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CHARACTERISATION AND ASPECTS OF  
THE BIOLOGY OF THE MEGALOPA LARVAE  
OF SCYLLA SERRATA (FORSKAL) AND  
VARUNA LITTERATA (FABR.) IN THE LAKE  
ST. LUCIA SYSTEM.

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## A B S T R A C T

Megalopae of Varuna litterata and Scylla serrata were successfully reared to later crab stages for identification. Features of the megalopae allowing for recognition of the species are described. The megalopae tolerated low salinities and the shorter moult intervals observed in reduced salinities suggest that the direction of recruitment is from the sea into an estuarine environment.

*fair.*

## I N T R O D U C T I O N

Records of megalopae occurrence in the St Lucia estuary made by Forbes (unpublished) over the period January 1982 to July 1984, show the recruitment of numerous unidentified megalopae which utilize the estuary for completion of post-larval development. The St Lucia estuary is a large South African estuarine lagoon which experiences wide salinity fluctuations (Hill, 1979) and clearly these megalopae are able to tolerate salinity changes without any apparent effect.

As there is a lack of information on megalopae of South African crabs, laboratory rearing experiments were initiated with the following major objectives: to successfully rear megalopae to later crab instars for identification; to give descriptions and illustrations of the megalopae found; to emphasise features which may aid in the identification of megalopae recruiting into South African estuarine systems and to investigate the effect of salinity on the time required for development as this may be a contributing factor in the induction of ecdysis.

*good.*

## M E T H O D S   A N D   M A T E R I A L S

Three batches of megalopae were collected from Natal estuaries.

The ...../

The first group comprising only of large grapsid megalopae was caught on 8 June 1984 in the Siaya lagoon on the Natal North Coast, in water of 0 ppt salinity and 21°C temperature.

The second batch was caught on 28 and 29 July 1984 in the St Lucia estuary (Figure 1) in water of 8 ppt salinity and 19°C temperature. Portunid and grapsid type megalopae were distinguished.

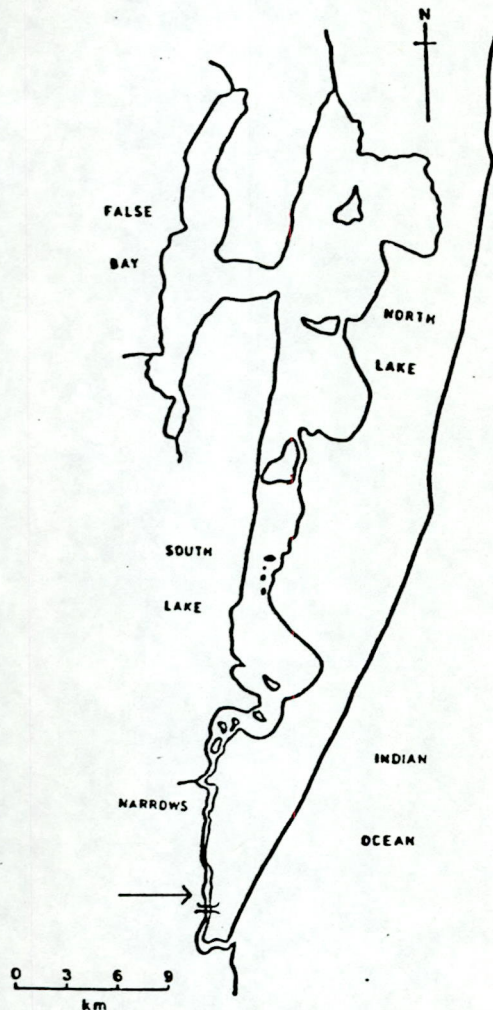


Figure 1. The St Lucia system. The area sampled is marked with an arrow (from Hill, 1979)

The third batch, again comprising portunid and grapsid type megalopae was caught between 10-13 September 1984 in the St Lucia estuary in water of 25-31 ppt salinity and 19-20°C temperature.

The rearing containers used were glass jars (diameter 10cm) each supplied with a separate airline and the salinity of the water was maintained at 25 ppt. The megalopae were kept singly to prevent death resulting from cannibalism and in order to keep track of the successive stages. Pieces of netting were placed in the jars to provide a refuge site, particularly ~~for~~ during moulting. ?

The jars were cleaned, the water changed once a week and the megalopae and crabs fed daily with Tetramarin (commercially prepared fish food). Temperatures were monitored daily, using a maximum and minimum thermometer and ranged from 19°C to 26°C. The rearing receptacles were observed daily for successive developmental stages and carapace widths of the megalopae and crab instars were measured with Vernier calipers.

The crab instars of the two different megalopae were identified with reference to Descriptive Catalogue of South African Decapod Crustacea (Barnard, 1950). Descriptions and illustrations of the megalopae and resulting crabs were made from preserved specimens.

The influence of salinity on the time required for the developmental stages was investigated. Six megalopae of the large grapsid type caught at 10 ppt were maintained at 10 ppt, while four megalopae were placed each into 5 ppt and 2 ppt. The time taken for the megalopae to moult was recorded.

### R E S U L T S

Positive identification of the two megalopae was made by the presence of certain features in the crab instars. The common large grapsid type was identified as Varuna litterata (Fabr.) and the portunid type was identified

as...../

as Scylla serrata (Forsk.) . A description (Table 1) and illustration (Figures 2 and 3) of each megalopa and resulting crab is given.

The most conspicuous difference between the megalopae was the difference in carapace width viz. Varuna litterata (3,3 mm) and Scylla serrata (1,8 mm). Furthermore, the absence of a rostral spine is described as a characteristic of most Grapsidae (Costlow and Bookhout, 1962) whereas the presence of a rostral spine is a feature of the Portunidae (Ong, 1964).

The first crab instars developed from a single megalopa stage and growth data for megalopae and crabs of Scylla serrata and Varuna litterata are summarised below (Table 2 and 3 respectively).

Table 2.

Mean carapace widths of the developmental stages of Scylla serrata

Stage	No of specimens	Mean carapace width (mm)	Standard deviation (mm)
Megalopa	9	1,78	0,17
Crab I	16	3,33	0,24
Crab II	1	4,20	0

Table 3.

Mean carapace widths of the developmental stages of Varuna litterata

Stage	No of Specimens	Mean carapace width (mm)	Std. deviation (mm)	Av. moult increment (mm)	Av. % moult increment
Megalopa	7	3,34	0,39	-	-
Crab I	18	4,92	0,66	1,58	47,3
Crab II	13	6,16	0,69	1,24	25,2
Crab III	7	8,11	0,42	1,95	31,7
Crab IV	1	10,10	0	1,99	24,5

The most advanced instar obtained in the limited time available was the fourth instar of Varuna litterata. The percentage moult increments in mean carapace width of the different instars of Varuna litterata were comparable to those observed in Scylla serrata by Ong (1966) in so far that the increment was greater for the early crab stages and decreased with successive development.

The effect of salinity changes in the induction of ecdysis are shown in Figure 4.

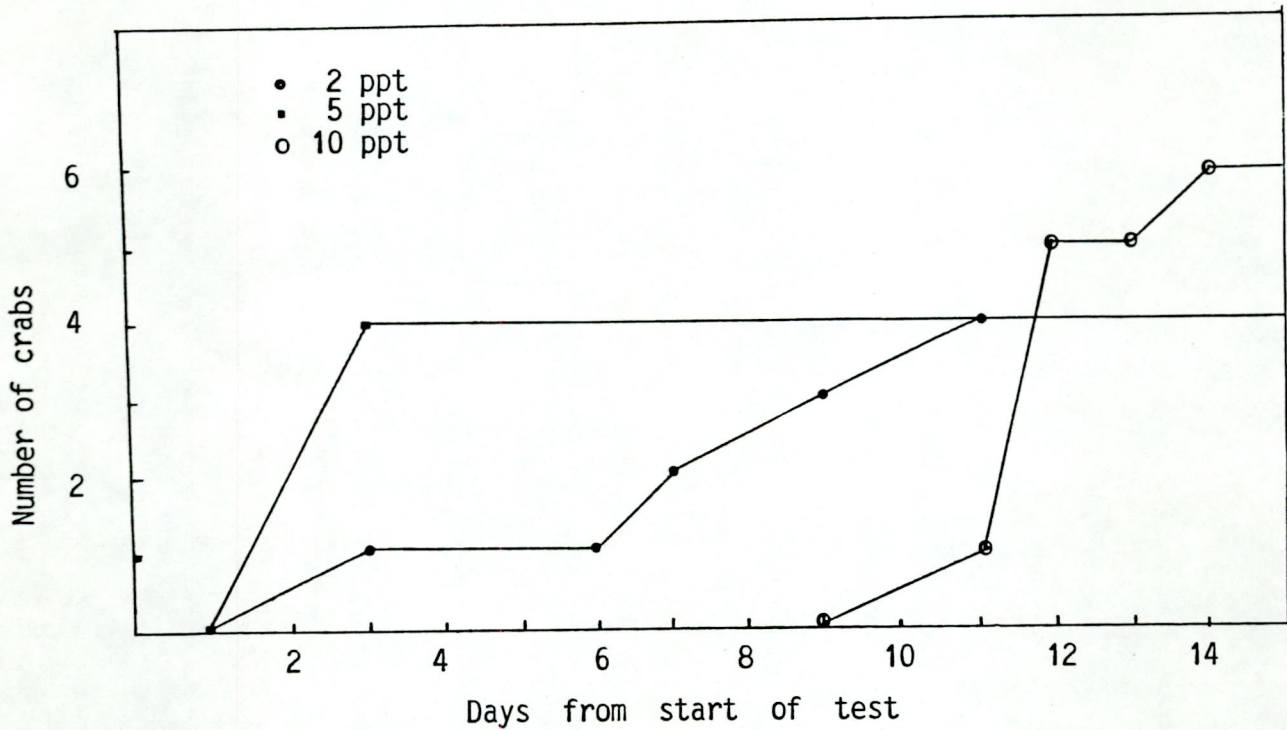


Figure 4. The effect of salinity on the duration of the megalopae stage in Varuna litterata.

From the results observed, it appears that moulting in the megalopae was induced more quickly in water of reduced salinity. Ong (1964) suggested that the faster rate of development in a reduced salinity indicates that the megalopae in nature move from the sea into an estuarine environment.

Records of recruitment of megalopae into the Lake St Lucia system over the period January 1982 to July 1984 are summarized in Figures 5, 6 and 7.

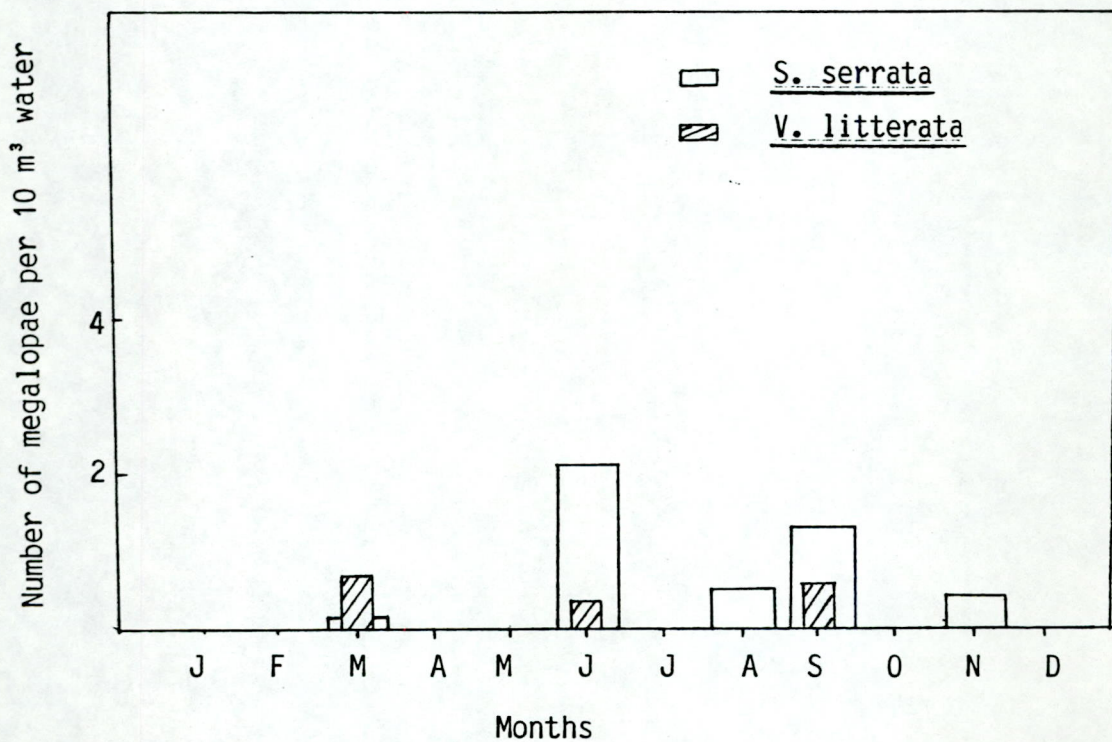


Figure 5. Monthly recruitment during 1982 of megalopae of *Scylla serrata* and *Varuna litterata* into the St Lucia system (from Forbes - unpublished).

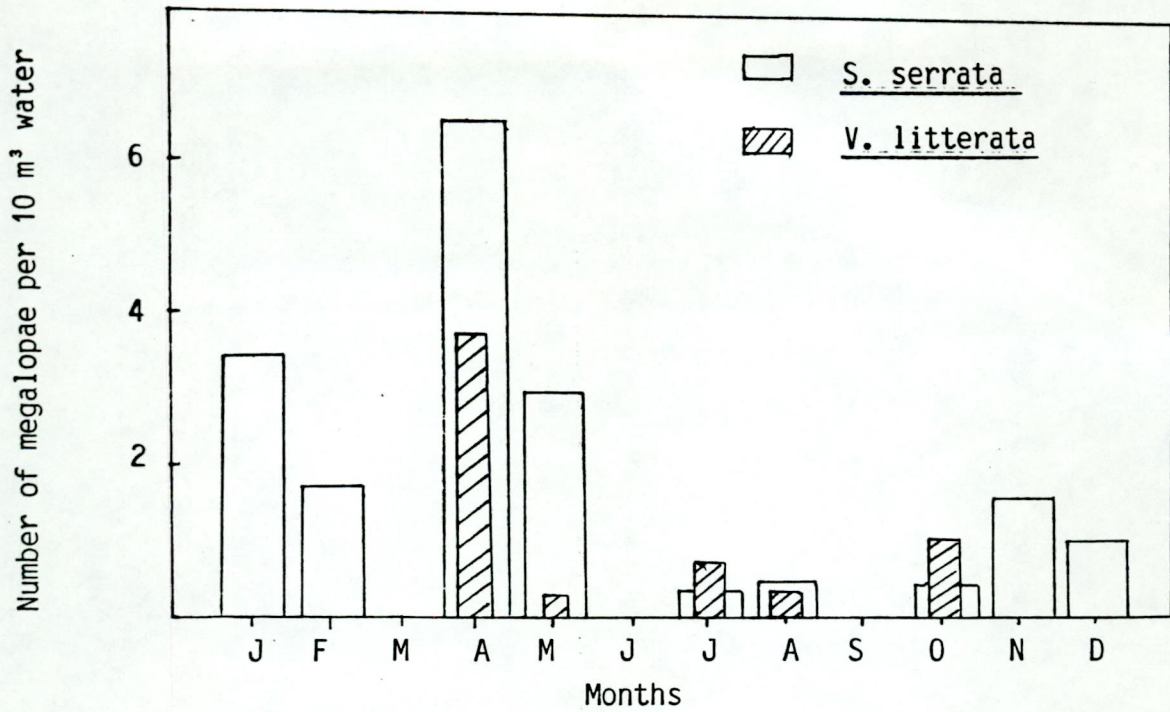


Figure 6. Monthly recruitment during 1983 of megalopae of *Scylla serrata* and *Varuna litterata* into the St Lucia system (from Forbes - unpublished).

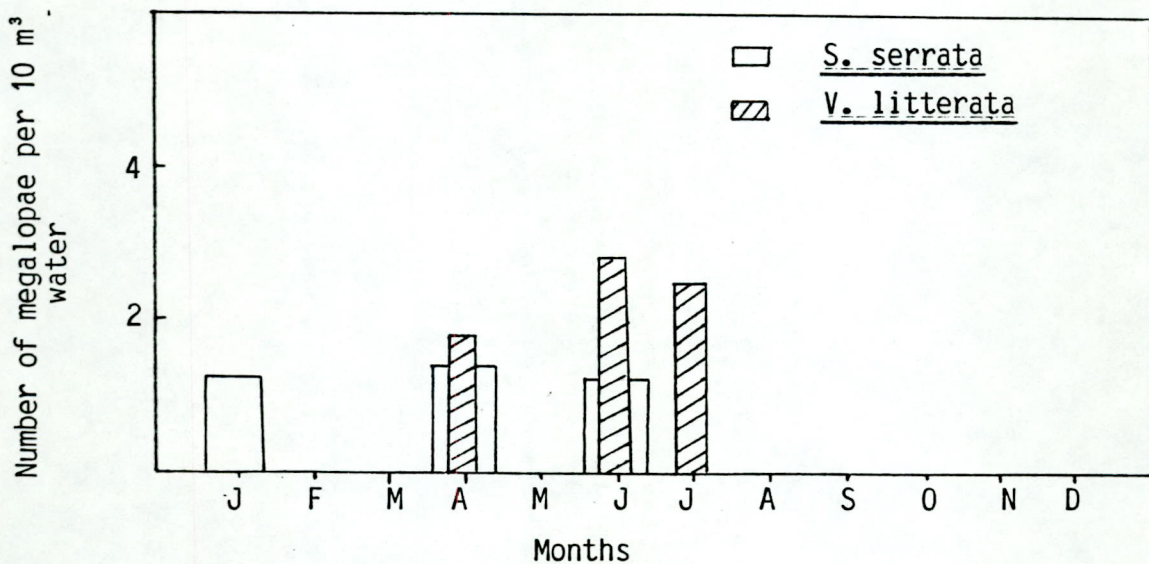


Figure 7. Monthly recruitment during 1984 of megalopae of *Scylla serrata* and *Varuna litterata* into the St Lucia system (from Forbes - unpublished).

Figures 5, 6 and 7 show a seasonal occurrence of Varuna litterata megalopae in the Lake St Lucia system. Peaks occur from April to July and there is an absence of megalopae from December to February. Megalopae of Scylla serrata occur more widely although definite peaks occur from January to June.

### D I S C U S S I O N

Scylla serrata and Varuna litterata were identified. Criteria which may aid in the identification of megalopae of Scylla serrata include the presence of a rostral spine; a pair of long curved spines directed caudally from the fourth thoracic sternite; the flattened dactylus of the fifth pereopod and a mean carapace width of 1,75mm. The megalopae of Varuna litterata are large (3,3mm) relative to those of Scylla serrata.

Characteristic features of Varuna litterata include short fifth pereopods with three long setae at the tip of the dactylus, whereas the remaining pereopods have a toothed, talonlike dactylus; pronounced dorsal lump near the thumb joint of the cheliped and the presence of many chromatophores on the carapace and pereopods.

Megalopae of Varuna litterata were found to be extremely tolerant of low salinities (2 ppt) as well as sudden changes in salinity of the order of 15 ppt. Hill (1979) similarly reports tolerance of Scylla serrata to low salinities in the St Lucia estuary. This ability clearly enables the megalopae to survive in the estuary after heavy rains, during which the entire system may become nearly fresh (Hill,1979).

Although the data obtained are insufficient to determine the effect of salinity on the total length of the megalopa stage of Varuna litterata its duration appeared to be salinity dependent. Ong (1966) suggested that shorter moult intervals observed for Scylla serrata in reduced salinities were closer to the natural growth rate and that the faster rate of development in low salinities is indicative of the direction of recruitment of the post larval stages entering the estuaries for maturation.

On the South African coast, adult females of Scylla serrata migrate to sea and extrude eggs in February - March (Hill, 1979).

From Figures 5, 6 and 7 it appears that peaks of megalopae recruitment for Scylla serrata occur from January to June, although occurrences of megalopae were recorded throughout the year. This is in support of Hill (1979) who reported recruitment of juvenile crabs in late winter or early spring.

*Could be more carefully worded. - How big were Hill's "juvenile crabs"?*

Observations by Ong (1966) suggest that multiple spawnings within a single instar of Scylla serrata occur and as no mating immediately precedes the later spawnings, the eggs must be fertilized by remains of spermatozoa received during the copulatory moult into that particular instar. Thus the sperm in Scylla serrata as in Callinectes sapidus (van Engel 1958 - cited in Ong, 1966) remain viable for fertilization to occur as often as the mature instar produces eggs (Ong, 1966). Although the latter spawnings produce fewer eggs (Ong, 1966), these observations of multiple spawning may partly account for the presence of megalopae throughout the year.

There appears to be little information regarding the breeding habits of Varuna litterata but observed emigration of adults to the sea (male and female) suggests that mating and egg production are seasonal and occur offshore (Bickerton and Sapsford, 1981). It was further observed that the adults do not return to the estuary but that the post-larval stages requiring an estuarine environment, recruit during April and May (Bickerton and Sapsford, 1981). Figures 5, 6 and 7 show that recruitment of Varuna litterata is seasonal to some extent in that no megalopae occurred from December to February, but that the period of recruitment appears to be extended beyond April and May.

In conclusion, it appears that Varuna litterata and Scylla serrata are among the crab species recruiting into estuaries along the coast for completion of post-larval development and that these megalopae have the ability to cope with the salinity fluctuations occurring in these estuaries.

TABLE 1:

DISTINGUISHING FEATURES OF SCYLLA SERRATA (FORSKAL) AND VARUNA LITTERATA (FABR.)

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	<u>Scylla Serrata</u> Portunidae	<u>Varuna litterata</u> Grapsidae
CARAPACE	Rostrum present ending in sharp spike. Shape - almost ovoid.  L/W ratio 1,45.	No rostrum present. Slight antero-median inden- tation. Shape - almost rectangular, longer than wide. L/W ratio 1,48. Many chromatophores on cara- pace, some on legs, none on chelipeds.
THORACIC STERNA	Last pair elongated into a curved spine, project- ing posteriorly, and visible from dorsal side.	Last pair with small protrusion projecting posteriorly.
CHELIPEDS	Robust, equal and smooth. Not folded under body, but projecting out. 3 teeth on inner margin of lower finger + one small tooth near joint. 4 teeth on upper thumb. Few setae present on claw.	Not robust tending to be folded under body.  3 indistinct teeth on inner margin of thumb. Tips of finger & thumb cross over. Pronounced dorsal lump near thumb joint on claw.

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Table 1 cont.

	<u>Scylla serrata</u>	<u>Varuna litterata</u>
EYES	Orbits complete on both surfaces, edges smooth.  Eye stalks extend beyond width of carapace. Setae on eyestalks.	Orbits complete with small lateral projections on the ventral side.  Eyes extend beyond width of carapace.
ANTENNAE	II 9 Segmented. 2 long setae present at base of 8th seg. 2 small setae at base of 9th seg. 2 long setae at the base of 4th seg. 2 long unequal setae terminally situated.	II 9 segmented. 2 setae on either side at base of 8th seg. 1 terminal seta.
ABDOMEN	4 segmented. 4th seg. with pair of lateral spines. Telson rounded and terminating in a point. Uropods, narrow and bearing long setae.	4 segmented.  Telson rounded.  Uropods rounded and small bearing many long setae.
PEREIOPODS	5th leg shortest, with flattened dactyl bearing many setae along margins. Propodus not flattened but bearing setae on margins. 2,3,4 legs with similar slightly curved setose dactyl.	5th leg shortest, dactyl not flattened, but pointed with 3 very long setae at the tip.  2,3,4 legs with talon-like dactyl. Inner margin bearing teeth. 2,3,4 all approx. same length No setae on pereiopods. A few shortish hairs at base of 4th pereiopod.

Figure 2. Megalopa and crab of Scylla serrata (Forsk.)  
(a) dorsal view of megalopa; (b) cheliped; (c) dactyl  
of 2nd, 3rd and 4th pereopod; (d) dactyl of 5th pereopod;  
(e) ventral view of 4th thoracic sternite; (f) ventral  
view of telson and uropods; (g) dorsal view of telson and  
uropods; (h) second antenna; (k) dorsal view of crab.

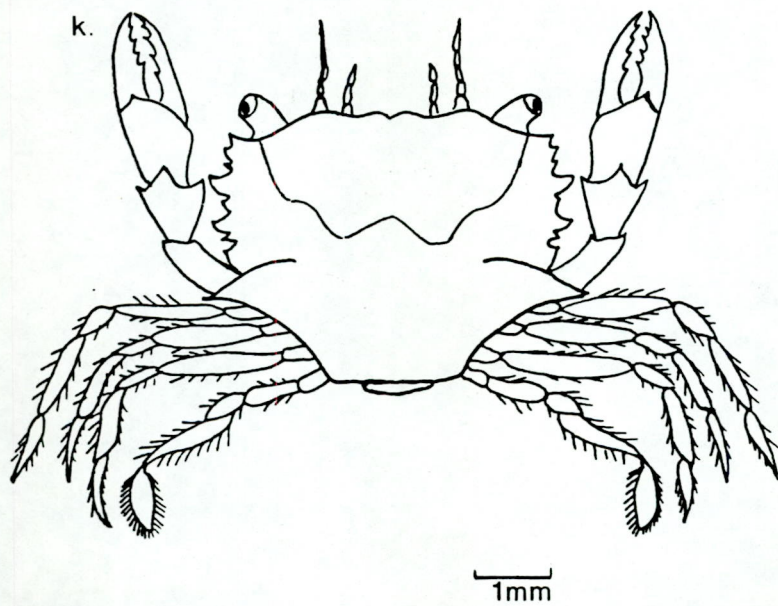
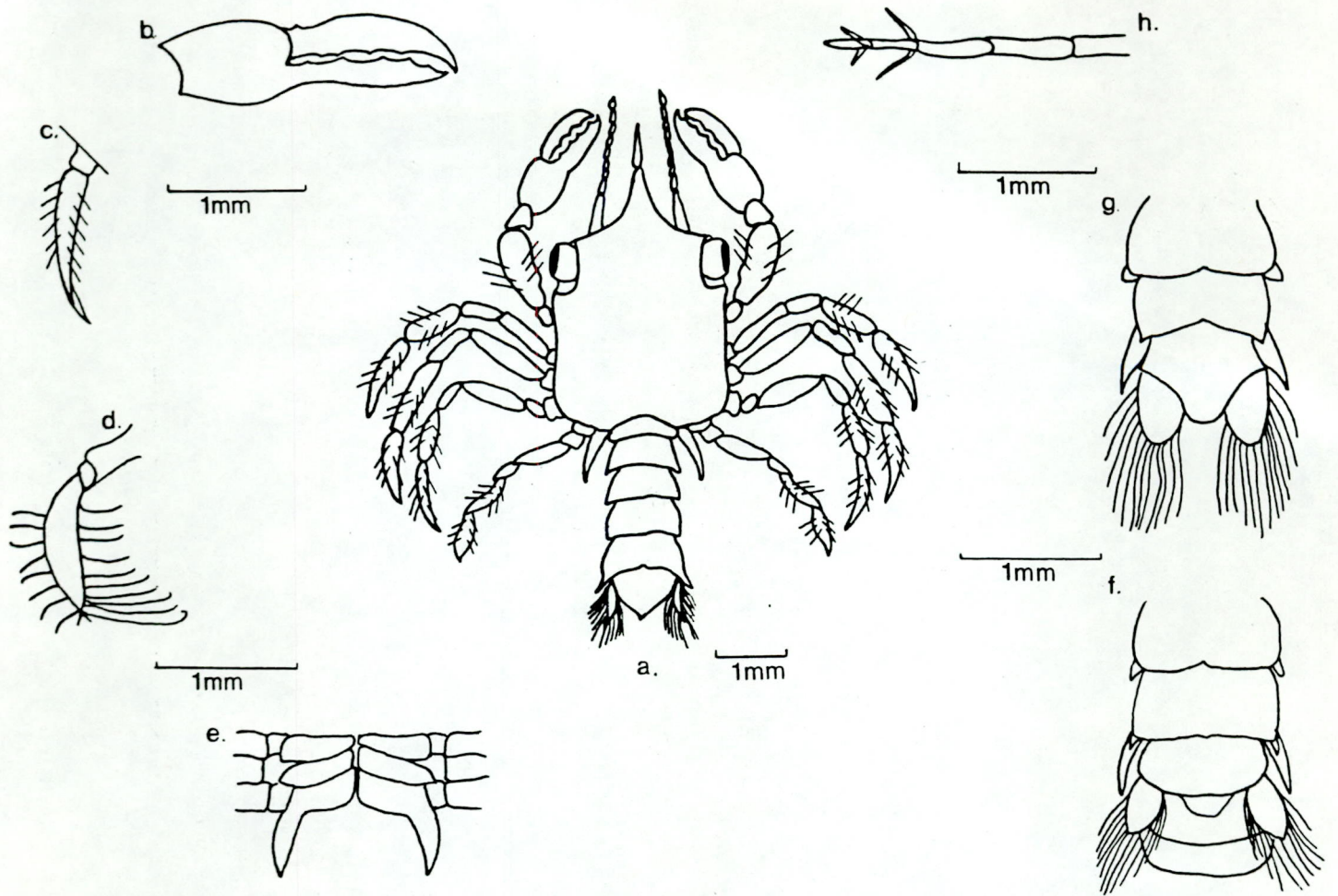
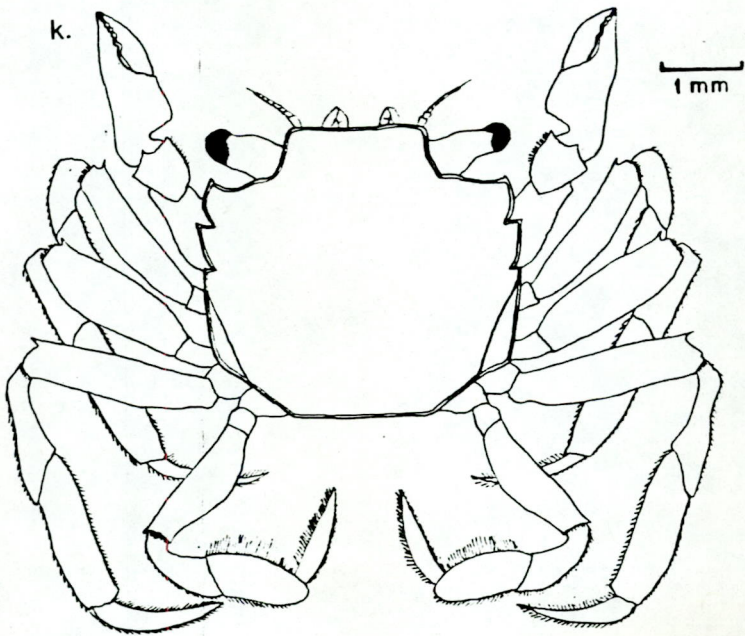
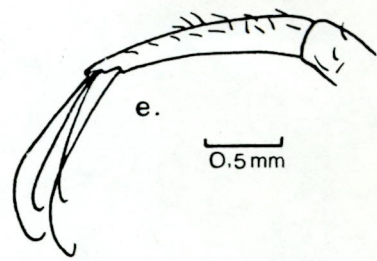
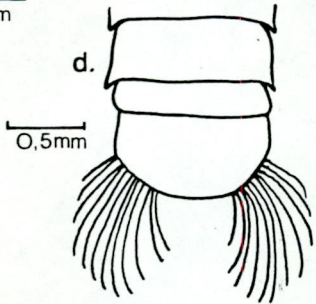
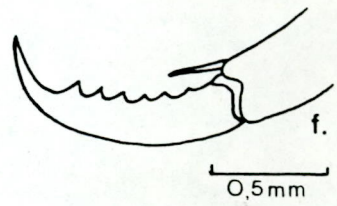
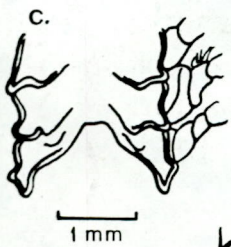
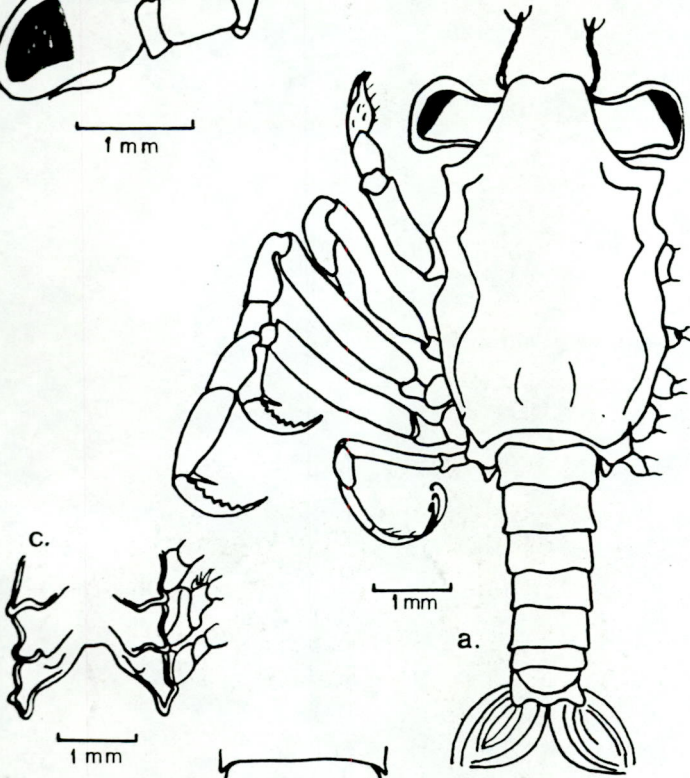
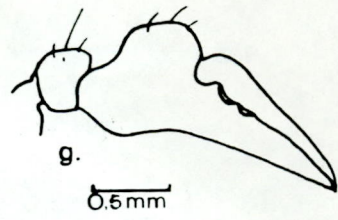
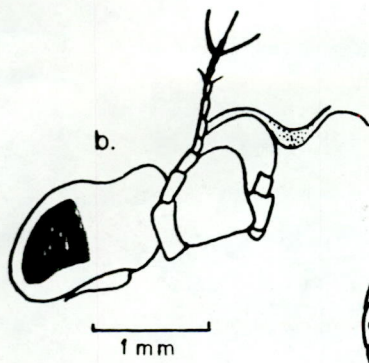


Figure 3. Megalopa and crab of Varuna litterata (Fabr.)  
(a) dorsal view of megalopa; (b) second antenna; (c) ventral  
view of fourth thoracic sternite; (d) dorsal view of telson  
(e) dactyl of fifth pereopod; (f) dactyl of 2nd, 3rd and 4th  
pereopods; (g) cheliped; (k) dorsal view of crab.



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Costlow & Bookhout '62 ?

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