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EGGS AND EARLY DEVELOPMENT OF TWO MORE CARANGIDS FROM MADRAS*

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THE early development of three carangid fishes from Madras waters was studied during 1961 and 1962. The account on the first type of eggs, which has been provisionally identified to be of *Caranx hippos*, has been published already (Subrahmanyam, 1964) and the present paper is the conclusive part. For an appraisal of the present state of knowledge of the development of Carangidae and methods adopted the earlier paper may be referred to, and only the development is described here.

TYPE II. DEVELOPMENT

Eggs (Fig. 1)

The eggs occurred in quite good numbers during the months of July and August 1961 and February 1962. They are smaller than those of *C. hippos* and are distinguishable by the abundance of pigment cells on the embryo. Each egg is perfectly spherical and measures 0.71 mm. in diameter. Perivitelline space is narrow. A single yellow oil globule is present that is 0.17 mm. in diameter. The embryo is in advanced stage of development showing well developed eyes, auditory vesicles and tubular heart. Pulsation of the heart can be made out. The head region is attached to the yolk sac but the tail is free. The yolk is colourless and is faintly segmented. Brown pigment cells are scattered all over the embryo while the black ones are confined to the inner surfaoe of the oil globule. Pigment cells are absent on the yolk sac.

Newly hatched pro-larva (Fig. 2)

The eggs hatched out at about 3 p.m. on the same day. Each pro-larva is transparent and measures on the average 1.15 mm. in length. The anterior margin of the distinct head extends beyond the margin of the yolk sac. Eyes are unpigmented and the auditory vesicles with two statocysts are located close to the eyes. The tubular heart shows regular pulsating movement. The yolk sac is prominent with still faintly segmented yolk. The gut is short and opens below the 13th myotome, there being 12 pre-anal and 15 post-anal myotomes. Yellow pigment cells are present on the embryo and the oil globule which is located on the anterior margin of the yolk sac. Black cells are found on the dorsal margins of the myotomes and on the inner surface of the oil globule. Some are observed on the head between the eyes and the auditory vesicles. Three faint bands of yellow pigment cells are observed on the larva, one behind the auditory vesicle, one at the anal region and

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the last at the posterior region of the body. The pro-larave float with yolk sac upwards.

The eggs were in an advanced stage of development at 7 a.m. when they were collected and they hatched out at 3 p.m. Therefore it is possible that spawning must have taken place in the night as in the case of *C. hippos*.

24 *hours after hatching* (Fig. 3)

The pro-larva now measures 1.82 mm. in length. The yolk sac is reduced in size and the oil globule is persistent. The head is distinct and now the fin folds are developed. The eyes are slightly brownish in the iris region. The heart is still tubular. The gut still opens below the 13th myotome, thus showing no shift anteriorly. The myotomal number is 28. Pectoral rudiments are developed. A few rays can be seen on the caudal fin fold. Yellow pigment cells are localised into three bands as already described, and they are also present on the head and on the posterior region of the eyes. The larva swims actively.

48 *hours after hatching* (Fig. 4)

There is no change in the length. The yolk sac is considerably reduced. The oil globule is still present. The eyes are large with brownish pigmentation as in the earlier stage. The gut opens still below the 13th myotome and now there are 29 myotomes in total. Two gill slits appear at the pharyngeal region. The mouth is also developed with two horny jaws. The 3 yellow pigment bands have disappeared. Brown and black pigment cells are restricted to the margins of the myotomes. Large black pigment cells are noticed on the margins of the gut. The pro-larva can swim well and starts snapping at the planktonic organisms provided.

72 *hours after hatching* (Fig. 5)

The yolk sac is completely absorbed and so the pro-larva transforms into post-larva. Now it measures 2.15 mm. in length. The head is large and the iris of the eyes is black and the margin of the eyes is silvery in colour. The heart develops two chambers. Two more gill slits appear. The jaws become distinct and the gape of the mouth is wide. The lower jaw protrudes slightly beyond the margin of the upper jaw. The gut shows slight differentiation into stomach and intestine and still opens below the 13th myotome. The fin folds are high without any fin rays. A few rays are present on the caudal fin fold. Yellow pigment cells are absent. Black pigment cells are distributed on the ventral margin of the body and gut. Large stellate chromatophores appear on the dorsal fin folds.

In spite of precautions the larvae died at this stage.

Type III. Development

Eggs (Figs. 6A & 6B)

These eggs were also collected in the morning like those of other two species. These eggs are smallest of the three types. Each egg measures 0.58 to 0.61 mm. in diameter. It is perfectly spherical and transparent. The yolk shows faint segmentation and a centrally located oil globule is present which measures 0.19 mm. in diameter. The egg membrane is smooth and the perivitelline space is very narrow. The embryo is well advanced in development. The head, eyes and the auditory vesicles with two statocysts are distinct. The heart exhibits pulsating movements.

Black pigment cells are present on the inner surface of the oil globule. Yellow pigment cells are scattered all over the embryo. The embryo exhibits twitching movements within.

Newly hatched pro-larva (Fig. 7)

The eggs hatch out at 5 p.m. The newly hatched pro-larva measures 1.13 mm. in length. The yolk mass does not extend beyond the anterior margin of the head. Yolk sac is large and the oil globule is located on the ventral side centrally. The gut is short and opens immediately behind the yolk sac below the 6th myotome. Only 8 post anal myotomes are distinct. Pigmentation is identical to that of the embryo.

24 *hours after hatching* (Fig. 8)

The pro-larva grows and now it measures 1.73 mm. in length. The yolk sac is considerably reduced and the oil globule is absorbed even at this stage. Eyes are large and the auditory vesicles are located in proximity to the eyes. The tubular heart can be made out at the pharyngeal region. The dorsal and ventral fin folds are prominent and fin rays are present only on the caudal fin fold. Pectoral rudiments appear by this time. There is no shift in the position of the anus and now there are 12-14 post-anal myotomes. Yellow pigment cells are present on the margins of the myotomes. Black cells are present only on the ventral margin.

48 *hours after hatching* (Fig. 9)

There is no difference in the length of this pro-larva. The eyes are enlarged and the iris becomes black. Mouth has developed and the lower jaw is prominent. Heart has developed two chambers. Two gill slits can be seen anterior to the heart. The yolk sac is shrivelled. The gut now opens below the 5th myotome. Pectoral rudiments are slightly enlarged and there is no change in the other fin folds. Pigmentation is restricted to the ventral margin of the body.

72 *hours after hatching* (Fig. 10)

The significant change is the absorption of yolk sac and the pro-larva is transformed into post-larva. The cleft of the mouth is wide and the lower jaw protrudes beyond the margin of the upper jaw. Eyes are black. Gill slits are now four in number and the heart has two distinct chambers. The gut is connected to the mouth and shows slight differentiation. The anus still opens below the 5th myotome. Pectoral rudiments are enlarged still and the other fin folds show no change except for the development of a few more rays on the caudal fin fold. Pigmentation is similar to the previous stage.

96 *hours after hatching* (Fig. 11)

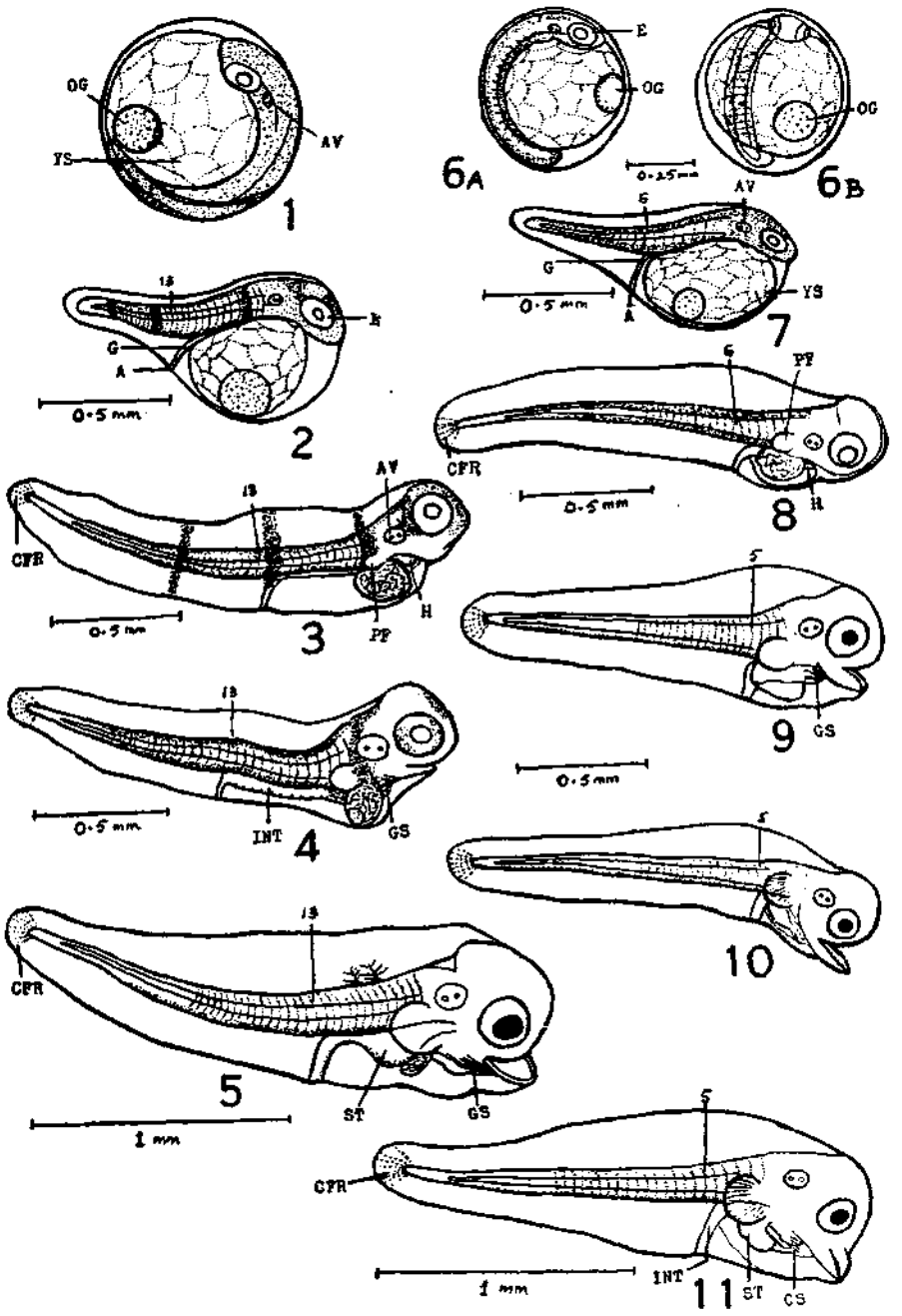
There is slight increase in size and the post-larva now measures 2.01 mm. in length. In all other characteristics it is similar to the previous stage.

The post-larvae perished at this stage.

Remarks

Type II.

The eggs and larvae of this type differ in several respects from those described by Nair (1952), Chacko (1950), Vijayaraghavan (1957) and Delsman (1926a). However, the pigmentation of the embryo and the position of anus below the 13th



FIGS. 1 to 5. *Caranx carangus*. FIG. 1. Egg. 2. Newly hatched pro-larva. 3. 24 hour old pro-larva. 4. 48 hour old pro-larva. 5. 72 hour old pro-larva.

FIGS. 6 A to 11. *Selar kalla*. 6.A & 6B. Lateral and ventral view. 7. Newly hatched pro-larva. 8. 24 hour old pr-larva. 9. 48 hour old pro-larva. 10. 72 hour old post-larva. 11. 96 hour old post-larva.

A=anus; AV=auditory vesicles; CFR=caudal fin rays; E=eye; G=gut; GS=gill slits; H=heart; INT=intestine; OG=oil globule; PR=pectoral rudiment; ST=stomach; YS=yolk sac.

myotome are similar to that of *Caranx mate* (Kuthalingam, 1959). But the eggs of this species are slightly larger in size. The rate of development of gills and mouth also shows a deviation as well as the pigment bands on the newly hatched and 24 hours pro-larva. These pigment bands persist in *C.leptolepis* (Bapat, 1955), which is a point of difference. The position of the anus and the size of the various pro-larvae also vary in *C.leptolepis*. Therefore these eggs may belong to some other species. The species that is very common during July and August on the Madras coast is *Caranx carangus* and ripe females are quite common in this period. As the intraovarian eggs of this species shows some correlation with the pelagic eggs collected it is probable that these may belong to that species. Therefore these eggs are provisionally referred to *Caranx carangus*.

Type III.

The typical features of these type of eggs and larvae are the small size of the egg and the position of the anus below the 6th myotome. The rate of development of gills and mouth opening is faster than in all the other types described by various authors. Eyes become black even on the second day. These characteristics indicate that these eggs belong to a different species not described before. One more species that is common in the fishery along the Madras coast is *Selar kalla*. The percentage of ripe females in the catches during July and August and the correlation between the intraovarian and pelagic eggs suggest that these eggs may belong to this species. Therefore these eggs are provisionally referred to *Selar kalla*.

SUMMARY

Two more types of pelagic eggs of carangids were obtained from the inshore plankton off Madras during the months of July and August and the development was followed up to 4th and 5th days. Type II eggs are provisionally referred to *Caranx carangus* and Type III to *Selar kalla*.

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