

# NORTH ATLANTIC SPECIES OF THE GENUS *STEGOCEPHALOIDES* SARS (AMPHIPODA, STEGOCEPHALIDAE)

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## SARSIA



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Four species (including one new to science) of the stegocephalid genus *Stegocephaloides* SARS, 1891 are recognized from the North Atlantic Ocean, viz. *Stegocephaloides auratus* (SARS, 1883), *S. barnardi* sp. nov., *S. christianiensis* (BOECK, 1871) and *S. wagini* (GURJANOVA, 1936). Descriptions of all four species are presented together with a discussion of the generic status of some of the other species (*S. katalia* BARNARD, 1962; *S. vegae* OLDEVIG, 1959 and *S. vanhoeffeni* SCHELLENBERG, 1926). The present paper is based primarily on material collected during the BIOFAR and BIOICE projects, and this revision brings the total number of species in the genus up to eight. A key is presented which allows all *Stegocephaloides* species to be distinguished.

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KEYWORDS: Amphipoda; Stegocephalidae; North Atlantic.

## INTRODUCTION

The genus *Stegocephaloides* was erected by SARS (1891) to separate the two species *S. christianiensis* (BOECK, 1871) and *S. auratus* (SARS, 1883) from *Stegocephalus*. SARS (1891) recognized that these two species differed from *Stegocephalus* mainly in a 'different structure of the superior antennæ, the subequal gnathopoda, and the different aspect of the penultimate pair of pereopoda...' (SARS 1891:201). These characters, especially the first and third, have later proven not to be absolutely diagnostic, which makes the value of a separate genus *Stegocephaloides* debatable (see below).

The genus *Stegocephaloides* SARS includes 8 species, some very incompletely described. Four species of this genus occur in the North Atlantic, one of these is new to the area, one is new to science. This paper contains descriptions of the North Atlantic species, and a discussion of the status of some of the other species (*S. katalia* BARNARD, 1962; *S. vegae* OLDEVIG, 1959 and *S. vanhoeffeni* SCHELLENBERG, 1926).

## MATERIAL AND METHODS

This study is based primarily on material from the BIOFAR and the BIOICE projects (BERGE & VADER 1997a), but supplementary material from other sources is also used. The type material of *Stegocephaloides wagini* (GURJANOVA, 1936) was kindly made available to us by Dr Stella

Vassilenko (St. Petersburg). All drawings have been prepared using a Zeiss microscope. Microscope preparations utilized polyvinyl-lactophenol with rose-bengal.

The descriptions and the key have been generated from the taxonomic database programmes Taxasoft (GOUDA 1993) and Delta (DALLWITZ & al. 1996). The classification of setae mainly follows that of WATLING (1989), but a new term is introduced: Maxilla Setae (MS). These setae are found on the outer plate of the first maxilla (see Fig. 1), and are clearly homologous to what LOWRY & STODDART (1992, 1993 & 1995) have called ST (Setal Teeth). However, although the setae are clearly homologous features of the outer plate, the evolution of the different arrangements of the MS in Stegocephalidae probably is not homologous to the evolution of different arrangements found in lysianassoids (explained in detail by LOWRY & STODDART (1992, 1993, 1995)). These setae are thus given a new name both to avoid the use of the term 'tooth and teeth' (see WATLING 1989) for setae, and to avoid any functional interpretations and speculations of the structure. Also the identification and interpretations of the different states (e.g. LOWRY & STODDART (1995) identified the presence of 9 MS in *Andaniotes bagabag* LOWRY & STODDART, 1995 as 'a modified 7/4 arrangement') is omitted. It will thus be possible to transfer the terminology to other groups of amphipods that possess homologous structures, without automatically inferring anything about function or polarity.

The type material of the new species is kept at the Institute of Biology, University of Iceland, Iceland.

Detailed records of species found in the BIOFAR and BIOICE samples are found in BERGE & VADER (1997a).

## TAXONOMY

*Stegocephaloides* Sars*Stegocephaloides* Sars, 1891

Type species. *Stegocephalus christianiensis* BOECK, 1871

Diagnosis. Body smooth. Mandibular incisor toothed. Maxilla 2 gaping and geniculate, setae on outer plate with single apical hooks. Palp of maxilliped 4-articulate, article 2 not or slightly produced distally on inner margin. Coxae 1-4 deep. Basis of pereopod 6 not, or very slightly, expanded. Pereopod 7 with 7 articles. Uropod 3 biramous. Telson cleft.

Remarks. This genus is very similar to *Stegocephalopsis* SCHELLENBERG, 1925 in that some species in both genera possess a 2-segmented palp on the first maxilla and a slightly expanded basis on pereopod 6. However, these two genera are separated primarily by the presence or absence of apical hooks on the long setae on outer plate on maxilla 2. While *Stegocephalopsis* possesses unhooked setae (contrary to what MOORE 1992 stated), *Stegocephaloides* has hooked setae and a generally more geniculated outer plate. Other characters that separate *Stegocephaloides* from *Stegocephalopsis* are the deep coxae 1-4 and the relatively large palp of maxilla 1 of *Stegocephaloides*.

The deep coxae also separate *Stegocephaloides* from both *Phippsiella* SCHELLENBERG, 1925 and *Stegocephalus* KRØYER, 1842. Originally, the long article 1 of the flagellum on the first antenna and the

unexpanded basis of pereopod 6 (see also above) were also considered to be important diagnostic characters, separating *Stegocephaloides* from *Stegocephalus* and *Phippsiella*. However, at least two *Stegocephaloides* species (*S. barnardi* and *S. christianiensis*) possess an expanded basis (although only slightly), while *S. barnardi* also possesses a flagellum very similar to that of *Phippsiella similis* Sars, 1891. In addition to this, all three genera possess a (more or less) produced inner margin of palp article 2 of the maxilliped. As a result of this, apart from the somewhat deeper coxae 1-4 in *Stegocephaloides*, there are no diagnostic characters left separating these genera. *Stegocephaloides* is, however, referred to as a genus although it probably does not constitute a monophyletic group (see species below).

Before a more thorough analysis of the entire group of stegocephalid species with a gaping and geniculate maxilla 2 can be provided, detailed descriptions and revisions of most of the species have to be carried out, as many species are only deficiently figured and described. For this reason, and because there are reasons to suspect that the genus is not a monophyletic group, the genus, and its relationship with the other closely related genera, is retained until a more thorough analysis of all these related genera is provided.

Species. *Stegocephaloides attingens* K.H. BARNARD, 1916; *S. auratus* (Sars, 1883); *S. australis* K.H. BARNARD, 1916; *S. barnardi* sp. nov.; *S. camoti* J.L. BARNARD, 1967; *S. christianiensis* (BOECK, 1871); *S. vanhoeffeni* SCHELLENBERG, 1926; *S. wagini* (GURJANOVA, 1936)

## KEY TO THE SPECIES OF THE GENUS STEGOCEPHALOIDES Sars

1. Uropod 3 outer ramus 1-articulate ..... 2
  - Uropod 3 outer ramus 2-articulate ..... *Stegocephaloides camoti*
2. Epimeral plate 3 posterior margin weakly produced and not serrated, uropod 3 peduncle clearly shorter than rami ..... 3
  - Epimeral plate 3 posterior margin produced and serrated, uropod 3 peduncle equal to rami ..... *Stegocephaloides vanhoeffeni*
3. Pereopod 7 basis acute and pointed distally, usually reaching the proximal part of propodus ..... 7
  - Pereopod 7 basis rounded distally, does clearly not reach the proximal part of propodus ..... 4
4. Antenna 2 peduncle article 4 about half the length of article 5 ..... *Stegocephaloides australis*
  - Antenna 2 peduncle article 4 about as long as article 5 ..... 5
5. Antenna 1 accessory flagellum shorter than flagellum article 1 ..... 6
  - Antenna 1 accessory flagellum longer than flagellum article 1 ..... *Stegocephaloides barnardi*
6. Posteroventral angle of epimeral plate 3 rounded (hind margin weakly concave) ..... *Stegocephaloides christianiensis*
  - Posteroventral angle of epimeral plate 3 pointed (hind margin weakly gibbous) ... *Stegocephaloides wagini*
- 7(3). Article 4 of peduncle antenna 2 shorter than article 5 ..... *Stegocephaloides auratus*
  - Article 4 of peduncle antenna 2 about as long as article 5 ..... *Stegocephaloides attingens*

*Stegocephaloidea auratus* (SARS, 1883) (Figs 1-3)

*Stegocephalus auratus* SARS, 1883, p. 86, pl. 3, fig. 8.  
*Stegocephaloidea auratus* SARS, 1891, p. 203, pl. 70, fig. 3.

**Type locality.** The west coast of Norway.

**Material examined.** BIOFAR material: BIOFAR 261: 6 specimens, 14 May 1988, 61°35.57'N 9°35.47'W, 1003 m, RP-sledge, 3.0 °C (estimated average bottom temp.); BIOFAR 267: 2 specimens, 15 May 1988, 62°42.40'N 8°33.75'W, 489 m, RP-sledge, 3.9 °C (estimated average bottom temp.); BIOFAR 690: 3 specimens, 12 May 1990, 60°34.59'N 12°16.63', 357 m, RP-sledge, 8.6 °C (estimated average bottom temp.); Additional 32 specimens from 11 BIOFAR stations.

BIOICE material: BIOICE 2410: 1 specimen, Stn 0561, 2 July 1993, 62°51.60'N 21°44.10'W, 1074 m, 4.0 °C, RP-sledge, silty sand; Additional 187 specimens from 26 different BIOICE samples.

Material from other sources: Bay of Biscay, collected by Dr J.C. Sorbe: E93-TS04-b, 3 specimens. Western Norway, collected by Dr L. Buhl-Mortensen: about 20 specimens.

**Diagnosis.** Antenna 1 flagellum article 1 shorter than half length of flagellum; labrum with lobes only weakly asymmetrical; labium with one simple, distally crenulate, distal finger; maxilla 1 palp 1-articulate, MS in a 6/3 arrangement; maxilla 2 gaping and geniculate, inner plate with 2 rows of pappose setae, both apparently marginal; pereopod 7 basis pointed and acute distally; epimeral plate 3 posteroventral angle with 1 to 3 small serrations; uropod 3 outer ramus 1-articulate.

**General distribution.** Known from the Bay of Biscay and the North Atlantic north to Trondheimsfjorden (Norway), also reported from the Kara Sea (GURJANOVA 1951, not checked).

**Head and Body.** Length of females 6.5 mm, males 5.5 mm; colour 'with a broad orange-coloured band, occupying the greater part of the metasome and corresponding coxal plates' (SARS 1891). Rostrum absent.

**Antennae.** Antenna 1 larger than antenna 2; antenna 1 peduncle article 2 much less than half length of article 1; flagellum article 1 larger than 2 x length of article 2, but not equal to half entire flagellum; flagellum 4-articulate; callynophore well developed in both sexes; accessory flagellum with 1 article; about as long as peduncle article 1; shorter than flagellum article 1.

Antenna 2 peduncle (articles 3-5) longer than flagellum; flagellum much longer than peduncle article 5; peduncle article 4 shorter than article 5; 7-8 articles in flagellum.

**Mouthparts.** Mouthparts not visible below coxae.

Mandible incisor toothed; right mandible with about as many teeth as left; lacinia mobilis toothed and about as powerful as the incisor.

Maxilla 1 palp 1-articulate; longer than half length of outer plate; apex not reaching apex of outer plate; with 3 long terminal pappose setae; terminal setae shorter than palp, but at least as long as half the length of palp; terminal robust setae lacking; outer plate not as broad as inner plate; distally with 9 robust Maxilla-Setae in a 6/3 arrangement; MS 1-6 weakly cuspidate; MS-C not cuspidate; inner plate with a well developed shoulder; with 15 large pappose setae in one row.

Maxilla 2 gaping and geniculate; outer plate with 10 long apically hooked setae; setae shorter than outer plate; setae on inner plate arranged in 2 rows, one marginal and one submarginal; 14 marginal setae, decreasing in size with the largest closest to outer plate; 21 submarginal pappose setae.

Maxilliped palp 4-articulate; palp article 2 not produced distally; article 2 shorter than article 1; palp article 3 shorter than article 2; the base of palp article 1 much lower than the middle of inner plate; inner plate not reaching palp article 2; distal margin clearly concave; lacking nodular setae; broader than palp article 1; outer plate subovate, inner margin obliquely truncate and slightly concave; not longer than 2 x breadth; inner margin of outer plate lacking robust setae.

Labrum longer than broad; lobes weakly asymmetrical (both lobes present); lacking setae.

Labium with one simple distal finger; finger powerful, apex crenulate.

**Pereopods.** Pereopods 6 & 7 coxae and bases sparsely covered with small setae; coxae 2 & 3 normal, longer than 2 x breadth.

Pereopod 1 coxal plate not deep, ratio depth:breadth less than 1.5; basis straight; propodus length 2.6 x breadth; subovate; with 14 marginal robust setae in one row; dactylus smooth.

Pereopod 2 like pereopod 1; ischium elongate, ratio length:breadth between 1 and 2; distal posterior margin with a group of long plumose setae; propodus length 2.2 x breadth; subovate; propodus in males larger than in females; dactylus smooth.

Pereopods 3-7 with setae and a distinct nail on dactylus.

Pereopod 3 merus, carpus and propodus with 2-8 groups of robust setae on posterior margin;

Pereopod 4 coxa with anterior margin slightly concave; the anterior part of the distal margin straight; posteroventral lobe very large, reaching beyond the base of the 7th pereon segment; max. depth 5.3 x breadth of attachment-line; basis posterior margin with long sim-

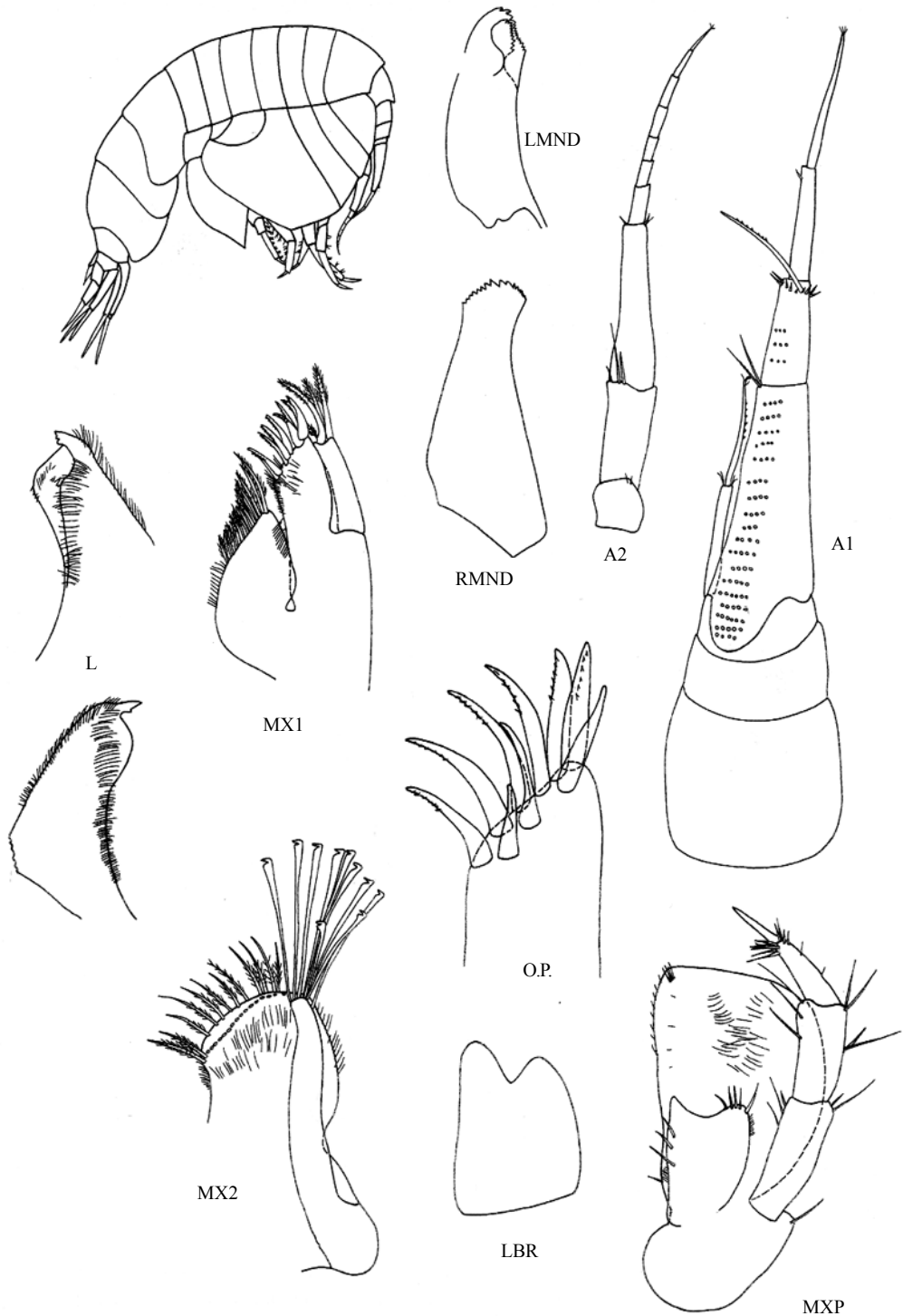


Fig. 1. *Stegocephalooides auratus*. Male A, BIOICE 2410. O.P.: Outer plate of maxilla 1.

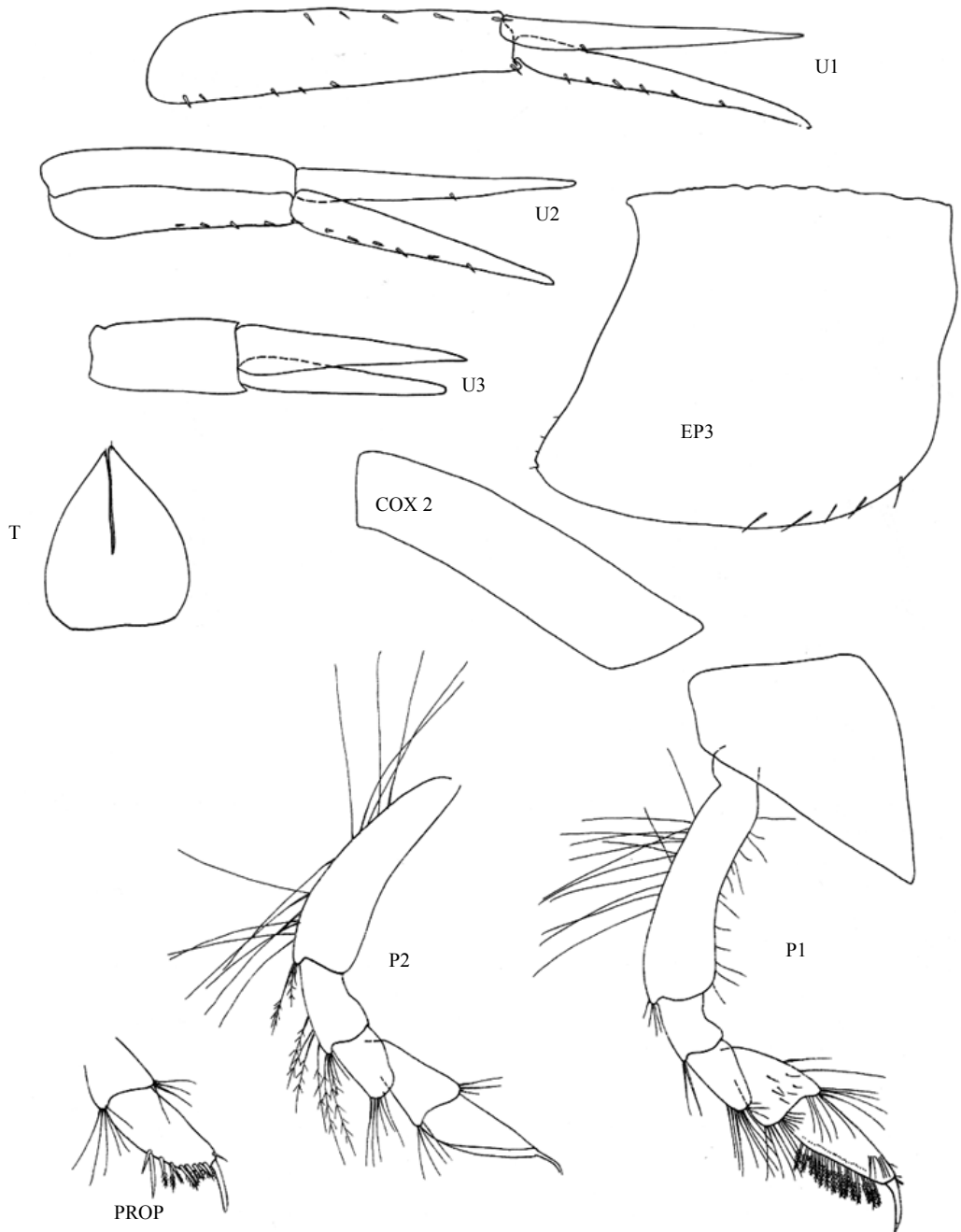


Fig. 2. *Stegocephaloidea auratus*. Male A, BIOICE 2410. PROP: Propodus and dactylus, Male A, BIOFAR 267.

EXPLANATIONS TO THE FIGURES

Symbols: A1: Antenna 1; A2: Antenna 2; MX1: Maxilla 1; MX2: Maxilla 2; MXP: Maxilliped; L: Labium; LMND: Left mandible; RMND: Right mandible; LBR: Labrum; P1: Pereopod 1; P2: Pereopod 2; P3: Pereopod 3; P4: Pereopod 4; P5: Pereopod 5; P6: Pereopod 6; P7: Pereopod 7; Cox: Coxa; U1: Uropod 1; U2: Uropod 2; U3: Uropod 3; EP3: Epimeral plate 3; T: Telson.

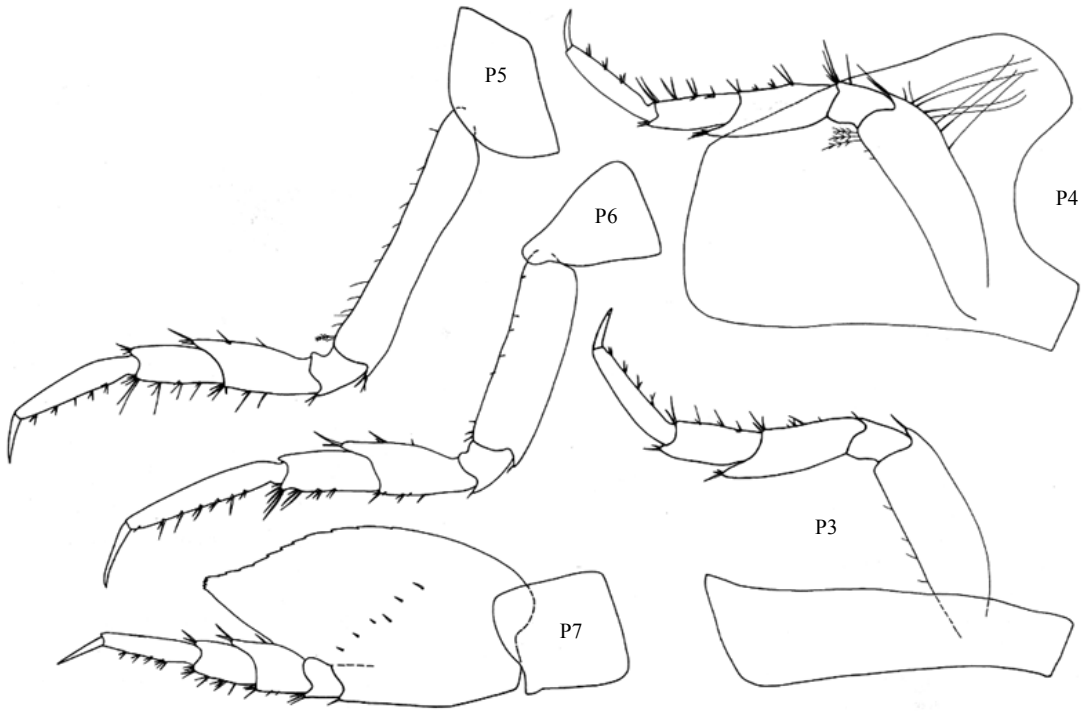


Fig. 3. *Stegocephaloides auratus*. Male A, BIOICE 2410.

ple setae; lower anterior margin with group of plumose setae; ischium distal posterior margin lacking plumose setae; merus, carpus and propodus posterior margins with 2-8 groups of robust setae.

Pereopod 5 merus, carpus and propodus anterior margins with 2-8 groups of robust setae.

Pereopod 6, basis unexpanded; merus subequal to carpus; posterior lobe not reaching the middle of carpus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus between  $3/2$  and  $2 \times$  length of carpus.

Pereopod 7 small, only about  $2/3$  of pereopod 6; basis acute and pointed distally with the posterior margin serrate; reaching at least to end of carpus; merus subequal to carpus; posterior lobe not reaching beyond middle of carpus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus long, but not more than  $2 \times$  length of carpus; dactylus long, length between  $1/2$  and  $2/3$  length of propodus.

Oostegites on pereopods 2 to 5. Gills on pereopods 2 to 7.

**Pleonites and urosomites.** Pleonites 1-3 dorsally smooth; epimeral plate 3 with 1-3 small serrations at posteroventral angle; the posteroventral angle

weakly produced into a rounded lobe; epimeral plates covered with scattered small setae.

Urosomites dorsally smooth and not fused.

Uropods 1-3 unequal in size, uropod 1 longest and uropod 3 shortest.

Uropod 1 peduncle longer than rami.

Uropod 2 peduncle shorter than rami.

Uropod 3 peduncle shorter than rami; outer ramus 1-articulate; rami subequal; rami without robust setae.

**Telson.** Telson longer than broad, but shorter than  $1.5 \times$  breadth; pointed, cleft between  $1/2$  and  $2/3$  of total length; with one submarginal seta near apex of each lobe.

**Biology.** Unknown, but MOORE & RAINBOW (1983) found ferritin crystals in the gut caeca. Considering that the mouthparts of this species closely resemble those of *S. christianiensis*, this may indicate a similar feeding biology as *S. christianiensis*.

The samples from the BIOFAR and the BIOICE programmes indicate that this species is restricted to relatively warm waters. The temperature range of samples in which this species was captured was  $3.0$  to  $8.1^\circ\text{C}$  (depths 156m to 1074m) (BERGE & VADER 1997a).

**Variables.** Sars (1891) drew the peduncle of uropods 2 & 3 longer (Ur. 2 ped. > rami, Ur. 3 ped = rami) than indicated below. The posteroventral angle of epimeral plate 3 is much more produced and acute in some specimens than indicated in Fig. 2 below.

**Remarks.** Although this species was named as early as 1883, the mouthparts have never been described. Sars (1891) did, however, state 'oral parts scarcely differing essentially from those in *Stegocephalus*' (Sars 1891:201).

This species is easily recognized by the very deep and acute basis of pereopod 7, separating it from all other *Stegocephaloidea* species, except *S. attingens*. The latter species, however, is recognized by the mouthparts being visible below coxae 1-4, and by the distal margin of coxa 4 not forming a straight line. Compared with the North Atlantic species, *S. auratus* has a very characteristic colour in life (see above), and adult specimens are also somewhat smaller than in other species in the genus. The mouthparts resemble those of *S. christianiensis*.

*Stegocephaloidea barnardi*, sp. nov. (Figs 4-8)

? *Stegocephaloidea christianiensis* J.L. BARNARD, 1964, p. 13, fig. 10.

**Holotype.** Female B, BIOICE 2697, length 5 mm, Stn 0726, 2 Sept 1994, 64°10.20'N 27°43.10'W, 1042 m, 4.2 °C, RP-sledge.

**Type locality.** Iceland Basin, south-west of Iceland 64°10.20'N 27°43.10'W, 1042m.

**Material examined** BIOICE 2697: 7 specimens, Stn 0726, 2 Sept 1994, 64°10.20'N 27°43.10'W, 1042 m, 4.2 °C, RP-sledge; BIOICE 2701: 2 specimens, Stn 0727, 2 Sept 1994, 64°05.50'N 27°49.70'W, 1121 m, 3.8 °C, RP-sledge; BIOICE 2704: 4 specimens, Stn 0728, 2 Sept 1994, 63°50.50'N 27°42.80'W, 1295 m, 3.8 °C, RP-sledge; BIOICE 2707: 1 specimen, Stn 0729, 3 Sept 1994, 63°55.30'N 28°16.80'W, 1407 m, 3.7 °C, RP-sledge; Additional 57 specimens from 7 BIOICE stations.

**Diagnosis.** Antenna 1 flagellum article 1 shorter than half length of flagellum; labrum with lobes only weakly asymmetrical; labium with one simple distal finger, pointed and distally acute; maxilla 1 palp 1-articulate, MS in a 5/3 arrangement; maxilla 2 gaping and geniculate, inner plate with 3 rows of pappose setae; pereopod 7 with basis not pointed and acute distally; epimeral plate 3 without serrations; uropod 3 outer ramus 1-articulate.

**General distribution.** Known from the Iceland Basin, at depths ranging from 1042 to 1407 m, and possibly from the East Mediterranean (BARNARD 1964).

**Head and Body.** Length of males 4 mm, females 6 mm. Rostrum very small. Colour in life unknown.

**Antennae.** Antenna 1 shorter than antenna 2; antenna 1 peduncle article 2 shorter than half length of article 1; peduncle longer than flagellum article 1; article 1 more than 2 x length of article 2, not equal to half of the entire flagellum; flagellum 6-articulate; calyphophore well developed in both sexes; accessory flagellum 1-articulate; length 4.9 x breadth; about as long as peduncle article 1; longer than flagellum article 1.

Antenna 2 peduncle (articles 3-5) longer than flagellum; flagellum much longer than peduncle article 5; peduncle article 4 (scarcely) shorter than article 5; 8-11 articles in flagellum.

**Mouthparts.** Mouthparts not visible below coxae.

Mandible incisor toothed; the right mandible with about as many teeth as the left; lacinia mobilis toothed and about as powerful as the incisor.

Maxilla 1 palp 1-articulate; medium-sized, subequal to half length of outer plate; apex not reaching outer plate distal margin; with 3 long terminal pappose setae; terminal setae shorter than palp, but at least as long as half length of the palp; outer plate not as broad as inner; with 8 robust Maxilla-Setae in a 5/3 arrangement distally; MS 1-5 weakly cuspidate; MS A-B cuspidate, MS C not cuspidate; inner plate with a well developed shoulder; with 17 large pappose setae in one row.

Maxilla 2 gaping and geniculate; outer plate with 8 long apically hooked setae; setae shorter than outer plate; inner plate distal setae in 3 rows, one marginal and two submarginal; 12-14 marginal setae and about 28-30 submarginal pappose setae.

Maxilliped palp 4-articulate; palp article 2 not produced distally; article 2 longer than article 1; palp article 3 shorter than article 2; the base of palp article 1 at about the middle of inner plate; inner plate not reaching palp article 2; distal margin concave; lacking nodular setae; broader than palp article 1; outer plate subovate, inner margin obliquely truncate and slightly concave; not longer than 2 x breadth; inner margin of outer plate lacking robust setae.

Labrum about as long as broad; lobes weakly asymmetrical (both lobes present); lacking setae.

Labium with one simple distal finger; apex of finger pointed and acute.

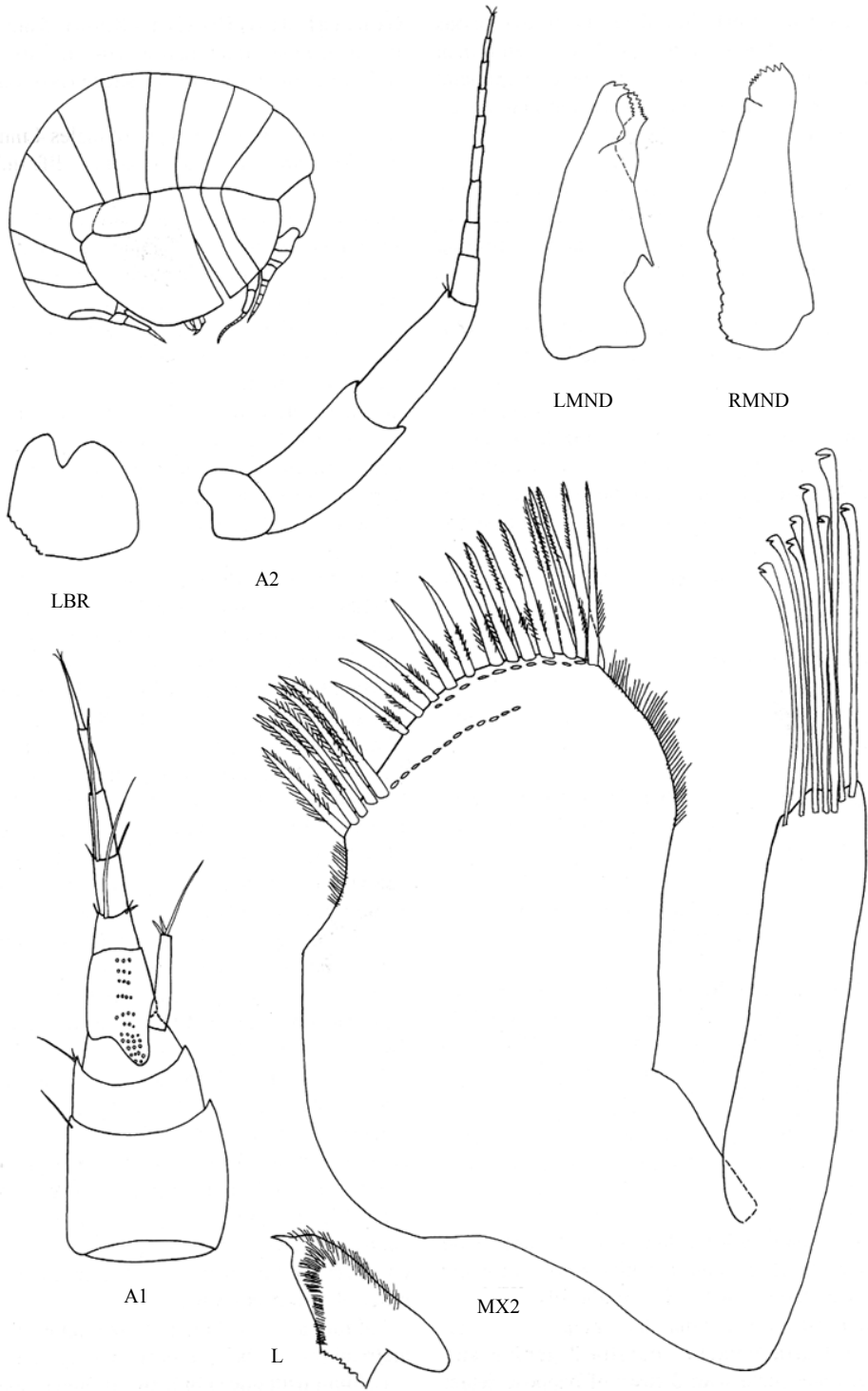


Fig. 4. *Stegocephalooides barnardi* sp. nov. Holotype.



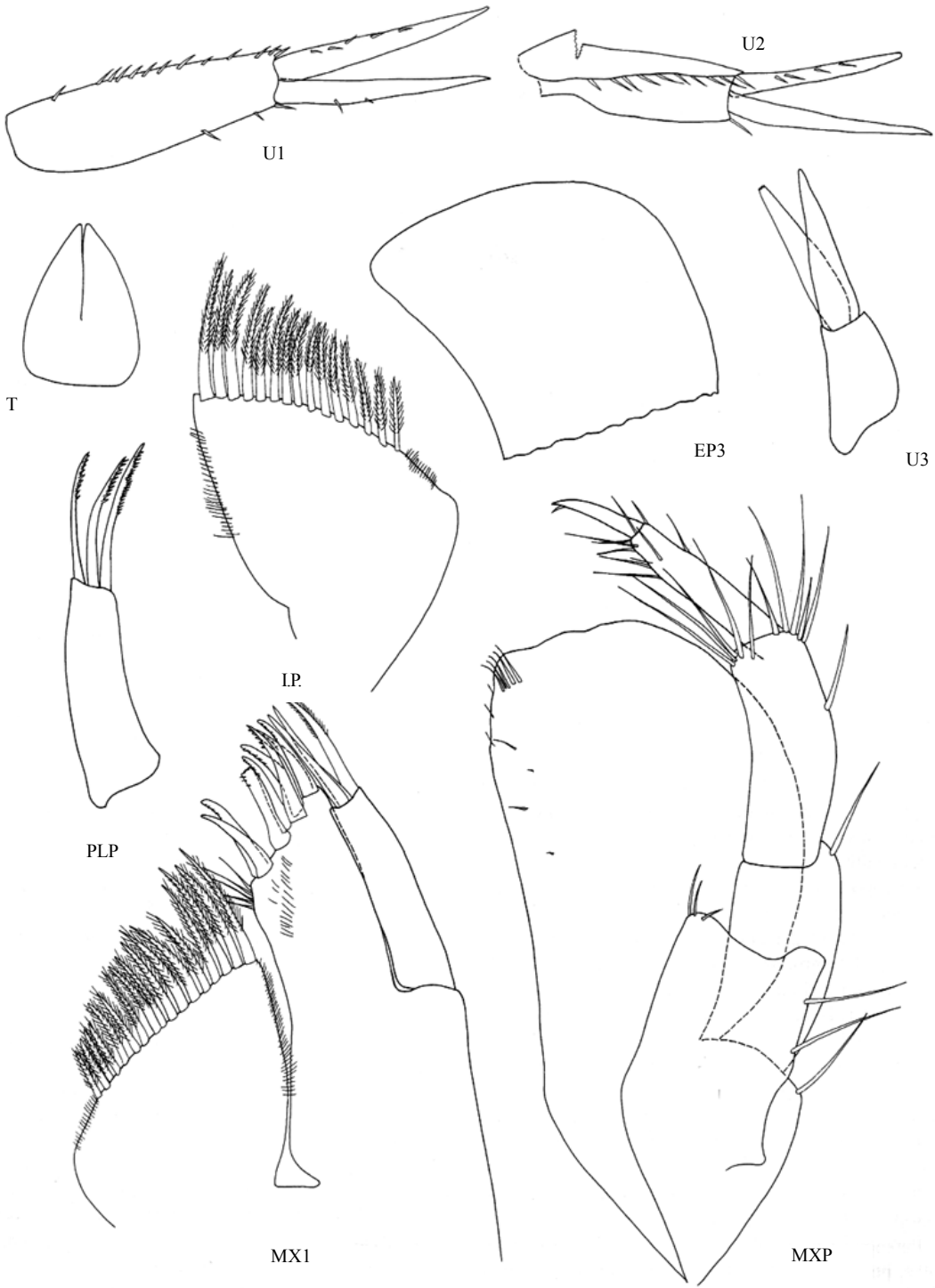


Fig. 5. *Stegocephaloidea barnardi* sp. nov. Holotype. PLP: Palp of maxilla 1; I.P.: Inner plate of maxilla 1.

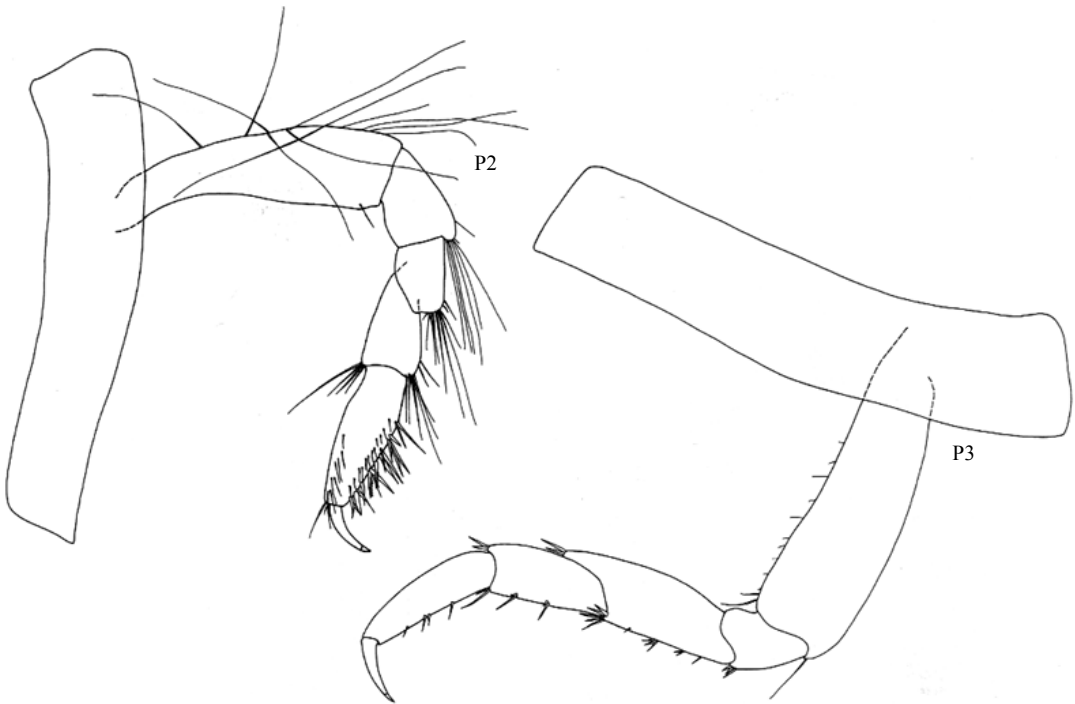


Fig. 6. *Stegocephaloides barnardi* sp. nov. Holotype.

**Pereopods.** Pereopods 6 & 7 coxae and bases covered with small setae; coxae 2 & 3 normal, longer than 2 x breadth.

Pereopod 1 coxal plate not deep, ratio depth:breadth less than 1.5; basis with anterior margin not straight; propodus length 2.4 x breadth; subovate; posterior margin with 8-10 groups of robust setae; dactylus smooth.

Pereopod 2 thinner, but not especially longer than pereopod 1; ischium elongate, ratio length:breadth between 1 and 2; distal posterior margin lacking plumose setae; propodus length 2.9 x breadth; subovate; propodus in males larger than in females; posterior margin with 8 groups of robust setae; dactylus smooth.

Pereopods 3-7 with setae and a distinct nail on dactylus.

Pereopod 3 merus, carpus and propodus posterior margins with 2-8 groups of robust setae.

Pereopod 4 coxa with the anterior margin slightly concave; posteroventral lobe very large, reaching beyond the base of the 7th pereon segment; max. depth 4.6 x breadth of attachment-line; basis posterior margin with long setae; distal anterior margin with group of plumose

setae; ischium lower posterior margin with a group of plumose setae; merus, carpus and propodus posterior margins with 2-8 groups of robust setae.

Pereopod 5 merus, carpus and propodus anterior margins with 2-8 groups of robust setae.

Pereopod 6 basis slightly expanded; subrectangular, with the posteriodistal angle almost 90°; the expansion smooth; merus longer than carpus; posterior lobe not reaching middle of carpus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus between 1 and 3/2 x length of carpus.

Pereopod 7 small, only about 2/3 of pereopod 6; basis rounded distally with the posterior margin serrate; not reaching beyond end of merus; merus shorter than carpus; the posterior lobe reaching about to the middle of carpus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus short, not more than 50 % longer than carpus; dactylus long, between 1/2 and 2/3 the length of propodus.

Oostegites on pereopods 2 to 5. Gills on pereopods 2 to 7.

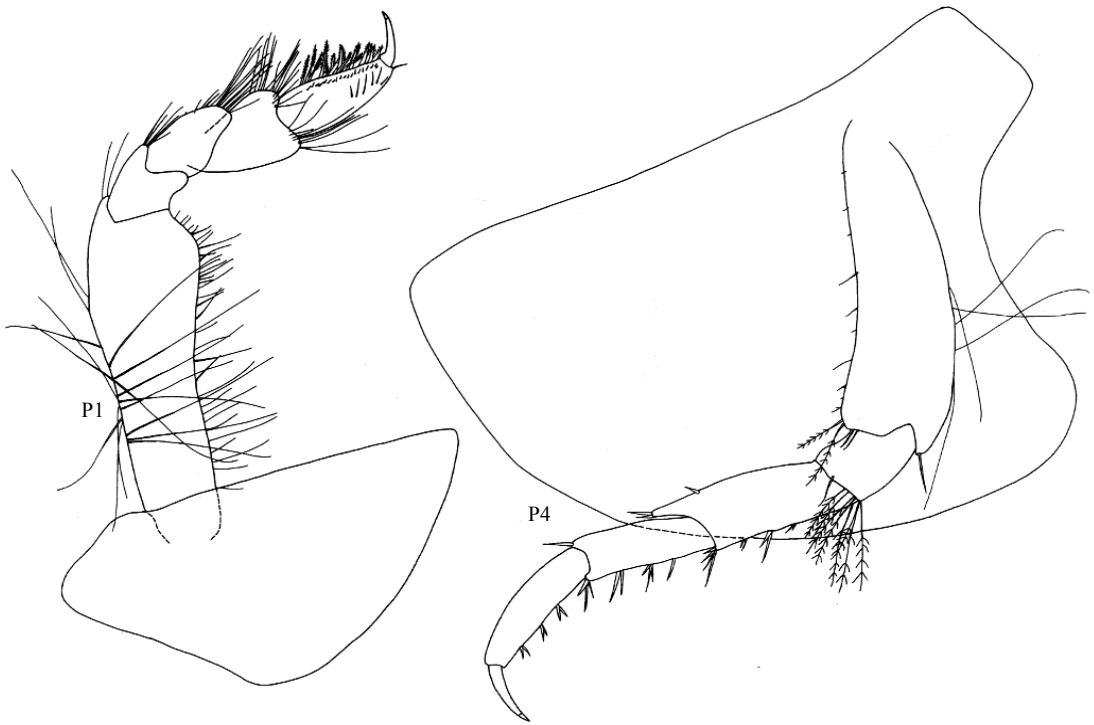


Fig. 7. *Stegocephaloidea barnardi* sp. nov. Holotype.

**Pleonites and urosomites.** Pleonites 1-3 dorsally smooth; epimeral plate 3 without serrations; the posteroventral angle produced into a rounded lobe; epimeral plates covered with small setae.

Urosomites dorsally smooth and not fused.

Uropods 1-3 unequal in size, uropod 1 longest and uropod 3 shortest.

Uropod 1 peduncle longer than rami.

Uropod 2 peduncle about equal to rami.

Uropod 3 peduncle shorter than rami; outer ramus 1-articulate; rami subequal; without robust setae.

**Telson.** Telson longer than broad, but shorter than 1.5 x breadth; pointed, cleft between 1/2 and 2/3 of total length.

**Biology.** Unknown.

**Etymology.** This species is named after the late Dr J.L. Barnard who identified (BARNARD 1964) specimens from the East Mediterranean as *S. christianiensis*. Both his figures and description, however, indicate that his material in reality was *S. barnardi*.

**Remarks.** The absence of both a 2-articulated outer ramus of uropod 3 and a basis of pereopod 7 with distal part pointed and acute, separate this species from *S. camoti* and *S. attingens*. *Stegocephaloidea australis* is easily separated by the absence of apically hooked setae on maxilla 2, the extremely asymmetrical lobes of labrum and the broad labium (similar to the form commonly found in the group of genera possessing an ordinary maxilla 2, e.g. *Andaniexis* STEBBING).

The Antarctic species *S. vanhoeffeni* possesses a strongly serrate epimeral plate 3 which is greatly produced distally, and is thus separated from this new species. *S. barnardi* has closest affinities to the other North Atlantic species of the genus, but is separated from these first of all by the shape of the first antenna: article 1 of the flagellum is short, not longer than peduncle article 1, and the flagellum consists of more than five articles. The accessory flagellum is clearly longer than flagellum article 1.

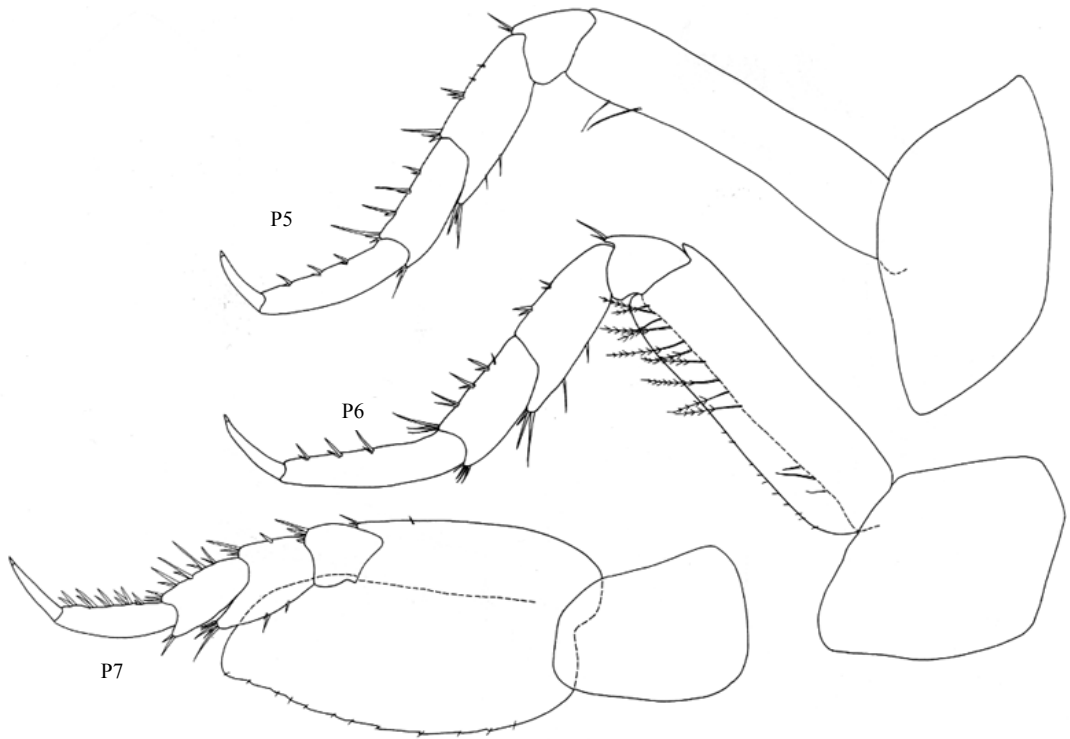


Fig. 8. *Stegocephaloides barnardi* sp. nov. Holotype.

*Stegocephaloides christianiensis* (BOECK, 1871)  
(Figs 9-11)

*Stegocephalus christianiensis* BOECK, 1871, p. 424-426,  
pl. 8, fig. 4; pl. 9, fig. 1

*Stegocephaloides christianiensis* SARS, 1891, p. 202, pl.  
70, fig. 2

*S. christianiensis* CHEVEREUX & FAGE, 1925, p. 74, figs  
64-65

*S. christianiensis* GURJANOVA, 1951, p. 300, fig. 165

*S. christianiensis* KARAMAN, 1974, p. 55-63, figs 1-5

*S. christianiensis* LINCOLN, 1979, p. 138, fig. 60

*S. christianiensis* RUFFO, 1993, p. 689-691, figs 472-473

Type locality. Christianiafjorden (= Oslofjorden)  
and Haugesund, here restricted to Oslofjorden.

Material examined. TM 9934: 9 specimens,  
Millport, Scotland, Feb. 1995, 80 m, collected by Prof.  
P.G. Moore; 5 specimens from the Zoologisches Institut  
und Zoologisches Museum der Universität Hamburg  
(catalogue number unknown): 3 females, 2 males,  
Trondheimsfjorden (Norway); 15 specimens from  
Gullmarfjorden, Western Sweden, collected by Dr L. Buhl-  
Mortensen.

Diagnosis. Antenna 1 flagellum article 1 shorter than  
half length of flagellum; labrum with lobes strongly asym-  
metrical; labium with one simple, apically crenulate  
distal finger; maxilla 1 palp 1-articulate, MS in a 8/4  
arrangement; maxilla 2 gaping and geniculate, inner plate  
with 2 rows of pappose setae, both apparently marginal;  
pereopod 7 basis with posteriodistal angle not pointed  
and acute; epimeral plate 3 with only 1-3 small serrations  
on the posterodistal angle; outer ramus of uropod  
3 1-articulate.

General distribution. Known from the western  
Mediterranean and the Atlantic Ocean north to  
Trondheimsfjorden, Norway.

Head and Body. Length of females up to 8 mm,  
males 5 mm; rostrum very small; 'dark greenish brown  
colour' (SARS 1891:202), and with the pigment arranged  
in a regular manner (SARS 1891).

Antennae. Antenna 1 equal to antenna 2; antenna 1  
peduncle article 2 about half length of article 1; article 1  
of flagellum  $> 2 \times$  length of article 2, but not equal to half  
entire flagellum; flagellum 3 to 4-articulate; accessory

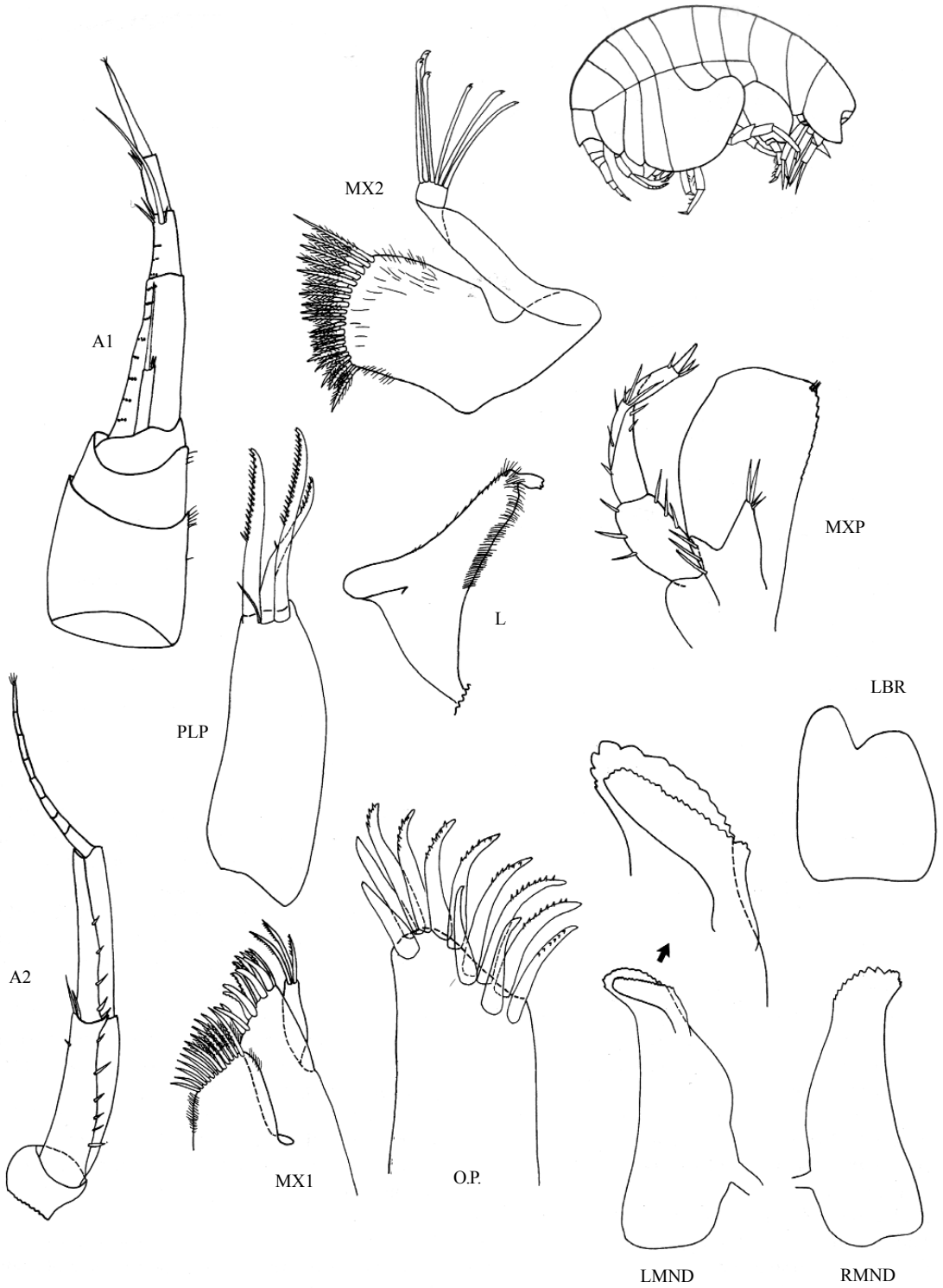


Fig. 9. *Stegocephaloidea christianiensis*. Female A, TM 9934. Habitus: Female B, TM 9934; PLP: Palp of maxilla 1.

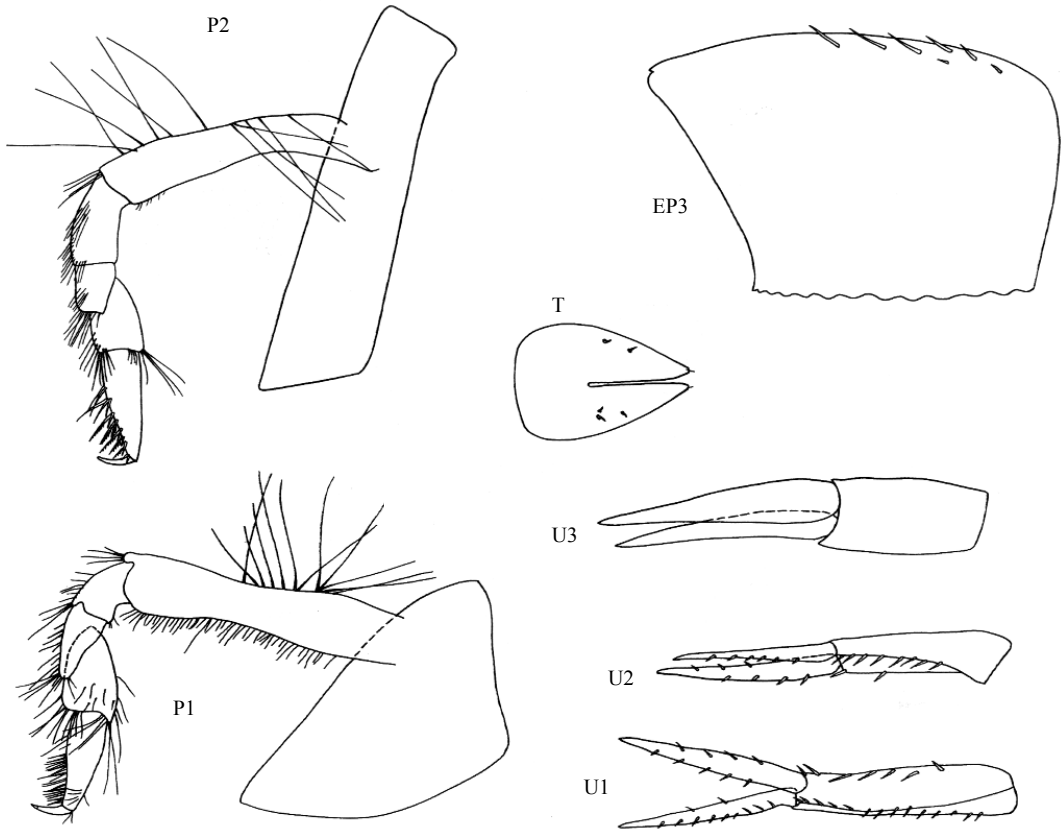


Fig. 10. *Stegocephalooides christianiensis*. Female A, TM 9934.

flagellum 1-articulate; length 3 x breadth; shorter than peduncle article 1; shorter than flagellum article 1.

Antenna 2 peduncle ( articles 3-5 ) longer than flagellum; flagellum much longer than peduncle article 5; peduncle article 4 equal to article 5; 6-8 articles in flagellum.

**Mouth parts.** Mouthparts partly visible below coxae.

Mandible incisor toothed; the right mandible with about as many teeth as the left; lacinia mobilis toothed and about as powerful as the incisor.

Maxilla 1 palp 1-articulate; larger than half the length of outer plate; apex reaching about to the apex of outer plate; with 3 long terminal pappose setae; terminal setae shorter than the palp, but at least as long as half the length of the palp; terminal robust setae lacking; outer plate about as broad as inner; distally with 12 robust Maxilla-Setae in a 8/4 arrangement; MS 1 not cuspidate, MS 2-8 strongly cuspidate; MS A - C not cuspidate, MS D weakly cuspidate; inner plate without a shoulder; with 12-14 large pappose setae in one row.

Maxilla 2 gaping and geniculate; with 8-10 long

apically hooked setae on outer plate; setae shorter than outer plate; setae on inner plate arranged in 2 rows, both apparently marginal (only one is figured); with 30-36 large pappose setae on inner plate.

Maxilliped palp 4-articulate; palp article 2 not produced distally; article 2 about as long as article 1; article 3 shorter than article 2; inner plate not reaching palp article 2; distal margin concave; lacking nodular setae; broader than palp article 1; outer plate subovate, inner margin obliquely truncate and straight; not longer than 2 x breadth; outer plate inner margin lacking robust setae, but with teeth distally.

Labrum about as long as broad; lobes strongly asymmetrical; lacking setae.

Labium with one simple distal finger; finger powerful, apex crenulate.

**Pereopods.** Pereopods 6 & 7 coxae and bases covered with small setae (see pereopod 3, plate 11); coxae 2 & 3 normal, longer than 2 x breadth.

Pereopod 1 coxal plate deep, between 1.5 and 2 times deeper than broad; basis with anterior margin not

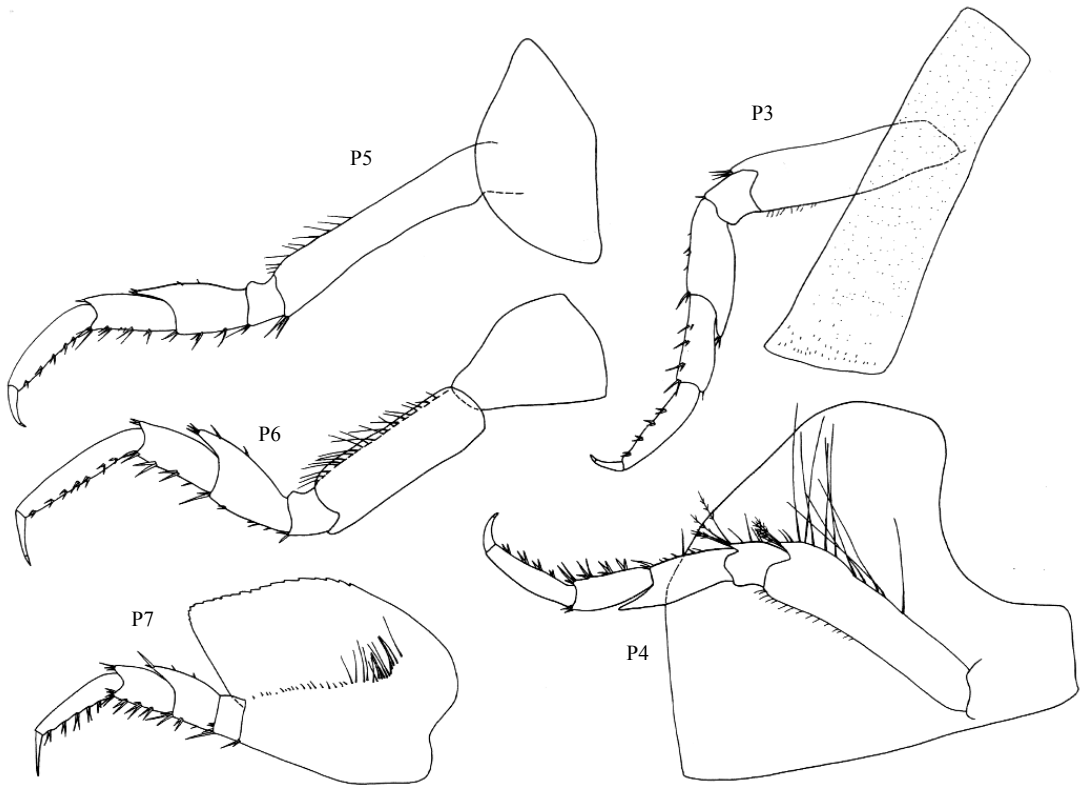


Fig. 11. *Stegocephaloidea christianiensis*. Female A, TM 9934.

straight; propodus length 3.7 x breadth; subovate; posterior margin with 9-10 groups of robust setae; dactylus smooth.

Pereopod 2 like pereopod 1; ischium elongate, ratio length:breadth between 1 and 2; distal posterior margin with a group of long plumose setae (not shown on the figure); propodus length 2.9 x breadth; subovate; posterior margin with 7-9 groups of robust setae; dactylus smooth.

Pereopods 3 - 7 with setae and a distinct nail on dactylus.

Pereopod 3 merus, carpus and propodus posterior margin with 2-8 groups of robust setae.

Pereopod 4 coxa anterior margin straight; the anterior part of the ventral margin forming a straight line; posteroventral lobe large, reaching about the base of the 7th pereon segment; max. depth 4 x breadth of attachment-line; basis posterior margin with long setae; anterior margin with a group of plumose setae distally; ischium posterior margin with a group of plumose setae distally; merus, carpus and propodus posterior margins with 2-8 groups of robust setae;

Pereopod 5 merus, carpus and propodus anterior margins with 2-8 groups of robust setae.

Pereopod 6 basis weakly expanded; merus shorter than carpus; posterior lobe not reaching middle of carpus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus between 3/2 and 2 x length of carpus.

Pereopod 7 smaller than pereopod 6, but larger than 2/3 of pereopod 6; basis rounded distally with the posterior margin serrate; not reaching beyond end of merus; merus shorter than carpus; the posterior lobe not reaching beyond the middle of carpus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus long, but not more than 2 x length of carpus; dactylus between 1/2 and 2/3 length of propodus.

Oostegites on pereopods 2 to 5. Gills on pereopods 2 to 7.

**Pleonites and urosomites.** Pleonites 1-3 dorsally smooth; epimeral plate 3 posteroventral angle with 1-3 serrations; the posteroventral part produced into a rounded lobe; epimeral plates covered with small setae (example on coxa pereopod 3; Fig. 11).

Urosomites dorsally smooth and not fused.

Uropods 1-3 unequal in size, uropod 1 longest and uropod 3 shortest.

Uropod 1 peduncle longer than rami.

Uropod 2 peduncle about equal to rami.

Uropod 3 peduncle shorter than rami; outer ramus 1-articulate; rami subequal; lacking robust setae.

**Telson.** Telson longer than broad, longer than 1.5 x breadth; pointed, cleft between 1/2 and 2/3 of total length; with one submarginal seta on apex of each lobe.

**Biology.** MOORE (1979) and MOORE & RAINBOW (1983) found ferritin crystals in the gut caeca, and remains of cnidarian nematocysts in the stomach of this species. Together with behavioural observations, they suggested that *S. christianiensis* feeds on *Pennatula phosphorea*. POWELL & MOORE (1991) reported continuous breeding for this species in western Scotland.

**Remarks.** Very similar to *S. wagini*, but adult specimens are much smaller (*christianiensis* up to 7mm, *S. wagini* up to 16mm). See also remarks under *S. wagini*. Differs from the other species of this genus in the same way as *S. wagini*.

*Stegocephaloides wagini* (GURJANOVA, 1936) (Figs 12-15)

*Stegocephalopsis wagini* GURJANOVA, 1936, p. 145-147, fig. 1

*Stegocephalopsis wagini* GURJANOVA, 1951, p. 294-295, fig. 159

*Stegocephaloides wagini* BARNARD & KARAMAN, 1991, p. 681

**Type locality.** 80°18'N 73°20'E, 285 m ('*Sedow*' expedition, 1934, Stn 28)

**Material examined.** Paratypes (2 specimens), from the '*Sedow*' expedition Stn 28, 80°18'N 73°20'E, 280 m.

BIOFAR material: BIOFAR 113: 2 specimens, 25 July 1987, 61°39.08'N 8°48.13'W, 872 m, RP-sledge, 0.0 °C (estimated bottom temp.); Additional 112 specimens from 9 BIOFAR stations.

BIOICE material: BIOICE 2367: 26 specimens, Stn 0023, 8 May 1993, 64°38.00'N 9°43.00'W, 719 m, RP-sledge; Additional 33 specimens from 5 BIOICE stations.

**Diagnosis.** Antenna 1 flagellum article 1 equal to half the length of flagellum; labrum with lobes only weakly asymmetrical; labium with one simple distal finger, pointed but not acute; maxilla 1 palp 2-articulate, MS in a 6/3 arrangement; maxilla 2 gaping and geniculate, inner plate with 3 rows of pappose setae; pereopod 7 basis with not pointed and acute distally; epimeral plate 3 lacking serrations; uropod 3 outer ramus 1-articulated.

**General distribution.** known from the Kara Sea, Iceland and the Faroes.

**Head and Body.** Length of females 8-16mm, males 6mm; rostrum very small; colour in life unknown.

**Antennae.** Antenna 1 longer than antenna 2; antenna 1 peduncle article 2 more than half length of article 1; peduncle shorter than flagellum article 1; article 1 of flagellum equal to half entire flagellum; flagellum 4-articulate; calyptophore well developed in both sexes; accessory flagellum 1-articulate; length 4-4.5 x breadth; shorter than peduncle article 1; shorter than flagellum article 1.

Antenna 2 peduncle ( articles 3-5 ) longer than flagellum; flagellum about as long as peduncle article 5; peduncle article 4 equal to, or longer than, article 5; 4-6 articles in flagellum.

**Mouthparts.** Mouthparts not visible below coxae.

Mandible incisor toothed; the right mandible with about as many teeth as the left; lacinia mobilis toothed and about as powerful as the incisor.

Maxilla 1 palp 2-articulate; larger than half length of outer plate; apex reaching about to distal margin of outer plate; with 3 long terminal pappose setae; terminal setae shorter than palp, but at least as long as half length of palp; terminal robust setae lacking; outer plate not as broad as inner; distally with 9 robust Maxilla-Setae in a 6/3 arrangement; MS 1-6 strongly cuspidate; MS A-C cuspidate; inner plate with a well developed shoulder; with 22 large pappose setae in one row.

Maxilla 2 gaping and geniculate; with 9 long apically hooked setae on outer plate; setae shorter than outer plate; setae on inner plate arranged in 3 rows, one marginal and two submarginal; 20 marginal setae and about 35 submarginal pappose setae on inner plate.

Maxilliped palp 4-articulate; palp article 2 weakly produced distally on inner margin; article 2 shorter than article 1; length of palp article 3 about equal to length of article 2; the base of palp article 1 much lower than the middle of inner plate; inner plate not reaching above the middle of palp article 2; distomedial angle produced; with 2 nodular setae; about as broad as palp article 1; outer plate subovate, inner margin obliquely truncate and straight; not longer than 2 x breadth; outer plate inner margin with slender robust setae proximally.

Labrum about as long as broad; lobes weakly asymmetrical; lacking setae.

Labium with one simple distal finger; apex of finger pointed, but not acute.



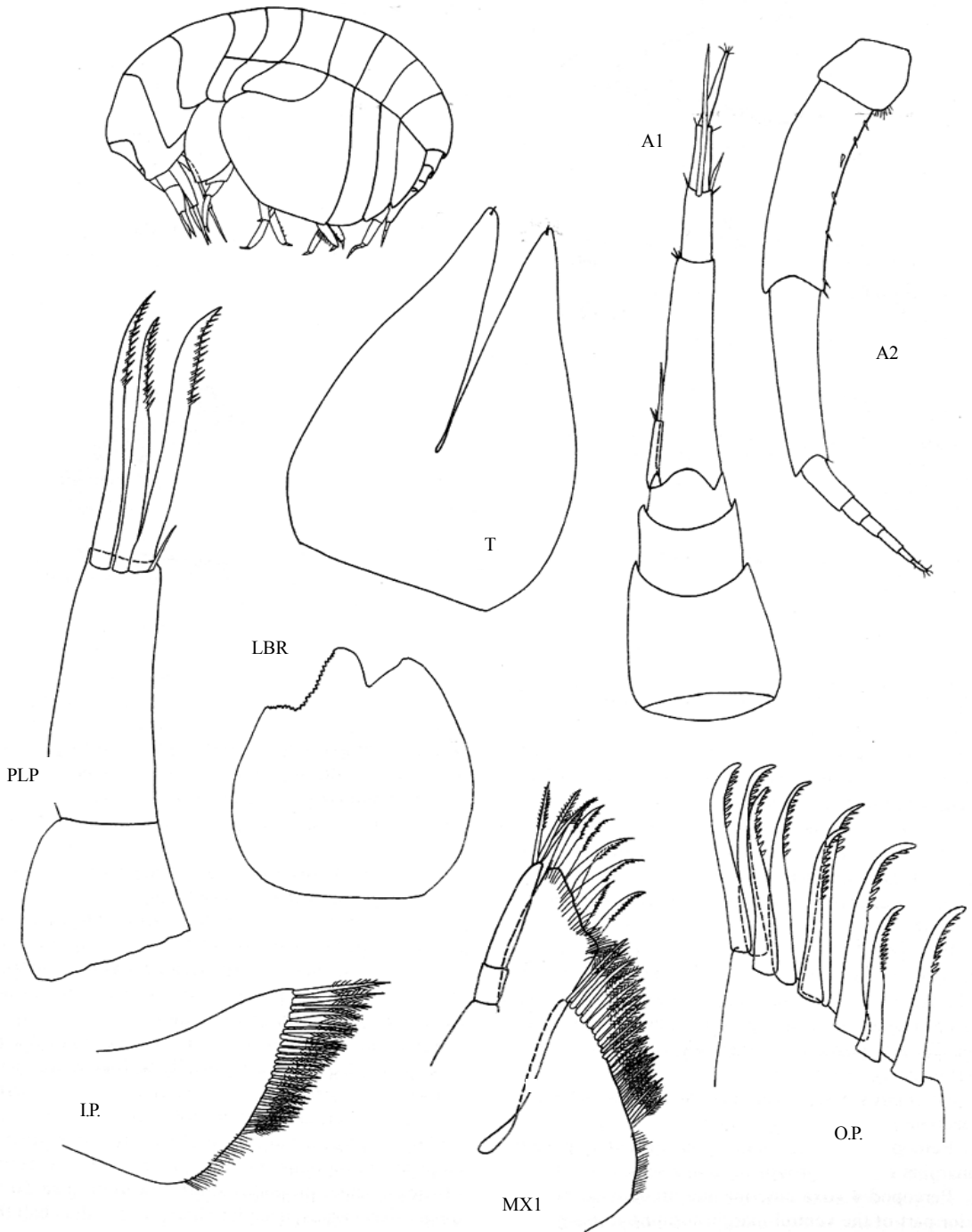


Fig. 12. *Stegocephaloidea wagini*. Female A, BIOICE 2367.

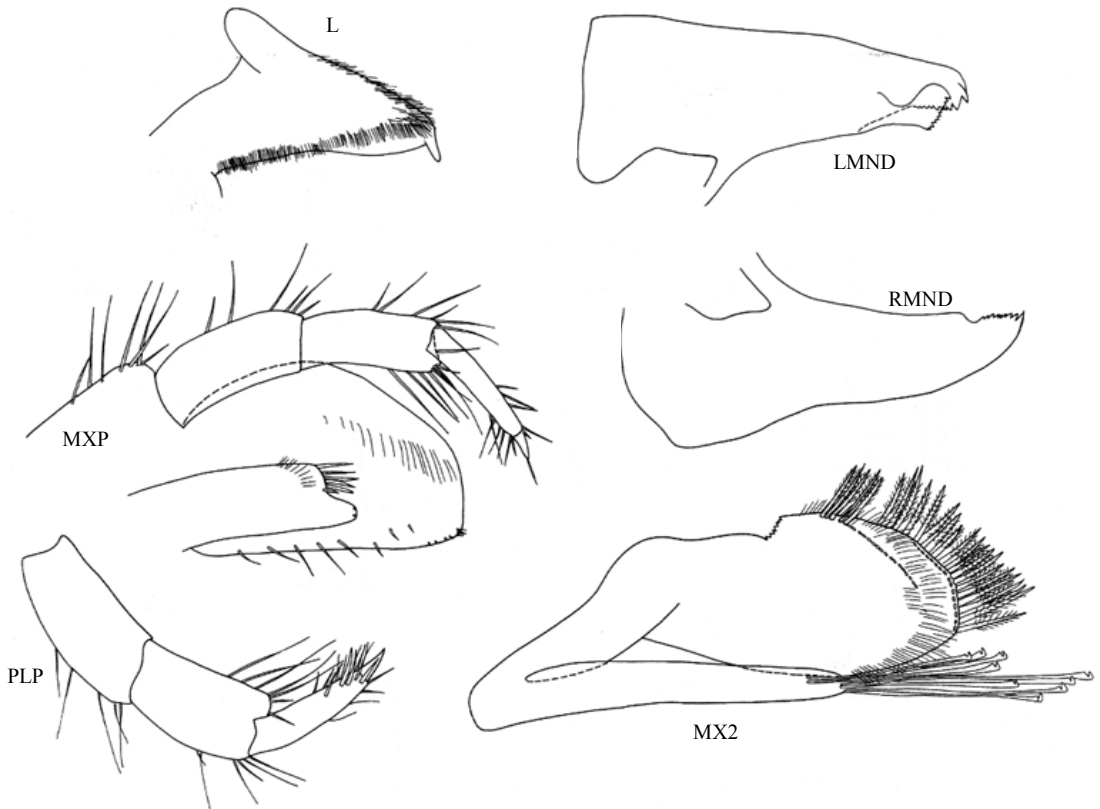


Fig. 13. *Stegocephalooides wagini*. Female A, BIOICE 2367.

**Pereopods.** Pereopods 6 & 7 coxae and bases on covered with small and ordinary setae; coxae 2 & 3 normal, longer than 2 x breadth.

Pereopod 1 coxal plate deep, between 1.5 and 2 times deeper than broad; basis with anterior margin not straight; propodus length 2.4 x breadth; subovate; posterior margin with 10 groups of robust setae; dactylus smooth.

Pereopod 2 like pereopod 1; ischium elongate, ratio length : breadth between 1 and 2; distal posterior margin with a group of long plumose setae; propodus length 3.1 x breadth; subovate; propodus larger in males than in females; posterior margin with 9 groups of robust setae; dactylus smooth.

Pereopods 3 - 7 with setae and a distinct nail on dactylus.

Pereopod 3 merus, carpus and propodus posterior margins with 2-8 groups of robust setae.

Pereopod 4 coxa anterior margin convex; the anterior part of the ventral margin forming a straight line; posteroventral lobe very large, reaching beyond the base of the 7th pereon segment; max. depth 4.5 x breadth of attachment-line; basis anterior and posterior margins

with long simple setae; anterior margin with group of plumose setae distally; ischium posterior margin with a group of plumose setae distally; merus, carpus and propodus posterior margins with 2-8 groups of robust setae.

Pereopod 5 merus, carpus and propodus anterior margins with 2-8 groups of robust setae.

Pereopod 6 basis unexpanded; merus about equal in length to carpus; posterior lobe not reaching the middle of carpus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus between 1 and 3/2 x length of carpus.

Pereopod 7 smaller but clearly larger than 2/3 of pereopod 6; basis rounded distally with posterior margin serrate; not reaching beyond end of merus; merus shorter than carpus; posterior lobe reaches beyond the middle of carpus, but not reaching propodus; merus, carpus and propodus anterior margins with 2-8 groups of robust setae; propodus short, not more than 50 % longer than carpus; dactylus short, shorter than half the length of propodus.

Oostegites on pereopods 2 to 5. Gills on pereopods 2 to 7.

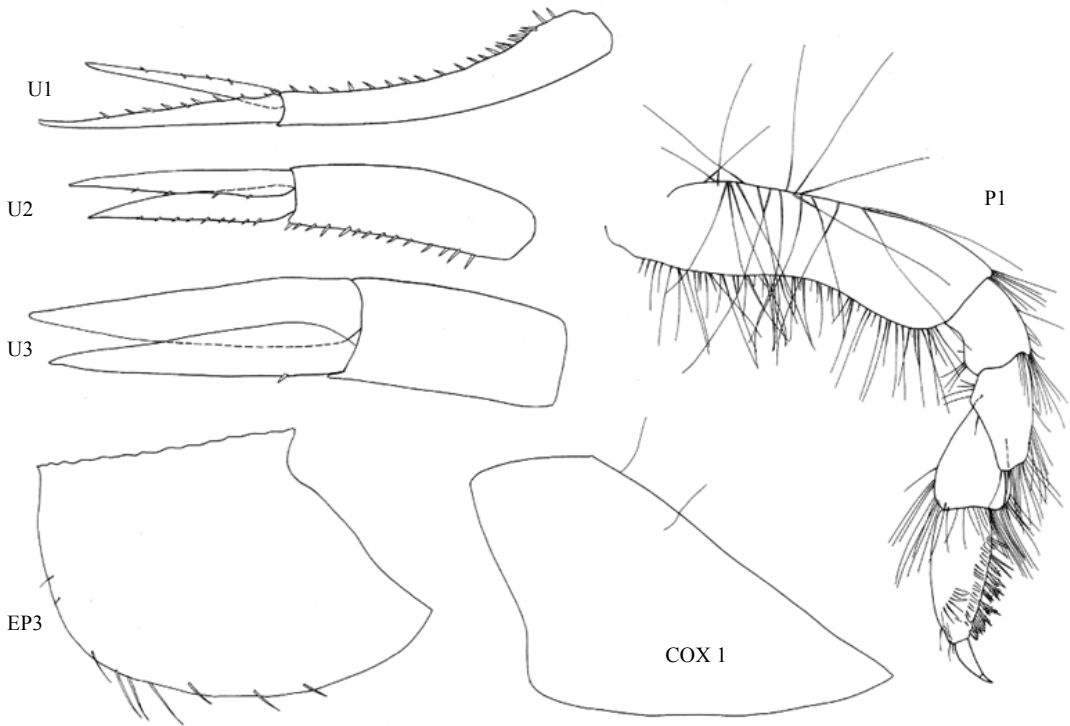


Fig. 14. *Stegocephaloidea wagini*. Female A, BIOICE 2367.

**Pleonites and urosomites.** Pleonites 1-3 dorsally smooth; epimeral plate 3 without serrations; the posteroventral angle produced into a pointed lobe; epimeral plates covered with both small and ordinary setae.

Urosomites dorsally smooth and not fused.

Uropods 1-3 unequal in size, uropod 1 longest and uropod 3 shortest.

Uropod 1 peduncle longer than rami.

Uropod 2 peduncle about equal to rami.

Uropod 3 peduncle shorter than rami; outer ramus 1-articulate and shorter than inner ramus; rami with only very few robust setae (1-3).

**Telson.** Telson longer than broad, longer than 1.5 x breadth; pointed, cleft between 1/2 and 2/3 of total length; with one submarginal seta near apex of each lobe.

**Variables.** The length of the flagellum of antenna 2, compared with the peduncle, decreases with age, while the length of article 1 of flagellum in antenna 1 increases with age. The number of articles of the flagellum of both antennae increases with age.

**Biology.** Unknown.

**Remarks.** GURJANOVA (1936) described this species in the genus *Stegocephalopsis* SCHELLENBERG, mainly due to the 2-articulate palp of the first maxilla and the unexpanded basis of pereopod 6. However, the presence of both a clearly gaping and geniculate outer plate and apically hooked setae on the second maxilla, indicates that this species does not belong in the genus *Stegocephalopsis*. In addition to this, the morphology of *S. wagini* is generally very similar to that of the other North Atlantic species of the genus *Stegocephaloidea* (especially to *S. christianiensis*). BARNARD & KARAMAN (1991) also transferred *S. wagini* to the genus *Stegocephaloidea* (without, however, any comments).

*Stegocephaloidea wagini* has closest affinities to *S. christianiensis*, but differs from this species primarily in the mouthparts: *wagini* has a 2-segmented palp of the first maxilla, 2 clearly differentiated rows of setae on inner plate of maxilla 2 (one marginal and one clearly submarginal), a simple finger on labium (not crenulated), a shoulder on inner plate of maxilla 1 and a labrum with almost symmetrical lobes. The corresponding characters found in *christianiensis* are a 1-segmented palp, 2 marginal rows of setae, a crenulated finger on labium, shoulder on maxilla 1 absent and clearly asymmetrical lobes on labrum. Also the short flagellum of antenna 2 and the shape of the hind margin on

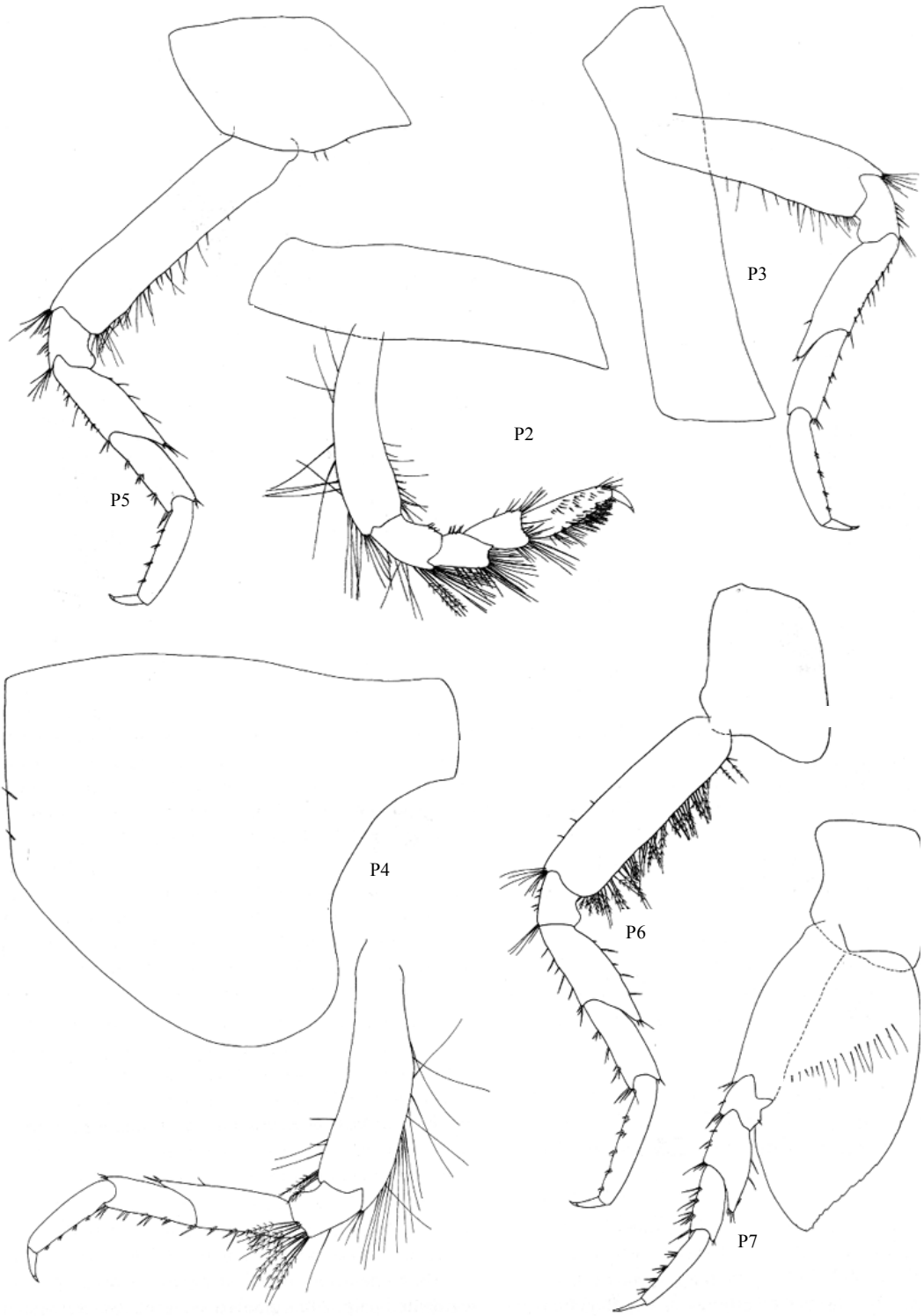


Fig. 15. *Stegocephaloides wagini*. Female A, BIOICE 2367.

epimeral plate 3 of *wagini* are important characters for identifying this species.

The combination of apically hooked setae on maxilla 2, the non pointed and acute distal part of basis pereopod 7, epimeral plate 3 without serrations and an unsegmented outer ramus of uropod 3 separate *S. wagini* from all the other species in this genus.

#### DISCUSSION

BARNARD & KARAMAN (1991) suggested that *S. vanhoeffeni* should be transferred to the genus *Stegocephalopsis*, together with *S. katalia*. Examination of the holotype of *S. vanhoeffeni* reveals no reason for transferring this species to *Stegocephalopsis*. The holotype of this species is, however, in a very poor condition, lacking both maxilliped and first maxilla. The structure of these two parts is essential for determining to which genus this species belongs, but the basis of pereopod 6 is not expanded as in *Stegocephalopsis*, and the long setae on the outer plate of maxilla 2 are apically hooked. *Stegocephalopsis katalia*, however, is transferred to *Stegocephalina* mainly because of the unhooked setae on outer plate of maxilla 2 and the clearly expanded basis of pereopod 6 (see BERGE & VADER 1997a for a further discussion).

*Stegocephaloides australis* does (according to the description of LEDOYER 1986) possess unhooked setae on outer plate of maxilla 2 and the palp of the first maxilla is 1-segmented, but for now, *S. australis* is retained in the genus *Stegocephaloides*, as the basis of pereopod 6 is not expanded (but see below for a further discussion on the value of this character).

Examination of the type specimens of *Stegocephaloides vegae* OLDEVIG, 1959, has revealed that this 'species' is the young of *Stegocephalopsis ampulla* (PHIPPS, 1774). It was not possible to carry out a detailed examination of the mouthparts, but all other characters resembled those of immature *S. ampulla*.

The genus *Stegocephaloides* was separated by SARS from *Stegocephalus* primarily on the non-expanded basis of pereopod 6 and the long article 1 of the flagellum of antenna 1. Both these characters seem to vary within this genus (*S. barnardi* in antenna 1 and *barnardi* and *christianiensis* in pereopod 6), which gives reasons to suspect that the genus was based on possible homoplasies. This is also the case for the palp of the first maxilla, where *wagini* has a 2-segmented palp (this is probably the reason why GURJANOVA (1936) described this species in the genus *Stegocephalopsis*), while this genus until now has been described as having a 1-segmented palp, in contrast to both *Phippsiella* and *Stegocephalopsis*. All four North Atlantic species of *Stegocephaloides* show a very close resemblance to each other, and it seems most improbable that these species

should not be closely related phylogenetically. Another character that groups the North Atlantic species together, is the presence of a deep coxa 4 where the distal margin forms almost a straight line.

If one assumes that these four species are closely related, this influences the systematics of other closely related genera (*Stegocephalopsis*, *Stegocephalus*, *Stegocephalexia*, *Phippsiella* and *Phippsia*) in that all of these genera were originally recognized on characters that the North Atlantic species of *Stegocephaloides* indicate probably are not synapomorphies. These characters are (1) the number of articles on the first maxillary palp, (2) the shape of the basis of pereopod 6, and (3) the length of the first article of the flagellum of antenna 1. If all these three characters are excluded from the diagnosis of the above mentioned genera, there are only few and often vague differences left between them. For this reason, detailed cladistic work is needed in order to divide these species into natural groups.

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#### REFERENCES

- Barnard, J.L. 1962. South Atlantic abyssal amphipods collected by R.V. *Vema*. Abyssal Crustacea. – *Vema Research Series* 1:1-78.
- 1964. Deep-Sea Amphipoda (Crustacea) collected by the R/V "Vema" in the eastern Pacific Ocean and the Caribbean and Mediterranean Seas. – *Bulletin of the American Museum of Natural History* 127:3-46.
- 1967. Bathyal and abyssal gammaridean Amphipoda of Cedros Trench, Baja California. – *Bulletin of the United States National Museum* 260:1-205.
- Barnard, J.L. & G.S. Karaman 1991. The Families and Genera of Marine Gammaridean Amphipoda (Except Marine Gammaroids). – *Records of the Australian Museum* Suppl.13:1-866.
- Barnard, K.H. 1916. Contributions to the crustacean fauna of South Africa. -No 5. The Amphipoda. – *Annals of the South African Museum* 15:105-302.
- Berge, J. & W. Vader 1997a. Stegocephalid (Crustacea, Amphipoda) species collected in the Biofar and Bioice programmes. – *Sarsia* 82:347-370.

- Berge, J. & W. Vader 1997b. North Atlantic and Mediterranean species of the genus *Phippsiella* Schellenberg (Amphipoda, Stegocephalidae). – *Journal of Natural History* 31:1501-1532.
- Boeck, A. 1871. Crustacea Amphipoda borealia et arctica. – *Videnskabs-Selskabets Forhandlinger for 1871*:83-280.
- Chevreaux, E. & L. Fage 1925. Amphipodes. – *Faune de France* 9:1-488.
- Dallwitz, M.J., T.A. Paine & E.J. Zurcher 1996. *Supplement to Edition 4 of: User's Guide to the DELTA System: A General System for Processing Taxonomic Descriptions. Edition 4.04.* – CSIRO Division of Entomology, Canberra. 13 pp.
- Dana, J.D. 1852. On the classification of the Crustacea Choristopoda or Tetradecapoda. – *American Journal of Sciences and Arts, Series 14*:297-316.
- Gouda, E.J. 1993. TAXASOFT: Taxonomic Software by E.J. Gouda Ver. 1.0.
- Gurjanova, E.F. 1936. Beitrage zur Amphipodenfauna des Karischen Meeres. – *Zoologischer Anzeiger* 116:145-152.
- 1951. Bokoplavy morej SSSR i sopredel'nykh vod (Amphipoda-Gammaridea). – *Akademiia Nauk SSSR, Opredeliteli po Faune SSSR* 41:1-1029.
- 1962. Bokoplavy severnoi chasti Tixogo Okeana (Amphipoda-Gammaridea) chast' 1. – *Akademiia Nauk SSSR, Opredeliteli po Faune SSSR* 74:1-440.
- Karaman, G.S. 1974. 62. Contribution to the knowledge of the Amphipoda. The Family Stegocephalidae from the Adriatic Sea. – *Poljoprivreda I Sumarstvo* 20(4):53-65.
- Krøyer, H. 1842. Nye nordiske Slægter og Arter af Amphipodernes Orden, henhørende til Familien Gammarina. (Foreløbigt Uddrag af et større Arbejde). – *Naturhistorisk Tidsskrift* 4:141-166.
- Ledoyer, M. 1986. Crustacés amphipodes gammariens. – *Faune de Madagascar* 59:599-1112.
- Lincoln, R.J. 1979. *British Marine Amphipoda: Gammaridea*. – London: British Museum (Natural History). 658 pp.
- Lowry, J.K. & H.E. Stoddart 1992. A revision of the genus *Ichnopus* (Crustacea: Amphipoda: Lysianassoidea: Uristidae). – *Records of the Australian Museum* 44(2):185-245.
- 1993. Crustacea Amphipoda: Lysianassoids from Philippine and Indonesian waters. In Crosnier A. (ed.). *Résultats des Campagnes MUSORSTOM, Volume 10.* – *Mémoires du Muséum National d'Histoire Naturelle, Paris* 156:55-109.
- 1995. The Amphipoda (Crustacea) of Madang Lagoon: Lysianassidae, Opisidae, Uristidae, Wandinidae and Stegocephalidae. – *Records of the Australian Museum, Supplement* 22:1-167.
- Moore, P.G. 1979. Crystalline structures in the gut caeca of the amphipod *Stegocephaloides christianiensis* Boeck. – *Journal of experimental marine Biology and Ecology* 39:223-229.
- 1992. A study on amphipods from the superfamily Stegocephaloidea Dana 1852 from the northeastern Pacific region: systematics and distributional ecology. – *Journal of Natural History* 26:905-936.
- Moore, P.G. & P.S. Rainbow 1983. Ferritin crystals in the gut caeca of *Stegocephaloides christianiensis* Boeck and other Stegocephalidae (Amphipoda : Gammaridea): a functional interpretation. – *Philosophical Transactions of the Royal Society of London B* 306:219-245.
- Oldevig, H. 1959. Arctic, subarctic and Scandinavian amphipods in the collections of the Swedish Natural History Museum in Stockholm. – *Göteborgs Kungliga Vetenskaps-Vitterhets-Samhälles Handlingar* 8:1-132.
- Phipps, C.J. 1774. Appendix, pp. 189-193 pl. 12 of: *A Voyage Towards the North Pole, Undertaken by His Majesty's Command, 1773.* London: J. Nourse.
- Powell, R. & P.G. Moore 1991. The breeding cycles of females of seven species of amphipod (Crustacea) from the Clyde Sea area. – *Journal of Natural History* 25:435-479.
- Sars, G.O. 1883. Oversigt af Norges Crustaceer med foreløbige Bemærkninger over de nye eller mindre bekendte Arter. I. (Podophthalmata - Cumacea - Isopoda - Amphipoda). – *Christiania Videnskabs-Selskabets Forhandlinger* 1883:1-124.
- 1891. Amphipoda. An Account of the Crustacea of Norway With Short Description and Figures of All the Species, Part IX: 185-212, pls. 65-72.
- Schellenberg, A. 1926. Amphipoda 3: Die Gammariden der Deutschen Tiefsee-Expedition. – *Wissenschaftliche Ergebnisse Deutschen Tiefsee-Expedition .... "Valdivia" 1898-1899* 23:195-243
- Watling, L. 1989. A classification system for crustacean setae based on the homology concept. In Felgenhauer, B.E., L. Watling & A.B. Thistle (eds). *Functional Morphology of Feeding and Grooming in Crustacea.* – *Crustacean Issues* 6:15-27, Balkema, Rotterdam.

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