliger kanagurta* were later found to be of another species. The available records on the reported capture of larvae of *Rastrelliger kanagurta* are from Vizhingham near Trivandrum (Balakrishnan 1957), and from Madras (Kuthalingam 1956). But neither publication includes illustrations or descriptions. Another record of larvae of *Rastrelliger kanagurta* is from Gulf of Tonkin (Gorbunova 1965). There are several records of the capture of larvae of the genus *Rastrelliger* from Gulf of Thailand during the Naga Expedition (Matsui 1963). A review of the literature of the records of the capture of young stages of *Rastrelliger* (Rao 1962) shows that they are only occasionally caught from the east and west coast of India.

OBSERVATIONS

This paper deals with the records of occurrence and descriptions of three early larval stages of *Rastrelliger* from the Indian Ocean plankton, collected by the vertical hauls of the Indian Ocean Standard Net from 200 m to the surface, during International Indian Ocean Expedition. These three early larvae (represented by three specimens only) measured 2.7 mm, 3.1 mm, and 5.3 mm, in total length, and were collected respectively from Persian Gulf, Red Sea and Bay of Bengal (Fig. 1). It is noteworthy that such very early stages have not been reported from the Indian Ocean hitherto. Details of the station data are given below (Table I).

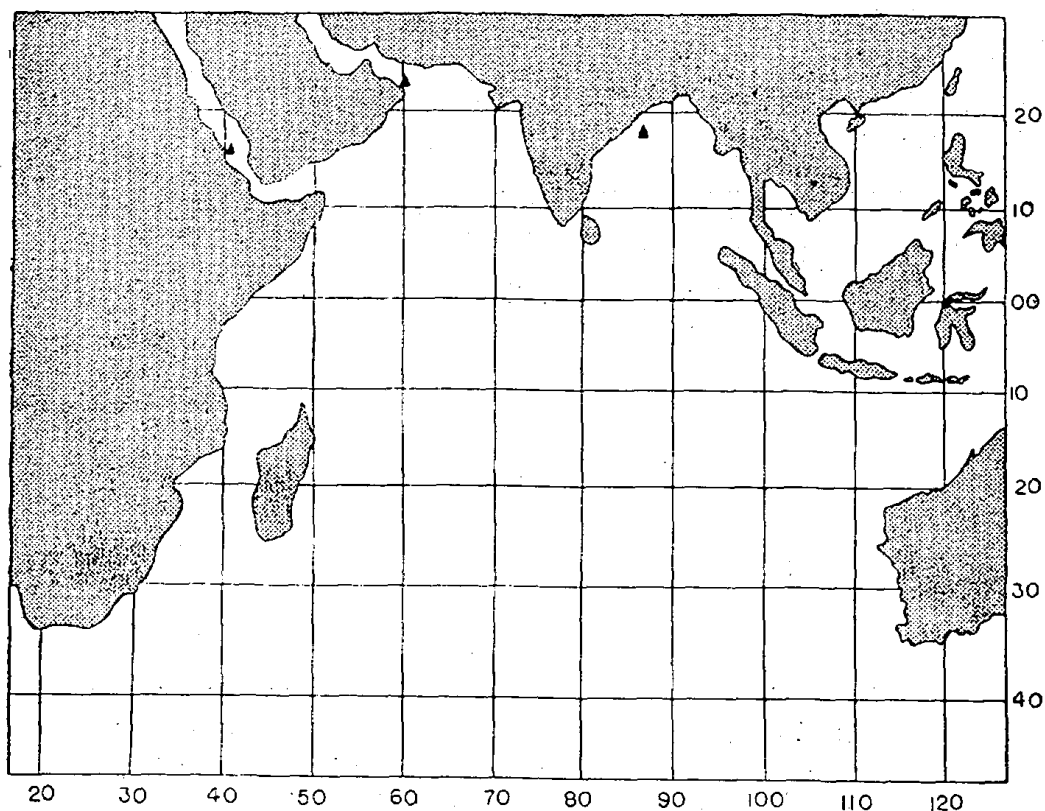


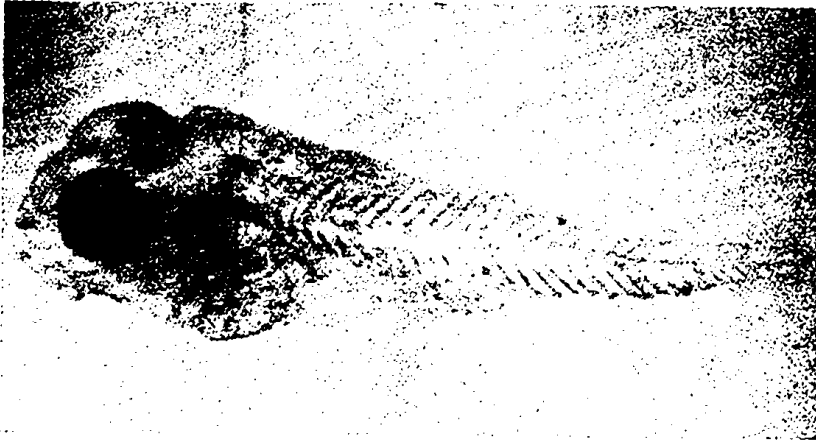
FIG. 1. Localities showing the capture of larvae of *Rastrelliger*.

TABLE I

Details showing the station data regarding the capture of larvae of *Rastrelliger*

Name of vessel	Station No.	Position		Date	Time (Local)	Length of specimen (mm)
		Lat.	Long.			
R. V. Anton Bruun	194	22°22'N	60°05'E	3-11-1963	0450	2.7
R. S. Meteor	73	16°37'N	41°09'E	7-12-1964	2145	3.1
R. V. Pioneer	16	18°15'N	87°48'E	8-5-1964	2000	5.3

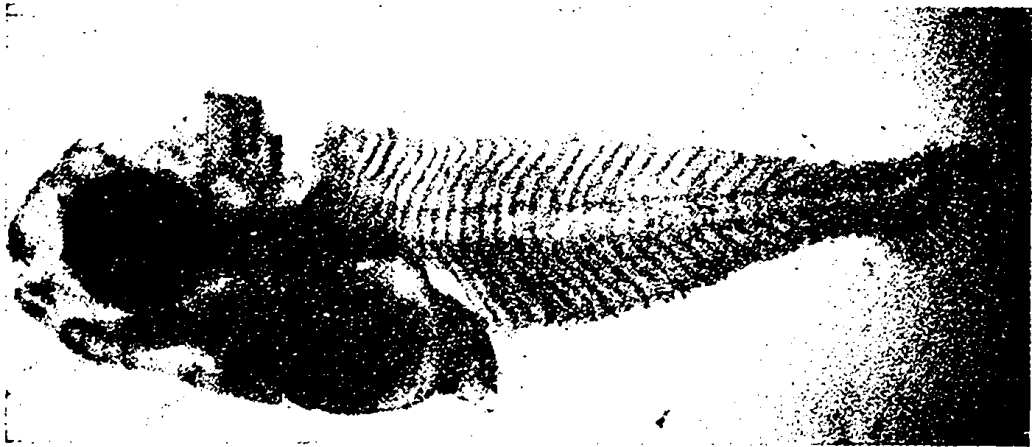
The developmental stages of the larvae (Figs. 2, 3, 4 and 5) very closely resemble in general pattern, the Pacific mackerel, *Pneumatophorus diego* (Ayres), the embryonic and larval development of which has been worked out by Kramer (1960). Further, these stages show a high degree of resemblance to the larvae of *Rastrelliger* described by Matsui (1963). The larvae under description have a fairly stubby body, with thirty myomeres, big eyes, wide mouth, coiled intestine and a large head devoid of opercular spines. They differ from the larvae of *Scomber* and *Pneumatophorus* in having a lesser degree of pigmentation and a comparatively deep body.



1



2



3

FIG. 2. Development of *Rastrelliger*—three different stages.

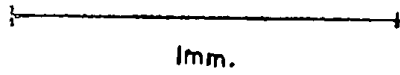
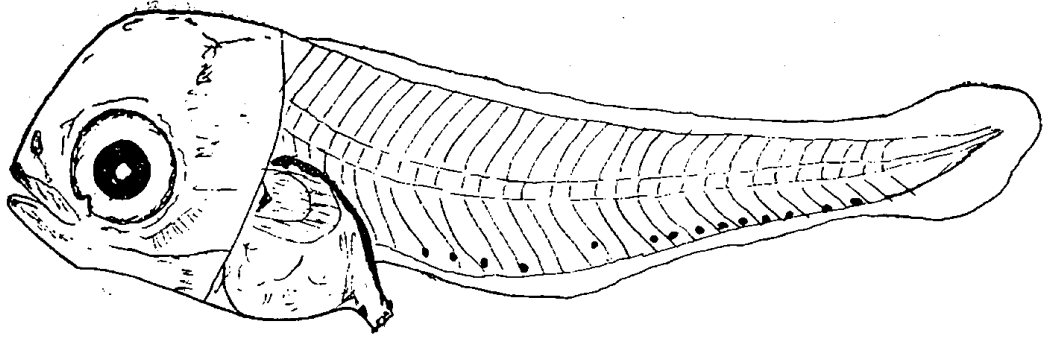


FIG. 3. Larva of *Rastrelliger* (2.7 mm).

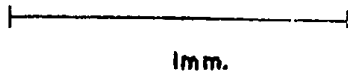
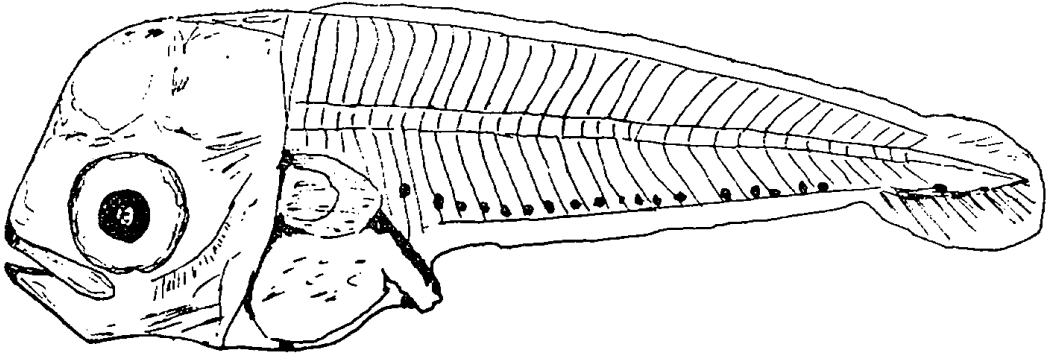


FIG. 4. Larva of *Rastrelliger* (3.1 mm).

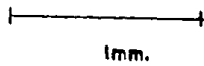
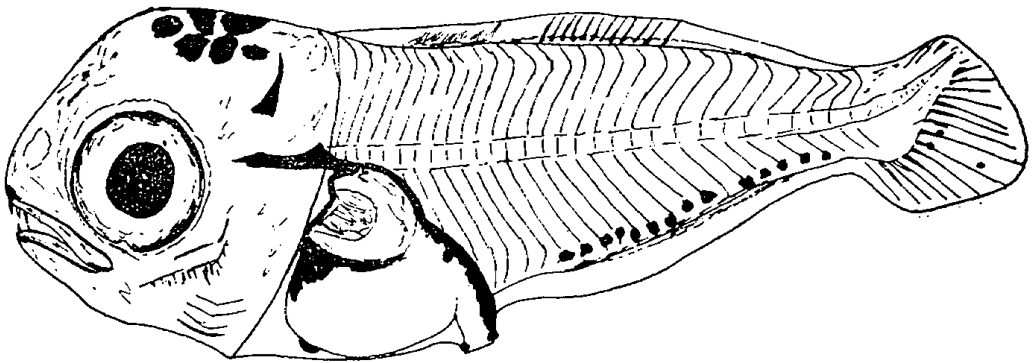


FIG. 5. Larva of *Rastrelliger* (5.3 mm)

The earliest of the stages collected (Fig. 3) measures 2.7 mm in total length. It has thirty well defined myomeres, of which seven are abdominal and thirteen are caudal. The alimentary canal is short and single coiled, the coiling being through the right side. The length of head measures 1.4 mm, and height 1.3 mm. The depth of the body at the region of the stomach is 1.5 mm. The mandibles, maxillae, cleithra and opercula are ossified to a greater degree than the rest of the skeletal elements. The notochord is straight, and partly ossified. Mouth is rather wide, and the inner corner of mouth extending up to the base of middle of eye. The diameter of eye measures 0.5 mm. The eyes are pigmented. The dorsal and anal fins are represented by the long finfold that extends throughout the length of the body. The pectoral fins are represented by two flattened membranous finfolds one on either side. The caudal has a symmetrical appearance with the tip of notochord passing through the centre. The dorsal part of the larva is quite unpigmented, whereas ventral part exhibits certain definite pattern of pigmentation. There are two pigment spots just below the stomach. Located at the anterior and posterior margins of the anal opening two pigment spots are also noticeable. Posterior to the anal opening, a row of melanophores numbering up to fifteen are seen on the ventrolateral margin of the myomeres. They extend from 8th to 29th myomeres. But the 14th, 15th, 18th and 30th myomeres lack this pigmentation. The caudal also does not show any sign of pigmentation.

The next stage in this series (Fig. 4) measures 3.1 mm. The larva has a more stubby-bodied appearance. The length of the head measures 1.5 mm and the height, 1.6 mm. The myomeres could be separated into seven abdominal and thirteen caudals. Some of the anterior myomeres have developed a zig-zag pattern. The processes of branchiostegal rays and gill arches are noticeable. The eyes also show proportional increase in size, having a diameter of 0.6 mm. The mouth lacks teeth at this stage. The notochord is still straight. The pectorals show a certain degree of advancement in their growth. They measure 0.5 mm in length and are very conspicuous. At this stage the larva might be capable of swimming fast. The dorsal parts of stomach and alimentary canal are well-pigmented. The pigmentation in the gut region is confined to the peritoneal cavity. On the top of the head are noticed two small pigment spots. The stomach and intestine retain the same pattern of pigmentation. Posterior to the anal opening as many as eighteen pigment spots could be counted. In the caudal region one pigment spot is noticed at the base of the hypural plates and another at the distal margin of the caudal rays.

The 5.3 mm long larvae (Fig. 5) looks very deep bodied and short. In relation to the greater size of the head, the eyes also show a proportional increase in size (0.7 mm in diameter). A lengthening of the intestine is also observed at this stage. The myomeres appear very compact and exhibit a high degree of zig-zagging, indicating further advancement in the muscle differentiation towards the adult condition. Nine abdominal and twenty-one caudal myomeres could be demarcated. Ossification of principal caudal rays is already noticed. The vertebral column and urostyle are almost completely ossified. The second dorsal, though appearing like a membranous finfold, shows signs of ossification of rays especially at the positions of the basals. Even though the entire finfold uniformly, exhibits a thickened margin towards

the base throughout its length, the future position of the second dorsal is clearly indicated. On close examination as many as twelve thickened basals and an equal number of very thin supporting rays could be noticed. Even though the first dorsal is not yet formed, its future site is demarcated by the thickening noticed just anterior to the second dorsal. The anal also is almost in the same stage of development as the second dorsal. It is located just opposite to the second dorsal, having about twelve thickened basals. The dorsal and anal finlets are not developed at this stage. The caudal has undergone a higher degree of ossification than the dorsal and anal and up to fifteen caudal rays could be counted. The tip of the urostyle is curved upwards. Of all the fins, the pectorals are the most conspicuous with a high degree of muscular support. The total length of the fin including the stalk measures 0.6 mm. Six teeth are noticed in the upper jaw and four in the lower. Gill rakers are better developed. Four branchiostegal rays are clearly visible. The dorsal side of the head and the tip of the snout are pigmented. Pigmentation is also seen all over the stomach, especially in the peritoneal cavity. Pigment spots present at the anterior and posterior margins of the anal opening as in the previous stages, are noticed in this stage too, but they appear to be more dark. Two other pigment spots are also noticed just below the stomach. The ventro-lateral row of pigment spots start from the 13th myomere onwards. The 23rd myomere is found to be unpigmented. On the caudal region three conspicuous pigment spots are present on the caudal fin also, of which two are below the hypurals and one towards the distal end of the fin rays. The melanophores on the occipital region and top of head form a more or less circular pattern. The number of ventral pigment spots is limited to fourteen, and they exhibit some degree of fading

DISCUSSION

The above larvae represent three important stages in the life history of *Rastrelliger*. In fact, they form a very significant link in the chain of mackerel fisheries research, as they give some clue regarding the location of spawning grounds of this commercially important fish. A comparative study of the material, with that of the illustrations and descriptions of *Pneumatophorus diego* (Kramer 1960) and of genus *Rastrelliger* (Matsui 1963) proves beyond doubt, that the larvae under description belong to the genus *Rastrelliger*. The larva of *Rastrelliger* is found to be in a more advanced stage of development, than all its nearest scombrid relatives of the same length size so far described. But the stages of larvae described here differ from the *Rastrelliger* collected from the Gulf of Thailand (Matsui 1963) in the following respects: Matsui observed the splitting of the ventral melanophores into right and left components only from the 4.5 mm long (standard length) larvae onwards. But such splitting of ventral melanophores has been observed even in the earliest stage referred in this paper. Similarly, the presence of dorsal pigmentation along each side of the base of the second dorsal and finlets are not seen in the corresponding stages described here. Further, the pigmentation on the top of head and at the tip of the snout is very conspicuous and it appears at an earlier stage than in the specimens described by Matsui. So these changes in the development of pigmentation pattern can be considered as a species character. Matsui does not consider

the larvae from the Gulf of Thailand, as belonging to the species *kanagurta* as the fish catch records prove otherwise. But *Rastrelliger kanagurta* is the dominant species in Indian waters. It is therefore to be expected that the present series belong to *Rastrelliger kanagurta*.

Literature regarding the breeding periodicity of mackerel (Rao 1962) shows that on the west coast the spawning is supposed to take place between March and September, and the data for the east coast are too meagre to draw any definite conclusion. In this connection, it is interesting to note that the present record of capture of larvae from the Arabian Sea area is during November-December and from Bay of Bengal, during May. The data based on the capture of eggs and early stages of larvae (whose power of locomotion is very limited) will give a definite clue for the location and time of spawning, than that based on fish catches. The indication of spawning grounds, by catching juveniles, or even adults with spent gonads will not always give a correct picture of such areas, because by the time they are caught they might have travelled long distances away from the actual spawning grounds.

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