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OBSERVATIONS ON THE ZOANTHID, *SPHENOPUS MARSUPIALIS* (GMELIN) (ANTHOZOA : ZOANTHIDEA : SPHENOPIDAE), ALONG THE SOUTHEAST COAST OF INDIA, WITH NOTES ON ITS BEHAVIOUR IN AQUARIA

By

A. K. NAGABHUSHANAM AND J. T. JOTHINAYAGAM

Marine Biological Station, Zoological Survey of India, Madras

(With 1 Chart and 2 Text-figures)

INTRODUCTION

Sphenopus marsupialis (Gmelin) is a very common zoanthid found in the general sea-area between low-water mark and depths of at least 60 metres offshore, along the southeast coast of India from at least Ennur in the north to Nagapattinam in the south, being particularly common on sandy and muddysand sea-bottoms with a coarse substratum ; information on distribution, food and feeding, colouration, locomotion, growth and longivity are presented in this paper.

Practically nothing is known in the literature about this zoanthid, although our data indicate it to be a common form, and hence it was taken up for detailed study.

Gravely (1941) has recorded the occurrence of this species among the organisms cast up on Madras beaches. Menon (1927) has mentioned the absence of this species at Krusadai. Menon (1931) has found the Semper's larvae of *Sphenopus* in the plankton of the Madras area during the general period from November to February, with swarms in January and February.

MATERIAL AND METHODS

Data were collected on the occurrence of this species during the regular trawling and dredging operations carried out between Ennur in the north and Kalpakkam in the south, and down to a depth of over 60 metres offshore by the R. V. CHOTA INVESTIGATOR (see Chart I) from March 1975 to August 1979 inclusive. These specimens were brought back alive and put into the experimental tanks of the Station for detailed studies ; batches of the animals being used for the various experiments. Specimens were also collected during the 1976

and 1977 southeast coastal surveys during which it was found that this species was of common occurrence from Ennur in the north to Nagapattinam in the south.

A size-range between 5 mm and 45 mm was taken during hauls mad by the R. V CHOTA INVESTIGATOR off Madras ; while a size-

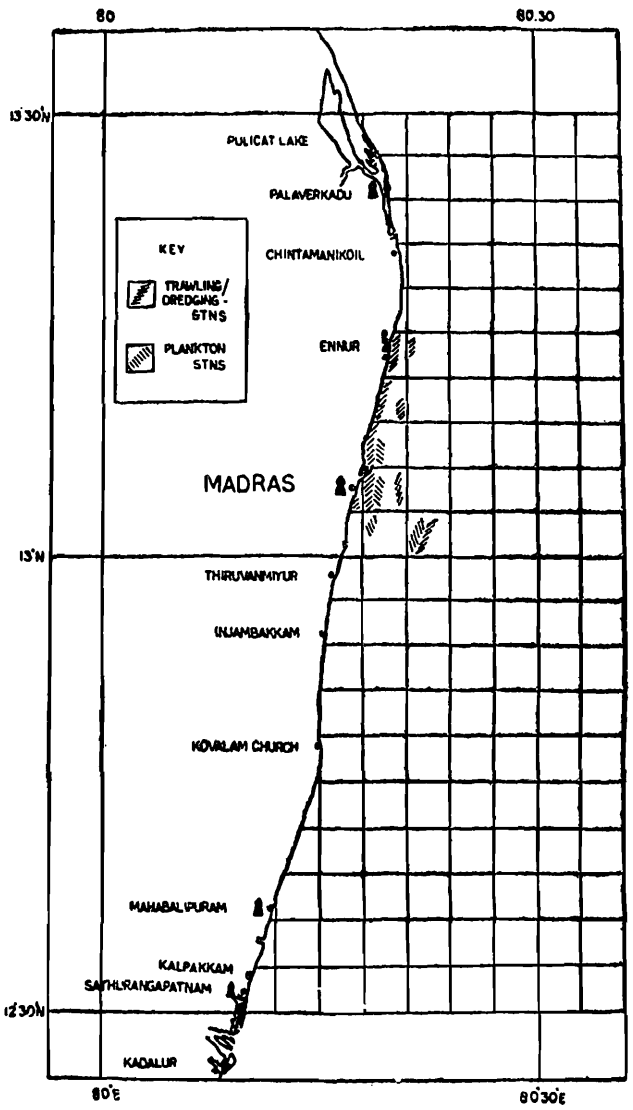


Chart 1. Operational area of R. V. "CHOTA INVESTIGATOR"

range between 20 mm and 75 mm was taken along the southeast coast during the general surveys.

Field Observations

This species is commonest on muddysand substrata with coarse sand grains ; it also occurred on coralline grounds in the deeper water—between 50 and 60 metres depths. This is the first time that this species is being recorded in such varying ecological habitats.

A Naturalist's dredge with a rectangular opening measuring 75 cms by 30 cms was used at a speed of approximately 2 knots over the grounds ; the dredge samples revealed that the species occurred

throughout the year and there did not appear to be any particular pattern in its distribution with increase in depth. A 10-minute operation of the dredge on muddysand substrata brought up 75-100 specimens, while a similar density of population was observed for coarse sand in depths ranging from 8-30 metres offshore ; a 10-minute dredge haul over coralline substrata landed 50-80 specimens. During the field surveys, the shore-seine hauls yielded large numbers of this species, when the inter-tidal and sub-tidal zones were sampled.

Thus, *Sphenopus marsupialis* is common on coarse sandy substrata, with or without an admixture of mud ; as well as on coralline substrata.

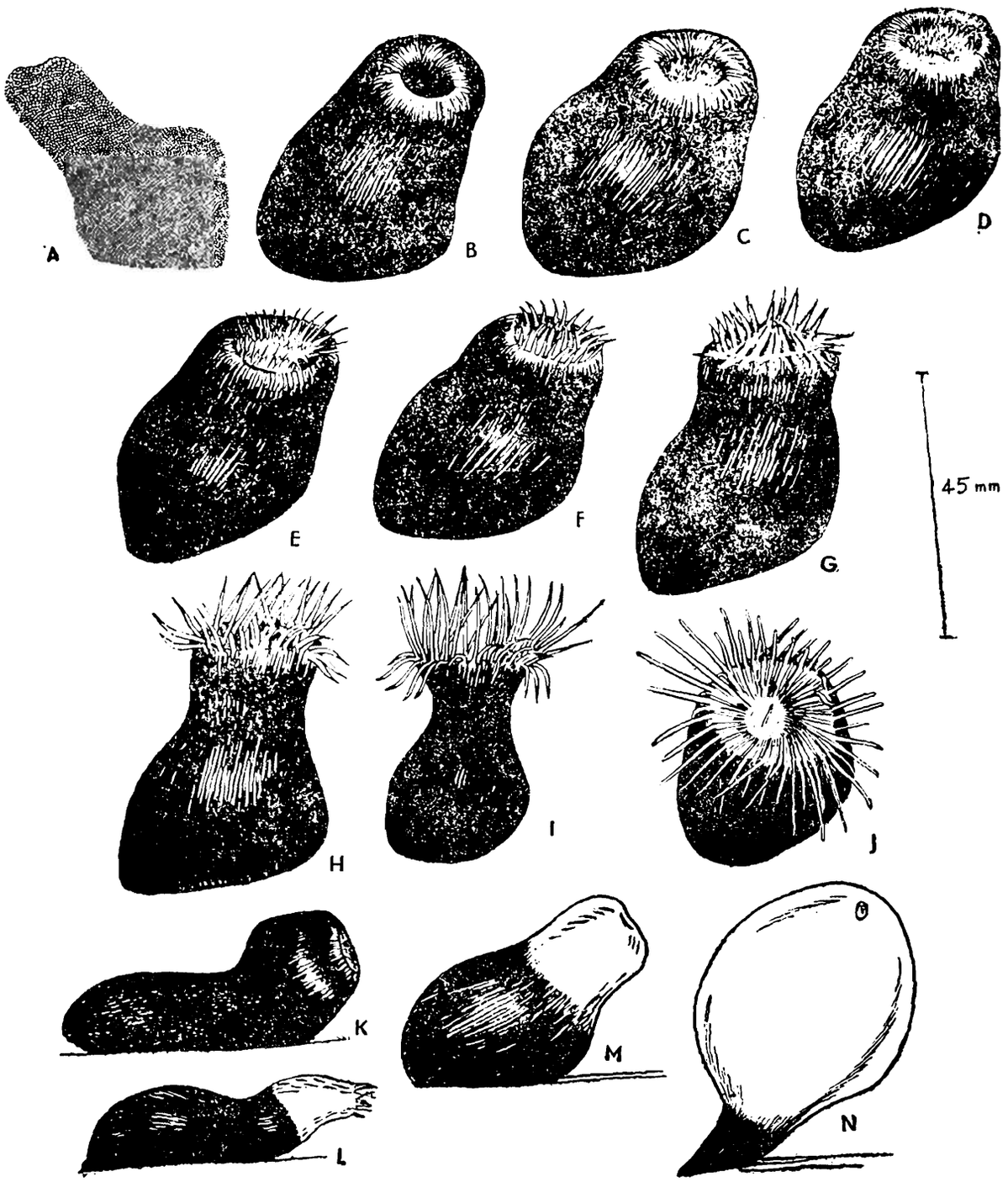
General Description

Sphenopus marsupialis has a laterally compressed, arrow-head shaped body in the resting, fully contracted condition, covered entirely with a 'coat' of sand particles when brought up from the seabed (Text-fig. 1-a) ; at first sight these blobs of sand do not even appear to contain an animal. When introduced into the aquarium, the animals throw off their sandy coat and unfold themselves into the typical zoanthid configuration, exhibiting muscular movements and a great range of body shape (Text-fig. 1 b-m).

When put on a sandy substratum in the aquarium, they burrow into the sand, exposing only the oral disc and tentacles above the surface ; indicating that this species forms a part of the infauna in the natural state. When disturbed, the animals moved from one location to another, using muscular contractions of the arrowhead shaped lower half of the body (see under : 'Locomotion').

Disturbance of the fully expanded animals results in immediate contraction, with invagination of the oral disc (Text-fig. 1-b). Approximately 30 minutes is taken by a fully contracted individual to fully expand itself (Text-fig. 1-c to j).

When fully expanded, the translucent inner row of oral tentacles are nearly half the length of the body while the outer row of tentacles fringing the oral disc are half the length of the inner row of tentacles. The tentacles usually hang down the sides of the columnar body (Text-fig. 1-i) which usually stands almost erect on the basal portion of the body. The two rows of oral tentacles surround the oral disc, which when fully expanded has a diameter nearly equal to the length of the animal for larger specimens (over 10 mm), and almost 3/4 the length of the body for smaller specimens. There are 27 tentacles in the outer row and 24-26 tentacles in the inner row for a specimen measuring 10 mm.



Text-fig. 1 (a to n). *Sphenopus marsupialis* (Gmelin). a—freshly caught specimen with sandy 'coat', b—'coat' of sandy grains thrown off ; c to i—stages in the unfolding/evagination of oral disc and tentacles ; j—oral view of tentacular rings, note slit-like oral opening in the centre of the oral disc ; grooves lead to the oral opening from the circular edge of the oral disc ; k, l—nearly tubular shape adopted by *Sphenopus* for rapid gliding movement along substratum ; m—body held at an angle (variable) to substratum, for slower gliding movements, note pale creamy colouration of oral part of body ; n—body with small wedge-shaped basal part of body adopted for slow gliding movements, note rare bloating of the body due to inrush of water which larger prey, and pale creamy colouration of almost the whole body except for basal end.

OBSERVATIONS IN AQUARIA

The live specimens were introduced into a tank of 150 litre capacity, the contained seawater being aerated and the animals were 'conditioned' for a week during which time they were not fed. Different batches of *Sphenopus* were used for feeding studies and locomotion observations.

Food and feeding habits :

After each feeding experiment, the test-animals were dissected to confirm that complete digestion of the food material had occurred.

Plankton townettings containing chiefly copepods, copepodites, *Sagitta*, fish eggs and larvae, *Pleurobrachia*, and pteropods (*Limacina*, *Creseus*), with small numbers of mysids, *Acetes* and shrimp larvae were introduced into the tank containing *Sphenopus*. When any of these plankters touched the oral disc, the cilia on the oral disc appeared to seize and convey the now passive food-organism along the grooves on the oral disc (Text-fig. 1-j) towards one of the tentacle bases of the inner row of tentacles. The cilia on the base of the tentacle took over the food-item and conveyed it to the tip of the tentacle ; the tentacular tip was then observed to bend over and drop the food organism into the slit-like mouth in the centre of the oral disc.

Sphenopus appeared to prefer the ciliary mode of feeding, to feeding on larger organisms. However, when bits of fish meat, etc., were dropped onto the disc of a *Sphenopus* while it was feeding on a rich plankton supply, the flesh ball was observed to be pushed away from the mouth by the ciliary mechanism of the oral disc, and ultimately it was toppled over the disc's edge to the aquarium floor. From this it would appear that *Sphenopus* prefers small living zooplankters to larger bits of dead organic material.

Table 1 gives details of observations made with different sizes of *Sphenopus*, food organisms taken, time for digestion, etc. ; it was also observed that larger dying animals were attacked by 6-7 *Sphenopus* which attached themselves by their oral discs to the prey, and digestion had occurred deep into the musculature of the prey at the sites of attachment of the oral discs.

The above observations indicate that while *Sphenopus* is chiefly a plankton feeder using a ciliary mechanism, it is also capable of ingesting a variety of living and dead material when deprived of its normal planktonic food-supply. The mode of capture of the larger organisms which fall on the oral disc is as follows : The tentacles push the food item into the oral slit by sharply bending inwards, simultaneously

the coelenteron enlarges so that there is a quick inrush of water into the body carrying the food item further deeper into the coelenteron, the oral end of the animal invaginates firmly sealing the oral end ; after digestion is completed the anterior end evaginates unfolding the two rows of oral tentacles and oral disc, any indigestible matter is now voided.

Locomotion :

The animals showed great plasticity of body shape (Text-fig. 1-k to n) ; and only in the contracted or resting condition was the typical arrow-head configuration of the body to be seen.

When starved of a copious supply of plankton, *Sphenopus* was observed to exhibit characteristic modes of locomotion, these may be detailed as follows :

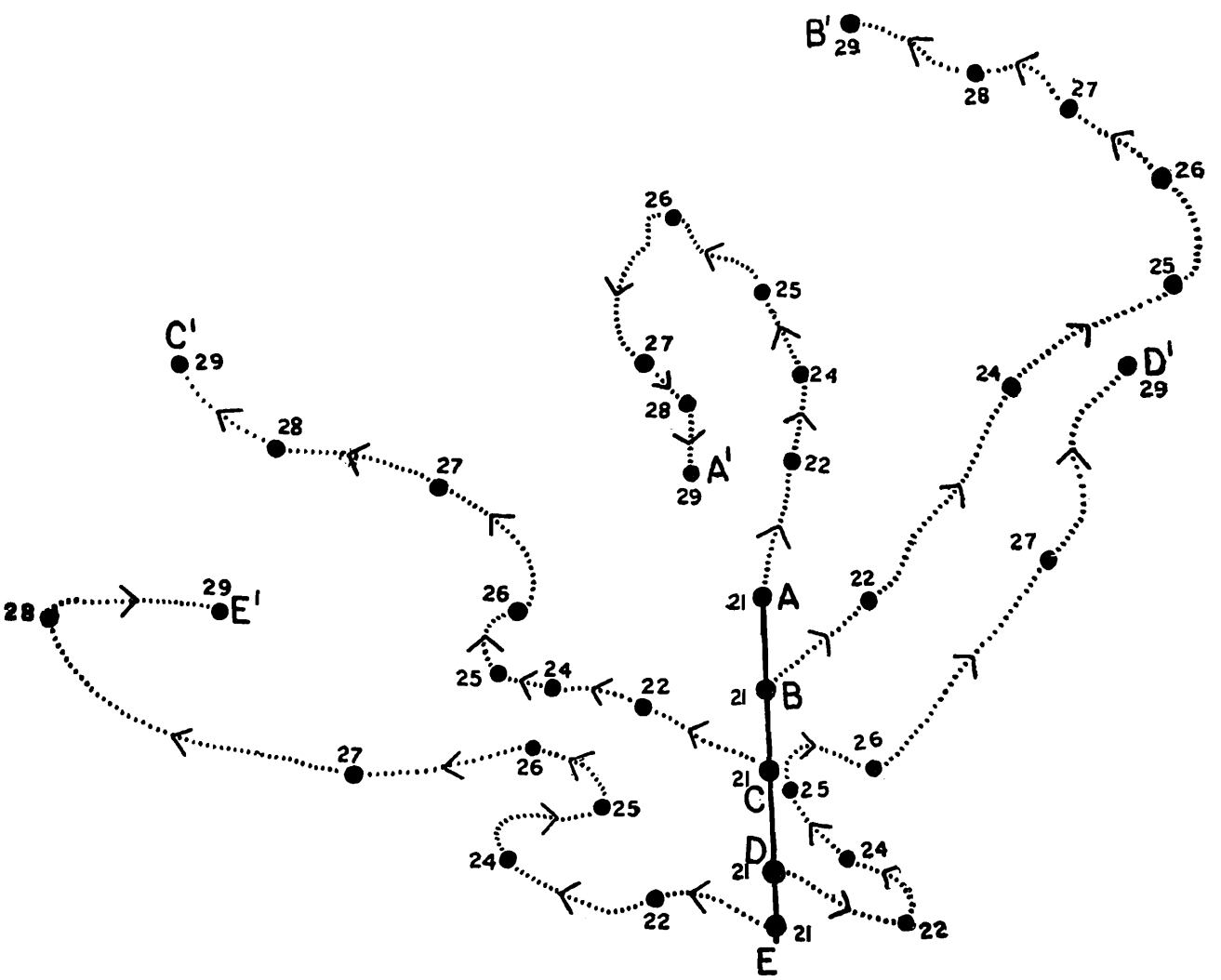
(i) From the near vertical position the animal falls over and becomes practically tubular (Text-fig. 1-k & l) ; usually, the body-wall is fairly hard to the touch, but when any area of the bodywall is in contact with the substratum, it first becomes soft to the touch and exhibits 'peristhalsis'. such that the animal moves forward with the oral end leading. During this type of locomotion the oral disc and tentacles may or may not be fully extended ; and is resorted to when the animal has to move quickly from point to point for feeding.

(ii) The animal does not fall over to the horizontal position, but leans over at an angle varying from near vertical to almost horizontal so that a varying area of the bodywall is apposed to the substratum ; and the animal moves at a slower speed from point to point (than that noted in (i) above) by peristhalsis (Text-fig. 1-m.)

(iii) The animal remains vertical, the basal end in contact with the substratum becomes broadened and exhibits peristhalsis in the direction of desired movement, usually with the oral disc and tentacles well expanded. The animal moves slowest by this mode of locomotion. (Text-fig. 1-n.)

The speed of locomotion is variable ; the maximum traversed in 24 hours was 115 mm, the minimum being 20 mm. Figure 2 shows the random movements exhibited by *Sphenopus* over several days from the 21st to 29th May, 1976. The 5 animals were arranged in a linear row, and a rich supply of plankton introduced more or less uniformly in the tank, throughout the period of observation. It was noted that the animals showed random movements from the initial position in

each case, in response to local concentrations of zooplankters. It would appear that even with a good supply of plankton, *Sphenopus* do move around to some degree and are not entirely static. However, sometimes the animals have been observed to remain more or less stationary for extended periods (24-48 hours) when the plankton in their immediate vicinity has been in copious supply, and the animals have remained steady in position. The movements of *Sphenopus* while primarily



Text-fig. 2. Random movements exhibited by *Sphenopus* between 21st and 29th of May, 1976 ; the maximum distance traversed was 115 mm, the minimum being 20 mm during a period of 24 hours.

motivated by food supply, being particularly pronounced while the animals were starved, could also be due to irritation. When objects are dropped on them, the animals tend to move away from the vicinity of such objects, particularly when such objects have no food value.

Other observations :

Sphenopus showed a variegated colouration ranging from an almost jet-black to a golden colour when taken from the sea, depending on the colour of the sandy 'coat' ; when this 'coat' of sand grains is cast

off in the aquarium, the body epidermis reveals itself to be darkly pigmented. The animals showed the capacity to change the colouration of the whole body save the basal portion, to a pale light creamy colour (Text-fig. 1-t to n). The exact stimuli which cause these changes in colouration have to be investigated, perhaps they are in response to different internal and external factors.

The smallest specimens collected during the present study measured 5 mm in body length, when fully expanded, and occurred during the months of March and December. Six specimens measuring 5 mm, during a period of study extending for 18 months, grew to a length of 35 mm when well fed and kept in a separate tank. No eggs and larvae were released by any of the *Sphenopus* kept in the aquaria.

Discussion

Sphenopus marsupialis (Gmelin) is a common zoanthid in the Madras area, and present data showed it to occur commonly along the south-eastern coast from Ennur in the north to at least Nagapttinam in the south, and occupying a variety of substrates varying in depth from the low-water tide mark to depths of 60 metres at least, and sea-bottoms of a sandy nature to a mixture of muddysand and gravel and also coralline bottoms. Previously Menon (1927) has recorded its absence at Krusadai, stating however that it was common near Madras. Gravely (1941) has recorded that it has been cast up on Madras beaches. Gray (1867) has described *Sphenopus marsupialis* (Gmelin) and figured it along with other zoanthids. Menon (1931) while giving a general account of the Madras plankton, has found the Semper's larvae of *Sphenopus* to occur from November to February inclusive, with large swarms of the long larvae commonly present in the plankton during the months of January and February. Our data indicates that specimens of 5 mm occurred demersally during December and March, and we have not been able to take the larvae in the open sea plankton.

There are no data on the biology of *Sphenopus* in the literature. Our data shows that this species is primarily a plankton feeder, being also capable of feeding on a variety of living and dead macro-organisms ; this would indicate that *Sphenopus* could play a scavenging role in the ecological niche inhabited by it. It is also capable of great plasticity of body form and also it is capable of movement foraging actively on living and dead benthic, nektonic and planktonic organisms. The factors that enable control of its pigmentation are not clear, but the animal exhibits changes of colouration of particularly the oral end of the body.

The species has a life-expectancy of at least 18 months, possibly more, as in nature forms larger than 35 mm (the size attained under observation, from 5 mm to 35 mm) have been taken in the gears used.

TABLE 1 : Showing the size of *Sphenopus*, size of prey captured, time taken for digestion, and remarks on voiding of waste matter, etc.

Sphenopus Length (mm)	Food, size : mm	Time for digestion (hrs)	Remarks
30	Young fish, *Scatophagus argus*, 20 mm total length	6	Small pellet voided.
30	Fish meat-ball, 15 mm dia.	3 1/2	Very little matter voided
35	*Aequora* sp., 15 mm dia.	1 1/2	———
35	*Aequora* sp., 20 mm dia.	1 3/4	———
40	*Rhopilema* sp., terminal appendage 45 mm length	4	*Rhopilema* was able to escape only after it lost its terminal appendage

Gravely (1941) has mentioned that it is due to embedding of microscopic grains of dark sand that the animal looks blackish in colour. Our data show that this is not the case, the 'coat' of sand grains varies in hue depending on the niche occupied by the animal, and the animal is capable of casting off this coat revealing a darkly pigmented body, and it is capable of changing the pigmentation of the anterior (oral) part of its body. Further work is necessary to determine the nature of the adhesive produced by the body of the animals by which they coat themselves with sand grains under natural conditions, as also the significance of such a coat, perhaps it is for camouflage and/or protection against predators.

Hyman (1940) has described the movements of actinians (sea-anemones) in general, and our data indicate both the speed and moed of such movements for *Sphenopus*.

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