ON A FEW POST-LARVAL STAGES OF *ANODONTOSTOMA CHACUNDA* HAMILTON

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Anodontostoma chacunda, popularly called the short-nose gizzard-shad, is a fairly common fish of minor economic importance found along the coasts and estuaries of India. Information hitherto available on its early life history is limited to the observations made on the eggs and larvae by Delsman (1926 *b*, 1933) from the Java Sea; Devanesan and Chidambaram (1941), Chacko (1950) and Bapat (1955) from Indian coastal waters. The present paper deals with five stages in the post-larval development of this fish collected from the plankton off Cannanore (south-west coast of India) at 6 fathoms depth on 8-2-1961. The figures and measurements given are of the larvae preserved in formalin. The term 'postlarva' is used in accordance with the definition given by Jones (1950).

POST-LARVAE

4 *mm stage* (Fig. 1)

This is the earliest larval stage available in the collection. The body is elongated, with an almost uniform width except in the region of the head and post-anal part of the body that tapers gradually and ends in a somewhat rounded tail. The yolk is, obviously, absorbed, the mouth is formed with well-developed jaws and the eyes are deeply pigmented black, all marking post-larval conditions. However, the pelvic, dorsal and anal fins are not yet indicated, pointing out that the larva is in a very early post-larval stage. The fin-fold is present in a reduced form and the caudal fin is in an early stage of development. The pectoral fin has a circular flap-like appearance with striations representing future rays. The lower jaw is longer than the upper; the auditory capsules are rather prominent. There are 31 pre-anal and 10 post-anal myotomes, their total number, 41, corresponding to the vertebral number of the adult. Pigmentation of the larva consists of a series of chromatophoral streaks along the ventral aspect of the alimentary canal in its anterior half, a few pigment spots in the dorsal aspect of the mid-gut, a trace along the dorsal aspect of the rectum, a few spots on the ventral aspect of the tail and a trace along the dorsal aspect of the body above the mid-gut region.

6.78 *mm stage* (Fig. 2)

The notable features in this stage are the indications of the dorsal and anal fins in the hinder one-third of the larva and behind the anus respeotively. Minute

teeth have appeared along the outer margins of the jaws. The pigmentation in this stage consists of a few black spots in the median region behind the operculum ventrally, a few patches along the dorsal aspect of the fore- and hind-gut, a few

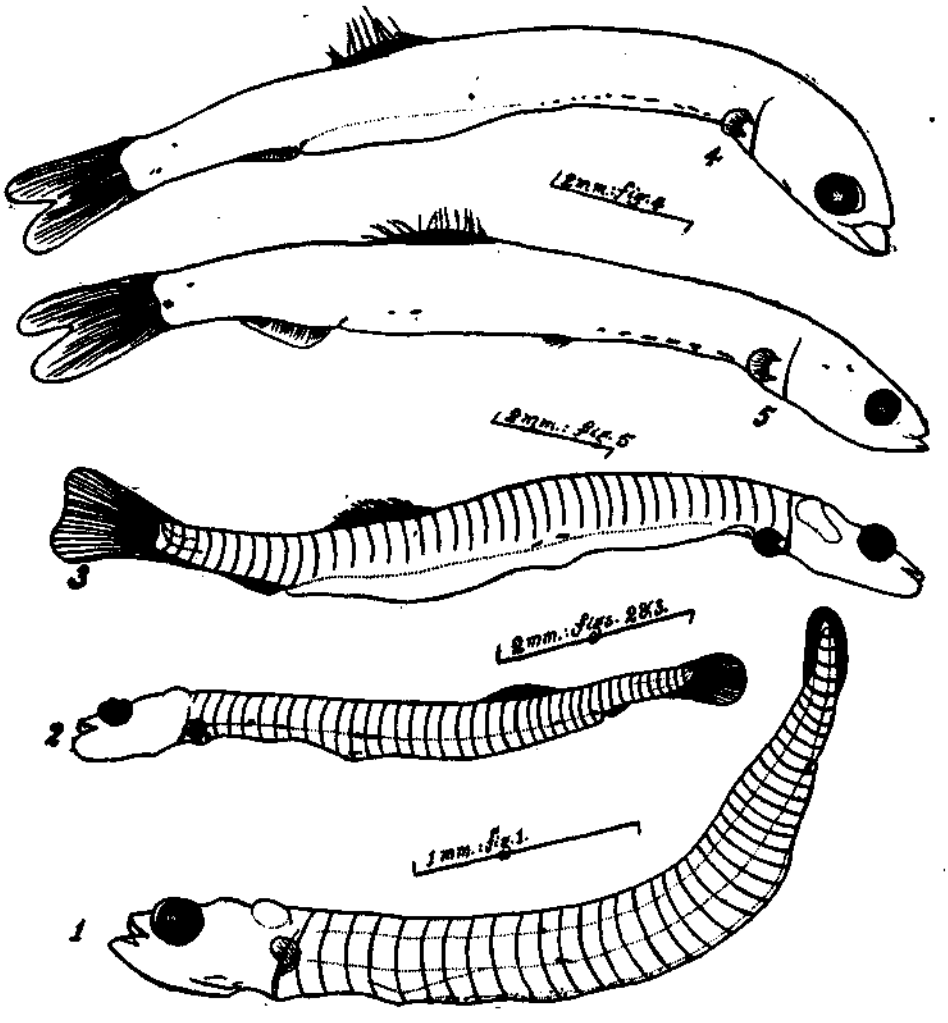

FIG. 1-5. Post-larvae of *Anodontostoma chacunda*. 1. 4 mm stage; 2. 6.78 mm stage; 3. 8.70 mm stage; 4. 12.8 mm stage; 5. 15.57 mm stage.

ventrally placed in the mid-gut, a patch above it and a few spots in the caudal region. The number and disposition of the myotomes in this stage, as well as in the succeeding two, remain the same as in the previous stage.

8.70 *mm stage* (Fig. 3)

In this all the fins that were present in the previous stage, have become more prominent with developing rays, the precise number of which is not yet distinguishable. The caudal fin shows the beginning of bifurcation. The pigmentation along the ventral aspect of the alimentary canal has disappeared.

12.80 *mm stage* (Fig. 4)

The caudal fin has become forked. There are 15 dorsal, 10 anal and 24 caudal rays. The pigmentation has increased in the anterior half of the body along its ventro-lateral aspect and in the lower half of the caudal fin. A trace of pigmentation has appeared along the median aspect in front of the operculum and a few in the lateral aspect of the caudal peduncle.

15.57 *mm stage* (Fig. 5)

The number of myotomes in the pre-anal region in this stage has decreased to 30 and the post-anal number increased to 11, obviously by the forward movement of the anus. The pelvic fin has appeared ventrally, well in front of the level of the anterior margin of the dorsal fin, in the form of a few rays. There are 16 dorsal, 16 anal and 24 caudal rays. The pectoral and pelvic fin rays have not yet become so well defined as to make out their number. Pigmentation has appeared in the tip of the lower jaw, in the dorso-lateral aspect in front of the operculum and on the lateral aspect of the hind-gut.

Discussion

Delsman (1926 *b*, 1933), assigning certain eggs to *Dorosoma chacunda* (=A. *chacunda*), has drawn attention (Delsman, 1933) to the myotome number of the larvae hatched out of them, and verified it with the vertebral number of the adult fish (41). He compared them with the number of larval myotomes as well as adult vertebrae of another species (that occurred along with *D. chacunda*), namely *Clupeoides lile* (=*Kowala coval*), which is 40 only. The larvae hatching from the eggs of *D. chacunda* identified by Delsman are shown to be much wider than those hatching from the eggs of *C. lile*. The former have 37 trunk (pre-anal) myotomes while the latter have only 34. Delsman (1933) has also stated that the anus in *D. chacunda* makes a forward movement covering 12 myotomes in the course of development.

The newly hatched larva measuring 2.66 mm identified by Devanesan and Chidambaram (1941) as belonging to *A. chacunda*, is stated to have 35 pre-anal and 12 post-anal myotomes and the 4.35 mm post-larva as having 25 pre-anal and 22 post-anal myotomes. Commenting on the difference between the total myotome number of the larva (47) and the adult vertebral number (41), these authors have stated that "further investigation appears to be necessary to reconcile

this difference". It is obvious that it is really difficult to reconcile the difference unless some other species is involved. Besides, the pre-anal number of myotomes in the 4.35 mm larva described by them (25), though corresponding to the adult pre-anal vertebral number, is too small for an early post-larval stage as this, because the number of pre-anal myotomes in clupeiform larvae is markedly higher than the pre-anal vertebral number in their adults.

Chacko (1950) gave a brief description of the eggs and early larva identified by him as of *A. chacunda*. The larva measuring 2.5 mm had 26 pre-anal myotomes. Though the number corresponds to the adult pre-anal vertebral number, it is too few for such an early stage which is evidently a pro-larva. This anomaly remains to be explained.

Bapat (1955) has given the salient features of the eggs identified as of *D. chacunda*, but no information of the larval stages has been given by him. The diameter range of the eggs collected by him agrees with the eggs of this species identified by Delsman (1926 *b*, 1933). The eggs of *D. chacunda* and of *Kowala coval* given by Bapat (*op. cit.*) differ from each other in the size of the egg and perivitelline space. Such dissimilarities were also pointed out by Delsman earlier.

The identification of the present larvae as of *A. chacunda* is based on the circumstantial evidence of the coincident occurrence of the larvae as well as eggs similar to those identified as belonging to this species by Delsman (1926 *b*, 1933) and Bapat (1955) and the appearance of partly spent fishes at Cannanore and is confirmed by the direct evidence afforded by the identical number of myotomes in the larvae and the vertebral number in the adult, namely 41. The only other dorosomid found in the seas around India, *Nematalosa nasus*, has 45 vertebrae. Among the various clupeid species available in our seas only a few have the vertebral number coming close to that of *A. chacunda*. Of these, *Sardinella sirm*, *S. albella* and *Macrura kelee* have 42 to 43 vertebrae, *Kowala coval* has 40 and *Pellona* spp. have more than 42. An examination of the vertebral number of these species during 1961 - 1963 has shown that the vertebral number in *K. coval* and *A. chacunda* is constant and in the other species the number is never below 42. It is obvious from this that identification of the post-larvae of these two species based on the number of myotomes will be valid.

The figure of a clupeid post-larva of 7.4 mm is given by Delsman (1926 *b*, Fig. 5), who has mentioned the probability that this belongs to *D. chacunda*. This larva is comparable to the 6.78 and/or 8.70 mm stages given in the present account. They show many features of resemblance with each other, but the latter can be easily distinguished from the former by the smaller number of myotomes, both pre-anal and total. In the present larvae there are $31 + 10 = 41$ myotomes while in the larva figured by Delsman there are 34 pre-anal and 9 post-anal myotomes (including the hinder tip) as shown in the figure, making a total of 43. Delsman

(*l. c.*) suspecting the identity of this larva stated that the number of trunk (pre-anal) myotomes in the larva (34) is "perhaps slightly higher than one might expect in this stage" of *D. chacunda*. It is obvious that the post-larva described by him belongs to a clupeid having 43 vertebrae.

In the small number of their myotomes, the post-larvae of *A. chacunda* bear resemblance to those of the species belonging to the engraulid genera *Thrissocles* and *Anchoviella*, the vertebral number of which varies from 41 to 45 and 38 to 43 respectively. But the early larvae of *A. chacunda* can be easily distinguished from those of *Thrissocles* (=*Engraulis*) (Delsman, 1929) and *Anchoviella* (=*Stolephorus*) (Delsman, 1931) by the fact that in the former there are 37 pre-anal myotomes (Delsman, 1926 *b*, 1933) while in the latter there are not more than 32. The post-larvae of *A. chacunda* can be easily differentiated from those of *Thrissocles* and *Anchoviella* (Delsman, 1929, 1931; Vijayaraghavan, 1957) by the fact that in the former the origin of the anal fin is far behind the level of the hinder end of the dorsal fin, while in the latter it is below the middle or hind end of the dorsal corresponding to their future disposition. Besides, the mouth in the post-larvae of *A. chacunda* is terminal while in those of Engraulidae it is rather inferior and somewhat oblique. In these respects the larvae of *A. chacunda* resemble those of *Sardinella* (=*Clupea*) (Delsman, 1926 *a*; Bensam, unpublished) from which they can be distinguished by their myotome number as pointed out earlier.

Summary

Five stages in the post-larval development of *A. chacunda*, from 4 mm to 15.57 mm, are described. The larvae assigned to this species by previous authors and the salient features in which the post-larvae differ from those of other clupeiform fishes found in the seas around India are discussed.

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