

Early developmental stages of some marine fishes from India

1. *Nematalosa nasus*, *Sardinella clupeioides*, *S. fimbriata*, *S. sirm* and *S. albella**

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Abstract: Among certain early developmental stages of twenty-five species studied during 1977-79, those of five Clupeiformes are described, most of them for the first time. These are eggs, larvae and postlarvae of *Nematalosa nasus*, *Sardinella clupeioides*, *S. fimbriata* and postlarvae of *S. sirm* and *S. albella*. Salient taxonomic features which may be of diagnostic value are commented upon.

1. Introduction

Among about 1,800 species of marine fishes known to occur in India, the early developmental stages of not even 10% is reported in sufficient detail. Since an adequate knowledge on this aspect is an essential prerequisite in judicious management of the resources, it was found essential to study and document them. In this connection, eggs, larvae, postlarvae and/or juveniles of twenty-five fishes were studied during 1977-79 at Porto Novo on the southeast coast of India, most of them for the first time. In the present paper the early developmental stages of five Clupeiformes are described. This Order contributes to about 25% of total marine fish production for India, from about sixty-five species. But, the early developmental stages of most of these species are either unknown or imperfectly known.

2. Materials and methods

Material for the present study was drawn from plankton collections off Porto Novo, at 11°30'N 79°46'E (Fig. 1), about 2 km off Vellar Estuary. Plankton net used was 1.5 m long and 0.5 m wide at its mouth. Each type of egg was separated based on diameter, presence or absence of oilglobules, nature of yolk, pigmentation, etc. Representative stages were

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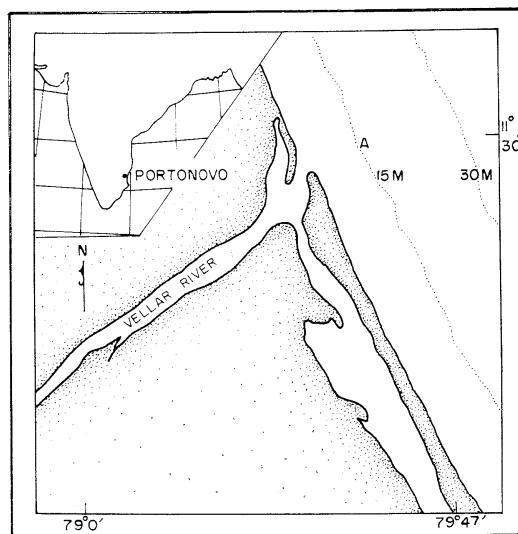


Fig. 1. Location (marked A) off Porto Novo on the southeast coast of India from where eggs, larvae, etc. of fishes in the plankton were collected.

studied and sketched with the aid of a mirror type camera lucida, in living condition. While rearing eggs and larvae, growth of microorganisms was minimised by adding Streptopenicillin at a concentration of 25 mg/100 ml of water. All larvae, postlarvae etc. were measured and sketched after fixing. Total length was measured from tip of snout or lower jaw to the tip of caudal fin end or larval finfold.

Guidelines used for identifications are as

followed by AHLSTROM and MOSER (1976, 1980, 1980). Some of the more important of these are: similarities between ripe ovarian eggs and planktonic eggs, oilglobules, nature of yolk, extent of perivitelline space, pigmentation of embryo, number and disposition of myomeres in larvae in relation to adult vertebral condition, etc. BLAXTER (1957) and HEMPEL and BLAXTER (1961) have pointed out that in larvae of *Clupea harengus* there were three or four myomeres more than adult vertebral number. In such cases, caution was applied to cross check identifications made, in relation to spawning season, egg size, etc. The urostyle was counted as the last vertebra/myomere in adults and larvae. The terminology used to denote early developmental stages is that by RUSSEL (1976).

3. Results and discussion

3.1. *Nematalosa nasus* (Bloch)

This fish is distributed all along Indian coasts. It is also invariably met with in fish catches from estuaries, lagoons, backwaters, etc. Apart from a report of KOWTAL (1970) on the eggs and early larvae of this species from Chilka Lake (northeast India), nothing is known on early developmental stages.

(a) Eggs (Fig. 2, A-C)

Eggs were collected in February and March 1978. These were pelagic, spherical, transparent and ranged in diameter from 0.94 to 1 mm in living condition. Each egg contained eight golden yellow oilglobules ranging in diameter from 0.036 to 0.081 mm. The oilglobules were usually found near the tail end of the embryo. A narrow perivitelline space was present all around the yolk. The yolk was spherical and vacuolated, the vacuoles being fairly large in size. In an egg ready for hatching (Fig. 2, C), a few black pigment spots were noted on the dorsal side of the embryo.

(b) Larvae (Fig. 2, D and E)

A just hatched larva measured 3 mm (Fig. 2, D) with a globular yolk sac, prominent finfold and ventrally placed oilglobules. The body tapered towards caudal end, yolk sac was rounded off posteriorly and alimentary canal was almost straight except at the vent. A series of black pigment spots was present at the base of the finfold dorsally. Thirty-five myomeres were pre-

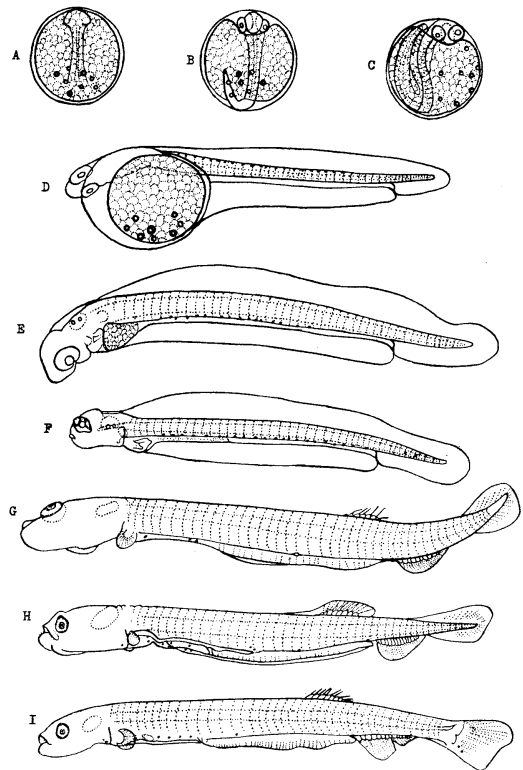


Fig. 2. Eggs, larvae and postlarvae of *Nematalosa nasus*. A, B and C: Eggs in three stages of development. D: Newly hatched larva. E: 4 mm larva. F: 4.8 mm postlarva. G: 6.7 mm in total length. H: 9 mm. I: 10.6 mm. All eggs were drawn in live condition. All larvae and postlarvae were drawn from preserved specimens.

sent in the preanal region. Precise number of myomeres in postanal region could not be ascertained due to imperfect nature of myosepta there.

A second larval stage obtained by rearing and measuring 4 mm (Fig. 2, E) had many progressive features such as reduction of yolk sac, formation of pectoral finbud and movement of dorsal pigments to above alimentary canal. Position of the mouth was marked below eye region. Eyes were unpigmented and anus opened below 35th myomere in this stage also. Myosepta have become more organised than in the previous stage in postanal region where about ten myomeres could be counted.

(c) Postlarvae (Fig. 2, F-I)

The earliest postlarva was reared in the laboratory, 24 hours old and measured 4.8 mm (Fig. 2, F). Yolk was fully utilised, mouth was formed and eyes were partially pigmented. Pectoral fin has become larger, pigmentation along dorsal aspect of alimentary canal has become more pronounced and opercular cleft has developed. There were 34 preanal and 11 post-anal myomeres.

Three postlarvae were collected from plankton in March 1978. In 6.7 mm stage (Fig. 2, G), the body has become broader and larval finfold has disappeared. Jaws have developed, eyes were pigmented and pectoral fins had indications of rays. Dorsal fin has developed between 23rd and 27th myomeres with about six rays. Anal fin was between 31st and 38th myomeres with about ten rays. Caudal region also showed indication of rays. There were 30 preanal and 15 postanal myomeres, the number and disposition corresponding to adult vertebral condition. Pigmentation has become slightly reduced from the previous stage, with only a few spots in foregut region.

In a 9 mm postlarva (Fig. 2, H), the progressive changes were further development of all the fins, an increase in pigmentation and development of minute conical teeth in the jaws. Eight rays were present in dorsal fin and about fifteen in anal fin. One pigment spot was present in front of opercular cleft, two posterior to pectoral fin and six in foregut region. Besides, two spots were present above midgut anteriorly, one posteriorly and one above vent.

In 10.6 mm stage (Fig. 2, I), about sixteen caudal and fifteen anal rays could be counted. Pigmentation has increased; two pigments have appeared at the base of lower caudal region, two in front of operculum ventrally, two in pectoral region, a series of four in foregut region, one large pigment above midgut and another above anus.

(d) Remarks

Identification of the present material as those of *N. nasus* is based on coincident occurrences of the eggs and postlarvae in plankton as well as mature and spent specimens in fish catches at Porto Novo; characters of the eggs and larvae; and rearing of postlarvae in ponds at Porto Novo. DELSMAN (1926b) assigned certain

eggs to this species from Java coast; but later (DELSMAN, 1933a) changed his view. KOWTAL (1970) identified the free eggs at first from Chilka Lake, based on characters of ripe ova. The two larval stages given in the present account show overall similarities to those described by KOWTAL (1970). Eggs of the closely allied species *Anodontostoma chacunda* (DELSMAN, 1933a) have a diameter of about 1 mm and contain 6-12 oilglobules. Besides, its larvae have a lesser number of myomeres than in those of *N. nasus*, in accordance with adult vertebral number namely 41.

Postlarvae of *N. nasus* may be distinguished from those of *A. chacunda* by the difference in number and disposition of myomeres, the total of which in the former is 45 and in the latter is 41 (BENSAM, 1971). Postlarvae of *Sardinella gibbosa* (*S. jussieu*, BENSAM, 1970) have a total of 45 myomeres; but could be distinguished from the postlarvae of *N. nasus* by difference in pigmentation pattern and delayed bifurcation of caudal fin in *N. nasus* when compared to *S. gibbosa*. Postlarvae of *S. fimbriata* which have 45-47 vertebrae, differ from those of *N. nasus* in the disposition of myomeres and pattern of pigmentation *vide* section 3.3. of present paper. Postlarvae of *Chanos chanos* (DELSMAN, 1926c; 1929b; CHAUDHURI, *et al.*, 1978; LIAO, *et al.*, 1979) differ from those of *N. nasus* in having a parallel arrangement of muscle fibres, as against crossed arrangement in the latter.

3.2. *Sardinella clupeioides* (Bleeker)

This species is observed in small quantities in sardine fisheries of southeast and southwest coasts of India. Till now no information is available on the early developmental stages of this fish.

(a) Eggs (Fig. 3, A and B)

Planktonic eggs were collected during February and April 1978. These were pelagic, spherical, transparent and ranged in diameter from 0.91 to 0.95 mm in living condition. Yolk was spherical, colourless and vacuolated with diameters ranging from 0.50 to 0.52 mm in living condition. A large perivitelline space was present and there was no oilglobule. The embryo and yolk had no pigmentation.

(b) Larvae (Fig. 3, C and D)

By rearing eggs in the laboratory, two stages

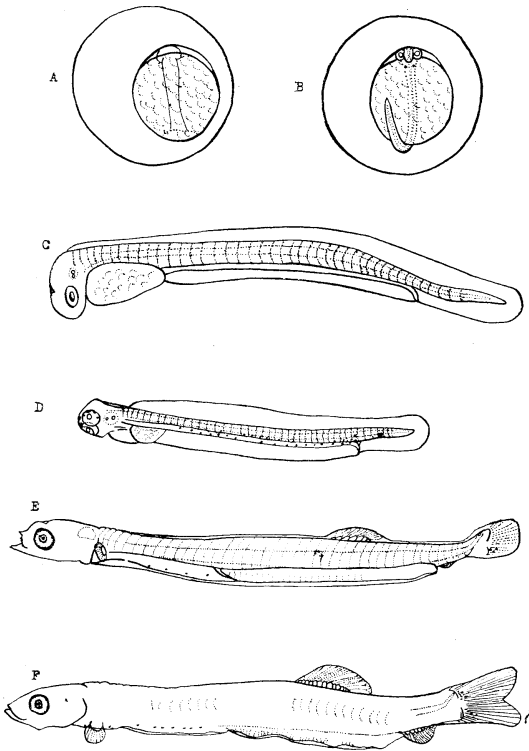


Fig. 3. Eggs, larvae and postlarvae of *Sardinella clupeioides*. A and B: Eggs in two stages of development. C: 3.6 mm larva. D: 4.5 mm. E: Postlarva of 10.2 mm total length. F: 13.1 mm. Both the eggs were drawn in live condition. All the larvae and postlarvae were drawn from preserved specimens.

in larval development were studied. In an earlier stage measuring 3.6 mm (Fig. 3, C), the body had a uniform depth behind yolk. There were 38 preanal and about 5 postanal myomeres. The larva was devoid of pigmentation. In a later stage measuring 4.5 mm (about 32 hours old) (Fig. 3, D), pigmentation has appeared in the form of two series of spots along the alimentary canal, one above the other. The lower series was more prominent and almost continuous from behind the yolk sac till vent. The upper series was at the dorsal aspect of the alimentary canal and was discontinuous. A pigment was present midlaterally above the vent and a partly branching pigment about half way in postanal region. In the snout a couple of pigments was present and on the dorsal side of eyes a few pigments have appeared. Mouth was not yet

formed although yolk sac was very much reduced. There were 43 myomeres of which 37 were preanal and 6 were postanal.

(c) Postlarvae (Fig. 3, E and F)

Both the postlarvae were collected from plankton during February 1978. In 10.2 mm stage (Fig. 3, E), the upper jaw showed minute conical teeth and the lower jaw was slightly longer than the upper. Pectoral fin has developed and eyes were pigmented. In the foregut four pigment spots and in the lower caudal region three spots were present. Dorsal fin has developed between 24th and 31st myomeres with about 7 rays. Caudal fin was somewhat club shaped with about 12 rays. Anal fin was indicated behind vent. There were 38 preanal and 5 postanal myomeres. In 13.1 mm postlarva (Fig. 3, F), the body has become slightly cylindrical, head has become pointed and caudal fin was forked. About 15, 18 and 7 rays could be counted in dorsal, caudal and anal fins respectively. Pigmentation consisted of a short series of black spots in the foregut, a few spots at the base of upper and caudal lobes and a single pigment above vent. Disposition of myomeres has changed to 35 preanal and 8 postanal.

(d) Remarks

The size of ripe ovarian ova in comparison with the size of yolk in early stages of embryonic development has aided the identification of planktonic eggs. As pointed out by MILLER (1952) and AHLSTROM and MOSER (1980), in sardine eggs the egg capsule develops only after the ova come into contact with water and increases in size thereafter. This is confirmed by the presence of 43 myomeres in the larvae hatching out of the eggs, tallying with adult vertebrae number. Eggs assigned by JOHN (1951) to *Sardinella sirm* had a diameter of 2.12 mm and did not have oilglobule. Eggs of *S. clupeioides* differ from those of *S. fimbriata* (DELSMAN, 1926a; this paper, 3.3) in that the latter have a diameter of 1.4–1.55 mm, yolk measured 0.8 mm in diameter and an oilglobule is present. Eggs assigned by DELSMAN (1926a) to *S. leiogaster* ranged in diameter from 1.42 to 1.63 mm with yolk measuring about 1 mm; and those assigned by DELSMAN (1933b) to *Clupea perforata* (*S. albella*, WHITEHEAD, 1972) did not exceed 1.1 mm and had an oilglobule. An oilglobule is

reported in the eggs of *S. longiceps* (NAIR, 1960) and *S. gibbosa* (BENSAM, 1970), apart from other differences.

While comparing the postlarvae of *S. clupeioides* with those of *S. gibbosa* (BENSAM, 1970), lesser pace of development in *S. clupeioides* than in *S. gibbosa* becomes apparent. In early postlarvae of the former species there are 37 myomeres as against only 33 in early postlarvae of the latter species. In later stages, preanal myomeres become 35 in *S. clupeioides* and only 30 in *S. gibbosa*. When compared to postlarvae of *S. dayi* (BENSAM, 1973) also, the rate of growth in *S. clupeioides* appears slower. This may be seen from the fact that although almost the same developmental features could be seen in 18.7 mm postlarva of *S. dayi* (BENSAM, 1973) and 13.1 mm postlarva of *S. clupeioides*, there is about 5 mm difference in linear growth. Besides, there is a progressively developing anal fin in the former which is absent in the latter.

3.3. *Sardinella fimbriata* (Valenciennes)

It is found in sardine catches off both east and west coasts of India. DELSMAN (1926a) described eggs, larvae and postlarvae presumed to be of this species from Java Coast. BAPAT (1955) and VENKATARAMANUJAM (1975) have reported on the eggs from India. The present section deals with a few eggs and postlarvae.

(a) Eggs (Fig. 4, A-D)

Eggs were collected in April 1978. These were pelagic, spherical, transparent and varied in diameter from 1.36 to 1.41 mm. Yolk was vacuolated and ranged in diameter from 0.80 to 0.89 mm. Perivitelline space was wide. A single golden yellow oilglobule of 0.102-0.109 mm diameter was present. None of the eggs reared in the laboratory has hatched out; but all were found dead on the next morning.

(b) Postlarvae (Fig. 4, E-G)

In 11.4 mm postlarva collected during October 1977, larval finfold has disappeared, lower jaw was a little longer than the upper and the latter was provided with a few conical teeth (Fig. 4, E). Dorsal fin has appeared above 28th to 33rd myomeres, with about 11 rays. Caudal fin showed an early stage of bifurcation with about 24 rays. Anal fin had about 7 rays. A series of black pigment streaks was present above alimentary canal, three spots ventrolaterally

towards the end of foregut, a single one towards the vent, a few at the base of lower caudal lobe and a couple of spots at the middle of caudal base. There were 39 preanal and 7 postanal myomeres. In a 12.3 mm stage collected in February 1978, the pigments in the mid and hind gut regions have moved to a ventral positions (Fig. 4, F), but those in the foregut region and the one above anus have remained in the same position. About 15 dorsal and 24 caudal rays could be counted. Number and disposition of myomeres remained the same as in the previous stage. A much longer postlarvae measuring 21.5 mm (Fig. 4, G) was collected during August 1977. The body has become massive and deeper. There were about 21 dorsal, 28 caudal and 18 anal rays. Pelvic fin has appeared below midgut in the form of a few rays. Pigmentation was in the form of black spots along ventral side of alimentary canal, at the bases of upper and lower caudal

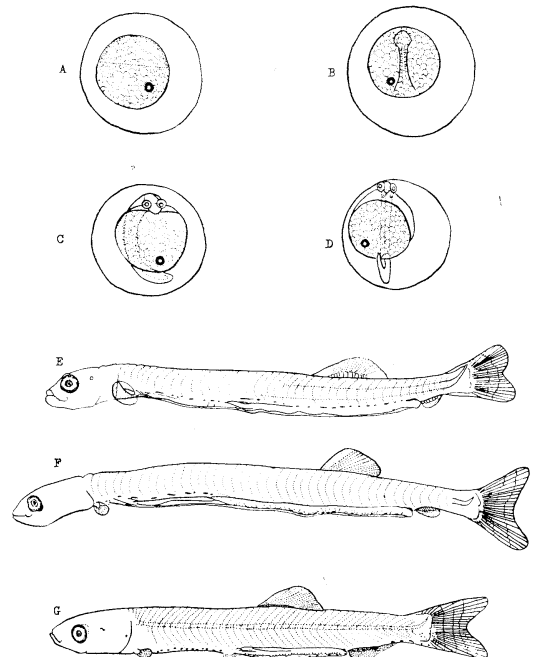


Fig. 4. Eggs and postlarvae of *Sardinella fimbriata*. A-D: Eggs in four stages of development. E: Postlarvae of 11.4 mm in total length. F: 12.3 mm. G: 21.5 mm. All the eggs were drawn in live condition. All the postlarvae were drawn from preserved specimens.

lobes and at the base of lower caudal peduncle. In head region there was a sunken pigment behind eye and another one in front of operculum. Disposition of myomeres has changed to 33 preanal and 13 postanal.

(c) Remarks

The only other Indian sardine which has an overall egg diameter similar to that of *S. fimbriata* is *S. longiceps*. But, the latter was not observed at Porto Novo during the present study and is in fact rarely reported from the southeast coast of India. This fact minimises the possibility of the present eggs as belonging to *S. longiceps*. Besides, diameter of yolk in the eggs of *S. longiceps* is not less than 1 mm as observed by DEVENESAN (1943), while it is only in *S. fimbriata* that the yolk diameter is about 0.8 mm, as pointed out by DELSMAN (1926a). Yolk in the eggs assigned by DELSMAN (1933b) to *S. albella* measured about 0.57 mm in diameter and in the eggs identified as of *S. gibbosa* by BENSAM (1970) measured 0.58–0.74 mm in diameter. Such features aid in segregating the eggs of *S. fimbriata* from those of allied species.

While describing some postlarvae from Java Coast, DELSON (1962a) has opined that the number of myomeres in them does not correspond with adult vertebral number of *S. fimbriata* and hence these could not belong to the above species. But, the 22 and 27.5 mm postlarvae described by the above author had 34 preanal and 12 or 13 postanal myomeres, the total number corresponding with adult vertebral number of *S. fimbriata* and thus confirming his identification. The 21.5 mm postlarva in the present section when compared to the 22 mm stage described by DELSMAN (1926a) shows lack of preventral pigmentation in the latter. Such a condition exists in the 27.5 mm stage also described by the above author. The total number of myomeres in *S. fimbriata*, *S. gibbosa*, *S. dayi* and *S. longiceps* being overlapping one another, may not be of much use in separating their postlarvae. But, differences in disposition of myomeres between postlarvae in somewhat same stages of development may be of some use in species discrimination. Thus, the 11.4 mm postlarva of *S. fimbriata* which is in the same stage of development as 9.92 mm postlarva of *S. gibbosa* (BENSAM, 1970) differs in having 39 pre-

anal and 7 postanal myomeres as against 30 preanal and 15 postanal myomeres in the latter. A comparison of the postlarvae of *S. fimbriata* with those of *S. dayi* (BENSAM, 1973) shows that in some developmental features the latter are quicker than the former, such as appearance of ventral fin and rate of growth. Between the postlarvae of *S. fimbriata* and those of *S. longiceps* described by UNDP/FAO (1976), distribution of pigments may be of use in their segregation because in the 12.3 mm stage of the former pigment spots in the mid and hind gut have occupied a ventral position, whereas even in the 13.1 mm stage of the latter species, pigment spots have still occupied a dorsal position.

3.4. *Sardinella sirm* (Walbaum)

It is one of the three species belonging to the subgenus *Amblygaster*, the other two being *S. clupeioides* and *S. leiogaster*, vide WHITEHEAD (1972). It is widely distributed in the Indo-Pacific; and in India it is particularly found off the southeast coast. DELSMAN (1926a) opined that the egg "f" collected from Java coast belonged to this species. JOHN (1951) identified the eggs from India. No information is available so far on its postlarval history. In the present section three postlarvae are described.

(a) Postlarvae (Fig. 5, A–C)

The earliest stage measuring 10.4 mm (Fig. 5, A) was collected during September 1977. Preanal width of the body was almost uniform. Lower jaw was slightly longer than upper jaw, the latter showing a few conical teeth. Two pigment spots were present in auditory region. Dorsal

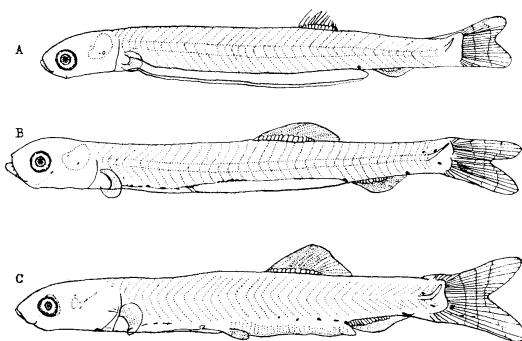


Fig. 5. Postlarvae of *Sardinella sirm*. A: 10.4 mm in total length. B: 13.4 mm. C: 14.1 mm. All the postlarvae were drawn from preserved specimens.

fin has developed above 23rd and 28th myomeres, with about 12 rays. Anal fin showed about 8 rays and caudal about 20 rays. A pigment spot was present above anal region. There were 42 myomeres of which 31 were preanal and 11 postanal. A 13.4 mm postlarva was collected during September 1978 (Fig. 5, B). The major change observed was an increase in pigmentation. Posterior to the lower margin of eye a pigment has developed; also a series of seven streaks in the post-pectoral region. In the dorsal aspect of midgut, behind the anal fin, in the caudal peduncular region and in the base of the lower caudal lobe, pigmentation has appeared. Dorsal and anal fins showed about 15 and 12 rays respectively. The myomere disposition has changed to 28 preanal and 14 postanal. A slightly longer stage of 14.1 mm (Fig. 5, C) was collected in July 1977. Apart from a slight increase in pigmentation, no progressive change was visible in this stage over the previous one.

(b) Remarks

Since the vertebral number in *S. sirm* (42) is only one lesser than that in *S. leiogaster* and *S. clupeioides* (43), this character alone may not be of much use in segregating their postlarvae. However, since spawning stock of *S. sirm* alone was observed at Porto Novo during the period when the above postlarvae were collected and not spawning stock of *S. leiogaster*, it appeared most probable that the present postlarvae belonged only to *S. sirm*. This is strengthened by the one lesser number of myomere in this species when compared to *S. leiogaster*. The present postlarvae showed vital differences from comparable stages of *S. clupeioides* given in the present paper. Although the 10.2 mm stage of *S. clupeioides* and 10.4 mm stage of *S. sirm* are almost of equal length, the former has a slender body, club shaped caudal fin and is in a much earlier condition of development than the latter. Besides, the number of preanal myomeres in the former is 38 but in the latter only 31. Similarly, the 13.1 mm postlarva of *S. clupeioides* comparable to 13.4 mm stage of *S. sirm* in size, differs from it in having 35 preanal myomeres as against only 28 in the latter. Besides, pelvic fin was quite prominent in 14.1 mm stage of *S. sirm*, but not even indicated in 13.1 mm stage of *S. clupeioides*, both of which showed many other

features in common. Postlarvae of *S. sirm* could be segregated from those of *Thryssa* and *Stolephorus* (DELSMAN, 1929a; 1931) in having a terminal mouth and a lower jaw slightly longer than the upper, when compared to a prominent snout and inferior mouth in these two genera.

3.5. *Sardinella albella* (Valenciennes)

Like many other species of *Sardinella*, *S. albella* is widely distributed in the Indo-Pacific and supports coastal fisheries at many centres in India. DELSMAN (1933b) gave an account of its eggs and larvae from Java Coast. CHACKO and MATHEW (1956) reported on its embryonic and larval development from the southwest coast of India. In the present section, a few postlarvae and an early juvenile are described, all collected during September–October, 1977.

(a) Postlarvae (Fig. 6, A–C)

A 6.6 mm postlarva (Fig. 6, A) showed remnants of larval finfold. Jaws were pointed, the lower one longer than the upper. Eyes were pigmented black and pectoral fin was membranous. Dorsal fin has developed above 23rd to 30th myomeres, with about 14 rays. Caudal fin was paddle shaped, with many rays. Pigmentation was sparse and consisted of a spot in the oesophageal region, a group of three sunken ones above midgut and three spots in the hindgut region, of which two were above and one below anal region. There were 34 preanal and 9 postanal myomeres. In an 8.4 mm postlarva, anal

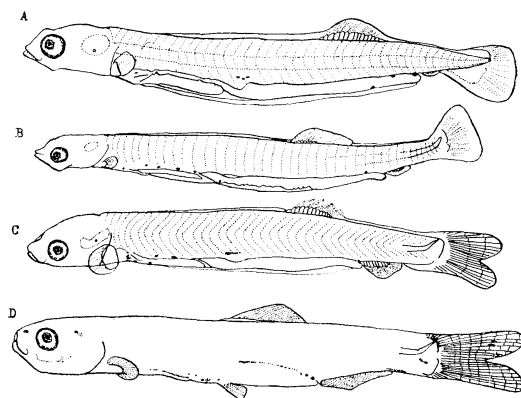


Fig. 6. Postlarvae and a juvenile of *Sardinella albella*. A: Postlarvae of 6.6 mm in total length. B: 8.4 mm. C: 11.0 mm. D: Juvenile of 19 mm in total length. All the postlarvae and the juvenile were drawn from preserved specimens.

fin has become more prominent and pigmentation has increased in the foregut, as a series of six spots. Preanal myomeres have decreased to 32 and postanal ones have increased to 11 (Fig. 6, B). In a transitional stage between postlarva and juvenile measuring 11 mm (Fig. 6, C), the body has become wider and more massive. There were about 14 dorsal, 10 anal and 20 caudal rays; and the caudal fin has become forked. A pigment has appeared in the auditory region; and a patch of sunken pigments is present above midgut. Number and disposition of myomeres remained the same as in the previous stage.

(b) Juvenile (Fig. 6, D)

A single early juvenile measuring 19 mm was collected from the mouth of Vellar Estuary in September 1977. Body has become massive and assumed a sardine like appearance. About 15 rays could be counted in the pectoral fin. Caudal fin showed about 28 rays, many of which were segmented. Anal fin has become longer and showed about 21 rays. Pelvic fin has developed at a level below the origin of dorsal fin, with about six rays. Pigmentation was in the form of a sunken patch behind the eye, a series behind pectoral region, two small spots slightly above the hind end of the series, a sunken spot in front of pelvic region and two branching chromatophores in front of it. On the dorsal aspect of the alimentary canal, behind the pelvic region, a series is present, ending with three chromatophores in the anal region. Behind the anal fin a sunken patch of pigments and behind the urostyle a group of four closely placed pigments could be seen. Caudal fin showed a few pigments at the base. Preanal myomeres have further decreased to 29 and postanal ones increased to 14, although the adult disposition of 27 preanal and 16 postanal has not yet reached.

(c) Remarks

S. albella was observed to spawn off Porto Novo during April/May to September/October period. The present postlarvae differ from those of *S. gibbosa* (BENSAM, 1970), *S. dayi* (BENSAM, 1973), *S. clupeioides* (section 3.2 of present paper) and *S. fimbriata* (section 3.3), in having a lesser number of myomeres. It may be noted in this connection that UNDOF/FAO (1976) have given a vertebral number of 45 for *S. albella* from

the southwest coast of India. But, from the southeast coast centres of Tuticorin (BENSAM, 1973) and Porto Novo in the course of 1977-79, specimens of *S. albella* showed only 43 vertebrae. This is in agreement with the observation of DELSMAN (1933b) that *S. perforata* (= *S. albella*, vide WHITEHEAD, 1972) from Java Coast had 32-43 vertebrae only. In having a total of 43 myomeres, the early postlarvae of *S. albella* resemble those of *Hilsa kelee* described by RAO (1973). But, in the postlarvae of the latter, pigment series are present along dorsal and ventral aspects of the alimentary canal. But, such a condition is absent in the postlarvae of *S. albella*.

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インド産魚類の初期発生段階

1. *Nematalosa nasus*, *Sardinella clupeoides*, *S. fimbriata*, *S. sirm* and *S. albella*

Pathrose BENSAN

要旨: 1977年から1979年にかけて採取したいわし型魚類6種の初期発生段階を記述した。*Nematalosa nasus*, *Sardinella clupeoides*, *S. fimbriata*, *S. sirm*, *S. albella* の卵, 幼生である。同定に役立つ顕著な分類形質について註釈を加えた。