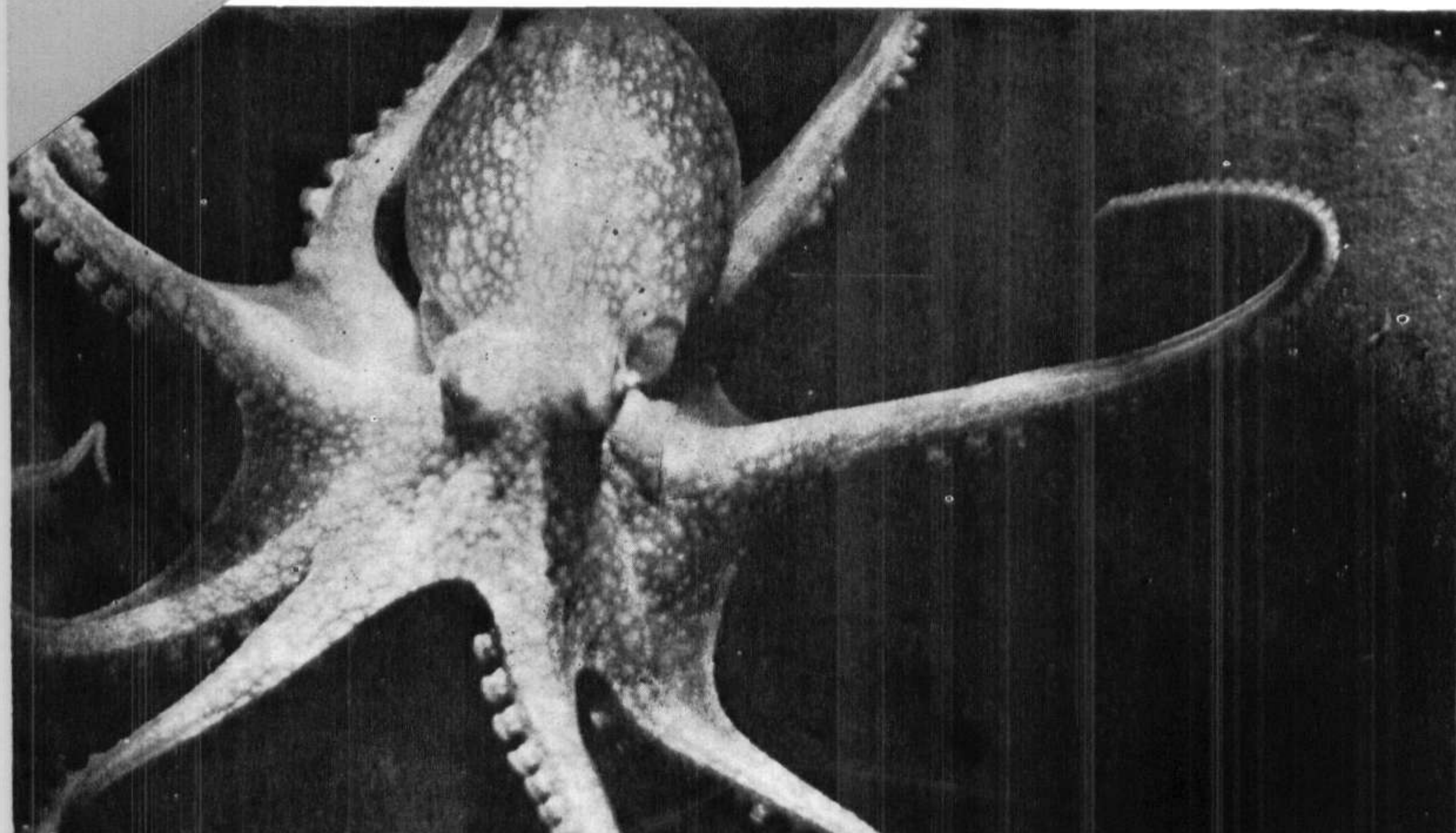
CMFRI
bulletin 37

JUNE 1985

CEPHALOPOD BIONOMICS, FISHERIES AND RESOURCES OF THE EXCLUSIVE ECONOMIC ZONE OF INDIA

Edited by : E. G. SILAS



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SOME OBSERVATIONS ON THE HATCHING AND POST-HATCHING BEHAVIOUR OF THE CUTTLEFISH *SEPIA PHARAONIS* EHRENBERG

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ABSTRACT

Egg capsules of the cuttlefish *Sepia pharaonis* were collected off Vizhinjam and the hatchlings studied in the laboratory. Most of the young ones hatch out within a period of eight days, and a few had premature hatching. The hatched young ones resembling the adult externally were found to move by swimming, crawling or darting by jet propulsion. They settled on the bottom and were attracted towards light. The young ones were reared for a period of twenty three days in the laboratory.

INTRODUCTION

A bunch of egg capsules of the cuttlefish *Sepia pharaonis*, which is the only species contributing to the cuttlefish fishery at Vizhinjam, was brought to the laboratory on January 4, 1974. These capsules were found attached to a bundle consisting of a piece of nylon fishing net, coir strands and a small dry twig. The bunch was collected in a shore seine operated in the Vizhinjam Bay (Trivandrum). There were over 600 capsules in the bunch. Another egg mass attached to the stem of a gorgonid and consisting of about 750 capsules was collected on December 22, 1981 from a depth of 45-50 m off Vizhinjam (Plate. IA). On both the occasions the capsules were kept for observations in aquarium tanks containing sea water which was changed periodically and aerated constantly. The account of the hatching and post-hatching behaviour given below is based on these observations.

OBSERVATIONS

The egg capsules were spherical to oval in shape having a length of 15-20 mm and a diameter of 14-17 mm. Each capsule was attached at one end to the substratum by a small stalk which in some cases was about the same length as the capsule or more upto 30 mm (Plate. IB). The free end of the capsule was sometimes drawn into a small teat-like projection. The capsules were opaque with a gelatinous consistency. Embryos were present in most of the capsules, seen through as a white mass and occasionally moving within the capsules. Some of the capsules, especially those in the interior of the egg mass, contained eggs in decaying condition and microscopic examination revealed very high concentration of ciliates around these eggs.

As the development of the embryo progressed within, the capsule became more transparent and slightly enlarged with the absorption of water. The embryo with its mantle, head, and arms resting on the globular yolk sac was more clearly visible through the capsule and when the embryo was dissected out of the capsule and placed in a watch glass, the expansion and contraction of the mantle were clearly seen. The posterior half of the mantle on the dorsal side was white because of the shell (cuttlebone) inside. Ventrally the internal ink sac was visible as a dark spot in the middle of the mantle. Within the capsule the embryo lay supine and this position was maintained even when the capsule was turned in different directions. At times it showed jerking movements within the capsule.

Fourteen days after the collection of the first bunch of the egg mass, the capsules became more enlarged; the largest one measured 25 mm in length and 20 mm in diameter. Except for the diminished yolk sac, the embryo with the suckered arms and chromatophores all over the body had general resemblance to an adult cuttlefish.

The young ones hatched out when they were fully-grown within the capsule. Before hatching they floated in the capsule for sometime and wriggled out through a small slit in the capsule. By the time the embryo became a full-grown young within the capsule, the yolk would have been fully absorbed. But in a few cases the diminished yolk sac still persisted and this was ejected before hatching. The discarded yolk sac could be seen within the empty capsule. In very rare cases the young ones hatched with the small yolk sac intact and its ejection took place only subsequently.

The hatched young ones were the miniature replicas of the adult cuttlefish externally. At this stage they measured 6.5-7 mm in dorsal mantle length. The chromatophores were very clear and distributed all over the body (Fig. 1 a, b). Generally the body was pale yellowish brown in colour, with prominent brown dots. When the young was disturbed the whole colour changed in a flash to pale white and then to dark brown. The zebra-pattern colouration of the adult was not seen in the newly-hatched young ones.

In the night of the 17th day after the collection of the first batch of egg mass, 10 young ones hatched out and by about the 24th day most of the hatchings took place. In the second set of experiments also it took 7 days for all the young ones to hatch out. A notable feature of the hatching process was that most of the hatchings took place during night time (this was true in the first case also) as seen in Table 1.

TABLE 1. *Details of hatching and mortality during 7 days from* 27-12-1981 to 2-1-1982.

Day	Number of eggs hatched			Mortality (nos)
	Day	Night	Total	
1	5	15	20	Nil
2	15	80	95	2
3	35	200	235	5
4	20	60	80	5
5	25	100	125	2
6	25	75	100	2
7	5	25	30	3
Total	130	555	685	19

A few egg capsules contained the white remnants of the cuttlebone, indicating that the embryos might have aborted and disintegrated within the capsule. A still fewer number had premature hatching, probably due to the stress caused by changing of water or the transfer of the capusules from one container to another.

After hatching, the young moved about by swimming in water or crawling on the bottom. Occasionally they showed a tendency to come to the surface for a while and then to return to the bottom and settle there.

The young ones showed good response to light. Often they crowded together, at times even one upon the other, in a corner of the tank where there was more light. When small pieces of stones were put in the tank the young ones settled near or on the stones, especially in the interspaces. The concentration was more near the place where there was more light.

In order to study their reaction to light, a table lamp (100 W) was placed at one side of a glass through containing newly-hatched young ones. All of them showed strong phototaxis and migrated to a position close to the light (Plate. I C, D). This sort of positive response to light was noticed only in the case of newly hatched young ones for a period of about 48 hours, and afterwards there was no regular response to light.

The posture of settling on the bottom is characteristic in that the fins and the arms are bent downwards as a support to the ventral mantle which is pressed against the substratum. When disturbed, the young slowly move about on the bottom using the arms and fins, or sometimes dart backwards suddenly by expelling water from the mantle cavity through the funnel. While moving by jet propulsion, the young cuttlefish even on the day of hatching emits ink upto 3-4 times in quick succession. Jet propulsion follows sudden excitement and on all such occasions the colour of the young one turns black and remains so for sometime.

On the bottom, the young move in small leaps by pressing the arms against the ground and moving forwards in short leaps. They also walk on the bottom with the help of the third pair of arms which are the largest among all the arms. These arms are moved alternately forwards and backwards. The other arms are held together and pointed forwards. Occasionally these arms are also used as support touching the bottom. Sometimes the first pair of arms may be moved freely in different directions as feelers. On a few occasions the young were seen moving with the third pair of arms probing the ground. When moving like this the body is kept in an oblique position with the head directed downwards; for maintaining balance the support is given by the movement of the fins.

In swimming, the movement is slow and the young move in all directions even without changing orientation. This is achieved by the undulating movements of the fins. When moving slowly the mantle is expanded and the animal assumes a more roundish shape The first pair of arms are pointed forwards or sometimes upwards. All the other arms are held together and bent downwards without moving them.

The retractile tentacles are not seen outside; they are always kept in the pouches, except at the time of capturing the prey.

Most of the settling or swimming young ones were not seen feeding, eventhough they were provided with

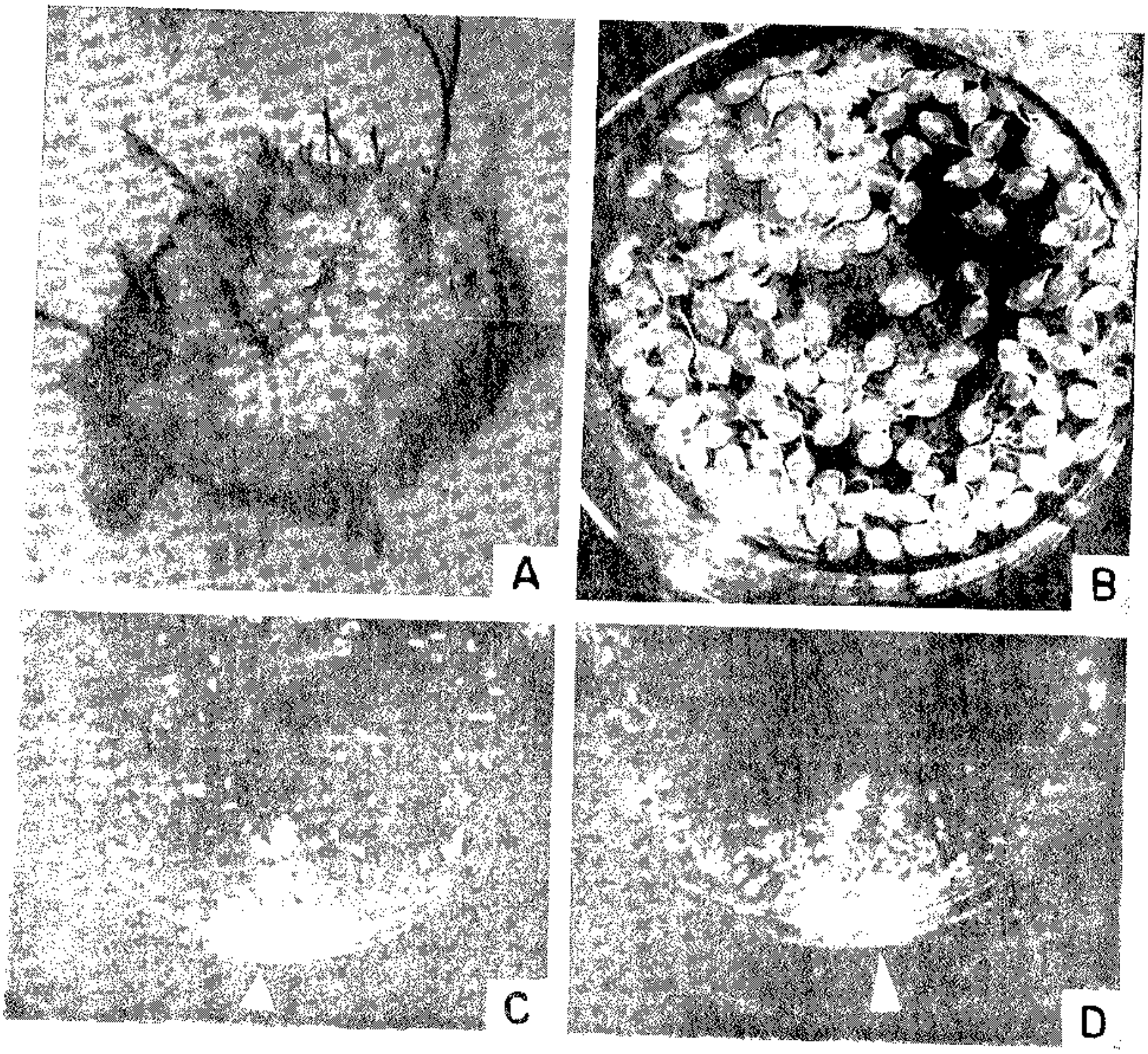

PLATE I. A-D. Egg capsules and young ones of *Sepia pharaonis* : A. Bunch of egg capsules attached to a gorgonid ; B. Capsules separated from the gorgonid : emryos are seen inside the capsules ; C. Young ones begin to move towards light ; D. Young ones congregate near the light. (Arrows show source of light).

live and dead plankton, finely minced fish and artificial feed. In a few instances when live mysids were introduced, some of the young responded positively. On sighting the prey they suddenly released the tentacles from the pouches, and in a very swift action the prey was caught with the tentacular clubs and slowly conducted to the mouth where it was held by the oral arms.

A few days after hatching, the young ones were found to come to the surface more frequently than before and started floating. When they were gently touched with a fine brush, some showed a tendency to migrate to the bottom and then to return to the surface again. They remained in a peculiar position with only the posterior portion of the animal touching the surface of the water ; the mantle and the head were obliquely pointed downwards. They were motionless in this head-down position, and when disturbed, the response was very feeble. They never attempted to swim away, except that the arms were moved very faintly. The chromatophores became thin, with the result that there was no sudden and strong change of colour. There was also no ejection of ink. The number of such floating young ones increased day by day, as evident from Table 2.

TABLE 2. *Details of surfacing of the young ones during* 10-1-1982 *to* 18-1-1982.

Day	Total no. of young ones	No. of young ones surfaced
1	666	11
2	655	45
3	610	50
4	560	50
5	510	40
6	470	105
7	365	105
8	260	130
9	130	130
Total	—	666

It is clear from the Table that the number of floating young ones was low during the first five days but increased sharply from the 6th day onwards. Each of the floating young one remained there for 1-2 days and died subsequently. In the first experiment the young remained alive for 10 days between the hatching of the first and the death of the last young ones, and in the second experiment they remained for a longer period, 23 days.

DISCUSSION

From the foregoing account it is seen that, apart from the striking morphological resemblence to the adult, the young ones at hatching have acquired most of the adult behaviour such as locomotion (crawling walking, swimming and jet propulsion), prey-capture, ejection of ink and sudden change of colour associated with excitement and escape bids. The periodic settling on the bottom is typical of a benthic adult life. According to Boleteky (1977), the young of *Sepia* show a tendency to settle on the bottom at a very early stage. They attach themselves to the substratum with the ventral integument of the mantle and the ventral arms. The behaviour of surfacing and floating of the young followed by death in the present experiments is peculiar, and the exact reasons for this are not known. Lack of feeding and the resultant reduction in metabolism rendering the animal unable to maintain the delicate buoyancy mechanism may be among the possible factors that cause floating and subsequent death.

Though feeding was poor, mysids seem to be the favourite food for the young of *Sepia pharaonis*. These small crustaceans were found to be preyed upon by the young of other cuttlefishes such as *Sepia esculenta, Sepia subaculeata, Sepiella maindroni* (Choe, 1966) and *Sepia aculeata* (Sivalingam and Pillai, 1983). According to Messenger (1977), very young cuttlefish (*Sepia officinalis* had fed on mysids during the first few days of their life after hatching. The prey capture of the young is similar to that of the adult. This is achieved by a visual feedback system. There are three phases of attacking the prey : fixating the prey binocularly, positioning itself in an attacking position, and striking the prey with the ejection of tentacles (Messenger, 1977). It is important that the prey must be in the visual field of the young one for it to initiate prey capture. Therefore, feeding may largely depend upon the availability of the right prey within the visual filed of the cuttlefish. In the present experiments, lack of availability of mysids in sufficient concentration within the visual fields of the young, especially of the settling ones, may perhaps account for the poor feeding and the subsequent events leading to death within a few days of hatching.

Choe (1966) has reared *Sepia subaculeata* to a full commercial size of 350-400 g. According to Sivalingam and Pillai (1983) the young ones of *Sepia aculeata* hatched in the laboratory survived for only 5 days. In a subsequent experiment the young of *Sepia* sp. were reared upto a size of 67 mm ; these were fed with mysids during the first month and with larval fishes during the later period (CMFRI Newsletter No. 26, 1984). With running water facilities and ideal conditions such as optimum environmental requirements, proper food and sufficient water space, it may be possible to rear the cuttlefish in the laboratory to a much larger size.

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