Ann. Naturhist. Mus. Wien	93	B	189–238	Wien, 30. August 1992

The Thalassinidea in the Museum of Natural History, Vienna; with some remarks on the biology of the species

By Peter C. Dworschak[1])

(With 18 Figures)

Manuscript submitted April 4th, 1991

Zusammenfassung

Die Thalassinidea sind eine Gruppe (Tribus, Überfamilie oder Unterordnung) dekapoder Krebse mit vorwiegend grabender Lebensweise. Eine umfangreiche Privatsammlung dieser Krebse wurde in die Sammlung des Naturhistorischen Museums in Wien übertragen. Dabei wurde der Bestand dieser Gruppe am Museum um 17 auf insgesamt 52 Arten erweitert und eine Sichtung der Bestände durchgeführt. Es zeigte sich, daß manche Bestimmungen zu korrigieren bzw. die Namen dem jetzigen Stand der Taxonomie dieser Gruppe anzupassen waren. Im lange Zeit unbestimmten Material fanden sich einige nun bekannte Formen, darunter z.B. ein Vertreter der seltenen Gattung *Ctenocheles*. Die meisten Arten (28) gehören zur Familie der Callianassidae. 15 Arten der Upogebiidae sind in der Sammlung vertreten; die Axiidae mit 5, Callianideidae und Thalassinidea mit je 2 Arten, die Laomediidae mit nur einer Art. Zu mehreren besser bekannten Formen werden Angaben zu ihrer Biologie angeführt. Zu manchen bislang nur spärlich dokumentierten Arten werden Abbildungen präsentiert.

Summary

Due to the transfer of a private collection of Thalassinidea – a group of mainly burrowing decapods – the number of species in the collection of the Museum of Natural History in Vienna has been increased by 17 species to a total of 52. A re-examination of the material already present in the collection made it necessary to correct some identifications or adapt them according to our recent knowledge of the taxonomy of this group. Eight formerly unidentified species belonged to now described species, among them one species of the rare genus *Ctenocheles*. Details on their biology of some of the better known species is given. In addition, certain poorly documented species are now figured.

Introduction

The Thalassinidea are a group (tribe, superfamily, or suborder) of decapod Crustacea with a mainly burrowing life habit. Several opinions exist about the systematic position of the Thalassinidea within the Decapoda, especially regarding their inclusion in the Anomura (Borradaile 1907; Balss 1957; Glaessner 1969; Sakai & Saint Laurent 1989) or not (Bouvier 1940; Zariquiey Alvarez 1968; McLaughlin & Holthuis 1985; Martin & Abele 1986).

[1]) Author's address: Dr. Peter C. Dworschak, Institut für Zoologie der Universität Wien, Althanstraße 14, A-1090 Wien, Austria.

They are a very inhomogenous group which have in common only the burrowing life habit (SAINT LAURENT, pers. comm. 1989). Several cladistic analyses show that they are certainly not a monophyletic group (KENSLEY, pers. comm. 1989).

Several years of work on the biology of thalassinideans led to an accumulation of several species from different parts of the world. Due to space problems this collection was transferred to the Museum of Natural History in Vienna (= NHMW). The opportunity was taken to also re-examine the thalassinidean material already present at the NHMW. The results of this re-examination are presented in this paper.

Data on the material examined is listed in the following order:

Regional Sea – country/state (only if widely distributed and material from different regions is present), town/island, exact location if stated, (details on habitat): number of males, number of females, (or unsexable specimens), name of collector and/or donator, and sampling method (if stated), date, NHMW No. (and acquisition number in brackets – if available).

Size of specimens is given in mm as total length (tl from tip of rostrum to end of telson) and carapace length (cl). Abbreviations used are: A 1 = antennule; A 2 = antenna; P 1, P 2, ... = pereiopod 1, pereiopod 2, ... ; mxp = maxilliped; pl = pleopod.

Family Callianassidae DANA, 1852

This family has been divided in the two subfamilies Callianassinae and Thomassiniinae by SAINT LAURENT (1979); only the first is represented in the collections.

Several genera were established in 1973 by SAINT LAURENT. With the exception of the genus *Callichirus,* all have been accepted in most subsequent publications. A more restricted definition of the genus *Callichirus* was given by MANNING & FELDER (1986). MANNING (1987) revived the genus *Glypturus* STIMPSON and established the genus *Corallianassa* for *C. longiventris,* with an emendation in 1988 (MANNING 1988). SAKAI (1988) described the new genus *Neocallichirus.* In 1989, MANNING & FELDER gave a communication in which they revive two former genera (*Lepidophthalmus* HOLMES and *Trypaea* DANA) and define five new genera for the West Atlantic members of the family.

Genus *Callianassa* LEACH, 1814

Callianassa audax DE MAN, 1911
(Fig. 1a-d)

Callianassa audax DE MAN, 1991: 223.

Callianassa (Callichirus) audax DE MAN, 1928b: 179, pl. 20, fig. 31–31i; VEDAVYASA RAO & RASACHANDRA KARTHA, 1967: 279, fig. 1–2; TIRMIZI, 1967: 151, fig. 1–2.

Callichirus audax SAINT LAURENT & LELOEUFF, 1979: 97.

Material: Penang, Siam: 1 male, STEINDACHNER don., NHMW No. 6707 (1882 I. 16.).

Remarks: The specimen is a male, with a total length of 61 mm (cl = 17 mm), pleopods 1+2 are present, the large P 1 is on the right. The shape of P 1

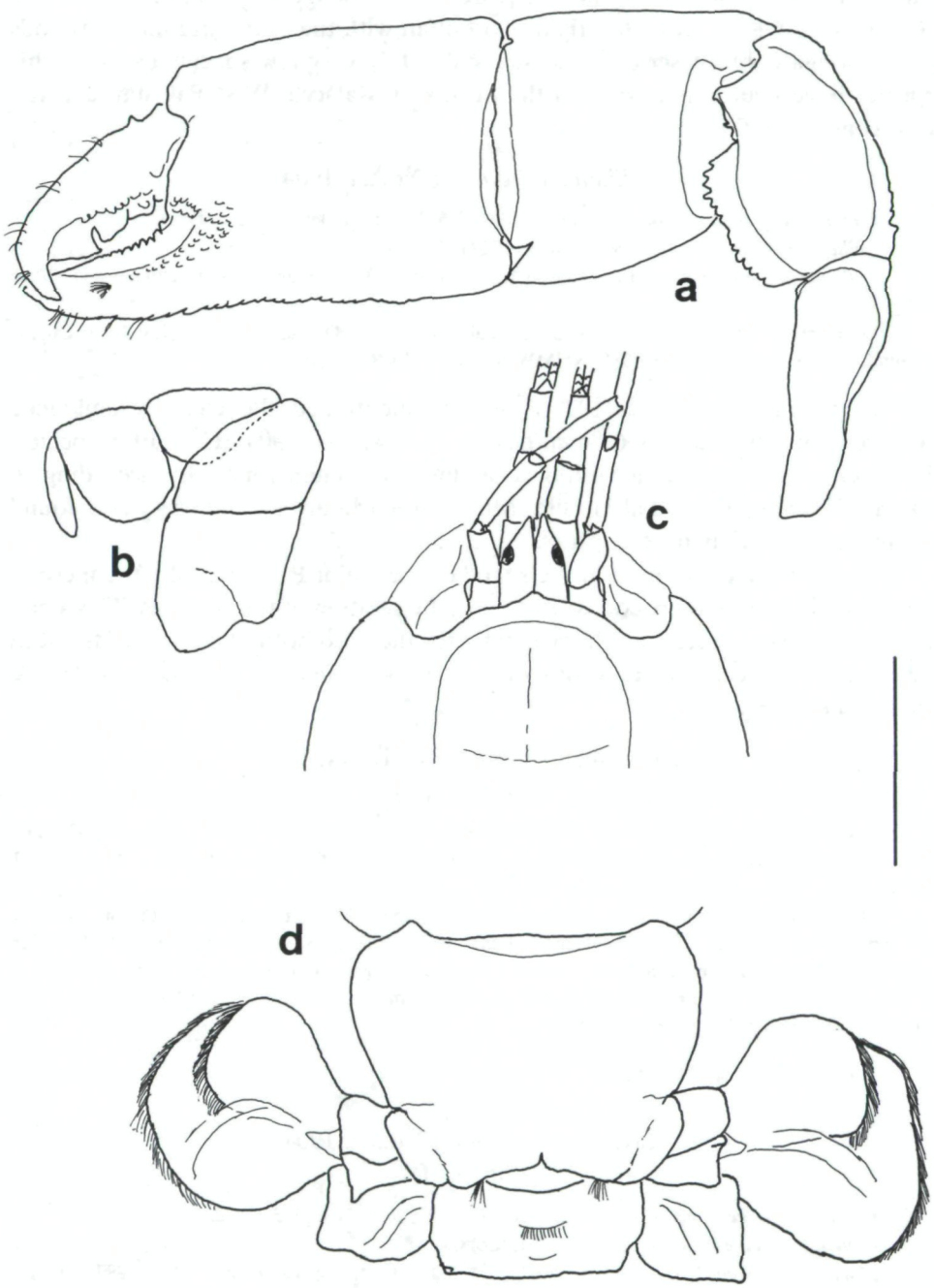

Fig. 1: *Callianassa audax* (NHMW No. 6707).
a: major cheliped, inner side; b: mxp 3, outer side, setae omited; c: front in dorsal view; d: fan tail in dorsal view; scale is 6 mm.

and mxp 3 is in good agreement with the figures given in DE MAN (1928). The inner uropod, however, is more squared, not triangular. VEDAVYASA RAO & RASACHANDRA KARTHA (1967) figured a tailfan with the outer and inner uropods more elongate, but described it as squarish. Only very few specimens (8) of this species have been reported from the Straits of Malacca, West Pakistan and the east coast of India.

Callianassa bouvieri NOBILI, 1904

Callianassa (Trypaea) Bouvieri NOBILI, 1904: 236; NOBILI, 1906: 105, pl. 6, fig. 3.

Callianassa (Trypaea) bouvieri DE MAN, 1928a: 27, 107.

Callianassa bouvieri HOLTHUIS, 1958: 38, fig. 15; SAKAI, 1970: 46; DWORSCHAK & PERVESLER, 1988: 3, fig. 3.

Material: Red Sea – Egypt, Safaga, 3 males, 2 females, DWORSCHAK coll. Nov. 1984; 1 male, 2 females, PERVESLER coll. May 1986; NHMW No. 6591 (1988 XVI.).

Remarks: DE MAN (1928a) already mentioned the close resemblance between this species and *C. maldivensis* BORRADAILE 1904. The latter species, however, was described according to a single specimen (once dry according to DE MAN 1928a) collected at Hulule (Male Atoll, Maldives), and was never found again since its original description.

There is great variation in the shape of the major P1 (especially the incision between dactylus and propodus) as well in the setation of the dactylus. This small (tl = 12–25 mm) species ist characteristic for the hard bottom mangal of the Red Sea, where it occurs in densities of up to 454 animals · m^{-2} (DWORSCHAK & PERVESLER 1988).

Callianassa californiensis DANA, 1854
(Fig. 2a, c, e)

Callianassa californiensis DANA, 1854: 175; HOLMES, 1900: 159, pl. 2 fig. 27; SCHMITT, 1921: 117, fig. 78; STEVENS, 1928, figs. 10–13, 16–17, 55–71; MACGINITIE, 1934: 166–176, pls. 5–6; 1935: 709, fig. 14.

Material: British Columbia, Vancouver Island: 1 male, MILNE EDWARDS coll. et don., NHMW No. 6612 (1864 III. 21); – California, Tomales Bay: 3 males, 2 females (1 ovigerous), NHMW No. 6616 (Alte Sammlung); – Lower California: 1 male, 1 female, STEINDACHNER don., NHMW No. 6617 (1874 I. 31; – Mexico, Baja California, Bahia de San Quintin: 10 males, 1 female, 2 juveniles, R. GRIFFIS coll. March 1987, NHMW No. 6781.

Remarks: see *C. gigas.*

Callianassa calmani NOBILI, 1904
(Fig. 3a–f)

Callianassa (Cheramus) Calmani NOBILI, 1904: 237; 1906: 104, pl. 5, fig. 2.

Callichirus calmani SAINT LAURENT & LELOEUFF, 1979: 97.

Material: Red Sea, Aquaba: 1 male, 1 female, J. DE VAUGELAS coll. Dec. 1987, NHMW No. 6780.

Remarks: This species is common in the sandy intertidal and shallow subtidal of the Red Sea (VAUGELAS 1990).

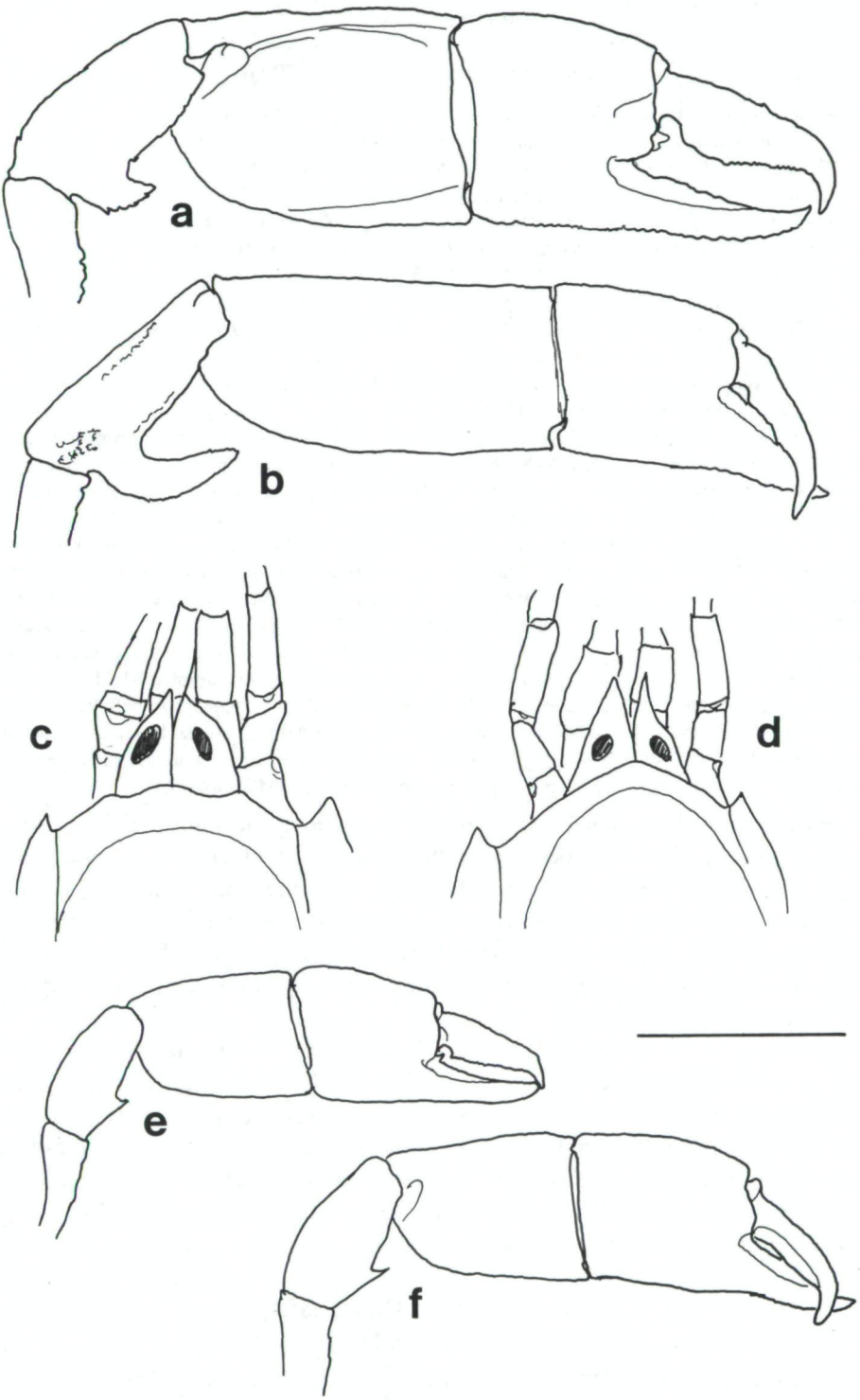

Fig. 2: *Callianassa californiensis* (NHMW No. 6781) and *C. gigas* (NHMW No. 6782).
a: major cheliped of *C. californiensis,* inner side (male with tl = 36 mm); b: same of *C. gigas* (male with tl = 31 mm); c: front in dorsal view *C. californiensis* (male with tl =36 mm); d: same of *C. gigas* (female with tl = 36 mm); e: major cheliped of *C. californiensis,* inner side (female with tl = 35 mm); f: same of *C. gigas* (female with tl = 36 mm); scale is 6 mm (a, b, e, f) and 3 mm (c, d).

Callianassa candida (OLIVI, 1792)

Cancer candidus OLIVI, 1792: 51, pl. 3, fig. 3.

Callianassa laticauda HELLER, 1863: 203 (not *C. laticauda* OTTO = *C. tyrrhena*).

Callianassa subterranea forma *pontica* CZERNIAVSKY, 1884: 81.

Callianassa (Callichirus) stebbingi PESTA, 1918: 201 (partim), fig. 63.

Callianassa (Callichirus) laticauda PESTA, 1918: 204 (not *C. laticauda* OTTO = *C. tyrrhena*).

Callianassa (Callichirus) Pestae DE MAN, 1928a: 34, pl. 9, fig. 16–16e.

Callianassa algerica LUTZE, 1938: 168, fig. 22–26, 26a–b, 27.

Callianassa pestai HOLTHUIS, 1953: 95, fig. 3.

Callianassa pontica SAINT LAURENT & BOŽIĆ, 1976: 24, figs. 5, 13, 21, 32 (complete synonymy); GARCIA RASO, 1983: 323, fig. 3.

Callianassa pestae MANNING & ŠTEVČIĆ, 1982: 295; FROGLIA & GRIPPA, 1986: 261.

Callianassa candida LEWINSOHN & HOLTHUIS, 1986: 20.

Material: Adriatic Sea – Slovenia, Strunjan (intertidal): 1 male, 1 female, P. DWORSCHAK coll. Sept. 1985 with yabby pump, NHMW No 6789; Piran (under stones): 2 males, LICHTENSTERN don., NHMW No. 313 (1886 IV. 1.); 1 ovigerous female, NHMW No. 314 (1886 IV. 1.); 8 males, 10 females, NHMW No. 317 (1884 I. 12.); Rovinj: 3 specimens (fragments), LICHTENSTERN don., NHMW No. 316 (1886 IV. 2.); Croatia, Rovinj, Montauro (boulder field in 3 m, sand under stone): 1 male, J. OTT coll. July 1988, NHMW No. 6778; S. Palu near Rovinj (intertidal in mud under stones): 1 female, P. DWORSCHAK coll. 2. August 1982, NHMW No. 6902; Lesina (= Hvar): 1 female, BUCCICH don., NHMW No. 318 (1888 VI. 1.). – Italy, Zaule: 1 male, MARENZELLER coll., NHMW No. 315 (1878 III. 5.); Adria?: 1 specimen (unsexable), NHMW No. 319 (Alte Sammlung); Aurisina: 1 juvenile, 1 female (9 m), 1 female (6 m), P. DWORSCHAK & P. PERVESLER coll. August 1984 with air lift sampler, NHMW No. 6790; Lido di Staranzano (intertidal), 2 males, 3 females (1 ovigerous), P. DWORSCHAK coll. with yabby pump. 9. October 1984, NHMW No. 6788; Lagoon of Grado (intertidal): 1 female P. DWORSCHAK coll. 11. November 1977, NHMW No. 6791; Punta Sabbioni (mudflat in Venice-lagoon, intertidal): 3 males, 2 females, P. DWORSCHAK coll. 25 March 1989 with yabby pump, NHMW No. 6761.

Remarks: This species is better known under the names *C. pontica* or *C. pestae (pestai)*. There has been much discussion as to which of these two names has priority, and in 1986 LEWINSOHN & HOLTHUIS used the name *candida*. Although the arguments for this decision are still not convincing – white cheliped of this species – and in contradiction with earlier arguments of HOLTHUIS (1953), especially with respect to the very poor figure in OLIVI (1792), the name *candida* is used here for sake of stability.

This species is, besides *C. tyrrhena* (see below), one of the most common callianassids in the Mediterranean. It can often be found together with *C. tyrrhena* and *Upogebia pusilla* in the same habitat, but occurs higher up in relation to tidal level and in more muddy sediments. In addition, this species is also common in coarse sand or mud under stones in the intertidal and shallow subtidal, and has also been found in sandy silt or mud in 7 to 9 m depth (THESSALOU-LEGAKIS & ZENETOS 1985; DWORSCHAK pers. obs.).

Callianassa gigas DANA, 1852
(Fig. 2b, d, f)

Callianassa gigas DANA, 1852a: 19; 1852b: 512; 1855: pl. 32, fig. 3; HOLMES, 1900: 162; SCHMITT, 1921: 119, fig. 80; STEVENS, 1928: 325, figs. 6–9, 14–15, 38–54; MACGINITIE, 1935: 712.

Callianassa longimana STIMPSON, 1857: 86; HOLMES, 1900: 161, pl. 2, fig. 28; SCHMITT, 1921: 117, fig. 79.

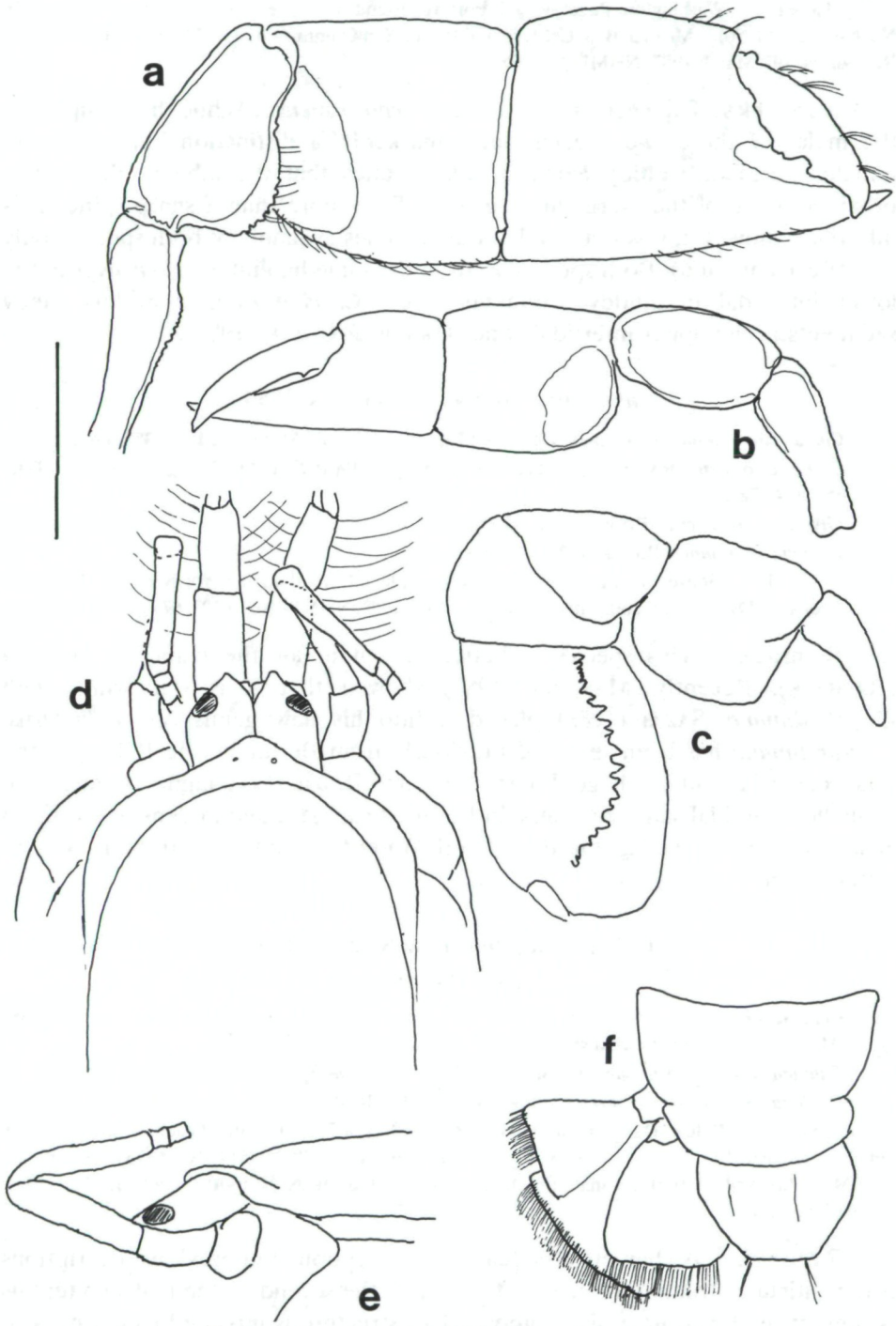

Fig. 3: *Callianassa calmani* (NHMW No. 6780, female).
a: major cheliped, inner side; b: minor cheliped, inner side; c: mxp 3, inner side, setae omitted; d: front in dorsal view; e: same in side view; f: tail fan in dorsal view; scale is 6 mm (a, b, f) and 3 mm (c, d, e).

Material: Washington, Puget Sound, Port Townsend: 1 female, STEINDACHNER coll., NHMW No. 6893 (1874 I. 56). – Mexico, Baja California, Bahia de San Quinitn: 4 males, 2 females (1 ovigerous), R. GRIFFIS coll. March 1987, NHME No. 6782.

Remarks: This species is similar to *C. californiensis*. While the chelipeds in the males of these two species differ markedly, a distinction between small females poses difficulties. STEVENS (1928) states that the lobe at the infero-proximal angle of the merus in *C. gigas* is little more than a sharp spine. This difference, however, was not visible in the females available of both species (only one of each at hand). Both species occur in the same habitat; *C. gigas* lives in the lower intertidal in muddy sediments, while *C. californiensis* prefers sandy sediments in the upper intertidal zone (GRIFFIS & CHAVEZ 1988).

Callianassa grandimana GIBBES, 1850

Callianassa grandimana GIBBES, 1850: 194; BIFFAR, 1971: 649; MANNING, 1987: 388, fig. 2.

Glypturus branneri RATHBUN, 1900: 150, pl. 8, figs. 5–8; 1901: 93; 1920: 328, fig. 3; SCHMITT, 1924a: 93; 1935a: 194, fig. 55.

Glypturus siguanensis BOONE, 1927: 85, fig. 17.

Callianassa branneri BIFFAR, 1971: 661, figs. 5–6.

Material: Belize, South Water Cay (lagoonside intertidal to 0.5 m): 5 males, 2 females (1 ovigerous), P. DWORSCHAK coll. with yabby pump June 1989, NHMW Nos. 6797, 6798, 6799, and 6896.

Remarks: This species is better known under the name *C. branneri* (RATHBUN). Recently, MANNING (1987) showed that it is synonymus with *C. grandimana*. SAKAI (1988) placed it into his new genus *Neochallichirus*. *C. grandimana* has been reported previously from Bermuda, the Bahamas, the west coast of Florida, Tobago, Puerto Rico, and Brazil. It is common in intertidal to shallow subtidal sandy bottoms. In Belize, it can be found in densities of up to 36 animals · m^{-2} at the lagoonside of South Water Cay from the intertidal to 0.7 m water depth.

Callianassa jamaicense SCHMITT, 1935
(Fig. 4a–d)

Callianassa jamaicense SCHMITT, 1935b: 9, pl. 1 fig. 1, pl. 2 fig. 6, 8, pl. 4 fig. 1; BIFFAR, 1971: 654 (key); MANNING, 1987: 397 (checklist)

Callianassa (Callichirus) jamaicensis RODRIGUES, 1971: 198 figs. 21–40.

Callianassa jamaicensis TIEFENBACHER, 1976: 314 fig. 1c, d.

Material: Belize, Dangriga, in front of Pelican Beach Resort (sandy beach between stones): 1 male, 1 female, P. DWORSCHAK coll. with yabby pump 6. June 1989, NHMW No. 6815. – Brazil, São Luiz-MA, Rio Anil, mare 0.0: 1 male (022), 1 female (020), S. DE A. RODRIGUES coll. 18. Feb. 1984, NHMW No. 6897.

Remarks: A characteristic feature not mentioned in previous descriptions is the cuticular structure on the ventral side of the second abdominal somite; this is present in all specimen listed above. This structure is missing in specimens of *C. louisianensis* from the Gulf of Mexico (see below), a species which has been described by SCHMITT (1935) as a variety of *C. jamaicense*. *C. jamaicense* has been

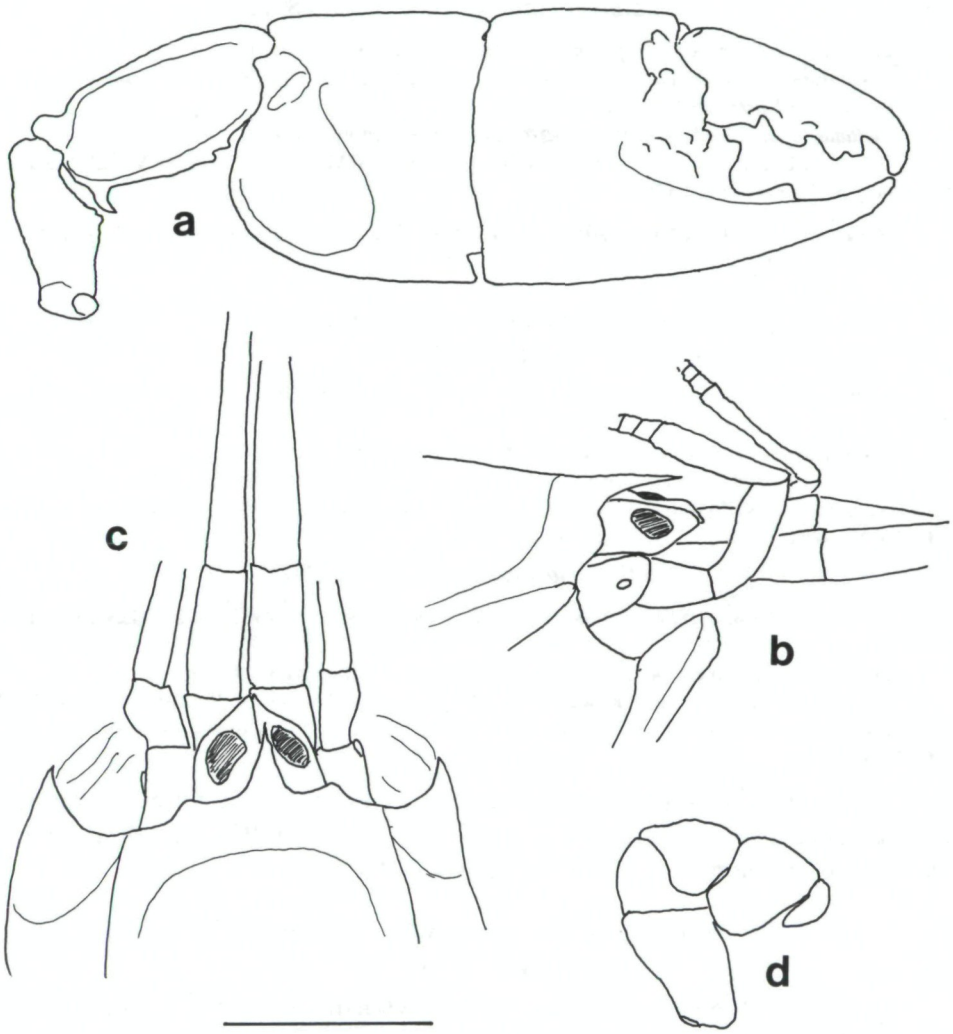

Fig. 4: *Callianassa jamaicense* (NHMW No. 6815, male).
a: major cheliped, inner side; b: front in side view; c: same in dorsal view; d: mxp 3, inner side; setae omitted; scale is 6 mm (a, d) and 3 mm (c, b).

reported from brackish environments in Jamaica and Brazil. In Belize, it can be found in the shallow intertidal in sand between stones and in the sandbars of the mouth of the Stann Creek River.

Callianassa japonica (ORTMANN, 1891)

Callianassa subterranea var. *japonica* ORTMANN, 1891: 56, pl. 1, fig. 10a.
Callianassa (Trypaea) japonica BORRADAILE, 1903: 546; DE MAN, 1928a: 19, pl. 5, figs. 10–10a.
Callianassa Harmandi BOUVIER, 1901: 332.
Callianassa japonica SAKAI, 1969: 232 (complete synonymy), pls. 9–12.

Material: Japan, 5 males, 2 females, RORETZ don., NHMW No. 6730 (1881 V. 12.); 6 males, 5 females, A. TAMAKI coll., NHMW No. 6804.

Remarks: Together with *U. major* the most common thalassinid of Japanese tidal flats.

Callianassa jousseaumei NOBILI, 1904
(Figs. 5a–d, 6a–c)

Callianassa (Cheramus) Jousseaumei NOBILI, 1904: 236; NOBILI, 1906: 101, pl. 6, fig. 2; DE MAN, 1928b: 26 (list), 100 (key).
Callichirus jousseaumei SAINT LAURENT & LELOEUFF, 1979: 97.

Material: Red Sea, Safaga, Tubaya Al-Kabir, 9 m: 1 specimen (fragments), P. DWORSCHAK coll. 1. November 1984, NHMW 6903; Aquaba: 1 female (ovigerous), J. DE VAUGELAS coll. 29. 5. 1984, NHMW No. 6980.

Callianassa kraussi STEBBING, 1900

Callianassa kraussi STEBBING, 1900: 39, pls. 2, 3: 1910: 369; KENSLEY, 1974: 277 (key); KENSLEY, 1976: 57.
Callianassa (Callichirus) kraussi BORRADAILE, 1903: 547; BARNARD, 1950: 506, fig. 94.

Material: South Africa, Kowie, Port Alfred: 1 male, 2 females, PENTHER coll., NHMW No. 6618 (1898 VIII. 15.); Keurbooms estuary: 5 males, 3 females (1 ovigerous), N. HANEKOM coll., NHMW No. 6895.

Remarks: This is a very common species in South African estuaries, occurring in densities of up to 200 animals · m^{-2} (BRANCH & PRINGLE 1987) and in a wide range of salinities (1.2 to 59‰) (FORBES 1974).

Callianassa louisianensis (SCHMITT, 1935)
(Fig. 7a–f)

Callianassa (Callichirus) jamaicense var. *louisianensis* SCHMITT, 1935b: 12, pl. 1, 2, fig. 2, 4, 7.
Callianassa jamaicense var. *louisianensis* PHILLIPS, 1971: 165–196, fig. 3A, C, E.
Callianassa jamaicense var. *louisianensis* TIEFENBACHER, 1976: 314, fig. 1 a, b.
Callianassa louisianensis WILLIAMS & al., 1989: 28, pl. 3, fig. 4.

Material: Gulf of Mexico – Florida (Perdido Key, Big Lagoon, 20–50 cm water depth): 1 male, 2 females, P. DWORSCHAK coll. with yabby pump 15. 9. 1990, NHMW No. 6978; – Alabama (Dauphin Island near airport, intertidal): 7 males, 4 females, P. DWORSCHAK coll. with yabby pump 12. 9. 1990, NHMW No. 6977; (Mobile Bay, Meaher Park, intertidal, 3‰ salinity): 1 male, 1 female, P. DWORSCHAK coll. 26. 9. 1990, NHMW No. 6976; – Mississippi (Bay St. Louis, intertidal): 5 males, 5 females, P. DWORSCHAK & J. STATON coll. with water jet 2. 10. 1990, NHMW No. 6979.

Remarks: Common inhabitant of estuarine tidal flats in the Gulf of Mexico, especially in sounds and bays with reduced salinity.

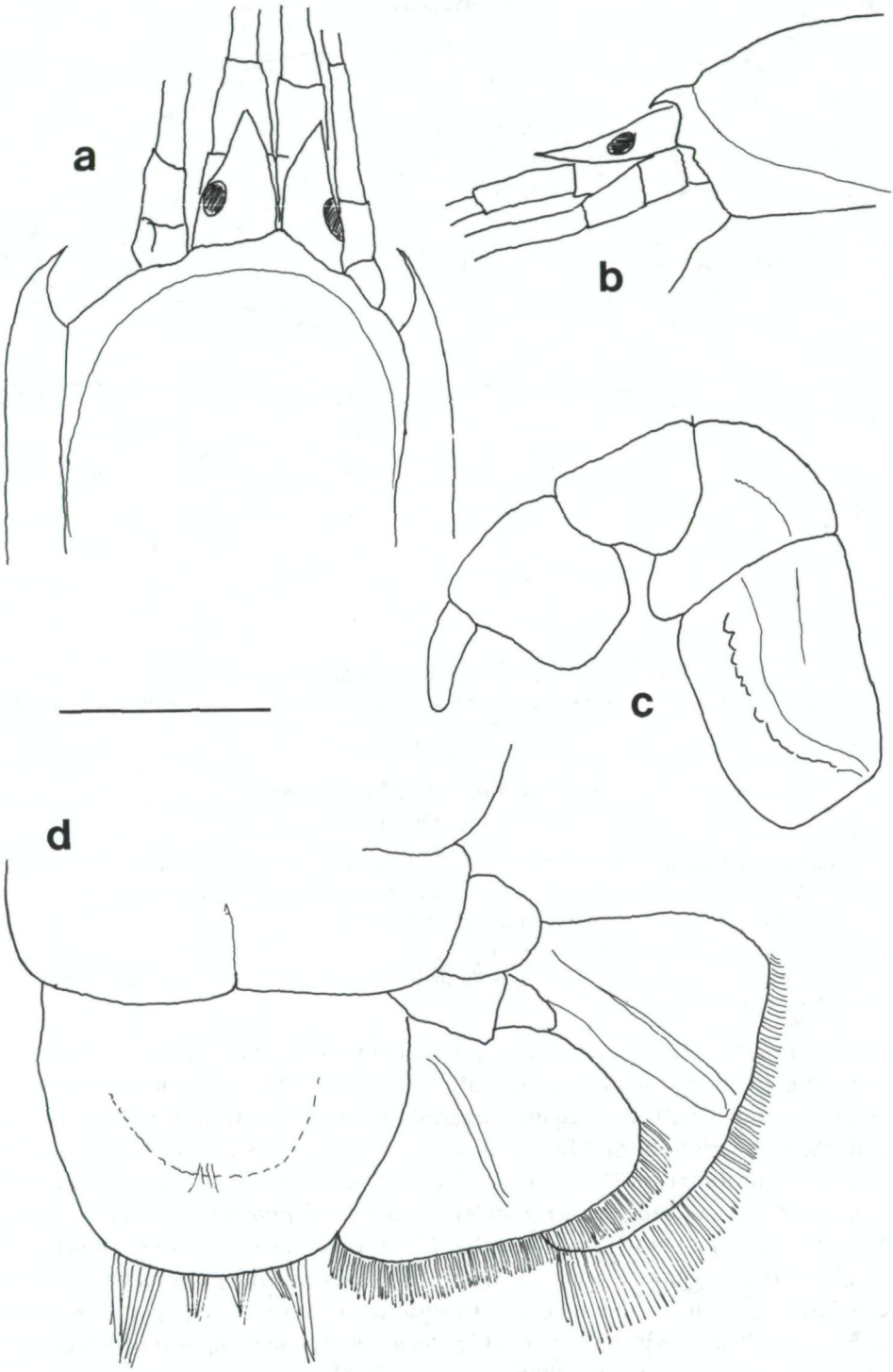

Fig. 5: *Callianassa jousseaumei* (NHMW No. 6980).
a: front in dorsal view; b: same in side view; c: mxp 3, inner side, setae omitted; d: tail fan in dorsal view; scale is 6 mm.

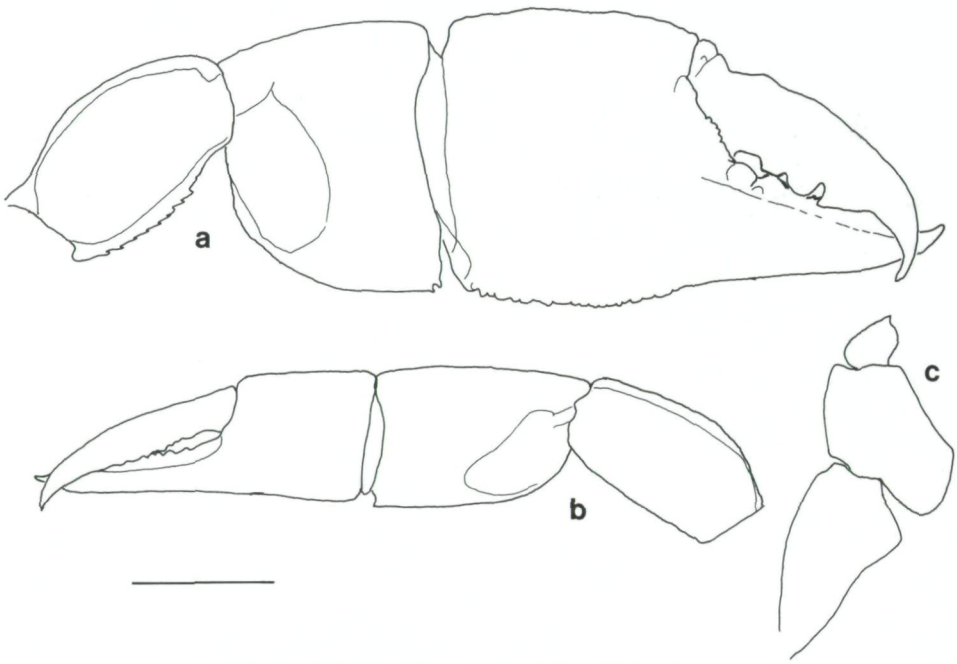

Fig. 6: *Callianassa jousseaumei* (NHMW No. 6980).
a: major cheliped, inner side; b: minor cheliped, inner side; c: P 3, inner side, setae omitted; scale is 6 mm.

Callianassa martensi MIERS, 1884
(Fig. 8a–e)

Callianassa Martensi MIERS, 1884: 13, pl. 1, fig. 1; DE MAN, 1888b: 482, pl. 21, fig. 1.
Callianassa (Callichirus) martensi BORRADAILE, 1903: 547; TIRMIZI, 1974: 286, fig. 1–4.
Callichirus martensi SAINT LAURENT & LELOEUFF, 1979: 97.
Callianassa martensi SAKAI, 1984: 99, fig. 3.

Material: Ceylon (= Sri Lanka), Belligom: 1 specimen (poor condition), SCHMARDER coll., NHMW No. 6708 (1929 XXI.).

Remarks: The specimen is in poor condition; pl 1 and 2 present, no female gonopore could be found, and both P1 are missing. All other characters are in good agreement with the original description given by MIERS (1884) as well as with the redescriptions and figures given by DE MAN (1888b) and TIRMIZI (1974). According to SAKAI (1984), *C. haswelli* POORE & GRIFFIN is a junior synonym of this species. SAKAI listed *martensi* under the genus *Glypturus* (1988: 61). Although MANNING (1987) already mentioned that *C. haswelli* may belong to *Glypturus*, the diagnosis of this genus given by SAKAI did not even consider one of the essential characters given in MANNING (1987). In addition, he refers to a paper of MANNING & FELDER (1986) in which the name *Glypturus* doesn't even appear – in this paper the genus *Callichirus* is redefined.

A total of 5 specimens have previously been reported from Mauritius, West Pakistan, and Amboina.

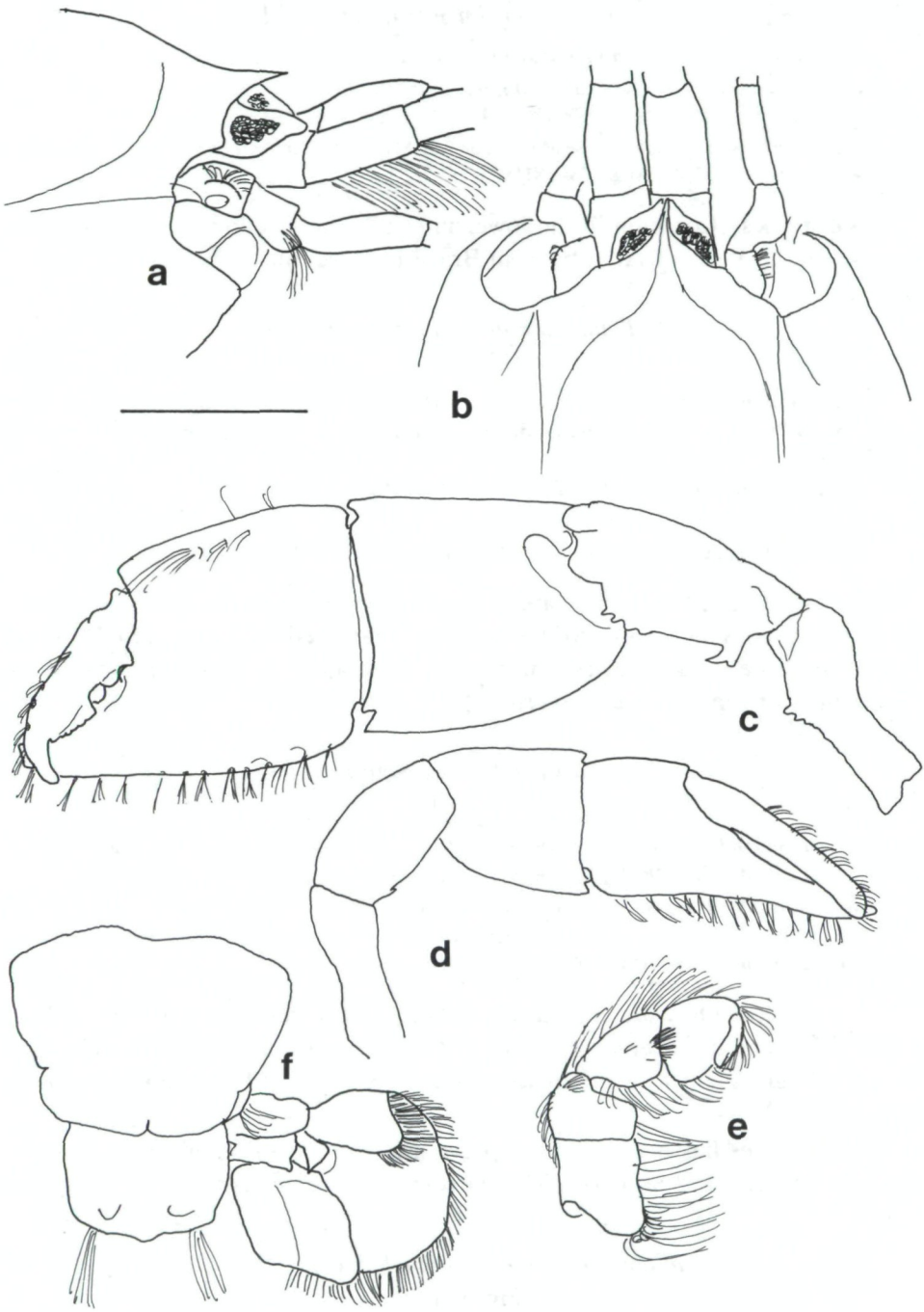

Fig. 7: *Callianassa louisianensis* (NHMW No. 6976, male).
a: front in side view; b: same in dorsal view; c: major cheliped, inner side; d: minor cheliped, inner side; e: maxilliped 3, inner side; f: tailfan in dorsal view; scale is 6 mm (c, d, e, f) and 3 mm (a, b).

Callianassa mirim RODRIGUES, 1971

Callianassa (Callichirus) mirim RODRIGUES, 1971: 214, figs. 77–98.

Callichirus mirim FERRARI, 1981: 12–16, figs. 1–18; RODRIGUES, 1983: 31 (complete synonymy), figs. 53–60; RODRIGUES & HÖDL, 1990: 50, fig. 1.

Material: Brazil, Praia de Jose Menino, Santos, São Paulo: 1 male, 1 female (ovigerous), 1 juv., S. DE A. RODRIGUES coll. 20. Aug. 1985, NHMW No. 6753.

Remarks: Common in the lower intertidal and shallow subtidal of sandy beaches in the Western Atlantic from Brazil to Argentina.

Callianassa mucronata STRAHL, 1861
(Fig. 9a–f)

Callianassa mucronata STRAHL, 1861: 1026; 1862: 883; A. MILNE EDWARDS, 1870: 94; DE MAN, 1888b: 484, pl. 20, fig. 2; 1928b: 175, pl. 19, fig. 30; TRIMIZI, 1977: 21, figs. 1–3; POORE & GRIFFIN, 1979: 273, figs. 34–35.

Callianassa brevicaudata A. MILNE EDWARDS, 1870: 91, pl. 2, fig. 2.

Callianassa novaeguineae THALLWITZ, 1890: 31

Material: Philippines, Luzon: 1 female, SEMPER don., NHMW No. 6706 (1861)

Remarks: All characters are in good agreement with the description given by STRAHL (1862) and figures of the holotype published by TIRMIZI (1977). SAKAI (1988: 61) listed this species among the Australian members of the genus *Glypturus* (for remarks see *C. martensi*).

Callianassa rathbunae SCHMITT, 1935
(Fig. 10)

Callianassa rathbunae SCHMITT, 1935b: 15, pl. 1 fig. 5, pl. 2 fig. 2, pl. 3 fig. 1., pl. 4 fig. 2; BIFFAR, 1971: 699, fig. 19–20; MANNING & HEARD, 1986: 347, fig. 1.

Callichirus rathbunae SAINT LAURENT & LELOEUFF, 1979: 97.

Material: Belize, Twin Cays, Cassiopeia Cove: 1 detached cheliped, P. DWORSCHAK coll. with weighted line 22 June 1989, NHMW. No. 6904.

Remarks: Only a cheliped was obtained by a weighted line trap at Twin Cays, Belize among several specimens of *Glypturus acanthochirus.* This cheliped is in good agreement with the figures given by SCHMITT (1935b) and MANNING & HEARD (1986).

This species has been reported previously from the east and west coast of Florida, Jamaica, and St. Croix. The burrows have been described by SUCHANEK (1983).

Callianassa rotundicaudata STEBBING, 1902
(Fig. 11a–f)

Callianassa rotundicaudata STEBBING, 1902: 41, pl. 8; KENSLEY, 1974: 277 (key).

Callianassa (Calliactites) rotundicaudata BORRADAILE, 1903: 545; BARNARD, 1950: 512, fig. 95i–l.

Material: South Africa, Kowie, Port Alfred: 1 specimen, PENTHER coll. et don., NHMW No. 6619 (1898 VIII. 16.).

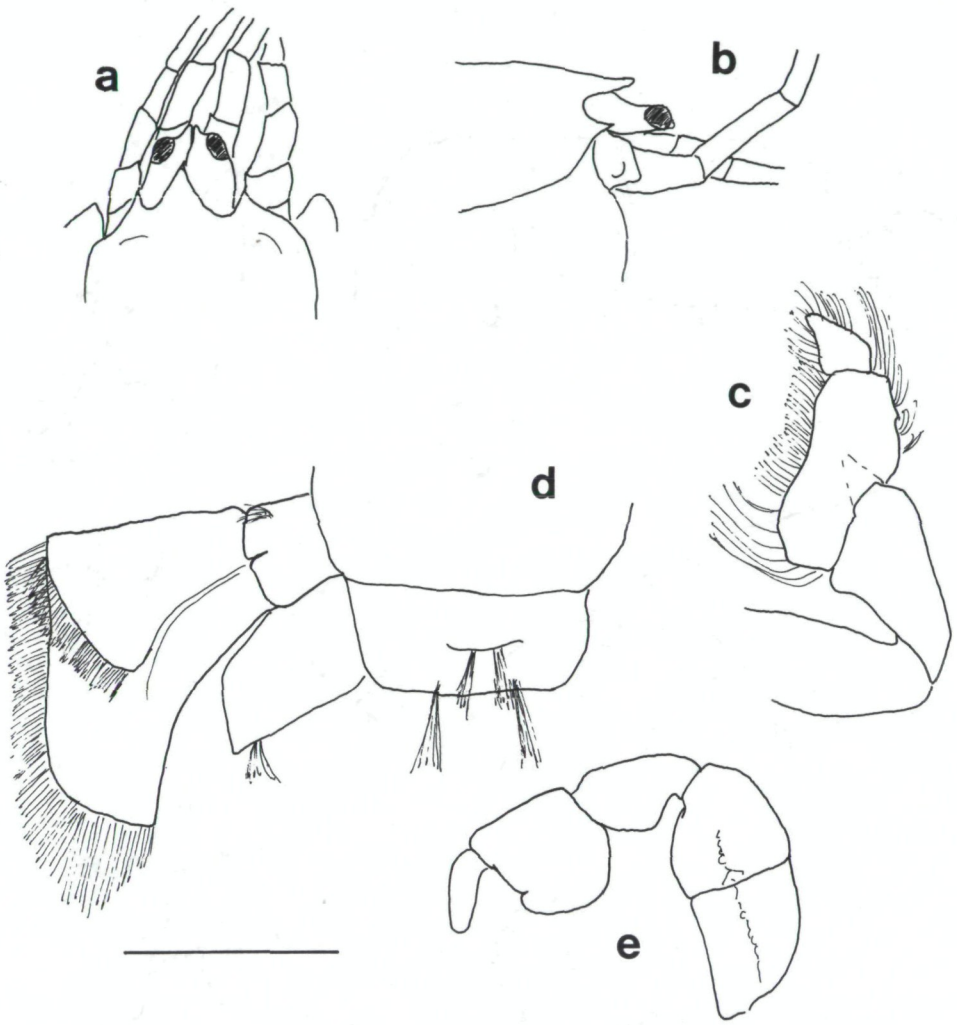

Fig. 8: *Callianassa martensi* (NHMW No. 6708).
a: front in dorsal view; b: same in side view; c: P 3, inner side; d: tail fan in dorsal view; e: mxp 3, inner side, setae omitted; scale is 6 mm.

Remarks: All characters are in good agreement with the description and figures of this species given by STEBBING (1902) and BARNARD (1950).

Callianassa subterranea (MONTAGU, 1808)

Cancer Astacus subterraneus MONTAGU, 1808: 89, pl. 3, fig. 1–2.

Callianassa subterranea LEACH, 1815b: pl. 32; BELL, 1853: 217, fig.; ADENSAMER, 1898: 620; LUTZE, 1938: 170, figs. 28–51; SAINT LAURENT & BOŽIĆ, 1976: 17, figs. 1, 9, 17, 28 (complete synonymy); ADEMA & al., 1982: 23, fig. 6a–c; WITBAARD & DUINEVELD, 1989: 209–219, fig. 1.

Callianassa (Cheramus) subterranea BOUVIER, 1940: 101, fig. 67.

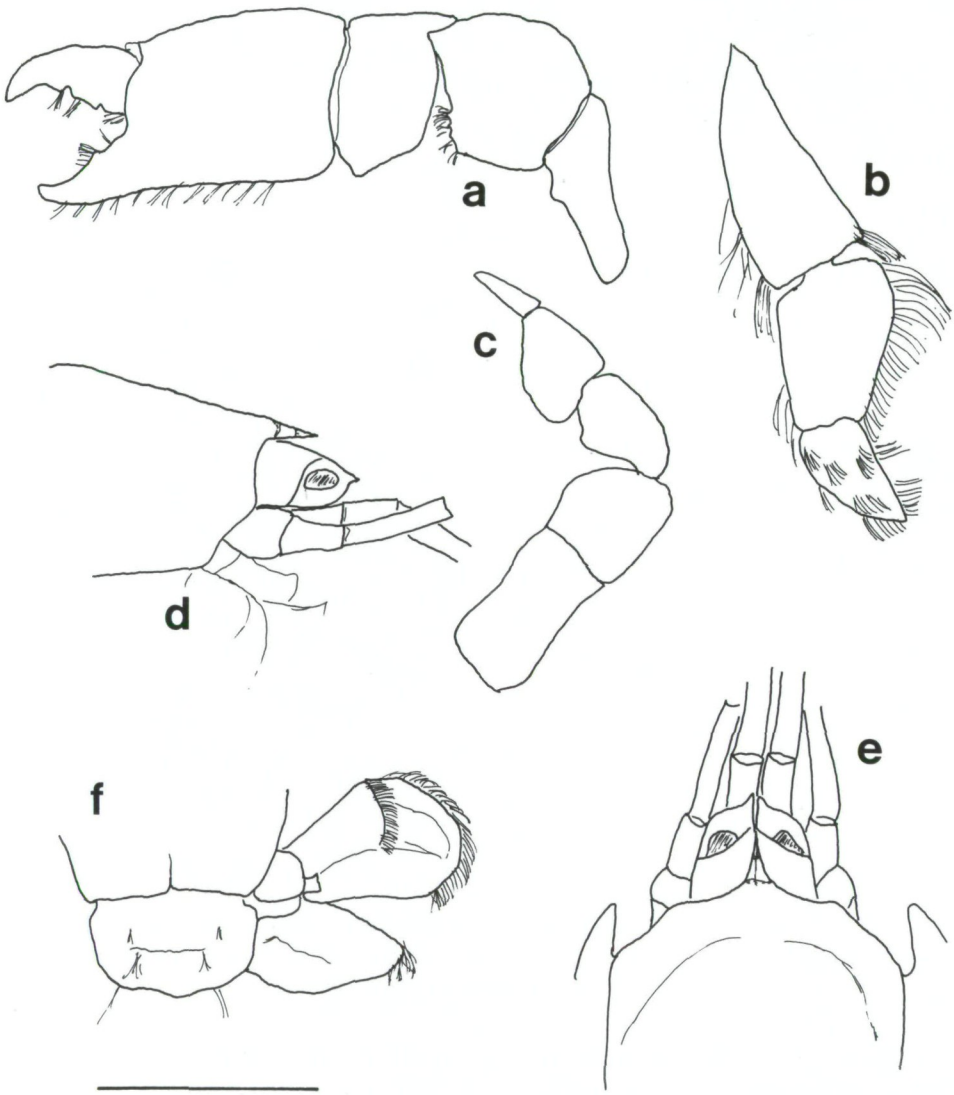

Fig. 9: *Callianassa mucronata* (NHMW No. 6706).
a: major cheliped, outer side; b: P 3, outer side; c: mxp 3, outer side, setae omited; d: front in side view; e: same in dorsal view; f: tail fan in dorsal view; scale is 6 mm (a, f) and 3 mm (b, c, d, e).

Callianassa pestae LUTZE, 1938: 167, fig. 10–21 (not *Callianassa pestae* DE MAN = *Callianassa candida* OLIVI)

Callianassa helgolandica LUTZE, 1938: 174, fig. 52–61.

Callianassa tyrrhena HOLTHUIS & GOTTLIEB, 1958: 101 (partim), fig. 13 (not *Callianassa tyrrhena* PETAGNA).

Material: North Sea, Oyster Ground? (REINECK box cores taken for G. IRION in May 1984): 1 female (damaged, K 30/1), 1 female (ovigerous, damaged, K 25/3), 1 male (damaged, K 25/2), 1 female (damaged, K 28/1), 1 female (K 25/1), 1 female (K 30/2), 1 female (damaged (K 24a), 1 juvenile (K 30/3), unsexable fragments of 6 specimens (K 17, K 22, K 24, K 26, K 26a, K 41), NHMW No. 6783. – Aegean Sea, St. 227,92 m „Pola"-Expedition 1890/93: 1 male, NHMW No. 6613 (1899 I. 22.).

Remarks: The specimen collected by the „Pola-Expedition" (NHMW No. 6613) is the one mentioned by ADENSAMER (1898: 620). PESTA added a label with the comment: „ADENSAMER bestimmte das Exemplar als den Typus (*C. subterranea* MONT.), doch dürfte es sich um die var. *minor* GOURRET handeln". As a consequence, he listed „?ADENSAMER 1898, *C. subterranea,* p. 620" in the list of synonyms for *C. subterranea* var. *minor* (PESTA 1918). The re-examination shows that this specimen is in fact a juvenile *C. subterranea.* The pediform maxilliped 3 has no endopod, the ovale is much more pronounced and the rostrum less pointed than in the two specimens of *G. denticulata* investigated. In addition, the shape of the cheliped (only one present, probably the minor) differs from that of *G. denticulata* and is in good agreement with the figures given for juveniles of *subterranea* by HOLTHUIS & GOTTLIEB (1958: fig. 13 under *C. tyrrhena*) and similar to that of the specimens collected in the North Sea.

This species is common in subtidal (10–80 m) muddy fine sands and muds of the northeast Atlantic and the Mediterranean where it may occur (e. g. in the North Sea) in densities of up to 50 animals · m^{-2}. The burrows have been described recently by WITBAARD & DUINEVELD (1989) and ATKINSON & NASH (1990).

Callianassa ?turnerana WHITE, 1861:

Callianassa turnerana WHITE, 1861: 42, pl 6; A. MILNE EDWARDS, 1870: 89; BORRADAILE, 1903: 547; LENZ, 1911: 316, figs. 1–11; VANHÖFFEN, 1911: 105; MONOD 1927: 595; DE MAN 1928b: 30, 114.

Callianassa Krukenbergi NEUMANN, 1878: 34.

Callianassa diademata ORTMANN, 1891: 565, pl. 1, fig. 11.

Callianassa (Callichirus) Krukenbergi DE MAN, 1928a: 51, pl. 12, figs. 21–21d.

Callichirus turneranus LELOEUFF & INTES, 1974: 40, figs. 10a–s, SAINT LAURENT & LELOEUFF, 1979: 64, figs. 14e, 19e, 20a–d, 23a–e.

Material: Africa, Gabon: fragments (P 2 and P 3), SALVIN don., ADENSAMER det. (as *C. diademata*), NHMW No. 6795 (1873 I. 8.)

Remarks: The jar is labelled as *Callianassa (Callichirus) diademata* on the outer side. In it is one label (faded) with remarks of ADENSAMER and a second indicating a revision by PESTA in 1915. It contains only one P 2 and one P 3, whose shapes are in good agreement with figures of *C. turnerana* given by SAINT LAURENT & LELOEUFF (1979).

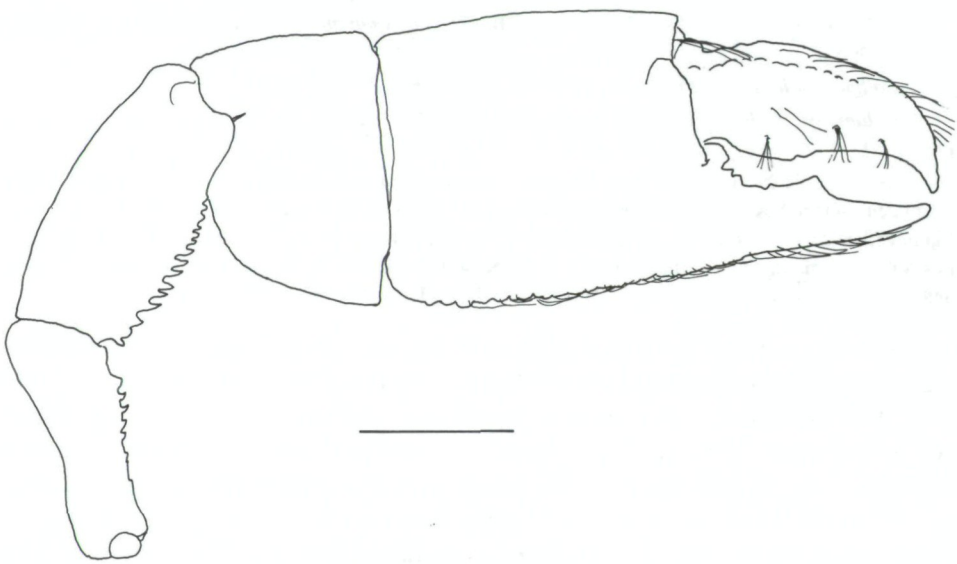

Fig. 10: *Callianassa rathbunae* (NHMW No. 6904).
Major cheliped outer side, scale is 6 mm.

This large (tl up to 150 mm) species occurs in lagoons and estuaries in the Gulf of Guinea from Togo to the Congo. Migrations into rivers have been reported several times.

Callianassa tyrrhena (PETAGNA, 1972)

Astacus tyrrhenus PETAGNA, 1792: 418, pl. 5, fig. 3.

Callianassa laticauda OTTO, 1821: 11; 1828: 345, pl. 21, fig. 3.

Callianassa subterranea H. MILNE EDWARDS, 1837a: 130, pl. 48, fig. 3–3e (not *Callianassa subterranea* MONTAGU).

Callianassa Stebbingi BORRADAILE, 1903: 547.

Callianassa (Callichirus) stebbingi PESTA, 1918: 201–204 (partim), fig. 63b.

Callianassa tyrrhena HOLTHUIS, 1947: 320, fig. 1; 1953: 92, fig. 1; SAINT LAURENT & BOŽIĆ, 1976: 22, figs. 4, 12, 20, 31 (complete synonymy); ADEMA & al., 1982: 26, fig. 7a–c; MANNING & ŠTEVČIĆ, 1982: 295; GARCIA RASO, 1983: 323, fig. 2.

Material: Mediterranean – Sicily: 1 male, 1 female, NHMW No. 6614; 1 male, NHMW No. 6615; – Tunisia, Zarzis, beach near Hotel Zita: 1 male, 1 female, P. DWORSCHAK coll. March 1986, NHMW No. 6814; – Greece, Thassos Limenas (fine sand in 0.5 m adjacent to *Posidonia* meadow): 3 males, 1 female (ovigerous), P. DWORSCHAK coll. with yabby pump July 1987, NHMW No. 6792, Thassos, Aliki (fine sand in 0.5 to 1 m): 3 females, (ovigerous), P. DWORSCHAK coll. with yabby pump August 1987, NHMW No. 6793; – Italy, Rimini (dead on beach): 6 males, 4 females, H. SCHWAMMER & M. STACHOWITSCH coll. July 1989, NHMW No. 6800; Ischia (3 m): 1 male, 3 females, P. DWORSCHAK coll Sept. 1982, NHMW No. 6794; Banco Mulla di Muggia (near Grado): 3 males, 1 female, P. DWORSCHAK coll with yabby pump 12 September 1984, NHMW No. 6809; Lido di Staranzano (near Monfalcone), intertidal: 2 males, 6 females, May 1988, NHMW No. 6807; 1 male, 7 females, May 1988, NHMW No. 6808; 3 males, 5 females, April 1987, NHMW No. 6813, P. DWORSCHAK coll. with yabby pump; – Slovenia, Strunjan (near Piran), intertidal: 3 males, 4 females, NHMW No. 6805; 3 males, 3 females, 1 juvenile, NHMW No. 6806, P. DWORSCHAK coll. 20 September 1983.

Atlantic , St. Malo: 1 male, DRASCHE coll. et don., NHMW No. 6620 (1883 I. 7.).

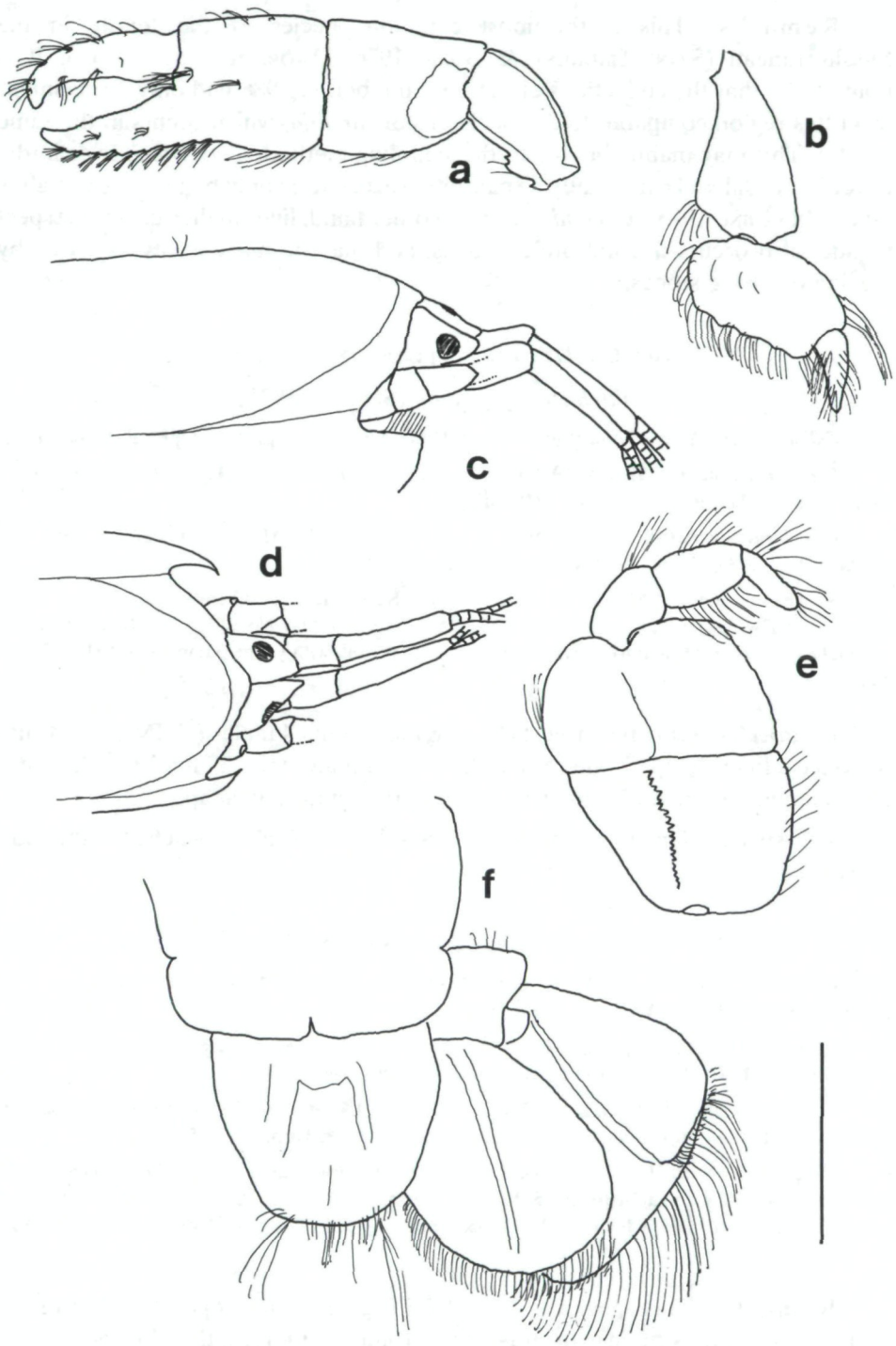

Fig. 11: *Callianassa rotundicaudata* (NHMW No. 6619).
a: major cheliped, inner side; b: P 3, outer side; c: front in side view; d: same in dorsal view; e: mxp 3, inner side; f: tail fan in dorsal view; scale is 6 mm (a) and 3 mm (b, c, d, e, f).

Remarks: This is the most common species of the family in the Mediterranean (SAINT LAURENT & BOŽIĆ 1976; DWORSCHAK pers. obs.). It is noteworthy that the collections at the museum before 1988 had only 2 specimens from this region compared to 27 specimens of *candida,* which occurs in the same habitat. This may mainly be due to the sampling method. *C. tyrrhena* lives in the lower intertidal and can usually be captured successfully only by means of a yabby pump (MANNING 1975). *C. candida,* on the other hand, lives higher up with respect to tide, also occurs in sand under stones, and may be more easily captured by digging or lifting stones.

Genus *Callichirus* STIMPSON, 1866 (s.s.)

Callichirus islagrande (SCHMITT, 1935)

Callianassa (Callichirus) islagrande SCHMITT, 1935b: 5, pl. 1 fig. 3, pl. 2 fig. 1, pl. 3 fig. 2, pl. 4 fig. 5.

Callianassa islagrande BIFFAR, 1971: 654; PHILLIPS, 1971: 165–196, fig. 3 B, D, F, 4; FELDER, 1973: 24, pl. 2 figs. 12–14; RABALAIS & al, 1981: 105.

Callichirus islagrande SAINT LAURENT & LELOEUFF, 1979: 79; MANNING & FELDER, 1986: 439; ABELE & KIM, 1986: 27, fig.; WILIAMS & al, 1989: 28.

Material: Gulf of Mexico – Florida (Perdido Key, beach, 20–40 cm water depth) 4 males, 4 females, P. DWORSCHAK coll. with yabby pump 15. 9. 1990, NHMW No. 6974; – Alabama (Dauphin Island, beach, 1 m water depth) 1 juvenile, P. DWORSCHAK coll. with yabby pump 14. 9. 1990, NHMW No. 6975.

Remarks: Only the largest (Cl = 18 mm) of the 4 males (NHMW 6974) has the typical long cheliped, whereas in the smaller males (cl = 15 mm) the chelipeds are subequal in size and similar to those of the females in shape.

This species is common in the shallow subtidal of sandy beaches in the Gulf of Mexico.

Callichirus major (SAY, 1818)

Callianassa major SAY, 1818: 238; LUNZ, 1937: 1–15, figs. 1–3; POHL, 1946: 71–80, figs. 7–28; RABALAIS & al, 1981: 105; WILLIAMS, 1984: 183, fig. 127.

Callianassa (Callichirus) major BORRADAILE, 1903: 547; DE MAN, 1928a: 30, pls. 7–8; 1928b: 28(list), 111(key); RODRIGUES, 1966: 22, figs. 1–20; 1971: 191, figs. 1–20.

Callichirus major STIMPSON, 1866: 47; 1871: 122; SAINT LAURENT, 1973: 514; RODRIGUES, 1983: 25, figs. 23–52; MANNING & FELDER, 1986: 439, fig. 1; RODRIGUES & HÖDL, 1990: 50, fig. 1.

Material: North Carolina, Cape Lookout, Barden inlet, ferry landing, intertidal: 1 male, P. DWORSCHAK coll. with yabby pump 25. 11. 1988, NHMW No. 6755; – Brazil, Praia de José Menino, Santos, São Paulo: 1 male, 1 female, 19. 9. 1985, 1 juv. May 1987, S. DE A. RODRIGUES coll., NHMW No. 6754.

Remarks: This species is typical for higher salinity open beaches of the east coasts of the Americas from North Carolina to Florida, the Gulf of Mexico, and Brazil. A bulk of literature exists, especially with respect to its deep (up to 4 m) burrows and the analogous trace fossil *Ophiomorpha* (e. g. FREY & al. 1978).

Genus *Glypturus* STIMPSON, 1866 (s.s.)

Glypturus acanthochirus STIMPSON, 1866

Glypturus acanthochirus STIMPSON, 1866: 46; 1871: 121; KINGSLEY, 1899: 821; RATHBUN, 1900: 150; 1901: 93, BORRADAILE, 1903: 548; MANNING, 1987: 390, figs. 3; POORE & SUCHANEK, 1988: 201, fig. 4d.

Callianassa acanthochirus SCHMITT, 1935b: 20, pl. 1 fig. 6, pl. 2 fig. 5, pl. 3 fig. 4, pl. 4 fig. 6; BIFFAR, 1971: 655, figs. 3–4; RABALAIS & al., 1981: 103, fig. 3.

Callichirus acanthochirus SAINT LAURENT & LELOEUFF 1979: 96.

Material: Belize, Cassiopeia cove, Twin Cayes (1.5–2 m): 1 male, 4 females, 9–23 June 1989, NHMW Nos. 6765 to 6769; South Water Cay (0.8 m): 1 female, 20 November 1987, NHMW No. 6770, P. DWORSCHAK coll. with weighted line.

Remarks: MANNING (1987) re-established the genus *Glypturus* with *C. acanthochirus* as type species. He further synonymized it with *C. armata* MILNE EDWARDS from the Indo-Pacific. SAINT LAURENT (pers. comm. 1988), however, thinks that they are distinct. POORE & SUCHANEK (1988) also didn't agree that *G. armatus* is a junior synonym of *G. acanthochirus.*

This species has been reported from the Atlantic coast of Florida, the Gulf of Mexico, and the entire Caribbean. In Belize, it occurs in coarse sand and silty fine sand in the shallow subtidal (0.5–2 m), where it produces large mounds and funnels.

Glypturus laurae (SAINT LAURENT, 1984)

Callichirus laurae SAINT LAURENT (in VAUGELAS & SAINT LAURENT), 1984: 147, pl. 1, figs A–D.

Glypturus laurae POORE & SUCHANEK, 1988: 201, fig. 4c.

Material: Red Sea, Aquaba: 1 female, J. COURBOULES coll. 12/86, NHMW No. 6973.

Remarks: This species is very close to *G. acanthochirus.* It occurs in the Red Sea at depths between 5 and 45 m. Their large, interconnected burrows have been described in detail by VAUGELAS (1984, 1990).

Genus *Ctenocheles* KISHINOUYE, 1926

Ctenocheles maorianus POWELL, 1949
(Figs. 12a–b, 13a–c)

Ctenocheles maorianus POWELL, 1949: 369, pl. 68, figs. 3–7; HOLTHUIS, 1967: 378.

Material: S. New Zealand, Little Town: 1 female, REISCHEK coll., NHMW No. 6733 (1979 LVII. 11.).

Remarks: *Ctenocheles maorianus,* described by POWELL in 1949, was the third species of this rare genus. He had one complete male specimen, two specimens lacking the large cheliped, and two detached chelipeds collected between 35 and 55 m on soft mud. Later, DELL (1956) reported of several detached chelipeds (see HOLTHUIS 1967).

Ctenocheles maorianus can easily be distinguished from all the other 5 species of this genus by its very short acute rostrum, which reaches only to 1/3 the length of the eyestalks, and by the very slender uropods.

The abdomen of the specimen is broken off between the 3rd and 4th segment and has been attached to the rest of the body by threads. The severed gut contains several bryozoans.

Genus *Gourretia* SAINT LAURENT, 1973

Gourretia denticulata (LUTZE, 1937)

Callianassa subterranea var. *minor* GOURRET, 1887: 1034; 1888: 96, pl. 8, fig. 1–15.
Callianassa (Cheramus) subterranea var. *minor* PESTA, 1918: 205 (partim).
Callianassa (Cheramus) minor DE MAN, 1928b: 26 (list), 100 (key).
Callianassa denticulata LUTZE, 1937: 6, fig. 1–7; 1938: 170.
Callianassa stebbingi GOTTLIEB, 1953: 440.
Callianassa minor HOLTHUIS & GOTTLIEB, 1958: 56, fig. 11–12.
Gourretia minor SAINT LAURENT, 1973: ?LELOEUFF & INTES, 1974: 26, fig. 4a–k; SAINT LAURENT & BOŽIĆ, 1976: 27, figs. 6, 14, 22, 37, 41, 48; MANNING & ŠTEVČIĆ, 1982: 296.
Gourretia serrata SAINT LAURENT 1979: 79 (footnote in SAINT LAURENT & LELOEUFF, 1979)
Gourretia denticulata LEWINSOHN & HOLTHUIS, 1986: 24.
nec:
Callianassa (Cheramus) subterranea var. *minor* PESTA, 1918: 205 (partim, material of ADENSAMER; [= *subterranea* MONTAGU]).

Material: Adriatic Sea, NXID 5: 1 male, „Najade" 1913, NHMW No. 320 (1914 VI.). – Tyrrhenian Sea, Ischia (dead *Posidonia* rhizome, sample VI/3/S/L): 1 female, W. TERTSCHNIG coll. NHMW No. 6784.

Remarks: For taxonomic peculiarities see LEWINSOHN & HOLTHUIS (1986).

Reported previously from the Gulf of Marseille, the Adriatic, the Ionian Sea, Cyprus, Malta and along the coast of Israel at depths between 2.5 and 146 m.

Genus *Corallianassa* MANNING, 1987

Corallianassa articulata (RATHBUN, 1906)
(Fig. 14a–e)

Callianassa articulata RATHBUN, 1906: 892, fig. 47.
Callianassa (Callichirus) articulata EDMONDSON, 1944: 54, fig. 9.

Material: Hawaii, Oahu, Honolulu, Harbor Ent.: 1 ovigerous female, PIETSCHMANN coll., NHMW No. 6621 (1928 X.).

Remarks: MANNING (1987) mentioned that this species may belong to the genus *Corallianassa*. It has in fact some characters of the genus – large triangular rostrum; lateral spinous projections on the carapace separated by an articular membrane; large eyes; second abdominal somite the longest. On the other hand the mxp 3 is more operculiform and the telson lacks the median prominences on the posterior margin. In the key of the species of this genus given by MANNING (1988), this species is not considered. Here, it is included into the genus *Corallianassa*. MANNING's (1988) key can thus be amended as follows:

1. Second abdominal somite longer than sixth, almost as long as sixth and telson combined 2
– Second abdominal somite subequal in length to sixth 3
3. Ventral margin of both chelipeds terminating in spine 4

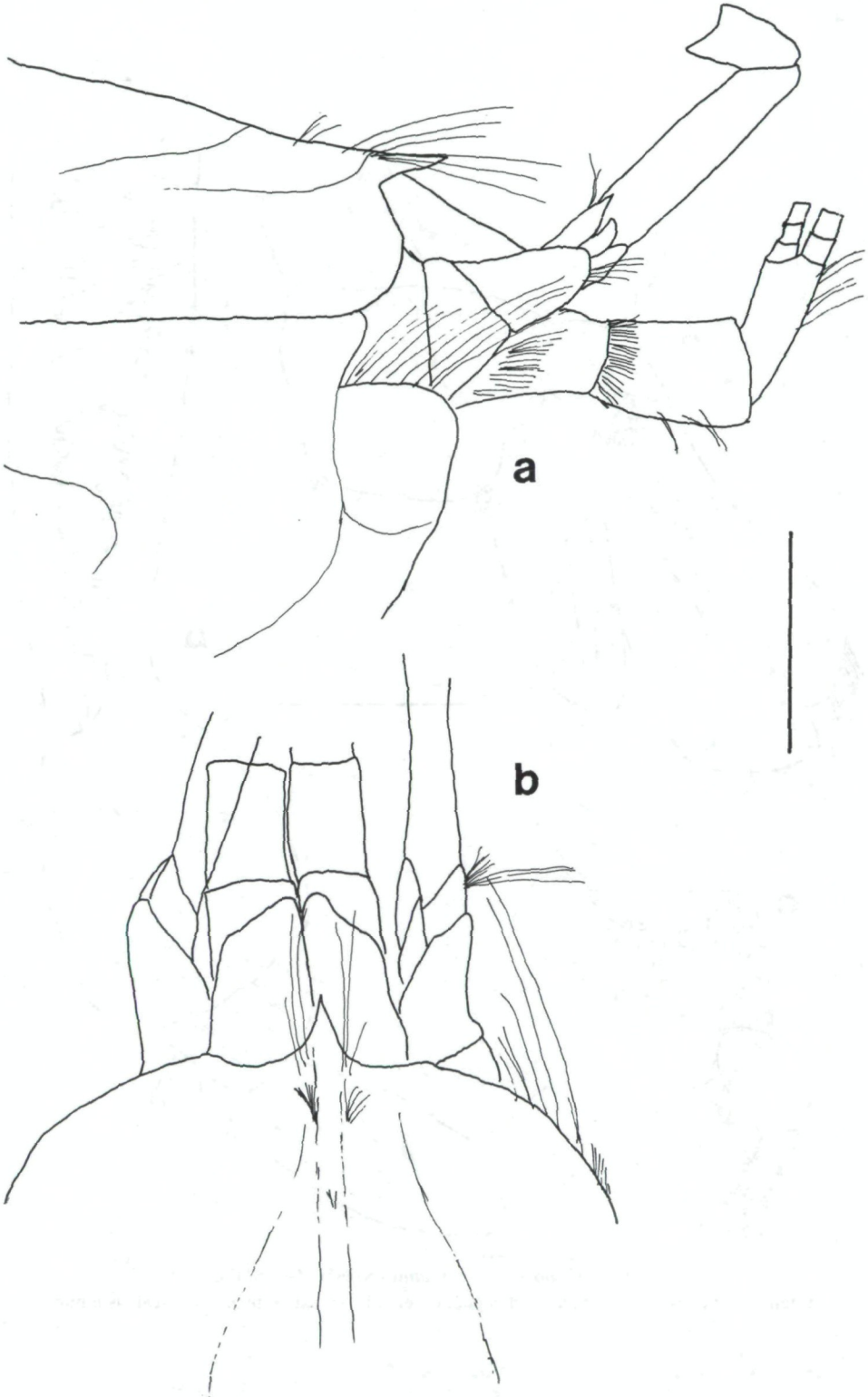

Fig. 12: *Ctenocheles maorianus* (NHMW No. 6733).
a: front in side view; b: same in dorsal view; scale is 3 mm.

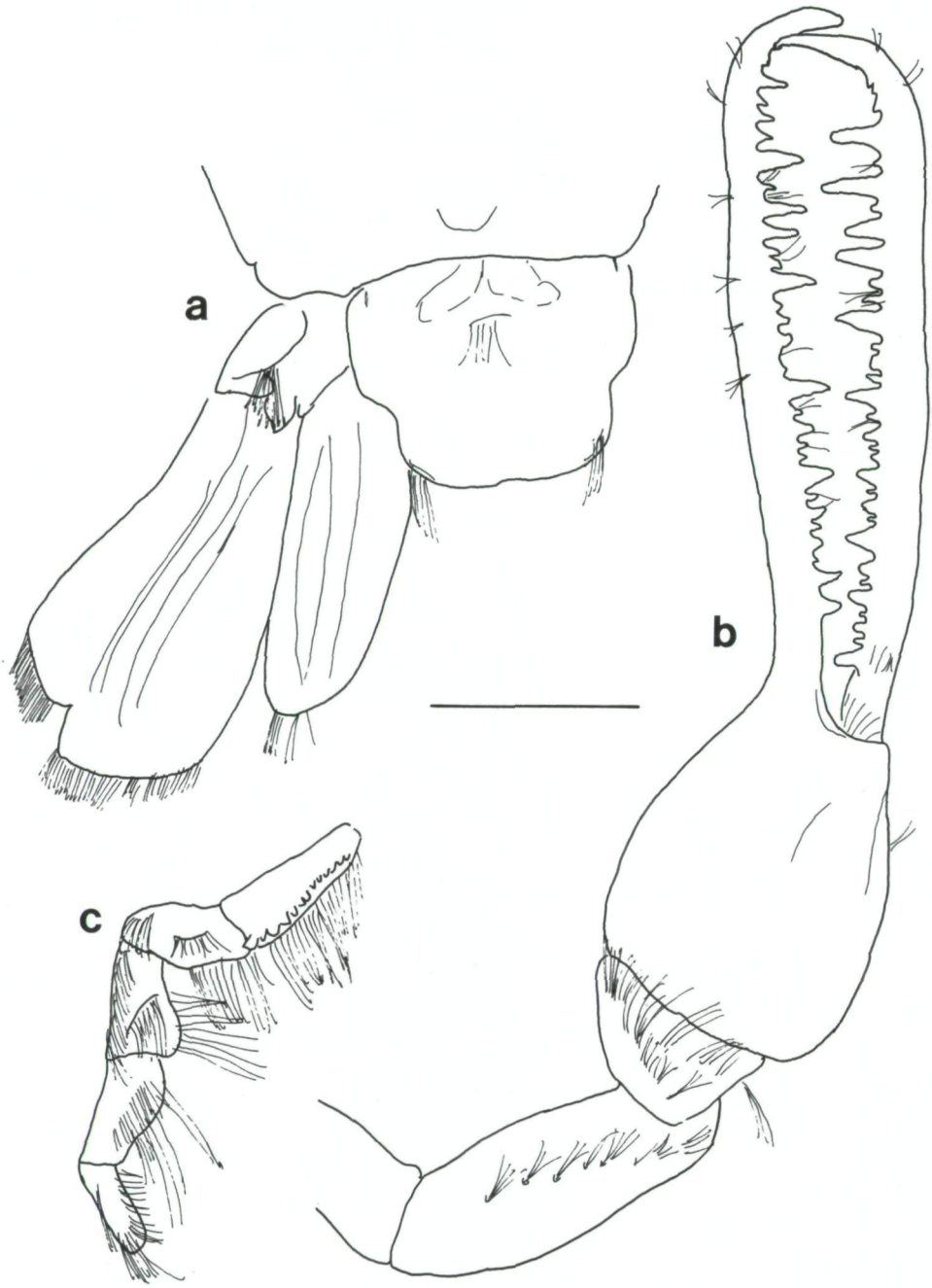

Fig. 13: *Ctenocheles maorianus* (NHMW No. 6733).
a: tail fan in dorsal view; b: major cheliped, outer side; c: mxp 3, inner side; scale is 6 mm.

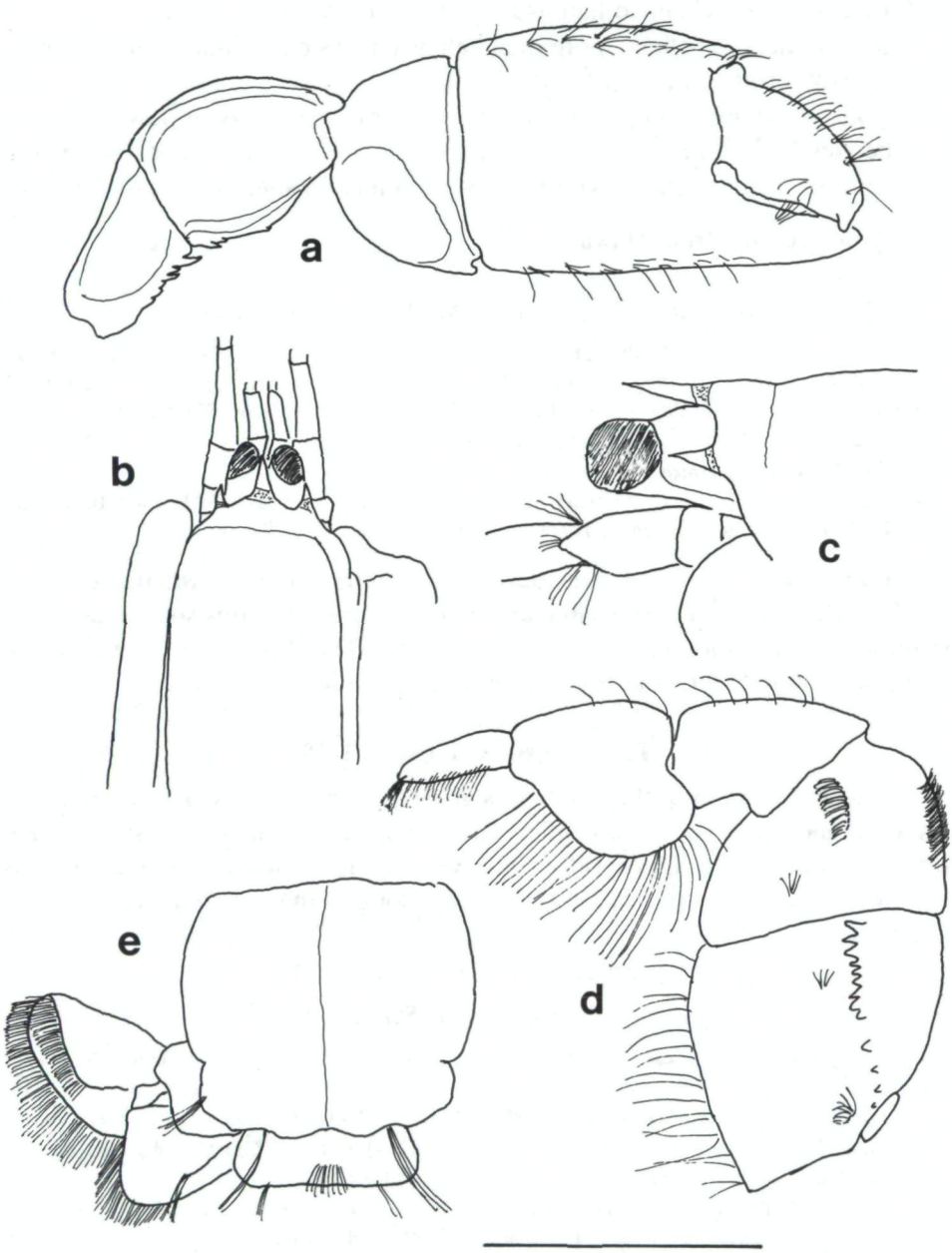

Fig. 14: *Corallianassa articulata* (NHMW No. 6621).
a: major cheliped, inner side; b: front in dorsal view; c: same in side view; d: mxp 3, inner sider; e: tail fan in dorsal view; scale is 4 mm (a, c, e), 8 mm (b) and 2 mm (d).

– Ventral margin of both chelipeds unarmed distally ..... *C. placida*

4. Carpus of major cheliped half as long as palm 5

– Carpus of major cheliped more than half as long as palm, inner ventral margin distinctly serrate ..... *C. xutha*

5. Carpus of major cheliped with inner ventral margin with low, indistinct tubercles. ..... *C. hartmeyeri*

– Carpus of major cheliped with inner ventral margin smooth ... *C. articulata*

Reported only from Hawaii.

Corallianassa longiventris (A. MILNE EDWARDS, 1870)

Callianassa longiventris A. MILNE EDWARDS, 1870: 92; BORRADAILE, 1903: 547; DE MAN, 1928a: 24, fig. 12h; 1928b: 29 (list), 108 (key); SCHMITT, 1935b: 4, pl. 1 fig. 4, pl. 2 fig. 3, pl. 3 fig. 3, pl. 4 fig. 3; GURNEY, 1944: 85, fig. 1–2; BIFFAR, 1971: 685 figs. 13–14; CHACE & al., 1986: 334, pl. 110.

Callichirus longiventris SAINT LAURENT & LELOEUFF, 1979: 97.

Corallianassa longiventris MANNING, 1987: 392, fig. 6.

Material: Belize, Carrie Bow Cay: 1 female (abdomen cut off), 1 juvenile, J. OTT & B. KENSLEY coll. 1984 NHMW No. 6774; 1 female P. DWORSCHAK coll. 23. 11. 1987 NHMW No. 6775.

Remarks: Reported previously from Bermuda, the Atlantic coast of Florida, Martinique, Virgin Island, and Jamaica. In Belize, this species occurs in shallow water in cabonate sand with coral rubble. The shrimp has been observed to catch floating seagrass at the burrow opening (SUCHANEK 1983).

Family Axiidae HUXLEY, 1879

A recent revision of the family was given by SAKAI & SAINT LAURENT (1989). They defined one new subfamily and nine new genera. KENSLEY (1989) resurrected the family Calocaridae ORTMANN. Members of this family are mainly burrowing, but many species are known to belong to the cryptofauna.

Genus *Axius* LEACH, 1815

Axius plectrorhynchus STRAHL, 1861

Axius plectrorhynchus STRAHL, 1861: 1060, figs. 2–4, 11; 1862: 387; DE MAN, 1888b: 463, pl. 19, fig. 5.

Axius (Neaxius) plectorhynchus BORRADAILE, 1903: 537; HALE, 1927: 84, fig. 81.

Axius (Neaxius) plectrorhynchus DE MAN, 1925: 13 (key); POORE & GRIFFIN, 1979: 238, fig. 9.

Strahlaxius plectrorhynchus SAKAI & SAINT LAURENT, 1989: 24.

Material: Philippines: 1 female (ovigerous), C. SEMPER coll., NHMW No. 6734; – S. Australia, Yorketown: 1 male, 1 female (broken), BRUNSIK coll., NHMW No. 2041.

Axius stirhynchus LEACH, 1815

Axius stirynchus LEACH, 1815a: 343; 1815b: pl. 33; BELL, 1853: 228, fig.

Axius stirhynchus BOUVIER, 1940: 93, fig. 65; ZARIQUIEY ALVAREZ, 1946: 103, fig. 131; 1968: 223, fig. 88a; BEAUBRUN, 1978: 69, fig. 44; SAKAI & SAINT LAURENT, 1989: 27, fig. 7.

Axiopsis mediterranea CAROLI, 1921: 254, fig. 1, pl. 9, figs. 1–14.

Material: Adriatic Sea, Piran (Pos. 1 in STACHOWITSCH 1984, 25 m, mud): 1 ovigerous female (damaged), P. DWORSCHAK coll. 15. Sept. 1983, NHMW No. 6758.

Remarks: This rare species occurs in the Atlantic and the Mediterranean. In England it has been reported from shallow water in sand.

Genus *Axiopsis* BORRADAILE, 1903

Axiopsis aethiopica NOBILI, 1904
(Fig. 15a–f)

Axiopsis aethiopica NOBILI, 1904: 235; TATTERSALL, 1921: 394.

Axiopsis (Paraxiopsis) aethiopica NOBILI, 1906: 93, pl. 6 fig. 1; BALSS, 1915: 1; DE MAN, 1925c: 72 (key)

Allaxius aethiopica SAKAI & SAINT LAURENT, 1989: 75.

Material: Red Sea, Haleib (= Halá'ib): 1 female (ovigerous), coll. 18 II 1895, NHMW No. 6894.

Remarks: This may be one of the specimens mentioned by BALSS (1915). The label inside is written in the same handwriting as that of *U.?darwini.* Although there is no collector noted on the label it was obviously collected during the „Pola" Expedition.

Axiopsis serratifrons (A. MILNE EDWARDS, 1873)

Axia serratifrons A. MILNE EDWARDS, 1873: 11, pl. 2, fig. 6.

Axius affinis DE MAN, 1888b: 469, pl. 20, fig. 1.

Axius spinipes DE MAN, 1888b: 464, pl. 19, fig. 6.

?*Axiopsis serratifrons* BORRADAILE, 1903: 538.

Axiopsis (Axiopsis) serratifrons DE MAN, 1925c: 72, pl. 6, fig. 12–12i; KENSLEY, 1980: 1253, fig. 1–5; RODRIGUES, 1983: 18 (complete synonymy), fig. 1–22.

Axiopsis serratifrons SAKAI & SAINT LAURENT, 1989: 76; WERDING & MÜLLER, 1989: 251; MANNING & CHACE, 1990: 31, figs. 16–17.

Material: Belize, Carrie Bow Cay: 1 male, B. KENSLEY & J. OTT coll. 1984, NHMW No. 6773; 1 male, 1 female (NW end, coral rubble, burrow of the pair continued in shell of buried conch), P. DWORSCHAK coll. June 1989 NHMW No. 6771; 1 male, P. DWORSCHAK coll. June 1989 NHMW No. 6772.

Remarks: This a widely distributed species (Atlantic and Indo-Pacific). In Belize, it can be found in shallow water in carbonate sand with coral rubble, where it lives in pairs in simple burrows.

Genus *Calocaris* BELL, 1846

Calocaris macandreae BELL, 1846

Calocaris Macandreae BELL, 1846: 233, fig.; ADENSAMER, 1899: 621.

Calocaris McAndreae BOUVIER, 1940: 96, pl. 4, figs. 1–2.

Calocaris macandreae PESTA, 1918: 191, fig. 59; CAROLI, 1921: 264, fig. 2; ZARIQUIEY ALVAREZ, 1946: 104, fig. 132; 1968: 225, fig. 88b; SAKAI & SAINT LAURENT, 1989: 56; NASH & al., 1984: 425–439 (passim), pl. 3a–d.

Material: Adriatic Sea, „Pola" Expedition 1894, Stations 274, 279, 368, 378, 396, June, July between 132 and 1196 m depth, 5 specimens, NHMW No. 295. – North Sea, Norway, Kristineberg, 20 m depth: 5 specimens, E. WOLLNER coll., NHMW No. 6720; Bergen, Mangerfjord 350 m depth: 11 specimens, NHMW No. 6718 (1923 XLIV.), 7 specimens NHMW No. 6717 (1923 XLIV.) RUNNSTRØM

coll. 18. June 1923. – Skagerrak, Sweden, Bahusia (= Bohuslän): 2 specimens (damaged), LOVÉN coll., NHMW No. 6719 (1862 V. 39).

Remarks: This hermaphroditic species occurs throughout the eastern boreal Atlantic-Mediterranean at depths from 30 to 1100 m. Its burrows and behaviour have been described by NASH & al. (1984)

Family Thalassinidea LATREILLE, 1831

Genus *Thalassina* LATREILLE, 1831

Thalassina anomala (HERBST, 1804)

Cancer (Astacus) anomalus HERBST, 1804: 45, pl. 62.

Thalassina scorpionides LATREILLE, 1806: 51; LAMARCK, 1818: 217.

Thalassina scorpionoides HELLER, 1868: 93

Thalassina anomala DE MAN, 1915: 445 (complete synonymy), pl. 29, figs 16–16b; 1928b: 5.

Material: Nicobar Islands. 1 male, „1. Österreichische Weltumseglung der Fregatte Novara in den Jahren 1837, 1838, 1839 ges. v. Hrn. ZELEBOR No. 149", NHMW No. 6724 (1866 I. 145); – Fiji, Viti Isl.: 1 female, Zool. Inst. Wien don., NHMW No. 6722 (1929 XXI.); – Sumatra, Deli: 1 male, HAGEN don., NHMW No. 1501 (1890 II. 33.); 2 males, 1 unsexable specimen (fragments), BREITENSTEIN coll., STEINDACHNER don., NHMW No. 6731 (1885 IV. 20); – Amboina: 1 male, DOLESCHAL coll., NHMW No. 6732 (1859 20) – Singapore: 2 females, LÖBELL don., NHMW No. 6889 (1899 XXV. 8); – Celebes: 1 specimen, NHMW No. 6898.

Remarks: This species is common in mangrove swamps throughout the Indo-Pacific, where they produce large mounds.

Thalassina squamifera (DE MAN, 1915)

Thalassina anomala var. *squamifera* DE MAN, 1915: 447; 1928b: 12, pl. 1 fig. 1.

Thalassina squamifera POORE & GRIFFIN, 1979: 285, fig. 42.

Material: „Südsee": 1 female (ovigerous), Zool. Inst. Wien coll., NHMW No. 6887 (1929 XXI.).

Remarks: Great confusion exists among the species of *Thalassina.* DE MAN (1915) described the variation *squamifera* for 4 specimens collected by the Siboga expedition. In addition he lists a second variation *(gracilis)* for 2 males from Hollandia (p. 452, pl. 29, figs. 16c and d). DE MAN (1928b: 12) mentioned that only 2 specimens from the Siboga-collection show the characters of var. *squamifera.* POORE & GRIFFIN (1979) summarized the main characters which separate *squamifera* from *anomala.* In the list of synonyms, however, they include DE MANS var. *gracilipes* (1915: pl. 29 fig. 16) as well as part of the material described under *anomala* by DE MAN (1928b: 4–12). According to SAINT LAURENT (pers. comm. 1989) at least 4 different species exist: *anomala* (HERBST), *squamifera* (DE MAN), *gracilis* DANA and one as yet undescribed; *Th. chilensis* STEENSTRUP & LÜTKEN may also prove to be valid.

The specimen from the „Südsee" is an ovigerous female which shows mainly the characters assigned to *squamifera:*

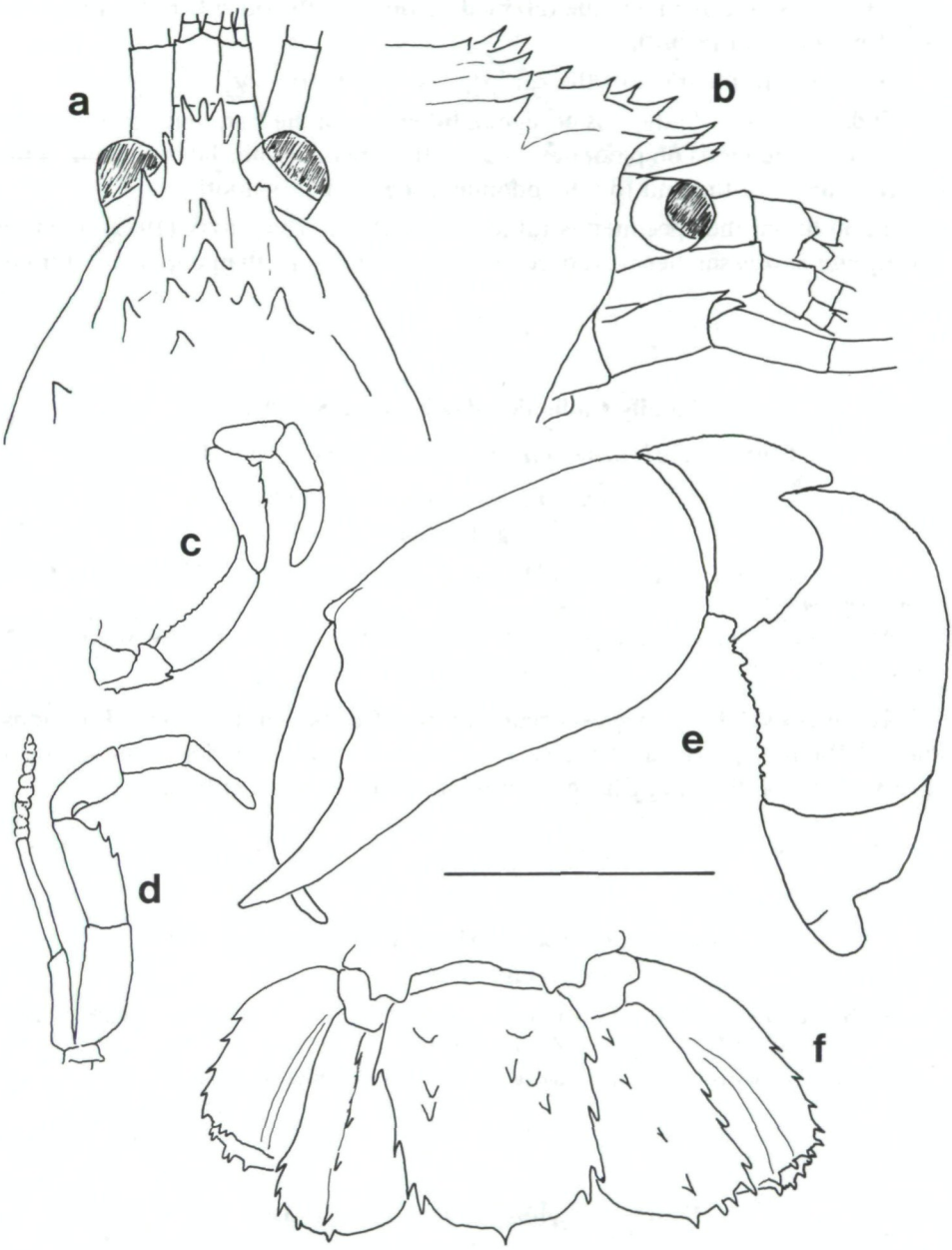

Fig. 15: *Axiopsis aethiopica* (NHMW No. 6894).
a: front in dorsal view; b: same in side view; c: mxp 3, inner side; d: same, outer side; e: major cheliped, outer side; f: tail fan in dorsal view; scale is 2 mm (a, b, c, d) and 4 mm (e, f).

1) the presence of a small scaphocerite

2) the absence of an oblique tuberculate ridge on the outside of the propodus of P 1 parallel to the cutting edge

3) the posterior spine of the carapace is very short.

It differs in that 1) there is no sign of tubercles on the transverse sternal ridge between the pleopods on pleonites 2–5, neither medially nor laterally and 2) the pleural margin of the 2nd to 6th abdominal segments is smooth.

In addition, the specimen is rather small. POORE & GRIFFIN (1979) mention that *squamifera* is smaller (carapace length up to 60 mm) than *anomala* (cl up to 100 mm).

Family Callianideidae KOSSMANN, 1880

Genus *Callianidea* H. MILNE EDWARDS, 1837

Callianidea laevicauda GILL, 1859
(Fig. 16a–f)

Callianidea laevicauda GILL 1859: 167; RATHBUN, 1901: 94; SCHMITT 1924b: 79; 1935a: 193, fig. 54; RODRIGUES, 1983: 34, figs. 61–78.

Material: Bonnaire, Curaçao, NL-WI: 1 specimen, WERNER don., NHMW No. 6611 (1923 XX.).

Remarks: This species occurs in the Caribbean (Jamaica, Barbados, Puerto Rico, Venezuela, Curaçao) in shallow water under stones. Some observations on its biology have been made by RODRIGUES (1983).

Callianidea typa H. MILNE EDWARDS, 1837
(Fig. 17a–d)

Callianidea typa H. MILNE EDWARDS, 1937a: 320, pl. 25 bis, figs. 8–14; DE MAN, 1928b: 31, pl. 1, figs. 3–3f; EDMONDSON, 1944: 38, fig. 2; MIYAKE, 1956: 304, figs. 1–3.

Material: Savaii: 1 female, D. RECHINGER coll. 1905, NHMW No. 6721.

Family Upogebiidae BORRADAILE, 1903

This family contains 112 species according to NGOC-HO (1989b); the majority is burrowing, 4 species are known to bore in corals, and 10 lives in sponges. Two new genera (*Tuerkayogebia* and *Wolffogebia*) have been defined by SAKAI (1982), and, recently, NGOC-HO (1989) described the genus *Gebiacantha* and WILLIAMS & NGOC-HO (1990) the genus *Pomatogebia*. Additional genera have been announced by NGOC-HO (pers. comm. 1989).

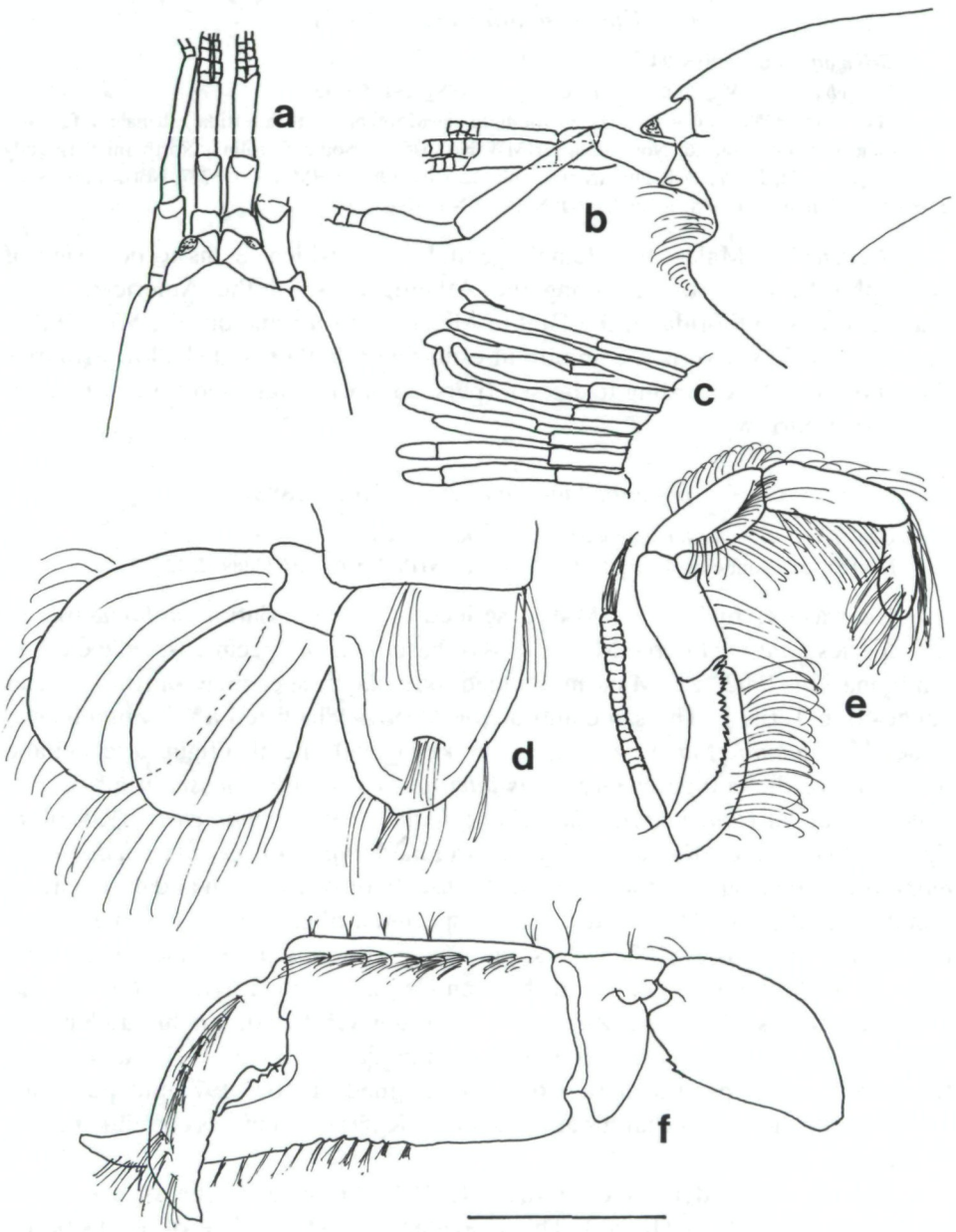

Fig. 16: *Callianidea laevicauda* (NHMW No. 6611).
a: front in dorsal view; b: same in side view; c: details of branchial filaments on pleopods; d: tailfan in dorsal view; e: maxilliped 3, inner side; f: major cheliped, inner side; scale is 6 mm (f), 3 mm (a, b, d, e) and 1.5 mm (c).

Genus *Upogebia* LEACH, 1814

Upogebia affinis (SAY, 1818)

Gebia affinis SAY, 1818: 241

Upogebia affinis WILLIAMS, 1965: 103, fig. 60; 1984: 191, fig. 133.

Material: North Carolina (Bogue Sound near Morehead City, intertidal): 1 male, 6 females, C. JENNER & J. OTT coll 26. Nov. 1988, NHMW No. 6757; – South Carolina, North Inlet, (muddy sandflat): 1 female, J. OTT & P. DWORSCHAK coll. 22. Nov. 1988, NHMW No. 6777; North Inlet, Sixty Bass Creek: 1 female, D. ALLEN coll. 1/80, NHMW No. 6796.

Remarks: Males show female genital pores, which seems to be a sign of hermaphroditism. It occurs along the Atlantic coast of the Americans from Massachusetts to Florida, in the Gulf of Mexico, and throughout the West Indies south to Brazil, where it is common in estuarine mudflats and shallow estuaries (WILLIAMS 1984). According to JENNER (pers. comm.) 1 male and several females live in one burrow.

Upogebia ?amboinensis (DE MAN, 1888)

Gebiopsis intermedia var. *amboinensis* DE MAN, 1888b: 462.

Material: Amboina: 1 female, DE MAN don., NHMW No. 6886 (1889 II. 12.).

Remarks: In 1888, DE MAN described briefly a variation *amboinensis* of the species *intermedia* DE MAN (1888a) based on 7 specimens, collected in Amboina. In 1902, DE MAN mentioned one more specimen of this species collected in Ternate. The same author (DE MAN 1928b) listed a var. *amboinensis* under *U. (Calliadne) ancylodactyla* in the key (p. 50); he also figured telson and antennule of the cotype of *Gebiopsis intermedia* var. *amboinensis* in his private collection under *Upogebia (Calliadne) ancylodactyla* var. *amboinensis* (1928, pl. 10 fig. 14). TIRMIZI & KAZMI (1979) re-examined types of *G. intermedia* var. *amboinensis* deposited in the Zoological Museum of Amsterdam and designated a female as lectotype. They state that this specimen might be the one mentioned and figured by DE MAN (1928b). SAKAI (1982: 25) also designated a lectotype for a male from Amboina and two further females as paralectotypes from BROCKS collection deposited at the Zoological Museum Göttingen. In his addendum, SAKAI (1982: 105) mentioned the designation made by TIRMIZI & KAZMI and thus the invalid lectotype designation of his own (made before 1977 but published 1982). He further states that his and TIRMIZI & KAZMIS specimens certainly belong to the same species.

The specimen deposited in the NHMW is obviously one of the seven mentioned by DE MAN (1888b). This is evident by (1) the date of acquisition – 1889, (2) the donator – DE MAN, (3) the note in the inventory of acquisitions „Im Tausche von Göttinger Universität (Prof. EHLERS)", and (4) the sampling location – Amboina.

SAKAI (1982) described a new species (*U.(U.) kuekenthali*) based on the specimen collected at Ternate and mentioned by DE MAN (1902) under *G. intermedia* var. *amboinensis*. The specimen at the NHMW has in fact

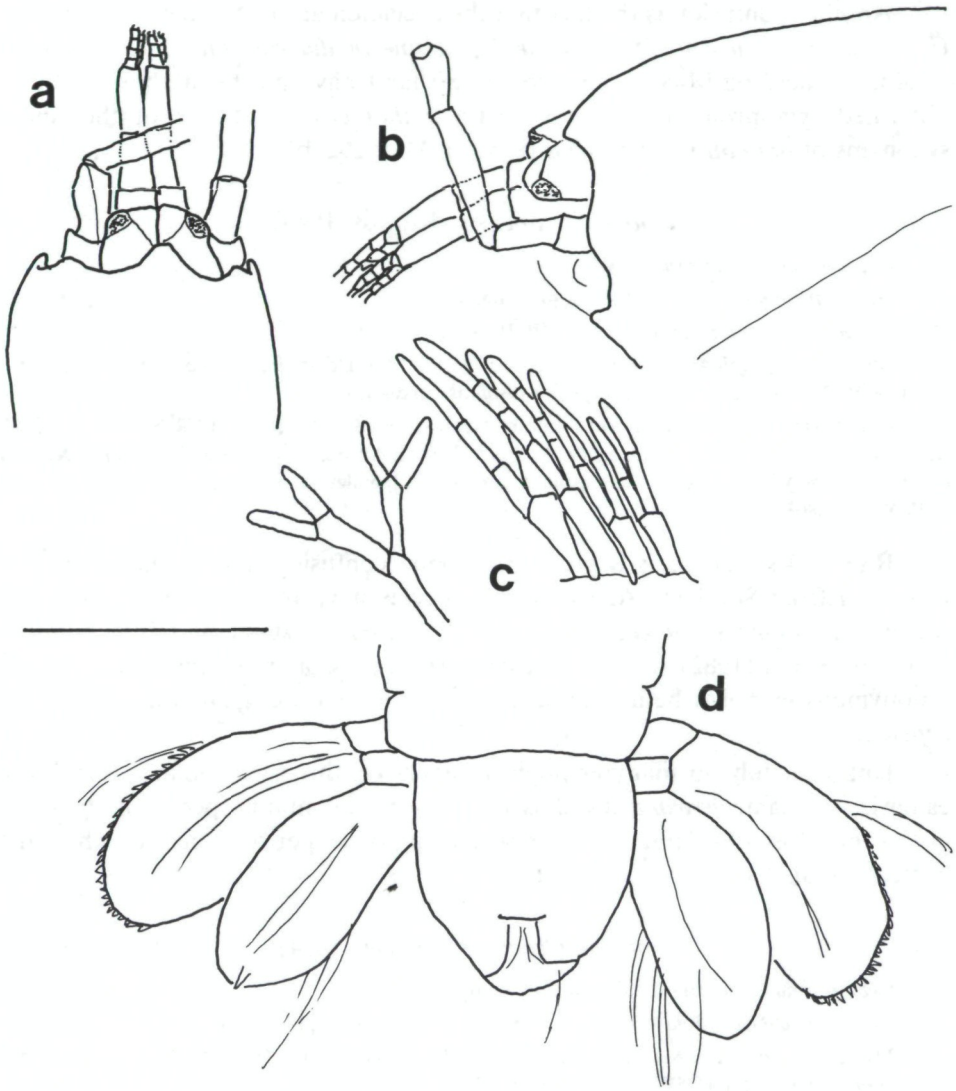

Fig. 17: *Callianidea typa* (NHMW No. 6721).
a: front in dorsal view; b: same in side view; c: detail of gill filaments on pleopods; d: tail fan in dorsal view; scale is 3 mm (a, b, d) and 1.5 mm (c).

characters which are intermediate between that of *amboinensis* and *kuekenthali* (sensu SAKAI). The rostrum is quite pointed (similar to *kuekenthali;* SAKAI 1982 fig. 6a), but the shape of the pereiopod – especially the dactylus and the fixed finger – are similar to *amboinensis* (SAKAI 1982: fig. 5a). In addition, the characters listed in the table by SAKAI (1982: 26–27) show virtually no difference and do not agree with the figures given for both species.

Another confusion is the fact that the specimen at the NHMW is labelled as *U. (Gebiopsis) darwini* MIERS [= *Gebiopsis intermedia* var. *amboinensis*], in the catalogue „det? DE MAN" is mentioned. So far I have not been able to trace a published synomization of *darwini* with *amboinensis,* but one of the junior synonyms of *darwini* is *intermedia* (e. g. DE MAN 1928b).

Upogebia capensis (KRAUSS, 1843)

Gebia major var. *capensis* KRAUSS, 1843: 54

Gebia africana ORTMANN, 1894: 22, pl. 2, fig. 4.

Upogebia africana BARNARD, 1946: 380; 1950: 519.

Upogebia (Upogebia) capensis SAKAI, 1982: 43, pls. A6, D5–6, fig. 9c (not *Upogebia capensis* DE MAN, 1927; BARNARD, 1950 = *Upogebia subspinosa* STIMPSON, 1860).

Material: South Africa, Port Elizabeth: 2 male, 1 female, ADLER coll. 1878, NHMW No. 1871; Kowie, Port Alfred: 2 females (damaged), A. PENTHER coll., ADENSAMER det. (as *U. deltaura*), NHMW No. 6702 (1898 VIII.9.); Keurbooms estuary: 5 males, 4 females (1 ovigerous), N. HANEKOM coll., NHMW Np. 6803.

Remarks: There is a great taxonomic confusion among the species of *Upogebia* from Southern Africa. Three species have been described from this region: *U. major* var. *capensis* KRAUSS, *U. africana* ORTMANN, and *U. subspinosa* STIMPSON. SAKAI (1982) showed that *capensis* KRAUSS and *africana* ORTMANN are synonymous, *capensis* being the senior synonym, and designated a neotype for *capensis.*

Unfortunately, in many ecological papers on this very common species in estuaries the name *africana* is still used. The second common species of *Upogebia* in this region is *subspinosa* STIMPSON (occurring in deeper bottoms) for which the name *capensis* has often been used.

Upogebia ?darwini (MIERS, 1884)

Gebiopsis darwinii MIERS, 1884: 281, pl. 32, fig. A.

Upogebia (Upogebia) darwini SAKAI, 1982: 17, figs. 3a, 4a–c, pls. A1–3, C3.

Material: Red Sea, Massanah: 1 male, Rot. Meer Polaexp. Mus. Wien, 28. 12. 1897, BALSS det. (as *Gebiopsis darwini*), NHMW No. 6885 (1889 II. 12).

Remarks: The specimen is very damaged. The carapace, the propodus of the only (left) cheliped and all calcified parts are broken off. Judging from the soft rostrum and the remaining part of the merus of P 1 it shows the characters of the species as shown in SAKAI (1982: fig. 3a and 4b). On the other hand, the shapes of the fixed finger and the dactylus of P 1, which are quite stout, are different. In addition, this group of species is a quite difficult one – SAKAI (1982: 17) lists 4 different synonyms for the species (*octoceras* NOBILI, *hexaceras* NOBILI, *hirtifrons* NOBILI, *bowerbankii* SAKAI) for which he designated a lectotype; the name *darwini* can be found in the list of synonyms of three other species *(barbata, ancylodactyla, carinicauda)* attributed by four different authors (NOBILI, NGOC-HO, POORE & GRIFFIN).

BALSS determined this specimen; it is, however, not listed in his publication of 1915. He mentioned *U. hirtifrons* NOBILI, 1906. DE MAN (1927: 43) investigated BALSS's specimen, collected by the „Pola" expedition 1895 in Suez, and assigned the name *U. Balssi* to it. According to SAKAI (1982), *balssi* is probably synonymous with *darwini.*

Upogebia deltaura (LEACH, 1815)

Gebia deltaura LEACH, 1815a: 342.

Gebia deltura LEACH, 1815b: pl. 31, fig. 9–10; BELL, 1853: 225, fig.; ADENSAMER, 1899: 621.

Upogebia (Gebiopsis) deltaura PESTA, 1918: 199, fig. 62; BOUVIER, 1940: 106, fig. 70.

Upogebia (Calliadne) deltaura DE MAN, 1927: 17, pl. 2, fig. 8, 8b.

Upogebia deltaura LELOEUFF & INTES, 1974: 56, fig. 19–19 bis; SAINT LAURENT & LELOEUFF, 1979: 40, fig. 3; ADEMA & al., 1982: 28, fig. 8.

Upogebia (Gebiopsis) deltaura PESTA, 1918: 199, fig. 62; BOUVIER, 1940: 106, fig. 70.

Upogebia (Calliadne) deltaura DE MAN, 1927: 17, pl. 2, figs. 8–8b.

Upogebia deltaura LELOEUFF & INTES, 1974: 56, figs. 19a–p, 19 bis; SAINT LAURENT & LELOEUFF, 1979: fig. 3.

Material: Skagerrak, Sweden, Bahusia (= Bohuslän): 1 female, LOVEN coll. 1862, NHMW No. 6699 (1862 V. 16.). – North Sea, Oystergrounds? (40 m): 2 males K 24 (1/2 of REINECK box core collected by IRION) May 1984, NHMW No. 6776. – Adriatic Sea, St. 279, 132 m depth, „Pola" Expedition 1894: 1 male, NHMW No. 302 (1899 I. 76); South of the Isle of Lagosta St. N 475: 1 female, Zool. Stat. Rovinj coll., VATOVA don., NHMW No. 6697 (1939 IV. 2.); Aurisina (Pos. 0, 8.5 m, mud): 1 female (damaged): P. PERVESLER coll. with air lift sampler (together with *U. tipica*) May 1985, NHMW No. 6786; Rovinj (20–25 m mud): 1 female, Zool. Inst. Vienna coll. July 1982, NHMW No. 6785.

Remarks: See below.

Upogebia cf. *deltaura* (LEACH, 1815)

Upogebia cf. *deltaura* KOCATAŞ, 1981: 162.

Material: Adriatic Sea, NXID 5 „Najade" 1913: 1 juvenile, NHMW No. 303.– Tyrrhenian Sea, Ischia (Lacco Ameno, 2 m, in *Posidonia* rhizome): 1 male, 2 females, K. WITTMANN coll. 1 June 1987, NHMW No. 6764; Ischia (Castello A, *Posidonia* rhizome): 2 males, 3 females (1 ovigerous) (VI/2/S/L), 1 male (VI/3/S/L), W. TERTSCHNIG coll. 14 May 1981, NHMW No. 6763; Ischia (*Posidonia* rhizome) 1 female, P. DWORSCHAK coll. 8 September 1982, NHMW No. 6912.

Remarks: In 1979, M. DE SAINT LAURENT distributed a key of the Western Atlantic and Mediterranean species of *Upogebia* („Tableau de détermination des *Upogebia* de l'Atlantique nord-oriental et de Méditerranée") at the II Colloquium Crustacea Mediterranea in Ancona, Italy. This key was then further distributed by M. DE SAINT LAURENT and the participants of the workshop. In this key a species close to *U. deltaura* is indicated. It is characterized by a more rounded pleuron of the first abdominal segment and the absence of a spine at the penultimate segment of the antennal (A2) peduncle. Subsequently, this species – distinct from *U. deltaura* LEACH – was recognized by KOCATAŞ (1981), THESSALOU-LEGAKIS & ZENETOS (1985) and THESSALOU-LEGAKIS (1986). Both forms are present in the collection of the NHMW. The typical *U. deltaura* is larger (up to tl 55 mm) and occurs in the North Sea and in the Mediterranean in deeper muddy bottoms (8.5 to 25 m) *U.* cf. *deltaura* is smaller (ovigerous females with tl =

40 mm), confined to the Mediterranean, and is a very common burrower in dead rhizomes of the seagrass *Posidonia.* A detailed description of the Mediterranean species is in preparation by SAINT LAURENT (pers. comm. 1989).

Upogebia macginitieorum WILLIAMS, 1986

Upogebia macginitieorum WILLIAMS, 1986: 30, fig. 11.

Material: Mexico, Baja California, Bahia de San Quintin: 2 males, 1 female, R. GRIFFIS coll. March 1987, NHMW No. 6756.

Remarks: This species has long been confused with *U. pugettensis* (WILLIAMS, 1986).

Upogebia major (DE HAAN, 1839)

Gebia major DE HAAN, 1839: pl. 35, fig. 7; 1849: 165; ORTMANN, 1891: 54, pl. 1, figs. 7a–b.

Upogebia (Upogebia) major DE MAN, 1927: 47, pl. 6, fig. 18; MAKAROV, 1938: 54, fig. 16–17; SAKAI, 1982: 67, pls. B 5, G 3–4, figs. 15g–h (complete synonymy).

Material: Japan: 1 male, 2 females, RORETZ coll., NHMW 6703 (1877 I. 25.); 1 male, ERBER coll. 1875, NHMW 6712; 1 male, 1 female, ERBER coll. 1875, NHMW No. 6713; 1 male, ERBER coll. 1875, NHMW No. 6723; 1 female (ovigerous), M. SAKAMOTO coll., NHMW No. 6892; 2 females, 8 juv, males, M. SAKAMOTO coll., NHMW No. 6891; 1 male, Zool. Inst. Wien don., NHMW No. 6890 (1929 XXI).

Remarks: The specimen NHMW 6890 has a label reading *Gebia maxima* DE HAAN. *U. major* is the most common member of the family in Japanese tidal flats.

Upogebia pugettensis (DANA, 1852)

Gebia pugettensis DANA, 1852a: 19; 1852b: 510; 1855: pl. 32, figs 1a–d.

Upogebia pugettensis STEVENS, 1928: 318, figs. 1–5; 1929: 400, figs. 1,3; WILLIAMS, 1986: 35, fig. 13 (complete synonymy)

Material: Washington State: 1 male (dissected, with commensal bivalve *Pythina* sp. on abdomen), Mus. Washington don., NHMW No. 6704 (1933 XXV.); – California, San Francisco: 1 male, STEINDACHNER don., NHMW No. 6705.

Remarks: This species occurs along the Pacific coast of North America from Alaska south to California and is very common in intertidal mudflats. Its natural history has been described in detail by STEVENS (1928) and MACGINITIE (1930, 1935).

Upogebia pusilla (PETAGNA, 1792)
(Fig. 18a, c, g, h)

Astacus pusillus PETAGNA, 1792: 418, pl. 5, fig. 5

Thalassina littoralis RISSO, 1816: 76, pl. 3, fig. 3

Gebia littoralis H. MILNE EDWARDS, 1937: 313.

Upogebia littoralis BORRADAILE, 1903: 543; DE MAN, 1927: 29, fig. 11–11b.

Upogebia (Upogebia) litoralis PESTA, 1918: 197 (partim), fig. 61a.

Upogebia pusilla HOLTHUIS, 1947: 321, fig. 1; ZARIQUIEY ALVAREZ, 1968: 231, fig. 94a; SAINT LAURENT & LELOEUFF, 1979: 43, fig. 5a.

Material: Mediterranean: 5 males, 13 females, NHMW No. 305 (Alte Sammlung); 1 male (dry), NHMW No. 306 (Alte Sammlung 1886); – Italy, Servola (near Trieste): 3 males, 1 female, 2 specimens (unsexable), coll. 1861, NHMW No. 307 (Alte Sammlung); Aurisina (7 m): 1 male, 4 females, 1 juv. exuvia, P. DWORSCHAK coll. August 1983, NHMW No. 6812; Aurisina (6 m): 2 males, 3 females (1 ovigerous), P. DWORSCHAK & P. PERVESLER coll. with air lift sampler 22. August 1984, NHMW No. 6811; 5 males, 19 females (6 ovigerous), P. DWORSCHAK & P. PERVESLER coll. 18. August 1984, NHMW No. 6802; Aurisina-Pta. Sdobba (station 8, 4 m): 1 female (ovigerous), P. PERVESLER coll. with air lift sampler May 1985, NHMW No. 6908; 1 female (ovigerous), NHMW No. 6711; Lido di Staranzano (intertidal): 4 males, 3 females, P. DWORSCHAK coll. May 1988, NHMW No. 6762; Lagoon of Grado (intertidal): P. DWORSCHAK coll., 1 male March 1977, NHMW No. 6899, 1 female (ovigerous) 11 April 1979, NHMW No. 6900, 1 male October 1978, NHMW No. 6901; Punta Sabbioni (mudflat in Venice-lagoon intertidal): 1 male, 2 females, P. DWORSCHAK coll. with yabby pump 25 March 1989, NHMW No. 6779; Emilia Romagna near Bellaria, 8 m: 2 females (ovigerous). H. SCHWAMMER & M. STACHOWITSCH coll. July 1989 (dead on sediment surface), NHMW No. 6801; Naples: 2 males, 4 females, ADENSAMER don., NHMW No. 6690 (1898 III. 6.); 1 male, 5 females, FISCHER don. 1877, NHMW No. 6692; Sicily: 1 male, NHMW No. 1726 (Alte Sammlung); 3 males, 4 females, NHMW No. 6691 (Alte Sammlung). – Slovenia, Bay of Strunjan (intertidal): 2 females, P. DWORSCHAK coll. September 1983, NHMW No. 6888; Croatia, Spalato (= Split): 2 females, O. PESTA coll., NHMW No. 311 (1912 29. V.); Rovinj, Kuvi 0 m: 1 male, 1 female, Z. ŠTEVČIĆ coll., NHMW No. 6695; Rovinj, Val Saline: 7 males, 9 females (6 ovigerous, P. DWORSCHAK coll. July 1983, NHMW No. 6810; Arbe (= Rab), Camparastrand (In einer Bucht im Meeressand auf Arbe 7. VI. 1911): 4 males, 1 female, NHMW No. 6694 (1934 VI.); – Turkey, Smyrna (= Izmir): 1 female (damaged), COCCHINI coll., NHMW No. 6693 (1895 II.61.); – Corsica, Ajacuio (= Ajaccio): 2 males, MANN coll. 1855, NHMW No. 6700; – Spain, Port Lligat, Cadaques (coarse sand, intertidal): 3 males, P. DWORSCHAK coll. with yabby pump April 1985, NHMW No. 6760. – Middle Atlantic, Teneriffa?: 1 male STEINDACHNER coll., NHMW No. 6696.

Remarks: This is the most common species of the family in the Mediterranean, occuring in intertidal mudflats. Its biology has been described in detail by DWORSCHAK (1983, 1987a, 1987b, 1988).

Upogebia savignyi (STRAHL, 1862)

Calliadne Savignyi STRAHL, 1862: 1064.

Upogebia (Calliadne) savignii BALSS, 1915: 2; DE MAN, 1927: 5, pl. 1, fig. 1.

Upogebia (Upogebia) savignyi SAKAI, 1982: 14, figs. 1c, 2f–h (complete synonymy).

Material: Red Sea, Berenice 26/11 „Pola" Expedition 1895: 1 female (ovigerous), BALSS det. NHMW No. 6701.

Remarks: This is obviously one of the two specimens mentioned by BALSS (1915). The species is common in the Red Sea and lives in sponges (BALSS 1915, DE MAN 1927).

Upogebia simsoni (THOMSON, 1893)

Gebia simsoni THOMSON, 1983: 49, pl. 1, figs. 3–5.

Upogebia simsoni HALE, 1927: 85.

Upogebia (Upogebia) simsoni POORE & GRIFFIN, 1979: 301, fig. 52.

Upogebia (Acutigebia) simsoni SAKAI, 1982: 71, figs. 14c–e.

Material: New Zealand: 1 female, Zool. Inst. Wien coll., NHMW No. 924 (1929 XXI.).

Remarks: This species has a crista dentata on mxp 3, a rather unusual character within the family Upogebiidae.

Upogebia tipica (NARDO, 1869)
(Fig. 18b, d–f)

Bigea tipica NARDO, 1847: 47 (nomen nudum); NARDO, 1869: 317, pl. 13, fig. 4.

Upogebia (Upogebia) litoralis PESTA, 1918: 197 (partim), fig. 61

Upogebia (Upogebia) gracilipes DE MAN, 1927: 40, pl. 4, fig. 15, 15a, pl. 5, fig. 15c–d; BOUVIER, 1940: 110, fig. 73.

Upogebia tipica HOLTHUIS & GOTTLIEB, 1958: 65

Material: Adriatic Sea – Italy, Aurisina (station 0, 8.5 m): 2 females (1 ovigerous), P. PERVESLER coll. with air lift sampler May 1985, NHMW No. 6907; Aurisina (9 m) P. DWORSCHAK & PERVESLER coll with air lift sampler: 1 male, August 1984, NHMW No. 6905; 1 female (ovigerous), NHMW No. 6911; Aurisina (12 m): P. DWORSCHAK & P. PERVESLER coll. with air lift sampler: 1 male, 17. August 1984, NHMW No. 6909; 1 female (exuvia), June 1984, NHMW No. 6910; Trieste: 1 specimen, NHMW No. 1727; 1 male, 2 females, STEINDACHNER coll., NHMW No. 308 (1907 10.V.); 3 males, NHMW No. 1691 (1904); Servola near Trieste: 1 female, NHMW No. 1502; Zaule near Trieste: 1 female, MARENZELLER don. 1877, NHMW No. 312. – Slovenia, Piran: 1 male, Mus. Vindob. Coll (type specimen of *U. gracilipes* DE MAN 1927), NHMW No. 304 (1884 I. 13.); Piran (station 1 in STACHOWITSCH 1984, 25 m mud): 2 males, 4 females (1 ovigerous), P. DWORSCHAK coll. 19. September 1983 dead on sediment surface, NHMW No. 6787; Croatia, Rovinj: 2 males, LICHTENSTERN don., NHMW No. 309 (1886 IV. 44.); Rovinj (mud, 20 m): 1 female (ovigerous), Zool. Inst. Vienna coll. July 1982, NHMW No. 6906. – ?Fundort: 1 male, ?FRAUENFELDS Nachlaß NHMW No. 6698.

Remarks: From the figures in PESTA (1918), DE MAN recognized that the material from the Adriatic listed under *U. littoralis* contained a second species. Based on PESTA's material he described *U. gracilipes* and separated it from *U. littoralis* (=*pusilla*) (DE MAN 1927). One of the types – a male – is deposited in the NHMW. The second type specimen is preserved in the collection of the Zoological Museum at Amsterdam. HOLTHUIS & GOTTLIEB (1958) found a senior synonym for this species in *tipica* (NARDO 1869). The most important characters given by different authors (DE MAN 1927, BOUVIER, 1940, SAINT LAURENT 1971) to distinguish *U. tipica* from *U. pusilla* are: 1) the long and narrow rostrum 2) the lack of the enlargement of the propodus at the fixed finger 3) the more slender propodus (length/width relation of approximately 3 in *U. tipica* compared to 1.5 in *U. pusilla)* and 4) the spination of the P 1, especially of the upper margin of the propodus. GARCIA RASO (1983), however, argued that these and other characters are not sufficiently clear: he found great morphological variations in *U. pusilla* specimens from Spain which may lead to confusion with *U. tipica.* He reported, for instance, a length/width relation of the propodus of P 1 between 1.47 and 2.65 in males, between 2.15 and 2.8 in females, and between 2.8 and 3.7 in juveniles. The material at the NHMW posed no problems in distinguishing *U. tipica* from *U. pusilla:* 1) in *U. tipica* the rostrum is long and narrow, at least 6 of the conical teeth on the dorsal face are visible between the tip and the prominent side tooth when viewed laterally and it extends almost to the penultimate segment of the A 2 peduncle – in *U. pusilla* the rostrum is broader and shorter, only up to 4 of the conical teeth are visible when viewed laterally, and 2) in *U. tipica* there is at least

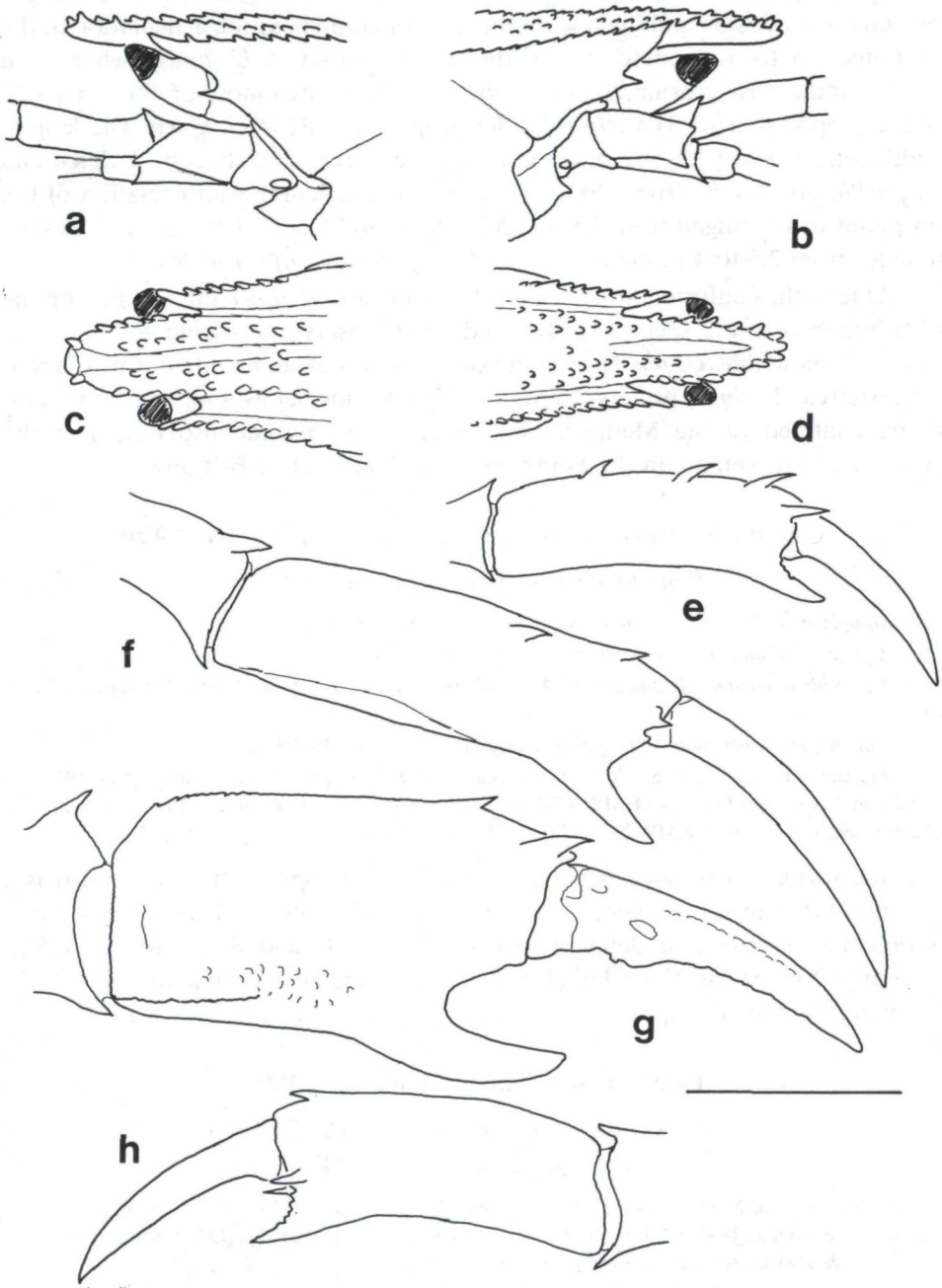

Fig. 18: *Upogebia pusilla* and *U. tipica.*
a and b: front of *U. pusilla* in side view and viewed from above (male with cl = 17.6 mm); b and d: same of *U. tipica;* e and f: chelipeds of *U. tipica,* inner side (female with cl = 13.7 mm, NHMW No. 1502 and male with cl = 14.2, NHMW No. 304); g and h: chelipeds of *U. pusilla* (same male as in a and female with cl = 16 mm, NHMW No. 6762); scale is 5 mm.

one prominent spine on the upper margin of the propodus of P 1 behind the one on the inner side and the one on the upper margin near the articulation of the dactylus. Up to 5 spines occur on the upper margin in *U. tipica,* whereas in *U. pusilla* there is occasionally only a row of teeth located more on the inner side of the propodus, and 3) a more slender propodus of P1 in *U. tipica.* The length/width ratio varies with size and sex and a great overlap between *U. tipica* and *U. pusilla* does exist, especially in the females. The length/width relation of the propodus of P1 ranged from 1.8 to 2.5 in males and from 2.1 to 3.5 in *U. pusilla;* females from 2.6 to 4 in males and from 3 to 4.9 in *U. tipica* males.

Due to the confusion in separating *U. pusilla* and *U. tipica* information on the distribution of these species is obscured. Own observations from the Adriatic, however, show that *U. pusilla* is common in intertidal sediments down to about 6 m, whereas *U. tipica* prefers deeper muddy bottoms below 9 m. *U. tipica* seems to be confined to the Mediterranean, whereas *U. pusilla* also occurs in the Atlantic to Mauretania in the South, and North at least to Brittany.

Genus *Pomatogebia* WILLIAMS & NGOC-HO, 1990

Pomatogebia operculata (SCHMITT, 1924)

Upogebia (Gebiopsis) operculata SCHMITT, 1924a: 91, pl. 5.

Upogebia (Calliadne) operculata SCHMITT, 1935b: 197, fig. 59.

Upogebia operculata KLEEMANN, 1984: 35–47, pl.1, fig.1–2; SCOTT & al 1988: 484, figs. 2b, 3a–b, 4a, 7a.

Pomatogebia operculata WILLIAMS & NGOC-HO, 1990: 614–616, fig. 1.

Material: Caribbean, St. Croix, Virgin Islands: K. KLEEMANN coll. 1982, 1 male (NHMW 4531) cl. 8.2 mm, 1 ovigerous female (NHMW 4532) cl. 7.1 mm; several pieces of corals with lebensspuren and silicone casts of borings (NHMW Nos. 4533 to 4542).

Remarks: This species is characterized by its operculated tail fan. It is a common borer in several species of corals in the Caribbean. Their lebensspuren have been described in detail by KLEEMANN (1984) and SCOTT & al. (1988). Recently, WILLIAMS & NGOC-HO (1990) described the genus *Pomatogebia* with *U. operculata* as the type species.

Family Laomediidae BORRADAILE, 1903

Genus *Jaxea* NARDO, 1847

Jaxea nocturna NARDO, 1847

Jaxea nocturna NARDO, 1847: 3; 1869: 318, pl. 13, fig. 5; PESTA, 1918: 193, fig. 60; CAROLI, 1921: 268, fig. 3; BOUVIER, 1940: 98, fig. 66; ZARIQUIEY ALVAREZ, 1946: 105, fig. 133; 1968: 226, fig. 94b; PERVESLER & DWORSCHAK, 1985: 33 (passim), pl. 1, fig. 1–3.

Calliaxis adriatica HELLER, 1862: 440, pl. 3, fig. 22–30; 1863: 208, pl. 6, fig. 16–18.

Material: Adriatic Sea – Italy, Miramare (near Trieste): 1 female, NHMW No. 301 (1868 6. IV.); Trieste: 1 male, NHMW No. 300 (1891 I. 54.); – Slovenia, Piran: 1 female, NHMW No. 297 (1884 I. 16); 1 male NHMW No. 299; Piran (station 1 in STACHOWITSCH 1984, 25 m): 1 male, 2 females, 1 male exuvia, P. DWORSCHAK coll. dead on sediment surface 18.–19. September 1983, NHMW No. 6759; Rovinj: 1 male, LICHTENSTERN don., NHMW No. 298 (1886 IV. 3.).

Remarks: This species occurs in the Atlantic and the Mediterranean in sandy mud between 9 and 250 m. Their characteristic, large (horizontal extension up to 110 cm and up to 90 cm deep) burrows, which are inhabited by a single shrimp (tl up to 49 mm), have been described by PERVESLER & DWORSCHAK (1985).

Acknowledgements

My thanks are due to all the colleagues who either helped me to obtain the specimens in the field or provided me with their material: D. ALLEN (Georgetown, SC), D. FELDER (Lafayette, LA), R. GRIFFIS (Davis, CA), N. HANEKOM (Tsitsikamma, Southern Africa), G. HERTWECK (Wilhelmshaven, Germany), C. JENNER (Chapel Hill, NC), J. OTT, P. PERVESLER (Vienna, Austria), S. DE A. RODRIGUES (São Paulo, Brazil), H. SCHWAMMER, M. STACHOWITSCH (Vienna, Austria), A. TAMAKI (Nagasaki, Japan), W. TERTSCHNIG, K. WITTMANN (Vienna, Austria), and J. DE VAUGELAS (Nice, France). The author is grateful to the entire staff of the 3rd Zoological Department of the NHMW for their help while working at the museum and to Dr. M. STACHOWITSCH for critical reading of the manuscript.

References

ABELE, L. G. & W. KIM (1986): An illustrated guide to the marine decapod crustaceans of Florida. – State of Florida, Department of Environmental Regulation, Technical Series **8** (1): i–xvii + 326 pp. (Part 1), 327–760 (Part 2), pls. – Tallahassee, FL.

ADEMA, J. P. H. M., F. CREUTZBERG & G. J. VAN NOORT (1982): Notes on the occurrence of some poorly known Decapoda (Crustacea) in the southern North Sea. – Zool. Bijdr.; **28**: 9–32. – Leiden.

ADENSAMER, T. (1898): Decapoden gesammelt aus S. M. Schiff Pola in den Jahren 1890–1894. Berichte der Commission für Erforschung des östlichen Mittelmeeres. XXII. Zoologische Ergebnisse. XI. – Denkschr. Akad. Wiss., Wien; **65**: 597–628, 1 fig. – Wien.

ATKINSON, R. J. A. & R. D. M. NASH (1990): Some preliminary observations on the burrows of *Callianassa subterranea* (MONTAGU) (Decapoda: Thalassinidea) from the west coast of Scotland. – J. Nat. Hist.; **24**: 403–413. – London.

BALSS, H. (1915): Die Decapoden des Roten Meeres. II Anomuren, Dromiaceen und Oxystomen. – Ber. Komm. ozeanogr. Forsch., Denkschr. Akad. Wien; **92**: 1–20. – Wien.

— (1957): Decapoda. VII. Systematik. – In. BRONNs Klassen und Ordnungen des Tierreichs; Band **5**, Abt. 1, Buch 7, Liefg. 12. – pp. 1505–1672, textfigs. 1131–1199. – Leipzig.

BARNARD, K. H. (1947): Description of new species of South African Decapod Crustacea, with notes on synonymy and new records. – Ann. Mag. Nat. Hist; (11) **13** (102), 1946: 361–392. – Capetown.

— (1950): Descriptive catalogue of the South African Decapod Crustacea (crabs and shrimps). – Ann. S. Afr. Mus.; **38**: 1–837, 154 figs. – Capetown.

BEAUBRUN, P. C. (1978): Crustacés Décapodes marcheurs des cotes Marocaines (Section des Astacidea, Eryonidea, Palinura, Thalassinidea). – Bull. Inst. Sci., Rabat; **3**: 1–110, 75 figs. – Rabat.

BELL, T. (1844–1853): A history of the British stalk-eyed Crustacea. – 386 pp., 174 figs. – London (J.Van Voorst).

BIFFAR, T. A. (1971): The genus *Callianassa* (Crustacea, Decapoda, Thalassinidea) in south Florida, with keys to the western Atlantic species. – Bull. Mar. Sci.; **21** (3): 637–715, 22 figs. – Miami.

BOONE, L. (1927): Scientific results of the first oceanographic expedition of the „Pawnee" 1925. Crustacea from tropical east American seas. – Bull. Bingham Oceanogr. Coll.; **1** (Art 2): 1–147. – New Haven, Conn.

BORRADAILE, L. A. (1903): On the classification of Thalassinidea. – Ann. Mag. Nat. Hist.; (7) **12**: 534–551. – London.

BORRADAILE, L. A. (1904): Marine Crustaceans. XIII. The Hippidea, Thalassinidea and Scyllaridea. – In: GARDINER, J. S. (Ed.) The fauna and geography of the Maldive and Laccadive Archipelagos, Vol. **2** (3): 753, pl. 58 – Cambridge (University Press).

— (1907): On the classification of the decapod crustaceans. – Ann. Mag. Nat. Hist.; (7) **19**: 457–486. – London.

BOUVIER, E. L. (1901): Sur quelques Crustacés du Japon, offerts au Muséum par M. le DR. HARMAND. – Bull. Mus. Hist. Nat.; **7**: 332–334. – Paris.

— (1940): Décapodes Marcheurs. – In: Faune de France; **37**: 1–404, 222 figs., 14 pls. – Paris (Lechevalier).

BRANCH, G. M. & A. PRINGLE (1987): The impact of the sandprawn *Callianassa kraussi* STEBBING on sediment turnover and on bacteria, meiofauna, and benthic microflora. – J. Exp. Mar. Biol. Ecol.; **107**: 219–235. – Amsterdam.

CAROLI, E. (1921): Talassinidei nuovi o rari del golfo di Napoli. – Pubbl. Staz. Zool., Napoli; **3**: 253–274, figs. 1–3, pls. 9–10. – Napoli.

CHACE, F. A. JR., J. J. MCDERMOTT, P. A. MCLAUGHLIN & R. B. MANNING (1986): Order Decapoda. – In: STERRER, W. (Ed.) Marine fauna and flora of Bermuda. – pp. 312–358, New York (J. Wiley).

CZERNIAVSKY, V. (1884): Crustacea Decapoda Pontica littoralia. Materalia ad Zoographiam Ponticam Comparatam. II. – Trans. Soc. Univ., Charkov; **13** (suppl.): 1–268, pls. 1–7. – Charkov.

DANA, J. D. (1852a): Conspectus of the Crustacea of the Exploring Expedition under Capt. WILKES, U. S. N. – Proc. Acad. Nat. Sci., Philadelphia; **6**: 6–28. – Philadelphia, PA.

— (1852b): Crustacea. United States Exploring Expedition during the years 1838–1842 under the command of Charles WILKES, U. S. N.; **13**: i–vii + 1618 pp. – Philadelphia (C. Sherman).

— (1854): Catalogue and descriptions of Crustacea collected in California by Dr. John L. LE CONTE. – Proc. Acad. Nat. Sci., Philadelphia; **7**: 175–177. – Philadelphia, PA.

— (1855): Crustacea: United States Exploring Expedition during the years 1838–1842 under the command of Charles WILKES, U. S. N. – Atlas, 27 pp., 96 pls. – Philadelphia (C. Sherman).

DELL, R. K. (1956): A record of *Latreillopsis petterdi* GRANT (Crustacea, Brachyura) from New Zealand, with notes on some other species of Crustacea. – Rec. Dominion Mus. New Zealand; **2** (3): 147–149, fig. 1.

DWORSCHAK, P. C. (1983): The biology of *Upogebia pusilla* (PETAGNA) (Decapoda, Thalassinidea). I. The burrows. – P. S. Z. N. I: Marine Ecology; **4** (1): 19–43, 14 figs. – Berlin, Hamburg.

— (1987a): Feeding behavior of *Upogebia pusilla* and *Callianassa tyrrhena* (Crustacea, Decapoda, Thalassinidea). – Inv. Pesq.; **51** (Supl. 1): 421–429. – Barcelona.

— (1987b): The biology of *Upogebia pusilla* (PETAGNA) (Decapoda, Thalassinidea) II. Environments and Zonation. – P. S. Z. N. I: Marine Ecology; **8** (4): 337–358. – Berlin, Hamburg.

— (1988): The biology of *Upogebia pusilla* (PETAGNA) (Decapoda, Thalassinidea) III. Growth and production. – P. S. Z. N. I: Marine Ecology; **9** (1): 51–77. – Berlin, Hamburg.

— & P. PERVESLER (1988): Burrows of *Callianassa bouvieri* NOBILI 1904 from Safaga (Egypt, Red Sea) with some remarks on the biology of the species. – Senckenbergiana marit.; **20** (1–2): 1–17, 5 text-figs., 1 tabel, 2 pls. – Frankfurt/M.

EDMONDSON, C. H. (1944): Callianassidae of the central Pacific. – Occ. Pap. Bernice P. Bishop Mus; **18** (2): 35–61, 11 figs. – Honolulu, HI.

FELDER, D. L. (1973): An annotated key to crabs and lobsters (Decapoda, Reptantia) from coastal waters of the northwestern Gulf of Mexico. – Center for Wetland Resources, Louisiana State University, Baton Rouge, Publ. No. LSU-SG-73-02. – 103 pp., 12 pls. – Baton Rouge, L. A.

FERRARI, L. (1981): Aportes para el conocimiento de la familia Callianassidae (Decapoda, Macrura) en el Oceano Atlantico sudoccidental. – Physis, Secc. A., **39** (97): 11–21, 1 fig., 3 pls. – Buenos Aires.

FORBES, A. T. (1974): Osmotic and ionic regulation in *Callianassa kraussi* STEBBING (Crustacea: Decapoda: Thalassinidea). – J. Exp. Mar. Biol. Ecol.; **16**: 301–311. – Amsterdam.

FREY, R. W., J. D. HOWARD & W. A. PRYOR (1978): *Ophiomorpha:* its morpologic, taxonomic, and environmental significance. – Paleogeogr. Paleoclimatol. Paleoecol.; **23**: 199–229.

FROGLIA, C. & G.B.GRIPPA (1986): A catalogue of the types kept in the collections of Museo Civico di Storia Naturale di Milano. VII. Types of decapod Crustacea (Annotated catalogue). – Atti. Soc. Ital. Sci. nat. Museo Civ. Stor. nat., Milano; **127**: (3–4): 253–283. – Milano.

GARCIA RASO, J. E. (1983): Aportaciones al conocimiento de los Thalassinidea LATREILLE, 1831 (Crustacea, Decapoda) del sur de España. – Inv. Pesq.; **47** (2): 317–324, 3 figs. – Barcelona.

GIBBES, L. R. (1850): On the carcinological collections of the cabinets of Natural History in the United States with an enumeration of the species contained therein, and description of new species. – Proc. Am. Ass. Adv. Sci.; **3**: 167–201. – Washington, D.C .

GILL, T. (1859): Description of a new species of *Callianidea* ED. – Proc. Acad Nat. Sci., Phila.; **11**: 167–168. – Philadelphia, PA.

GLAESSNER, M. F. (1969): Decapoda. – In. R. C. MOORE (Ed.) Treatise on invertebrate paleontology. – pp. R399–R533. – Kansas (University Press).

GOTTLIEB, E. (1953): Decapod Crustaceans in the collections of the Sea Fisheries Research Station, Israel. – Bull. Res. Counc., Israel; **2**: 440–441. – Jerusalem.

GOURRET, P. (1887): Sur quelques Décapodes Macroures nouveaux du golfe de Marseille. – C. R. hebd. Seances Acad. Sci., Paris; **105**: 1033–1035. – Paris.

— (1888): Révision des Crustacés Podophthalmes du golfe de Marseille, suivie dún essai de classification de la classe des Crustacés. – Mem. Mus. Hist. Nat., Marseille; **3** (5): 1–212, 18 pls. – Marseille.

GRIFFIS, R. B. & F. L. CHAVEZ (1988): Effects of sediment type on burrows of *Callianassa californiensis* DANA and *C. gigas* DANA. – J. Exp. Mar. Biol. Ecol.; **117**: 239–253. – Amsterdam.

GURNEY, R. (1944): The systematics of the crustacean genus *Callianassa.* – Proc. Zool. Soc. London; **114** (5): 82–90, 19 figs. – London.

HAAN, W. DE (1833–1850): Crustacea. – In. SIEBOLD, P. F. (Ed.) Fauna japonica sive descriptio animalium, quae in itinere per Japoniam, jussu et auspicies superiorum, qui summum in India Batavia Imperium tenent, suscepto, annis 1823–1830 collegit, notis, observationibus et adumbrationibus illustravit. – 243 pp., pls. 1–55, A-Q. – Amsterdam (J. Müller & Co.).

HALE, H. M. (1927): The Crustaceans of South Australia. – 201 pp., 202 figs. – Adelaide (Harrison Weir).

HELLER, C. (1862): Untersuchungen über die Litoralfauna des adriatischen Meeres. – Sitzungsber. Wiener Akad. Wiss.; (Abt 1) **46**: 435–443, pl. 3. – Wien.

— (1863): Die Crustaceen des südlichen Europa. Crustacea Podophthalmia. Mit einer Übersicht über die horizontale Verbreitung sämtlicher europäischer Arten. – I–XI + 336 pp., pls. 1–10. – Wien.

— (1868): 1. Crustaceen. Reise der Österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. VON WÜLLERSDORF-URBAIR. Zoologischer Teil Band 2, III Abteilung. – 280 pp., 25 pls. – Wien.

HERBST, J. F. W. (1782–1804): Versuch einer Naturgeschichte der Krabben und Krebse, nebst einer systematischen Beschreibung ihrer verschiedenen Arten. – 3 Volumes, 62 pls. – Berlin & Stralsund.

HOLTHUIS, L. B. (1947): Nomenclatorial notes on European Macrurous Crustacea Decapoda. – Zool. Meded.; **27**: 312–322, 1 fig. – Leiden.

— (1953): On the supposed validity of the specific names *Callianassa laticauda* OTTO and *Callianassa pontica* CZERNIAVSKY. – Pubbl. Staz. Zool., Napoli; **24** (1): 91–98, 5 figs. – Napoli.

— (1958): Crustacea Decapoda from the Northern Red Sea (Gulf of Aqaba and Sinai Peninsula). I. Macrura. Contributions to the knowledge of the Red Sea No. 8. – Bull. Sea Fish Res. Stn., Haifa; **17**: 1–40, 15 figs. – Haifa.

— (1967): Biological investigations of the deep sea. 30. A survey of the genus *Ctenocheles* (Crustacea: Decapoda: Thalassinidea), with a discussion of its zoogeography and its occurrence in the Atlantic Ocean. – Bull. Mar. Sci.; **17** (2): 376–385, 2 figs. – Miami, FL.

— & E. GOTTLIEB (1958): An annotated list of the Decapod Crustacea of the Mediterranean coast of Israel, with an appendix listing the Decapoda of the eastern Mediterranean. – Bull. Res. Counc. Israel (B) **7** (1–2): 1–126, 15 figs. 3 pls., 2 maps. – Jerusalem

KENSLEY, B. (1974): The genus *Callianassa* (Crustacea Decapoda) from the west coast of South Africa with a key to the South African species. – Ann. S. Afr. Mus.; **62** (8): 265–278, 5 figs. – Capetown.

— (1976): Records of mud-prawns (genus *Callianassa*) from South Africa and Mauritius (Crustacea, Decapoda, Thalassinidea). – Ann. S. Afr. Mus.; **69**: 47–58, 5 figs. – Capetown.

— (1980): Notes on *Axiopsis (Axiopsis) serratifrons* (A. MILNE EDWARDS) (Crustacea: Decapoda: Thalassinidea). – Proc. Biol. Soc. Wash.; **93** (4): 1253–1263, 5 figs. – Washington, D.C .

— (1989): New genera in the thalassinidean families Calocaridae and Axiidae (Crustacea: Decapoda). – Proc. Biol. Soc. Wash.; **102** (4): 960–967, 1 fig. – Washington, D.C .

KINGSLEY, J. S. (1899): Synopsis of Astacoid and Thalassinoid Crustacea. – Am. Nat.; **33**: 819–824. – Chicago, Il.

KLEEMANN, K. (1984): Lebensspuren von *Upogebia operculata* (Crustacea, Decapoda) in karibischen Steinkorallen (Madreporaria, Anthozoa). – Beitr. Paläont. Österreich; **11**: 35–57, 5 pls. 13 figs. – Wien.

KOCATAŞ, A. (1981): Liste préliminaire et repartition des Crustacés Décapodes des eaux Turques. – Rapp. Comm. Int. Mer. Medit.; **27** (2): 161–162. – Monaco.

KRAUSS, F. (1843): Die Südafrikanischen Crustaceen. – 68 pp., 4 pls. – Stuttgart.

LAMARCK, J. B. P. A. (1818): Histoire naturelle des animaux sans vertèbres. Decapoda. – **5**: 200–273. – Paris.

LATREILLE, P. A. (1806): Genera Crustaceorum et Insectorum ordinem naturalem in familias disposita. – **1**: 24–55. – Paris.

LEACH, W. E. (1814): Crustaceology. – In: BREWSTER, D. (Ed.) The Edinburgh Encyclopedia; **7:** 383–437. – Edinburgh.

— (1815a): A tabular view of the external characters of four classes of animals, which LINNÉ arranged under Insecta; with the distribution of the genera composing three of these classes into orders etc. and descriptions of several new genera and species. – Trans. Linn. Soc., London; **11** (2): 306–400. – London.

— (1815b): Malacostraca Podophthalmata Britanniae; or descriptions of the British species of crabs, lobsters, prawns, and of other Malacostraca with pedunculated eyes. – 124 pp., 45 pls. – London.

LELOEUFF, P. & A. INTES (1974): Les Thalassinidea (Crustacea Decapoda) de Golfe de Guinée: Systématique, Ecologique. – Cah. ORSTOM, Sér. Oceanogr.; **12** (1): 17–69, 22 figs., 5 pls. – Paris.

LENZ, H. (1911): *Callianassa turnerana* WHITE und *Callianassa diademata* ORTM. – Sitzungsber. Ges. Naturf. Freunde, Berlin; **3**: 316–318, 16 figs. – Berlin.

LEWINSOHN, C. H. & L. B. HOLTHUIS (1986): The Crustacea Decapoda of Cyprus. – Zool. Verh.; **230**: 3–64, 1 fig. – Leiden.

LUNZ, G. R. (1937): Notes on *Callianassa major* SAY. – Charleston Mus. Leaflet; **10**: 1–15, 5 figs., 2 pls. – Charleston, SC.

LUTZE, J. (1937): Eine neue *Callianassa*-Art aus der Adria. – Note Ist. Biol., Rovigno; **2** (1): 3–12, 1 pl., 7 figs, 1 map. – Rovinj.

— (1938): Ueber Systematik, Entwicklung und Oekologie von *Callianassa.* – Helgol. Wiss. Meeresunters.; **1** (1–3): 162–199, 107 figs. – Helgoland.

MACGINITIE, G. E. (1930): The natural history of the mud shrimp *Upogebia pugettensis* (DANA). – Ann. Mag. Nat. Hist.; (10) **6**: 36–44, pls. 1–3. – London.

— (1934): The natural history of *Callianassa californiensis* DANA. – Am. Midl. Nat.; **15** (2): 166–176, pls. 5–6. – Notre Dame.

— (1935): Ecological aspects of a California marine estuary. – Am. Midl. Nat.; **16** (5): 629–765. – Notre Dame.

MAKAROV, V. V. (1938): Crustacés Décapodes Anomures. – In: Faune de l'URSS (nov. ser. No. 16), Acad. Sci. de l'URSS; **10** (3): i–x + 324 pp., 113 figs. 5 pls. – Moscow, Leningrad (Russian with English Summary).

MAN, J. G. DE (1888a): Report on the podophthalmous Crustacea of the Mergui Archipelago, collected for the trustees of the Indian Museum, Calcutta, by Dr. John ANDERSON, F. R. S. Superintendent of the Museum. – J. Linn. Soc., Zool.; **22**: 1–312, 19 pls. – London.

— (1888b): Bericht über die von Herrn Dr. J. BROCK im indischen Archipel gesammelten Decapoden und Stomatopoden. – Arch. Naturg.; **53**: 213–600, pls. 7–12a. – Berlin.

— (1902): Die von Herrn Professor KÜKENTHAL im Indischen Archipel gesammelten Dekapoden und Stomatopoden . – Abh. Senckenberg. naturf. Ges.; **25**: 465–929, pls. 19–27. – Frankfurt/M.
— (1911): On two new species of decapod Crustacea. – Notes Leyden Mus.; **33**: 223–232. – Leiden.
— (1915): Zur Fauna von Nord-Neuguinea. Nach den Sammlungen von Dr. P. N. VAN KAMPEN und K. GJELLERUP in den Jahren 1910–1911. Macrura. – Zool. Jb. Syst.; **38**: 385–458, pls. 27–29. – Jena.
— (1925): The Decapoda of the Siboga-Expedition. Part 6. The Axiidae collected by the Siboga-Expedition. – Siboga Exped. Monogr.; **39a5**: 1–127, 10 pls. – Leiden.
— (1927): A contribution to the knowledge of 21 species of the genus *Upogebia* LEACH. – Capita Zool.; **2** (5): 1–58, 6 pls. – s'Gravenhage.
— (1928a): A contribution to the knowledge of twenty-two species and three varieties of the genus *Callianassa* (LEACH). – Capita Zool.; **2** (6): 1–56, 12 pls. – s'Gravenhage.
— (1928b): The Decapoda of the Siboga-Expedition. Part 7. The Thalassinidae and Callianassidae collected by the Siboga-Expedition with some remarks on the Laomediidae. – Siboga Exped. Monogr.; **39a6**: 1–183, 20 pls. – Leiden.
MANNING, R. B. (1975): Two methods for collecting decapods in shallow water. – Crustaceana; **29** (3): 317–319. – Leiden.
— (1987): Notes on western Atlantic Callianassidae (Crustacea: Decapoda: Thalassinidea). – Proc. Biol. Soc. Wash.; **100** (2): 386–401, 9 figs. – Washington, D.C .
— & F.A. CHACE, (1990). Decapod and stomatopod Crustacea from Ascension Island, South Atlantic Ocean. – Smiths. Contr. Zool.; **503**: 1–91, 47 figs., 4 tables. – Washington, D. C.
— & D. L. FELDER (1986): The status of the callianassid genus *Callichirus* STIMPSON, 1866 (Crustacea: Decapoda: Thalassinidea). – Proc. Biol. Soc. Wash.; **99** (3): 437–443, 3 figs. – Washington, D. C.
— & R. W. HEARD (1986): Additional records for *Callianassa rathbunae* SCHMITT, 1935, from Florida and the Bahamas (Crustacea: Decapoda: Callianassidae). – Proc. Biol. Soc. Wash.; **99** (2): 347–349, 1 fig. – Washington, D. C.
— & Z. ŠTEVČIĆ (1982): Decapod fauna of the Piran gulf. – Quad. Lab. Tecnol. Pesca; **3** (2–5): 285–304. – Ancona.
MARTIN, J. W. & L. G. ABELE (1986): Phylogenetic relationships of the genus *Aegla* (Decapoda: Anomura: Aeglidae), with comments on anomuran phylogeny. – J. Crust. Biol.; **6** (3): 576–616. – Lawrence, Kansas.
MCLAUGHLIN, P. & L. B. HOLTHUIS (1985): Anomura versus Anomala. – Crustaceana; **49** (2): 204–209. – Leiden.
MIERS, E. J. (1884a): Crustacea. – In. Report on the zoological collection in the Indopacific Ocean during the voyage of H. M. S. „Alert" 1881–82. – pp. 178–322, pls. 18–32. – London.
— (1884b): On some Crustaceans from Mauritius. – Proc. Zool. Soc., London; **1884**: 10–17, pl. 1. – London.
MILNE EDWARDS, A. (1870): Révision du genre *Callianassa* (LEACH) et desription de plusieurs espèces nouvelles de ce groupe. – Nouv. Arch. Mus. Hist. Nat., Paris; **6**: 75–102, pls. 1–2. – Paris.
— (1873): Descriptions de quelques Crustacés nonveaux ou peu connus provenant du Musée de M. C. GODEFROY. – J. Mus. Godeffroy; **4**: 77–88, Hamburg.
MILNE EDWARDS, H. (1937): Histoire naturelle des crustacés, comprenant lánatomie, la physiologie et la classification de ces animaux. – Vol. **2**: 531 pp. – Paris (Libraire encyclopédique de Roret).
MIYAKE, S. (1956): Invertebrate fauna of the intertidal zone of the Tokara Islands. XIII. Anomura. – Publ. Seto Mar. Biol. Lab.; **5** (3): 303–337, 23 figs. – Sirahama.
MONOD, T. (1927): Sur le Crustacé auquel le Cameroun doit son nom (*Callianassa turnerana* WHITE). – Bull. Mus. Nat. Hist. Nat., Paris; **33** (1): 80–85. – Paris.
MONTAGU, G. (1808): Description of several marine animals found on the South Coast of Devonshire. – Trans. Linn. Soc., London; **9**: 18–114, pls. 2–8. – London.
NARDO, G. D. (1847): Sinonimia moderna delle specie registrate nellópera intitolata: descrizione de' Crostacei, de' Testacei e de' Pesci che abitano le lagune e golfo veneto rappresentati in figure, a

Chiaro-Scuro ed a colori dall'Abate Stefano CHIEREGHINI Ven. Clodiense applicata per commissione governativa. – i–xi + 10 pp. – Venezia.

— (1869): Annotazioni illustranti cinquantaquattro specie di Crostacei (Pottottalmi, Stomapodi, Edriottalmi e Succhiatori) del mare Adriatico precedute dalla stoia antica e recente della carcinologia Adriatica. – Mem. Ist. Veneto Sci. Lett. Arti; **14**: 217–344, 4 pls. – Venezia.

NASH, R. D. M., C. J. CHAPMAN, R. J. A. ATKINSON & P. J. MORGAN (1984): Observations on the burrows and burrowing behaviour of *Calocaris macandreae* (Crustacea: Decapoda: Thalassinoidea). – J. Zool. Lond.; **202**: 425–439. – London.

NEUMANN, R. (1878): Systematische Uebersicht der Gattungen der Oxyrhynchen. Catalog der Podophthalmen Crustaceen des Heidelberger Museums. Beschreibung einiger neuer Arten. – Ph. D.-thesis, Leipzig, 39 pp. – Leipzig.

NGOC-HO, N. (1989): Sur le genre *Gebiacantha* gen. nov., avec la description de cinq espèces nouvelles (Crustacea, Thalassinidea, Upogebiidae). – Bull. Mus. natn. Hist. nat., Paris; 4e sér, **11,** section A, (1): 117–145, figs. 1–9. – Paris.

NOBILI, G. (1904): Diagnoses préliminaires de vingt-huit espèces nouvelles de Stomatopdes et Décapodes Macroures de la Mer Rouge. – Bull. Mus. Hist. Nat., Paris; **10** (5): 230–238. – Paris.

— (1906): Faune carcinologique de la Mer Rouge: Décapodes et Stomatopodes. – Ann. Sci. Nat. Zool.; Ser. 9, **4** (1–3): 1–347, 11 pls., 12 figs., – Paris.

OLIVI, G. (1792): Zoologia Adriatica ossia Catalogo ragionato degli Animali del Golfo e delle Lagune di Venezia; preceduto da una Dissertazione sulla Storia fisica e naturale del Golfo; e accompagnato da Memorie, ed Osservazioni di Fisica Storia naturale ed Economia. – i–xxxii + 334 pp., 9 pls. – Bassano.

ORTMANN, A. (1891): Die Dekapodenkrebse des Straßburger Museums. III. Die Abteilungen der Reptantia BOAS: Homaridea, Loricata and Thalassinidea. – Zool. Jb. Syst.; **6**: 1–58, pl. 1. – Jena.

— (1894): Crustaceen. In: SEMON, R. (Ed.). Zoologische Forschungsreisen in Australien und dem Malayischen Archipel. – Denkschr. med.-naturw. Ges., Jena; **8**: 1–80, pls. 1–13. – Jena.

OTTO, A.W. (1828): Beschreibung einiger neuen, in den Jahren 1818 und 1819, im Mittelländischen Meere gefundener Crustaceen. – Nova Acta Leop. Carol.; **14**: 331–354, pls. 1–3, – Bonn.

PERVESLER, P. & P. C. DWORSCHAK (1985): Burrows of *Jaxea nocturna* NARDO in the Gulf of Trieste. – Senckenbergiana marit; **17** (1–3): 33–53, 3 figs, 4 pls. – Frankfurt/M.

PESTA, O. (1918): Die Decapodenfauna der Adria. Versuch einer Monographie. – X + 500 pp., 150 figs., 1 map. – Leipzig–Wien.

PETAGNA, V. (1792): Institutiones Entomologicae. – XII + 718 pp., 10 pls. – Napoli.

PHILLIPS, J. P. (1971): Observations on the biology of mudshrimps of the genus *Callianassa* (Anomura: Thalassinidea) in Mississippi Sound. – Gulf Research Reports; **3** (2): 165–196, 8 figs. – Ocean Springs, MS.

POHL, M. E. (1946): Ecological observations on *Callianassa major* SAY at Beaufort, North Carolina. – Ecology; **27** (1): 71–80, 28 figs. – Brooklyn, NY.

POORE, G. C. B. & D. J. G. GRIFFIN (1979): Thalassinidea (Crustacea: Decapoda) of Australia. – Rec. Austr. Mus.; **32** (4–6): 217–321, 56 figs. – Sydney.

— & T. H. SUCHANEK (1988): *Glypturus motupore,* a new callianassid shrimp (Crustacea: Decapoda) from Papua New Guinea with notes on its ecology. – Rec. Austr. Mus.; **40** (3): 197–204, 4 figs. – Sydney.

POWELL, A. W. B. (1949): New species of Crustacea from New Zealand of the genera *Scyllarus* and *Ctenocheles* with notes on *Lyreidus tridentatus.* – Rec. Auckland Inst. Mus.; **3** (6): 368–371, pl. 68. – Auckland, NZ.

RABALAIS, N. N., S. A. HOLT, & R. W. FLINT (1981): Mud shrimps (Crustacea, Decapoda, Thalassinidea) of the northwestern Gulf of Mexico. – Bull. Mar. Sci.; **31** (1): 96–116, 6 figs. – Miami, FL.

RATHBUN, M. J. (1900): The decapod and stomatopod Crustacea. Results of the BRANNER–AGASSIZ ecpedition to Brazil. – Proc. Wash. Acad. Sci.; **2**: 133–155, pl. 8. – Washington, D.C .

— (1901): The Brachyura and Macrura of Porto Rico. – Bull. U. S. Fish Comm. for 1900; **20** (2): 1–127. – Washington, D. C.

— (1906): The Brachyura and Macrura of the Hawaiian Islands. – Bull. U. S. Fish Comm. for 1903; **23** (3): 829–930, pls. 1–24. – Washington, D. C.

RISSO, A. (1816): Histoire naturelle des Crustacés des environs de Nice. – 175 pp., 3 pls. – Nice.

RODRIGUES, S. DE A. (1971): Mud shrimps of the genus *Callianassa* LEACH from the Brazilian coast (Crustacea, Decapoda). – Arquivos Zool.; **20** (3): 191–223, 98 figs. – São Paulo.

— (1983): Aspectos da biologia de Thalassinidea do Atlantico tropical Americano. – Tese apresentada ao Instituto de Biociencias da Universidade de São Paulo como parte dos requisitos para obtencao do Titulo de Livre Docente, 174 pp., 156 figs. – São Paulo.

— & W. HÖDL (1990): Burrowing behaviour of *Callichirus major* and *C. mirim*. – Begleitveröffentlichung zum wissenschaftlichen Film C 2199 des ÖWF. Wiss. Film (Wien); **41**/April: 48–58. – Wien.

SAINT LAURENT, M. DE (1971): Capture, en Méditerraneé, d'*Upogebia talismani* BOUVIER, 1915 (Crustacea Decapoda Callianassidae). – Bull. Mus. Nat. Hist. Nat; (2) **42** (6): 1259–1262. – Paris.

— (1973): Sur la systematique et la phylogénie des Thalassinidea: définition des familles des Callianassidae et des Upogebiidae et diagnose de cinq genres nouveaux (Crustacea Decapoda). – C. R. Acad. Sci., Paris; **227D**: 513–516. – Paris.

— & B. BOŽIĆ (1976): Diagnoses et tableau de détermination des Callianasses de l'Atlantique nord oriental et de Méditerranée (Crustacea Decapoda Thalassinidea). – Thalassia Jugosl.; **8** (1): 15–40, 35 figs. – Zagreb.

— & P. LELOEUFF (1979): Crustacés décapodes: Thalassinidea. 1. Upogebiidae et Callianassidae. – Ann. Inst. Océanogr., Paris (Nouv. Ser.); **55** (Suppl.): 29–101, 28 figs. – Paris.

SAKAI, K. (1969): Revision of Japanese callianassids based on the variation of larger cheliped in *C. petalura* STIMPSON and *C. japonica* ORTMANN (Decapoda, Anomura). – Publ. Seto Mar. Biol. Lab.; **17** (4): 209–252, 8 figs, pls. 9–15. – Sirahama.

— (1970): A small collection of thalassinids from the waters around Tsushima islands, Japan, including a new species of *Callianassa* (Crustacea, Anomura). – Publ. Seto Mar. Biol. Lab. **18** (1): 37–47, 4 text-figs. – Sirahama.

— (1982): Revision of Upogebiidae (Decapoda, Thalassinidea) in the Indo-West Pacific region. – Researches on Crustacea, Special Number **1**: 1–106, 7 pls., 20 figs. – Tokyo (The Carcinological Society of Japan).

— (1984): Some thalassinideans (Decapoda: Crustacea) from Heron Is., Queensland, eastern Australia, and a new species of *Gourretia* from east Africa. – The Beagle, Occasional Papers of the Northern Territory Museum of Arts and Sciences; **1** (11): 95–108, 7 figs. – Darwin.

— (1988): A new genus and five new species of Callianassidae (Crustacea: Decapoda: Thalassinidea) from Northern Australia. – The Beagle, Records of the Northern Territory Museum of Arts and Sciences; **5** (1): 51–69, 10 figs. – Darwin.

— & M. DE SAINT LAURENT (1989): A check list of Axiidae (Decapoda, Crustacea, Thalassinidea, Anomura), with remarks and in addition descriptions of one new subfamily, eleven new genera and two new species. – Naturalists; **3**: 1–104, figs. 1–25, table 1–4. – Tokushima.

SAY, T. (1818): An account of the Crustacea of the United States. Part 5. – J. Acad. Nat. Sci., Phila.; **1/2** (1): 235–253. – Philadelphia, PA.

SCHMITT, W. L. (1921): The marine decapod Crustacea of California with special reference to the decapod Crustacea collected by the United States Bureau of Fisheries steamer „Albatross" in connection with the biological survey of San Francisco Bay during the years 1912–1913. – Univ. Calif. Publ. Zool.; **23**: 1–470, 165 textfigs., 50 pls. – San Francisco, CA.

— (1924a): Report on the Macrura, Anomura, and Stomatopoda collected by the Barbados-Antigua expedition from the University of Iowa in 1918. – Stud. Nat. Hist. Iowa Univ.; **10** (4): 65–99, pls. 1–5. – Iowa City, IA.

— (1924b): The Macruran, Anomuran and Stomatopod Crustacea. Bijdragen tot de Kennis der fauna von Curacao. Resultaden sener reis von Dr. C. J. van der HORST in 1920. – Bijdr. Dierk.; **23**: 9–82, 7 figs. 1 pl. – Amsterdam.

— (1935a): Crustacea Macrura and Anomura of Porto Rico and the Virgin Islands. – Scient. Surv. Porto Rico; **15** (2): 127–227, 78 figs. – New York, NY.

— (1935b): Mud shrimps of the Atlantic coast of North America. – Smiths. Misc. Coll.; **93** (2): 1–21, 4 pls. – Washington, D. C.

SCOTT, P. J. B., H. M. REISWIG & B. M. MARCOTTE (1988): Ecology, functional morphology, behaviour, and feeding in coral- and sponge-boring species of *Upogebia* (Crustacea: Decapoda: Thalassinidea). – Can. J. Zool.; **66**: 483–495, 8 figs. – Ottawa.

STACHOWITSCH, M. (1984): Mass mortality in the Gulf of Trieste: the course of community destruction. – P. S. Z. N. I: Marine Ecology; **5** (3): 243–264. – Berlin–Hamburg.

STEBBING, T. R. R. (1900): South African Crustacea. – Mar. Invest. S. Afr.; **1**: 1–66, pls. 1–4. – Cape Town.

— (1902): South African Crustacea. Part 2. – Mar. Invest. S. Afr.; **2**: 1–92, pls. 5–16. – Cape Town.

STEENSTRUP, J. & C. LÜTKEN (1862): Om *Thalassina anomala* (HERBST). – Vidensk. Medd. naturhist. Foren., Kjobenhavn; **1861**: 267–248, pls. 1–7. – Kjobenhaven.

STEVENS, B. A. (1928): Callianassidae from the West Coast of North America. – Publ. Puget Sound Biol. Stat.; **6**: 315–369, 71 figs. – Seattle, Wash.

— (1929): Ecological observations on Callianassidae of Puget Sound. – Ecology; **10**: 399–405, 3 figs. – Durham, NC.

STIMPSON, W. (1857): Notices of new species of Crustacea of western north America; being an abstract from paper to be published in the journal of the society. – Proc. Boston Soc. Nat. Hist; **6**: 84–89. – Boston, Mass.

— (1860): Prodromus descriptionis animalium evertebratorum, quae in expeditione ad Oceanum Pacificum septemtrionalem, a Republica Federata missa, Cadwaladaro RINGOLD et Johanne RODGERS ducibus, observavit et descripsit. Pars 8. Crustacea Macrura. – Proc. Acad. Nat. Sci. Philadelphia; **1860**: 22–47. – Philadelphia, PA.

— (1866): Description of new genera and species of macrurous Crustacea drom the coasts of North America. – Proc. Chicago Acad. Sci.; **1**: 46–48. – Chicago, IL.

— (1871): Notes on North American Crustacea, in the museum of the Smithsonian Institution. No. 3 – Ann. Mag. Nat. Hist.; **10** (3–4): 92–136. – London.

STRAHL, C. (1861): Ueber einige neue von Hrn. JAGOR eingesandte Thalassinen und die systematische Stellung dieser Familie. – Monatsber. Kön. Akad. Wiss., Berlin; **1861**: 1055–1072, pl. 1. – Berlin.

— (1862): On some new Thalassinae sent from the Philippines by M. JAGOR, and on the systematic position of that family. – Ann. Mag. Nat. Hist.; (3) **9**: 383–396. – London.

SUCHANEK, T. H. (1983): Control of seagrass communities and sediment distribution by *Callianassa* (Crustacea, Thalassinidea) bioturbation. – J. Mar. Res.; **41**: 281–298. – New Haven, CT.

TATTERSALL, W. M. (1921): Report on the stomatopod and macrurous Decapoda collected by Mr. Cyril CROSSLAND in the Sudanese Red Sea. – J. Linn. Soc., London (Zoology); **34**: 345–298, pls. 27–28. – London.

THESSALOU-LEGAKIS, M. (1986): Preliminary data on the occurrence of Thalassinidea (Crustacea, Decapoda) in the Greek Seas. – Biol. Gallo-Hellenica; **12**: 181–187. – Athens.

— & A. ZENETOS (1985): Autoecological studies on the Thalassinidea (Crustacea, Decapoda) of the Patras Gulf and Ionian Seas. – Rapp. Comm. Int. Mer. Medit.; **29** (5): 309–312, 1 fig. – Monaco.

THOMSON, G. M. (1893): Notes on Tasmanian Crustacea, with descriptions of new species. – Pap. Proc. R. Soc. Tasm.; **1892**: 45–76, 6 pls. – Hobart Town.

TIEFENBACHER, L. (1976): *Callianassa jamaicensis* SCHMITT (Decapoda, Thalassinidea) an der brasilianischen Küste südlich der Amazonasmündung. – Crustaceana; **30** (3): 314–316, 1 fig. – Leiden.

TIRMIZI, N. M. (1967): On the occurrence of *Callianassa (Callichirus) audax* DE MAN off west Pakistan (Decapoda, Thalassinidea). – Crustaceana; **13** (2): 151–154, 2 figs. – Leiden.

— (1974): A description of *Callianassa martensi* MIERS, 1884 (Decapoda, Thalassinidea) and its occurrence in the northern Arabian Sea. – Crustaceana; **26** (3): 286–292, 4 figs. – Leiden.

— (1977): A redescription of the holotype of *Callianassa mucronata* STRAHL, 1861 (Decapoda, Thalassinidea). – Crustaceana; **32** (1); 21–26, 3 figs. – Leiden.

— & Q. B. KAZMI (1979): Results of the study of the type material of some species of *Upogebia* (Decapoda, Thalassinidea). – Crustaceana; Suppl. **5**: 105–114. – Leiden.

VANHÖFFEN, E. (1911): Ueber die Krabben, denen Kamerun seinen Namen verdankt. – Sitzungsber. Ges. Naturf. Freunde Berlin; **2**: 105–110, 1 fig. – Berlin.

VAUGELAS, J. DE (1984): Preliminary observations on two types of callianassid (Crustacea, Thalassinidea) burrows. Gulf of Aqaba (Red Sea). In: SAAD, M. A. H. (ed.) Proceedings of the Symposium on Coral Reef Environment of the Red Sea, Jeddah, Jan. 1984. – 520–539. – Jeddah.

— (1990): Ecologie des Callianasses (Crustacea, Decapoda, Thalassinidea) en milieu récifal Indo-Pacifique. Conséquences du remaniement sédimentaires sur la distribution des matieres humiques, des métaux traces et des radionucléides. – Memoire présenté à l'Université de Nice – Sophia Antipolis pour lóbtention du Diplome d'Habilitation à diriger des recherches en sciences. 226 pp. – Nice.

— & M. DE SAINT LAURENT (1984): Premières données sur l'écologie de *Callichirus laurae* DE SAINT LAURENT sp. nov. (Crustacé Décapode Callianassidae): son action bioturbatrice sur les formations sédimentaires du golfe d'Aqaba (Mer Rouge). – C. R. Acad. Sci. Paris; (3) **298** (6): 147–152, 1 pl., 2 textfigs. – Paris.

VEDAYVYASA RAO, P. & K. N. RASACHANDRA KARTHA (1967): On the occurrence of *Callianassa (Callichirus) audax* DE MAN (Crustacea Decapoda – Callianassidae) on the Southwest coast of India with a description of the male. – Mar. Biol. Ass. India, Symp. Ser.; **1**: 279–284, 2 figs. – Cochin.

WERDING, B. & H.-G. MÜLLER (1989): Axiidae aus dem südlichen Karibischen Meer (Decapoda: Thalassinidea). – Zool. Anz.; **223** (5–6): 249–253. – Jena

WHITE, A. (1861): Descriptions of two species of Crustacea belonging to the families Callianassidae and Squillidae. – Proc. Zool. Soc., London; **1861**: 42–44, pls. 6–7. – London.

WILLIAMS, A. B. (1965): Marine decapod crustaceans of the Carolinas. – Fishery Bull., Fish Wildl. Serv. U. S.; **65** (1): 1–298, 252 figs. – Washington, D. C.

— (1984): Shrimps, lobsters, and crabs of the Atlantic coast of the eastern United States, Maine to Florida. – i–xviii + 550 pp., 380 figs. – Washington, D.C . (Smithsonian Inst. Press).

— (1986): Mud shrimps, *Upogebia,* from the eastern Pacific (Thalassinoidea: Upogebiidae). – San Diego Soc. Nat. Hist., Mem.; **14**: 1–60, 21 figs. – San Diego, CA.

— L. G. ABELE, D. L. FELDER, H. H. HOBBS JR., R. B. MANNING, P. MCLAUGHLIN & I. PÉREZ FARFANTE (1989): Common and scientific names of aquatic invertebrates from the United States and Canada: Decapod Crustacea. – American Fisheries Society Special Publication; **17**: 1–77, 4 pls. – Bethesda, MD.

— & N. NGOC-HO (1990): *Pomatogebia,* a new genus of thalassinidean shrimps from western hemisphere tropics (Crustacea: Upogebiidae). – Proc. Biol. Soc. Wash.; **103** (3): 614–616, 1 fig. – Washington, D. C.

WITBAARD, R. & G. C. A. DUINEVELD (1989): Some aspects of the biology and ecology of the burrowing shrimp *Callianassa subterranea* (MONTAGU) (Thalassinidea) from the southern North Sea. – Sarsia; **74**: 209–219, 7 figs. – Bergen.

ZARIQUIEY ALVAREZ, R. (1946): Crustáceos Decápodos Mediterráneos. – Inst. Esp. Est. Medit., Barcelona: 1–181, 174 figs., 16 pls. – Barcelona.

— (1968): Crustáceos Decápodos Ibéricos. – Inv. Pesq.; **32**: i–xv + 510 pp., 164 figs. – Barcelona.

Note added in press

Since the submission of this paper, the revision of the American Callianassidae has been published (MANNING & FELDER 1991). They recognized two families, one new (Ctenochelidae), and seven subfamilies, six new for the taxa

previously assigned to the Callianassidae. Within the restricted family Callianassidae they recognized four new genera *(Biffarius, Neotrypaea, Notiax,* and *Eucalliax*), revived four former genera (*Lepidophtalmus* HOLMES, *Trypaea* DANA, *Cheramus* BATE, and *Scallasis* BATE), and confirmed the genus *Neocallichirus* SAKAI.

Of the species mentioned in this paper, *Ctenocheles maorianus* and *Gourretia denticulata* would have to be placed into the family Ctenochelidae, *Callianassa californiensis* and *C. gigas* into the genus *Neotrypaea; C. jamaicense* and *C. louisianensis* into the genus *Lepidophthalmus;* and *C. grandimana, C. mirim,* and *C. rathbunae* into the genus *Neocallichirus.* Only *C. subterranea* would have to be placed in the restricted genus *Callianassa.* No attempt has been made to accomodate the remaining species mentioned in this paper into the genera recognized by MANNING & FELDER (1991).

MANNING, R. B. & D. L. FELDER (1991): Revision of the American Callianassidae (Crustacea: Decapoda: Thalassinidea). – Proc. Biol. Soc. Washington; **104** (4): 764–792. – Washington, D.C.

In addition, a revision of the family Callianideidae has been published recently by KENSLEY & HEARD (1991), and MANNING & FELDER (1992) recognized the new genus *Gilvossius* within the Callianassidae.

KENSLEY, B. & R. W. HEARD (1991): An examination of the shrimp family Callianideidae (Crustacea: Decapoda: Thalassinidea). – Proc. Biol. Soc. Washington; **104**: 493–537. – Washington, D.C.

MANNING, R. B. & D. L. FELDER (1992): *Gilvossius,* a new genus of callianassid shrimp from the eastern United States – (Crustacea: Decapoda: Thalassinidea). – Bull. Mar. Sci.; **49**: 558–561. – Miami.