



More cautionary tales: family, generic and species synonymies of recently published taxa of ghost and mud shrimps (Decapoda: Axiidea and Gebiidea)

PETER C. DWORSCHAK¹ & GARY C. B. POORE²

¹Dritte Zoologische Abteilung, Naturhistorisches Museum, Burgring 7, A 1010 Wien, Austria.

E-mail: Peter.Dworschak@nhm-wien.ac.at

²Museums Victoria, GPO Box 666, Melbourne, Vic. 3001, Australia. E-mail: gpoore@museum.vic.gov.au

Abstract

Re-examination of the holotype of *Neoaxius nicoyaensis* Sakai, 2017 showed that it is conspecific with the axiid *Guyanacaris caespitosa* Squires, 1979 and thus *Neoaxius* Sakai, 2017 and Neoaxiidae Sakai, 2017 are respectively subjective junior synonyms of *Guyanacaris* Sakai, 2011 and Axiidae Huxley, 1879. The types and numerous specimens of the callianassid *Trypaea vilavelebita* Sakai & Türkay, 2012 are juveniles of the common northeastern Atlantic-Mediterranean species, *Callianassa subterranea* (Montagu, 1808); the name is therefore a subjective junior synonym. The monotypic callianopsid genera *Pleurocalliax* Sakai, 2011, *Neocallianopsis* Sakai, 2011 and *Phaetoncalliax* Sakai, Türkay, Beuck & Freiwald, 2015 are found not to differ from *Callianopsis* de Saint Laurent, 1973, the only alleged differences found to be untrue or trivial. *Phaetoncalliax mauritana* Sakai, Türkay, Beuck & Freiwald, 2015 and *Neocallianopsis africana* Sakai, Türkay, Beuck & Freiwald, 2015 are thereby transferred to *Callianopsis*, the latter a subjective junior synonym of the former. Contrary to the assertion of its author, the gourretiid *Pseudogourretia portsudanensis* Sakai, 2005, the only species in its genus, has no pleurobranchs. The genus *Pseudogourretia* Sakai, 2005 is therefore synonymised with *Gourretia* de Saint Laurent, 1973. The respective holotypes of *Paracalliax stenophthalmus* Sakai, Türkay, Beuck & Freiwald, 2015 and *Paracalliax bollerei* de Saint Laurent, 1979 were re-examined. Both are from the Banc d'Arguin, off Mauritania, and are identical at the species level. The upogebiid *Kuwaitupogebia nithyanandan* Sakai, Türkay & Al Aidaroos, 2015 from Kuwait is identical to *Upogebia balmaorum* Ngoc-Ho, 1990 from the Seychelles, Madagascar and tropical Western Australia. *Kuwaitupogebia* Sakai, Türkay & Al Aidaroos, 2015 is therefore synonymised with *Upogebia* Leach, 1814 and Kuwaitupogebiidae Sakai, Türkay & Al Aidaroos, 2015 with Upogebiidae Borradaile, 1903.

Key words: Axiidae, Callianassidae, Callianopsidae, Upogebiidae, *Neoaxius*, *Guyanacaris*, *Phaetoncalliax*, *Neocallianopsis*, *Callianopsis*, *Pseudogourretia*, *Gourretia*, *Kuwaitupogebia*, *Upogebia*, taxonomy

Introduction

All decapods have two pairs of independent antennae attached to the anterior cephalothorax, plus five pairs of pleopods of which the first and second are almost always sexually modified. When an editor or reviewer receives a manuscript describing a new taxon in which these structures are not so, they should be alarmed. The response should be similar when faced with a manuscript describing a taxon that looks remarkably like another already described from the same locality, or is based on specimens that are so fragmentary that confident identification would be difficult, or display features that are so anomalous compared to others that observations are doubtful.

Here, we discuss six taxa where one or other of these faults are apparent. All were published recently in papers by Katsushi Sakai and colleagues. We follow similar critiques of taxa published by the same senior author with or without co-authors (see Felder & Dworschak 2015; Komai 2017; Poore & Dworschak 2017).

Material and methods

The type specimens of the species in question were obtained on loan from the Forschungsinstitut Senckenberg in

Frankfurt a. M. (SMF) and viewed at the Naturhistorisches Museum, Vienna (NHMW) and the Muséum nationale d'Histoire naturelle, Paris (MNHN). Comparative material is housed in Museo de Zoología, Universidad de Costa Rica, San José (MZUCR), Naturhistorisches Museum, Vienna (NHMW), and Naturalis Biodiversity Center, Leiden (RMNH).

Specimens were examined by incident and transmitted light under a dissection light microscope. Digital photographs were taken with a Nikon 995 camera mounted on a stereomicroscope. Stacks of several frames of different focal planes were fused using CombineZ5 (Haug *et al.* 2011).

Sizes (in mm) are given as carapace length (CL). Abbreviations A1 and A2 refer to the antennule and antenna, P1–P5 to pereopods 1 to 5, and Plp1–Plp5 refer to pleopods 1 to 5. For one type specimen (*Phaetoncalliax mauritana*) the original text of the labels is cited in quotation marks; \ is used to indicate a line break. Each species is discussed in turn with its updated synonymy.

Systematics

Infraorder Axiidea de Saint Laurent, 1979

Family Axiidae Huxley, 1879

Axiidae Huxley, 1879: 785.—Poore & Collins 2009: 222 (diagnosis, synonymy).—Poore 2017: 364–365 (synonymy).

Calocarididae Ortmann, 1891: 47.

Eiconaxiidae Sakai & Ohta, 2005: 69.

Eiconaxiopsididae Sakai, 2011: 289–291.

Neoaxiidae Sakai, 2017: 504. **Syn. nov.**

Remarks. We follow the family diagnosis of Poore & Collins (2009) and synonymy of Poore (2017) rather than those of Sakai (2011). The synonymy of Neoaxiidae Sakai, 2017 is justified in the discussion of the species *Guyanacaris caespitosa* (Squires, 1979), below.

Genus *Guyanacaris* Sakai, 2011

Guyanacaris Sakai, 2011: 119–120 [type species *Calocaris (Calastacus) hirsutimana* Boesch & Smalley, 1972, by original designation, gender feminine]

Neoaxius Sakai, 2017: 504–505 [type species *Neoaxius nicoyaensis* Sakai, 2017, by original designation and monotypy, gender masculine]. **Syn. nov.**

Remarks. The synonymy of *Neoaxius* Sakai, 2017 is justified in the discussion of the species *Guyanacaris caespitosa* (Squires, 1979), below.

Guyanacaris caespitosa (Squires, 1979)

(Fig. 1)

Axiopsis (Axiopsis) caespitosa Squires, 1979: 1584–1589, figs 1–3, tabs 1, 2.—Hendrickx 1987: 355.

Acanthaxius caespitosa.—Sakai & de Saint Laurent 1989: 73.—Lemaitre & Alvarez-León 1992: 44.—Hendrickx 1995: 390 (list), 393, 394, figs.—Hendrickx *et al.* 2005: 171.

Guyanacaris caespitosa.—Sakai 2011: 120–121.—Dworschak 2013: 40.

Guyanacaris hirsutimana.—Sakai 2011: 121–123 (part, Pacific material).—Sakai 2017: 509 (Table I) (part, Pacific material) [not *Calocaris (Calastacus) hirsutimana* Boesch & Smalley, 1972].

Neoaxius nicoyaensis Sakai, 2017: 505–509, figs 1–3. **Syn. nov.**

Material examined. Holotype of *Neoaxius nicoyaensis*, Pacific Costa Rica, Gulf of Nicoya 9°33.9'N 84°52.9'W–9°34.6'N 84°54.7'W, 239 m, SMF 31563 (male 33.1 mm, detached right P1, P3, P4, right Plp2, 3, 4 dissected, in separate vial).

Pacific Costa Rica, 8 mi S.E. Punta Chayote [Punta Coyote], Puntarenas, 1.337, 108 m, MZUCR 1665-01 (1 ovigerous female, 39.5 mm) (examined by PCD in 2011).

Remarks. Sakai (2017) presented the following argument for the new genus and family: “*Neoaxius nicoyaensis* sp. nov. as described below, is very characteristic in that it possesses highly unique morphological features of the genital organs, which cannot be found in any species of any genera of the families currently included in the superfamily Axioidea. This means that this new species could not be classified under any of the genera of these families. That is precisely why the new species is to be classified under a new genus established in the present paper, as *Neoaxius nicoyaensis* gen. et sp. nov.”. By genital organs he presumably meant the unmodified pleopod 1. Most decapods have a modified first male pleopod so this finding should have been seen as suspect to any knowledgeable reviewer as it was to us.

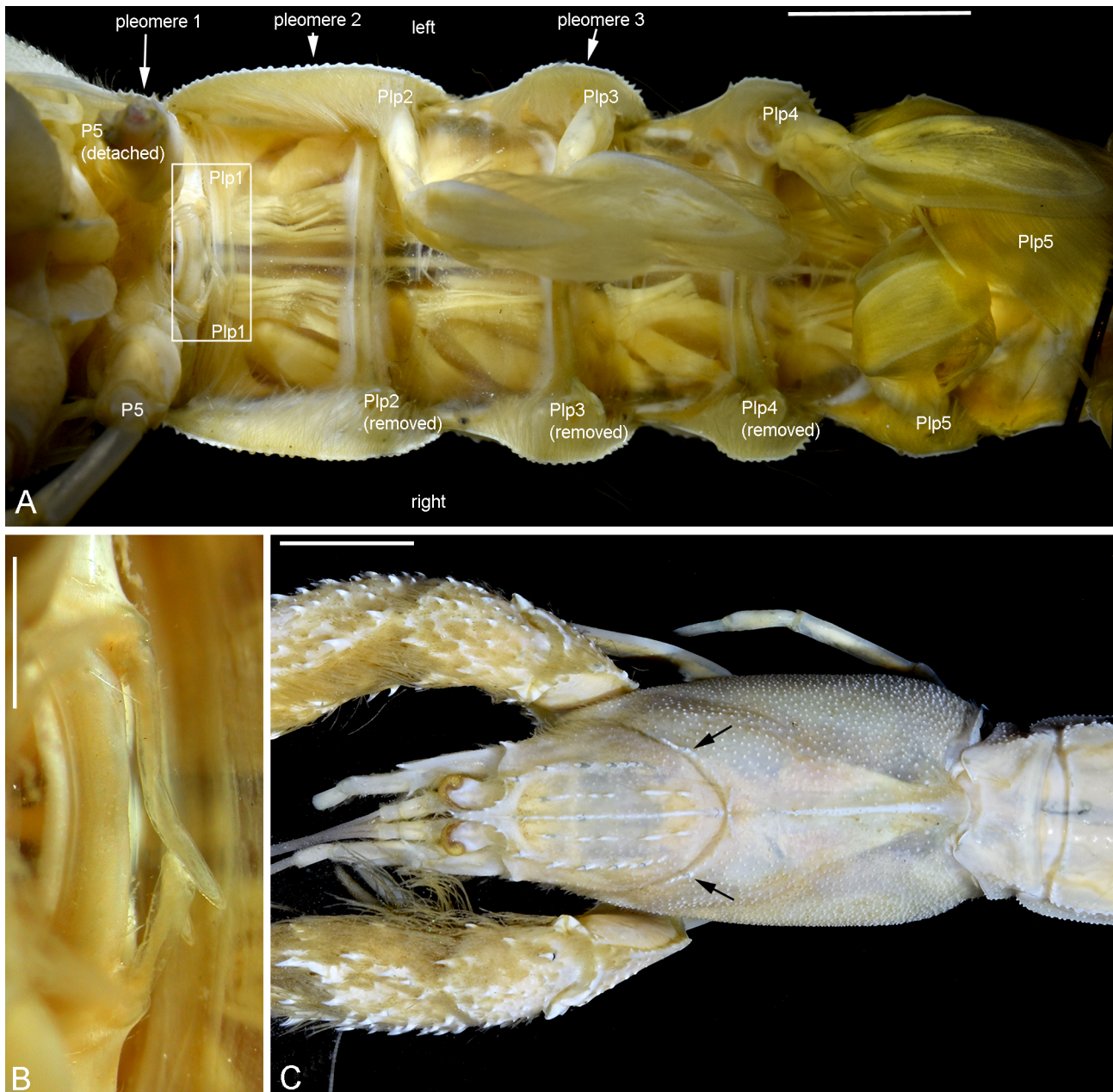


FIGURE 1. *Guyanacaris caespitosa* (Squires, 1979). SMF 31563, male (holotype of *Neoaxius nicoyaensis*). A, pleomeres 1–5 in ventral view; B, detail of pleopod 1 from frame in A; C, carapace in dorsal view (photo: S. M. Schnedl), arrows point to spines behind cervical groove. Scale bar: A, C = 10 mm; B = 1 mm.

Study of the holotype of *Neoaxius nicoyaensis* shows clearly that Sakai has overlooked the small, uniramous first pleopods that are still attached (flexed on right side) on the ventrally narrow pleomere 1 (Fig. 1A, B). He

dissected the right pleopods 2–4, interpreted one of either the third or fourth as pleopod 1 (fig. 2A) labelling the other pleopod 3 (fig. 3D) and correctly figured pleopod 2 (fig. 3B); all were erroneously stated to be from the left side.

As the ‘unique’ character used to establish the new higher taxa is based on an error, Sakai’s (2017) reasons to establish a new genus and family lack any justification. *Neoaxius* is hereby synonymised with *Guyanacaris* and Neoaxiidae with Axiidae.

Although Sakai (2017: 504) mentioned in his remarks on the new family that the new genus is similar to *Litoraxius* Komai & Tachikawa, 2008, he compared his new species with *Guyanacaris hirsutimana* in his table I, referring to two specimens (the holotype USNM 137428 from British Guyana and one male, SMF 31827, from Pacific Costa Rica) he had dealt with earlier (Sakai 2011). This table contains—besides the misinterpreted pleopod 1—other errors: (1) the holotype of *G. hirsutimana* has a postcervical carina as figured by Boesch & Smalley (1972: fig. 1) and Sakai (2011: fig. 22B); (2) *G. hirsutimana* sometimes also possesses distinct carinae on pleomeres 1 to 5 as shown by Blanco-Rambla (1995: fig. 11g). Sakai (2017) overlooked the prominent spines near the cervical groove (see Fig. 1C) that are typical of *G. caespitosa*.

Guyanacaris is known from two species, *G. hirsutimana* from the Atlantic (Gulf of Mexico to British Guyana) and *G. caespitosa* from the Pacific (Mexico to Colombia). Squires (1979: table 1) outlined the differences between the two species, noting that the median carina of *G. hirsutimana* has eight spines while that of *G. caespitosa* has three. The specimen (MZUCR 1665-01) attributed to *G. caespitosa* by Dworschak (2013) had more than three. That this specimen was found only about 30 km west of the type locality of *N. nicoyaensis* supports the synonymy of the two species.

Sakai (2011) reported two specimens of *G. hirsutimana* (the Atlantic species) from the Pacific, one from Golfo Dulce, Costa Rica (SMF 31827) and one from Peru (RMNH D31563). We could not study those specimens, but they are certainly attributable to *G. caespitosa*. Sakai’s (2011) account with almost identical diagnosis for both species of *Guyanacaris* shows that he was not aware of their differences.

Family Callianassidae Dana, 1852

Callianassidae Dana, 1852: 12.—Manning & Felder 1991: 766.—Sakai 1999b: 7.—Sakai 2011: 353–357.

Callianassinae Dana, 1852: 10.—Manning & Felder 1991: 767.—Sakai 1999b: 10.—Sakai 2011: 357–358.

Remarks. Manning & Felder (1991) introduced subfamily names for Callianassidae, some of which have been more recently elevated to family rank. Sakai (2011), basing his conclusions largely on his own reviews, included ten families in ‘Callianassoidea’. He restricted Callianassidae s.s. to two subfamilies, Callianassinae (incorporating Cheraminae Manning & Felder, 1991) and Callichirinae Manning & Felder, 1991. Here, we discuss species in this and two other families recognised by him, Callianopsidae Manning & Felder, 1991 and Gourretiidae Sakai, 1999. Another, Paracalliinae Sakai, 2005 was largely ignored in Sakai’s (2011) synthesis but becomes relevant below.

Genus *Callianassa* Leach, 1814

Callianassa Leach, 1814: 400 (type species: *Cancer Astacus subterraneus* Montagu, 1808, by monotypy, gender feminine).—Manning & Felder 1991: 767–768.—Sakai 1999b: 11–13.—Ngoc-Ho 2003: 465–466.

Callianassa subterranea (Montagu, 1808)

(Figs 2, 3)

Cancer Astacus subterraneus Montagu, 1808: 88, pl. 3 figs 1, 2.

Callianassa subterranea.—Ngoc-Ho 2003: 468–472, figs 9, 10.—Sakai 2011: 360 (complete synonymy).—Sakai & Türkay 2012: 734–735, fig. 5.

Trypaea vilavelebita Sakai & Türkay, 2012: 741–746, figs 8, 9. **Syn. nov.**

Material examined. North Sea, Oyster Ground? (REINECK box cores), NHMW 6783 (ovigerous female, 11.0

mm; 4 females, 3.9–9.0 mm; 2 males, 2.8, 10.0 mm; fragments of 6 specimens). Aegean Sea, 92 m (Pola Expedition stn 227), NHMW 6613 (female, 3.8 mm). Tyrrhenian Sea, Livorno, Secce della Meloria, *Posidonia* rhizomes, NHMW 25023 (male, 10.3 mm). Adriatic Sea, Rovinj, off Polari, NHMW 19597 (male, 4.6 mm; female, 4.0 mm; ovigerous female, 4.3 mm). Rovinj, Pirozi, 25–32 m, NHMW 18376 (2 males, 3.6, 2.8 mm); NHMW 19941 (2 males, 3.4, 2.6 mm; female, 3.4 mm); NHMW 19949 (2 males, 4.6, 2.5 mm; female, 4.1 mm; ovigerous female (pleon only); juvenile, 1.8 mm); NHMW 20482 (male, 3.6 mm; female, 3.7 mm); NHMW 25024 (4 males, 2.6–4.9 mm; 2 females, 3.6, 2.9 mm); NHMW 25235 (2 males, 3.7, 2.1 mm; female, 4.0 mm; juvenile, 1.9 mm); NHMW 25641 (5 males, 3.6–4.5 mm; ovigerous female, 4.8 mm); NHMW 25758 (male, 5.0 mm); NHMW 25759 (ovigerous female, 5.2 mm); NHMW 25760 (male, 3.6 mm).

Remarks. Sakai & Türkay (2012: 745) stated that their new species differed from *C. subterranea* as follows: “In *T. vilavelebata* sp. nov. the A1 peduncle is slightly longer than the A2 peduncle (vs. the A1 peduncle is slightly shorter than the A2 peduncle, see Ngoc-Ho, 2003, fig. G, H [sic]; Sakai, 2005, fig. 7G, H), the male Plp1 is uniramous and bisegmented (vs. the male Plp1 is uniramous and uni-, bi-, or trisegmented, see fig. 5A), and the male Plp2 is absent (vs. male Plp2 is uniramous (fig. 5B), though rarely biramous by deformed protopod protruded short distolaterally).” This is not supported by their figure of the holotype (Sakai & Türkay 2012: fig. 8A), which shows the peduncle of the antenna to be clearly longer than that of the antennule. Only in dorsal view (fig. 9A) does the antennule appear shorter than the antennal peduncle, probably because it was not illustrated in the horizontal plane.

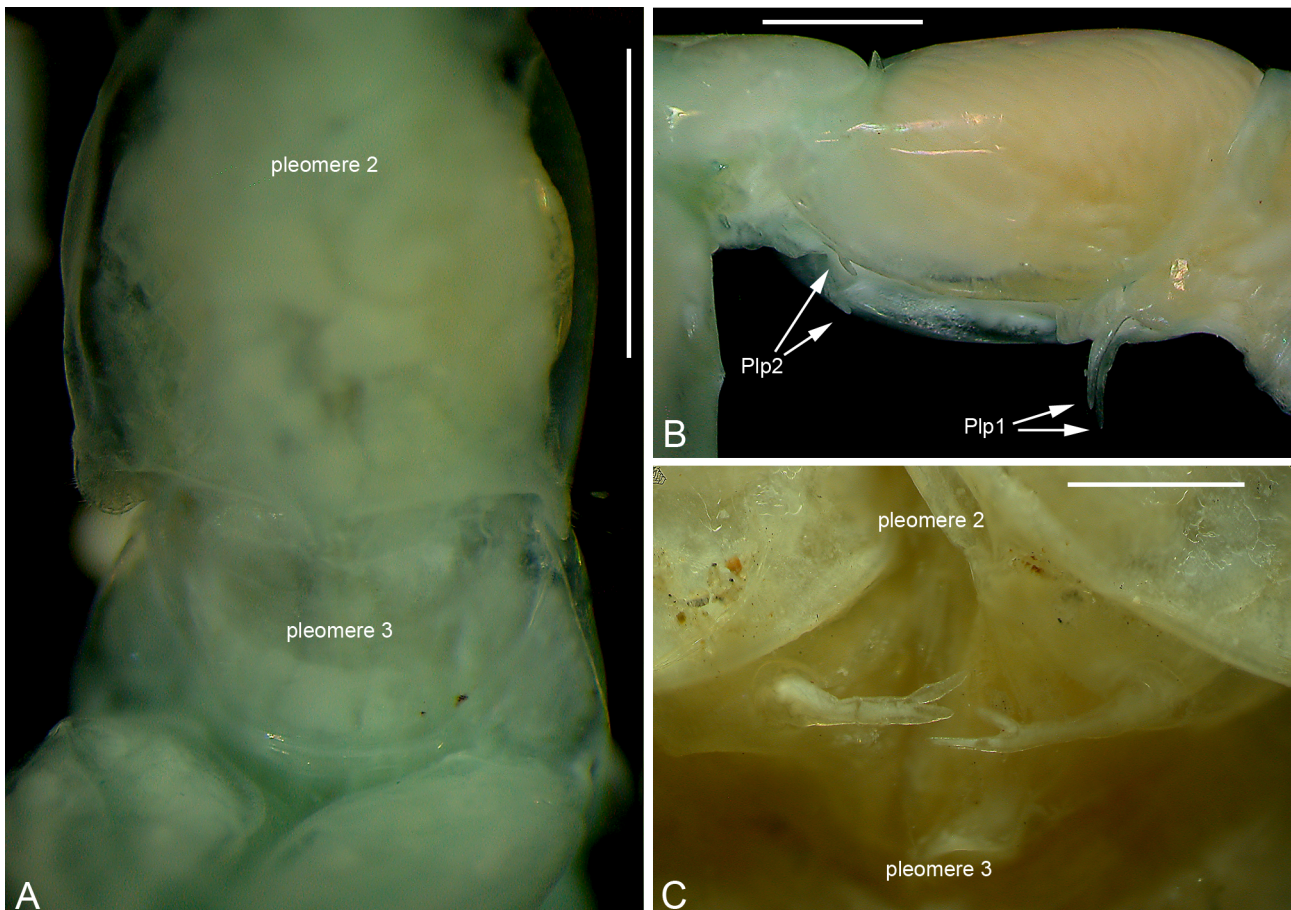


FIGURE 2. *Callianassa subterranea* (Montagu, 1808). A, NHMW 25024 (male, 2.4 mm), pleomeres 2 and 3, ventral aspect; B, NHMW 25641 (male, 4.3 mm), pleomeres 1–3, lateral aspect; C, NHMW 25023 (male, 10.3 mm), Plp2, ventral aspect. Scale bar = 1 mm.

The observed differences from *C. subterranea* in presence/absence of pleopod 2 of the male, which prompted them to place the species in another genus, represent two stages of maturity. The development of both pleopods 1 and 2 is a secondary sexual character. Small males often lack or show only a vestigial pleopod 2, whereas it is well developed in larger specimens. Ngoc-Ho (2003) has reported that in *C. subterranea* the male pleopod 2 is

sometimes absent. Male pleopods 2 are also often absent in *C. ceramica* (see Poore & Griffin 1979: 260) and Dworschak (2003) demonstrated the variability of pleopods 1 and 2 over the entire size range in *C. aqabaensis*.

We refrained from requesting the type material of *T. vilavelebata* on loan as “All of the present specimens examined were extensively damaged and no complete specimens were collected” (Sakai & Türkay 2012: 745).

Most of our study material comes from one population in the Adriatic Sea near Rovinj, not far from the localities of *C. subterranea* reported by Sakai & Türkay (2012) and the type locality of *T. vilavelebata*. In fact, they reported both species from the same sample (stn SJ-005 [erroneously as JS-005 on p. 735], 45°18.4'N, 13°08.0'E, 31 m). Our examples have been collected mainly with a Van Veen grab from a muddy bottom between 25 and 32 m water depth and consist of small specimens with CL ranging from 1.8 to 5.0 mm. Some specimens with CL 1.8–5.0 mm showed no trace of pleopod 2 (Fig. 2A) while others of CL 2.1–4.9 mm had a vestigial bud-like pleopod 2 ranging in length from 35 to 392 µm (Fig. 2B). Only the largest male available (from Livorno) had a biramous pleopod 2 1400 µm long (Fig. 2C). The relationship between the lengths of male pleopods 1 and 2 and carapace length is shown in Fig. 3.

It is concluded that *Trypaea vilavelebata* is not a valid species but represents juvenile *Callianassa subterranea* with an undeveloped pleopod 2. The former is thus synonymised with the latter.

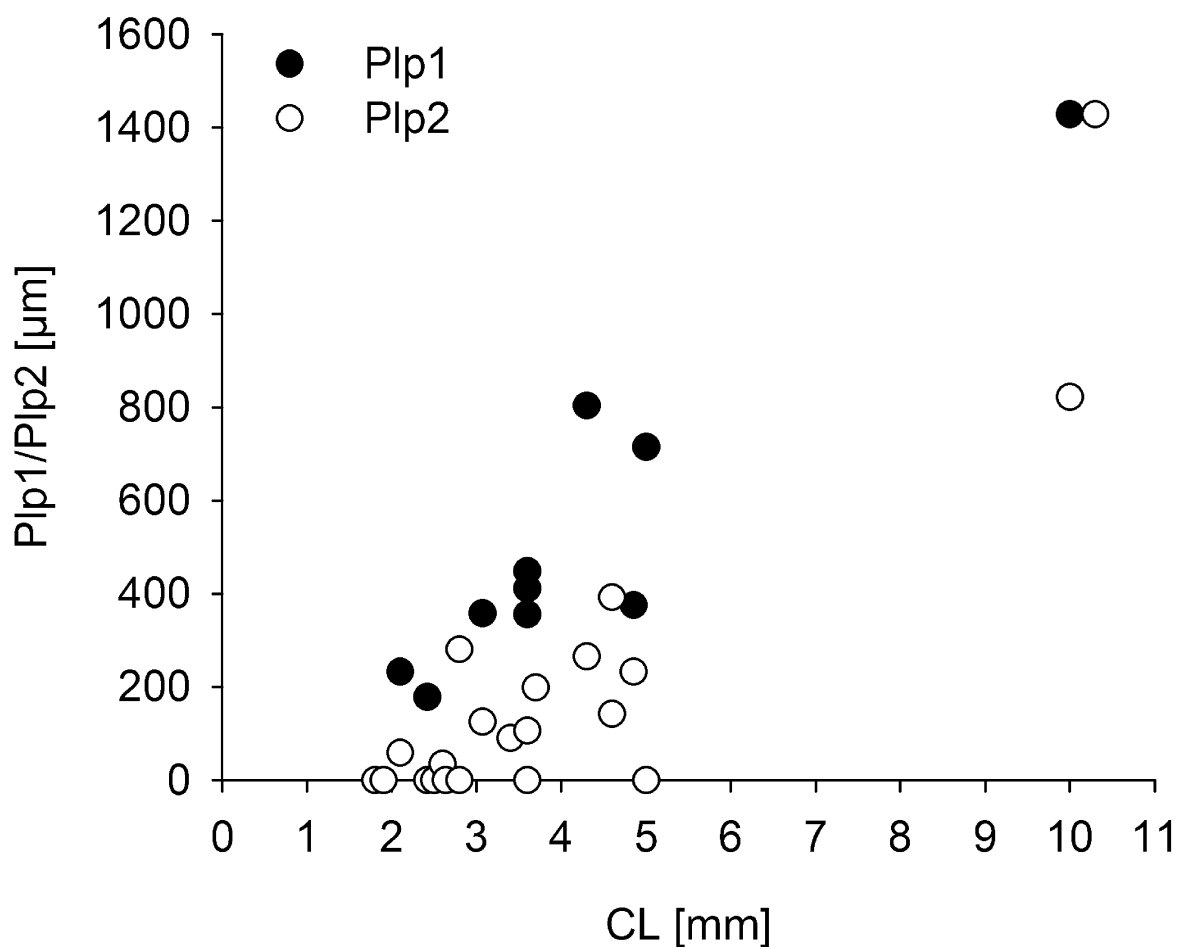


FIGURE 3. *Callianassa subterranea* (Montagu, 1808). Relationship between the lengths of male pleopods 1 and 2 and carapace length.

Family Callianopsidae Manning & Felder, 1991

Callianopsinae Manning & Felder, 1991: 787–789.—Schweitzer Hopkins & Feldmann 1997: 237.—Sakai 2005: 226–227.—Sakai 2011: 477–478.—Sakai *et al.* 2015b: 122–124.
Callianopsidae.—Sakai 2011: 477.—Sakai *et al.* 2015b: 121–122.

Neocallianopsinae Sakai, 2011: 482. **Syn. nov.**

Remarks. Sakai (2011) elevated Callianopsinae to family rank and added a second subfamily, Neocallianopsinae. The latter was said to differ from the former only in the absence of a ‘dorsal oval’ and cardiac sulci. Comparison of *Callianopsis anovalis* Lin, Komai & Chan, 2007, type and only species of *Neocallianopsis*, with other species of the genus shows them to differ little; notably they share a similar rostrum, telson, uropod, maxilliped 3, chelipeds, and pleomere 6 with a pair of lateral teeth. The dorsal oval is difficult to define in these basal genera (unlike in Callichiridae). De Saint Laurent (1973) diagnosed the genus as having the ‘ovale bien délimité’ which was figured by Schweitzer Hopkins & Feldmann (1997) and *Phaetoncalliax mauritana* Sakai, Türkay, Beuck & Freiwald, 2015, otherwise similar to *Callianopsis*, has what appears to be a weak discontinuity between the gastric region and the rostrum (Fig. 4A). There would appear a continuum from well marked to undetectable in this variable character that is thereby unreliable as a generic or subfamily character. As we show below, all three genera recognised by Sakai (2011), plus *Phaetoncalliax* Sakai, Türkay, Beuck & Freiwald, 2015 are subjective junior synonyms of *Callianopsis* de Saint Laurent, 1973, the only genus, so subfamilies are superfluous.

Genus *Callianopsis* de Saint Laurent, 1973

Callianopsis de Saint Laurent, 1973: 515 (type species: *Callianassa goniophthalma* Rathbun, 1902, by original designation and monotypy, gender feminine)

Pleurocalliax Sakai, 2011: 480–481 (type species: *Callianassa caecigena* Alcock & Anderson, 1894 by original designation and monotypy, gender feminine). **Syn. nov.**

Neocallianopsis Sakai, 2011: 482 (type species: *Callianopsis anovalis* Lin, Komai & Chan, 2007 by original designation and monotypy, gender feminine). **Syn. nov.**

Phaetoncalliax Sakai, Türkay, Beuck & Freiwald, 2015: 124–128 (type species: *Phaetoncalliax mauritana* Sakai, Türkay, Beuck & Freiwald, 2015, by original designation and monotypy, gender feminine). **Syn. nov.**

Remarks. The type and only species of *Pleurocalliax* Sakai, 2011 was said to be “rather similar to the type species of the genus *Callianopsis*, *C. goniophthalma* ... but differs in that in *Calliactites coecigena* [sic] abdominal pleuron 2 is armed with a laterally directed acute projection posteroventrally, pleura 3–4 with a laterally-directed acute projection medioventrally, and pleura 5–6 with a laterally-directed acute projection anteroventrally; whereas in *Callianopsis goniophthalma* abdominal pleura 2–5 are unarmed and pleuron 6 is armed with a laterally-directed acute projection anteroventrally”. The only figures of *Callianassa caecigena* (Alcock & Anderson, 1896: pl. 26 fig. 2) illustrate the pleural spines. As well as the strong lateral tooth on pleuron 6, both *C. goniophthalma* (Rathbun 1904: 156, pl. 8) and *C. anovalis* (Lin *et al.* 2007: fig. 1) possess a spine or angle on pleura 1 and 5, while *Phaetoncalliax mauritana* has a spine on pleura 1 and 6 (Fig. 4F).

The synonymy of *Neocallianopsis* Sakai, 2011 with *Callianopsis* was discussed above.

Sakai *et al.* (2015b: 125) asserted that their new genus *Phaetoncalliax* differs from *Callianopsis* in that pleopod 1 is biramous (vs uniramous) and pleopod 2 has different relative lengths of appendix masculina and endopod. In addition, they listed the presence (Table 3) of a dorsal postcervical ridge on the carapace (present in *Phaetoncalliax*, absent in *Callianopsis* and *Pleurocalliax*).

Study of the holotype and male paratype of *Phaetoncalliax mauritana* shows, that the distal article of pleopod 1 is entire (Fig. 4C–F) and uniramous as in *Callianopsis*. The difference in the pleopod 2 is not convincing when comparing Sakai (2011: fig. 631 for *C. goniophthalma*) and Sakai *et al.* (2015b: fig. 6f for *P. mauritana*). Contrary to Sakai *et al.*’s (2015b) statement, both *C. goniophthalma* and *C. anovalis* have an elevated mid-dorsal ridge near the posterior margin of the carapace as does *P. mauritana* (Fig. 4A). Given the similarity between all four species in the carapace, pleonite 6, uropods, chelipeds and elsewhere, the alleged differences are insufficient to warrant generic differentiation and the genera are therefore synonymous.

***Callianopsis mauritana* (Sakai, Türkay, Beuck & Freiwald, 2015) comb. nov.**
(Fig. 4)

Phaetoncalliax mauritana Sakai, Türkay, Beuck & Freiwald, 2015: 128, figs 4–6.

Neocallianopsis africana Sakai, Türkay, Beuck & Freiwald, 2015: 129, fig. 7. **Syn. nov.**

Material examined. SMF 44111, holotype (male, 14.5 mm), paratype (male, 11.0 mm), former labelled: “Senckenberg-Mus. ____ Frankfurt-Main \ Callianassidae 3 Expl. \ mitführende SaM-ID 1210 \ MSM 16/3 St. 14 862-1 Station Gerät BG \ bearbeitet von J. Bludau am. 19.10.12”, “Phaetoncalliax mauritana sp. nov. \ sp.nov. (Gen.nov.) \ SMF 001, Holotype, male (TL/CL 55.0/14.5 mm, \ missing small cheliped on right side), Canyon area \ Souther Banc d'Arguin, GKB, BG, 82 m \ 19°44.234'N, 17°08.745'W, 07.11.2010 \ R/V Maria S. Merian, Reise 11/3, 'Phaeton', \ Atlantic, around Mauretania \ Det. K. Sakai, 04.iii.2013, Tokushima”.

Remarks. Sakai *et al.* (2015b) reported the holotype and paratype from station 14862-1 at a depth of 545 m, a depth confirmed in the cruise report (Westphal *et al.* 2014). The depth (82 m) and the cruise number (11/3 instead of 16/3) given on the labels are errors, as is the placement of this station on their map (Sakai 2015b: fig. 1).

The male pleopod 1 differs slightly between the holotype and paratype, the former having a proximal rounded tip and a distal acute tip (Fig. 4B–E), while the latter has two acute tips (Fig. 4F). In addition, the length/width ratio of the articles differs between the two specimens.

Neocallianopsis africana was described from an incomplete, damaged specimen, lacking both chelipeds and the pleon posterior to pleomere 3. It came from station 14848-1, one of the same stations where *P. mauritana* was recorded. Except for lacking a dorsal oval (see above) it apparently does not differ from *P. mauritana* and is thus synonymised here.

Family Gourretiidae Sakai, 1999

Gourretiinae Sakai, 1999a: 95.—Ngoc-Ho 2003: 498.—Sakai 2005: 217–218.

Ctenochelidae [partim].—Ngoc-Ho 2003: 498.

Gourretiidae.—Sakai 2004: 556–557.—Sakai 2005: 217.—Sakai 2011: 507–508.

Pseudogourretiinae Sakai, 2005: 230.

Pseudogourretiidae Sakai 2011: 523. **Syn. nov.**

Remarks. Sakai (2005) justified Pseudogourretiinae, a new subfamily later elevated to family rank (Sakai 2011), on the presence of pleurobranchs in the type species of a new genus and species, *Pseudogourretia portsudanensis*. Pleurobranchs are present in Micheleidae, some Axiidae and some Upogebiidae (Poore, 1994). Our study of the holotype of *Pseudogourretia portsudanensis* detected no pleurobranchs (see below). Pseudogourretiidae is therefore synonymised with Gourretiidae.

Genus *Gourretia* de Saint Laurent, 1973

Gourretia de Saint Laurent, 1973: 514 [type species *Callianassa denticulata* Lutze, 1937, by original designation and monotypy; gender feminine]

Pseudogourretia Sakai, 2005: 230 [type species *Pseudogourretia portsudanensis* Sakai, 2005 by original designation and monotypy; gender feminine]. **Syn. nov.**

Remarks. The synonymy of *Pseudogourretia* Sakai, 2005 with *Gourretia* de Saint Laurent, 1973 follows from the synonymy of Pseudogourretiidae with Gourretiidae (see above).

Gourretia portsudanensis (Sakai, 2005) comb. nov.

Pseudogourretia portsudanensis Sakai, 2005: 231–234, fig. 42.

Material examined. Holotype, Red Sea, Port Sudan, SMF 28105 (male, 8.2 mm, lacking pleomere 2 to telson, chelipeds).

Remarks. During our careful dissection of the holotype (stained with methyl blue) we could not detect any pleurobranchs. *Pseudogourretia* and Pseudogourretiinae are therefore synonymised with *Gourretia* and

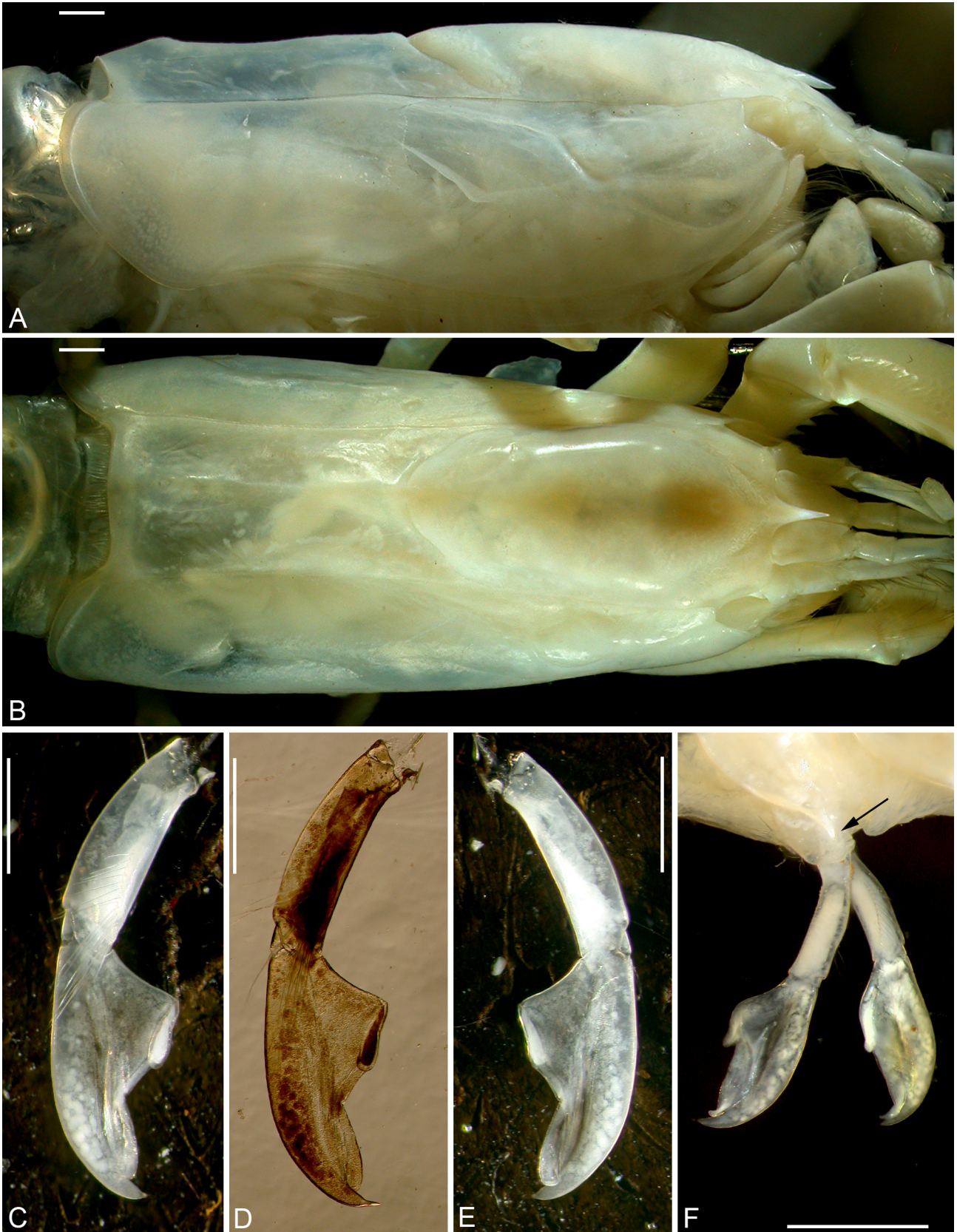


FIGURE 4. *Callianopsis mauritana* (Sakai, Turkey, Beuck & Freiwald, 2015). A–E, holotype of *Phaetoncalliax mauritana*, F, paratype of *P. mauritana*, SMF 44111. A, carapace in lateral view; B, same in dorsal view; C, D, left pleopod, posterior view; E, same, anterior view; F, left and right pleopods 1 in situ, arrow points to pleuron 1 spine. Scale bar = 1 mm.

Gourretiidae, respectively. Similar species of *Gourretia* (with a spine on merus of maxilliped 3 and a linear pereopod 3 propodus) are *G. laevidactyla* Liu & Liu, 2010 and *G. phuketensis* Sakai, 2002, both from the Indo-West Pacific.

Family Paracalliidae Sakai, 2005 stat. nov.

Paracalliinae Sakai, 2005: 215.

Remarks. Sakai (1999) included *Paracalliax* de Saint Laurent, 1979 with *Ctenocheles* in the callianassid subfamily Ctenochelinae, and excluded *Dawsonius* and *Gourretia*, which had previously been included, in a new subfamily Gourretiinae. Sakai (2004) elevated Gourretiinae to family rank and in 2005 elevated Ctenochelinae to family rank. Sakai (2011, 2015) confined Ctenochelidae to *Ctenocheles*, placed *Paracalliax* in Gourretiidae, and ignored Paracalliinae. The only species, *Paracalliax bollorei* de Saint Laurent, 1979 (see below) differs from all other callianassoid species in similarity of pleopod 2 to pleopods 3–5, incipient axiid-like interaction between the carapace and pleomere 1, and distinct pleonal pleura 1 and 2. It shares with few species the uropodal exopod without a dorsal plate and a pediform maxilliped 3 (de Saint Laurent & LeLoeuff 1979). While similar to Ctenochelidae, Gourretiidae, Callianopsidae and Anacalliidae, separate family status is justified.

Genus *Paracalliax* de Saint Laurent, 1979

Paracalliax de Saint Laurent, 1979: 1396.—de Saint Laurent & LeLoeuff 1979: 84–86.—Sakai 2005: 215–216.—Sakai *et al.* 2015b: 130 (type species: *Paracalliax bollorei* de Saint Laurent, 1979 by original designation and monotypy, gender feminine).

Paracalliax bollorei de Saint Laurent, 1979

(Fig. 5)

Paracalliax bollorei de Saint Laurent, 1979: 1396.—de Saint Laurent & LeLoeuff 1979: 86–89, figs 26–28.—Sakai 2005: 216.—Sakai 2011: 515.

Paracalliax stenophthalmus Sakai, Turkey, Beuck & Freiwald, 2015: 130–131, figs 8, 9. **Syn. nov.**

Material examined. Holotype of *Paracalliax bollorei*, Banc d'Arguin, Mauritania, 20–100 m, MNHN IU-2014-22948 (Th404) (female, 21 mm).

Holotype of *P. stenophthalmus*, southern Banc d'Arguin (stn GeoB 14847-1) 19°51.143'N, 17°15.816'W, 369 m, SMF 44114 (female, 13.6 mm, lacking major cheliped).

Remarks. Sakai *et al.* (2015b) mentioned that *Paracalliax stenophthalmus* differs from *P. bollorei* because “1) the eyestalks are elongate, circular in cross section and narrowly triangular anteriorly, slightly overreaching the distal margin of the proximal segment of the A1 peduncle (vs. in *Paracalliax bollorei*, the eyestalks are elongate, but flattened and rounded anteriorly, and are distinctly shorter than the distal margin of the proximal segment of the A1 peduncle); 2) the A1 peduncle reaches the proximal third of the distal segment of the A2 peduncle (vs. the A1 peduncle being almost as long as the A2 peduncle) ...”

Study of the holotype of *P. stenophthalmus* shows that the eyestalks are not narrowly triangular anteriorly and are distinctly shorter than the proximal segment of the antenna (Fig. 5A). Both species have been reported from the same locality, the Banc d'Arguin, off Mauritania. As there exists no evident difference from *P. bollorei*, *P. stenophthalmus* is synonymised with the former species.

The species epithet “*stenophthalmus*” as a Greek Latinised name ending in -ophthalmus, -a, -um is an adjective (Kottelat 2012). The gender of *Paracalliax* is feminine, the combination should therefore be corrected to “*Paracalliax stenophthalma*”.

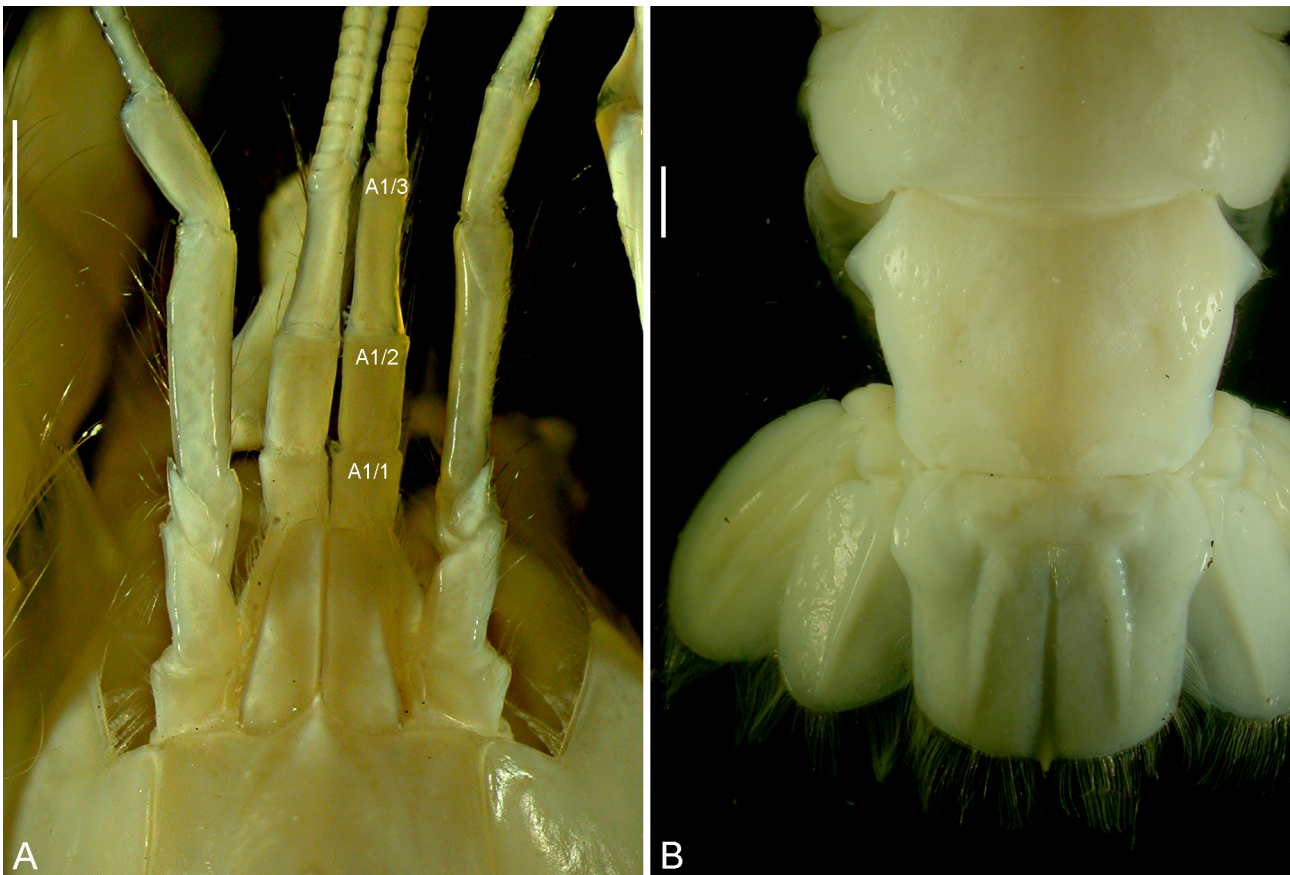


FIGURE 5. *Paracalliax bollorei* de Saint Laurent, 1979, SMF 44114, female holotype of *Paracalliax stenophthalmus*. A, front in dorsal view (A1/1–3: first to third antennular peduncular articles); B, pleomeres 5, 6, telson and left uropods in dorsal view. Scale bar = 1 mm.

Infraorder Gebiidea de Saint Laurent, 1979

Family Upogebiidae Borradaile, 1903

Upogebiinae Borradaile, 1903: 542.

Upogebiidae.—de Saint Laurent 1973: 516 (diagnosis).—de Saint Laurent & LeLoeuff 1979: 35.

Kuwaitupogebiidae Sakai, Türkay & Al Aidaroos, 2015: 1223. **Syn. nov.**

Remarks. Sakai *et al.* (2015a: 1223) justified their new family in this way: “(1) the rostrum is indiscernible on the anterior margin of the carapace (vs. it is good-sized and distinct, protruding anteriorly); (2) the eyestalks are short, stout, and contiguous to each other, located just in front of the anterior margin of the carapace (vs. they are rather long and not contiguous to, but separated from each other, and located anterolaterally behind the distinct rostrum); (3) the A1 is not in parallel with the A2, but directed inwards from the proximal part of the A2, and then upturned [comparable as in the species of the family Diogenidae ...] (vs. it is in parallel with the A2, and not upturned); (4) the linea thalassinica is absent (vs. it is present).” It is difficult to interpret from this exactly how the relationship between the antennules and antennae differs from that in other species. But examination of the holotype on which the family is based has shown that all four characters are within the range of several species of *Upogebia*, and that the holotype belongs to a well known species. The synonymy of Kuwaitupogebiidae with Upogebiidae follows (see below).

Genus *Upogebia* Leach, 1814

Upogebia Leach, 1814: 400 [type species *Cancer Astacus stellatus* Montagu, 1808 by monotypy, gender feminine].—de Saint Laurent & LeLoeuff 1979: 36 (synonymy).—Sakai 2006a: 38–40.

Kuwaitupogebia Sakai, Turkey & Al Aidaroos, 2015: 1223–1224 [type species *Kuwaitupogebia nithyanandan* Sakai, Turkey & Al Aidaroos, 2015, by original designation and monotypy, gender feminine]. **Syn. nov.**

Remarks. Sakai *et al.* (2015a) repeated their arguments to justify separating the new genus from *Upogebia*. As shown below, none of the differences is real. Upogebiidae includes 11 genera (Sakai 2006a) but the synonymy of *Kuwaitupogebia* with *Upogebia*, rather than with any other, has been determined after examination of its type species and comparison with similar species (see below).

Upogebia balmaorum Ngoc-Ho, 1990

(Fig. 6)

Upogebia balmaorum Ngoc-Ho, 1990: 966–969, figs 1, 2a–d.—Ngoc-Ho 1994: 77, fig. 12a.—Sakai 2006a: 93.—Ngoc-Ho 2008: 141–143, fig. 5.

Upogebia tractabilis.—Sakai 1982: 16–17 (part, Madagascar material).—Sakai 1993: 91 (part) [not *Upogebia tractabilis* Hale, 1941].

Kuwaitupogebia nithyanandan Sakai, Turkey & Al Aidaroos, 2015: 1223–1227, figs 1, 2. **Syn. nov.**

Material examined. Holotype of *Kuwaitupogebia nithyanandan* Sakai, Turkey & Al Aidaroos, 2015, Kuwait, Al-Khiran, SMF 48913 (ovigerous female, 6.3 mm). Paratypes, same locality, SMF 48914 (4 ovigerous females, 4 females, 5 males).

Remarks. Sakai *et al.* (2015a: 1227) repeated their argument yet again in the species discussion, stating that, “The specimens from Kuwait examined are outstandingly different from all known upogebiid species reported up to now, because of the peculiar forms of the eyestalks and the A1, and the absence of the rostrum and of a linea thalassinica. It would be suggested from these morphological features that they are to be determined as a new species, which could not be classified under any genera of the family Upogebiidae. This means that this new species is to be classified under a new genus, and this genus also, in its turn, in a new family in the Thalassinidea, as is established in the present paper.”

The study of the type material showed that: (1) a linea thalassinica is present, clearly visible in the holotype and all paratypes anterior to the cervical groove as in almost all Upogebiidae (Fig. 6A, B); (2) the antennules and antennae run parallel as in all other Upogebiidae, the antennules directed downwards (in the holotype and most paratypes), the antenna directed upward (the right flagellum broken off in the holotype) (Fig. 6B) or forward. In dorsal view (Fig. 6A), the antennules are not visible in most specimens. It appears that K. Sakai interpreted the dense setation on the antenna article 4 as flagella of the antennule. Nothing is unusual with the rostrum—except being very short—or the eyestalks. The rostrum of the holotype is one of the shortest among the specimens (Fig. 6A, B); in most paratypes the rostrum is triangular (Fig. 6C, E) and may even reach to the end of the cornea (Fig. 6D).

Another inaccuracy is that the authors even figured two flagella on the antenna (Sakai *et al.* 2015a: fig. 1B). The characteristic prominent proximal spine on the uropodal exopod (Fig. 6C; Ngoc-Ho 1990: fig. 1i; Ngoc-Ho 2008: fig. 5G) has been erroneously interpreted as being on the protopod (Sakai *et al.* 2015a: fig. 1H).

As observations on the specimens by Sakai *et al.* (2015a) are mainly based on errors, the genus *Kuwaitupogebia* and the family Kuwaitupogebiidae lack any justification and are synonymised with *Upogebia* and Upogebiidae, respectively.

Ngoc-Ho (1990: table 1) compared three species of *Upogebia* that have a very short rostrum: *U. tractabilis* Hale, 1941 from South Australia, *U. laemanu* Ngoc-Ho, 1990 and *U. balmaorum* Ngoc-Ho, 1990 from the Seychelles, all three often associated with sponges. Both species of Ngoc-Ho were synonymised with *U. tractabilis* by Sakai (1993) while he considered them distinct later (Sakai, 2006a). Additional records of *U. balmaorum* are from Queensland, Australia (Ngoc-Ho, 1994), Madagascar and Dampier Archipelago, Western Australia (Ngoc-Ho, 2008).

With a median groove on the rostrum, four or five lateral teeth on the rostrum, presence of a small ventral spine

on the antennal article 1, absence of ventral and carpal spines on pereopod 1, the sexual dimorphism of pereopod 1 and the presence of a proximal spine on the uropodal exopod, the material studied herein shows many of the characters of *U. balmaorum* and is within its known geographical range. *Kuwaitupogebia nithyanandan* is therefore synonymised with *U. balmaorum*.

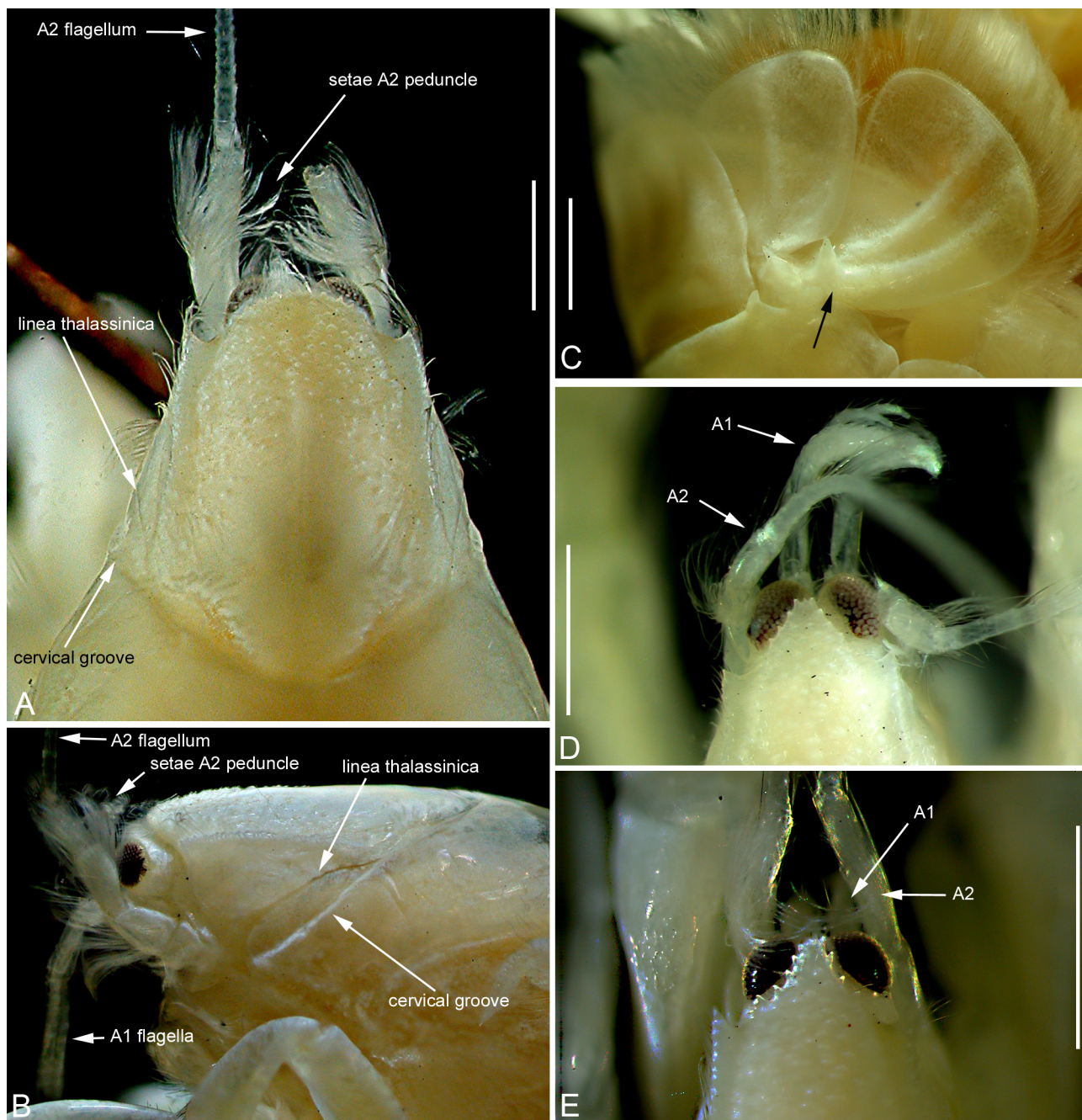


FIGURE 6. *Upogebia balmaorum* Ngoc-Ho, 1990. A, B, C, female holotype of *Kuwaitupogebia nithyanandan*, SMF 48913; D, male paratype of *K. nithyanandan* (3.4 mm); E, female paratype of *K. nithyanandan* (3.6 mm), SMF 48914; A, D, E, front, dorsal aspect; B, front, lateral aspect; C, uropods, arrow points to proximal spine on exopod. Scale bar = 1 mm.

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References

- Alcock, A. & Anderson, A.R.S. (1894) An account of a recent collection of deep sea Crustacea from the Bay of Bengal and Laccadive seas. Natural history notes from H.M. Indian marine survey steamer 'Investigator' commander C.F. Oldham commanding. *Journal of the Asiatic Society of Bengal*, 63 (part 2 No.3), 141–185. Available from: <https://decapoda.nhm.org/pdfs/29276/29276.pdf> (accessed 26 July 2017)
- Alcock, A. & Anderson, A.R.S. (1896) *Illustrations of the zoology of the Royal Indian marine surveying steamer Investigator, under the command of Commander C.F. Oldham, R.N. Crustacea.—Part IV, Plates XVI–XXVII*. Office of the Superintendent of Government Printing, India, Calcutta, pp. Available from: <http://biodiversitylibrary.org/page/38717112> (accessed 26 July 2017)
- Boesch, D.F. & Smalley, A.E. (1972) A new axiid (Decapoda, Thalassinidea) from the Northern Gulf of Mexico and tropical Atlantic. *Bulletin of Marine Science*, 22 (1), 45–52. Available from: <http://www.ingentaconnect.com/content/umrsmas/bullmar/1972/00000022/00000001/art00005> (accessed 26 July 2017)
- Borradaile, L.A. (1903) On the classification of the Thalassinidea. *Annals and Magazine of Natural History*, Series 7, 12, 534–551 + Addendum on pp. 638. Available from: <http://biodiversitylibrary.org/page/29993300> (accessed 26 July 2017)
- Dana, J.D. (1852) Conspectus crustaceorum, &c. Conspectus of the Crustacea of the Exploring Expedition under Capt. Wilkes, U.S.N. Macroura. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 6 (1), 10–28. Available from: <http://biodiversitylibrary.org/page/1779546> (accessed 24 February 2017)
- Dworschak, P.C. (2003) A new species of ghost shrimp from the Gulf of Aqaba (Crustacea: Decapoda: Callinassidae). *Annalen des Naturhistorischen Museums in Wien, Serie B*, 104, 415–428. Available from: http://www.zobodat.at/pdf/ANNA_104B_0415-0428.pdf (accessed 26 July 2017)
- Dworschak, P.C. (2013) Axiidea and Gebiidea (Crustacea: Decapoda) of Costa Rica. *Annalen des Naturhistorischen Museums in Wien, Serie B*, 115, 37–55. Available from: http://www.zobodat.at/pdf/ANNA_115B_0037-0055.pdf (accessed 27 July 2017)
- Felder, D.L. & Dworschak, P.C. (2015) Comments on two questionably new axiidean taxa from the Gulf of Mexico (Crustacea: Decapoda). *Zootaxa*, 4057 (2), 265–272. <https://doi.org/10.11646/zootaxa.4057.2.7>
- Hale, H.M. (1941) Decapod Crustacea. *British, Australian and New Zealand Antarctic Research Expedition, 1929–1931. Reports—Series B (Zoology and Botany)*, 4 (9), 257–286. Available from: <https://decapoda.nhm.org/pdfs/16690/16690.pdf> (accessed 27 July 2017)
- Haug, C., Mayer, G., Kutschera, V., Waloszek, D., Maas, A. & Haug, J.T. (2011) Imaging and documenting gammarideans. *International Journal of Zoology*, 2011 (Article ID 380829), 1–9. <https://doi.org/10.1155/2011/380829>
- Hendrickx, M.E. (1987) The species of Axiidae (Crustacea: Thalassinidea) from the Pacific coast of Mexico, with a key for their identification. *Revista de Biología Tropical*, 35 (2), 355–358. Available from: <http://revistas.ucr.ac.cr/index.php/rbt/article/view/24121/24245> (accessed 26 July 2017)
- Hendrickx, M.E. (1995) Langostas (Langostas espinosas, bogavantes y cigalas, cigarras y zapateras, langostas de lodo, etc.). In: Fischer, W., Krupp, F., Schneider, W., Sommer, C., Carpenter, K.E. & Niem, V.H. (Eds.), *Guía FAO para la identificación de especies para los fines de la pesca. Pacífico centro-oriental. Vol. I. Plantas e invertebrados*. FAO, Roma, pp. 383–415. Available from: <https://decapoda.nhm.org/pdfs/16921/16921.pdf> (accessed 26 July 2017)
- Hendrickx, M.E. (2005) Additional records of *Acanthaxius caespitosus* (Squires, 1979) (Decapoda, Thalassinidea, Axiidae) from the eastern tropical Pacific. *Crustaceana*, 77 (10), 1277–1278. <https://doi.org/10.1163/1568540043166065>
- Huxley, T.H. (1879) On the classification and distribution of the crayfishes. *Proceedings of the Zoological Society of London*, 1878, 752–788. <https://doi.org/10.1111/j.1469-7998.1878.tb08020.x>
- Komai, T. (2017) *Gilvossius chichijimaensis* Sakai, 2015 (Crustacea: Decapoda: Axiidea: Callinassidae), a junior subjective synonym of *Paratrypaea bouvieri* (Nobili, 1904). *Zootaxa*, 4291 (2), 391–395. <https://doi.org/10.11646/zootaxa.4291.2.11>
- Komai, T. & Tachikawa, H. (2008) Thalassinidean shrimps (Crustacea: Decapoda) from the Ogasawara Islands, Japan. *Natural History Research*, 10 (1), 19–52. Available from: http://www.chiba-muse.or.jp/NATURAL/publication/nhr_10-1_4komai.pdf (accessed 27 July 2017)
- Kottelat, M. (2012) Conspectus Cobitidum*: an inventory of the loaches of the world (Teleostei: Cypriniformes: Cobitoidei). *Raffles Bulletin of Zoology*, Supplement 26, 1–199. Available from: https://lknhm.nus.edu.sg/app/uploads/2017/06/Conspectus_cobitidum.pdf (accessed 9 January 2018)
- Leach, W.E. (1814) Crustaceology. In: Brewster, D. (Ed.), *The Edinburgh Encyclopedia, Vol. 7*, 383–437. Blackwood, Edinburgh. Available from <http://decapoda.nhm.org/pdfs/26050/26050.pdf> (accessed 27 July 2017)
- Lemaitre, R. & Alvarez-León, R. (1992) Crustaceos decapodes del Pacífico Colombiano: lista de especies y consideraciones zoogeográficas. *Anales del Instituto de Investigaciones Marinas de Punta Betín*, 21, 33–76. Available from: <http://www.scielo.org.co/pdf/mar/v21n1/v21n1a04.pdf> (accessed 26 July 2017)
- Lin, F.-J., Komai, T. & Chan, T.-Y. (2007) First record of the thalassinidean genus *Callianopsis* de Saint Laurent, 1973 (Decapoda, Ctenochelidae) in the west Pacific, with a description of a new species from Taiwan. *Crustaceana*, 80 (10), 1193–1203. <https://doi.org/10.1163/156854007782321191>

- Liu, W. & Liu, R., (J. Y. Liu). (2010) Two new species of the axiidean genus *Gourettia* de Saint Laurent, 1973 (Decapoda: Ctenochelidae) from the South China Sea. *Journal of Crustacean Biology*, 30 (4), 745–756.
<https://doi.org/10.1651/10-3282.1>
- Lutze, J. (1937) Eine neue *Callianassa*-Art aus der Adria. *Note dell'Istituto Italo-Germanico di Biologia Marina di Rovigno d'Istria*, 2 (1), 1–12.
- Manning, R.B. & Felder, D.L. (1991) Revision of the American Callianassidae (Crustacea: Decapoda: Thalassinidea). *Proceedings of the Biological Society of Washington*, 104, 764–792.
 Available from: <http://biodiversitylibrary.org/page/34809466> (accessed 22 February 2017)
- Montagu, G. (1808) Description of several marine animals found on the South Coast of Devonshire. *Transactions of the Linnean Society of London*, 9, 81–114. Available from: <http://biodiversitylibrary.org/page/757838> (accessed 26 July 2017)
- Ngoc-Ho, N. (1990) Nine Indo-Pacific Species of *Upogebia* Leach (Crustacea: Thalassinidea: Upogebiidae). *Journal of Natural History*, 24 (4), 965–985.
<https://doi.org/10.1080/00222939000770611>
- Ngoc-Ho, N. (1994) Some Callianassidae and Upogebiidae from Australia with description of four new species (Crustacea: Decapoda: Thalassinidea). *Memoirs of the Museum of Victoria*, 54, 51–78.
 Available from: <http://biodiversitylibrary.org/page/39767494> (accessed 27 July 2017)
- Ngoc-Ho, N. (2003) European and Mediterranean Thalassinidea (Crustacea, Decapoda). *Zoosystema*, 25, 439–555. Available from: <http://sciencepress.mnhn.fr/sites/default/files/articles/pdf/z2003n3a5.pdf> (accessed 22 February 2017)
- Ngoc-Ho, N. (2008) Upogebiidae (Decapoda: Thalassinidea) mostly from the Dampier Archipelago, Western Australia. *Records of the Western Australian Museum*, 73 (Supplement), 131–159.
<https://doi.org/10.18195/issn.0313-122x.73.2007.131-159>
- Ortmann, A. (1891) Die Decapoden-Krebse des Strassburger Museums, mit besonderer Berücksichtigung der von Herrn Dr.Döderlein bei Japan und bei den Liu-Kiu Inseln gesammelten und z.Z. im Strassburger Museum aufbewahrten Formen. III.Theil: Die Abtheilungen der Reptantia Boas: Homaridea, Loricata und Thalassinidea. *Zoologische Jahrbücher*, 6, 1–58.
 Available from: <http://biodiversitylibrary.org/page/10194632> (accessed 26 July 2017)
- Poore, G.C.B. (1994) A phylogeny of the families of Thalassinidea (Crustacea: Decapoda) with keys to families and genera. *Memoirs of the Museum of Victoria*, 54, 79–120. <https://doi.org/10.24199/j.mmv.1994.54.03>
- Poore, G.C.B. (2017) Synonymy and problematic species of *Eiconaxius* Spence Bate, 1888, with descriptions of new species (Crustacea: Decapoda: Axiidea: Axiidae). *Zootaxa*, 4231 (3), 364–376.
<https://doi.org/10.11646/zootaxa.4231.3.4>
- Poore, G.C.B. & Collins, D.J. (2009) Australian Axiidae (Crustacea: Decapoda: Axiidea). *Memoirs of Museum Victoria*, 66 (2), 221–287. <https://doi.org/10.24199/j.mmv.2009.66.20>
- Poore, G.C.B. & Dworschak, P.C. (2017) Family, generic and species synonymies of recently published taxa of ghost shrimps (Decapoda, Axiidea, Eucalliidae and Ctenochelidae): cautionary tales. *Zootaxa*, 4294 (1), 119–125.
<https://doi.org/10.11646/zootaxa.4294.1.6>
- Poore, G.C.B. & Griffin, D.J.G. (1979) The Thalassinidea (Crustacea: Decapoda) of Australia. *Records of the Australian Museum*, 32, 217–321.
<https://doi.org/10.3853/j.0067-1975.32.1979.457>
- Rathbun, M.J. (1902) Description of new decapod crustaceans from the west coast of North America. *Proceedings of the United States National Museum*, 24, 885–905.
<https://doi.org/10.5479/si.00963801.1272.885>
- Rathbun, M.J. (1904) Decapod crustaceans of the northwest coast of North America. *Harriman Alaska Expeditions*, 10, 1–210.
 Available from: <http://www.biodiversitylibrary.org/item/15921> (accessed 26 July 2017)
- Saint Laurent, M. de (1973) Sur la systématique et la phylogénie des Thalassinidea: définition des familles des Callianassidae et des Upogebiidae et diagnose de cinq genres nouveaux. *Comptes Rendus Hebdomadaires de Séances de l'Académie des Sciences, Paris*, 277, 513–516. Available from: <http://gallica.bnf.fr/ark:/12148/bpt6k5474901n/f589.image> (accessed 23 August 2017)
- Saint Laurent, M. de (1979) Sur la classification et la phylogénie des Thalassinides: définitions de la superfamille des Axioidea, de la sous-famille des Thomassiniinae et de deux genres nouveaux (Crustacea Decapoda). *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences, Paris*, 288D, 1395–1397. Available from <http://gallica.bnf.fr/ark:/12148/bpt6k6124237z/f203.image> (accessed 23 August 2017)
- Saint Laurent, M. de & LeLoeuff, P. (1979) Campagnes de la Calypso au large des côtes Atlantiques Africaines (1956 et 1959) (suite). 22. Crustacés Décapodes Thalassinidea. I. Upogebiidae et Callianassidae. In: Forest, J. (Ed.), *Résultats Scientifiques des Campagnes de la Calypso. Fasc. 11 (22). Annales de l'Institut Océanographique, Monaco et Paris*, 55 (Supplement), 29–101. Available from: <https://decapoda.nhm.org/pdfs/15408/15408.pdf> (accessed 22 February 2017)
- Sakai, K. (1982) Revision of Upogebiidae (Decapoda, Thalassinidea) in the Indo-West Pacific region. *Researches on Crustacea (The Carcinological Society of Japan)*, Spec. No.1, 1–106. Available from: <http://ci.nii.ac.jp/lognavi?name=nels&lang=en&type=pdf&id=ART0002972656&naid=110002695902> (accessed 27 July 2017)
- Sakai, K. (1993) On a collection of Upogebiidae (Crustacea, Thalassinidea) from the Northern Territory Museum, Australia, with the description of two new species. *The Beagle, Records of the Northern Territory Museum of Arts and Sciences*, 10 (1), 87–114. Available from: <https://decapoda.nhm.org/pdfs/21964/21964.pdf> (accessed 27 July 2017)
- Sakai, K. (1999a) Redescription of *Ctenocheles balssi* Kishinouye, 1926, with comments on its systematic position and

- establishment of a new subfamily Gourretiinae (Decapoda, Callianassidae). *Crustaceana*, 72 (1), 85–97.
<https://doi.org/10.1163/156854099502899>
- Sakai, K. (1999b) Synopsis of the family Callianassidae, with keys to subfamilies, genera and species, and the description of new taxa (Crustacea: Decapoda: Thalassinidea). *Zoologische Verhandlungen*, 326, 1–152. Available from: <http://www.repository.naturalis.nl/document/46257> (accessed 22 February 2017)
- Sakai, K. (2002) Callianassidae (Decapoda, Thalassinidea) in the Andaman Sea, Thailand. In: Bruce, N.L., Berggren, M. & Bussawarit, S. (Eds.), *Biodiversity of crustacea of the Andaman Sea. Proceedings of the International Workshop on the Crustacea in the Andaman Sea. Phuket Marine Biology Center, Special Publication*, 23, 461–532. Available from: <https://decapoda.nhm.org/pdfs/21976/21976.pdf> (accessed 2 August 2017)
- Sakai, K. (2004) Dr. R. Plante's collection of the families Callianassidae and Gourretiidae (Decapoda, Thalassinidea) from Madagascar, with the description of two new genera and one new species of the Gourretiidae Sakai, 1999 (new status) and two new species of the Callianassidae Dana, 1852. *Crustaceana*, 77 (5), 553–601.
<https://doi.org/10.1163/1568540041718019>
- Sakai, K. (2005) Callianassoidea of the world (Decapoda: Thalassinidea). *Crustaceana Monographs*, 4, 1–285. Available from: <https://decapoda.nhm.org/references/pdfpick.html?id=21980&pdfroot=https://decapoda.nhm.org/pdfs> (accessed 22 February 2017)
- Sakai, K. (2006a) Upogebiidae of the world (Decapoda, Thalassinidea). *Crustaceana Monographs*, 6, 1–185. Available from: <https://decapoda.nhm.org/pdfs/21981/21981.pdf> (accessed 27 July 2017)
- Sakai, K. (2006b) A new subfamily, Dawsoniinae in the Callianassoidea Dana, 1852 (Decapoda, Thalassinidea). *Crustaceana*, 79 (10), 1275–1278.
<https://doi.org/10.1163/156854006778859515>
- Sakai, K. (2011) Axiioidea of the World and a Reconsideration of the Callianassoidea (Decapoda, Thalassinidea, Callianassida) *Crustaceana Monographs*, 13, 1–616. Available from: <https://decapoda.nhm.org/pdfs/32288/32288.pdf> (accessed 27 July 2017)
- Sakai, K. (2017) One new species of a new genus, *Neoaxius* gen. nov., in a new family, Neoaxiidae fam. nov., from the Gulf of Nicoya, Costa Rica (Decapoda, Axiioidea). *Crustaceana*, 90 (4), 503–510.
<https://doi.org/10.1163/15685403-00003650>
- Sakai, K. & Ohta, S. (2005) Some thalassinid collections by R/V 'Hakuhou-Maru' and R/V 'Tansei-Maru', University of Tokyo, in the Sulu Sea, Philippines, and in Sagami Bay, and Suruga Bay, Japan, including two new species, one new genus, and one new family (Decapoda, Thalassinidea). *Crustaceana*, 78 (1), 67–94.
<https://doi.org/10.1163/1568540054024619>
- Sakai, K. & Saint Laurent, M. de (1989) A check list of Axiidae (Decapoda, Crustacea, Thalassinidea, Anomula), with remarks and in addition descriptions of one new subfamily, eleven new genera and two new species. *Naturalists, Publications of Tokushima Biological Laboratory, Shikoku University*, 3, 1–104. Available from: <https://decapoda.nhm.org/pdfs/12320/12320.pdf> (accessed 2 August 2017)
- Sakai, K. & Türkay, M. (2012) A collection of Thalassinidea Latreille, 1831 (Decapoda, Pleocyemata) from the Senckenberg Forschungsinstitut und Natural History Museum, Frankfurt am Main. *Crustaceana*, 85 (6), 723–765.
<https://doi.org/10.1163/156854012X643735>
- Sakai, K., Türkay, M. & Aidaroos, A.A. (2015a) One new species of a new genus, *Kuwaitupogebia* gen. nov., in a new family, Kuwaitupogebiidae fam. nov., from Kuwait, and two new species of the genus *Upogebia* from the Red Sea (Decapoda, Thalassinidea). *Crustaceana*, 88 (10–11), 1221–1234.
<https://doi.org/10.1163/15685403-00003474>
- Sakai, K., Türkay, M., Beuck, L. & Freiwald, A. (2015b) A collection of the Infraorder Callianassidea (Decapoda, Pleocyemata) with one new genus and five new species from the Eastern Atlantic off Mauritania (R/V Maria S. Merian cruise MSM 16/3 'PHAETON'). *Marine Biodiversity*, 45 (1), 113–133.
<https://doi.org/10.1007/s12526-014-0227-2>
- Schweitzer Hopkins, C. & Feldmann, R.M. (1997) Sexual dimorphism in fossil and extant species of *Callianopsis* de Saint Laurent. *Journal of Crustacean Biology*, 17 (2), 236–252.
<https://doi.org/10.1163/193724097X00279>
- Squires, H.J. (1979) *Axiopsis (Axiopsis) caespitosa* (Thalassinidea, Axiidae), a new species from the Pacific coast of Colombia. *Canadian Journal of Zoology*, 57, 1884–1891.
<https://doi.org/10.1139/z79-207>
- Westphal, H., Beuck, L., Braun, S., Freiwald, A., Hanebuth, T., Hetzinger, S., Klicpera, A., Kudrass, H., Lantzsch, H., Lundälv, T., Vicens, G.M., Preto, N., Reumont, J. von, Schilling, S., Taviani, M. & Wienberg, C. (2014) Phaeton - Paleoclimatic and paleo-climatic record on the Mauritanian Shelf—Cruise No. MSM16/3 - October 13—November 20, 2010 - Bremerhaven (Germany)—Mindelo (Cap Verde). *MARIA S. MERIAN-Berichte*, MSM16/3, 1–58 + A1–A83.
https://doi.org/10.2312/cr_msm16_3