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***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.

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**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  
*Jousseumea* Coutière (1896: 381).

*Salmoneus* Holthuis (1955: 88) {replacement name for *Jousseumea* Coutière, 1896, junior homonym of *Jousseumea* 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 2<sup>nd</sup> 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, 4<sup>th</sup> and 5<sup>th</sup> 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 1<sup>st</sup> 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 1<sup>st</sup> 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 movables 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.

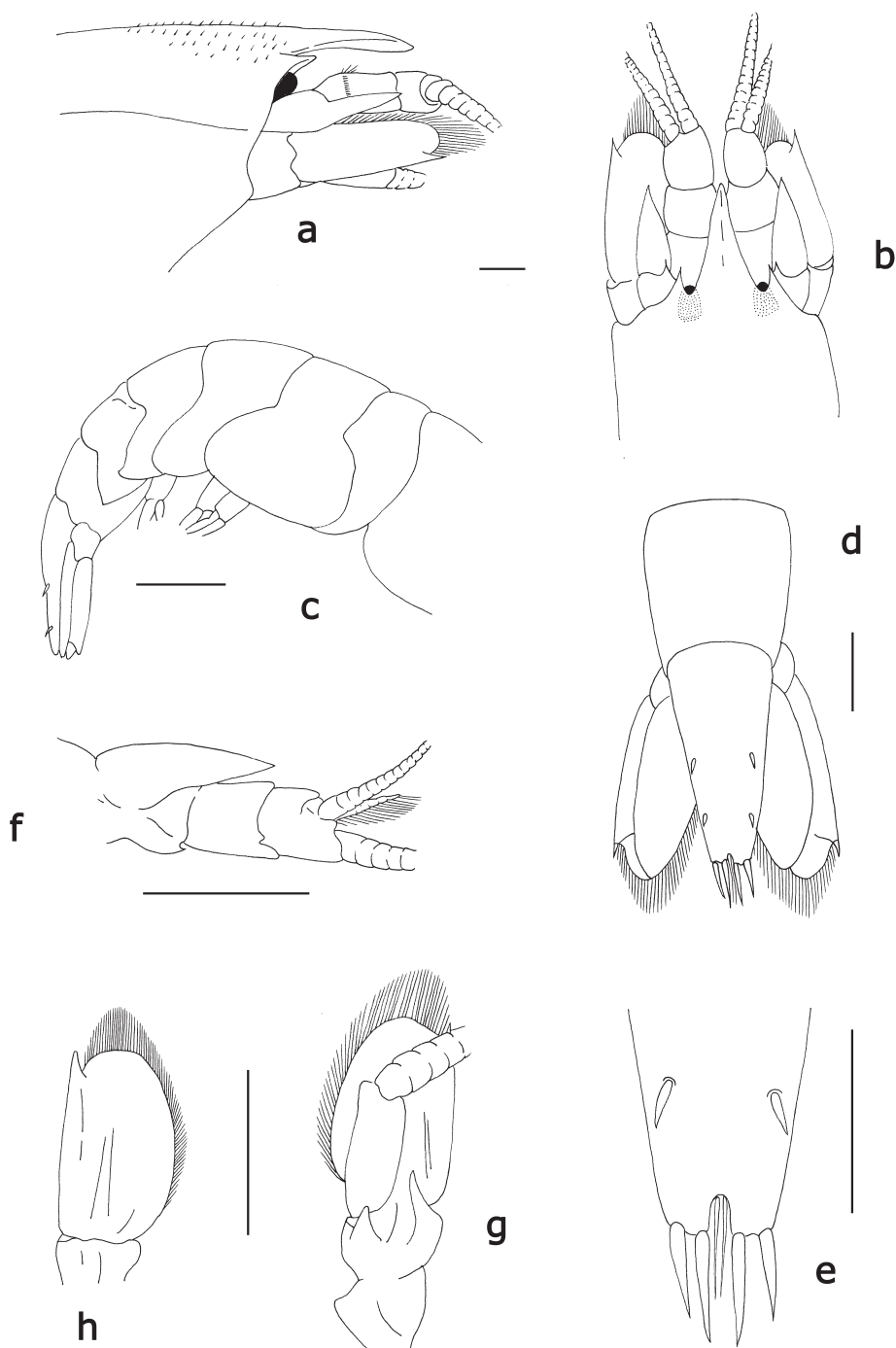
Etymology: the specific name derives from the location where the specimen was collected.

## Discussion

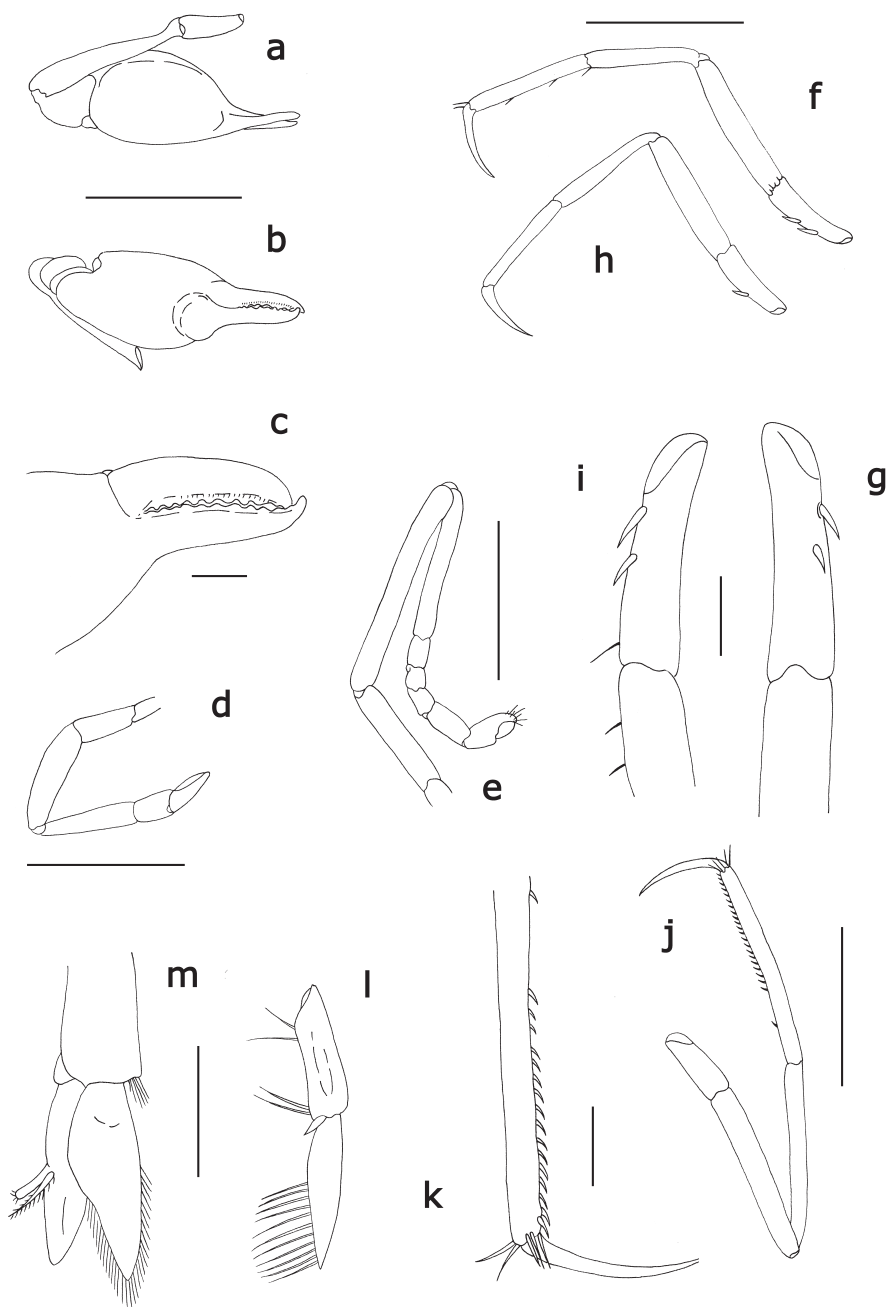
Currently 21 species are assigned to the genus *Salmoneus*. Two groups are recognised (DWORSCHAK *et al.*, 2000) by the development of the first pereopods; those with minor functional cheliped longer than major, or with both of conspicuous size, and species with minor cheliped small and of similar shape 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:** *Salmonsia 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 – *Salmonius serratidigitus* (Coutiere, 1896) and *Salmonius cristatus* (Coutière, 1897).

*Salmonius 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 3<sup>rd</sup> 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 3<sup>rd</sup> 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 - *Salmonius tafaongae* Banner & Banner, 1966b, *Salmonius rostratus* Barnard, 1962 and *Salmonius 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 3<sup>rd</sup> 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 6<sup>th</sup> abdominal segment ...’ this suggests that the species is not truly a *Salmonius*, as stated by HOLTHUIS (1993), but may be closer to *Deioneus* Dworschak, ANKER & ABED-NAVANDI, 2000.

Since the publication of the key to *Salmonius* 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 2<sup>nd</sup> 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 *Salmonius sibogae* (de Man, 1910) and *Salmonius 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 *Salmonius jarli* by Holthuis & Gottlieb (1958) could actually belong to *Salmonius 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. ortmanni</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. tafaongae</i> 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. brevirostris</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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