

## ON A FEW POST-LARVAL STAGES AND JUVENILES OF THE SARDINE, *SARDINELLA DAYI* REGAN

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### ABSTRACT

*Sardinella dayi* contributes to a minor extent to the sardine fishery of the Tuticorin area in the Gulf of Mannar. A few post-larval stages of this species in the size range of 18.70 mm.—20.25 mm and juveniles of 28 mm—36 mm are described. The food of the post-larvae consisted mainly of copepods. A discussion on the identity of the larvae and juveniles as those of *S. dayi* is given based on circumstantial evidence and characteristic features distinguishing them from similar stages of related species.

### INTRODUCTION

Among the ten species of the genus *Sardinella* Valenciennes reported to occur in the seas around India, namely *S. albella* (Valenciennes), *S. jussieu* (Lecepede), *S. clupeioides* (Bleeker), *S. dayi* Regan, *S. fimbriata* (Valenciennes), *S. longiceps* Valenciennes, *S. melanura* (Cuvier), *S. perforata* (Cantor), *S. sindensis* (Day) and *S. sirm* (Walbaum), *S. dayi* is one about which very little is known at present. Probably, the first to record the presence of *S. dayi* in fish catches is Sekharan (1955) from Mandapam in the south east coast. In Tuticorin area, further south of Mandapam, this species occurs in small quantities with other sardines such as *S. albella*, *S. jussieu* etc. in the catches of the indigenous crafts operating gill nets such as 'Chala valai' and 'Kola valai' in about 10 fathoms depth off Tuticorin area in the Gulf of Mannar. An examination of the maturity conditions of *S. dayi* at Tuticorin during 1965-1967 has shown that this fish spawns from December/January to April/May period along the Tuticorin coast. An attempt has been made to collect the larval stages of this species from the catches of the indigenous crafts as well as mechanised vessels operating off Tuticorin. In the course of January to April, 1968, a few post-larvae and juveniles identified as of *S. dayi* were collected from the Government of India, Offshore Fishing Station trawler, M.F.V. 'Meenabharati'; and descriptions of these are given in the present paper. All the larvae and smaller juveniles were translucent in the fresh condition; and became opaque and whitish when preserved in formalin. The larger juveniles were having a dusky colouration.

## POST-LARVAE

**18.70 mm larva (Fig. 1)**

The larva in this stage shows many features characteristic of advanced postlarval conditions of sardines. These include the absence of larval finfold, appearance of pelvic and anal fins, progressive development of the other fins with many rays supporting them and the prominent head with jaws. The head is the widest and most massive part of the larva which tapers posteriorly ending in a caudal peduncle. It is a little less than 5 in total length with prominent eyes, the diameter of which is 4 in head. Minute conical teeth are present along the outer margin of the upper jaw. The pectoral fin is fan-like and supported by about 6 rays. The alimentary canal is in an early stage of coiling. The pelvic fin has a somewhat triangular shape with about 9 rays. It originates well in front of the level of origin of the dorsal fin. The dorsal fin is situated at about the middle of the body and has about 20 rays. The predorsal length is slightly more than the postdorsal length. The anal fin has about 10 rays and the caudal has about 26 rays. There are 34 preanal and 12 postanal myotomes. The pigmentation consists of a few black spots posterior to the eye and pectoral fin, a few chromatophores above the pelvic fin and some on the anal and caudal fins.

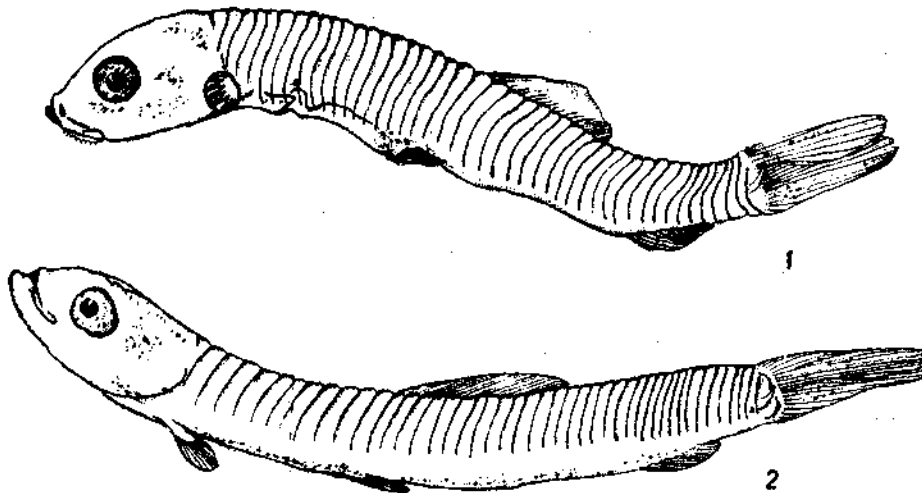


FIG. 1. 18.70 mm postlarva of *Sardinella dayi*.  
FIG. 2. 20.25 mm postlarva of *Sardinella dayi*.

**20.25 mm larva (Fig. 2)**

Except for the disposition of the myotomes which is 32 preanal and 14 postanal as well as pigmentation, the larva in this stage does not show marked changes from the previous one. A few black pigment spots have appeared

along the operculum and two series of pigments along the ventrolateral aspect of the body; one in between the pectoral and pelvic fins and the other between the pelvic and anal fins. The predorsal length has become less than the postdorsal length, obviously by the forward movement of the dorsal fin, a feature observed in clupeoid larvae.

#### JUVENILES

##### *28 mm juvenile (Fig. 3)*

Although this specimen does not show all the features of the juveniles, the structure of the body and the head, disposition of the fins and appearance of scutes point out that this stage is an early juvenile. The body has become wider, massive and sardine like. The lower jaw is a little longer than the upper and the mouth is more or less terminal. The dorsal fin has moved a little more forward. Origin of the pelvic is below the level of the anterior half of the dorsal fin base. The number of fin rays have become more discernible and there are 14 pectoral, 21 dorsal, 8 pelvic, 11 anal and 30 caudal rays. About 6 preventral and 4 postventral scutes are visible. Black chromatophores have appeared on the jaws, posteriodorsal aspect of the orbit, below the eyes, at the base of the dorsal fin, dorsal aspect of the precaudal region and on the caudal fin. The two series between pectoral and anal fins observed in the 20.25 mm postlarva have disappeared. The number and disposition of the myotomes remain the same as in the oldest postlarva observed. Faint semicircular markings of the skin are present (Fig. 4), indicating the areas where the scales would develop. The depth of the body at the level of the origin of the dorsal fin is more than 7 of the total length.

##### *32.5 mm juvenile (Fig. 5)*

In this stage pigmentation of the body has increased. This consists of a number of black pigment spots on the supra-orbital region continued as a zone of pigments on the upper lateral part of the body till the caudal end. The lower lateral part of the body remains unpigmented except for a few spots along the anal base and on the lower jaw. The area of pigmentation along the body, till the origin of the dorsal fin, is very small. The head, in proportion to the total length is a little more than 5, thereby showing difference from the previous juvenile stage and the postlarvae. This is obviously due to the higher rate of growth of the body than the head. There are 12 preventral and 15 postventral scutes. The body depth has also increased considerably, as it is only about 6 in relation to total length, when compared with the previous juvenile stage. The relation between the eye diameter and head length also has undergone a progressive change and it is a little more than 3, while in the previous juvenile it is  $3\frac{1}{2}$  and in the larval stages 4 only. About 15 anal and 36 caudal rays are visible in this stage. The number of rays of the other fins remain the same as in the previous stage.

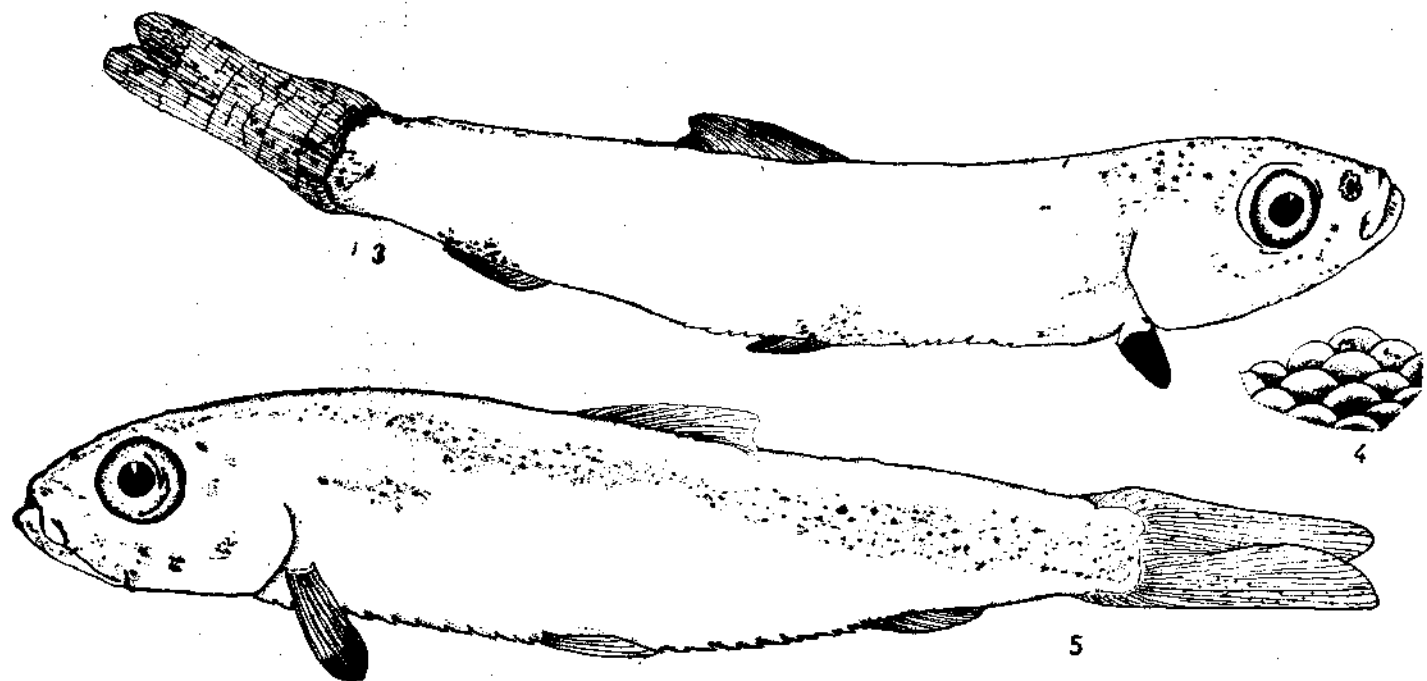


FIG. 3. 28 mm juvenile of *Sardinella dayi*.      FIG. 4. A portion of the skin with semi circular areas.  
FIG. 5. 32.5 mm juvenile of *Sardinella dayi*.

**33-35 mm juveniles (Figs. 6-10)**

The juveniles in this size range have more or less the same characteristic features as the 32.5 mm stage and differ from it mostly in pigmentation which shows increase with growth. There are many pigment spots on the snout and chin (Fig. 6), followed on the dorsal side by a number of chromatophores above the region of the brain (Fig. 7). Behind this there is a series of closely packed pigments on either side of the mid-dorsal line. Rows of pigments are also present laterally along the boundaries of the myotomes (Fig. 8). Behind the dorsal fin the pigments get diffused and are present along the posterior margins of the scales under development (Fig. 9). On the caudal peduncle a few chromatophores arranged approximately in two rows are present ventrally (Fig. 10). The number and disposition of the scutes remain the same as in the previous stage.

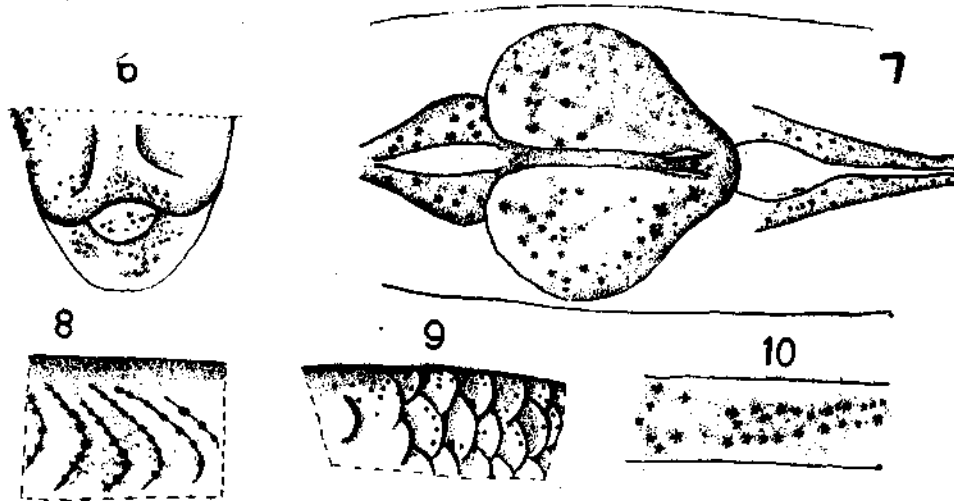


FIG. 6-10. Pigmentation in *S. dayi* juveniles of size range 33-35 mm. Fig. 6 pigment spot on the snout and chin; Fig. 7 pigmentation in the brain region; Fig. 8 pigmentation along myotome boundaries; Fig. 9 pigmentation along posterior margin of scales in the post dorsal region; Fig. 10 pigmentation in the ventral region of the caudal peduncle.

**36 mm juvenile (Figs. 11-13)**

The pigmentation has increased considerably more in this stage, particularly in regions which were sparsely pigmented in earlier stages. Some pigment spots have appeared in the tongue and in the preopercular as well as opercular regions (Fig. 11). On the body of the juvenile (fig. 12) there is a zone of densely arranged pigments followed by a lower less dense region. There are about 17 preventral and 15 postventral scutes. The scales of the juveniles

(Fig. 13) are in an early stage of development, with the circuli arranged in an almost straight pattern, instead of the semicircular one observed in well developed scales.

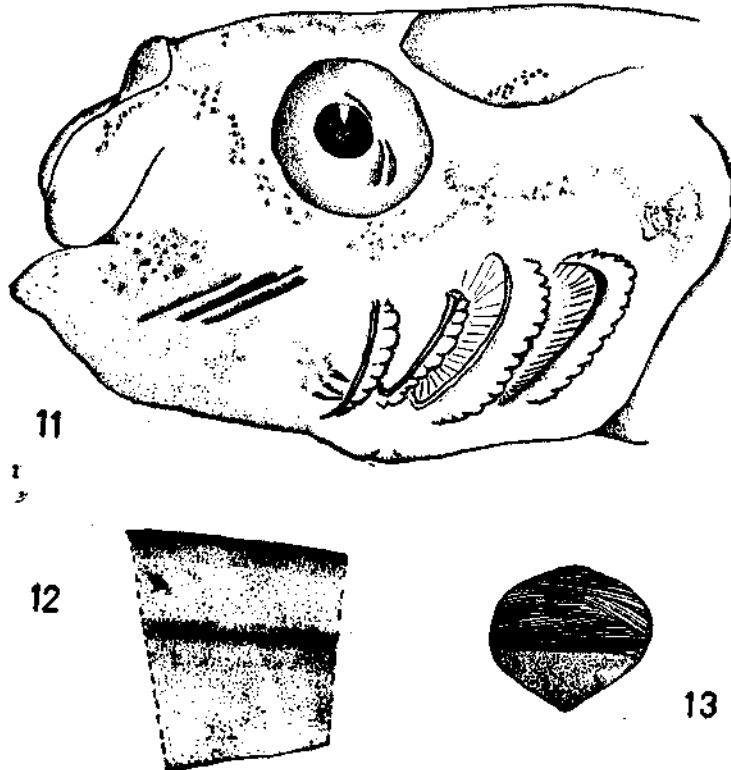


FIG. 11. Pigmentation on head of a juvenile 36 mm in length.

FIG. 12-13. Pigmentation along the body (FIG. 12) and arrangement of circuli in the scales (FIG. 13) of 36 mm juvenile.

#### FOOD OF JUVENILES

The stomachs of all the juveniles (28 mm stage onwards) were moderately filled with food elements. The predominant item was copepods (about 80% in volume), followed by crustacean larval stages, chiefly *protozoa* and *zoea* (about 12%) and larval bivalves (8%). Only in the case of a large-sized juvenile (36 mm long) that a few numbers of the diatom *Coscinodiscus* spp. (about 1% in volume) were found; and except this the phytoplankton items were completely absent. It thus appears that the food of the early juveniles is composed of zooplankters.

## DISCUSSION

The identification of the larvae and juveniles described in this paper as belonging to *Sardinella dayi* is based, apart from the circumstantial evidence of the coincident occurrence of the spawners as well as the larvae and early juveniles at Tuticorin (the other sardine having advanced gonadial maturity during this period was *S. albelli* only), upon the direct evidence furnished by the vital features which differentiate them from similar stages of the other sardines, to which *S. dayi* is related. Of them *S. albelli* differs in body proportions, number of gill rakers and number of vertebrae. *S. dayi* has 46 vertebrae while *S. albelli* has only 42-43. It is needless to mention that post-larvae and juveniles of *S. albelli* would have had 42-43 myotomes or vertebrae. *S. sirm* also has 42-43 vertebrae only. The present larvae and juveniles may be distinguished from those of *S. jussieu* (Bensam, 1971) in the differences observed in their sizes in relation to the developmental stage as well as in the body proportions. The 18.7 mm larva which is in the same stage of development as the 13.45 mm larva of *S. jussieu*, differs from it in having a head longer in proportion to total length and in having 34 preanal + 12 postanal myotomes, as against 30 + 15 of *S. jussieu*. Similarly, the 28 mm juvenile of *S. dayi* comparable to 24.7-26.7 mm juveniles of *S. jussieu* differs in the number and disposition of the myotomes or vertebrae, namely 32 preanal and 14 postanal (total 46) as against 29 + 16 = 45 myotomes or vertebrae of the postlarvae and juveniles.

The other two species of *Sardinella* having vertebral range overlapping that of *S. dayi* reported from along the south-east coast of India are *S. longiceps* and *S. fimbriata*. The former has, according to Delsman (1926) and Nair (1959) 46-48 vertebrae; and is rather rare along the south-east coast. It is known to spawn off the south-west coast of India from about July-August to October-November. Based on the scarcity of this species along the south-east coast it appears remote that the present larvae and juveniles should belong to *S. longiceps*. This view is confirmed by the fact that the postlarvae of *S. longiceps* described by Nair (1959) have 48 myotomes, while the postlarvae of *S. dayi* have only 46 myotomes. Kuthalingam (1960) has given an account of the eggs, larvae and juveniles which he has assigned to *S. longiceps*. Of the different stages given in the present account the 18.7 mm. postlarva may be compared to a similar stage ("Larvae 30th day after hatching") given by Kuthalingam (1960). The latter differs from the former in such crucial features as the presence of vestigial larval finfold, absence of pelvic fin and teeth in the jaws, shape of the caudal fin and, above all, the number and disposition of the myotomes. There are 38 preanal myotomes in the "Larvae of 30th day after hatching" and the number of postanal myotomes is not given for this stage. However, 14 postanal myotomes are said to be present in an early postlarval stage ("The newly formed postlarve"), when the number of myotomes usually gets stabilised and the total number corresponds with the adult vertebral number, a phenomenon observed in Clupeiform development. The total number of myotomes in the newly formed post-larva dealt with by Kuthalingam (1960) is