

*Reprinted from:*

# STYGOFAUNA MUNDI

*A Faunistic, Distributional, and Ecological Synthesis  
of the World Fauna inhabiting Subterranean Waters  
(including the Marine Interstitial)*

149

EDITED BY

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## DECAPODA

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The classification of the higher taxa within the order Decapoda is still far from stable and, although various systems are found in modern literature, none of these is quite satisfactory. The classification used here is based mainly on the one adopted in Waterman & Chace (1960, *Physiology of Crustacea*, 1: 25-26) and in other modern handbooks.

The greater number of the more than 8000 species of Decapod Crustacea is marine; the fresh-water species form a minority, and compared to the other two groups, the number of terrestrial Decapod species is negligible. Nevertheless all three groups are represented in subterranean habitats. Four terrestrial Decapoda have been reported from caves: *Birgus latro* and three species of Gecarcinid crabs; they are mentioned here as they cannot exist without considerable moisture. Of the true stygobionts the number of species occurring in fresh water exceeds that of the species living in marine habitats by more than 5 times.

The assignment of the Decapod species, that so far have been found in subterranean waters, to the categories stygobionts, stygophiles and stygoxenes is not an easy task. This is especially true since in many cases too little is known of the biology and ecology of the species, and of the variability of its morphological characters. Of course it is not difficult to classify a species which is found only in total darkness, shows no pigment, has the eyes reduced and the appendages strongly elongated, as a stygobiont; similarly a species that shows no adaptations to subterranean life, is frequent in epigean waters, and has once or twice been met with in a subterranean habitat, can be easily recognized as a stygoxene. But all intermediates between these extremes occur. A better knowledge of a species may change our idea of whether it is or is not a stygobiont. A good example is that of two species of the genus *Euryrhynchus*, viz., *E. wrzesniowskii* Miers, 1870 and *E. burchelli* Calman, 1907. Both species were originally described as collected from a well (from Cayenne and Pará, respectively); as the pigment of the eyes seemed somewhat reduced, both species were usually classed as stygobionts until about 1935, when numerous field observations showed that *E. wrzesniowskii* is a characteristic inhabitant of brown-coloured acid savannah creeks in the three Guianas, while *E. burchelli* was frequently found in epigean water of the Amazon basin. Neither species, apart from the

original record, was ever again reported from subterranean water; they are now considered stygoxenes. Another example is the crab *Thelphusula bidiensis* originally described (as *Potamon (Thelphusa) bidiense*) by Lanchester (1900: 256, 257) from the "absolute dark part" of a cave in southern Sarawak, Borneo. Although the legs were long, and the colour "perhaps paler than in the Thelphusidae generally", the eyes did not show an appreciable reduction. As long legs were also found in related epigean species, Lanchester thought the evidence, that the species is a true subterranean form, to be "very little, and not much can be deduced from it in either direction". The discovery of the species in three more caves in the general area of the type locality, being found there in good numbers, inclines me to treat the species, which so far has not been found in epigean waters, as a stygobiont. It is possible, however, that this opinion might well have to be revised when the species becomes still better known. I have used my best judgment to distinguish between stygobionts (listed here in tabular form) and non-stygobionts, but it is to be expected that mistakes will have been made.

To the category of stygobionts I have also assigned the anchialine shrimps (Natantia). As pointed out before (Holthuis, 1973: 3) the anchialine habitat is formed by salt or brackish water pools that are situated rather close to the sea coast in porous rock (fossil coral reefs, lava, etc.). Such pools have no direct open connection with the sea, but, as the water level in the pools rises and falls with the tides (sometimes with a delay), there must be some subterranean connection with the sea. These pools often are situated in darkness (e.g., in caves) or semi-darkness, but if exposed to daylight they always are directly connected with subterranean bodies of water. The anchialine shrimps found in such open pools always have the possibility of retreating into the subterranean spaces (cf. the description of the behaviour of *Parhippolyte uveae* by Wear & Holthuis, 1977: 125-140). As most anchialine shrimps, apart from their red colour, have distinct characters of stygobionts (reduced eyes, long appendages) and evidently pass at least part of their life in subterranean waters, it seemed best to treat them here as stygobionts.

No effort has been made here to divide the subterranean non-stygobionts in stygophiles and stygoxenes, as in most cases our knowledge is simply insufficient to do so.

As already briefly mentioned above, the typical charac-

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ters of a stygobiont Decapod Crustacean are (1) the reduction or degeneration of the eyes, (2) the absence of pigment, and (3) the elongation of the appendages. These characters apply in the first place to the freshwater stygobionts, an excellent example is *Troglocambarus maclanei* Hobbs, which has the eyes strongly reduced and without the slightest trace of pigment, the body almost completely transparent and likewise without pigment, the legs, and especially the antennae very long and slender. Some stygobiont shrimps are so transparent that they become practically invisible in the water; a good example of this is provided by the story of the discovery of the only Western European stygobiont shrimp, *Troglocaris inermis* Fage: M. de Joly, while swimming in the Grotte de Cambous (dépt. Gard, S. France), felt several slight stings on his skin without being able to see what caused them; a handnet scraped over his body produced to his surprise several rather sizable shrimps which were glassy transparent.

Although in the true freshwater stygobionts the body is usually transparent or whitish, anchialine shrimps as a rule are characterized by a red colour. Numerous red chromatophores scattered over the body of anchialine shrimps, when expanded, give these a brilliant red colour. The intensity of the colour is regulated by the expansion or contraction of the chromatophores, and when these are fully contracted the animal is quite transparent. Apart from their peculiar habitat, the red colour is practically the only feature that anchialine shrimps have in common. In some the eyes are reduced, but always contain some pigment; the appendages are slender, but not always strikingly so. The species *Troglocaris phreaticus* has all the features of an anchialine shrimp, being of an "orange-red" colour and having the eyes reduced but still with a small black pigment spot, but its habitat, although close to the sea, is not typically anchialine as it is a well containing fresh (potable) water and there are no published indications that the water level in the well is subject to tidal influence.

A few attempts have been made previously to list all or part of the known subterranean Decapoda. Wolf (1934-1938) in *Animalium Cavernarum Catalogus* enumerated all animal species, including Crustacea, known at that time from subterranean habitats. A list of all known subterranean shrimps (Decapoda Natantia) was published by Holthuis (1956, *Vie et Milieu*, 7 (1): 43-76). In 1977 Hobbs, Hobbs & Daniel (Smithson. Contrib. Zool., 244: i-v, 1-183) gave a beautifully illustrated account of all known trogllobiont Decapoda of North, Middle and South America, to which was added a geographically arranged list of troglophile and troglaxene species (pp. 148-150). In the present paper these three sources have been repeatedly referred to; the references given in them as a rule have not been repeated.

Before listing the stygobiont Decapoda in tabular form, an enumeration is provided here of the stygophiles and stygoxenes as far as these are known to me. Included in this

list are the records of such species in the literature, as well as of some unpublished material in the collections of the Muséum d'Histoire Naturelle, Geneva, Switzerland and the Rijksmuseum van Natuurlijke Historie, Leiden. Some of the reports of the occurrence of epigeal species in subterranean habitats are rather casual or published in obscure places; therefore, although efforts have been made to make this list exhaustive, several records may have escaped my attention.

#### List of stygophile and stygoxene Decapod Crustacea

Subordo Natantia Boas, 1880

Penaeidae Rafinesque, 1815

*Penaeus indicus* H. Milne Edwards, 1837. Mangapwani Cave, north of Zanzibar, E. Africa. Holthuis, 1956: 64.

Atyidae De Haan, 1849

*Atya innocous* (Herbst, 1792). Jamaica. Hobbs, Hobbs & Daniel, 1977: 150.

*Atya lanipes* Holthuis, 1963. Jamaica. Hobbs, Hobbs & Daniel, 1977: 150.

*Australatya striolata* (McCulloch & McNeill, 1923). Gloucester Caves, New South Wales, Australia. Bishop, 1967, in Weatherley (ed.), Australian Inland waters and their fauna: 119.

*Caridina brevirostris* Stimpson, 1860. Ryugado Cave, Kochi prefecture, Shikoku Island, Japan. Torii, 1953, Annot. Zool. Japon., 26: 248, 252.

*Caridina ? gladiifera* J. Roux, 1929. Ambovononby Cave near Namoroka, N. W. Madagascar. Holthuis, 1956: 65.

*Caridina japonica* De Man, 1892. Akiyoshido Cave, Yamaguchi prefecture, Honshu, Japan. Torii, 1955, Bull. biogeographical Soc. Japan, 16-19: 423.

*Caridina nilotica* (P. Roux, 1833). Ambovononby Cave near Namoroka, N. W. Madagascar. Holthuis, 1956: 64.

*Caridina novaecaledoniae* J. Roux, 1926. Koumac Cave near Koumac, New Caledonia, 4-5 April 1977, leg. P. Strinati and V. Aellen, 4 specimens; same locality, 4 August 1978, leg. S. B. Peck, 9 specimens (Museum Geneva, Switzerland). Strinati & Aellen, 1983, Mém. Spéléo-Club Paris, 9: 21.

*Caridina sakishimensis* Fujino & Shokita, 1975. Izaga Cave, Miyako Island, Ryukyu Islands. Fujino & Shokita, 1975, Bull. Sci. Engin. Div. Univ. Ryukyus (Mathem. nat. Sci.), 18: 99. — Suirendo Cave, China-cho, Okinoerabu-shima, Amami Group, Ryukyu Islands, Japan. Shokita & Nishijima, 1976, Ecol. Stud. Nature Conserv. Ryukyu Isl., 2: 35.

*Caridina typus* H. Milne Edwards, 1837. Ginnodo Cave, Tokuno-shima; Suirendo Cave, Okinoerabu-shima; cave at Kotohira, Yoron-shima; all three islands in Amami Group, Ryukyu Islands, Japan. Shokita & Nishijima, 1976, Ecol. Stud. Nature Conserv. Ryukyu Islands, 2: 33, 34. — Hakka-do Cave near Nakijin, Okinawa, Ryukyu Islands. Torii, 1944, Annot. zool. Japon., 22 (4): 199. — Adio Cave near

Poya, New Caledonia, 2 April 1977, leg. P. Strinati and V. Aellen, 1 specimen (Museum Geneva, Switzerland). Strinati & Aellen, 1983, Mém Spéleo-Club Paris, 9: 19. — Stream in cave near Maloloei, Upolu, Samoa. Johnson, 1963, Bull. Nat. Mus. Singapore, 32: 27.

*Caridinopsis brevinaris* Holthuis, 1956. Garrigues Cave near Souguéta, French Guinea, West Africa. Holthuis, 1956: 56; Hobbs, Hobbs & Daniel, 1977: 150. Remarks: The species was originally thought to be a stygobiont species. Later investigations showed the differences with the epigeal *Caridinopsis chevalieri* Bouvier, 1912, to be so slight that Rutherford (1975, Crustaceana, 28 (2): 189) decided to synonymize the two species. The species was listed by Hobbs, Hobbs & Daniel (1977: 150) in error as originating from French Guiana (northern South America) instead of from French Guinea (West Africa).

*Neocaridina denticulata* (De Haan, 1844). Akiyoshi-do Cave, Yamaguchi prefecture, Honshu, Japan. Kamita, 1961, Studies on the fresh-water shrimps, prawns and crawfishes of Japan: 44.

*Paratya australiensis* Kemp, 1917. Buchan Caves, Victoria, Australia. Bishop, 1976, in Weatherley (ed.), Australian inland waters and their fauna: 119.

*Paratya curvirostris* (Heller, 1862). Waitomo Cave, South Auckland, New Zealand. Yaldwyn, 1959, Vie et Milieu, 9 (3): 335.

*Xiphocaris elongata* (Guérin, 1855). Rock Springs Cavern, St. Mary Parish, Jamaica, and perhaps other caves in Jamaica; Puerto Rico. Hobbs, Hobbs & Daniel, 1977: 150.

#### Palaemonidae Rafinesque, 1815

##### Euryrhynchinae Holthuis, 1950

*Euryrhynchus burchelli* Calman, 1907. Well near Pará, Brazil. Holthuis, 1956: 68; Hobbs, Hobbs & Daniel, 1977: 150. Only once (in the original description) reported from a well; later found only in surface waters.

*Euryrhynchus wrzesniowski* Miers, 1870. In a well, Cayenne, French Guiana. Holthuis, 1956: 68; Hobbs, Hobbs & Daniel, 1977: 150. Only once (in the original description) reported from a well; later found only in surface waters (acid savannah creeks). The statement in Hobbs, Hobbs & Daniel (1977: 150) that the species was reported from subterranean waters in all three Guianas rests on an error.

##### Palaemoninae Rafinesque, 1815

*Macrobrachium australe* (Guérin, 1838). Blauwe Grot (= Blue Cave), Biak Island, West New Guinea, Irian Jaya, Indonesia. Holthuis, 1956: 66.

*Macrobrachium brasiliense* (Heller, 1862). Ecuador. Hobbs, Hobbs & Daniel, 1977: 150.

*Macrobrachium carcinus* (Linnaeus, 1758). St. Augustine and Silver Springs, Florida, U.S.A. (in pools fed by subterranean water); Chiapas, Mexico; La Cueva Chica, San Luis Potosi, Mexico; Jamaica. Hobbs, Hobbs & Daniel, 1977: 148, 149, 150. — El Convento Cave, Puerto Rico. Nicholas,

1974, Int. Journ. Speleol., 6: 111.

*Macrobrachium clymene* (De Man, 1902). Deer Cave and Snake Cave, Gunong Mulu National Park, northern Sarawak, Borneo. Holthuis, 1979, Zool. Verhand. Leiden, 171: 7.

*Macrobrachium faustinum* (De Saussure, 1857). Pos Caranja, Bonaire, Netherlands Antilles. Holthuis, 1956: 67.

*Macrobrachium formosense* Bate, 1868. In "cave and subterranean waters" of the Ryukyu Islands, Japan. Shokita & Nishijima, 1976, Ecol. Stud. Nature Conserv. Ryukyu Isl., 2: 35.

*Macrobrachium hendersoni* (De Man, 1906). Siju Cave, Assam, India. Holthuis, 1956: 67.

*Macrobrachium heterochirus* (Wiegmann, 1836). Jamaica. Hobbs, Hobbs & Daniel, 1977: 150.

*Macrobrachium japonicum* (De Haan, 1849). Suirendo Cave, Okinoerabu-shima; cave at Kotohira, Yorón-shima; both localities in Amami Group, Ryukyu Islands, Japan. Shokita & Nishijima, 1976, Ecol. Stud. Nature Conserv. Ryukyu Isl., 2: 36. — Hakkado Cave near Nakijin, Okinawa, Ryukyu Islands. Torii, 1944, Annot. Zool. Japon, 22 (4): 199.

*Macrobrachium lamarrei* (H. Milne Edwards, 1837). Saltore colliery, a coal mine about 130 miles from Calcutta, India. Holthuis, 1956: 60.

*Macrobrachium lar* (Fabricius, 1798). Guwã Ningrong Cave, Gunong sewu, Jogjakarta, near south coast of Central Java, Indonesia; "Blauwe Grot" (= Blue Cave), Biak Island, West New Guinea, Irian Jaya, Indonesia. Holthuis, 1956: 66. — Cave near Danuwieriah, 2 km east of Fakfak, West New Guinea, Irian Jaya, Indonesia; in fresh water in total darkness, 15 m under ground, August 1955, F. R. J. Eibrink Jansen, 1 specimen (Museum Leiden). — Marbo Cave, Guam, 17 August 1980, leg. J. A. Maciolek, 3 specimens (Museum Leiden). — Suirendo Cave, Okinoerabu-shima, Amami Group, Ryukyu Islands, Japan. Shokita & Nishijima, 1976, Ecol. Stud. Nature Conserv. Ryukyu Isl., 2: 36.

*Macrobrachium pilimanus* (De Man, 1879). Bua Cave, Sijungjung, W. Sumatra; Caves at Panumbangan, West Java; Guwã Gremeng Cave, Gunong Sewu, near south coast of Central Java, all three localities in Indonesia. Holthuis, 1956: 67. — Deer Cave and Clearwater Cave, Gunong Mulu National Park, northern Sarawak, Borneo. Holthuis, 1979, Zool. Verhand. Leiden, 171: 9.

*Palaemon adspersus* Rathke, 1837. Canal souterrain du Rove near Marseilles, France. Holthuis, 1956: 65, as *P. squilla* (L.).

*Palaemon affinis* H. Milne Edwards, 1837. Intertidal sea cave, Portobello Peninsula, Otago Harbour, New Zealand. Yaldwyn, 1959, Vie et Milieu, 9 (3): 337.

*Palaemon concinnus* Dana, 1852. Blauwe Grot (= Blue Cave), Biak Island, western New Guinea, Irian Jaya, Indonesia. Holthuis, 1956: 65.

*Palaemonetes antennarius* (H. Milne Edwards, 1837). Sub-

terranean water near Bilivir, Dalmatia, Jugoslavia. Holthuis, 1956: 65.

*Palaemonetes paludosus* (Gibbes, 1850). Gopher Sinkhole, Leon Co., Florida, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

Pontoniinae Kingsley, 1878

*Palaemonella burnsi* Holthuis, 1973. Anchialine pools in Maui and Hawaii, Hawaiian Islands. Probably only accidental inhabitant of this habitat (J. A. Maciolek, in litt.). See also in table of stygobionts under no. 65.

Alpheidae Rafinesque, 1815

*Automate dolichognatha* De Man, 1888. Tucker's Town Cave, Bermuda. Hart & Manning, 1981: 453.

Hippolytidae Bate, 1888

*Alope spinifrons* (H. Milne Edwards, 1837). Intertidal sea cave, Portobello Peninsula, Otago Harbour, New Zealand. Yaldwyn, 1959: 336.

Subordo Reptantia Boas, 1880

Cambaridae Hobbs, 1942

*Cambarus* (*C.*) *bartonii* (Fabricius, 1798). Indiana and Kentucky, U.S.A. Wolf, 1934: 104, both under *Cambarus bartonii* (Fabricius) and *Cambarus barbatus* (Le Conte). — Alabama, Georgia, Virginia and West Virginia, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148, 149. — Remarks: Since the publication of Wolf's Animalium Cavernarum Catalogus (1934-1938) the classification of the Cambaridae has undergone very important changes: the status of the genera, as well as that of many species and subspecies has been completely revised and numerous new species added. Therefore the records listed by Wolf should be used with the utmost care. Wolf's listing of "*Cambarus barbatus*" [= *Procambarus* (*Leconticambarus*) *barbatus* (Faxon, 1890)] among the subterranean species rests on an error. Wolf misread his source (Harris, 1872, Kansas University Sci. Bull., 2 (3): 72); the cited records were mentioned by Harris under *Cambarus bartonii*, not under *C. barbatus*, which was dealt with by Harris on the same page.

*Cambarus* (*C.*) sp. Virginia, U.S.A. Hobbs, Hobbs & Daniel, 1977: 149.

*Cambarus* (*Depressicambarus*) *latimanus* (Le Conte, 1856). Georgia, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Cambarus* (*Depressicambarus*) *striatus* Hay, 1902. Alabama and Georgia, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Cambarus* (*Erebicambarus*) *laevis* Faxon, 1914. Indiana and Kentucky, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Cambarus* (*Erebicambarus*) *ornatus* Rhoades, 1944. Kentucky, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Cambarus* (*Erebicambarus*) *tenebrosus* Hay, 1902. Alabama, Kentucky and Tennessee, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148, 149. — Indiana, Kentucky and Tennessee, U.S.A. Wolf, 1934: 104 (based on Fage, 1931, Arch. Zool. expér. gén., 71 (3): 373).

*Cambarus* (*Jugicambarus*) *dubius* Faxon, 1884. Virginia, U.S.A. Hobbs, Hobbs & Daniel, 1977: 149.

*Cambarus* (*Puncticambarus*) *robustus* Girard, 1852. New York, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Orconectes immunis* (Hagen, 1870). Indiana, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Orconectes luteus* (Creaser, 1933). Missouri, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Orconectes meeki brevis* Williams, 1952. Arkansas and Oklahoma, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Orconectes n. neglectus* (Faxon, 1885). Missouri and Oklahoma, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Orconectes palmeri longimanus* (Faxon, 1898). Oklahoma and Texas, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148, 149.

*Orconectes propinquus* (Girard, 1852). Indiana, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Orconectes punctimanus* (Creaser, 1933). Missouri, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Orconectes virilis* (Hagen, 1870). Alabama, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148. — Missouri, U.S.A. Wolf, 1934: 105; based on Garman, 1889, Bull. Mus. comp. Zool. Harvard Coll., 17 (6): 232.

*Procambarus* (*Austrocambarus*) *cubensis rivalis* (Faxon, 1912). Hoyo de Fañía, in Gran Caverna de Santo Tomás, Pinar del Río Province, Cuba. Holthuis, 1977, Résult. Expéd. biospéol. Cubano-Roumaines Cuba, 2: 274.

*Procambarus* (*Austrocambarus*) *mirandai* Villalobos, 1954. Chiapas, Mexico. Hobbs, Hobbs & Daniel, 1977: 149.

*Procambarus* (*Austrocambarus*) *sbordonii* Hobbs, 1977. Cueva del Nacimiento de Río S. Domingo near Bochil, Chiapas, Mexico. Hobbs, 1977, Quaderni Problemi attuali Sci. Cultura Accad. Naz. Lincei, 171 (3): 201.

*Procambarus* (*Girardiella*) *s. simulans* (Faxon, 1884). Oklahoma and Texas, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148, 149.

*Procambarus* (*Ortmannicus*) *a. acutus* (Girard, 1952). Texas, U.S.A. Hobbs, Hobbs & Daniel, 1977: 149.

*Procambarus* (*Ortmannicus*) *acutus cuevachicae* (Hobbs, 1941). San Luis Potosi, Mexico. Hobbs, Hobbs & Daniel, 1977: 149.

*Procambarus* (*Ortmannicus*) *fallax* (Hagen, 1870). Florida, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Procambarus* (*Ortmannicus*) *tolteca* (Hobbs, 1943). Hidalgo, San Luis Potosi and Tamaulipas, Mexico. Hobbs, Hobbs & Daniel, 1977: 149.

*Procambarus* (*Ortmannicus*) *villalobosi* Hobbs, 1969. San Luis Potosi, Mexico. Hobbs, Hobbs & Daniel, 1977: 149.

*Procambarus* (*Scapulicambarus*) *clarkii* (Girard, 1852). Texas, U.S.A. Hobbs, Hobbs & Daniel, 1977: 149.

*Procambarus* (*Scapulicambarus*) *paeninsulanus* (Faxon, 1914). Florida, U.S.A. Hobbs, Hobbs & Daniel, 1977: 148.

*Procambarus* (*Villalobosus*) *xochitlanae* Hobbs, 1975. Puebla, Mexico. Hobbs, Hobbs & Daniel, 1977: 149; Hobbs, 1982,

Bull. Assoc. Mexican Cave Stud., 8 (= Bull. Texas Mem. Mus., 28): 44.

*Procambarus (Villalobosus) cuetzalanae* Hobbs, 1982. Four subterranean localities near Cuetzalan, Puebla, Mexico. Hobbs, 1982, Bull. Assoc. Mexican Cave Stud., 8 (= Bull. Texas Mem. Mus., 28): 39.

#### Astacidae Latreille, 1802

*Astacus astacus* (Linnaeus, 1758). Škocjanska Jama (= Caverne di S. Canziano, = Höhle von Sankt Kanzian, = Reka Höhle) near Divača, Slovenia, Yugoslavia. Spandl, 1926, Speläol. Monogr., 11: 95 (as *Astacus (Potamobius) fluviatilis*); Chappuis, 1927, Binnengewässer, 3: 90 (as *Potamobius astacus*); Boldori, 1932, Grotte d'Italia, 6: 122 (as *Astacus fluviatilis*); Stammer, 1932, Zool. Jahrb. Syst., 63 (5/6): 608 (as *Astacus fluviatilis*); Wolf, 1934: 104 (as *Astacus fluviatilis*); Holthuis, 1964, Crustaceana, 7 (1): 44. — Pivka Jama (= Abisso della Piuca, = Pivka Höhle) being a part of the complex of the Postojnska Jama (= Grotte du Postumia, = Adelsberger Grotte), Slovenia, Yugoslavia. Schiner, 1854, in: A. Schmidl, Die Grotten und Höhlen von Adelsberg: 305 (as *Astacus fluviatilis*); Kraus, 1886, Mitt. Höhlenkunde Oesterreichischen Touring-Club: 15 (as *Astacus fluviatilis*); Wolf, 1934: 104 (as *Astacus fluviatilis*). — Paroș Cave near Paroș-Peștera, Hunedoara department, Rumania. Chappuis, 1927, Binnengewässer, 3: 90 (as *Potamobius astacus*). The identity of the specimens on which the records of the above cited three localities are based, is rather doubtful; it is possible that the authors reporting on their specimens used the names *Astacus fluviatilis* or *Potamobius astacus* rather loosely and did not try to distinguish them from the other European species of Astacidae. According to Müller (1926, in Bertarelli & Boegan, Duemila Grotte: 68) the only species of crayfish found in the Škocjanska Jama near Divača is "*Astacus saxatilis*" (= *Austropotamobius torrentium*, see below), this in fact being the only species in the "Timavo Superiore" (= upper Reka River). In recent years it is *Austropotamobius torrentium* and not *Astacus astacus* that has been reported from the Postojna cave complex (see below), while the former of these two species also is the only one reported from Rumanian caves by Băcescu (1967, Fauna Republicii Soc. România, Crust., 4 (9): 212), including the cave near Paroș-Peștera. It would therefore be not surprising if all above records of *Astacus astacus* actually pertain to the next species.

*Austropotamobius torrentium* (Schränk, 1803). Škocjanska Jama (= Caverna di S. Canziano, = Höhle von Sankt Kanzian, = Reka Höhle) near Divača, Slovenia, Yugoslavia. Müller, 1926, in Bertarelli & Boegan, Duemila Grotte: 68 (as *Astacus saxatilis*); Holthuis, 1964, Crustaceana, 7 (1): 44. — Tkalca Jama (= Škocjanska Jama) near Rakek, about 5 km ENE of Postojna, in subterranean Rak River, Slovenia, Yugoslavia (not to be confused with the Škocjanska Jama near Divača). Bott, 1972, Rev. Suisse Zool., 79 (1): 393 (as *Austropotamobius (A.) torrentius macedonicus* (Karaman)). —

Peștera Ponorului, regio Pui, department Hunedoara; caves in the regio Hațeg (Mălăești, Paroș-Peștera, Bretea Streiului, Valea Purcărești), department Hunedoara; Peștera Moanei, regio Luncavita, department Banat; the subterranean river Lunca Federului; all in Romania. Băcescu, 1967, Fauna Republ. Soc. România, Crust., 4 (9): 212, 214, 215. Remarks: It is possible that the subterranean records of *Astacus astacus* (L.) are actually based on specimens of the present species (see above under *A. astacus*). Dr. M. Băcescu (in litt., 30 March 1982) confirmed that *Austropotamobius torrentium* is the only Decapod crustacean found in subterranean waters in Romania and that it can be found in the entire carstic region of the departments of Banat, northern Oltenia and in the Apuseni Mountains.

The old records of a blind crayfish from the Škocjanska Jama near Divača are almost certainly based on a mislabeled specimen of the North American Cambarid *Orconectes pellucidus* (Tellkampf), a true troglobiont (see Holthuis, 1964, Crustaceana, 7 (1): 42-46).

#### Parastacidae Huxley, 1879

*Paranephrops planifrons* White, 1842. Waitomo Cave, South Auckland, New Zealand. Yaldwyn, 1959, Vie et Milieu, 9 (3): 336.

#### Palinuridae Latreille, 1802

*Jasus edwardsii* (Hutton, 1875). Intertidal sea cave, Portobello Peninsula, Otago Harbour, New Zealand. Yaldwyn, 1959, Vie et Milieu, 9 (3): 337 (as *Jasus lalandei* (H. Milne Edwards, 1837)).

#### Infraorder Anomura MacLeay, 1838

##### Aeglidae Dana, 1852

*Aegla strinati* Türkay, 1972. Gruta da Tapagem, São Paulo, Brazil. Türkay, 1972, Rev. Suisse Zool., 79 (1): 417; Hobbs & Daniel, 1977: 150.

##### Coenobitidae Dana, 1851

*Birgus latro* (Linnaeus, 1758). Cave near Banadel, and Asteo Cave near Kalabera, both localities in Saipan. Torii, 1944, Annot. Zool. Japon., 22 (4): 192.

##### Infraorder Brachyura Leach, 1815

##### Potamidae Ortmann, 1896

*Geothelphusa dehaanii* (White, 1847). Ryugado Cave, Kochi Prefecture, Shikoku, Japan. Torii, 1953, Annot. Zool. Japon., 26 (4): 250, 252, fig. 5. — Akiyoshido Cave, Yamaguchi Prefecture, Honshu, Japan. Torii, 1955, Bull. biogeogr. Soc. Japan, 16-19: 423.

*Potamon fluviatile algeriense* Bott, 1967. Subterranean water in the Algerian Sahara. Spandl, 1926, Speläol. Monogr., 11: 97 (as *Potamon edule* (Latreille)).

##### Isolapotamidae Bott, 1968.

*Isolapotamon collinsi* Holthuis, 1979. Sinkhole of Clearwater River, Gunong Mulu National Park, northern Sarawak, Borneo. Holthuis, 1979, Zool. Verhand. Leiden, 171: 21.

## Potamonautidae Bott, 1970

*Liberonautes latidactylus* (De Man, 1903). Souguéta Cave, French Guinea, West Africa. Bott, 1959, Bull. Inst. Français Afrique Noire, 21 (A3): 1008.

*Potamonautes (Isopotamonautes) anchietae* (de Brito Capello, 1871). Cave near Thysville (= Mbanza-Ngungu), Zaire. Bott, 1951, Rev. Zool. Bot. Africaines, 44 (3): 233-235 (as *Potamonautes biballensis* Rathbun, 1905).

## Gecarcinucidae Rathbun, 1904

*Barytelphusa falcidigitis* (Alcock, 1910). Siju Cave, Garo Hills, Assam, India. Kemp, 1924, Rec. Indian Mus., 26 (1): 41; Wolf, 1934: 106.

*Thelphusula ? kadamiana* (Borradaile, 1900). Pitfall trap, Gua Kelawar (= Bat Cave) near Long Pala, Gunong Mulu National Park, northern Sarawak, Borneo, 10 February 1981, leg. P. Chapman, 1 specimen (Mus. Leiden).

## Sundathelphusidae Bott, 1969

*Perithelphusa ? borneensis* (Von Martens, 1868). Jambusan Cave, Gunong Jambusan near Bau, southern Sarawak, Borneo; main stream-way, mud-floored with some guano; dark zone, 22 November 1980, leg. P. Chapman, 2 specimens (Mus. Leiden).

*Sundathelphusa tenebrosa* Holthuis, 1979. Deer Cave, Deer Water Cave, and Clearwater Cave, Gunong Mulu National Park, northern Sarawak, Borneo. Holthuis, 1979, Zool. Verhand. Leiden, 171: 39. — Water Polo Cave, Gunong Api, Gunong Mulu National Park, northern Sarawak, Borneo; static canal with muddy bottom and mud banks, 18 December 1980, leg. P. Chapman, 1 specimen (Mus. Leiden).

## Parathelphusidae Colosi, 1920

*Parathelphusa convexa* De Man, 1879. Guwã (= Cave) Djumblang, Gunong Sewu, near south coast of Central Java, Indonesia. Ihle, 1912, Notes Leyden Mus., 34: 177.

## Pseudothelphusidae Ortmann, 1893

*Epilobocera a. armata* Smith, 1870. Cueva de Machoon, E. of Cienfuegos, Las Villas province, Cuba. Hobbs, Hobbs & Daniel, 1977: 150.

*Epilobocera cubensis* Stimpson, 1860. Caves near Ashton and Modesta, Pinar del Río province, W. Cuba. Eigenmann, 1909, Publ. Carnegie Inst. Washington, 104: 203 ("in many of the caves" in Cuba); Hay, 1903, Proc. U. S. Nat. Mus., 26 (1316): 435, studied Eigenmann's material and reported the species from Ashton and Modesta; Wolf, 1934: 105.

*Epilobocera gertraudae* Pretzmann, 1965. Mouth of Los Baños Cave, 4 miles N. of Viñales, Pinar del Río province, western Cuba. Hobbs, Hobbs & Daniel, 1977: 150 (as from Las Villas province).

*Epilobocera sinuatifrons* (A. Milne Edwards, 1866). Aguas Buenas Caves, Puerto Rico. Hobbs, Hobbs & Daniel, 1977: 150. — El Convento Cave system, S. W. Puerto Rico. Nichollas, 1974, Int. Journ. Speleol., 6: 111.

*Eudaniela garmani* (Rathbun, 1898). Grotte de Goering, Monagas State, Venezuela. Rodriguez, 1982, Faune tropicale, 22: 154, 156.

*Isabellagordonia (I.) longipes* Pretzmann, 1972. Cave at Lanquin, Guatemala. Hobbs, Hobbs & Daniel, 1977: 149.

*Isabellagordonia (Phrygiopilus) acanthophallus* (Smalley, 1970). Seamay Cave, Alta Verapaz, Guatemala. Hobbs, Hobbs & Daniel, 1977: 149.

*Potamocarcinus (Megathelphusa) m. magnus* (Rathbun, 1895). Pozo Azul, Costa Rica. Hobbs, Hobbs & Daniel, 1977: 149.

*Pseudothelphusa (P.) sonorae* Rodriguez & Smalley, 1972. Mine tunnel at La Aduana near Alamos, Sonora, Mexico. Hobbs, Hobbs & Daniel, 1977: 149.

*Pseudothelphusa (Tehuana) cordobensis* Rodriguez & Smalley, 1972. Cueva de Ojo de Agua Grande near Cordoba, Vera Cruz, Mexico. Hobbs, Hobbs & Daniel, 1977: 149.

## Gecarcinidae Macleay, 1838

*Cardisoma guanhumi* Latreille, 1825. La Habana, Las Villas and Oriente provinces, Cuba; Jamaica; Puerto Rico. Hobbs, Hobbs & Daniel, 1977: 149, 150.

*Gecarcinus lateralis* (de Fréminville, 1835). Oriente province, Cuba. Hobbs, Hobbs & Daniel, 1977: 150.

*Gecarcinus ruricola* (Linnaeus, 1758). Las Villas and Oriente provinces, Cuba; Jamaica. Hobbs, Hobbs & Daniel, 1977: 150.

## Grapsidae Macleay, 1838

*Eriocheir japonica* (De Haan, 1835). Ryugado Cave, Kochi prefecture, Shikoku, Japan. Torii, 1953, Annot. Zool. Japon., 26 (4): 252.

*Sesarma bidentatum* Benedict, 1892. Jamaica. Hobbs, Hobbs & Daniel, 1977: 150.

*Sesarma miersii* Rathbun, 1897. Jamaica. Hobbs, Hobbs & Daniel, 1977: 150.

*Sesarma roberti* H. Milne Edwards, 1853. Guatemala. Hobbs, Hobbs & Daniel, 1977: 149.

*Sesarma* sp. Oriente province, Cuba. Hobbs, Hobbs & Daniel, 1977: 150.

## Majidae Samouelle, 1819

*Paramithrax* (?) sp. Intertidal sea cave, Portobello Peninsula, Otago Harbour, New Zealand. Yaldwyn, 1959, Vie et Milieu, 9 (3): 337.

In the tabular part of this chapter the known stygobiont Decapod Crustacea are listed. The species and subspecies are numbered consecutively; the numbers are placed in column 1. The second column contains the names of the taxa, in hierarchical order down to the families, in alphabetical order within the families, genera, and species. The geographical localities where the species or subspecies have been found are listed in column 3, while column 4 contains ecological details; the numbers and letters used in these two columns are explained in the annexes at the end of this volume.

The Notes provided after the tabular part refer by num-

ber to the species and subspecies enumerated in this part. In most cases these notes refer to recent publications dealing with the species or subspecies.

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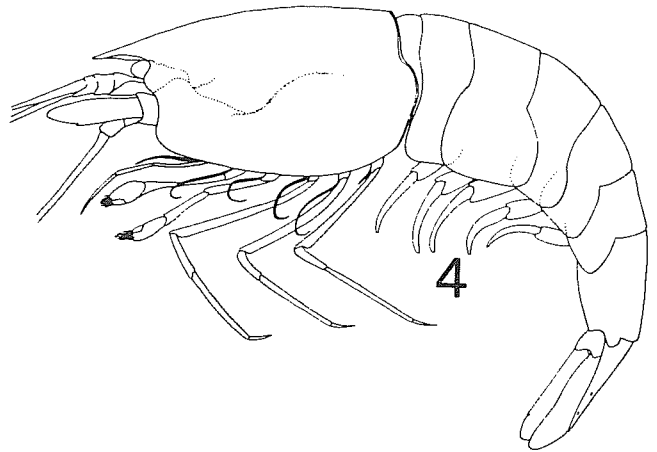
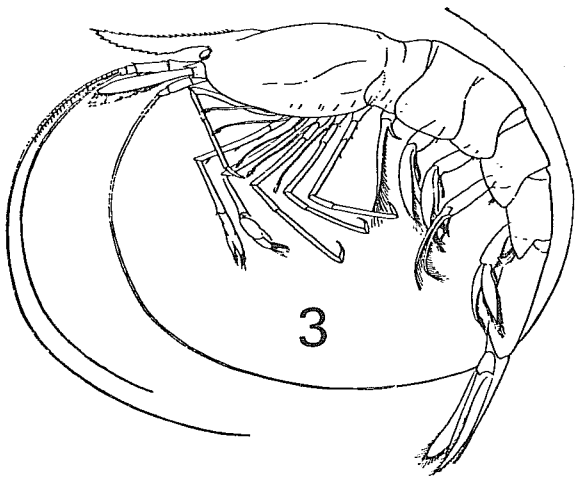
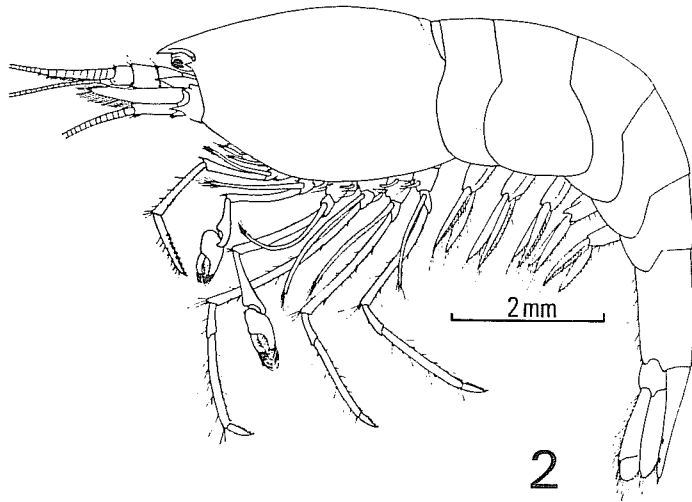
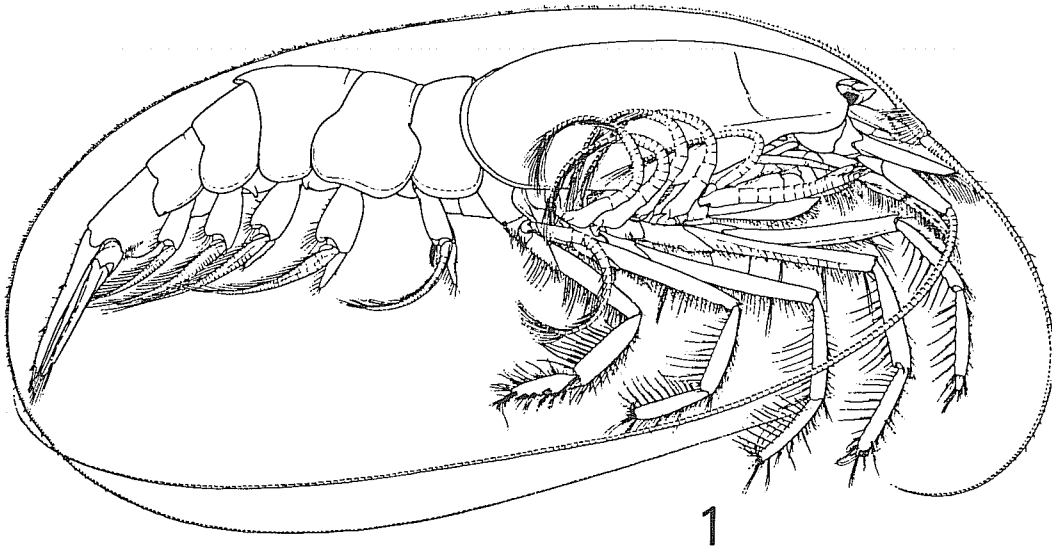
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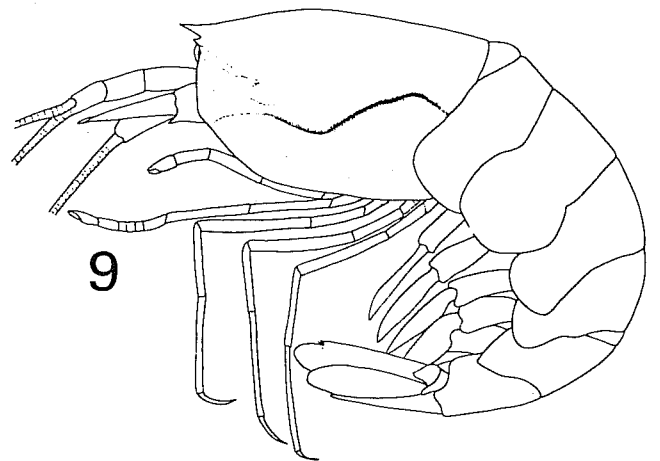
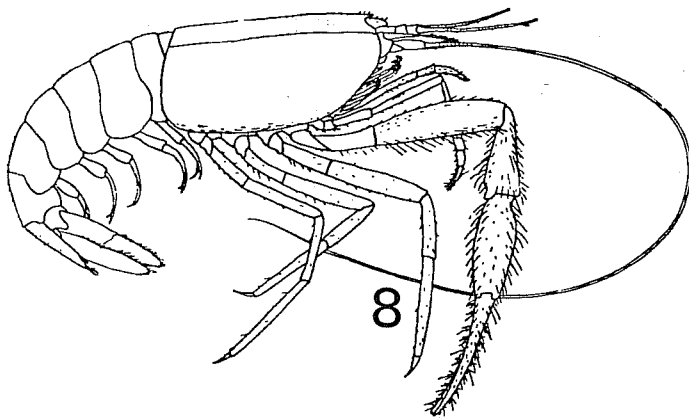
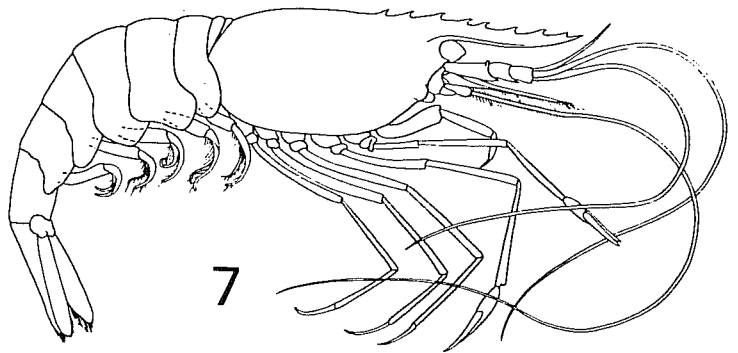
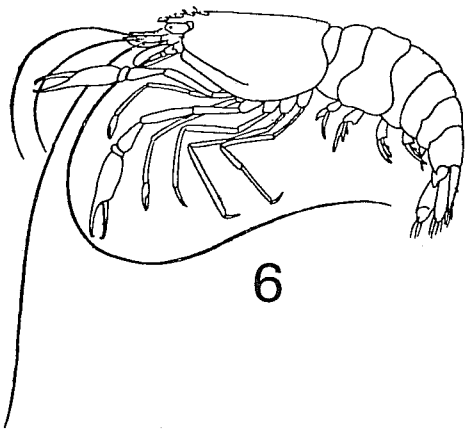
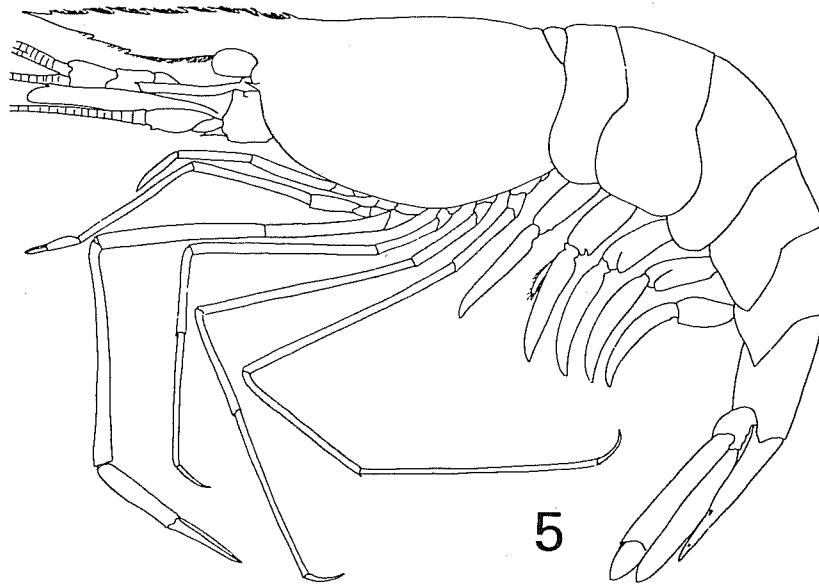


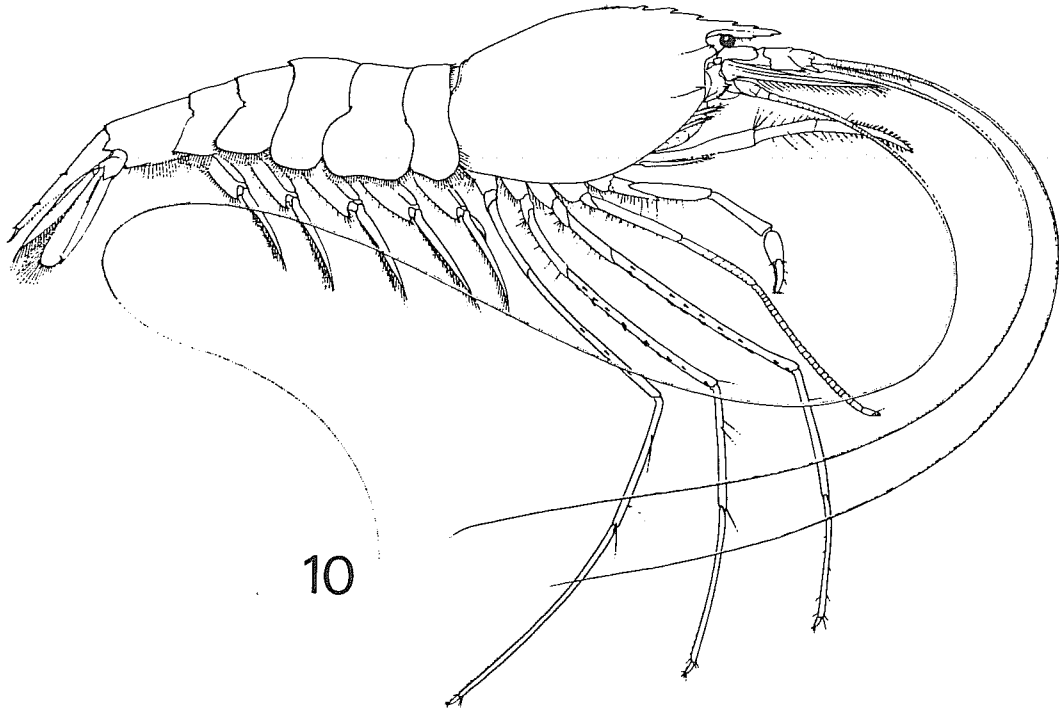
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## FIGURES

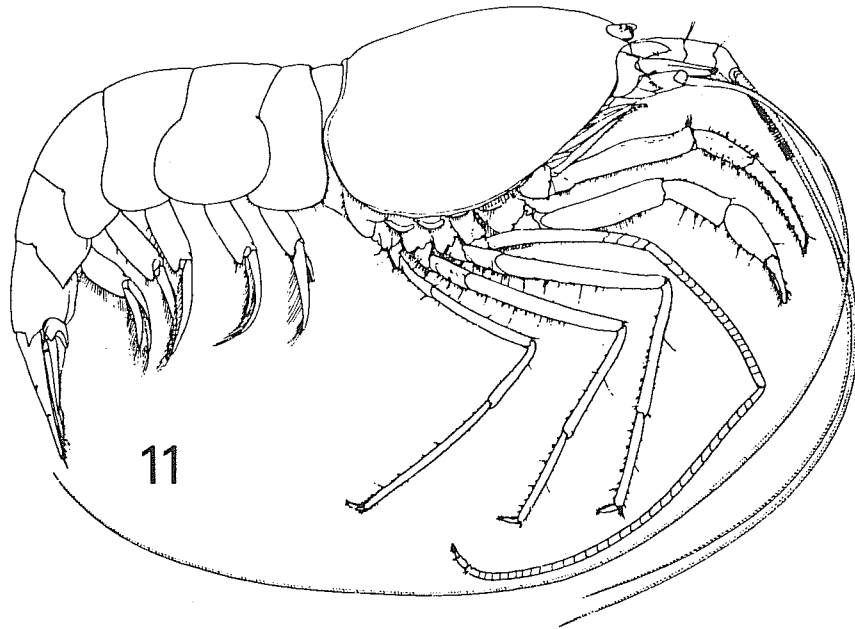
1: *Procaris ascensionis* (after Chace & Manning, 1972); 2: *Antecaridina lauensis* (after Suzuki, 1980); 3: *Troglocaris a. anophthalmus* (after Stammer, 1932, *Zool. Jb. Syst.*, 63 (5/6): 606); 4: *Typhlatya pearsei* (after Hobbs, Hobbs & Daniel, 1977); 5: *Macrobrachium villalobosi* (after Hobbs, Hobbs & Daniel, 1977); 6: *Troglicaridius phreaticus* (after Sankolli & Shenoy, 1979); 7: *Troglocubanus eigenmanni* (after Hobbs, Hobbs & Daniel, 1977); 8: *Typhlocaris galilea* (after Calman, 1909, *Trans. Linnean Soc. London, Zool.* (2) 11 (5): pl. 19); 9: *Potamalpheops stygicola* (after Hobbs, Hobbs & Daniel, 1977); 10: *Barbouria cubensis* (after Hobbs, Hobbs & Daniel, 1977); 11: *Calliasmata rimolii* (after Hobbs, Hobbs & Daniel, 1977); 12: *Somersiella sterreri* (after Hart & Manning, 1981); 13: *Orconectes inermis testii* (after Hay, 1893, *Proc. U. S. Nat. Mus.*, 16: pl. 44); 14: *Munidopsis polymorpha* (after Calman, 1904, *Ann. Mag. nat. Hist.*, (7) 14: 216); 15: *Cerberusa coeca* (after Holthuis, 1979); 16: *Rouxana phreatica* (after Holthuis, 1982); 17: *Typhlopseudothelphusa mocinoi* (after Hobbs, Hobbs & Daniel, 1977); 18: *Sesarmoides verleyi* (after Hobbs, Hobbs & Daniel, 1977).



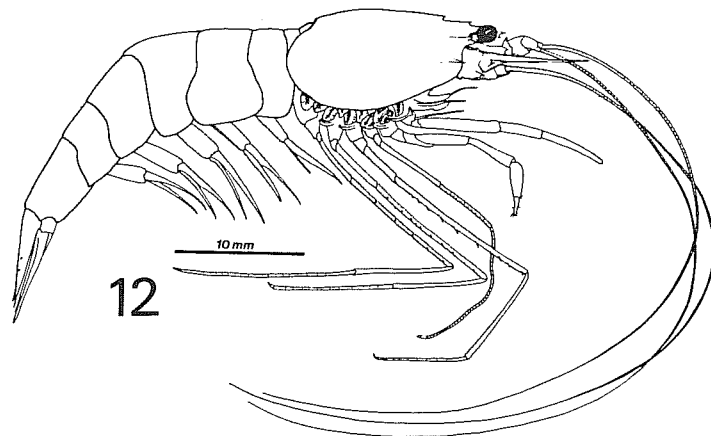




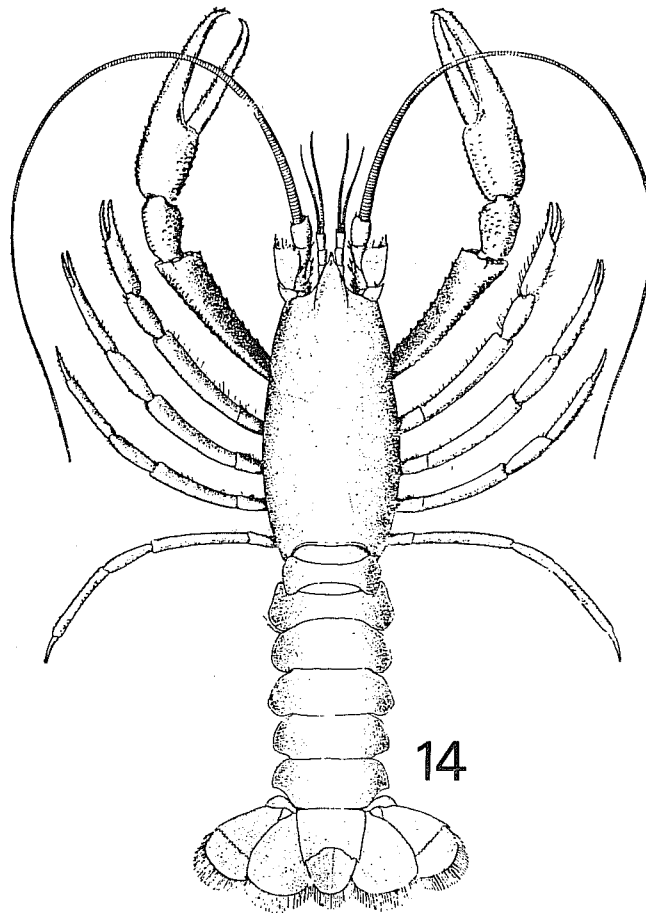
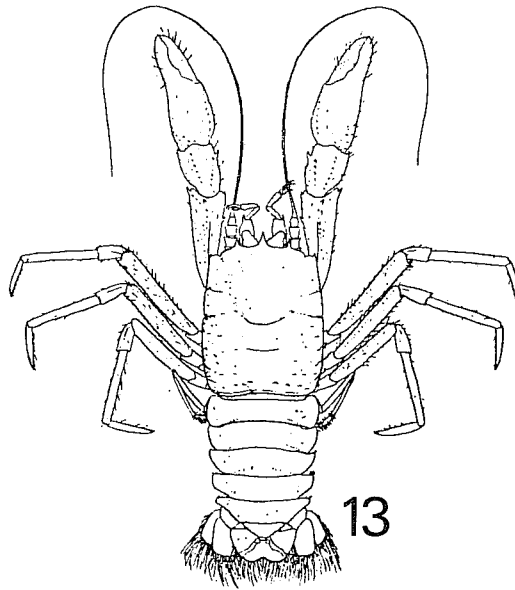
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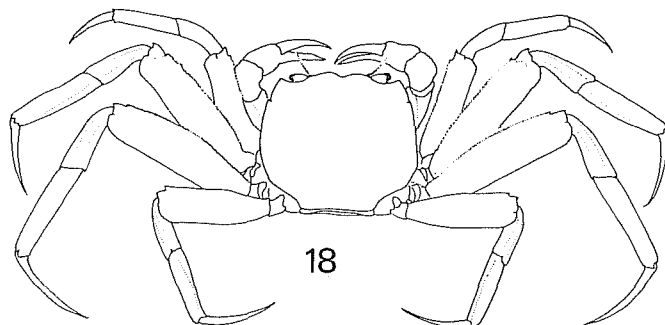
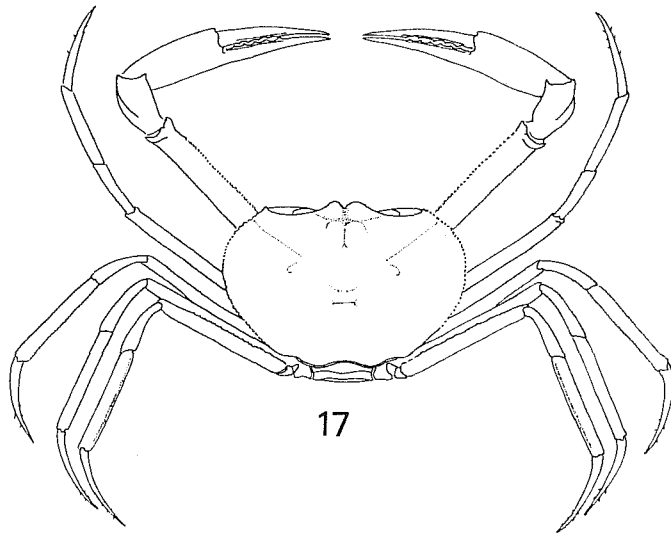
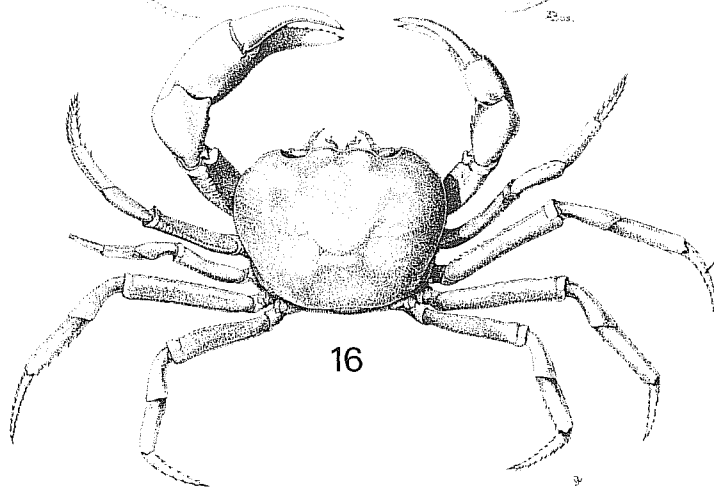
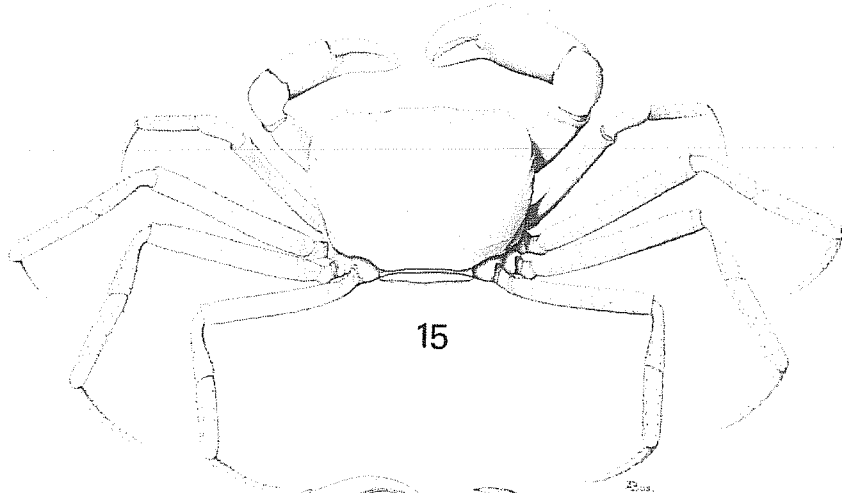


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	Ordo Decapoda Latreille, 1802		
	Subordo Natantia Boas, 1880		
	Infraordo Caridea Dana, 1852		
	Superfamilia Procaridoidea Chace & Manning, 1972		
	Procarididae Chace & Manning, 1972		
	<b>Procaris</b> Chace & Manning, 1972		
1	ascensionis Chace & Manning, 1972	III 6: Ascension Island, South Atlantic.	H. Anchialine lava pools
2	hawaiiana Holthuis, 1973	VI 5: Maui and Hawaii, Hawaiian Islands.	H. Anchialine lava pools
	Superfamilia Oplophoroidea Dana, 1852		
	Atyidae De Haan, 1849		
	<b>Antecaridina</b> Edmondson, 1954		
3	lauensis (Edmondson, 1935)	III 5: Kuroshima, Yaeyama Group, Ryukyu Islands; Minami-daito, Daito Islands. IV 7: Entedebir, Dahlak Ids., Red Sea; Europa Island. VI 5: Uipi, New Georgia, Solomon Ids.; Lau Ids., Fiji Archipelago; Maui and Hawaii, Hawaiian Islands.	G. Pools in coral limestone
	<b>Caridina</b> H. Milne Edwards, 1837		
4	japonica De Man, 1892 ssp. shikokuensis Kubo, 1938	III 5: Ryugado Cave, Kochi prefecture, Shikoku, Japan.	C. Subter- ranean stream
5	lanzana Holthuis, 1980	IV 2: Bog Der well, Nogal Valley, northern Somalia.	K. Well in desert area
6	lovoensis Roth-Woltereck, 1955	IV 3: caves of Lovo 20 km from Thysville (= Mbanza-Ngungu), Zaire.	A. "Kalk- höhlen"
7	rubella Fujino & Shokita, 1975	III 5: Izaga cave, Morikaga cave, and well at Nikadori (Hirara City); all three localities on Miyako Id., Ryukyu Ids.	A, $\alpha$ . "caves or wells, which are saline"

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8	troglydites Holthuis, 1978	VI 5: Danmin Cave near Konogusgus, New Ireland.	C. "subterranean stagnant pool" near subterranean river
	<b>Edoneus</b> Holthuis, 1978		
9	atheatus Holthuis, 1978	V 4: cave near Santiago, Maddela area, Isabela province, Luzon, Philippines.	A. "Cave"
	<b>Halocaridina</b> Holthuis, 1963		
10	rubra Holthuis, 1963	VI 5: Oahu, Molokai, Maui, and Hawaii, Hawaiian Islands.	H. Anchialine lava pools
	<b>Halocaridinides</b> Fujino & Shokita, 1975		
11	trigonophthalma (Fujino & Shokita, 1975)	III 5: Kaneshi and Aja, Okinawa Island. VI 5: Angaur Island, Palau, W. Caroline Islands.	G. In deep wells and in a large anchialine pond (former phosphate mine)
	<b>Palaemonias</b> Hay, 1901		
12	alabamae Smalley, 1961	VIII 3: Shelta Cave and Bobcat Cave, near Huntsville, Madison Co., Alabama, U.S.A.	D. Standing pools or permanent lake
13	ganteri Hay, 1901	VIII 3: Mammoth Cave, and Crystal Cave, Kentucky, U.S.A.	D. Standing pools or permanent lake
	<b>Parisia</b> Holthuis, 1956		
14	edentata Holthuis, 1956	IV 5: near Bekopaka, Majunga province, W. Madagascar.	I. "Dark deep well in a limestone region"
15	fowleri Gordon, 1968	IV 7: Kufile, Zanzibar Id., Tanzania.	D. "Subterranean lake"
16	gracilis Williams, 1964	VI 3b: Brennon's Brook in caves 16 miles S of Katherine, Northern Territory, Australia.	C. Small freshwater stream in limestone cave
17	macrophthalma Holthuis, 1956	IV 5: Grotte des Fanihy, N. of Ambilobé, N. W. Madagascar.	C? D? Freshwater pool in cave, in total darkness
18	microphthalma (Fage, 1946)	IV 5: Grotte des Fanihy, N. of Ambilobé, N. W. Madagascar.	C. subterranean rivulet and pool in total darkness



19	unguis Williams, 1964	VI 3b: Brennon's Brook in caves 16 miles S. of Katherine, Northern Territory, Australia.	C. In small freshwater stream in limestone
	<b>Spelaecaris</b> Matjašič, 1956		
20	pretneri Matjašič, 1956	I 7d: Cave near Trebišnjica spring near Bileća, S. E. Hercegovina, Yugoslavia. I 7f: Obodska pećina near Rijeka Crnojevića, not far from Lake Scutari (= Skadarsko jezero), Montenegro, Yugoslavia.	α. In "unterirdischen Gewässern", in "Höhlen"
	<b>Stygiocaris</b> Holthuis, 1960		
21	lancifera Holthuis, 1960	VI 3a: Yardie Creek Station, North-West Cape Peninsula, Western Australia.	I. In wells in coral limestone
22	stylifera Holthuis, 1960	VI 3a: Yardie Creek Station, North-West Cape Peninsula, Western Australia.	I. In wells in coral limestone
	<b>Troglocaris</b> Dormitzer, 1853		
23	anophthalmus anophthalmus (Kollar, 1848)	I 5a: Monfalcone (Venezia Giulia) and Trieste, Italy. I 7a: Gorica, St. Peter, Postojna, Planina, Struge, Kumpolje, Ljubljana, Krka and Kočevje, all in Slovenia, Yugoslavia. I 7b: Pulj, Cotticina, and Matteredia, Istria. ? I 7d: Zavala and Popovo Polje, Hercegovina.	C. Subterranean streams and pools left by such streams
24	anophthalmus intermedia Babić, 1922	I 7c: Mikašinić's cave near Ogulin, Croatia, Yugoslavia. ? I 7d: Vjetrenica cave near Zavala, and Popovo Polje, both localities Hercegovina, Yugoslavia (these originally reported as T. a. anophthalmus).	A. Water with sandy bottom
25	anophthalmus planinensis Birstein, 1948	I 7a: Cave near Planina, Slovenia.	A.
26	hercegovinensis (Babić, 1922)	I 7d: Vjetrenica cave near Zavala; Babja pećina cave 1.5 km from Zavala at Popovo Polje; Trebišnjica near Bileća; all three localities in S. Hercegovina. I 7f: Obodska pećina near Rijeka Crnojevića, Crna gora (= Montenegro), near Lake Scutari (= Skadarsko jezero).	A.
27	inermis Fage, 1937	II 3: Grotte de Cambous, near St. Hippolyte-du-Fort, dépt. Gard; Grotte des Cent Fonts near Causse-de-la-Selle, dépt. Hérault; unconfirmed reports from Aven de la Baraque and Grotte du Lirou near Les Matelles, dépt. Hérault; all S. France.	C. Pools left by subterranean rivers
28	kutaissiana kutaissiana (Sadovsky, 1930)	I 10: Rion cave near Kutais, and cave near the shore of Zchal-Ziteli River near Kutais, Georgia, U.S.S.R.	A.
29	kutaissiana ablaskiri Birstein, 1939	I 10: Achkhshe-tyzgua cave and a nameless cave near Atap, Abkhazia, western Transcaucasia, Georgia, U.S.S.R.	C. Subterranean river
30	kutaissiana fagei Birstein, 1939	I 10: Near Psyrztkha, Abkhazia, western Transcaucasia, Georgia, U.S.S.R.	D. Subterranean freshwater lake
31	kutaissiana jusbashjani Birstein, 1948	I 10: Mazesta, western Transcaucasia, Georgia, U.S.S.R.	α

32	kutaissiana osterloffii Jusbaschjan, 1940	I 10: cave at Lower Shakuran near Zebelda, Suchumi district, Abkhazia, western Transcaucasia, Georgia, U.S.S.R.	A. In cave
	<b>Typhlatya</b> Creaser, 1936		
33	campecheae Hobbs & Hobbs, 1976	VII 2: Grutas de Xtacumbilxunam, Bolonchenticul, Campeche, Mexico.	B. In small pool in cave
34	consobrina Botosaneanu & Holthuis, 1970	VII 10: Cueva del Agua, Sierra de Cubitas, Camagüey province, Cuba. Cueva del Agua, Guanahacabibes peninsula, Pinar del Río province, Cuba.	D. In subterranean lakes
35	galapagensis Monod & Cals, 1970	IX 5: Santa Cruz Island (4 localities near the south and south-east coast) and Santa Isabela Island (1 locality near south-east coast), Galapagos Islands.	H? Brackish or slightly brackish water, subterranean or in deep lava cracks
36	garciai Chace, 1942	VII 10: Potrero del Molino cave, Las Cuatrocientas Rosas, Banes, Oriente province, Cuba, and Cueva de las Represas, Gran Caverna de Santo Tomás, Pinar del Río province, Cuba. VII 12: 1.2 km N. of Blue Hills airstrip, Providenciales, Caicos Islands.	D, C. In subterranean freshwater lakes or in pools formed by cave river
37	iliffei Hart & Manning, 1981	VIII 10: Tucker's Town Cave, Bermuda.	G. "anchialine habitat"
38	mittchelli Hobbs & Hobbs, 1976	VII 2: 11 cenotes in the north-eastern and north-western parts of the state of Yucatan, Mexico.	E. Cenotes
39	monae Chace, 1954	VII 5: Dark Cave, Barbuda. VII 7: Isla Mona near Puerto Rico; Shelter Cave and Cueva Murciélagos, in Guanica Forest, on south coast of Puerto Rico. VII 8: La Furnia de los Corrales, Villas del Mar, Dominican Republic.	D, K, or I. Well; phreatic pools in caves
40	pearsei Creaser, 1936	VII 2: thirteen localities in the state of Yucatán, Mexico (see Hobbs, Hobbs & Daniel, 1977: 43). And Cueva Coop near Pamul, Territorio de Quintana Roo, Yucatan Peninsula, Mexico.	A, E
41	rogersi Chace & Manning, 1972	III 6: Shelly Beach, Ascension Island, Atlantic Ocean.	H. Anchialine habitats ("Marl Pool" and "Coral Pool") in lava flow
	<b>Typhlopatsa</b> Holthuis, 1956		
42	pauliani Holthuis, 1956	IV 5: Mitoho Cave, N. E. corner of Tsimanampetsotsa Lake, Mahafaly province, S. W. Madagascar.	D. "Large subterranean freshwater pool"
	Superfamilia Palaemonoidea Rafinesque, 1815		

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	Palaemonidae Rafinesque, 1815		
	Palaemoninae Rafinesque, 1815		
	<b>Bithynops</b> Holthuis, 1973		
43	luscus Holthuis, 1973	VII 1: Grutas del Arco, La Trinitaria, Chiapas, Mexico.	C. Shallow cave stream
44	perspicax Holthuis, 1977	VII 1: Cenote La Cueva, Lagunas de Montebello, La Trinitaria, Chiapas, Mexico.	E. Cenote
	<b>Creaseria</b> Holthuis, 1950		
45	morleyi (Creaser, 1936)	VII 2: throughout northern Yucatán state, Mexico (19 localities listed by Hobbs, Hobbs & Daniel, 1977:49,50), and Cueva Coop near Pamul, Territorio de Quintana Roo, Yucatan Peninsula, Mexico.	D, E. Pools in caves; cenotes
	<b>Macrobrachium</b> Bate, 1868		
46	acherontium Holthuis, 1977	VII 1: Grutas del Coconá, near Teapa, Tabasco, Mexico.	C. Slowly flowing water in wet season; in pools in dry season
47	cavernicola (Kemp, 1924)	V 2: Siju Cave, Garo Hills, and cave near Cherrapundji, both localities in Assam, India.	C. Streams and pools in cave
48	lucifugum Holthuis, 1974	VII 4: Sjingod cave near Hato, Curaçao; Playa, Pos Caranja, Pos di Booi, Pos Calbas, all 4 in Bonaire. VII 8: 4 caves in Santo Domingo. VII 9: Green Grotto Cave, N. Jamaica. VII 10: 4 caves in Oriente and Pinar del Río provinces, Cuba.	D, F, G. Caves with fresh, brackish and sea water
49	microps Holthuis, 1978	VI 5: Danmin Cave near Konogusgus, New Ireland.	C. in fast flowing subterranean river
49a	poeti Holthuis, 1984	V 5: Luwang Jurangjero, Luwang Tong Pocot, and Gua Sodong, Gunung Sewu, Jogjakarta, Central Java, Indonesia.	C. Subterranean rivers
50	villalobosi Hobbs, 1973	VII 1: Cueva del Nacimiento del Río San Antonio, near Acatlán, Oaxaca, Mexico.	D. Subterranean lake
	<b>Neopalaemon</b> Hobbs, 1973		
51	nahuatlus Hobbs, 1973	VII 1: Cueva del Guano near Valle Nacional, Oaxaca, Mexico.	C. In deep permanent stream

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	<b>Palaemonetes</b> Heller, 1869		
	s.g. <b>Palaemonetes</b> Heller, 1869		
52	cummingi Chace, 1954	VIII 2a: Squirrel Chimney, near Gainesville, Alachua Co., Florida, U.S.A.	D. Subterranean pool at the bottom of a vertical chimney
	s.g. <b>Alaocaris</b> Holthuis, 1949		
53	antrorum Benedict, 1896	VIII 7a: Beaver Cave, Ezell's Cave, Wonder Cave, Frank Johnson's Well, San Marcos Springs, and Artesian Well at San Marcos, Hays Co., Texas, U.S.A. and Carson Cave near Montell, Uvalde Co., Texas, U.S.A.	C, I. Subterranean rivers; wells in limestone reaching subterranean stream; artesian well
54	holthuisi Strenth, 1976	VIII 7a: Ezell's Cave, San Marcos, Hays Co., Texas, U.S.A.	C. Sluggish subterranean stream
	<b>Troglindicus</b> Sankolli & Shenoy, 1979		
55	phreaticus Sankolli & Shenoy, 1979	V 2: Fort well near All-weather Port, Ratnagiri, Maharashtra State, India.	α. In "fresh-water well in close proximity of the sea"
	<b>Troglocubanus</b> Holthuis, 1949		
56	calcis (Rathbun, 1912)	VII 10: Cueva de la Chaveta, between Madruga and Aguacate, La Habana province, Cuba. Cueva del Agua and Cueva de la Lechuza, both Sierra de Cubitas, Camagüey province, Cuba.	D. Pools in caves
57	eigenmanni (Hay, 1903)	VII 10: 10 caves in the provinces of La Habana, Matanzas, and Pinar del Río, Cuba, excluding Isla de Pinos (for details see Hobbs, Hobbs & Daniel, 1977:60). VII 11: Isla de Pinos, Cuba.	D. Subterranean lakes in caves
58	gibarensis (Chace, 1943)	VII 10: Aguada del Montañés, and Cueva de los Panaderos, both near Gibara, Oriente province, Cuba. Cueva Grande de Caguanes, near Yaguajay, Las Villas province, Cuba.	C, D. Underground stream. Lakes in cave
59	inermis (Chace, 1943)	VII 10: Cueva del Agua, Sierra de Cubitas, near Camagüey, Camagüey province, Cuba, and Cueva de la Chaveta, between Madruga and Aguacate, La Habana province, Cuba.	D. Subterranean pool and subterranean lake
60	jamaicensis Holthuis, 1963	VII 9: cave near Goshen, Saint Mary Parish, Jamaica.	C. Stream in a limestone cave
61	perezfarfanteae Villalobos, 1974	VII 1: Sótano de la Tinaja, near Valles, San Luis Potosí, Mexico.	D. Deep lake in deepest part of cave

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	Typhlocaridinae Annandale & Kemp, 1913		
	<b>Typhlocaris</b> Calman, 1909		
62	galilea Calman, 1909	I 12: En-Nur near Tabgha near Lake Kinneret (= Sea of Galilee), northern Israel.	D, T. Subterranean water tract in karst, emptying in a spring
63	lethaea Parisi, 1921	I 13: Grotta del Lete (= Giok-Kebir) east of Bengasi, Lybia.	D. Subterranean lake in cave
64	salentina Caroli, 1923	I 5b: "La Zinzulusa" and "Abisso", two caves near Castro Marina, Otranto, S. E. Italy, and Grotta dei Diavoli, Porto Badisco, S. of Otranto, prov. Lecce, Italy.	D. Slightly brackish pools in caves
	Pontoniinae Kingsley, 1878		
	<b>Palaemonella</b> Dana, 1852		
65	burnsi Holthuis, 1973	VI 5: Cape Kinau Peninsula, Maui, and Kaloko Fish Pond, Kona coast, Hawaii, both localities in Hawaiian Islands.	H. Anchialine lava pools. Perhaps only accidental inhabitant of this habitat
	<b>Periclimenes</b> Costa, 1844		
66	pholeter Holthuis, 1973	I 12: Ras Muhammad Crack, Ras Muhammad, southern tip of Sinai Peninsula. IV 6: Aldabra.	G. Pools in coral rock
	Superfamilia Alpheoidea Rafinesque, 1815		
	Alpheidae Rafinesque, 1815		
	<b>Metabetaeus</b> Borradaile, 1899		
67	lohena Banner & Banner, 1960	VI 5: Cape Kinau Peninsula, Maui Island, and Kona coast (west coast) and south coast of Hawaii, Hawaiian Islands.	G. Lava pools
68	minutus (Whitelegge, 1897)	VI 5: Islands of the Arno and Jaluit Atolls, Marshall Archipelago; Funafuti Atoll, Ellice Archipelago; Fakaofu, Tokelau Archipelago.	G. Pools in coral rock
	<b>Potamalpheops</b> Powell, 1979		
69	stygicola (Hobbs, 1973)	VII 1: Cueva del Nacimiento del Río San Antonio, near Acatlán, Oaxaca, Mexico.	D. Subterranean lake
	Hippolytidae Bate, 1888		

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<b>Barbouria</b> Rathbun, 1912			
70	cubensis (Von Martens, 1872)	VII 10: between Cojimar and Morro Castle, and E. of Río Cojimar, Habana prov.; near Matanzas, Matanzas prov.; near Guarda la Vaca and near Velazco, Oriente prov., Cuba. VII 12: Abaco and San Salvador, Bahama Islands; Providenciales, Caicos Islands. VII 13: Cayman Brac, Cayman Islands. VIII 10: Tucker's Town Cave, Bermuda.	G. Limestone cracks and caves near seashore
<b>Calliasmata</b> Holthuis, 1973			
71	pholidota Holthuis, 1973	I 12: Ras Muhammad Crack near Ras Muhammad, southern tip of Sinai Peninsula. VI 5: Fangafale Islet, Funafuti Atoll, Élice Islands; Cape Kinau, Maui, and South Cape, Hawaii, both Hawaiian Islands.	G. Pools in lava or coral rock
72	rimolii Chace, 1975	VII 8: cave near Estero Hondo, Puerto Plata prov., northern Dominican Republic.	G?, D? Subterranean lake with "barely brackish" water
<b>Janicea</b> Manning & Hart, 1984			
72a	antiguensis (Chace, 1972)	VII 10: in cave, S. of Cooper's Island, Bermuda	A(D?) water depth 13-14 m
<b>Parhippolyte</b> Borradaile, 1899			
73	uveae Borradaile, 1899	IV 6: Aldabra. V 4: Tiniguiban near Guimaras Id., Panay, Philippines. VI 1: Halmahera, Moluccas, Indonesia. VI 5: Fangafale Islet, Funafuti Atoll, Ellice Islands; Vatulele, Vanua Vatu, and Vanua Levu Isds, Fiji Archipelago; Uvea, Loyalty Islands.	C. Pools in or near coral rock
<b>Somersiella</b> Hart & Manning, 1981			
74	sterreri Hart & Manning, 1981	VIII 10: Tucker's Town Cave, Bermuda, and Chalk Cave, Smith's Parish, Bermuda.	G. Pools in caves in coral rock
Subordo Reptantia Boas, 1880			
Infraordo Astacidea Latreille, 1802			
Cambaridae Hobbs, 1942			
<b>Cambarus</b> Erichson, 1846			
s.g. <b>Aviticambarus</b> Hobbs, 1969			
75	hamulatus (Cope, 1881)	VIII 1 and 3: numerous caves in Alabama and Tennessee, U.S.A. Hobbs, Hobbs & Daniel, 1977:76, list all known localities and give the range as "from the upper Sequatchie Valley, Bledsoe County, Tennessee, southwestward to Blount County, Alabama".	C. In cave streams

76	jonesi Hobbs & Barr, 1960	VIII 3: caves in northern Alabama, U.S.A. (Colbert, Lauderdale, Limestone, Madison, Marshall and Morgan Counties). Hobbs, Hobbs & Daniel, 1977: 78-80).	C, D? "In the pools"
	s.g. <b>Erebicambarus</b> Hobbs, 1969		
77	hubrichti Hobbs, 1952	VIII 4: Carter, Oregon, Phelps, Pulaski, Ripley and Shannon Counties, Missouri, U.S.A. Hobbs, Hobbs & Daniel, 1977: 82.	C. In cave rivers
	s.g. <b>Jugicambarus</b> Hobbs, 1969		
78	cryptodytes Hobbs, 1941	VIII 2: Decatur Co., Georgia, and Jackson Co., Florida, U.S.A. Hobbs, Hobbs & Daniel, 1977: 83.	D. Pools in caves
79	setosus Faxon, 1889	VIII 4: Christian, Dade, Greene, and Jasper Counties, S. W. Missouri; Delaware and Mayes Counties, Oklahoma, U.S.A. Hobbs, Hobbs & Daniel, 1977: 86.	D. Cave pools
80	tartarus Hobbs & Cooper, 1972	VIII 4: Stansberry-January Cave System near Colcord, Delaware Co., N. E. Oklahoma, U.S.A.	C. Sluggish to moderate flowing cave stream
81	zophonastes Hobbs & Bedinger, 1964	VIII 4: Hell Creek Cave, Stone Co., Arkansas, U.S.A.	C. In cave stream
	s.g. <b>Puncticambarus</b> Hobbs, 1969		
82	nerterius Hobbs, 1964	VIII 1: Greenbrier and Pocahontas Counties, West Virginia, U.S.A.	C. In cave streams
	<b>Orconectes</b> Cope, 1872		
83	australis australis (Rhoades, 1941)	VIII 3: "From the northern tributaries of the Tennessee River in Jackson and Madison counties, Alabama, north-northeastward on the western edge of the Cumberland Plateau to Fentress County, Tennessee, and Wayne County, Kentucky". Hobbs, Hobbs & Daniel, 1977: 95.	C. In cave streams
84	australis packardi Rhoades, 1944	VIII 3: McCreary, Pulaski, Rockcastle, and Wayne Counties, Kentucky, U.S.A. Hobbs, Hobbs & Daniel, 1977: 98.	C. In pools which make up a stream
85	incomptus Hobbs & Barr, 1972	VIII 3: Jackson and Putnam Counties, Tennessee, U.S.A. Hobbs, Hobbs & Daniel, 1977: 100.	C. In "pool areas of moderately flowing streams"
86	inermis inermis Cope, 1872	VIII 3: "From Green and Hart counties, Kentucky, north-northwestward into Crawford county, Indiana, U.S.A." Hobbs, Hobbs & Daniel, 1977: 102.	C. In pools and slow flowing shallow streams

87	<i>inermis testii</i> (Hay, 1891)	VIII 3: "Monroe, Owen and Greene (?) counties, Indiana", U.S.A. Hobbs, Hobbs & Daniel, 1977: 107.	D. In pools
88	<i>pellucidus</i> (Tellkamp, 1844)	VIII 3: "karst area (Pennyroyal Plateau) extending south- westward from Hart County to Trigg County, and Montgomery County, Tennessee", U.S.A. Hobbs, Hobbs & Daniel, 1977: 111.	D. In pools
<b>Procambarus</b> Ortmann, 1905			
s.g. <b>Austrocambarus</b> Hobbs, 1972			
89	<i>niveus</i> Hobbs & Villalobos, 1964	VII 10: Cuevas de Santo Tomás, Sierra de los Organos, near Ponce, Pinar del Río province, Cuba.	C. Large pools left by subterranean river
90	<i>oaxacae</i> <i>oaxacae</i> Hobbs, 1973	VII 1: Cueva del Guano near Valle Nacional, Oaxaca, Mexico.	C. From a stream within a cave
91	<i>oaxacae reddelli</i> Hobbs, 1973	VII 1: Cueva del Nacimiento del Río San Antonio, near Acatlán, Oaxaca, Mexico.	D. Subter- ranean lake
92	<i>rodriguezi</i> Hobbs, 1943	VII 1: Cueva de Ojo de Agua Grande, near Córdoba, Veracruz, Mexico.	C. In sub- terranean stream con- sisting of pools
s.g. <b>Leonticambarus</b> Hobbs, 1972			
93	<i>milleri</i> Hobbs, 1971	VIII 2a: well in Miami, Florida, U.S.A.	I. From well
s.g. <b>Lonnbergius</b> Hobbs, 1972			
94	<i>acherontis</i> (Lönnberg, 1894)	VIII 2a: subterranean rivulet near Lake Brantley, and Palm Springs near Orlando, both localities in Seminole County, Florida, U.S.A.	C. In subterranean pools and stream
s.g. <b>Ortmannicus</b> Fowler, 1912			
95	<i>erythrois</i> Relyea & Sutton, 1975	VIII 2: three sinks and perhaps one cave in Suwannee Co., northern Florida, U.S.A.	D. In pools at bottom of sinks
96	<i>franzi</i> Hobbs & Lee, 1976	VIII 2a: Orange Lake Cave, Marion County, Florida, U.S.A.	D. In cave pool
97	<i>horsti</i> Hobbs & Means, 1972	VIII 2: Big Blue Springs near Wacissa, Jefferson County, Florida, U.S.A.	T, D. In karst spring, but also in cave room behind source
97a	<i>leitheuseri</i> Franz & Hobbs, 1983	VIII 2a: several localities in Hernando and Pasco Counties, Florida, U.S.A.	D. "In flooded caves". Water depth 16.7-69.9 m.



98	lucifugus lucifugus (Hobbs, 1940)	VIII 2a: "Citrus and Hernando Counties northward to Marion County, Florida", U.S.A. Hobbs, Hobbs & Daniel, 1977: 128.	D. In tuberranean pools
99	lucifugus alachua (Hobbs, 1940)	VIII 2a: "Southwestern Alachua and western Gilchrist counties, Florida", U.S.A. Hobbs, Hobbs & Daniel, 1977: 130.	D. In subterranean pools
100	orcinus Hobbs & Means, 1972	VIII 2: "Panhandle of Florida between the Apalachicola and Aucilla Rivers", Leon and Wakulla Counties, Florida, U.S.A. Hobbs, Hobbs & Daniel, 1977: 132.	D, C. Sink-holes and subterranean streams
101	pallidus (Hobbs, 1940)	VIII 2a: "northwestern part of Alachua County, southwestern Columbia County, and western Suwannee County", Florida, U.S.A. Hobbs, Hobbs & Daniel, 1977: 135.	D. Spring, pools, and stagnant water
	s.g. <b>Remoticambarus</b> Hobbs, 1972		
102	pecki Hobbs, 1967	VIII 3: "Tennessee River basin in Colbert, Lauderdale, and Morgan counties, Alabama", U.S.A. Hobbs, Hobbs & Daniel, 1977: 136.	D. Subterranean pools
	s.g. <b>Scapulicambarus</b> Hobbs, 1972		
103	xilitlae Hobbs & Grubbs, 1982	VII 1: Hoyo de las Guaguas near Xilitla, San Luis Potosí, Mexico.	D. Sump pool
	<b>Troglocambarus</b> Hobbs, 1942		
104	maclanei Hobbs, 1942	VIII 2, 2a: "Citrus to Suwannee counties, Florida", U.S.A. Hobbs, Hobbs & Daniel, 1977: 138.	D. Subterranean pools
	Infraordo Anomura Macleay, 1838 (= Anomalina Latreille, 1817; = Anomax Latreille, 1816)		
	Superfamilia Galatheoidea Samouelle, 1819		
	Aeglidae Dana, 1852		
	<b>Aegla</b> Leach, 1821		
105	cavernicola Türkay, 1972	IX 3: Grutas das Areias, São Paulo, Brazil.	C. Freshwater basin with slight current
	Galatheidae Samouelle, 1819		
	<b>Munidopsis</b> Whiteaves, 1874		
106	polymorpha Koelbel, 1892	III 6: Jameo de Agua, Lanzarote, Canary Islands.	F-H. Sea water cave (lava tube)

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	Infraordo Brachyura Leach, 1815 (= Brachyuri L., 1758)		
	Superfamilia Potamoidea Ortmann, 1896		
	Potamidae Ortmann, 1896		
	<b>Cerberusa</b> Holthuis, 1979		
107	coeca Holthuis, 1979	V 3: Deer Cave, Green Cave, and Clearwater Cave, Gunong Mulu National Park, northern Sarawak, Borneo.	C. In pool and small streams
108	tipula Holthuis, 1979	V 3: Clearwater Cave, Cave of Winds, and Wonder Cave, Gunong Mulu National Park, northern Sarawak, Borneo.	D. In pools and on land
	Hydrothelphusidae Bott, 1955		
	<b>Madagapotamon</b> Bott, 1965		
109	gollhardi Bott, 1965	IV 5: Cave near Ankara, Madagascar.	A. In cave, "in völliger Dunkelheit"
	Gecarcinucidae Rathbun, 1904		
	<b>Adeleana</b> Bott, 1969		
110	chapmani Holthuis, 1979	V 3: Niah Great Cave, near Miri, northern Sarawak, Borneo.	A. "Small guano-floored pools in the dark zone"
	<b>Thelphusula</b> Bott, 1969		
111	bidiensis (Lanchester, 1900)	V 3: Caves at Bidi, southern Sarawak, Borneo. Posih Cave and Jambusan Cave both at Gunong Jambusan, and Fairy Cave, Gunong Kapor; all three caves near Bau, southern Sarawak, Borneo.	C. In pools sometimes near stream
	Sundathelphusidae Bott, 1969		
	<b>Holthuisana</b> Bott, 1969		
112	alba Holthuis, 1980	VI 2: Askembutem Cave near Tabubil, West Sepik District, Papua New Guinea.	D. In pools
	<b>Rouxana</b> Bott, 1969		
113	phreatica Holthuis, 1982	VI 2: "Hydra Hole", Finim Tel Plateau, Bahrmann Mts. near Mt. Fugilil Dabom, West Sepik District, Papua New Guinea.	D. "In muddy sump pool connecting... phreatic areas in the dark zone"

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	Pseudothelphusidae Ortmann, 1893		
	<b>Typhlopseudothelphusa</b> Rioja, 1953		
114	juberthiei Delamare Deboutteville, 1976	VII 3: cave of Chiacam, Sierra de Chamà, Alto Verapaz Province, north of Guatemala City, Guatemala.	C. Pools left by river
115	mitchelli Delamare Deboutteville, 1976	VII 3: caves in Sierra de Pampur, Alta Verapaz Province, Guatemala.	D, T
116	mocinoi Rioja, 1953	VII 1: Cueva del Tío Ticho, Cueva de los Murcielagos, and Cueva de los Llanos, Chiapas, Mexico	C. In pools and stream
	Trichodactylidae H. Milne Edwards, 1853		
	<b>Trichodactylus</b> Latreille, 1828		
117	bidens Bott, 1969	VII 1: Arroyo del Solpho cave, and Cueva el Azufre, both near Tapijulapa, Tabasco, Mexico. Possibly two names for the same cave.	A.
118	mensabak Cottarelli & Argano, 1977	VII 1: Cueva de Nicholas Bravo, near Tila, Chiapas, Mexico.	D. In small lake
	Superfamilia Grapsoidea Macleay, 1838		
	Grapsidae Macleay, 1838		
	<b>Sesarmoides</b> Serène & Soh, 1970		
119	cerberus (Holthuis, 1964)	VI 1: Nusa Lain island, west of Amboina, Moluccas, Indonesia.	A. "In complete darkness" of cave
120	jacobsoni (Ihle, 1912)	V 5: Guwã Djumblang and Guwã Ningrong caves, Gunong Sewu, Jogjakarta, central Java, Indonesia.	C. Subterranean rivers
121	verleyi (Rathbun, 1914)	VII 9: caves in Saint Elizabeth, Saint Mary, Saint Catherine, and Saint Ann parishes, Jamaica. Hobbs, Hobbs & Daniel, 1977: 147.	C. Subterranean streams

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## NOTES

- 1: see also Provenzano, 1978: 170.  
3: see Holthuis, 1963: 267; 1973: 19; Suzuki, 1980: 47; Smith & Williams, 1981: 49.  
4: see Torii, 1953: 248, 252.  
6: see Holthuis, 1956: 56.  
10: see Holthuis, 1973: 21; Couret & Wong, 1978: 301.  
11: see Holthuis, 1982: 32.  
12: see Hobbs, Hobbs & Daniel, 1977: 28.  
13: see Hobbs, Hobbs & Daniel, 1977: 30.  
17: see Holthuis, 1956a: 107.  
18: see Holthuis, 1956a: 105.  
23-32: see Holthuis, 1956: 45-50. Subspecies no. 25 is perhaps synonymous with subspecies 23.  
33-36, 38-40: see Hobbs, Hobbs & Daniel, 1977: 32-43.  
42: see Holthuis, 1956a: 98.  
45: see Hobbs, Hobbs & Daniel, 1977: 46.  
47: see Holthuis, 1956: 60.  
50-53: see Hobbs, Hobbs & Daniel, 1977: 50-56.  
56-61: see Hobbs, Hobbs & Daniel, 1977: 58-64.  
62: see Holthuis, 1956: 61; Tsumamal, 1978: 195; 1978a: 225.  
63, 64: see Holthuis, 1956: 62, 63.  
67: see Banner & Banner, 1974: 423, 427.  
68: see Holthuis, 1963: 269.  
69: see Hobbs, Hobbs & Daniel, 1977: 67 (under *Alpheopsis* s.).  
69a: first reported from the docks at English Harbour, Antigua. Later mentioned from Bermuda caves (without details) by Iliffe, Hart & Manning (1983: 141). Additional information by Dr. C. W. Hart (in litt.).  
70: see Hobbs, Hobbs & Daniel, 1977: 67; Hobbs III, 1978: 99; Hart & Manning 1981: 447  
72: see Hobbs, Hobbs & Daniel, 1977: 72.  
73: see Wear & Holthuis, 1977: 125.  
75-95, 97-102, 104, 105: see Hobbs, Hobbs & Daniel, 1977: 76-142.  
106: see Fage & Monod, 1936: 102; Parzefall & Wilkens, 1975: 325.  
116: see Hobbs, Hobbs & Daniel, 1977: 144; Delamare Deboutteville, 1976: 124.  
117: see Cottarelli & Argano, 1977: 210.  
121: see Hobbs, Hobbs & Daniel, 1977: 146.