

Brachyura (Grapsidae, Ocypodidae, Portunidae, Xanthidae and Leucosiidae) of Umm Al Quwain mangal, United Arab Emirates

S.M. AL-GHAIS and R.T. COOPER

Desert and Marine Environment Research Center, United Arab Emirates University, P.O. Box 17777, Al Ain, United Arab Emirates

Received 5 November 1994, accepted 8 July 1995

The paper presents findings from a recent collection of crabs made during 1993 and 1994 from the mangal of the United Arab Emirates. The mangal invertebrate fauna of the UAE is not well known and an account is given of the families Grapsidae, Ocypodidae, Portunidae, Xanthidae and Leucosiidae collected from Umm Al Quwain khawr. For each species comments are made about their identification, habitat preferences and geographical distribution.

KEY WORDS: Brachyura, Grapsidae, Ocypodidae, Portunidae, Xanthidae, Leucosiidae, Arabian Gulf, United Arab Emirates, mangal, distribution.

Introduction	409
Collecting sites	410
Collections	411
Family Grapsidae	411
Family Ocypodidae	415
Family Portunidae	423
Family Xanthidae	425
Family Leucosiidae	426
Discussion	427
Acknowledgements	428
References	428

INTRODUCTION

In 1993 the Desert and Marine Environment Research Centre (D & MERC) of the United Arab Emirates University initiated a research programme to study the mangal ecosystem of the United Arab Emirates. The present paper describes the brachyuran crabs (Grapsidae, Ocypodidae, Portunidae, Xanthidae and Leucosiidae) of Umm Al Quwain mangal and represents the first of a contribution to the knowledge of the UAE mangal.

Mangrove swamps, tidal forests or mangal are an important feature of tropical marine shores and can be found growing on coasts sheltered from wave action. They can be divided into two contrasting categories (although there are intermediary types), the classical estuarine, 'soft bottom' mangal and the 'hard bottom' mangal (POR 1984). The former is representative of most mangrove forests worldwide and found along tropical and subtropical coasts with significant freshwater inputs. This mangal usually forms a wide forest belt, sometimes several kilometers in width and is typified by a relatively complex forest structure. The latter hard bottom mangal is found along coastlines with a dry climate with no significant freshwater input and is typical of that found in Umm Al Quwain khawr (khawr = coastal inlet).

Crabs are a conspicuous component of the invertebrate macrofauna of Umm Al Quwain mangal with the Grapsidae and Ocypodidae contributing most species. The identification, distribution and habitat preferences of each species are discussed.

COLLECTING SITES

Umm Al Quwain khawr covers an area of approximately 60 km² (Fig. 1) with several islands densely covered with monospecific *Avicennia marina* vegetation reaching a maximum height of approximately 4 m. While mangrove is found principally on these islands, stunted bushes are also found along the mainland coast.

The mangal of Umm Al Quwain typically consists of three and sometimes four habitat types. A mud flat of soft to very firm mud may extend from the sublittoral edge, characterized by a dense growth of seagrass *Halodule uninervis*, to the seaward edge of the mangrove zone. *Avicennia* forms a band of usually no more than 40 m width extending up into the littoral fringe. Typically at the landward edge of the mangrove is a low, sandy ridge of less than 0.5 m height. Saltmarsh vegetation, an *Arthrocnemum* community, may extend from the mangrove edge and form a band of sparse saltmarsh immediately landward of the ridge interspersed with areas of bare mud. Narrow channels bordered with mixed mangrove and saltmarsh vegetation, and with water several centimetres deep at low tide, were also found to flow through the saltmarsh zone in a few locations.

To try and ensure a representative collection of species from the mangal, specimens were collected from five sites differing in environmental factors such as sediment type, exposure, and mangrove growth, as follows:

Station (1). The most exposed sampling station facing the southern entrance of the khawr. Intertidal width is over 100 m, with a mangrove zone of 40 m and a seaward mud flat of 70 m width. Maximum mangrove height is 2 m. A small sandy ridge and sparse saltmarsh is found landward of the mangrove. The sediment consists of firm mud.

Station (2). Located on the eastern side of the main channel running through the khawr. The chosen transect cuts across the northwestern tip of the island. The seaward mud flat extends for 100 m and consists of soft mud. In this area, mangroves show their greatest development reaching a maximum height of nearly 4 m.

Station (3). A sheltered station with a relatively narrow intertidal width. The seaward sand flat extends for approximately 40 m adjoining a shrubby mangrove zone (maximum height 2.5 m) 20 m wide. The sediment consists of muddy sand. The landward fringe of the mangrove is interspersed with saltmarsh with a small sandy ridge delimiting the edge of the mangrove zone. Saltmarsh continues farther landwards with a scattering of isolated mangrove bushes.

Station (4). The most sheltered sampling location with the greatest intertidal width. The seaward mud flat is approximately 200 m wide and the mangrove zone extends for 30 m up to a low sandy ridge at the mangrove landward edge. Farther landward is saltmarsh, with mixed saltmarsh and mangrove bordering the creek system of the area. The sediment of the seaward mud flat and mangrove zone consists of soft mud.

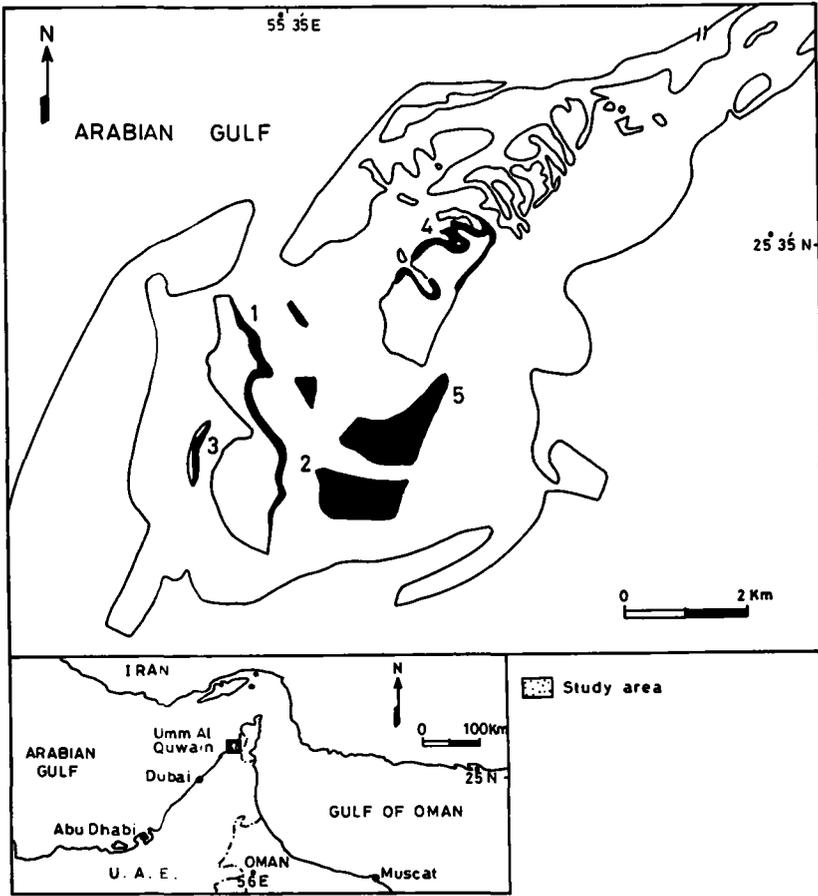


Fig. 1. — Map of the eastern United Arab Emirates and Umm Al Quwain khawr. Shaded areas represent densest mangrove cover. Numbers indicate sampling stations.

Station (5). Located on the eastern channel of the khawr, this station is moderately exposed. The seaward mud flat is 120 m wide, and the mangrove zone of average development attaining a maximum height of nearly 3 m.

Repeated sampling of intertidal and shallow subtidal areas were made by hand collection and beach seine net on a quarterly basis for a period of 1 year.

COLLECTIONS

Family Grapsidae

Metopograpsus messor (Forskål 1775) (Fig. 2)

Material examined: 57 specimens (37 males, 17 females, 3 unsexable juveniles); one ovigerous female (carapace width 12.6 mm) collected in May. Maximum carapace width and length of male

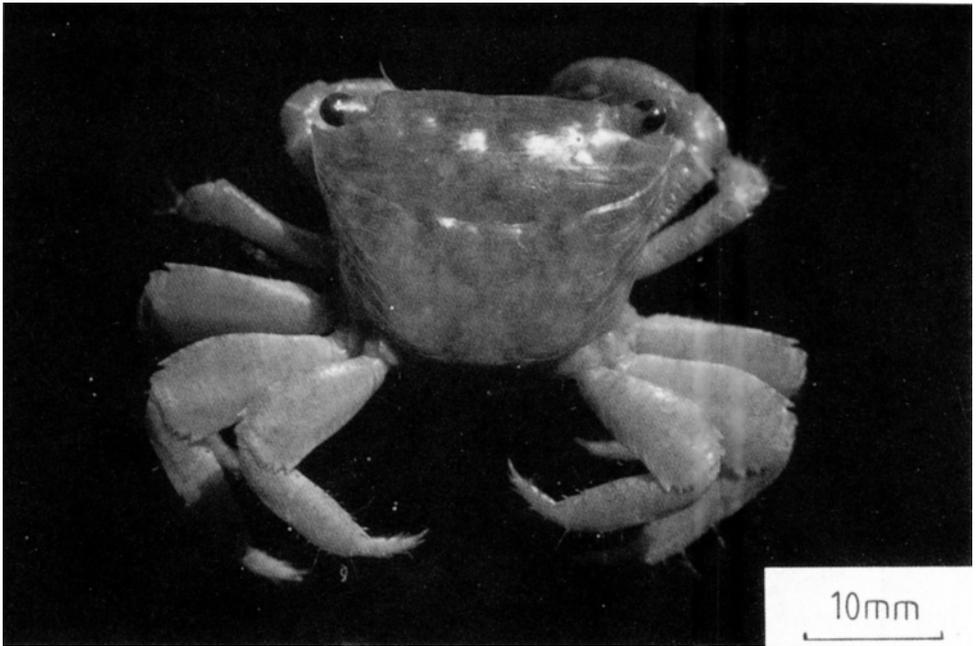


Fig. 2. — *Metopograpsus messor* (Forskål 1775), male.

28.4 and 21.8 mm, and of female 22.7 and 16.7 mm respectively. A conspicuous resident of the mangrove zone, found in the shade of the mangrove tree *Avicennia marina* and amongst its pneumatophores: station 1 (5 males, 1 juvenile), station 2 (3 males, 2 females, 1 juvenile), station 3 (3 males, 3 females), station 4 (13 males, 8 females), station 5 (9 males, 1 female, 1 juvenile). Occasional specimens also caught from the seaward mud flat: station 1 (1 female), station 3 (1 male, 1 female), station 5 (1 male); and from saltmarsh immediately landward of the mangrove zone: station 1 (2 males), station 4 (1 female). One male specimen was collected from a small oyster encrusted rocky outcrop in the mangrove seaward mud flat of station 4.

Colouration. Variable. Large adults may have a dark purplish carapace and walking legs. In formaldehyde preservative, colours fade to a dark red or brownish carapace. Most preserved adult specimens exhibit significant mottling of the carapace, red speckled legs and red brown chelae, chestnut brown in larger specimens. The sternum and abdomen are pale yellow brown. In smaller specimens colours are less distinctive. The observed colours and dark mottling variability are similar to the findings of other authors (BANERJEE 1960, HOLTHUIS 1977).

Distribution. Widely distributed, from the Red Sea, Suez Canal, Aden, Madagascar, east coast of Africa, Seychelles, Hawaii to Japan (CROSNIER 1965, GUINOT 1967). Probably restricted to the western part of the Indo-Pacific region as, according to BANERJEE (1960), a number of records for this species were based on incorrectly identified material due to confusion with *M. thukubar* (Owen 1839) and *M. frontalis* Miers 1880.

M. messor has been reported in the mangal of the Red Sea by FISHELSON (1971), HOLTHUIS (1977) and POR et al. (1977). LAURIE (1915) reported it living in or near mud flats of the Suez and CHHAPGAR (1957) recorded it among rocks on the west coast of India. Along the Arabian Gulf coast, APEL (1994) reported its habitat as 'under rocks, in mangroves and saltmarshes'.

Remarks. Good descriptions of this species have been given by TWEEDIE (1949), BANERJEE (1960) and CROSNIER (1965). The first male pleopod which is characteristic of the species was figured by STEPHENSEN (1945), TWEEDIE (1949) and CROSNIER (1965). In the female, the chitinous projection in the oviducal aperture, figured by BANERJEE (1960: fig. 4ii), is a useful feature for identification.

***Metopograpsus thukuhar* (Owen 1839) (Fig. 3)**

Material examined 1 female specimen. Carapace width and length 24.4 and 18.5 mm respectively. Collected from the mangrove zone of station 4.

Colouration. Live specimen with distinct orange chelae and legs. Carapace blotchy red and orange.

Distribution. *M. thukuhar* is widely distributed in the Indo-West Pacific region from the east coast of Africa, South Africa, Madagascar, to Hawaii, Japan and

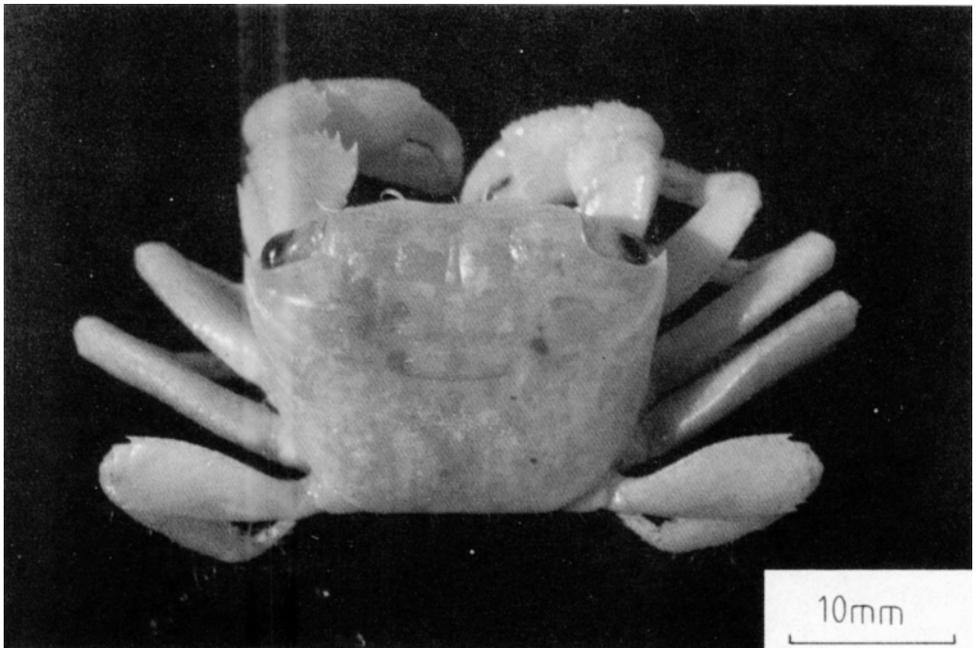


Fig. 3. — *Metopograpsus thukuhar* (Owen 1839), female.

Australia (CROSNIER 1965, GUINOT 1967). *M. thukuhar* has been found associated with mangrove habitats in the Red Sea by POR et al. (1977) and HOLTHUIS (1977), and in Tanzania by HARTNOLL (1975). The latter author found it in the sheltered landward coastal mangrove belt and distributed throughout creek mangrove; it is interesting to note that the specimen caught in the Umm Al Quwain study was from one of the more sheltered sampling sites.

Remarks. The specimen is distinct from the closely related *Metopograpsus messor* and agrees with the accounts given by BANERJEE (1960) and CROSNIER (1965) of the species. Features that distinguish *M. thukuhar* from *M. messor* include a squarer carapace with lateral margins less convergent backwards, and a blunt sub-orbital tooth with an indistinct keel from its tip to its base. As the Umm Al Quwain specimen is female, the absence of a chitinous projection in the oviducal aperture also assists identification. Males can be readily identified by examining the form of the first pleopod (CROSNIER 1965).

***Sesarma (Parasesarma) plicatum* (Latreille 1806) (Fig. 4)**

Material examined: 10 specimens (7 males, 3 females). Maximum carapace width (distance between external orbital teeth) and length of male 31.8 and 24.9 mm, and of female 25.4 and 19.5 mm respectively. Specimens collected from saltmarsh (*Arthrocnemum* community) immediately landward of mangrove zone: station 1 (1 male), station 4 (6 males, 3 females).

Colouration. In formaldehyde, carapace dark grey and tips of chelae red.

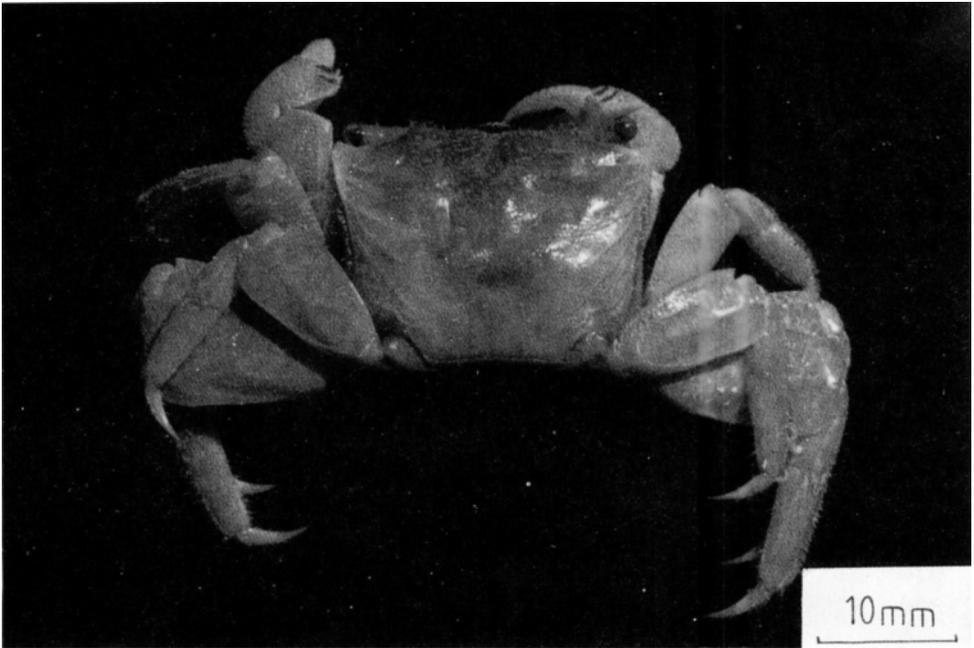


Fig. 4. — *Sesarma (Parasesarma) plicatum* (Latreille 1806), male.

Distribution. A widely distributed species found across the whole Indo-Pacific region from the east coast of Africa, South Africa, Madagascar, Mauritius, Seychelles, India, New Caledonia and Japan (CROSNIER 1965, GUINOT 1967). *Sesarma* (*Parasesarma*) *plicatum* has previously been recorded from Madagascan mangrove by CROSNIER (1965) and in burrows at the edge of saltmarsh in the northern Arabian Gulf by JONES (1986).

Remarks. An account of the species is given by CROSNIER (1965). Important systematic characters for the genus *Sesarma* include the form of the male first pleopod and abdomen, chela ornamentation such as the presence of pectinated crests on the propodus upper surface and tuberculation on the dactylus upper surface. Female specimens, however, can be trickier to identify due to less distinct chela ornamentation (CROSNIER 1965).

The genus *Sesarma* Say s.l. includes more than 100 Indo-Pacific species, and of these more than 60 are predominantly associated with the mangal (JONES 1984). SERÈNE & SOH (1970) revised the difficult systematics of this genus dividing it into several genera and subgenera and established that *Sesarma* Say 1817 s.s. was not represented in the Indo-West Pacific region. Although the genus *Sesarma* s.l. is in need of further division, SERÈNE & SOH's proposal was preliminary and according to HOLTHUIS (1977) still had several discrepancies.

***Ilyograpsus paludicola* (Rathbun 1909)**

Synonym: *Ilyograpsus rhizophorae* Barnard 1955.

Material examined: 2 specimens (2 ovigerous females) collected in March and August. Maximum carapace width (distance between third anterolateral teeth) and length 6.0 and 5.2 mm respectively. One specimen was collected from the seaward edge of the mangrove zone (station 5), the other from the shallow sublittoral in a beach seine sample (station 5).

Colouration. In formaldehyde, yellowish-white.

Distribution. Reported from the east coast of Africa, Madagascar (CROSNIER 1965), India and Malaysia (JONES 1986). CROSNIER (1965) recorded it in the Madagascan mangrove and BARNARD (1955) in the mangrove of Inhambane. In the Arabian Gulf, APEL (1994) observed it in the mid-eulittoral of sandy/muddy shores and JONES (1986) reported it high on the shore beneath rocks.

Remarks. The specimen agrees well with the descriptions given by BARNARD (1955), CROSNIER (1965) and APEL (1994). The carapace is quite distinctive having four antero-lateral teeth (including the external orbital tooth). The first three teeth are marked and the fourth very small. The first and third teeth are pointed and the second blunt.

Family Ocypodidae

***Macrophthalmus depressus* Ruppell 1830 (Fig. 5)**

Material examined: 62 specimens (27 males, 35 females); 7 ovigerous females (carapace width ranging from 14.0 to 20.8 mm) collected in November and January. Maximum carapace width



Fig. 5. — *Macrophthalmus depressus* Ruppell 1830, male.

(distance between second anterolateral teeth) and length of male 23.6 and 15.6 mm, and of female 20.8 and 14.4 mm respectively. The carapace width/length ratio varied between 1.32 to 1.53 for a male, and 1.33 to 1.53 for a female. Abundant within the mangrove zone: station 1 (1 male, 4 females), station 2 (11 males, 15 females), station 3 (1 male, 2 females), station 5 (3 males, 2 females); and found in the seaward mud flat: station 1 (4 males, 5 females), station 4 (2 females). Occasionally found in the mangrove landward fringe: station 1 (1 male, 1 female), station 4 (4 males, 2 females); and saltmarsh/mud flat: station 1 (2 males, 2 females).

Colouration. In preservative carapace of large adult specimens may be dark blue-grey, legs light brown and chelae blue. Smaller specimens with less distinct colouration.

Distribution. Distribution ranges from the Suez Canal, Red Sea, Aden, Inhambane, Madagascar (GUINOT 1967), east coast of Africa, Arabian Gulf and India (JONES 1986). Reports of *M. depressus* in the Arabian Gulf include those by APEL (1994) who reported it from the mid and lower eulittoral of muddy shores and JONES (1986) who observed it in burrows on muddy flats around mean sea level. Studies carried out on the mangal biota of Bahrain (JONES 1985, VOUSDEN 1988: cited in SHEPPARD et al. 1992) described it as common below mangrove to the low tide mark. Its occurrence in mangrove and mud flat biotopes in Umm Al Quwain is similarly reflected to findings in Tanzania (HARTNOLL 1975), Mozambique (MACNAE & KALK 1962) and Madagascar (CROSNIER 1965).

Remarks. The genus *Macrophthalmus*, which comprises 38 valid Indo-West Pacific species (BARNES 1977), exhibits a wide range of structural diversity with characters that can vary '(a) with size of the animal, (b) amongst material from a single locality,

and (c) from locality to locality' (BARNES 1970). Nevertheless, as BARNES (1970) commented 'this well known species has been remarkably free from controversy, perhaps because the only feature in which it exhibits any marked degree of variation is the degree of hairiness'. Good descriptions and illustrations of the species can be found in the accounts given by CROSNIER (1965) and BARNES (1970, 1977).

***Macrophthalmus dilatatus sulcatus* H. Milne Edwards 1852 (Fig. 6)**

Synonyms: *Macrophthalmus sulcatus* H. Milne Edwards 1852; *Macrophthalmus sandakani* Rathbun 1914; *Macrophthalmus maiaccensis* Tweedie 1937.

Material examined: 1 male specimen collected in January from the mangal upper seaward mud flat of station 4. Carapace width (measured between second anterolateral teeth) and length 30.0 and 13.0 mm respectively.

Colouration. In preservative carapace blue grey, chelae and surface of third maxillipeds grey, legs pale brown.

Distribution. *M. dilatatus sulcatus* has been recorded across the Indo-West Pacific area from the Far East, India, Mauritius (BARNES 1970), Andamans (ALCOCK 1900) and the Arabian Gulf (APEL 1994).

The subspecies *M. dilatatus sulcatus* was formed by BARNES (1970) after the similarities between *M. sulcatus* H. Milne Edwards 1852, *M. sandakani* Rathbun 1914

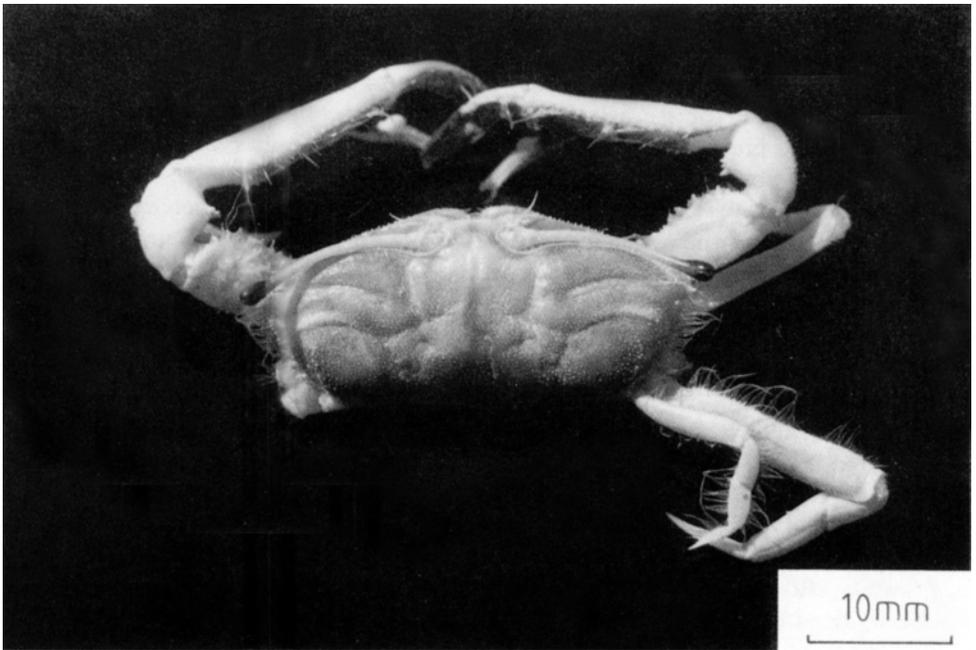


Fig. 6. — *Macrophthalmus dilatatus sulcatus* H. Milne Edwards 1852, male.

and *M. malaccensis* Tweedie 1937 led to them being synonymized. While this subspecies is recorded from the western and southern regions of the Indo-West Pacific, the other subspecies described by BARNES (1970), *M. dilatatus dilatatus* (de Haan 1835), has been found in Japan. The division into a southern *M. d. sulcatus* and northern *M. d. dilatatus* subspecies was considered by BARNES (1970), but as many of the differences between the two subspecies appear to vary in a clinal manner he suggested more material should be sought for further clarification.

Remarks. The specimen agrees closely with the accounts given of *M. d. sulcatus* by BARNES (1970, 1977) and APEL (1994). The carapace is over twice as wide as long, carapace length/width ratio 0.43, and the surface covered entirely with small granules except for the rather inconspicuous bare patches towards the anterior tip of the protogastric regions. Conspicuous short rows of larger granules are found in the branchial regions.

There are three anterolateral teeth. The external orbital tooth is small and sharp and the tip directed slightly backwards. This is, according to BARNES (1970), typical of *M. d. sulcatus* from the western part of its range, while specimens collected from the eastern part of its range also have a small tooth but with the tip directed outwards and sometimes forwards. The second lateral tooth, separated from the first by a deep cut, is large, and pointed and extends beyond the external orbital tooth. Unlike the description given by BARNES (1970) for this subspecies where the second tooth is directed outwards and forwards, it is directed straight outwards at an angle of 90° to the longitudinal carapace axis. The third lateral tooth, separated from the second by a narrow groove, is small and directed outwards and forwards.

The cornea of the ocular peduncle projects beyond the tip of the external orbital tooth and half of the cornea length extends past the tip of the second anterolateral tooth.

The specimen agrees with the description given by BARNES (1970) on the distribution of tubercles and granules on the merus of *M. d. sulcatus*.

The carpus inner surface has a dorsal tubercle with one or two centrally near to the joint with the propodus. The palm is elongate with an outer surface covered by small granules. A longitudinal row of small tubercles decreasing in size towards the index runs close and parallel to the lower margin. A row of large tubercles runs along the upper margin and the lower margin is coarsely granulated. The inner surface of the palm and both fingers are entirely covered with dense hair except for the lower and proximal areas. One to three large spines are found proximally in a row of granules that form a boundary between the hairless and tomentous regions.

The index is noticeably deflexed with a proximal convex lower margin. Its cutting edge has a large subproximal subrectangular tooth. The dactylus is slightly curved with a small low tooth formed from about seven proximal contiguous granules.

The male first pleopod is slightly curved with a hooked tip and is similarly described by APEL (1994).

Although *M. d. sulcatus* closely resembles *M. d. dilatatus* and *M. grandidieri* A. Milne Edwards 1867, there are several features that enable them to be distinguished. *M. d. sulcatus* differs from *M. grandidieri* by the presence of tubercles on the inner and outer margins of the merus, the presence of a large tubercle on the dorsal inner surface of the carpus and a row of granules on the inner surface of the palm (BARNES 1970).

The two subspecies *M. d. dilatatus* and *M. d. sulcatus* differ in only a few features

and then as BARNES (1970) commented only in the degree of expression. The index tooth of the Umm Al Quwain sample is very distinct and probably more characteristic of the westernmost *M. d. sulcatus*. The external orbital angle is also much smaller than that figured by BARNES (1970) for *M. d. dilatatus*, the granules on the outer surface of the palm are much smaller and more numerous, the dactylus tooth is smaller and the carapace length/breadth ratio of 0.43 falls within the range 0.41 to 0.45 quoted by BARNES (1970) for *M. d. sulcatus*.

Uca annulipes (H. Milne Edwards 1852) (Figs 7-8)

Material examined: 94 specimens (68 males, 26 females). One ovigerous female (carapace width 8.4 mm) collected in April. Maximum carapace width and length of male 16.8 and 9.9 mm, and of female 14.5 and 8.3 mm respectively. The commonest species of *Uca* observed in Umm Al Quwain mangal. Mostly found in the drier sandier landward fringe of mangrove vegetation: station 1 (6 males, 2 females), station 3 (7 males, 4 females), station 4 (9 males, 3 females); with its distribution extending into saltmarsh (*Arthrocnemum* community) at station 1 (8 males, 3 females). Also commonly found in the inner mangrove zone in muddy sediment: station 1 (8 males, 3 females), station 2 (31 males, 11 females).

Colouration. Live specimens with brown/black carapace and white mottling, male large chela white with occasional pink colouration (based on a few records).

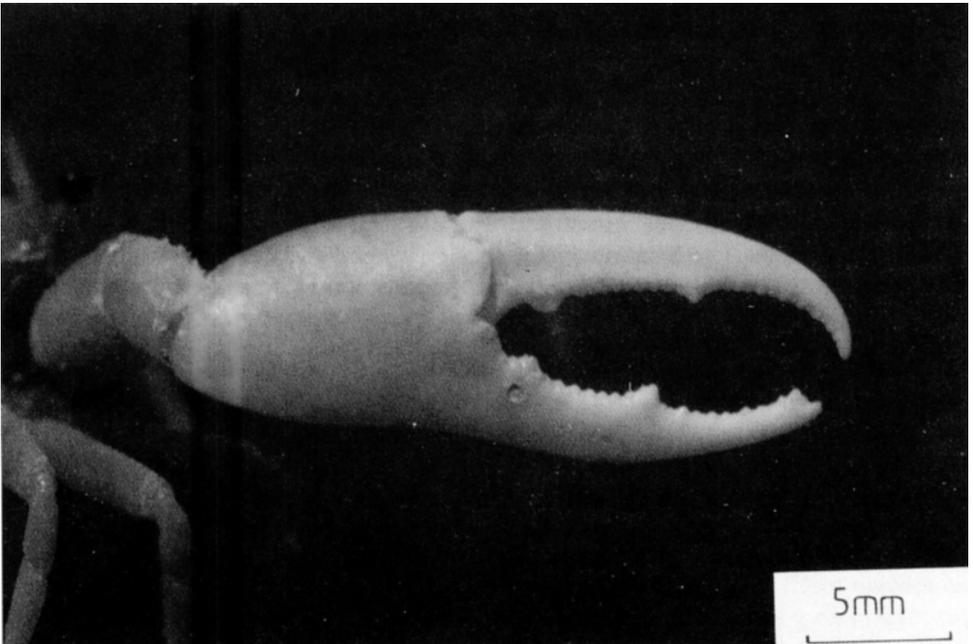


Fig. 7. — *Uca annulipes* (H. Milne Edwards 1852), large chela of male, forma *typica*.



Fig. 8. — *Uca annulipes* (H. Milne Edwards 1852), large chela of male, forma *anodonta*.

Distribution. Widely distributed in the Indo-Pacific ranging from the Red Sea, east coast of Africa, Madagascar, South Africa, Mauritius (GUINOT 1967), to India, Samoa and Japan (CROSNIER 1965). *U. annulipes* has previously been reported in the Arabian Gulf by JONES (1986), STEPHENSEN (1945) and NOBILI (1906a).

Its habitat preference in Umm Al Quwain mangal is similar to that described in the African mangal. HARTNOLL (1975) reported finding it in Tanzania from the drier landward part of coastal mangrove and as abundant in the creek mangrove of the *Avicennia* and *Ceriops* zones, and in the landward sand flat and deeper zones of the mangrove. BARNARD (1950) recorded it from muddy shores and mangrove swamps in South Africa.

Remarks. The species can be readily identified by reference to the accounts by BARNARD (1950), CROSNIER (1965) and SERÈNE (1973a, 1973b).

Two different forms of the male major chela were observed in this study. The existence of dimorphic males of a single species of *Uca* has been documented by SERÈNE (1973a, 1973b) and HARTNOLL (1975). SERÈNE (1973a) suggested designating the different forms of *Uca annulipes* as forma *typica*, *anodonta* and *intermedia*; forma *typica* would be represented by males with a major chela with elongate palm, a submedian tooth on each finger and a dactylus 1.45 times the palm length, and forma *anodonta* with a shorter palm, without a submedian tooth on either finger and with a dactylus 1.80 times as long as the palm. Intermediate forms would be designated forma *intermedia* with a dactylus 1.55 times as long as the palm. Of the 68 males

collected in this investigation 41 were of the form *typica* and 18 form *anodonta*; several specimens were small with undifferentiated chelae.

SERÈNE (1973a) noted that the subvertical distal and subdistal crests of the inner palm surface could be used as additional specific identifying characteristics. The subdistal and distal granules of the subvertical crests from forma *typica* specimens ranged from 10 to 18 granules for the subdistal crest and 4 to 8 for the distal crest, while forma *anodonta* specimens displayed similar but less distinct and occasionally irregular granular distributions.

Uca vocans forma *excisa* (Nobili 1906)

Synonyms: *Uca marionis* Barnard 1950; *Uca marionis* form *excisa* Crosnier 1965.

Material examined: 1 male specimen collected in November from a burrow in the mangrove zone of station 2 and sympatric with abundant *Uca annulipes*. Carapace width and length 18.5 and 12.7 mm respectively.

Colouration. In formaldehyde, carapace light brown with orange blotches towards the posterior. Fixed finger and lower half of propodus orange and dactylus purple.

Distribution. *Uca vocans* forma *excisa* is widely distributed across the Indo-Pacific region ranging from the east coast of Africa, Madagascar, Red Sea, India, Samoa to Japan (CROSNIER 1965) with *Uca vocans* forma *vocans* (Linnaeus 1758) reported as far as eastern Australia (BARNARD 1950, CROSNIER 1965). I believe this to be one of the first reports of *U. vocans* in the Arabian Gulf.

Remarks. The specimen agrees well with the descriptions and illustrations given by BARNARD (1950), CROSNIER (1965) and SERÈNE (1973c) for the species. The three formae of the species *Uca vocans* (Linnaeus 1758) can be distinguished by examining the type of chela as described and figured by SERÈNE (1973c). The latter author also noted that 'the three forms can be collected on a same given spot and are not geographical forms'.

Uca inversa (Hoffmann 1874)

Material examined: 1 male specimen collected in January from a creek bordered with sparse *Avicennia* and *Arthrocnemum* vegetation running through the saltmarsh/mud flat of station 4. Carapace width and length 22.8 and 14.1 mm respectively.

Colouration. Live specimen with brown carapace and white blotches. Large chela with upper external propodus surface orange, middle region pink and lower propodus and both fingers white. Legs orange.

Distribution. Previously recorded from the Red Sea, east coast of Africa, South Africa and Madagascar (GUINOT 1967), extending along the southern tip of the Arabian peninsula including the island of Socotra (CRANE 1975: cited in COLLINS et al. 1984). It appears that the only other record of *Uca inversa* in the Arabian Gulf is of

one specimen collected from Iraq, cited by COLLINS et al. (1984). In the present study only one specimen of *U. inversa* was observed.

Remarks. Previously described by BARNARD (1950), CROSNIER (1965) and COLLINS et al. (1984). It can be easily distinguished from other *Uca* species by several features including chela and pleopod form.

Serenella leachii (Audouin 1826) (Fig. 9)

Synonym: *Macrophthalmus leachii* Audouin 1826.

Material examined: 16 specimens: 4 males, 12 females; 5 ovigerous females (carapace width ranging from 7.7 to 9.8 mm) collected in January and March. Maximum carapace width and length of males 9.1 and 6.2 mm, and of females 9.8 and 6.6 mm respectively. Specimens collected from the mangrove zone: station 2 (3 males, 6 females), station 4 (2 females), station 5 (4 females); and saltmarsh at station 4 (1 male).

Colouration. In formaldehyde, carapace and legs pale brown.

Distribution. *Serenella leachii* has previously been recorded from the Red Sea by POR et al. (1977) and JONES (1985: cited in SHEPPARD et al. 1992). This is the first record of this species in the Arabian Gulf.

Remarks. The specimens correspond well with the descriptions and figures of GORDON (1931) and MANNING & HOLTHUIS (1981).



Fig. 9. — *Serenella leachii* (Audouin 1826), male.

The genus *Serenella* was established by MANNING & HOLTHUIS (1981) with *S. leachii* the only member of the genus, although the latter authors considered the inclusion of *Tylodioplax indica* Alcock 1900. *S. leachii* can be distinguished from the latter by a number of features including the form of the male first pleopod (compare STEPHENSEN 1945: fig. 58E with MANNING & HOLTHUIS 1981: fig. 55 and GORDON 1931: fig. 27), the shape of the third maxillipeds and the form of the chelae. The pleopod is strongly reflexed upon itself with a tip bearing a triangular lobe, and the expansion of the antero-lateral corner of the merus of the third maxillipeds is not as pronounced as for *T. indica* (STEPHENSEN 1945: fig. 58C). The chelae exhibit sexual dimorphism unlike *T. indica*, are larger in the male and have a large square tooth on the cutting edge of the dactylus.

Family Portunidae

Portunus pelagicus (Linnaeus 1766)

Material examined: 38 specimen (15 males, 19 females, 4 unexable juveniles). Maximum carapace width and length of male 75.2 and 31.4 mm, and of female 65.4 and 29.4 mm respectively. Collected from sublittoral using a beach seine net: station 2 (6 males, 11 females, 1 juvenile), station 4 (2 males, 3 females), station 5 (6 males, 5 females, 1 juvenile); 1 male and 2 juveniles were collected at station 3 in standing water on the seaward mud flat.

Colouration. In preservative, carapace may be pale brown with off-white mottling.

Distribution. Widely distributed and commercially important species. Known from the Mediterranean (B. GALIL pers. comm.) and western area of the Indo-West Pacific region including the east coast of Africa, South Africa, Madagascar, Mauritius, Red Sea and Suez Canal, to the eastern region including Japan, Philippines, Australia and New Zealand (GUINOT 1967, STEPHENSEN 1972). Previously recorded in the Arabian Gulf by NOBILI (1906a), STEPHENSEN (1945) and JONES (1986). It is commonly found in shallow sublittoral waters and also caught offshore in locally made gargoor fish traps by artisanal fishermen.

Remarks. CROSNIER (1962) and STEPHENSEN (1972) provide good accounts of the species.

Thalamita crenata (Latreille 1829)

Material examined: 5 specimens (4 males, 1 ovigerous female). Ovigerous female (carapace width and length 57.4 and 37.7 mm respectively) collected in April. Maximum carapace width and length of males 78.0 and 51.6 mm respectively. Specimens were caught from a creek and pools of standing water in the mangal seaward mud flat of station 1 (1 female), station 2 (1 male) and station 4 (2 males), and from the shallow sublittoral of station 1 (1 male).

Colouration. Live specimen with brownish red carapace, olive green legs, dactylus and fixed finger bluish green with red tips. In alcohol, carapace and legs brown red, dactylus and fixed finger red with brown tips.

Distribution. *Thalamita crenata* ranges from the Red Sea, Madagascar, South Africa, Mozambique, Seychelles, Mauritius (GUINOT 1967), to Australia and Japan (CROSNIER 1962). It has been recorded in the Arabian Gulf by BASSON et al. (1977) and from Umm Al Quwain khor (ANONYMOUS 1984) although no details were given. Habitat preferences were recorded by STEPHENSON & HUDSON (1957) as 'intertidal, mud flats, under stones, boulders and mussel clumps, also mud banks, near mangroves, very occasionally amongst coral near the mainland'.

Remarks. The specimens agree well with the accounts given of the species by STEPHENSON & HUDSON (1957) and CROSNIER (1962). One minor difference was observed however, the metagastric transverse line running between the last anterolateral teeth is interrupted in the middle.

***Thalamita poissoni* (Audouin & Savigny 1817) (Fig. 10)**

Material examined: 9 specimens (3 males, 6 females); 3 ovigerous females (carapace widths ranging from 19.6 to 22.2 mm) collected in March. Maximum carapace width (measured between fifth anterolateral teeth) and length of males 33.5 and 22.1 mm, and of females 22.2 and 14.2 mm respectively. Specimens were caught from the shallow sublittoral at station 4 (1 male, 5 females) and station 5 (2 males, 1 female) during the months of March and May.

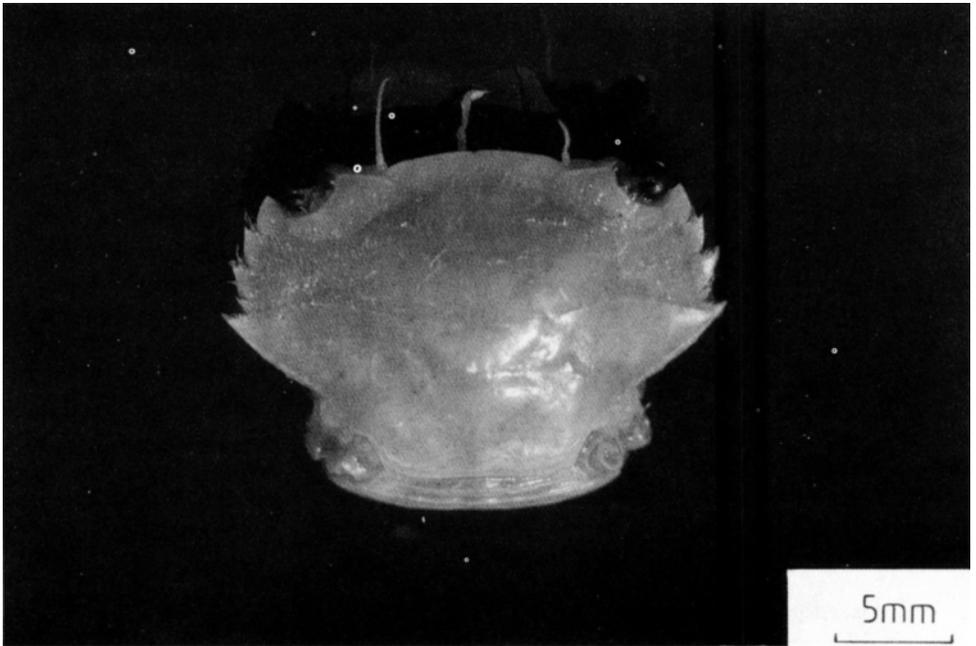


Fig. 10. — *Thalamita poissoni* (Audouin & Savigny 1817), female.

Colouration. In formaldehyde, carapace pale brown with red orange blotches.

Distribution. Reported from the Mediterranean (B. GALIL pers. comm.) and throughout the Indo-Pacific region from the Red Sea, east coast of Africa, Madagascar, Sri Lanka, Laccadive Islands, Marshall Islands and Japan (CROSNIER 1962, STEPHENSON 1972). Previous records from the Arabian Gulf include those by NOBILI (1906a) and STEPHENSEN (1945). STEPHENSON (1972) described its habitat as sandy mud and sand, and found to depths of 80 m.

Remarks. Can be readily identified as *Thalamita poissoni* (Audouin & Savigny) by reference to STEPHENSEN (1945), STEPHENSON & HUDSON (1957), CROSNIER (1962) and STEPHENSON (1972).

The carapace is hairless except in the vicinity of the anterolateral teeth, orbits and along the transverse ridges. The anterolateral border of the carapace is cut into five teeth and the fourth tooth considerably smaller compared to the others. The front is cut into two lobes and the basal antennal joint, which is of particular diagnostic value in the genus *Thalamita*, is slightly granular. The sixth segment of the male abdomen has convex lateral margins and further aids identification.

While this species can be specifically identified on general macroscopic features, STEPHENSON & HUDSON (1957) stressed the systematic importance of male first pleopods for precise identifications. The pleopod of *T. poissoni*, figured by STEPHENSEN (1945: fig. 31F-G), is quite distinctive having a recurved tip with up to about eight spines on the convex outer side.

Family Xanthidae

Eurycarcinus integrifrons De Man 1879 (Fig. 11)

Material examined: Collected from the mangal seaward mud flat of station 2 (2 males) and station 4 (2 males), and from the mangrove zone of station 5 (1 male). Maximum carapace width and length 36.1 and 25.5 mm respectively.

Colouration. In formaldehyde, carapace and upper chela pinkish or brownish.

Distribution. *Eurycarcinus integrifrons* has been recorded from the Red Sea, Aden, India, Pakistan and Far East (BALSS 1938) and from the Arabian Gulf in the lower eulittoral of muddy and sandy shores and seagrass beds (APEL 1994). Other members of the genus include *Eurycarcinus orientalis* A. Milne Edwards 1867, also reported from the Gulf (for example JONES 1986, APEL 1994) and found in the littoral fringe and upper eulittoral of muddy shores (APEL 1994), and *Eurycarcinus natalensis* (Krauss 1843). While the latter has not been found in the Gulf, it has been recorded from the Saudi Arabian mangal of the Red Sea (PRICE et al. 1987) and has a range extending to the east coast of Africa.

Remarks. Specimens agree with the descriptions and illustrations given by DE MAN (1879), NOBILI (1906b), BALSS (1938) and APEL (1994). *E. integrifrons* can be distinguished from other members of the genus by a number of features. For example, the three anterolateral teeth behind the external orbital angle differ; in *E. integrifrons* the first tooth is rounded and the last two are of a more dentiform (NOBILI 1906b) or

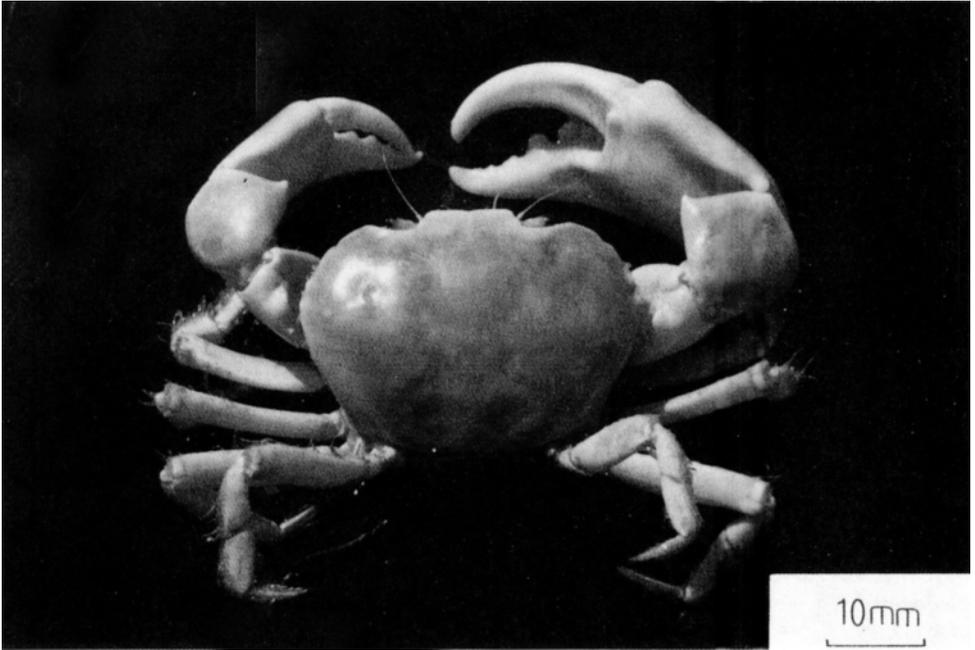


Fig. 11. — *Eurycarcinus integrifrons* De Man 1879, male.

acute (APEL 1994) shape, while *E. orientalis* has a rounded second and acute third. The second and third teeth of the Umm Al Quwain specimens are dentiform in shape, certainly in comparison to the first, but not as distinct as that illustrated by NOBILI (1906b: pl. XI). NOBILI (1906b) described the carapace front of *E. integrifrons*, which is similar to the Umm Al Quwain specimens, as straight with a slight medial notch and quite different from *E. orientalis* with a 'profonde et large échancrure triangulaire'.

The carapace width/length ratio also aids identification, with Umm Al Quwain specimens being 1.35 to 1.41 times as wide as long. This corresponds to the findings of APEL (1994) who assigned a ratio of at least 1.5 to *E. orientalis* and a value of less than 1.4 to *E. integrifrons*.

Pilumnopeus sp.

Material examined: 12 specimens (8 males and 4 females including one ovigerous) of the genus *Pilumnopeus* were collected from the sublittoral fringe of station 5 (1 male), and the shallow sublittoral of station 1 (2 males, 1 female), station 3 (4 males, 3 females) and station 5 (1 male).

Family Leucosiidae

Ebalia sp.

Material examined: 3 male specimens were collected in August from the shallow sublittoral of station 5. *Ebalia* has been reported from the mid to lower eulittoral of muddy and sandy shores in the Arabian Gulf (APEL 1994).

DISCUSSION

Of the 317 specimens collected during this study a total of 14 species and two genera (Grapsidae 4, Ocypodidae 6, Portunidae 3, Xanthidae 2 and Leucosiidae 1) were identified. Whereas most species are known from the Arabian Gulf, a number extend their geographical ranges; the presence of *Metopograpsus thukuhar*, *Uca vocans* forma *excisa* and *Serenella leachii* are recorded for the first time.

There exists limited literature on the brachyuran fauna of the Arabian Gulf and is particularly scarce with regard to mangal associated crabs. On the Gulf coast mangrove-associated biota have been documented in Saudi Arabia (BASSON et al. 1977, APEL 1994) and Bahrain (JONES 1985, VOUSDEN 1988: cited in SHEPPARD et al. 1992), and the present study provides a further insight into the carcinological fauna of the Gulf coast mangal ecosystem. The brachyuran species composition and ecological zonation of Umm Al Quwain mangal is similar to that found in the above areas with many species represented by the Ocypodidae and Grapsidae.

Of the Grapsidae, *Metopograpsus messor* is the most dominant in the mangrove zone and occasionally sighted landward and seaward of this zone. In addition to its conspicuous presence in mangroves, it is abundant on rocky intertidal substrates and most other intertidal habitats in the Gulf (BASSON et al. 1977). Another species *Metopograpsus thukuhar*, observed in the Red Sea by HOLTHUIS (1977) and described as a 'mangrove crab', is recorded from the Gulf for the first time; the latter author observed it together with *M. messor* amongst the pneumatophores of *Avicennia* in shallow water in the Gulf of Aqaba. In the saltmarsh immediately landward of the mangrove, *Sesarma (Parasesarma) plicatum* was observed. While recorded by JONES (1985) in Kuwait, its presence in Umm Al Quwain is apparently the only other record of this species along the southern Gulf coast. *Ilyograpsus paludicola*, previously recorded in the northern Gulf and Saudi Arabia (JONES 1986, APEL 1994), was the fourth grapsid species encountered. Interestingly, the present study did not come across any specimen of *Metaplex indica* (H. Milne Edwards 1852); its absence surprising given that it is reported from the mid to lower intertidal of muddy shores in Saudi Arabia and Kuwait (JONES 1986, APEL 1994).

Of the Ocypodidae, *Macrophthalmus depressus* and *Uca annulipes* are most numerous. The intertidal distribution of the former, extending from the mid to the lower intertidal of mud flats is described elsewhere in the Gulf (JONES 1986, APEL 1994). Also from the mangal seaward mud flat, one specimen of *Macrophthalmus dilatatus sulcatus* was unearthed; another record being from Saudi Arabia (APEL 1994). While *Uca* are absent from Saudi Arabia, three species of fiddler crab were recorded in Umm Al Quwain. All specimens collected were *Uca annulipes* except for one specimen representing each of the other two species *Uca vocans* forma *excisa* and *Uca inversa*. *U. v. excisa* is recorded in the Gulf for the first time. *U. inversa* was previously reported in Iraq although COLLINS et al. (1984) suggest that populations may not be contiguous with the main distribution that extends along the eastern coast of Africa, Red Sea to the southern tip of the Arabian peninsula. *U. annulipes* is well known from the Gulf (NOBILI 1906a, STEPHENSEN 1945, COLLINS 1984, JONES 1986) and the present study shows it to be commonly associated with mangrove and saltmarsh of the upper intertidal. Several specimens of another ocypodid *Serenella leachii*, were also found in the mangal and represent an extension of its distribution from the Red Sea (POR et al. 1977, JONES 1985: cited in SHEPPARD et al. 1992).

Three species of portunid were recorded. The most commonly encountered was *Portunus pelagicus*, with occasional specimens of *Thalamita crenata* and *Thalamita poissoni*. All are widely distributed throughout the Indo-Pacific region and well known from the Arabian Gulf. *P. pelagicus* and *T. poissoni* are also reported from the Levant Basin of the Mediterranean.

From the collections two xanthids were identified: *Eurycarcinus integrifrons* and a species of *Pilumnopus*. While few xanthids have been observed from mangal and muddy shores of the Arabian region (JONES 1985, VOUSDEN 1988: cited in SHEPPARD et al. 1992, APEL 1994) considerable collections have been described from other intertidal and shallow subtidal habitats in Oman (HOGARTH 1994) and along the east coast of Africa (GALIL & CLARK 1988, GALIL & LEWINSOHN 1983, GALIL & VANNINI 1990). In their studies on the brachyura of Somalia, GALIL & VANNINI (1990) reported *Leptodius exaratus*, *L. gracilis* and *L. sanguineus* as prominent xanthoids of mangrove creeks and sheltered pools. However, while not observed in the present study, more intensive sampling of the creek system in particular, may reveal the presence of these and other xanthids.

Probably one of the least reported crab families associated with the mangal is the Leucosiidae. In the present study three specimens of one species belonging to the genus *Ebalia* were collected. Another record of *Ebalia* in the Gulf is from Saudi Arabia by APEL (1994).

ACKNOWLEDGEMENTS

Thanks are due to colleagues of the Desert and Marine Environment Research Center for their assistance during the long hours of field work, and to Dr D.A. Jones of the University of Wales and Dr R. Hartnoll of the University of Liverpool for their help with some specimen identifications. Thanks also go to the Desert & Marine Environment Research Center of the United Arab Emirates University, and to Shell Gas Abu Dhabi and Shell Markets Middle East for funding the study.

REFERENCES

- ALCOCK A. 1900. Materials for a carcinological fauna of India, No. 6. The Brachyura Catometopa and Grapsoidea. *Journal of the Asiatic Society of Bengal* 69 (2) No. 3: 280-456.
- ANONYMOUS 1984. Study on the mariculture environment of Umm Al Quwain lagoon and experimental rearing of shrimp, rabbitfish and mullet. *Technical Report No. 8, United Arab Emirates Department of Fisheries*.
- APEL M. 1994. Identification key for soft-sediment intertidal brachyura, pp. 434-437. In: Feltkamp E. & Krupp F., Edits. Establishment of a marine habitat and wildlife sanctuary for the Gulf region. *Final Report for Phase II. Jubail & Frankfurt CEC/NCWCD*.
- BALSS H. 1938. Ueber einige Xanthidae (Crustacea Decapoda) von Singapore und Umgebung. *Bulletin of the Raffles Museum* 14: 48-63.
- BANERJEE S.K. 1960. Biological results of the Snellius Expedition. XVIII. The genera *Grapsus*, *Geograpsus* and *Metopograpsus* (Crustacea Brachyura). *Temminckia* 10: 132-199.
- BARNARD K.H. 1950. Descriptive catalogue of South African decapod Crustacea. *Annals of the South African Museum* 38: 1-837.
- BARNARD K.H. 1955. Additions to the fauna-list of South African Crustacea and Pycnogonida. *Annals of the South African Museum* 43: 1-107.

- BARNES R.S.K. 1970. The species of *Macrophthalmus* (Crustacea: Brachyura) in the collections of the British Museum (Natural History). *Bulletin of the British Museum of Natural History (Zoology)* 20: 206-251.
- BARNES R.S.K. 1977. Concluding contribution towards a revision of, and a key to, the genus *Macrophthalmus* (Crustacea: Brachyura). *Journal of Zoology, London* 182: 267-280.
- BASSON P.W., BURCHARD J.E., HARDY J.T. & PRICE A.R.G. 1977. Biotopes of the Western Arabian Gulf. *Aramco, Dhahran*, 284 pp.
- CHHAPGAR B.F. 1957. On the marine crabs (Decapoda: Brachyura) of Bombay State. *Journal of the Bombay Natural History Society* 54: 399-439, 503-549.
- COLLINS M.J., JONES D.A. & CLAYTON D.A. 1984. Redescription of *Uca sindensis* (Alcock, 1900) (Brachyura: Ocypodidae) with notes on the ecology of a population from Kuwait. *Journal of Crustacean Biology* 4 (2): 318-328.
- CRANE J. 1975. Fiddler crabs of the world (Ocypodidae: genus *Uca*). *Princeton, New Jersey: Princeton University Press*, 736 pp.
- CROSNIER A. 1962. Crustacés Decapodes, Portunidae. *Faune de Madagascar* 16: 1-154.
- CROSNIER A. 1965. Crustacés Decapodes, Grapsidae et Ocypodidae. *Faune de Madagascar* 18: 1-143.
- DE MAN J.G. 1879. On some new or imperfectly known podophthalmous Crustacea from the Leyden Museum. *Notes from the Leyden Museum* 1: 53-73.
- FISHELSON L. 1971. Ecology and distribution of the benthic fauna in the shallow waters of the Red Sea. *Marine Biology* 10: 113-133.
- GALIL B. & CLARK P.F. 1988. On a collection of *Acropora*-inhabiting trapeziids (Crustacea Brachyura Xanthoidea) from East Africa. *Tropical Zoology* 1: 137-151.
- GALIL B. & LEWINSOHN CH. 1983. Researches on the coast of Somalia. *Trapezia richtersi* n. sp., a new trapezid crab (Decapoda Brachyura). *Monitore Zoologico Italiano (Nuova Serie) Supplemento* 18: 159-166.
- GALIL B. & VANNINI M. 1990. Research on the coast of Somalia. Xanthidae, Trapeziidae, Carpiliidae, Menippidae (Crustacea Brachyura). *Tropical Zoology* 3: 21-56.
- GORDON I. 1931. Brachyura from the coasts of China. *Journal of the Linnaean Society London, Zoology* 37, No. 254: 525-558.
- GUINOT D. 1967. La faune carcinologique (Crustacea Brachyura) de l'Océan Indien occidental et de la Mer Rouge. Catalogue, remarques biogéographiques et bibliographie. *Memoires de l'Institut Fondamental d'Afrique Noire* 77: 235-352.
- HARTNOLL R.G. 1975. The Grapsidae and Ocypodidae (Decapoda: Brachyura) of Tanzania. *Journal of Zoology, London* 177: 305-328.
- HOGARTH P.J. 1994. Brachyuran crabs (Xanthoidea: Xanthidae, Pilumnidae, Menippidae and Trapeziidae) of southern Oman. *Tropical Zoology* 7: 93-108.
- HOLTHUIS L.B. 1977. The Grapsidae, Gecarcinidae and Palicidae (Crustacea: Decapoda: Brachyura) of the Red Sea. *Israel Journal of Zoology* 26: 141-192.
- JONES D.A. 1984. Crabs of the mangal ecosystem, pp. 89-109. In: Por F.D. & Dor I., Edits. *Hydrobiology of the mangal. The Hague: Dr. W. Junk Publishers*, 260 pp.
- JONES D.A. 1985. The biological characteristics of the marine habitats found within the ROPME Sea Area. *Proceedings of ROPME Symposium on Regional Marine Pollution Monitoring and Research Programmes (ROPME/GC-4/2)*: 71-89.
- JONES D.A. 1986. A field guide to the seashores of Kuwait and the Arabian Gulf. *University of Kuwait and Blandford Press, Poole*, 192 pp.
- LAURIE R.D. 1915. Reports on the marine biology of the Sudanese Red Sea XXI. On the Brachyura. *Journal of the Linnaean Society of London (Zoology)* 31: 407-475.
- MACNAE W. & KALK M. 1962. The ecology of the mangrove swamps at Inhaca Island, Mozambique. *Journal of Ecology* 50: 19-34.
- MANNING R.B. & HOLTHUIS L.B. 1981. West African brachyuran crabs (Crustacea: Decapoda). *Smithsonian Contributions to Zoology* 306: 1-379.
- NOBILI G. 1906a. Crustacés Decapodes et Stomatopodes. Mission J. Bonnier et Ch. Pérez (Golfe Persique 1901). *Bulletin Scientifique de la France et de la Belgique, Paris* 40: 13-159.
- NOBILI G. 1906b. Faune carcinologique de la Mer Rouge, Décapodes et Stomatopodes. *Annales des Sciences Naturelles (Zoologie), Paris* (9) 4: 1-347.

- POR F.D. 1984. The ecosystem of the mangal, general considerations, pp. 1-14. In: Por F.D. & Dor I., Edits. The hydrobiology of the mangal. *The Hague: Dr. W. Junk Publishers*, 260 pp.
- POR F.D., DOR I. & AMIR A. 1977. The mangal of Sinai: limits of an ecosystem. *Helgoländer Wissenschaftliche Meeresuntersuchungen* 30: 295-314.
- PRICE A.R.G., MEDLEY P.A.H., McDOWALL R.J., DAWSON-SHEPPARD A.R., HOGARTH P.J. & ORMOND R.F.G. 1987. Aspects of mangal ecology along the Red Sea coast of Saudi Arabia. *Journal of Natural History* 21: 449-464.
- SERÈNE R. 1973a. A key for the separation of the Indo-Pacific species of *Uca* Leach 1814. *Special Publication of the Marine Biological Association, India*: 349-361.
- SERÈNE R. 1973b. Notes sur quelques espèces de brachyours de Nouvelle-Calédonie. *Cahiers du Pacifique* 17: 119-161.
- SERÈNE R. 1973c. The names of the forms of *Uca vocans* (Linnaeus) (Decapoda, Ocypodidae). *Crustaceana* 24: 337-339.
- SERÈNE R. & SOH C.L. 1970. New Indo-Pacific genera allied to *Sesarma* Say 1817 (Brachyura, Decapoda, Crustacea). *Treubia* 27: 387-416.
- SHEPPARD C., PRICE A. & ROBERTS C. 1992. Marine ecology of the Arabian Region, patterns and processes in extreme tropical environments. *London: Academic Press*, 359 pp.
- STEPHENSON K. 1945. The Brachyura of the Iranian Gulf. *Danish Scientific Investigations in Iran* 4: 57-237.
- STEPHENSON W. 1972. An annotated check list and key to the Indo-West-Pacific swimming crabs (Crustacea: Decapoda: Portunidae). *Bulletin of the Royal Society of New Zealand* 10: 1-64.
- STEPHENSON W. & HUDSON J.J. 1957. The Australian portunids (Crustacea; Portunidae) II. The genus *Thalamita*. *Australian Journal of Marine and Freshwater Research* 8 (3): 312-368.
- TWEEDIE M.W.F. 1949. The species of *Metopograpsus* (Crustacea, Brachyura). *Bijdragen tot de Dierkunde, Leiden* 28: 466-471.
- VOUSDEN D.H.F. 1988. The Bahrain marine habitat survey. Vol. 1. *The Technical Report, ROPME*, 103 pp.