

LABORATORY REARED FISH EGGS AND LARVAE AND
SUBSEQUENT STAGES FROM PLANKTON OF VELLAR ESTUARY,
PORTO NOVO: II. THE FLATFISH, *CYNOGLOSSUS PUNCTICEPS*
(RICHARDSON)

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ABSTRACT

Eggs and larvae of the flatfish, *Cynoglossus puncticeps* were collected from Vellar estuary and reared in the laboratory upto 72 hr (4 stages) while the rest of the 7 stages (6 postlarvae and 1 juvenile) were collected from plankton samples. Of two batches of eggs appeared in the plankton, the first batch was from January-April (sal. 30.76-34.77‰; temp. 27.43-31.18°C) and second from July-October (35.37-19.81‰; temp. 28.65-29.63°C). Subsequently larvae were collected from January-December (sal. 35.78-2.25‰; temp. 28.38-26.68°C). Larval growth and the morphometric measurements have been described.

Key-words : Larval development, flatfish, *Cynoglossus puncticeps*, Vellar estuary.

INTRODUCTION

Flatfishes are abundant in the open continental shelf and are fished on a commercial scale (Munro, 1967). Representatives are also found in bathyal depths, coral reefs, estuaries and rivers (Punpoka, 1964) and in fresh water springs, many miles inland (Topp and Hoff Jr., 1972). They mainly inhabit the soft muddy bottom, but some inhabit the areas of gravel or sand. Ramanathan (1977) reported thirty two species of flatfishes from Porto Novo coastal waters of which the family Cynoglossidae alone represented six species.

Knowledge of an early development of *Cynoglossus* spp. from Indian waters is based on the works of Nair (1952), Bapat (1955), Kuthalingam (1957), Vijayaraghavan (1957), Balakrishnan (1961), Bensam (1965), Venkataramanujam (1975) and Ramanathan and Natarajan (1979). The early life history of *Cynoglossus puncticeps* had not been reported earlier. The present communication reports on the development of *C. puncticeps* from the egg to 72 hr larval stage reared in the laboratory and 4.8 mm postlarvae to 15 mm juvenile collected from plankton samples.

MATERIALS AND METHODS

Eggs and larvae were collected with a zooplankton net (bolting silk cloth, No. 10, 158 µm) from the Vellar estuary (lat. 11° 29' N; long. 79° 49' E)

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by mechanised boat *Medusa*. Surface water temperature and salinity were also recorded. Eggs were sorted out and kept in culture troughs containing filtered and well aerated estuarine water of collection site. The larvae were preserved in 5% neutralised formalin immediately after collection. Stages of development are shown in Fig.1 (A to K). The eggs and larvae were measured by an ocular micrometer. Drawings were made by using prism type camera lucida. The terminology and other laboratory rearing techniques were followed as given by Thangaraja (1982).

RESULTS AND DISCUSSION

Developing Egg (Fig. 1A): Eggs pelagic, perfectly spherical transparent with an average diameter of 0.672 mm. Perivitelline space very narrow. Yolk colourless, unsegmented and 0.656 mm in diameter. Embryo not developed when the eggs were collected around 7.30 a.m. At 3.45 p.m., it developed without any pigments, but with 16 somites and rudiments of eye discernible. Oil globules (14-16) with average diameter 0.021 mm were located at the centre of the yolk sometimes but spread all over the yolk at other times.

Postlarva-45 hr (Fig. 1B): All the eggs hatched at about 9.00 p.m. Total length of the 15 hr prolarva was 1.925 mm. Larva sluggish and settling at the bottom. Chromatophores developed around the eyes and other parts of the head, extended laterally upto the middle of the yolk sac where they appeared in the form of yellow patches together with punctate black pigments. The oil globules present on the yolk sac. Four patches of chromatophores (including the one on the anal region) present in the postanal region. The third postanal patch was the largest and the extreme caudal patch was the smallest. Yellow patches were invariably in combination with the punctate black pigments. Alimentary canal was rather straight anteriorly, but inclined posteriorly towards the anus. Myotomes were not clearly exposed due to the prominent patches of chromatophores. Striations on the caudal fold indicated the formation of caudal rays.

Postlarva-45 hr (Fig. 1C): The postlarva had grown to 2.239 mm in length. Yolk sac was almost absorbed, and mouth was being formed. Eyes were pigmented. Auditory vesicle appeared just behind the eyes. Pectoral fin was developing, but absent in the adult, a feature characteristic of the cynoglossidae. A rudimentary tentacle developed just behind the supraorbital crest, at the origin of the dorsal finfold. A line of yellowish black ramified pigments was seen on the tentacle. Convolution of alimentary canal which is characteristic of flatfishes was also observed at this stage. Yellow pigments on the body were now cut off from the head pigments, forming a band just above the alimentary canal region. Anal chromatophore (counted as the first postanal patch in the previous stage) had shifted to the postanal position. Five bands of branched chromatophores of varying intensities were present between pectoral and caudal regions. Only a few pigment spots remained dorsal to

the eyes, unlike in the previous stage. A few bits of pigments from the 2nd to the 3rd postanal bands of chromatophores extend upto the dorsal and ventral margins of the larval finfold.

Postlarva-72 hr (Fig. 1D): Postlarva measured 2.358 mm in length. It remained at the bottom of the trough, and moved about only when there was agitation of water caused by the aerator. Dorsal tentacle was better developed than in the previous stage. The second and the third bands of postanal chromatophores extended upto the dorsal and anal finfolds. No noticeable change was observed in the other chromatophores, except that the orbital chromatophores had completely disappeared.

Postlarva of 4.8 mm length (Fig. 1E): The body was flat and transparent. Two dorsal tentacles were present instead of one observed in the earlier stages. The anterior tentacle was longer than the posterior one. Behind the tentacles rays were discernible on the dorsal finfold. There were 102 dorsal fin rays and 82 anal fin rays. Pectoral fin had disappeared. The abdomen was seen bulging out slightly. Rudiment of pelvic fin appeared at the junction of the operculum with the trunk. Snout was distinctly bulging out, separated from the postorbital part by a notch at a level dorsal to the eye. The right eye had migrated dorsalwards just anterior to the dorsal notch. The tip of the rostral portion had grown towards the snout. The pattern of chromatophores had changed drastically. Reticulate chromatophores on the midlateral side of the body had broken up into pigments of minute punctate and stellate forms, now distributed in the following parts of the body, at the tip of jaws, snout; just posterior to the isthmus; air bladder; along the dorsoventral side; just ventral to the dorsal fin rays from behind the head to the caudal tip in a row which was in the form of clusters of pigment separated by narrow gaps; again from the caudal tip to the anal region ventrolaterally in the above form. Another row extended from the anus to the caudal tip along the base of each anal fin ray. Other regions were free from pigmentation. The mouth was nearly terminal.

Postlarva of 5.2 mm length (Fig. 1F): The mouth had assumed a ventral position. The dorsal tentacles were slightly reduced in length. Migrating right eye had come to the upper margin of the left side of the head. Six branchiostegals were clearly seen. Near the caudal region, the pigments from the dorsolateral and venterolateral clusters migrated dorsoventrally (perpendicularly) to form a band like structure. All the other characteristics remained the same as in the previous stage.

Postlarva of 5.6 mm length (Fig. 1G): The dorsal tentacles were greatly reduced in size. Since the right eye had completely migrated to the left side, the rostral end had first grown forward and eventually downward towards the snout, becoming adnate to it. Only the groove was seen at the dorsal level of the orbit. Pterygiophores were developed along the ventrolateral aspect in between the already existing two rows of pigments. Pigments were found on

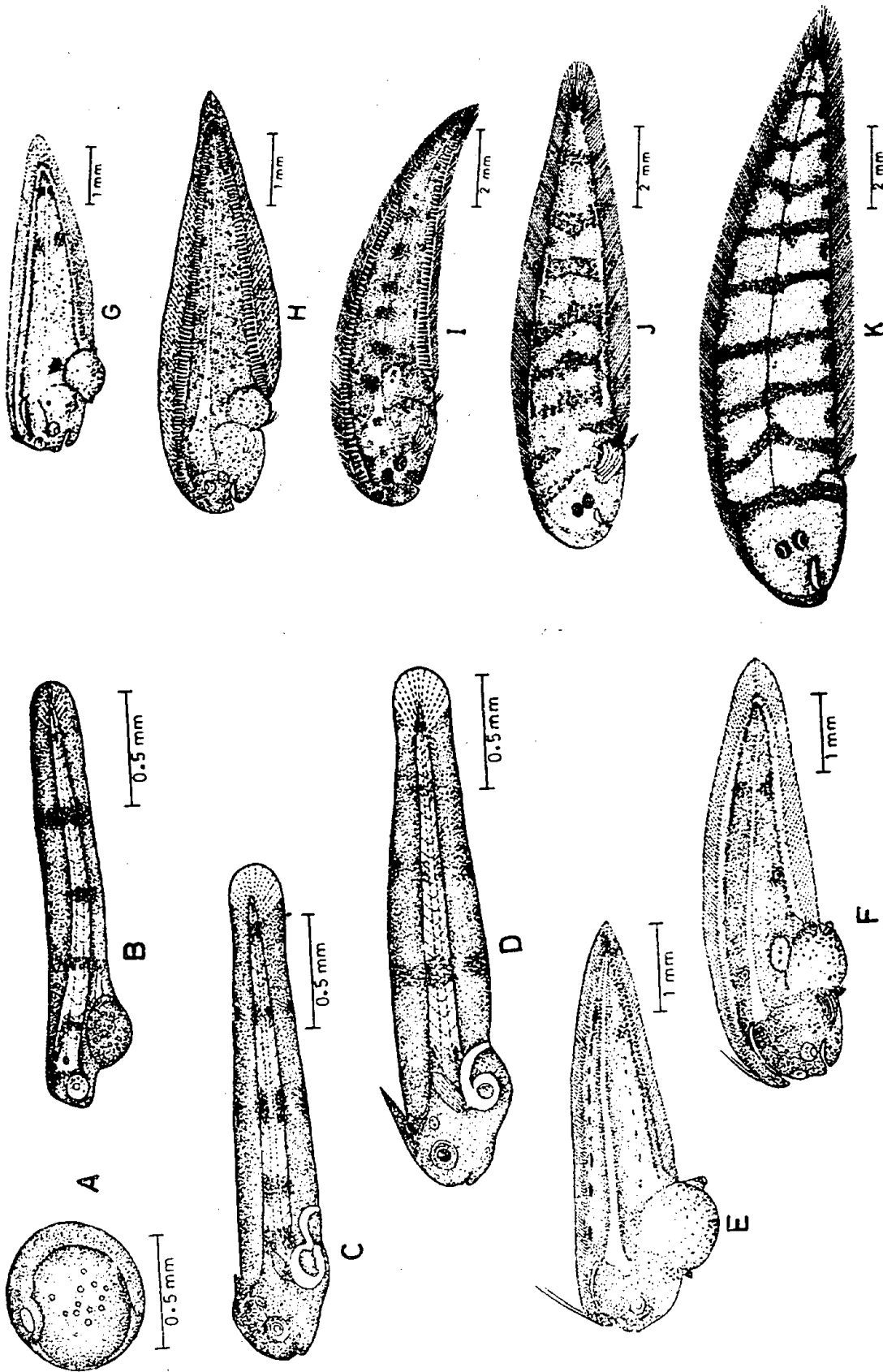


Fig. 1. A - Developing eggs, B - 15 hr prolarva, C - 45 hr postlarva, D - 72 hr postlarva, E - 4.8 mm postlarva. F - 5.2 mm postlarva, G - 5.6 mm postlarva, H - 6.2 mm postlarva, I - 10.5 mm postlarva, J - 12.0 postlarva, K - 15.0 mm juvenile.

the ventral part of the operculum also. Besides, 2 caudal bands of pigments were seen, one at the caudal tip and another just in front of it. A few more punctate pigments were seen along the midventrolateral aspect, behind the anus.

Postlarva of 6.2 mm length (Fig. 1H): The right eye had completed its migration assuming its adult position on the left side near the left eye. Chromatophores were found distributed all over the body including the fin rays except the caudal rays. Pelvic fin had developed four rays. Pterygiophores were found on both sides of the body.

Postlarva of 10.5 mm length (Fig. 1I): Mouth had further moved towards the ventral side, as in the adult. All the pigments were found to regroup themselves into 7 clusters of chromatophores, confined mainly along the lateral aspect, following the vertebral column.

Postlarva of 12.0 mm length (Fig. 1J): The chromatophores were of stellate type and arranged into 8 prominent bands. The first band was opercular in position just behind the eyes and across the branchiostegal rays.

Juvenile of 15.0 mm length (Fig. 1K): Nine vertical bands were present. Chromatophores were seen distributed between the bands along the base of dorsal and anal fin rays. They were also seen on the caudal peduncle and along the base of caudal rays. The branchiostegals and alimentary canal were no more visible external. The fin formula was D.98, A.76; V.4, C.11.

Rate of body growth: The relation between total length (Y) and seven major characters such as head length (Y_1), head depth (Y_2), snout length (Y_3), eye diameter (Y_4), body depth (Y_5), preanal (Y_6) and postanal (Y_7) distances was studied. The results showed that the total body length is directly proportional to all the seven characters. The relationship can be described as follows:

$$Y = 0.2452 Y_1 - 0.1513$$

$$Y = 0.1997 Y_2 + 0.1121$$

$$Y = 0.0980 Y_3 - 0.2460$$

$$Y = 0.0272 Y_4 + 0.0769$$

$$Y = 0.2067 Y_5 + 0.0322$$

$$Y = 0.1880 Y_6 + 0.4752$$

$$Y = 0.8139 Y_7 - 0.5086$$

Head length: Head length increased by about 0.09 mm for every 1 mm in total length. Head length was 9.42% of the total length at 1 mm stage, 21.4% at 5 mm stage, 23.01% at 10 mm stage and 23.51% at 15 mm stage. This showed that the head length increased rapidly up to 5 mm stages (Fig 2A).

Head depth: It increased by about 0.3 mm for every 1 mm of total length. Head depth was 31.18, 22.21, 21.0 and 20.71% of the total length at 1, 5, 10 and 15 mm stages respectively. Although the head depth increased

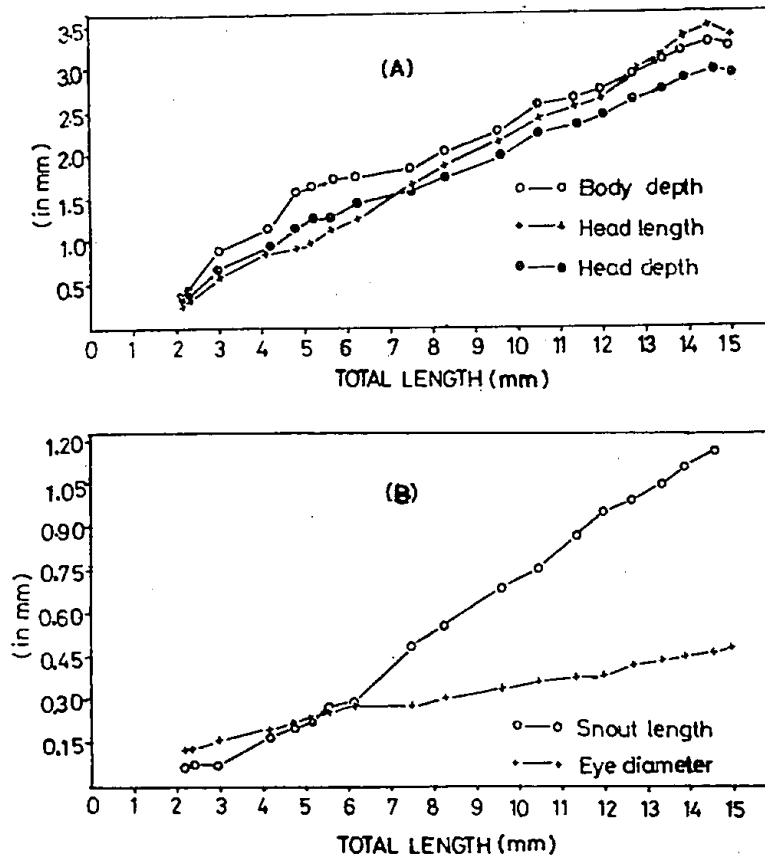


Fig. 2. A. Relationship among body depth, head depth and head length on total length; B. Relationship among snout length and eye diameter on total length.

in direct proportion to the total length of the larvae, the percentage of growth was decreasing.

The correlation of head length and head depth was 0.98, which indicated a significant correlation. The comparative graphical illustration (Fig. 2A) of head length and head depth showed that the rate of growth of head length was slow upto 7.5 mm length and faster thereafter.

Snout length: Snout growth was about 0.04 in length for each 3 mm of total length. The percentage growth of snout length for 3, 5, 10 and 15 mm stages were 1.60, 4.88, 7.34 and 8.16% respectively.

The growth of the head and snout lengths showed correlation with each other (correlation coefficient: 0.96).

Eye diameter: Eye diameter increased 0.1 mm for each 1 mm of total length. The growth of eye diameter was 4.25% for 5 mm, 3.48% for 10 mm and 3.23% for 15 mm stages.

The correlation coefficient of snout length and eye diameter was 0.94. The comparative growth study showed (Fig. 2B) that the snout length was lesser than eye diameter upto 5.4 mm stages. Subsequently (from 6.2 mm stages) the rate of growth of snout length increased rapidly. This was due to the complete migration of right eye to the left side and also complete forward growth of rostral end towards the snout.

Body depth: It increased at a rate of approximately 0.52 mm for every 1 mm increase in total length. Body depth at 5 mm stage was 21.11%, at 10 mm 23.89% and at 15 mm stage 22.8%.

Correlation coefficient of head depth and body depth was 0.98. The rate of growth of head depth was directly proportional to that of body depth (Fig. 2A) at all stages of development.

Preal distance: Preanal distance increased approximately by 0.66 mm for every 1 mm of total length. It was 28.3% of the total length at 5 mm stage, 23.5% at 10 mm and 21.9% at 15 mm stage.

Postanal distance: Postanal growth increased at a rate of approximately 0.3 mm for every 1 mm of total length. It was 71.2, 76.3 and 77.9% at 5, 10 and 15 mm stages respectively.

Correlation coefficient of preanal and postanal distance was 0.93.

The eggs of *Solea* sp. (Ehrenbaum, 1909) and of *Solea ovata* (Thangaraja and Ramamoorthi, 1982) possessed a large number of oil globules. Subsequent studies (Nair, 1952; Kuthalingam, 1957; Vijayaraghavan, 1957; Bensam, 1965; Venkataramanujam, 1975; Ramanathan and Natarajan, 1979; Thangaraja, 1982) have shown that the eggs of *Cynoglossus* also possessed numerous oil globules in the unsegmented yolk. It has also been brought to light that the dorsal tentacle was not developed in the larva of *Solea* (Ehrenbaum, 1909; Thangaraja and Ramamoorthi, 1982) while it is a characteristic larval feature of *Cynoglossus*. The other important larval characteristics of *Cynoglossus* are: the presence of both eyes on left side of head; dorsal and anal fins being confluent with the caudal; hooked snout; absence of pectoral fin; and unfringed lips.

In Porto Novo waters, the family Cynoglossidae is represented by two genera and six species: *Paraplagusia* with a single species, *P. billineata* while the other genus *Cynoglossus* is represented by 5 species. Among these species, the life of *Cynoglossus macrolepidotus* and *C. monopus* were studied (Ramanathan and Natarajan, 1979). Bensam (1965) described the eggs and larvae of *C. semifaciatus*. Venkataramanujam (1975) described the eggs and a few pro-larval stages of *Cynoglossus* sp. collected from the Porto Novo coast. The description of the present material agreed with that of the eggs and prolarvae of *Cynoglossus* sp. described by Venkataramanujam (1975) from the same locality.

Cynoglossus puncticeps is a coastal breeder, but eggs and postlarvae were found to be distributed upto and including gradient zone. Based on hydrological data Ramamoorthi (1954) demarcated the Vellar estuary into the marine, the gradient, the tidal and the fresh water zones. Two batches of eggs and larvae appeared in the plankton, first batch from January–April (sal. 30.76–34.77‰, temp. 27.43–31.18 °C) and second one from July–October (sal. 35.37–19.81‰, temp. 28.65–29.63 °C) and larvae from September–December (sal. 35.78–2.25‰, temp. 28.38–26.68 °C). The juveniles occurred even in the fresh water zone of the estuary.

The total agreement of the meristic counts of the present postlarvae and juvenile with that of adult *C. puncticeps* might be taken as conclusive proof that the early stages described here belong to *C. puncticeps*. The eggs and larvae, belonging to *Cynoglossus puncticeps* on the basis of occurrence of eggs in the plankton and spawners in the local catches, were concurrent from the same period.

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