

***Salmoneus kekovae*, a new species of alpheid shrimp (Crustacea: Decapoda: Caridea) from the south-western coast of Turkey**

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Abstract

A new species of Salmoneus collected in Turkish waters is described. It appears to live in burrows associated with gobiid fish or thalassinidean decapods, as do other species in the genus. Previously, twenty Salmoneus species have been recognised worldwide, two of which are known from the Mediterranean. Some morphological features are discussed in order to determine their taxonomic value. A table summarises the geographical distribution of the 21 species currently recognised.

Keywords: Alpheidae; *Salmoneus* sp. n.; Mediterranean; Turkey; Associations.

Introduction

In July 2000 the author collected decapods in the Lycian waters of Turkey between Fethiye and Finike. Sampling was carried out between the tide level and about 10 m depth. Near the small island of Kekova a specimen of *Salmoneus* was found at a depth of about 3 m on a sandy bottom with some vegetation. It was at the entrance of a burrow: the occupant is unknown, but its size and shape suggest being a goby, though in the same site many thalassinids were collected.

Systematics

Salmoneus Holthuis, 1955
Jousseamea Coutière (1896: 381).

Salmoneus Holthuis (1955: 88) {replacement name for *Jousseamea* Coutière, 1896, junior homonym of *Jousseamea* Sacco, 1894 (Mollusca)}.

Salmoneus kekovae sp. n. Fig.1-2

Type locality: Kekova – southwest coast of Turkey

Holotype: Turkey, Kekova. Fine sandy bottom, 3 m. July 2000, 1 ov. fem. cat. MSNM Cr2/2427

Pereion sparsely covered with short and slender setae. Rostrum overreaching 2nd segment of antennular peduncle, triangular, with straight lateral margins and with faint median dorsal carina extending almost to the base. Supraocular teeth prominent and acute, about one quarter as long as the rostrum.

Branchiostegal margin of carapace lightly rounded, slightly produced over the base of antenna. Faint lateral suture extending on carapace.

Abdomen with pleura of somites 1-3 broadly rounded, 4th and 5th produced posteriorly into a minute tooth.

Telson about 5 times as long as its width at posterior margin, and 1.9 times as long as maximal width; armed with two pairs of dorsolateral spines, one at midlength and the other at $\frac{3}{4}$ length from the base; two pairs of terminal spines, the internal longer than the external. Deep mesial notch with only one pair of long setae.

Uropods overreaching the telson, external branch armed with strong distolateral movable spine and dieresis.

Eyes only partially concealed from dorsal view, clearly distinguishable from lateral view.

Antennular peduncle quite short and robust, with the two distal articles broad rather than long and of the same length; stylocerite with acute distal tip reaching the base of the third segment and about as long as the rostrum. External antennular flagellum biramous with 2-3 fused proximal articles and five free ones, carrying aesthetascs.

Antennal scale 0.4 times as wide as its length, with distal tooth reaching anterior blade margin.

Third maxillipeds reach tip of the scaphocerite.

Major 1st pereopod with strong chela, 0.39 times as wide as its length, barrel shaped, dactylus 0.4 times as long as the propodus; fingers armed with 9/10 teeth, regularly distributed along the whole of the cutting edges, with twisted distal tips. Without spines on ischium.

Minor 1st pereopod much smaller and of regular shape like the other pereopods, dactylus 0.5 times propodus length, chela as long as the carpus.

Second pereopods with small chela as long as first segment of the carpus, with the dactylus

0.42 times as long as the propodus. Carpus segments $1 > 5 > 2 > 3 = 4$.

Third pereopod with long thin dactylus more than 0.65 times as long as the propodus, propodus 1.1 times as long as the carpus, carpus 0.8 times the merus length, ischium with two strong movable spines.

Fourth pereopods quite similar to third, but with 2 movable ischial spines on one leg and only one on the other.

Fifth pereopod with dactylus about 0.4 times the propodus length, propodus length 1.3 times the carpus, the latter as long as the merus, ischium without movable spines. Internal distal half of the propodus armed with a row of small movable spines, and 5 longer spines on the distal tip.

Colour: Pink-orange.

Size: 12 mm.

Eggs size: 0.3 mm.

Etymology: the specific name derives from the location where the specimen was collected.

Discussion

Currently 21 species are assigned to the genus *Salmoneus*. Two groups are recognised (DWORSCHAK *et al.*, 2000) by the development of the first pereopods; those with minor functional cheliped longer than major, or with both of conspicuous size, and species with minor cheliped small and of similar shape to other pereopods. Previously all species of the first group occurred in the Eastern Atlantic and the Mediterranean, whereas the Indo-Pacific and Western Atlantic species belonged to the second group.

Moreover, the Indo-Pacific and Western Atlantic species had an evident medial notch on the distal telson margin, with the exception of *Salmoneus bruni* BANNER & BANNER, 1966a. The East Atlantic species did not, or at best had a very small incision.

The Mediterranean *S. kekovae* breaks this pattern, having a deep notch as in most Indo-Pacific species. It could be a Lessepsian migrant from the Red Sea, where two other

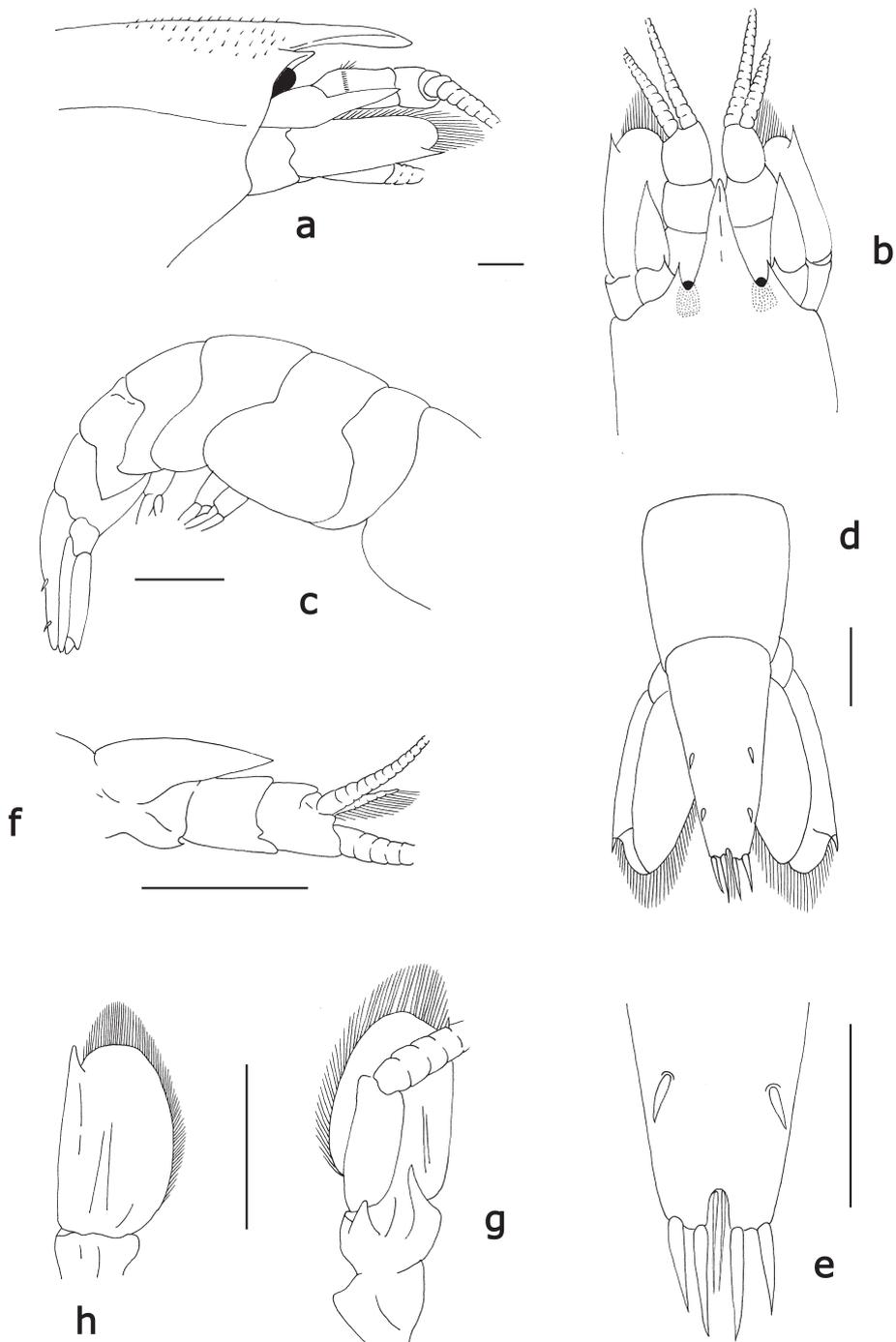


Fig. 1: *Salmoneus kekovae* sp. n., holotype, female 12 mm. a) anterior region lateral view; b) anterior region dorsal view; c) abdomen; d) telson; e) telson tip detail; f) stylocerite; g) scaphocerite ventral view; h) scaphocerite dorsal view. Scale in a, b, c, d, f, g, h = 1 mm, in e = 0.1 mm.

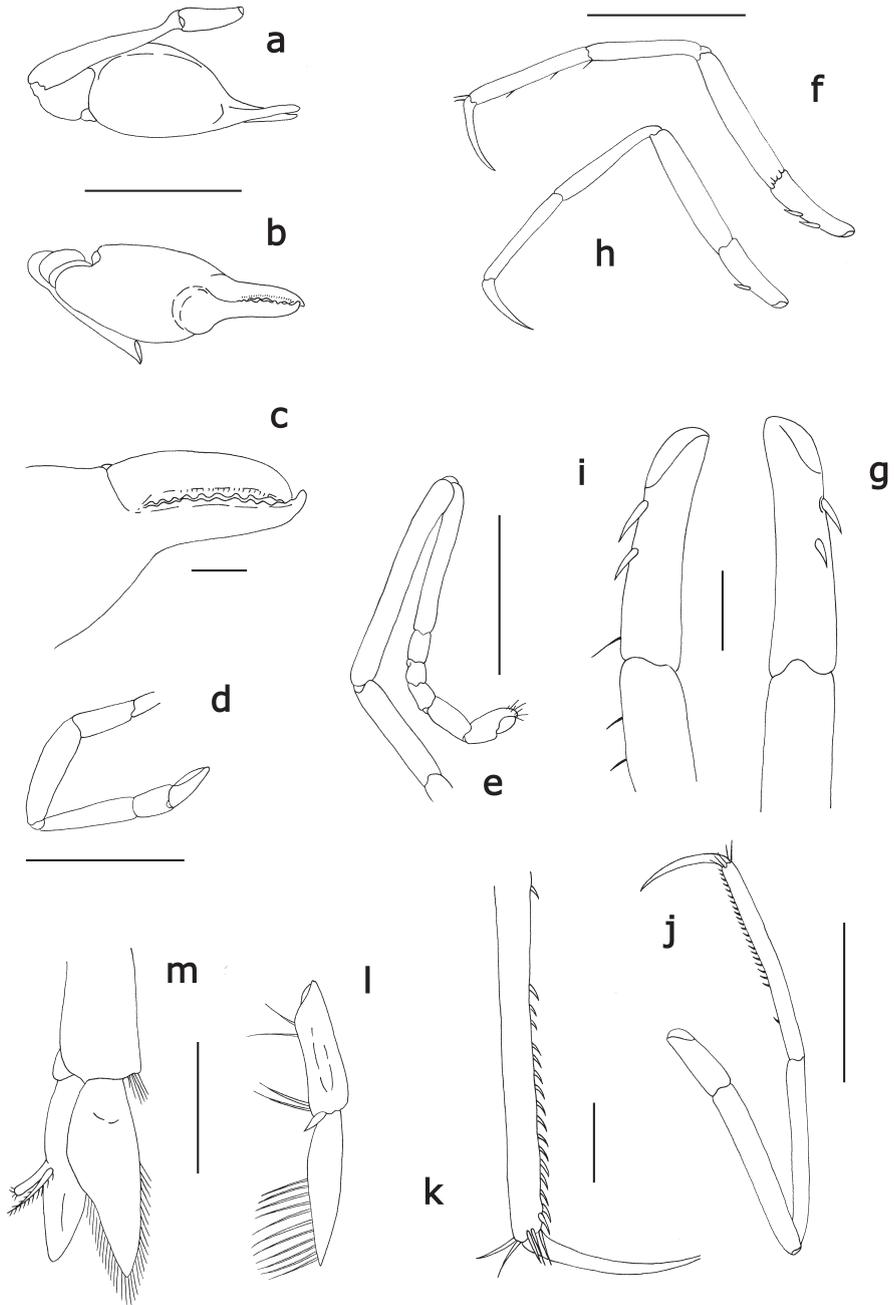


Fig. 2: *Salmeoneus kekovae* sp. n., holotype, female 12 mm. a) major first pereiopod internal view; b) major first pereiopod mesial view; c) detail of cheliped; d) minor first pereiopod external view; e) second pereiopod external view; f) right third pereiopod internal view; g) ischium of right third pereiopod; h) right fourth pereiopod internal view; i) left ischium of fourth pereiopod; j) right fifth pereiopod internal view; k), dactylus and propodus detail of right fifth pereiopod; l) first pleopod; m) second pleopod. Scale in a, b, d, e, f, h, j, l, m = 1mm; in c, g, i, k = 0.2 mm.

species are known – *Salmoneus serratidigitus* (Coutiere, 1896) and *Salmoneus cristatus* (Coutière, 1897).

Salmoneus kekovae can be distinguished from *S. cristatus* by the rostrum being much shorter and lacking a conspicuous dorsal carina, by eyes not concealed in dorsal view, by the shape of the major cheliped, by the 3rd pereopod having ischial teeth and a much longer dactylus, and by the telson emargination bearing one pair of setae.

The new species appears more closely related to *S. serratidigitus*, which has the 3rd pereopods with the dactylus much shorter and 3 ischial spines instead of two, the telson shorter, eyes completely concealed, marked rostral carina, scaphocerite proportionally longer, stylocerite always longer, the major cheliped much longer with more teeth on cutting edges and a typical lateral protrusion on the palm.

Among the other Indo-Pacific species all but three - *Salmoneus tafaongae* Banner & Banner, 1966b, *Salmoneus rostratus* Barnard, 1962 and *Salmoneus gracilipes* Miya, 1972 - have the eyes concealed.

S. rostratus is characterized by a rostrum bearing an accessory denticle on the tip (DE GRAVE & WILKINS, 1997), the presence of a dorsal carina, having the antennular articles much longer than the width, a long scaphocerite, and the major cheliped being very slender with fingers armed with only three proximal teeth.

S. gracilipes is quite similar to *S. kekovae*, but has a much more slender cheliped armed with 14 teeth, the 3rd legs with a short dactylus and 3 ischial spines, and much longer telson.

S. tafaongae is easily distinguishable by the rostrum being particularly long and thin, by the supraocular spines being upturned, by the long antennular articles and by the small telson emargination. Unfortunately, nothing is known about the major cheliped from the sole damaged specimen known.

Moreover, the authors BANNER & BANNER (1966b) stated that it ‘... has the

articulated plate at posterolateral angle of the 6th abdominal segment ...’ this suggests that the species is not truly a *Salmoneus*, as stated by HOLTHUIS (1993), but may be closer to *Deioneus* Dworschak, ANKER & ABED-NAVANDI, 2000.

Since the publication of the key to *Salmoneus* species by BANNER & BANNER (1981), other species have been described. The characters used to distinguish the species appear sometimes uncertain, mainly because few specimens have been collected for each species. Moreover, CARVACHO (1989) remarked how the presence of the appendix masculina on the 2nd pleopod of the females, including ovigerous ones, is a typical character of this genus, so that probably some specimen may have been erroneously described as male. The result is that reliable morphological data on possible dimorphism are lacking.

Furthermore, FELDER & MANNING (1986) pointed out that characters such as length of the stylocerite, shape of the antennular peduncle, length of the rostrum and the ischial spines can change with age and sex. In addition, BANNER & BANNER (1981) noted considerable variation in the shape of the rostrum and even the concealment of the eyes, and synonymised *Salmoneus sibogae* (de Man, 1910) and *Salmoneus latirostris* (Coutière, 1896) with *S. serratidigitus*. MIYA (1972) noted that the setae of the telson can also vary in number. Because of these uncertainties a revised key is not presented here. However, we summarise the distribution of the species (Table 1).

DWORSCHAK *et al.* (2000) suggested that the specimen described as *Salmoneus jarli* by Holthuis & Gottlieb (1958) could actually belong to *Salmoneus erasimorum* DWORSCHAK, ANKER & ABED-NAVANDI, 2000. I agree with this, although in the illustrations of the two species the length of the telson looks longer in *S. jarli* than in *S. erasimorum*: therefore, in the table the record of *S. jarli* Holthuis, 1951 in the Mediterranean Sea has been omitted.

Table 1
Geographical distribution of the described species of *Salmoneus*

<i>S. jarli</i> Holthuis, 1951	East Atlantic: Nigeria (HOLTHUIS, 1951)
<i>S. caboverdensis</i> Dworschak, Anker & Abed-Navadi, 2000	East Atlantic: Cape Verde Islands (DWORSCHAK <i>et al.</i> , 2000)
<i>S. erasimorum</i> Dworschak, Anker & Abed-Navadi, 2000	Mediterranean: Adriatic Sea (DWORSCHAK, <i>et al.</i> 2000)
<i>S. sketi</i> Fransen, 1991	Mediterranean: Adriatic Sea (FRANSEN, 1991)
<i>S. kekovae</i> sp. n.	Mediterranean: South Turkey
<i>S. teres</i> Manning & Chace, 1990	East Atlantic: Ascension Island (MANNING & CHACE, 1990)
<i>S. setosus</i> Manning & Chace, 1990	East Atlantic: Ascension Island (MANNING & CHACE, 1990)
<i>S. cavicolus</i> Felder & Manning, 1986	West Atlantic: Florida (FELDER & MANNING, 1986)
<i>S. arubae</i> (Schmitt, 1936)	West Atlantic: Caribbean, Cuba, Curacao (SCHMITT, 1936; MARTINEZ IGLESIAS <i>et al.</i> , 1996; HOLTHUIS, 1990)
<i>S. ortmani</i> (Rankin, 1898)	West Atlantic: Caribbean, Bermuda, Bahamas, Brazil, Gulf of California (CHACE, 1972; CHRISTOFFERSEN, 1982; RAMOS-PORTO <i>et al.</i> , 1994; RANKIN, 1898; SCHMITT, 1936; RIOS & CARVACHO, 1982)
<i>S. bruni</i> Banner & Banner, 1966	Indo-Pacific: Thailand (BANNER & BANNER, 1966a)
? <i>S. tafaonga</i> e Banner & Banner, 1966	Pacific: Samoa (BANNER & BANNER, 1966b)
<i>S. rostratus</i> Barnard, 1962	Indo-Pacific: Madagascar, Papua New Guinea (BARNARD, 1962; DE GRAVE & WILKINS, 1997)
<i>S. brevisrostris</i> (Edmonson, 1930)	Indo-Pacific: Madagascar, Arabian Sea, Thailand, Pakistan, Hawaiian Islands (EDMONSON, 1930; BANNER & BANNER, 1966A; BARNARD, 1962; BANNER & BANNER, 1983; KAZMI, 1974)
<i>S. serratidigitus</i> (Coutière, 1896)	Indo-Pacific: Red-Sea, Indonesia, Marshall Is., Cook Is., Fiji Is., Society Is., Seychelles Is., E. Africa, Madagascar, Gulf of California (HENDRICKX, 1996; CHACE, 1988; COUTIÈRE, 1896; BANNER & BANNER, 1981; BANNER & BANNER, 1966B; BANNER & BANNER, 1983)
<i>S. tricristatus</i> Banner, 1959	Pacific: Japan, Australia, Caroline Is., Marshall Is., Cook Is., Samoa Is., Society Is., Seychelles Is., E. Africa, (MIYA, 1972; BANNER & BANNER, 1967; BANNER & BANNER, 1971; BANNER, 1959; BANNER & BANNER, 1983)
<i>S. mauiensis</i> (Edmonson, 1930)	Pacific: Hawaiian Islands (EDMONSON, 1930)
<i>S. cristatus</i> (Coutière, 1897)	Indian: Red Sea, Thailand, Kenya, Seychelles Is. (HOLTHUIS, 1958 ; COUTIERE, 1897 ; BANNER & BANNER, 1966A ; BANNER & BANNER, 1983 ; BRUCE, 1976)
<i>S. hilarulus</i> (de Man, 1910)	Pacific: Singapore, Indonesia (DE MAN, 1910)
<i>S. babai</i> Miyake & Miya, 1966	Pacific: Japan (MIYAKE & MIYA, 1966; MIYA, 1972)
<i>S. gracilipes</i> Miya, 1972	Pacific: Japan (MIYA, 1972)

Table 1 shows three species known in the Mediterranean - *Salmoneus sketi* Fransen, 1991, *S. erasimorum* and *S. kekovae* sp. n. - four in the East Atlantic, three in the West Atlantic and 11 in the Indo-Pacific.

The only widespread species are *S. serratidigitus* (including the distributions of its synonym *S. sibogae* and *S. latirostris*) that has been found from the Red Sea to the Gulf of California (COUTIÈRE, 1896; BANNER & BANNER, 1981; CHACE, 1988; HENDRICKX, 1996), *S. tricristatus* Banner, 1959 from Japan to Australia (BANNER, 1959; BANNER & BANNER, 1971; MIYA, 1972) and *S. cristatus* from the Red Sea to Thailand (COUTIÈRE, 1897; HOLTHUIS, 1958; BANNER & BANNER, 1966a).

Salmoneus ortmanni (Rankin, 1898) has an extensive latitudinal distribution from the Bahamas to Brazil (RANKIN 1898; SCHMITT, 1936; CHACE, 1972; CHRISTOFFERSEN, 1982; RAMOS-PORTO *et al.*, 1994), and it has been found also in the Gulf of California by RIOS & CARVACHO (1982).

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References

BANNER, A. H., 1959. Various small collections from the Central Pacific area, including supplementary notes on alpheid shrimp from Hawaii: Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean, Part IV. Pacific Science 13: 130-155.
 BANNER, A. H. & BANNER, D. M., 1966a. The alpheid shrimp of Thailand. The Siam Society Monograph Series 3: 1-168.
 BANNER, A. H. & BANNER, D. M., 1966b. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean, Part X. Collections

from Fiji, Tonga, and Samoa. Pacific Science 20: 145-188.
 BANNER, A. H. & BANNER, D. M., 1967. Contributions to the knowledge of the alpheid shrimp of the Pacific Ocean. Part XI. Collections from the Cook and Society Islands. Occasional Papers Bernice Pauahi Bishop Museum 23: 253-286.
 BANNER, D. M. & BANNER, A. H., 1971. The alpheid shrimp of Australia. Part I: The lower genera. Records of the Australian Museum 28: 291-382.
 BANNER, D. M. & BANNER, A. H., 1981. Annotated Checklist of the alpheid shrimp of the Red Sea and Gulf of Aden. Zoologische Verhandlungen 190: 1-99.
 BANNER, D. M. & BANNER, A. H., 1983. An annotated checklist of the alpheid shrimp from the Western Indian Ocean. Travaux et Documents de l'ORSTOM 158: 1-164.
 BARNARD, K. H., 1962. New records of marine Crustacea from the East African region. Crustaceana 3: 239-245.
 BRUCE, A. J., 1976. A report on a small collection of shrimps from Kenya marine parks at Malindi, with notes on selected species. Zoologische Verhandlungen 145: 1-72.
 CARVACHO, A., 1989. Sur l'appendix masculina chez *Salmoneus* (Decapoda, Alpheidae). Crustaceana 57: 253-256.
 CHACE, F. A., 1972. The shrimps of the Smithsonian-Bredin Caribbean expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). Smithsonian Contributions to Zoology 98: 1-179.
 CHACE, F. A., 1988. The caridean shrimps (Crustacea: Decapoda) of the *Albatross* Philippine expedition, 1907-1910, Part 5: family Alpheidae. Smithsonian Contributions to Zoology 466: 1-99.
 CHRISTOFFERSEN, M. L., 1982. Distribution of warm water alpheid shrimp (Crustacea, Caridea) on the continental shelf of eastern south America between 23 and 35° lat. S. Boletim do Instituto Oceanográfico, Sao Paulo 31: 93-112.
 COUTIERE, H., 1896. Note sur quelques genres nouveaux ou peu connus d'Alpheides formant la soufamille des Alpheopsidés. Bulletin du Muséum d'Histoire Naturelle 2: 380-386.

- COUTIERE, H., 1897. Note sur quelques Alpheés nouveau. Bulletin du Muséum d'Histoire Naturelle 3: 303-306.
- DE GRAVE, S. & WILKINS, H. K. A., 1997. A new record of *Salmoneus rostratus* Barnard, 1962 (Decapoda, Alpheidae) from Hansa Bay, Papua New Guinea. Crustaceana 70: 633-636.
- DWORSCHAK, P. C., ANKER, A. & ABED-NAVANDI, D., 2000. A new genus and three new species of alpheids (Decapoda: Caridea) associated with thalassinids. Annalen des Naturhistorischen Museums in Wien 102B: 301-320.
- EDMONSON, C. H., 1930. New Hawaiian Crustacea. Occasional Papers Bernice Pauahi Bishop Museum 9: 2-18.
- FELDER, D. L. & MANNING, R. B., 1986. A new genus and two new species of alpheid shrimps (Decapoda: Caridea) from South Florida. Journal of Crustacean Biology 6: 497-508.
- FRANSEN, C.H.J.M., 1991. *Salmoneus sketi*, a new species of alpheid shrimp (Crustacea: Decapoda: Caridea) from a submarine cave in the Adriatic. Zoologische Mededelingen 65: 171-179.
- HENDRICKX, M. E., 1996. Habitats and biodiversity of decapod crustaceans in the S.E. Gulf of California, Mexico. Revista de Biología Tropical 44 : 585-601.
- HOLTHUIS, L. B., 1951. The caridean Crustacea of Tropical West Africa. Atlantide Report 2: 7-187.
- HOLTHUIS, L. B., 1958. Contributions to the knowledge of the Red Sea. No. 8. Crustacea Decapoda from the Northern Red Sea (Gulf of Aqaba and Sinai Peninsula) I. Macrura. Bulletin of the Sea Fisheries Research Station, Haifa 17: 1-40.
- HOLTHUIS, L. B., 1990. Notes on *Salmoneus arubae* (Schmitt, 1936) (Crustacea, Decapoda, Caridea). Beaufortia 41: 109-114.
- HOLTHUIS, L. B., 1993. The Recent Genera of the Caridean and Stenopodidean Shrimps (Crustacea, Decapoda): with an Appendix on the Order Anphionidacea. Nationaal Natuurhistorisch Museum Leiden.
- HOLTHUIS, L. B. & GOTTLIEB, E., 1958. An annotated list of the decapod Crustacea of the Mediterranean coast of Israel, with an appendix listing the Decapoda of the eastern Mediterranean. Bulletin of the Research Council of Israel 7B: 1-126.
- KAZMI, M. A., 1974. *Salmoneus brevisrostris* (Edmonson) (Decapoda, Caridea) from the Indian Ocean. Crustaceana 27: 310-312.
- MAN, J. G. DE, 1910. Diagnosis of new species of macrurous decapod Crustacea from "Siboga Expedition". Tijdschrift van de Nederlandse Dierkunde Vereniging II, 11: 287-319.
- MANNING, R. B. & CHACE, F. A., 1990. Decapod and stomatopod Crustacea from Ascension Island, South Atlantic Ocean. Smithsonian Contributions to Zoology 503: 1-91.
- MARTINEZ IGLESIAS, J. C., CARVACHO, A. & RIOS, R., 1996. Catalogo de los carideos marinos (Crustacea, Decapoda, Caridea) de las aguas someras de Cuba. Avicennia 4-5: 27-40.
- MIYA, Y., 1972. The Alpheidae (Crustacea, Decapoda) of Japan and its adjacent waters, Part I. Publications of Amakusa Marine Biological Laboratory, Kyushu University 3: 23-101.
- MIYAKE, S. & MIYA, Y., 1966. On a new species and a new record of alpheid shrimps from Japan. Journal of the Faculty of Agriculture Kyushu University 14: 133-141.
- RANKIN, W. M., 1898. The Northrop Collection of Crustacea from the Bahamas. Annals of the New York Academy of Sciences 11: 225-258.
- RAMOS-PORTO, M., VIANA, G. F. S. & LACERDA, P. R., 1994. Ocorrença de *Salmoneus ortmanni* no nordeste brasileiro. Revista Nordestina de Biologia 1: 44-60.
- RIOS, R. & CARVACHO, A., 1982. Caridean shrimps of the Gulf of California. 1. New records, with some remarks on amphiamerican distribution. Pacific Science 36: 459-466.
- SCHMITT, W. L., 1936. Macruran and anomuran Crustacea from Bonaire, Curaçao and Aruba. No 16. In Zoologische Ergebnisse einer Reise nach Bonaire, Curaçao and Aruba im Jahre 1930. Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere 67: 363-378.