

## THE EGGS AND EARLY DEVELOPMENT OF A MURAENID EEL\*

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OCCURRENCE of eel eggs in the Indian coastal waters has been recorded only on a few occasions, probably owing to their relative scarcity. The first to report of their occurrence were Aiyar, Unny and Varkey (1944) from the Madras Coast. Nair and Bhimachar (1950) described three types of eggs and two types of early larvae from the plankton off Tuticorin, Gulf of Mannar. Bapat (1955) gave brief notes on an eel egg and newly-hatched larva from the plankton of Mandapam area. Descriptions of the early larvae belonging to Ophichthyidae, obtained by rearing the eggs collected from Madras Coast are given by Jones and Pantulu (1955). Ganapati and Raju (1960) described the eggs and early development of *Murdena* sp. and *Ophichthys* sp. off Waltair Coast. Nair and Dharmamba (1960) gave an account of the early development of an Ophichthyid egg from the Lawson's Bay, Waltair. The present communication deals with the eggs and early development of a Muraenid species, collected off Cannanore, south-west coast of India.

The eggs were obtained in the living condition from the routine plankton collections made with a  $\frac{3}{4}$  metre net of fine organdie cloth towed for 15 minutes in the surface region of the 6 fathom station in the early morning hours. During the period January 1961 to November 1964 only on two occasions that eel eggs were met with in the collections, 21-1-1964 and 3-4-1964: a single egg on the former date and ten eggs on the latter. The eggs collected on both the days belonged to a single species, as revealed by their characteristics. Those obtained on 3-4-1964 were reared in the laboratory for the stages in the early development. Owing to the paucity of the eggs in the subsequent collections, the development could not be traced beyond the one-day old larval stage.

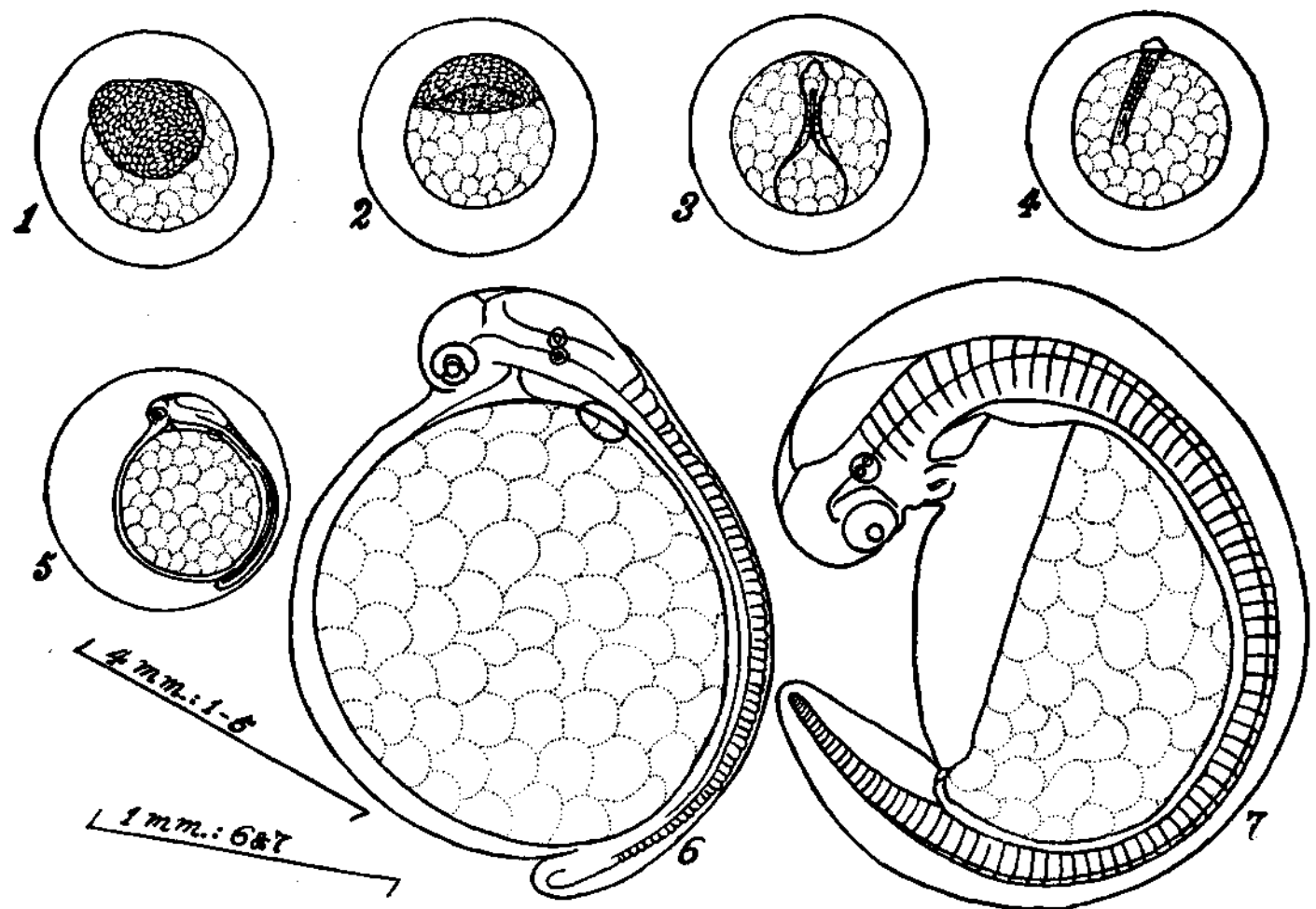
*Egg*: The egg is pelagic, transparent and spherical with an average diameter of 2.853 mm. The yolk is centrally placed, spherical, transparent and vacuolated with an average diameter of 1.777 mm. The perivitelline space is wide. No oil globule is present.

*Embryonic development*: The eggs collected on 3-4-1964 when brought to the laboratory (at 09.00 hours) were in a very early stage of development (fig. 1). Cleavage is completed and the micromeres are in the form of a cluster occupying one pole of the yolk. In the egg collected on 24-1-1964 (fig. 2) the germinal disc has commenced spreading over the yolk, marking the initial stage of gastrulation.

Within  $5\frac{1}{4}$  hours of their life in the laboratory the eggs obtained on 3-4-1964 have shown indication of the embryo (fig. 3). In this stage the boundaries of four myotomes can be distinguished. At the end of 7 hours the boundaries of five more myotomes are visible (fig. 4). The embryo has become slender and longer in this stage with developing optic vesicles.

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FIGURES 1-7. FIG. 1. Egg showing the earliest developmental stage. FIG. 2. Initial stage of gastrulation. FIG. 3. Four myotomes stage. FIG. 4. Nine myotomes stage. FIGS. 5. and 6. Fifty-six myotomes stage under different magnifications. FIG. 7. Ninety-one myotomes stage.

By the end of 24 hours of their life in the laboratory (at 0.900 hrs. on 4-4-1964) the embryo has grown considerably long (figs. 5 and 6). The trunk and tail are under progressive development. The optic cups with lens, otoliths, oesophageal pouch, a tubular functioning heart and rudiments of the larval fin are the other organs noticed. Fifty-six myotomes are present in this stage.

At the end of the 45th hour (at 06.00 hrs. on 5-4-1964) the embryo (fig. 7) has 91 myotomes of which 65 are pre-anal and 26 post-anal. The head and tail are free from the yolk. The larval fin has extended to the ventral side of the tail. The oesophageal pouch has become flattened and the alimentary canal is indicated.

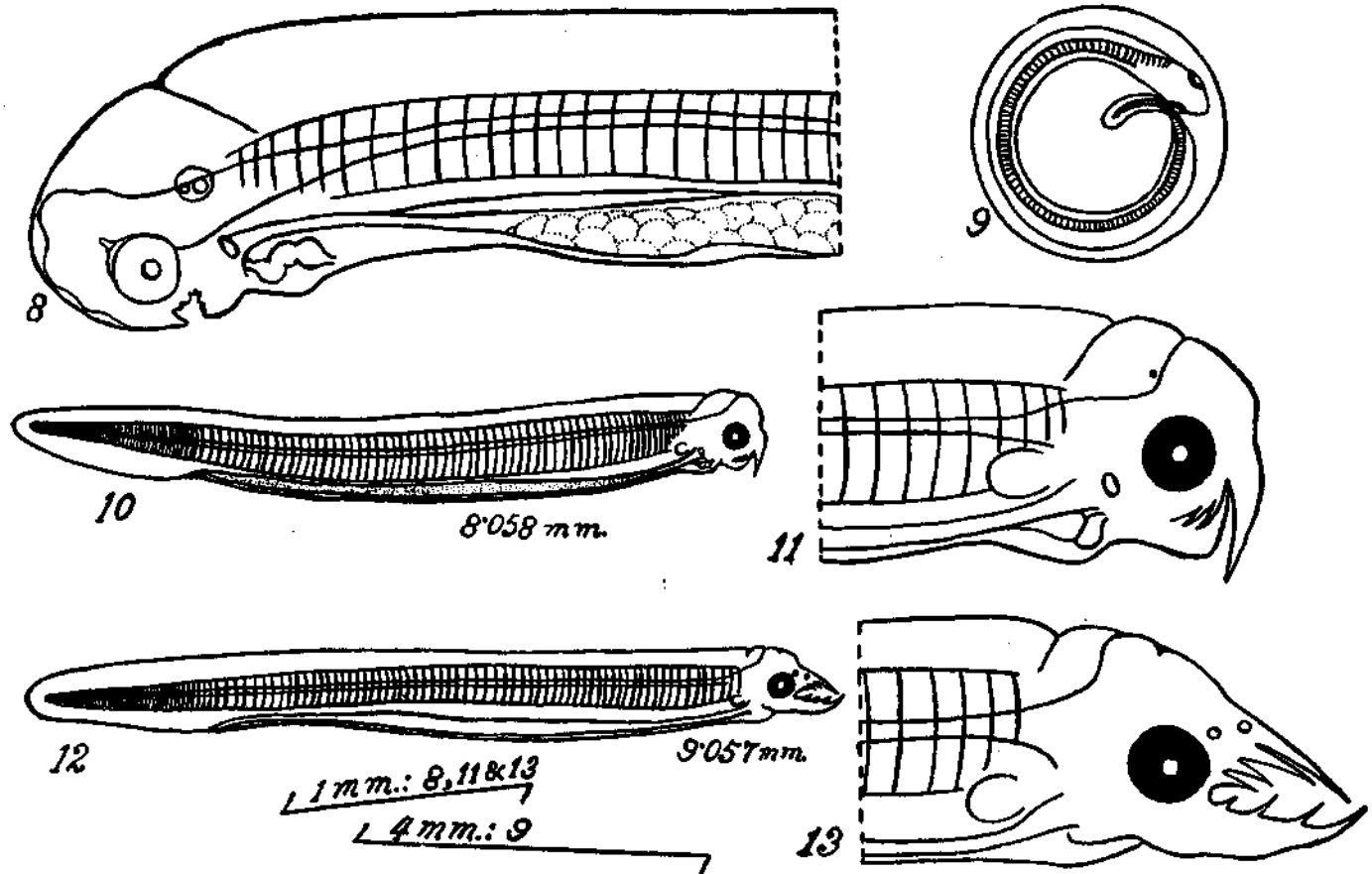
On 6-4-1964 at 10.00 hours, by the end of the 73rd hour of its life in the laboratory, the embryo has become curled up inside the egg capsule and makes occasional movements of its body. It measures 7.659 mm. (on being artificially liberated). The important changes noticed are (fig. 8) the development of the stomodaeal pouch with dental papillae, differentiation of the heart into various sections, progressive absorption of the yolk and reduction in size of the oesophageal pouch. There are 65 pre-anal and 47 post-anal myotomes. The embryo is transparent and unpigmented.

At the end of the 98th hour (at 11:00 hrs. on 7-4-'64) the embryo is ready for hatching (fig. 9). The eyes are pigmented black in this stage. Besides, a circular golden-yellow colouration is present on the dorsal side of the head but vanishes on fixation. The embryo does lateral and longitudinal movements of its body accompanied by lashing of the head and trunk against the egg capsule.

*Hatching* : The process of hatching was observed for the larva hatched out on 7-4-'64 at 11.15 hours, at the end of 98½ hours of life in the laboratory. From the stage of development of the eggs when brought to the laboratory on 3-4-'64, it appears probable that fertilization had taken place and development commenced within a couple of hours before and not longer. It may therefore be tentatively stated that the embryonic period lasts for about 100 hours.

At the time of hatching the embryo does oft-repeated movements inside the egg membrane, as a result of which the latter adjacent to the head ruptures suddenly and the embryo quickly pierces its way out. From the moment the capsule breaks till the larva emerges out it takes about ten seconds.

**Newly-hatched larva** : The newly-hatched larva soon emerging from the egg capsule swims actively. In the initial few seconds of its free life, the body remains partly curled. It is transparent with black-pigmented eyes and a circular golden-yellow colouration on the head. The length of the larva is 8.058 mm. with the maximum height in the anterior half of its body (figs. 10 and 11). The posterior half of the larva tapers gradually and terminates in a rounded tail. The mouth is somewhat sub-terminal in position and the dorsal side of the head is a little flattened. The jaws and the teeth are not fully exposed though the first set of larval teeth are visible. The dental formula is  $1+3/1+3$ . The teeth are long and conical and in both the jaws the front-most teeth are the longest and the others decrease in size backwards. The snout is short and the nasal depression is located in front of the eye. The eyes are somewhat circular in shape. Remnant of the yolk is still present inside the alimentary canal. The myotomes are arranged compactly. The pre-anal myotomes are broad and clear while near the tip of the tail they are very narrow, thus rendering the post-anal number difficult to be ascer-



FIGS. 8-13. FIG. 8. Anterior region of the embryo artificially liberated by the end of the 73rd hour of life in the laboratory. FIG. 9. Egg at the end of the 98th hour of life in the laboratory with embryo ready for hatching. FIG. 10. Newly hatched larva. FIG. 11. Head region of the newly-hatched larva. FIG. 12. One-day old larva. FIG. 13. Head region of the one-day old larva.

tained. There are about 115 myotomes of which 65 are pre-anal. The oesophageal pouch has become smaller in size and oval in shape. The alimentary canal is long and straight. The pectoral fin has developed as an oval flap-like structure. The larval fin is continuous. It begins from the nape and ends behind the anus. The larva is devoid of pigmentation.

**One-day old larva :** The one-day old larva has increased to a length of 9.057 mm. There is a slight reduction in the height of the larva (figs. 12 and 13) in the anterior region of the trunk. The maximum height is measured in the middle region. The head has grown a little longer with well-developed mouth and jaws. The latter have become protruded out in this stage. The lower jaw is slightly larger than the upper. The dental formula is the same as in the previous stage but the teeth have become longer and are directed forwards. All the teeth are exposed. The nasal pits are seen clearly. The yolk and oesophageal pouch have disappeared. There is no change in the position of the anus and the number and disposition of the myotomes.

#### DISCUSSION

The early developmental stages of muraenid eels from Indian waters were recorded very rarely. Nair and Bhimachar (1950) described three types of eggs of which eggs I and II do not possess oil globule. Of them egg I has a diameter of 2.5 mm. and egg II is 3.2 mm. Bapat (1955) noted an eel egg without oil globule and measuring 3.1-3.2 mm. in diameter. In its size and embryonic features the egg noted by Bapat (*l. c.*) resembles egg II described by Nair and Bhimachar (*l. c.*). The eggs of *Muraena* sp. described by Ganapati and Raju (1960) have a diameter of 3.2-3.6 mm. It is likely that the egg II described by Nair and Bhimachar (*l. c.*), the egg noted by Bapat (*l. c.*) and the eggs of *Muraena* sp. described by Ganapati and Raju (*l. c.*) belong to closely allied species, if not the same species.

From the Java sea Delsman (1933) described certain eggs assigned by him to muraenid species, having  $2\frac{3}{4}$  mm. diameter and without oil globule. The stage figured by him may be compared to the similar stage, figs. 5 and 6, in the present paper. The eggs in both these cases bear similarity to each other in all essential characters. The larva hatched from the egg described by Delsman (*l. c.*) on the other hand has 74 trunk and 70 tail myotomes while in the present case there are only 65 pre-anal and 50 post-anal myotomes. The egg I described by Nair and Bhimachar (1950) and the eggs of *Muraena* sp. given by Ganapati and Raju (1960) differ from the present eggs in their size. Apart from this the eggs and or early larvae of muraenid species given by the above authors differ from the present ones in that the eyes do not get pigmented in the embryonic stage itself. In the case described by Delsman (*l. c.*) the eyes become pigmented in the "few days older larva" while in that observed by Ganapati and Raju (*l. c.*) the eyes are unpigmented in the newly-hatched larva, become brown in the one-day old stage and black only in the two-days old larva. In this respect the present eggs and larvae resemble those of such cold water species as *Muraena halena* (Schmidt, 1913).

In the absence of direct evidence, the identity of the eggs and larvae is difficult to be ascertained, in the present state of our knowledge on the biology of Indian eels. The presence of the pre-leptocephaline stage in the early life-history of these eels adds much to this uncertainty. Schmidt (1913) based on connected series of larval stages identified the eggs and early larvae of a few muraenid and

ophichthyid species from the Mediterranean. The eggs and larvae of ophichthyid species identified by him are characterised by stalked nature of the yolk in the embryo, presence of distinct swellings of the gut and of pigment groups along its ventral aspect. The eggs of muraenid species are generally devoid of oil globule. Besides, the early larvae of Muraenidae are generally unpigmented. If pigmented, it is not in the form of distinctly separated conspicuous groups as in Ophichthyidae. Delsman (1933) and Ganapati and Raju (1960) assigned similar eggs and early larvae to Muraenid species. Nair and Dharmamba (1960) remarking on egg II and larva I described by Nair and Bhimachar (1950) state that the extension of the yolk-sac upto the anus, termination of the larval fin behind the anus, the compactness and straight disposition of the myotomes, ("in contrast to the slightly angular nature of the myotomes of the other larvae"), recalling the condition in *Muraena* spp. given by Schmidt (1913), justify "the assumption that the egg and larvae described by Nair and Bhimachar belong to Muraenidae".

Just as is the case with the eggs, the occurrence of pre-leptocephaline stages belonging to Muraenidae is rare in the Indian Coastal waters, although leptocephali are commonly found. The description of larva I given by Nair and Bhimachar (1950) is evidently that of a muraenid pre-leptocephaline stage, as pointed out by Nair and Dharmamba (1960). The 7.7 mm. larva described by them has 146 myotomes of which 84 are pre-anal. This is different from the early larvae (pre-leptocephaline) in the present paper, in their length and the number of myotomes, total as well as pre-anal. The early larvae noted by Bapat (1955) and described by Ganapati and Raju (1960) are hatched from larger eggs.

It is also difficult to compare the present larvae with the muraenid leptocephali described from Indian waters, as all of them are in advanced stages of metamorphosis. The number of myotomes, a crucial character in comparing the larval stages, is subject to variation between different stages. The presence of golden-yellow patches on the dorsal side of the head of the present larvae and in the anterior and posterior regions of the eye of the leptocephalus of *Muraena macrura* (Nair, 1947) point out that they probably belong to allied species.

#### ACKNOWLEDGEMENTS

My deep gratitude is due to Dr. S. Jones, Director, Central Marine Fisheries Research Institute, for critically going through the paper and for offering valuable comments. I am grateful to Mr. K. V. Narayana Rao for the help given in the present work at Cannanore.

#### SUMMARY

Eight stages in the embryonic development from the germinal disc stage to the fully formed embryo lasting for about 100 hours of a muraenid eel are described. The process of hatching and notes on the newly-hatched larva and one-day old larva are given. The developmental stages are compared and contrasted with similar ones described from Indian waters.

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