

investigations would therefore be needed to show if barium meal and/or X-rays exert any inimical effect directly or indirectly on the parasite. The finding, if positive, would be of immense value to provide a novel approach in the treatment of gnathostomosis in animals and possibly in man also, for which no effective treatment is known as yet.

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March 22, 1978.

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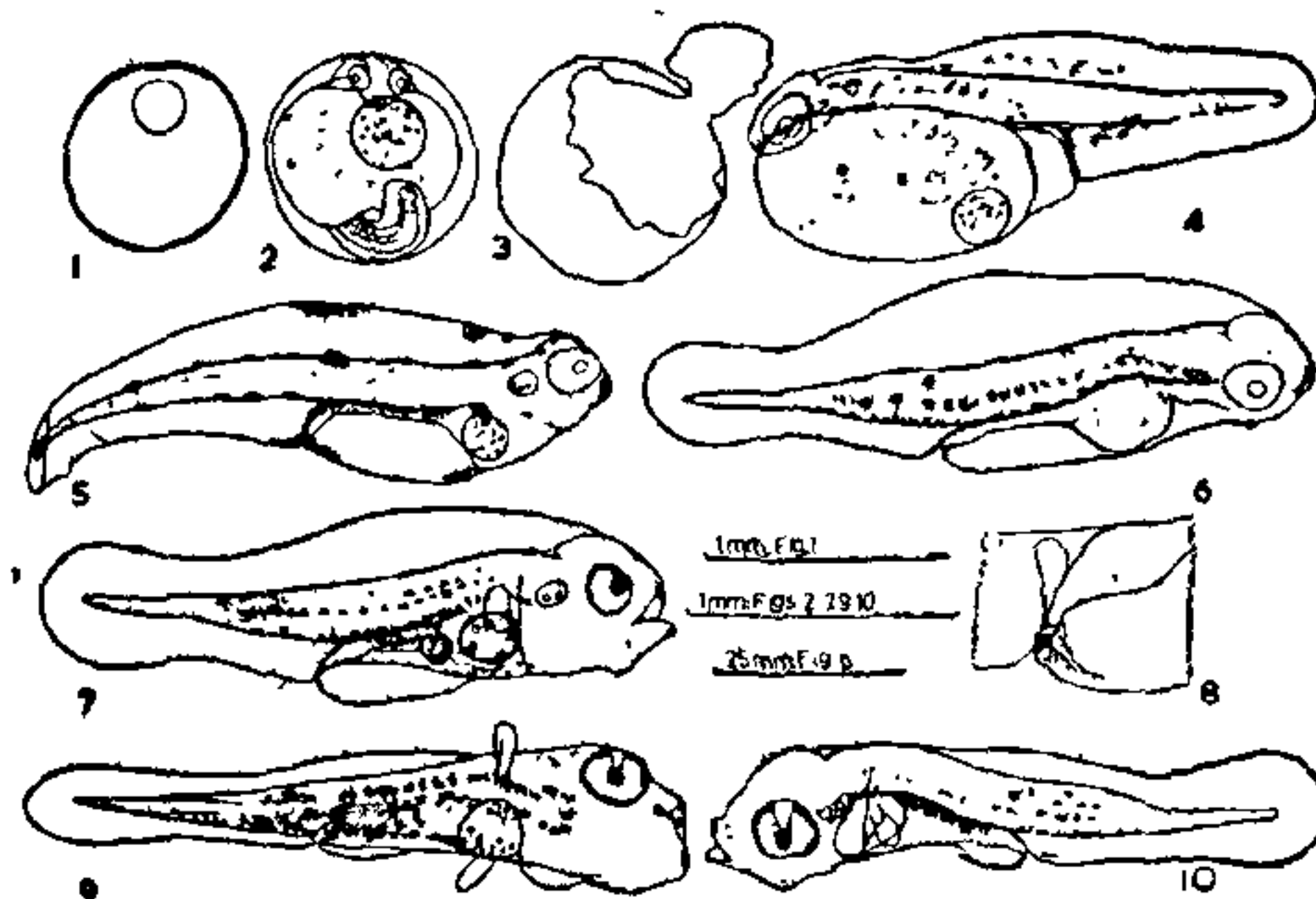
### EGGS AND EARLY LARVAE OF THE INDIAN MACKEREL, *RASTRELLIGER KANAGURTA* (CUVIER) FROM NEARSHORE WATERS OF PORTO NOVO

THE planktonic eggs of the widely distributed and commercially valuable Indo-Pacific species *Rastrelliger kanagurta*<sup>1</sup> and the larvae hatching out of them have not yet been identified positively and described. Although Delsman<sup>2,3</sup> attributed certain eggs collected from Java coast at first to this species, later, based on certain vital features, he expressed doubt on the validity of his identification. Subsequently, from the south-west coast of India, a couple of reports on the occurrence of mackerel eggs were made<sup>4,5</sup>. But, in the absence of adequate descriptions and illustrations, these accounts are not considered as reliable<sup>6,7</sup>. As such, the present communication on the eggs identified as of this species, collected from the nearshore waters of Porto Novo, may be of interest.

The Indian mackerel spawns along the south-east coast of India from January to November<sup>8</sup>; and, spawners as well as spent specimens were collected at Porto Novo during February and March, 1978. A search for the eggs in the plankton samples collected from the 10 metres depth area off Porto Novo during these months revealed the presence of mackerel eggs for the first time on 8th March 1978; and a batch of twelve eggs were isolated alive and ten numbers were reared in the laboratory for the early larval stages.

The eggs were spherical and, although pelagic, had a tendency to sink slightly and remain suspended below the water surface. The diameters of five live eggs ranged from 0.731 mm to 0.890 mm, with an average of 0.786 mm. A large oil globule was present in each, ranging in diameter from 0.204 mm to 0.250 mm, with an average of 0.208 mm. The diameter ranges of the planktonic eggs and oil globules agreed with those of ripe unfertilized eggs and oil globules recorded earlier<sup>9,10</sup> and the unpublished data with

one of us (P.B., Fig. 1). The yolk was neither segmented nor vacuolated and the eggs were pale yellowish owing to the pigmentation present on the embryo, yolk-sac and oil globule. In the egg figured at 10.00 hours on 8-3-1978 (Fig. 2) the embryo was well indicated with pale yellow pigmentation on the head, along the sides of the body and a few dark spots on the trunk and posterior region. On the yolk-sac there were a few black branching pigments. Pigmentation on the oil globule was characteristic, with pale yellow xanthophores as well as dendritic melanophores, particularly in the region facing the embryo anteriorly.



FIGS. 1-10. Camera-lucida drawings of the eggs and early larvae of *R. kanagurta*. Fig. 1. Ripe, unfertilized ovum. Fig. 2. Planktonic egg. Fig. 3. Empty egg capsule after hatching. Fig. 4. Newly-hatched larva. Fig. 5. 20 hours old larva. Fig. 6. 26 hours old larva. Fig. 7. 46 hours old larva. Fig. 8. Anal region of 46 hours old larva enlarged to show the melanophore. Fig. 9. 68 hours old larva. Fig. 10. About 73 hours old larva.

The embryo at the time of hatching was observed to split the egg capsule and emerge out of it (Fig. 3) in a partly curved condition. Soon the newly hatched larva straightened out (Fig. 4), measuring 2.09 mm long and 0.75 mm deep at the deepest region. The oil globule was situated at the hind end of the massive yolk-sac. Pale yellow reticulation and dark spots along the dorsal and ventral margins of the body were present in the postanal region. A few pale yellow pigment spots were seen on the larval finfold dorsally and on the yolk-sac. Pigmentation of the oil globule conformed with that of the embryonic condition. The myosepta were clearly discernible, with 13 preanal and 18 postanal myotomes, which number and disposition agreeing with the adult vertebral condition.

By rearing the early larvae in the laboratory, five more stages were obtained, viz., 20h old (Fig. 5), 26h old (Fig. 6), 46h old (Figs. 7 and 8), 68h old (Fig. 9) and about 73h old (Fig. 10) measuring 2.14, 2.47, 2.32, 2.42 and 2.26 mm respectively. The

most salient features in the course of development as may be seen from the figures were the gradual elongation of the body, pigmentation of the eyes, formation of the mouth, coiling of the alimentary canal, coagulation of the yolk and increase in pigmentation. From 26h old stage onwards, owing to the increase in pigmentation, all the myosepta were not clearly discernible, but in the 73h old stage 13 myosepta could be counted in the preanal region and 9 in the postanal region. As development progressed, highly diffused black pigments have appeared as a series from the postorbital region upto the urostyle, especially along the ventral margin of the body. Laterally also a series has appeared, initially in the postanal region and then extending anteriorly till the orbit. From 46h old stage onwards, a series of black pigments was present ventral to the viscera upto and beyond the isthmus. A pale brownish or pinkish colouration was present in the living and newly-fixed larvae, particularly beneath the mid-lateral line from behind the anus to the snout. A dendritic melanophore was present in the anal region in the 26h, 46h (Fig. 8) and 68h old larvae. Pigmentation in the 68h old stage (Fig. 9) was highly diffused ventrally; but in the 73h old larva (Fig. 10) the pigmentation was more clearly defined, in the form of a band dorsal to the viscera, a series anterior to it and another in the postanal region ventrally. Also, pigments were present ventral to the viscera, on the snout, lower jaw, etc.

The ripe ova of the Indian mackerel ranges in diameter from 0.629 to 0.900 mm<sup>9, 10</sup> and their oil globules from 0.20 to 0.25 mm. The perivitelline space is rather narrow; and, as in the case of the Japanese mackerel<sup>11</sup>, the eggs do not appear to undergo marked increase in size in the course of development. The identity of the present material as those of the Indian mackerel is based on the similarities in the size-ranges of the eggs and their oil globules as well as on the number and disposition of the myotomes, particularly in the earlier stages. The lesser number of myotomes in the 73h old larva may be explained as a feature similarly found in certain stages in the course of development, reported earlier<sup>7</sup>. Apart from these facts, the general appearance of the larvae and the pattern of pigmentation are similar to those of the Japanese and European mackerels<sup>11, 12</sup>. The position of the vent as well as the relative lengths of the preanal and postanal components of the body in the larvae of these species are seen to differ from each other and from one stage to another. Also, in both these cases, a forward shifting of the vent takes place in the early developmental stages. Thus, in the newly hatched larva of *Scomber scombrus*<sup>12</sup> (2.4 mm) the preanal length is 40.3%, but in the 3.7 mm stage it is only 34.6%, showing a decrease of 5.7%. In the present material also, a decrease in the preanal

length is observed, from 55.5% in the newly-hatched larva (2.09 mm) to 50.7% in the 73hrs old stage (2.26 mm), showing a reduction of 4.8%. Hence, it is reasonable to expect that the preanal length would become further less and postanal length much more than in the earlier stages. This feature is obviously linked with the number and disposition of larval myotomes in the course of development.

Apart from *R. kanagurta*, two more species of mackerels were reported from the Indian region, viz., *R. brachysoma* from Andamans<sup>13</sup> and *R. faughni* from Madras<sup>14</sup>. Among all these species, *R. brachysoma* is the shortest bodied one and *R. faughni* the longest bodied. The former species is only confined to Andamans and the latter is rather oceanic and not yet recorded from Porto Novo. During February and March, 1978, mature and spawning specimens of *R. kanagurta* alone were available off Porto Novo, thus confirming that the present eggs and larvae are only those of *R. kanagurta*.

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March 25, 1978.

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