The zoeal development of *Sesarma eulimene* de Man (Decapoda, Brachyura, Grapsidae), and identification of larvae of the genus *Sesarma* in South African waters

R. Pereyra Lago
Department of Zoology, University of Transkei, Private Bag X1 (UNITRA), Umtata, Transkei

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The five zoea larval stages of the estuarine crab *Sesarma eulimene* de Man 1897 (Brachyura, Grapsidae) are described in detail from specimens reared in the laboratory. The morphology of larval Grapsidae is briefly discussed and an updated summary of larval diagnostic characters in the genus *Sesarma* is given as an aid to identifying specimens in plankton samples from South African waters.

Die vyf soöea larwale stadia van die strandmeerkrap *Sesarma eulimene* de Man 1897 (Brachyura, Grapsidae) word in besonderhede beskryf aan die hand van voorbeelde wat in die laboratorium grootgemaak is. Die morfologie van die Grapsidae-larwe word kortliks beskryf en 'n bygewerkte samevatting van diagnostiese larfeienskappe by die genus *Sesarma* word gegee om die identifisering van eksemplare in planktonmonsters uit Suid-Afrikaanse waters te vergemaklik.

The larval stages of brachyuran crabs are often found in large numbers in plankton samples from estuaries and littoral waters along the South African south and east coasts. In most cases the parentage of these larvae is not known and they cannot be identified to species. Workers have tended to group them together under headings such as 'decapod larvae' or 'brachyuran larvae', and discuss them in that context. Clearly these multispecific groupings bear little taxonomic or ecological significance, as they usually include taxa with widely diverse habitats, life histories, and ecological requirements. Consequently, ecological inferences drawn from this type of data analysis will be severely restricted in scope and accuracy.

This problem becomes particularly acute when dealing with estuarine species. Estuarine brachyurans often display complex rhythmic patterns of larval release and larval vertical migration in the water column (Sulkin 1984; Forward 1987). These are linked to a specific life-history strategy of larval dispersal and recruitment which include, in many cases, an obligatory marine phase of development (Epifanio 1988; Wooldridge 1991; Pereyra Lago 1993. The understanding of these phenomena as factors regulating the demography of the species and its particular sensitivity to environmental disturbances, hinges on the ability of the practising planktologist to perform an unglamorous and boring task; i.e. accurately identifying larvae in plankton samples to specific level.

The epifauna of estuarine saltmarshes and mangrove swamps in South Africa is dominated by grapsid crabs of the genus *Sesarma* together with some ocypodids (i.e. genera *Uca, Paratylodyplax)* (Day 1981). *Sesarma* species are deposit feeders or feed on fallen mangrove leaf litter, and constitute an essential link in the estuarine detritus food web (Emmerson & McGwynne 1992). Eight species of *Sesarma* have been recorded in South Africa (Kensley 1981) but only four of them (i.e. *Sesarma catenata, S. meinerti, S. eulimene,* and *S. guttatum)* maintain large breeding populations.

In the present study, the larval (zoeal) stages of *Sesarma eulimene* are described in detail from laboratory-reared specimens. The morphology of larval Grapsidae is discussed at subfamilial level and the larval morphology of the most common *Sesarma* species is compared, to facilitate the specific identification of individuals in plankton samples.

Material and Methods

Ovigerous females of *Sesarma eulimene* were collected from the upper intertidal of the mangrove swamps at the mouth of the Mntafufu river, Transkei, Southern Africa (Figure 1). Females with advanced eggs (eye spot formed) were kept in unfiltered sea water in a temperature-controlled room at 26°C, under a 10 : 14 h LD light cycle. Hatching occurred within two days after collection. Ten newly hatched zoea larvae were placed in 25 ml glass beakers filled with 34 ‰ salinity, micropore filtered and UV irradiated estuarine water from the Mntafufu estuary. Twenty-five cultures holding 10 larvae each were kept at

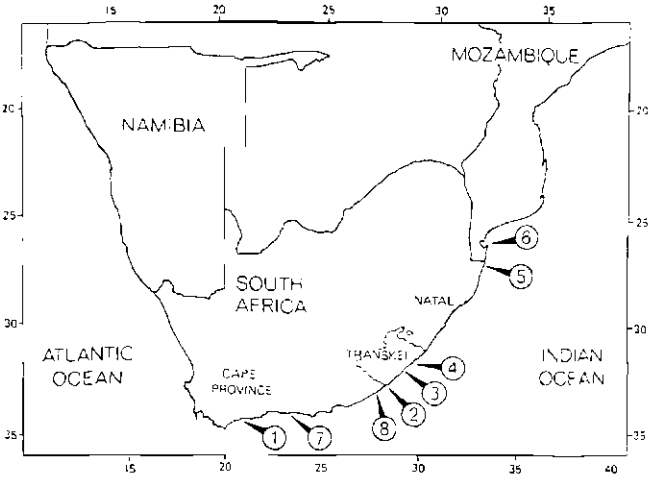

Figure 1 Area of study. 1: Breede River, 2: Kei River, 3: Mngazana River, 4: Mntafufu River, 5: Kosi Bay, 6: Inhaca Island, 7: Plettenberg Bay, 8: East London.

26°C (± 1°C) constant temperature under a 10 : 14 h LD illumination. The water in the culture vials was replaced every 24 h and newly hatched *Artemia* sp. nauplii (less than 6 h old) were subsequently added as food. Zoea larvae were observed daily under a dissecting microscope to check for moulting and remove dead specimens from the cultures. Specimens used for illustration purposes were reared under similar conditions in three batch cultures of 100 larvae each from three different females. These specimens were fixed in 4% buffered formalin and dissected in a 25% lactic acid solution. Illustrations were made with a camera lucida attached to a compound microscope. All features illustrated belonged to the same specimen, which was selected from a sample of six examined from three different broods, and represented an 'average' individual. Measurements of appendages were made according to Webber & Wear (1981). Nomenclature of secondary setation follows Bookhout & Costlow (1974). Drawing techniques and the formulation of tables follows standards by Rice (1979) and Pereyra Lago (1987, 1989).

Results

Life span of zoeal stages and survival in the cultures are shown in Figure 2. A breakdown of the temperature control system in the culture room forced the premature termination of the cultures on day 16 after hatching, before any moulting to megalopa larvae occurred. However, the morphology of the fifth zoeal stage (see below) clearly indicates that this stage represents the last of the zoeal series. Measurements of zoeal morphological features are listed in Table 1. The setal formulae of zoeal cephalothoracic appendages are listed in Table 2.

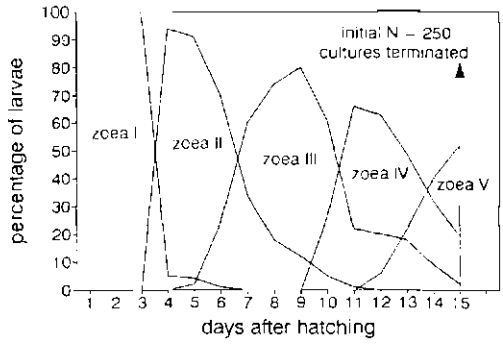

Figure 2 Life span and survival in the cultures of zoeal stages, of *Sesarma eulimene*, reared in the laboratory at 26°C. See text for details.

First zoea (Figures 3a and 4a–i)

On lateral view the carapace is subcircular and smooth, with markedly extended posterolateral edges. Dorsal spine small, evenly curved posteriorly, with a small constriction on its basal half. Rostral spine short and slender, directed downwards at *ca* 90° from the long axis of the carapace. Minute spinules densely distributed over the distal two-thirds of the spine (see Discussion, Figure 9d). A small seta present on each side of the carapace below the base of the dorsal spine. Eyes sessile. Antenna as long as rostral spine, extending forward and downwards at *ca* 45° from the long axis of the carapace. Abdomen with five somites plus telson. Two pairs of dorsolateral knobs present on somites 2–3 respectively. Somites 3–5 with narrow-based, short, spinous posterolateral projections (Figure 4h). Telson with three pairs of posteromedian spines denticulated laterally, and a wide, U-shaped median notch. Telson cornua slender, slightly curved dorsally, and slightly divergent. Dorsal surface with two lateral rows of denticles. Ventral surface with minute spinules as illustrated (Figure 4i). Setation of appendages as in Figure 4 and Table 2.

Second zoea (Figures 3b and 5a–i)

Carapace subquadrate on lateral view, and smooth. Anterodorsal section with a conspicuous lump above and behind the eye stalks (Figure 3b). Dorsal spine almost straight, with only the distal tip slightly curved posteriorly. The dorsal spine is positioned further posteriorly on the carapace in relation to the first zoea, and extends at an angle of *ca* 45° to the carapace long axis. Two pairs of small setae now present midfrontally, one sparsely plumose seta now present on each posterolateral margin. Eyes stalked. Abdominal somites 1–5 with small posterolateral spinous projections as illustrated (Figure 5h). Telson median notch shallower than in the first zoea, and cornua not noticeably divergent (Figure 5i). Setation of appendages as in Figure 5 and Table 2.

Table 1 Measurements of morphological features of zoeal stages of *Sesarma eulimene*. CL: carapace length. DL: length of dorsal spine. RL: length of rostral spine. DRL: distance from tip of dorsal spine to tip of rostral spine. LTC: length of left telson cornua. All measurements are in mm

	Zoea I (n = 10)		Zoea II (n = 10)		Zoea III (n = 10)		Zoea IV (n = 8)		Zoea V (n = 8)	
	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*	mean	*SD*
CL	0,39	0,01	0,46	0,01	0,53	0,02	0,67	0,03	0,75	0,02
DL	0,20	0,00	0,29	0,01	0,32	0,02	0,39	0,02	0,42	0,01
RL	0,15	0,01	0,22	0,01	0,26	0,02	0,29	0,02	0,32	0,01
DRL	0,64	0,01	0,81	0,03	0,97	0,02	1,18	0,03	1,27	0,02
LTC	0,17	0,01	0,22	0,01	0,25	0,01	0,29	0,00	0,32	0,01
DL/CL	0,51		0,63		0,60		0,58		0,56	
RL/CL	0,38		0,47		0,49		0,43		0,42	

Table 2 Setation of appendages of *Sesarma eulimene* zoeal stages. A: aesthetasc, S: simple, SP: sparsely plumose, P: plumose, HP: highly plumose, PD: plumodenticulate, D: denticulate, pdt: PD terminal. All symbols except 'A' refer to setae

	Zoea I	Zoea II	Zoea III	Zoea IV	Zoea V
Antennule					
terminal	3A + 2S	5A + 4S	2A + 1S	3A + 2S	4A
subterminal	0	0	0	1S	3A
Antenna					
Exopodite	2S + 1 tooth	2S + 1 tooth	2S + 1 tooth	2S + 1 tooth	2S + 1 tooth
Endopodite	absent	absent	absent	< ⅓ protopodite	> ⅓ protopodite
Maxillule					
Coxopodite	0	1HP	1HP	1HP	1HP
Basal endite	3D,2PD	5D,2PD	5D,2PD	5D,5PD,1S	5D,6PD,1S
Coxal endite	2D,4PD	6PD	2D,4PD	3D,3PD	1D,6PD
Endopodite proximal segment	1S	1S	1S	1S	1S
distal segment	1S,4SP	1S,4SP	1S,2SP,2SPpdt	1S,2SP,2SPpdt	2SP,3SPpdt
Maxilla					
Basal endite proximal lobe	4PD	4PD	5PD	5PD	7PD
distal lobe	4PD	4PD	4PD	5PD	6PD
Coxal endite proximal lobe	6PD	5PD	5PD	5PD	6PD,1S
distal lobe	3PD	3PD	3PD	3PD	4PD,1S
Endopodite proximal lobe	2SP	1SP,1SPpdt	1SP,1SPpdt	1SP,1SPpdt	1SP,1SPpdt
distal lobe	3SP	2SP,1SPpdt	3SP	3SP	3SP
Scaphognathite	4HP	5HP + 3HP	7HP + 3HP	14HP	25HP
First maxilliped					
Basipodite	10S	4S,6SP	7SP,2S,1SPpdt	8SP,2SPpdt	6SP,4SPpdt
Endopodite proximal segment	2S	1S,1SP	1S,1SP	1S,1SP	2SP
second segment	1S,1SP	1S,1SP	1S,1SP	1S,1SP	1S,1SPpdt
third segment	1SP	1SP	1SP,1P	1SP,1P	1P,1SPpdt
fourth segment	2S	2SP	1S,1SP	1S,1SP	2SP
fifth segment	3S,2SP	5SP	1P,2SP,2SPpdt	1P,1S,2SP,2SPpdt	1P,5SPpdt
Exopodite	4P	6P	8P	9P	11P
Second maxilliped					
Basipodite	4S	3S,1SP	2SP,2S	3SP,1S	4SPpdt
Endopodite proximal segment	0	0	0	0	0
second segment	1D	1D	1D	1D	1D
third segment	5S,1D	5S,1D	5S,1D	5S,1D	5S,1D
Exopodite	4P	6P	8P	10P	11P

Third zoea (Figures 3c and 6a–i)

Carapace subtriangular and smooth. Dorsal spine as in second zoea. Anterodorsal region between the dorsal and rostral spines slightly convex. Frontal lump still present but much less pronounced than in the second zoea. Rostral spine extending downwards and forward at *ca* 60° from the carapace long axis. One pair of small setae now present above the base of the dorsal spine. Two plumose and one sparsely plumose setae now present on each posterolateral margin (Figure 3c). Third maxilliped and first pereiopod now present beneath the carapace as small, undifferentiated buds. Abdomen with six somites plus telson. First somite with one long, simple dorsal seta. Posterolateral projections on somites 1–5 as illustrated (Figure 6h). Somite 6 with smooth posterolateral ridges. Posteromedian margin of telson only slightly concave, with a very shallow median notch (Figure 6i). Setation of appendages as in Figure 6 and Table 2.

Fourth zoea (Figures 3d and 7a–i)

Carapace as in the third zoea except for size (Table 2). Two plumose and four sparsely plumose setae now present on each posterolateral margin. Third maxilliped and pereiopods 1–5 buds now present under the carapace; the third maxilliped appears as a three-lobed structure (Figure 3d). Abdominal somites 2–5 with pleopod buds. Somites 1–6 with posterolateral projections as illustrated (Figure 7h). Telson as in third zoea, but the median notch has almost disappeared (Figure 7i). Setation of appendages as in Figure 7 and Table 2.

Fifth zoea (Figures 3e and 8a–i)

Carapace globose, with posterolateral and and ventrolateral shallow grooves, but otherwise showing a smooth surface. A number of small setae now present dorsally as illustrated (Figure 3c). Nine sparsely plumose setae now present on each ventrolateral margin. Third maxilliped and pereiopods 1–5 further developed, protruding from beneath the carapace. Pereiopod 1 shows chela articulation, and third maxilliped and pereiopods 1–4 show epipodite buds (Figure 8i). First abdominal somite with three sparsely plumose setae dorsally. Posterolateral projections on somites 1–6 as in Figure 8h. Pleopod buds on somites 1–5 further developed,

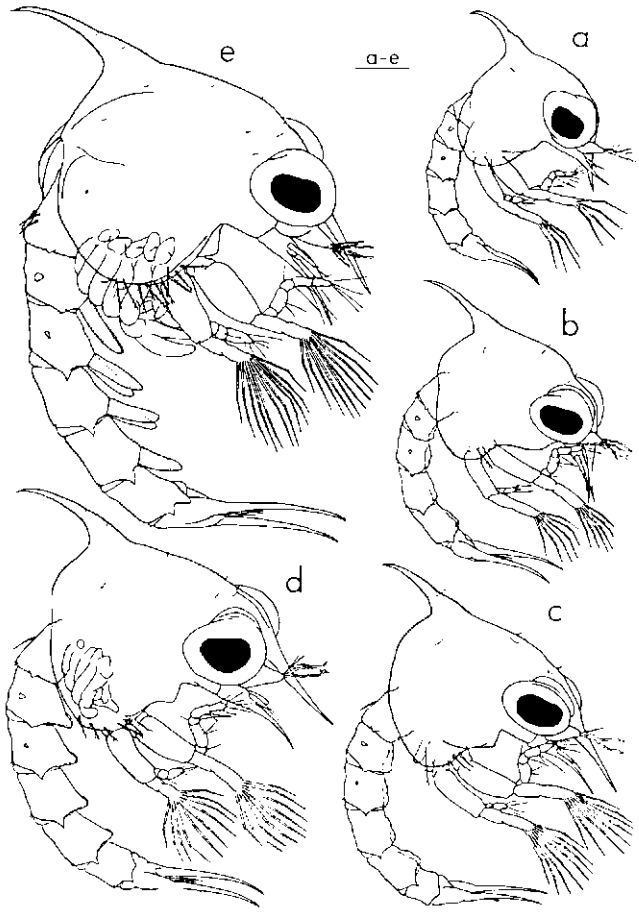

Figure 3 Zoeal stages of *Sesarma eulimene*. a: first zoea, b: second zoea, c: third zoea, d: fourth zoea, e: fifth zoea. Reference bars in this and subsequent figures represent 0,1 mm.

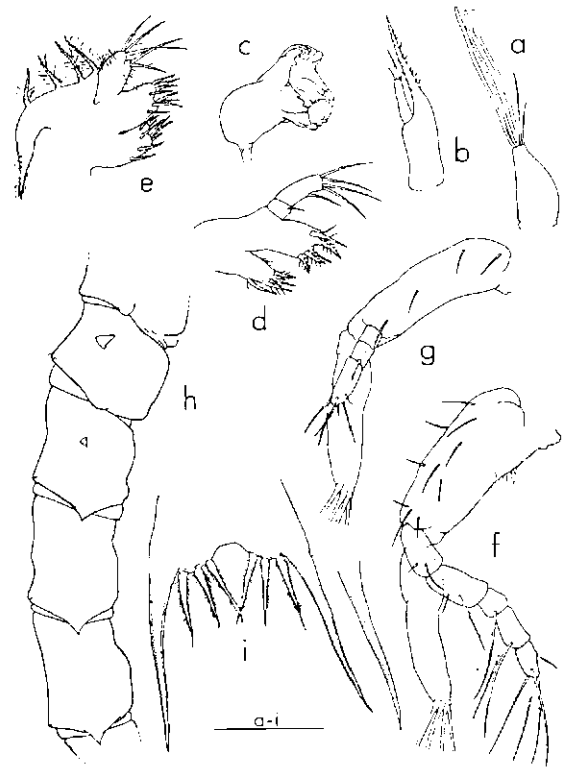

Figure 4 *Sesarme eulimene* first zoea. a: antennule, b: antenna, c: mandible, d: maxillule, e: maxilla, f: first maxilliped, g: second maxilliped, h: abdominal somites 1–5, lateral view, i: telson, dorsal view.

with endopodite buds. Somite 6 lacking pleopod buds. Telson as in fourth zoea. Setation of appendages as in Figure 8 and Table 2.

Discussion

Rice (1980: 359–361) provided a comprehensive identification key for larval (zoeal) brachyurans to family level. This key should be adequate to identify the larvae of all brachygnathan families of marine and estuarine crabs cited by Kensley (1981) for southern African waters. Kensley (1981) refers to 14 genera and 31 species of Grapsidae in southern Africa, 28 of which are distributed along the Indian Ocean coast from the southern Cape to southern Mozambique (see Table 3), and include representatives of all four grapsid subfamilies; i.e. Grapsinae, Varuninae, Plagusiinae, and Sesarminae.

Wear (1970) and Rice (1980) distinguished four morphological types of grapsid zoeae: two groups corresponding closely to the adult subfamilies Grapsinae and Plagusiinae respectively, and two other groups comprising a cross-section of genera from the Varuninae and Sesarminae subfamilies. From the study of New Zealand larval grapsid representatives, Wear & Fielder (1985) subsequently concluded that the latter two larval groups were not justifiably separated, and lumped all larval Varuninae and Sesarminae together into a single subfamilial division. Pereyra Lago (in press) arrived at the same conclusion from the analysis of mouthpart setation patterns in 37 Varuninae and Sesarminae species. He pointed out, however, that within this heterogeneous subfamilial group the genus *Sesarma* s.l. [not represented in New Zealand and not part of Wear & Fielder's (1985) analysis] constituted a distinct larval morphological unit.

For identification purposes, adequate diagnoses of the Grapsinae and Plagusiinae subfamilial larval groups, and the Varuninae-Sesarminae larval group, are to be found in Wear & Fielder (1985) and Pereyra Lago (in press) respectively.

No record exists on the larval morphology of the South African Varuninae species and genera, but a comparative wealth of information is available on the Sesarminae species (see Table 3). Pereyra Lago (in press) distinguished the genera *Aratus*, *Metasesarma*, *Sesarma* (including here within *Sesarma* Serene & Soh's (1970) genera *Chiromanthes*, *Sesarmops* and *Bresedium*), and possibly also *Sarmatium* as a distinct larval subgroup within the Varuninae-Sesarminae. Zoea larvae of these genera lack carapace spines, have 2+3 setae on the endopodite of the maxilla, 5,5 setae on the endites of the maxillule and 7–8 setae on the coxal endite of the maxilla (first zoea), the setal formula 2,2,3,3 on the basipodite of the first maxilliped, and only three pairs of posterior telson spines throughout the zoeal series. Of the above genera only *Sesarma* and *Sarmatium* are present in South Africa (Table 3). The sesarmid crab *Helice leachi* (Hess) is not mentioned by Kensley (1981) but is fairly common in the mangroves of the Mngazana and Mntafufu estuaries in Transkei (pers. obs.) (see Figure 1), and probably also in Natal. *Helice leachi* zoeal stages are

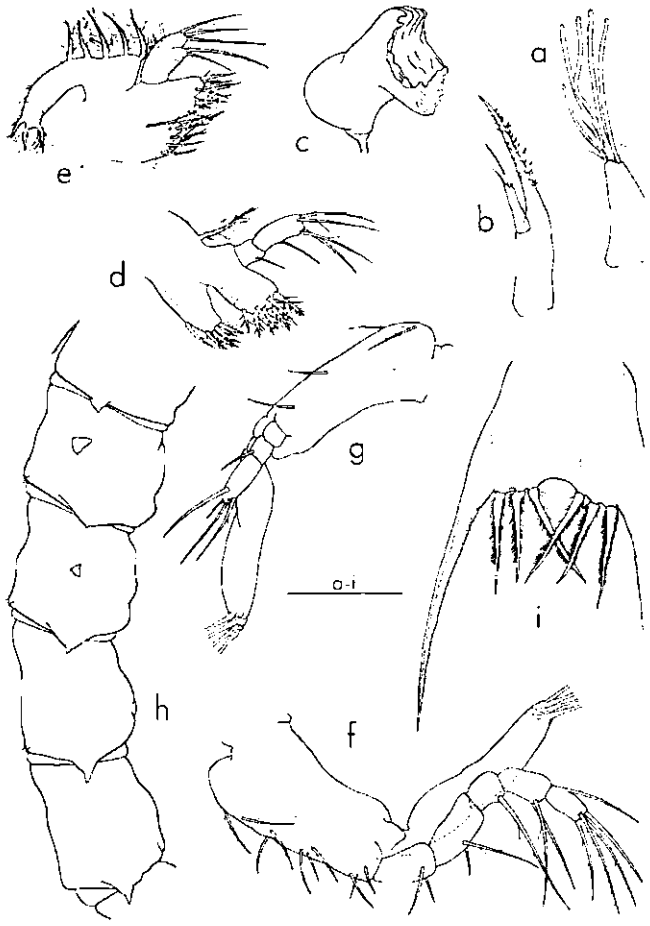

Figure 5 *Sesarma eulimene* second zoea. a: antennule, b: antenna, c: mandible, d: maxillule, e: maxilla, f: first maxilliped, g: second maxilliped, h: abdominal somites 1–5, lateral view, i: telson, dorsal view.

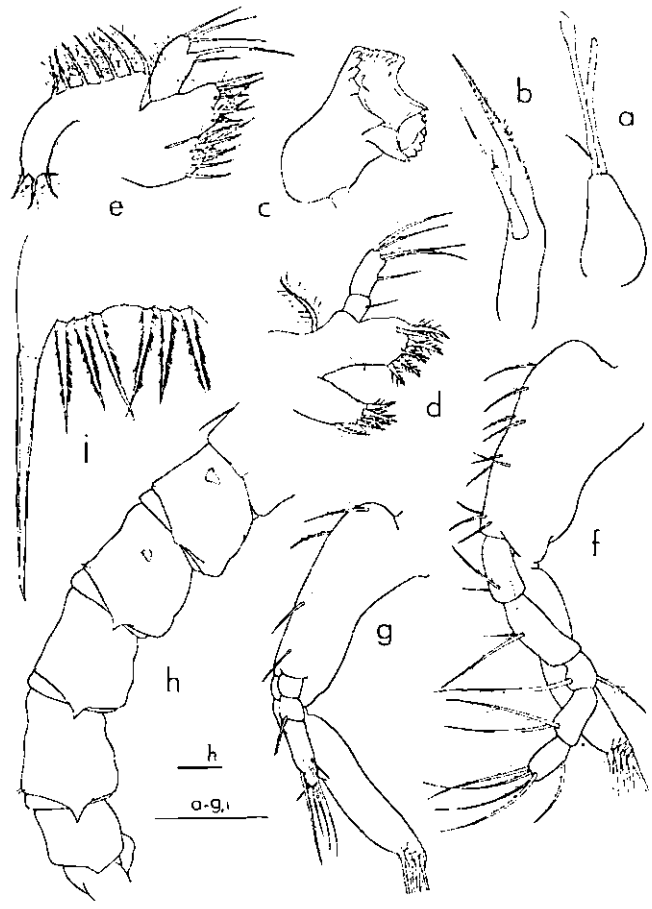

Figure 6 *Sesarma eulimene* third zoea. a: antennule, b: antenna, c: mandible, d: maxillule, e: maxilla, f: first maxilliped, g: second maxilliped, h: abdominal somites 1–6, lateral view, i: partial view of telson, dorsal view.

similar to those of *Sesarma* in overall appearance, but can be distinguished by the morphology of the antenna and the telson, and the presence of 2+2 setae on the endopodite of the maxilla (Baba, Fukuda, & Nakasone 1984).

Identification of larval *Sesarma*

Of the eight *Sesarma* species listed by Kensley (1981), only four species maintain large breeding populations in South Africa, and their larvae are the most likely to be found in plankton samples from estuaries and coastal waters. *Sesarma catenata* Ortmann is an endemic species and is distributed from the Breede River to Inhaca Island in southern Mozambique. *Sesarma eulimene* de Man has its centre of distribution in east Africa (Crosnier 1965) and extends as far south as the eastern Cape coast. *Sesarma meinerti* de Man and *Sesarma guttatum* A. Milne Edwards live in association with mangroves, and are found in Natal and Transkei north of the Kei River (Figure 1).

The remaining four *Sesarma* species listed in Table 3 are rarely found in South African estuaries. *Sesarma smithii* H. Milne Edwards is associated with the mangrove *Ceriops tagal* (Emmerson & McGwynne 1992). Although isolated individuals of *S. smithii* have been recorded as far south as the Mngazana estuary in Transkei (W. Emmerson, pers. comm., 1992), the southernmost breeding population is probably situated in the Kosi estuary in northern Natal (see Figure 1), which also represents the southern limit of distribution of *Ceriops* (Ward & Steincke 1982). *Sesarma longipes* Krauss and *Sesarma plicatum* (Latreille) are present but very rare in estuaries in Transkei and Natal (Branch & Grindley 1979; W. Emmerson, pers. comm., 1992). *Sesarma elongatum* A. Milne Edwards has not been recorded in South Africa.

The zoea larvae of *Sesarma catenata*, *S. meinerti*, *S. eulimene*, and *S. guttatum* show very similar morphology, but identification is possible from the existing descriptions (see larval references in Table 3). Figure 9 and Table 4 include some diagnostic characters which are easily observable and do not require dissection of specimens.

Zoea larvae of *Sesarma catenata* are distinguishable by the relatively long and strongly curved dorsal spine (in the first and second zoeae, see Table 4 and Figure 9a), and the long, smooth telson cornua (Figure 9e). The relative length of the dorsal spine changes in subsequent zoeae (Table 4), but the shape is characteristic of the species (Pereyra Lago 1987, Figure 3). *S. catenata* also lack spinous posterolateral projections on the abdominal somites, and the endopodite of the antenna is armed with one long and one short simple seta, the shorter seta about one-half to two-thirds the length of the longer one.

Sesarma eulimene zoeae are the smallest in overall size

Figure 7 *Sesarma eulimene* fourth zoea. a: antennule, b: antenna, c: mandible, d: maxillule, e: maxilla, f: first maxilliped, g: second maxilliped, h: abdominal somites 1–6, lateral view, i: partial view of telson, dorsal view.

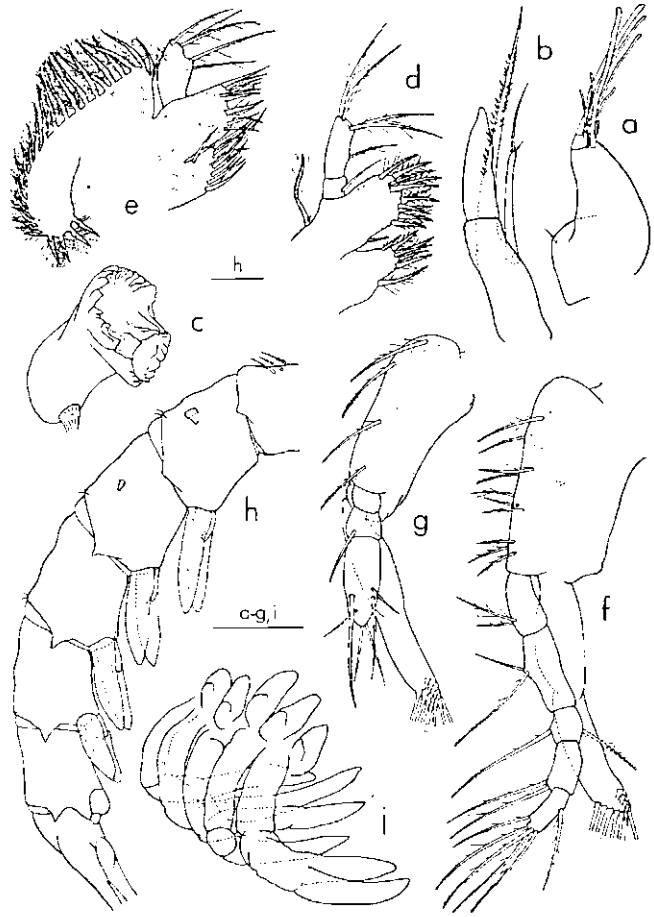

Figure 8 *Sesarma eulimene* fifth zoea. a: antennule, b: antenna, c: mandible, d: maxillule, e: maxilla, f: first maxilliped, g: second maxilliped, h: abdominal somites 1–6, lateral view, i: pereiopods 1–5.

(Table 4). The rostral spine is densely covered with small spinules in all zoeal stages, and in the third, fourth and fifth zoeae it is characteristically directed forward from the anterior edge of the carapace (Figure 3). The exopodite of the antenna is armed with two simple setae and a small tooth-like spine (Figures 4b–8b).

Sesarma meinerti and *Sesarma guttatum* are very similar in overall dimensions (Table 4). The posterolateral projections on the abdominal somites are slightly longer and more conspicuous in *S. meinerti* zoeae. The exopodite of the antenna of *S. guttatum* bears two very unequal simple setae, the shorter setae less than one-third the length of the longer one. In *S. meinerti* zoeae, the antennal exopodite is armed with two simple setae and two additional lateral tooth-like spines.

Caution should be exercised when utilizing metric characters such as overall larval dimensions and the relative length of carapacial spines for identification purposes. These features have been shown to vary intraspecifically in relation to environmental conditions, most notably egg incubation temperature, and temperature and food availability during larval development. Also the absolute range of variation in body size usually increases in subsequent zoeal stages (Anderson & Ford 1976; Kunisch & Anger 1984; Shirley, Shirley, & Rice 1987).

The larval descriptions of the *Sesarma* species considered here were all based upon laboratory-reared specimens, cultured under 'optimal' constant temperature conditions (i.e. between 20°C and 26°C) and the range of variation in body size in nature is not known. Consequently, body size and length of carapace and carapacial spines may be confidently used to compare specimens in the same plankton sample, or in samples collected within the same general locality, but they provide circumstantial evidence only when comparing individuals collected from regions with different climatic regimes (e.g. Natal and eastern Cape), or from early and late in the breeding season.

The megalopa larva is the last stage in the development of brachyurans and represents an intermediate morphological state between a true larva (i.e. zoea) where the maxillipeds are used mainly for locomotion, and the benthic adult morphology. Few diagnostic characters are carried over through metamorphosis from the last zoeal stage to the megalopa. This makes it difficult to assign individuals in plankton samples to a particular larval series without prior knowledge of their parentage.

Relatively few megalopa larvae of species within the Varuninae-Sesarminae group have been described in detail and intergeneric comparisons are still premature. However, from the analysis of appendage setation patterns in a number

Table 3 List of species of the grapsidae family cited by Kensley (1981) for southern Africa, and references on existing specific or co-specific larval descriptions. Most distributional data taken from Kensley (1981), Crosnier (1965), and MacNae (1968), with modifications according to personal observations

Species		Distribution	Larval reference
Grapsus grapsus	G	Northern Namibia	Aikawa 1937
G. fourmanoiri	G	East London to Mozambique	
G. tenuicrustatus	G	Plettenberg Bay to Mozambique	
Hyograpsus paludicola	G	Mozambique	
Metopograpsus messor	G	East London to Mozambique	Rajabai 1961
M. thukhuar	G	Mozambique	
Pachygrapsus minutus	G	Mozambique	*P. crassipes* (Schlotterbeck 1976)
P. plicatus	G	Natal to Mozambique	
P. polypodus	G	Natal	
P. transversus	G	Northern Namibia	Lebour 1944
Planes cyaneus	G	Natal to Mozambique	*P. marinus* (Wear 1970)
P. minutus	G	West coast	Hyman 1924
Percnon planissimum	P	Natal to Mozambique	Hartnoll 1992, *P. gibbesi* (Paula & Hartnoll 1989)
Plagusia chabrus	P	Southern Ocean	Wear 1970, Wear & Fielder 1985
P. depressa tuberculata	P	Natal to Mozambique	*P. depressa* (Wilson & Gore 1980)
Pseudograpsus elongatus	V	Natal to Mozambique	
Ptychognathus onyx	V	Natal	
Varuna litterata	V	Breede River to Mozambique	
V. tormentosa	V	Transkei and Natal	
Cyclograpsus punctatus	S	Southern Ocean	Fagetti & Campodonico 1971
Sarmatium crassum	S	Natal to Mozambique	
Sesarma catenata	S	Breede River to Inhaca Island	Pereyra Lago 1987
S. elongatum	S	Mozambique	
S. eulimene	S	Eastern Cape to Mozambique	This paper
S. guttatum	S	Transkei to Mozambique	Pereyra Lago (in press)
S. longipes	S	Natal to Mozambique	
S. meinerti	S	Transkei to Mozambique	Pereyra Lago 1989
S. plicatum	S	Natal	
S. smithii	S	Natal to Mozambique	
Helice leachi	S	Transkei to Mozambique	Baba, Fukuda & Nakasone 1984

G: Grapsinae, P: Plagusiinae, V: Varuninae, S: Sesarminae

of genera, Pereyra Lago (in press) tentatively defined the megalopa of the genus *Sesarma* (s.l.) as follows. Antennule lacking inner flagellum. Antennal seventh segment always with two long, stout, often denticulated terminal setae, plus two or three small, simple terminal or subterminal setae. Distal segment of the mandibular palp with only four setae. Scaphognathite of the maxilla with about 40 HP setae or less. Epipodite of the first maxilliped with five setae. Second maxilliped lacking epipodite. Endopodite of the second maxilliped almost always with 0,1,3,6 setae (*S. guttatum* bears 0,1,4,7 setae) but basal segment always unarmed. Distal segment of uropods with 6–7 (usually six) setae.

Of the local Sesarminae species, the megalopa larvae of *Cyclograpsus punctatus*, *Sesarma catenata*, *S. guttatum*, and *S. meinerti* have been described (see references in Table 3). The megalopa of *Helice leachi* is not known, but that of *Helice crassa* has been described by Wear & Fielder (1985). This may facilitate the identification of *Helice leachi* megalopae, at least to generic level.

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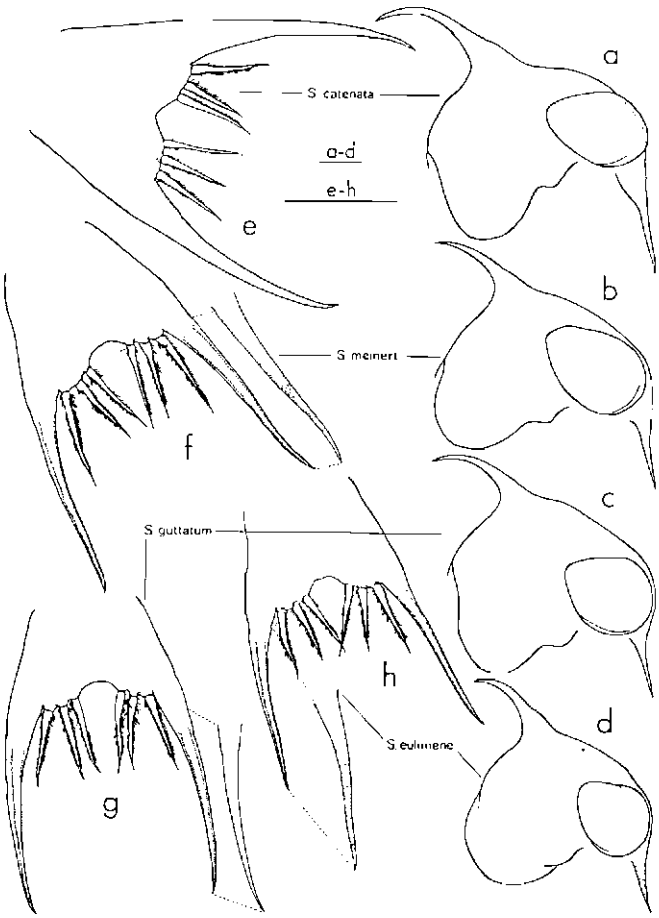

Figure 9 First zoea of *Sesarma catenata*, *Sesarma meinerti*, *Sesarma guttatum*, and *Sesarma eulimene*. a–d: *idem*, outline of the carapace, lateral view. e–i: *idem*, dorsal view of the telson. Drawings based on individuals collected from the plankton of the Mntafufu estuary, Transkei, from January to March 1987.

Table 4 Some morphological features of zoea larvae of *Sesarma catenata*, *Sesarma eulimene*, *Sesarma meinerti*, and *Sesarma guttatum*. Symbols as in Tables 1 and 2. References as in Table 3. Measurements of *S. catenata* zoeal stages are based on larvae reared in the laboratory at 23°C. All measurements are means (n = 8–10) and are expressed in mm; maxil. = maxilliped

	CL	DL	RL	DRL	First maxil. exopodite	Second maxil. exopodite	Carapace lateral setae	Pleopod buds
Zoea I								
S. catenata	0,48	0,33	0,22	0,84	4	4	0	–
S. eulimene	0,39	0,20	0,15	0,64	4	4	0	–
S. meinerti	0,41	0,19	0,13	0,67	4	4	0	–
S. guttatum	0,43	0,23	0,15	0,69	4	4	0	–
Zoea II								
S. catenata	0,56	0,35	0,26	1,07	6	6	2P	–
S. eulimene	0,46	0,29	0,22	0,81	6	6	1P	–
S. meinerti	0,51	0,28	0,21	0,84	6	6	1P	–
S. guttatum	0,54	0,33	0,27	0,97	6	6	1P	–
Zoea III								
S. catenata	0,63	0,37	0,28	1,13	8	8	4P	+
S. eulimene	0,53	0,32	0,26	0,97	8	8	1P,2HP	–
S. meinerti	0,57	0,34	0,25	1,08	8	8	2P	–
S. guttatum	0,64	0,36	0,34	1,09	8	8	3P	+
Zoea IV								
S. catenata	0,75	0,48	0,36	1,43	9	10	8P	+
S. eulimene	0,67	0,39	0,29	1,18	9	10	4P,2HP	+
S. meinerti	0,70	0,40	0,37	1,36	10	10	5P	+
S. guttatum	0,75	0,44	0,38	1,31	9	10	3P,2HP	+
Zoea V								
S. eulimene	0,75	0,42	0,32	1,27	10	11	9P	+
S. meinerti	0,78	0,43	0,41	1,42	11	11	5P	+
S. guttatum	0,82	0,45	0,44	1,39	10	11	4P,2HP	+

(+) = present, (–) = absent

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