

Fig. 57. *Ilyarachna aspidophora* n.sp.; a, left maxilliped; b, pereopod VI.

more than twice as long as I and prp. III still a little longer than II, with ischium much longer and basis much shorter than in II. Prp. IV one-fifth longer than III, i.e. more than twice as long as the body; prps. V and VI almost equal (57b), with a rather broad propodus and very slender dactylus; prp. VII slender and without feathered setae.

*Operculum* (58a-b) with a median, broad incision distally and the lateral margins forming an obtuse angle in the middle. The distal part of the operculum and the median, narrow and rather high keel covered with long setae, usually feathered.

*Pleopod 3* (58c) with three stout, feathered setae on both branches, the outer branch broad and apparently 1-jointed.

*Uropod* (58d) rather angular with the endopod only present. The setae not feathered.

*Size*: Total length 3.2 mm, maximum width 1.4 mm.

*Embryos*: About twenty embryos present in the very prominent marsupium (Fig. 54). Each of them

measures  $0.30 \times 0.35$  mm and primordium of head and appendages are faintly visible (58e). They correspond closely to "2tes Embryonal-(Marsupial-) Stadium" (FORSMAN 1944, p. 23, pl. 1, 2).

#### Remarks:

This new species combines features of other species of *Ilyarachna* previously believed to belong to different genera. Thus, the general shape is reminiscent of "*Aspidarachna*" *clypeata* and *aries*, although the two latter have biramous uropods. The mandibles resemble those of the (valid) genus *Pseudarachna*. The species can be easily distinguished by the shape of the body, the first antennular joint, the mandibles, and the operculum. The aberrant shape of the mandibles may, perhaps, justify the erection of a new genus in the future.

#### Occurrence:

East of the North Island of New Zealand, 213 m, c. 14.7°C.

### FAMILY EURYCOPIDAE

#### Diagnosis:

Body usually oval, rarely elongated. Head free, eyes absent. Pereonites divided into sections, the first four being free and similarly shaped, the latter three with convex front and concave hind margin (except the hind margin of prn. 7), and often fused. Antennulae dorsal, with first joint plate-shaped (except in *Syneurycope*), and usually with an inner projection; flagellum with several joints. Antennae probably always longer than body. Mandibles normal, rarely reduced to any extent; palp very rarely absent. Palp of maxilliped with the first three joints nearly always expanded, as broad as or broader than endite. Pereopods I-IV equal, except in length, or prp. I distinctly prehensile; all basipodites more or less elon-

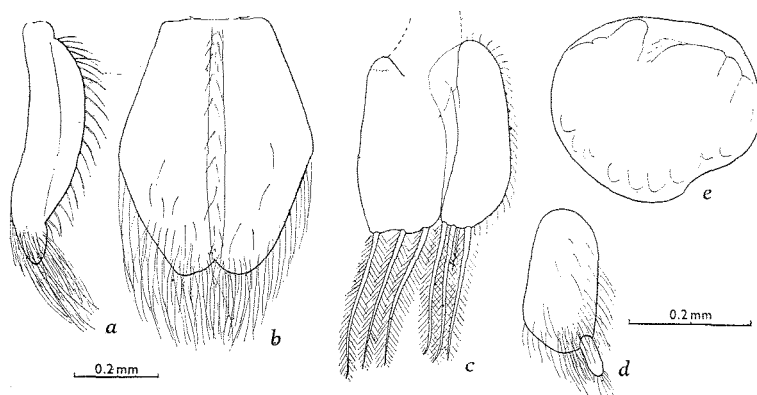


Fig. 58. *Ilyarachna aspidophora* n.sp.; a-b, operculum from the side and from outside (most setae feathered); c, pleopod 3; d, uropod; e, embryo from marsupium.

gated; coxal processes or spines usually present. Prps. V-VII natatory, with carpus and propodus somewhat or greatly expanded, and furnished with feathered setae; dactylus always present. Uropods almost always ventral, uni- or biramous.

#### Remarks:

In his diagnosis MENZIES (1962b, p. 138) stated that the peduncle of the uropods is "not flattened". This probably means it is in opposition to the oval, leaf-like peduncle in Ilyarachnidae, but this may be misunderstood; the peduncle being actually flattened and often considerably broader than long in e.g. a great many species of *Eurycope*. MENZIES did not include *Bathypsirus* Nordenstam and *Lipomera* Tattersall in the key to the genera.

MENZIES (1956b) pointed out that *Acanthocope* is in many respects close to *Eurycope* and *Storthingura* and referred it to the family in his 1962b paper. I agree with this, the more so since it definitely does not belong to HANSEN's Munnopsini (Munnopsidae) to which it has been referred by e.g. NIERSTRASZ (1941, p. 298) – probably on account of the uniramous uropods. The similarly shaped pereopods I-IV

and the presence of dactylus on prps. V-VII in *Acanthocope* clearly separate it from Munnopsidae.

Eurycopidae has below been divided into four subfamilies owing to a number of marked differences. Acanthocopinae differs from the others in having pereopods I-IV subequal in length and the uropods uniramous. It is further characterized by the coalescence of pereonites 5-7 and pleon, and the shape of the latter. Syneurycopinae is unique in the terminal position of the antennulae and the subcylindrical shape of their first joint, in the presence of denticles on the maxillipedal palp and in the short length of the pleopods. Bathypsarinae is unique in the shape of prns. 5-7, pleon and the female operculum, the position of the spine-row of the right mandible and the long length of basipod of prp. I compared to that of prps. II-IV. Eurycopinae differs from the others in having carpus and propodus of prps. V-VII more expanded and dactylus rather short (not known in Bathypsarinae).

The very aberrant shape of the uropods in *Lipomera* may contribute to a new subfamily or family being established when this genus becomes better known (cf. p. 118).

#### Key to the subfamilies of Eurycopidae

1. Uropods uniramous. Pleotelson suboval, with two pairs of lateral and one long, terminal spine. Pereopods I-IV of almost equal length, V-VII with narrow carpus and propodus..... Acanthocopinae (p. 109)
1. Uropods biramous. Pleotelson never with two pairs of lateral spines and one terminal (except in *Storthingura atlantica*). Prp. I much shorter than III and IV in particular, and prps. V-VII generally with moderately or greatly expanded carpus and propodus..... 2
2. Antennulae inserted terminally on head, with joint 1 shorter than joint 2. Pleon at least one and a half times longer than broad. Carpus and propodus of prps. V-VII rather narrow, dactylus long and strong ..... Syneurycopinae (p. 116)
2. Antennulae inserted dorsally, with joint 1 much larger than joint 2. Pleon, at most, a little longer than broad. Carpus and propodus generally expanded, dactylus feeble..... 3
3. Pereonites 5-7 and pleon very large and considerably swollen, being about as high as broad. Antennulae inserted between the antennae. Joints 2 and 3 of palp of maxilliped not greatly expanded in comparison with joints 4 and 5..... Bathypsarinae (p. 170)
3. Prns. 5-7 and pleon more or less flattened, never as high as broad. Antennulae inserted above (behind) the antennae. First joints of palp of mxp. greatly expanded..... Eurycopinae (p. 117)

#### *Acanthocopinae* nov. subfam.

##### Diagnosis:

Frontal margin straight, slightly concave or convex. Pereonites 5-7 fused with each other and with pleon. Pleotelson suboval, longer than broad, with two pairs of distinct spines and one long terminal spine. Antennulae inserted above (behind) the an-

tennae, with first joint broadened, much larger than second. Mandibles normal, with or without palp. Inner margin of maxillipedal palp without denticles. Pereopods I-IV similarly shaped, slender and not greatly varying in length; prps. V-VII with narrow carpus and propodus and a long and slender dactylus with terminal setae and claw (on prp. VII).

Uropods uniramous, two-jointed, slender and almost always ventral.

In MENZIES' diagnosis (1962b) to *Acanthocope*, the only genus of the subfamily, he stated: "Dorsum of body spinous"; *acutispina* Beddard is completely devoid of dorsal spines. Further: "Pleon with a single somite"; it is almost certain that there is a vestigial pleonite in front of pleotelson in *spinicauda* (p. 111) and quite probably also in *galathea* (Fig. 63b) and *spinosissima* (MENZIES 1956a, fig. 1 A.)

#### Genus *Acanthocope* Beddard, 1885

*Acanthocope* Beddard, 1885, p. 922; BEDDARD 1886b, p. 78; MENZIES 1956a, p. 2; 1962b, p. 152.

With the characters of the subfamily.

This genus was erected for the two species *spinicauda* and *acutispina*. With some hesitation BEDDARD united both species in one genus, their main differences (of possible generic significance) being: (1) Lateral spines on pereonites 2-4 coxal in *spinicauda*, emerging directly from the segments in *acutispina*; (2) a ventral spine arising below the attachment of pereopod VI (and probably prps. V and VII) in the former, not present in the latter; (3) first joint of antennula not much larger than the succeeding in the former, very large in the latter; (4)

flagellum long and multi-jointed in the former, short and with few joints in the latter.

The two holotypes and only specimens are kept in the British Museum, London, and are both still mounted on slides and in fairly good condition. A close examination, the result of which is given in the following descriptions, showed (1) that the lateral spines are coxal in both, (2) that the ventral spine on right side of pereonite 6 in *spinicauda* is dubious, (3) that the first antennular joint is large in both, and (4), that the outer part of the flagellum has probably been broken off in *acutispina*. Moreover, both the recently described species, *spinosissima*, which no doubt belongs to *Acanthocope* (MENZIES 1956a, p. 2), and the new species *galathea*, have a short antennular flagellum with few joints. Thus, it is perfectly in order to include both *spinicauda* and *acutispina* in one genus.

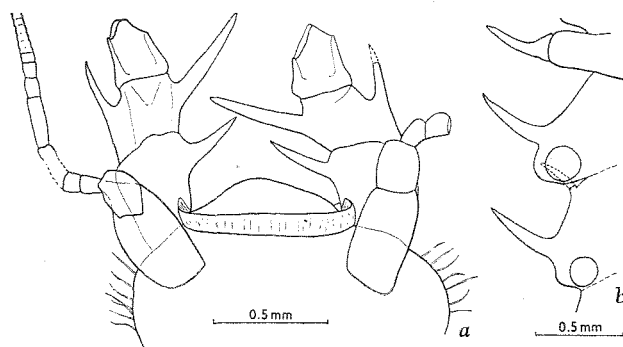
The reasons for not referring *Storthyngura atlantica* (Beddard) and *intermedia* (Beddard) to *Acanthocope* are given p. 119.

In his key and in the diagnosis for the new species *argentinae*, MENZIES (1962b) stated that the flagellum of the antennula has 6 and 5 joints, respectively. However, the entire antennula of that species has 7 joints and at least the first 4 belong to the peduncle (cf. *spinosissima* Menzies and *galathea* n.sp.), as is also probably the case with joint 5. Thus, *argentinae* has 2 (or 3) joints only in the flagellum.

#### Key to the species of *Acanthocope*

- |   |  |
|---|--|
| 1. Lateral spines on pereonites 2-4 emerge directly from the segments (not from coxal plates).....                                | 2  |
| 1. Lateral spines on prns. 2-4 coxal.....   | 5  |
| 2. Paired dorsal spines on prns. 5-7. Lateral spines on pleon directed forwards. Uropods inserted postero-laterally.....          | <i>galathea</i> n. sp. (p. 113)          |
| 2. No dorsal spines on prns. 5-7. Lateral spines on pleon directed outwards-backwards. Uropods inserted ventrally.....            | 3  |
| 3. No dorsal spines on prns. 1-3. Dorsal spine on prn. 4 reaching forward to the frontal margin.....                              | <i>unicornis</i> Menzies, 1962 b         |
| 3. Dorsal spines on prns. 1-3. Dorsal spine on prn. 4 not reaching beyond anterior margin of prn. 3                               | 4  |
| 4. Frontal margin distinctly convex. Flagellum of antennula with numerous joints.....   | <i>annulatus</i> Menzies, 1962 b         |
| 4. Frontal margin slightly concave. Flagellum of antennula with only two (or three) joints.....                                   | <i>argentinae</i> Menzies, 1962 b        |
| 5. A long, median spine anteriorly on pleon. Prn. 6 with two lateral spines on each side.....                                     | <i>spinicauda</i> Beddard, 1885 (p. 111) |
| 5. No median spine on pleon. Prn. 6 with one lateral spine on each side.....  | 6  |
| 6. Posterior spine-pair on pleon pointing forwards. Mandibular palp one- or two-jointed, final joint very elongated.....          | <i>spinosissima</i> Menzies, 1956 a      |
| 6. Posterior spine-pair on pleon pointing backwards. Mandibular palp three-jointed, final joint no longer than preceding one..... | <i>acutispina</i> Beddard, 1885 (p. 112) |

Fig. 59. *Acanthocope spinicauda* Beddard, ♂ holotype; a, frontal margin, antennulae and antennae; b, left side of pereonites 4-6 from above. The shape and direction of the anterior spine on prn. 6 is identical with the corresponding spine on the right side of this segment.



*Acanthocope spinicauda* Beddard, 1885  
(Pl. IV C; Text-figs. 59-60)

*Acanthocope spinicauda* Beddard, 1885, p. 922;  
BEDDARD 1886b, p. 79, pl. VIII, 6-12.

Additional description:

**Head** according to description, but the front margin seems to be not only straight (or rather slightly concave), but collar-shaped, i.e. bent somewhat upwards or backwards (Fig. 59a). A similar feature is found in *acutispina* and probably also in *spinosissima*, according to MENZIES' fig. 1 A (1956a).

**Pereonites** (Pl. IV C). The dorsal spines mentioned and figured by BEDDARD are now extremely difficult to see on the first four segments and although they may be present, I found it impossible to distinguish them from the underlying muscles on the two last pereonites. The lateral spines on prns. 5-7 are *not* coxal as shown in BEDDARD's fig. 6, but emerge from the segment proper (Fig. 59b). The spine on one side (the right) of prn. 6 is somewhat mysterious; it

is impossible to distinguish its offspring and the fact that a similar ventral spine could not be found on the opposite side of prn. 6 or on prns. 5 and 7, makes its position here very doubtful. However, a pair of lateral spines, shorter and more slender than the ordinary ones, are found on the anterior corner of prn. 6, very conspicuous on the right side and bent under the body on the left (59b). The lateral spines on prn. 7 were probably straight originally and only slightly directed backwards. Prns. 5-7 seem to be immovably fused with each other and with pleon.

**Pleon.** It appears that the dorsal spine emerges from a separate, rather short pleonite in front of pleotelson. The very long, terminal spine originally pointed somewhat downwards and is furnished with scattered, rather long and very thin setae (60d); this is also the case with the other spines on pleon. The emergence of the uropods and the large anus are correctly shown in BEDDARD's fig. 11.

**Antennula** has joint I considerably larger than that shown in BEDDARD's figs. 6 and 7. Probably owing

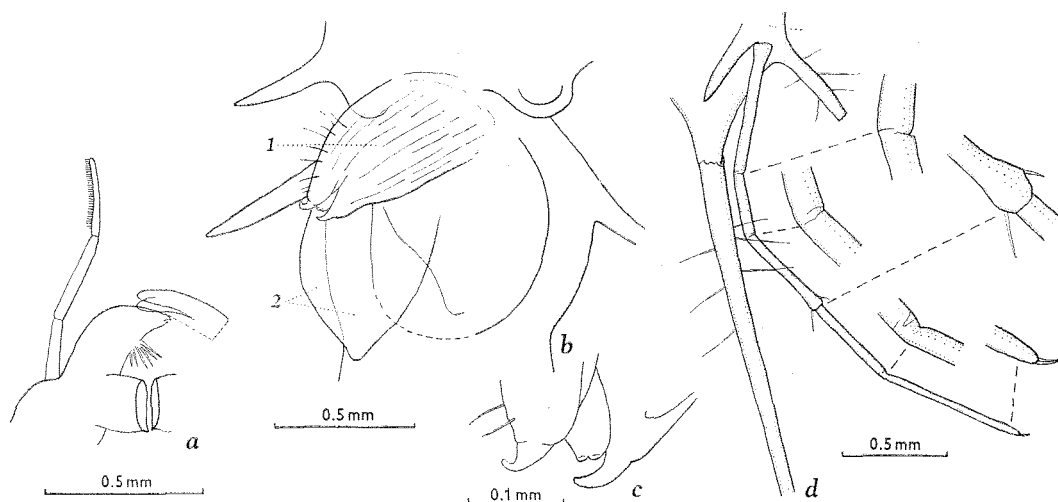


Fig. 60. *Acanthocope spinicauda* Beddard; a, right mandible and incisive part of left mandible from below; b, pleopods 1 and 2; c, apex of pleopods 1; d, uropod.

to distortion, the proximal joint of the left and right antennulae are not quite equal (59a). – The actual shape of the first four joints of the *antenna* is shown in Fig. 59a; the first joint is not visible.

**Mandibles.** As stated by BEDDARD, the molar processes are certainly very strong, and almost straightly cut off distally (60a). Incisive part of the right mandible apparently rather pointed, in the left it seems to consist of two projecting, blunt teeth. Some (at least three) extraordinary, stout and hook-shaped spines probably belong to the movable lacinia of the left mandible. The spine-row of the right mandible consists of a few spines, but they could not be clearly made out. Palp very difficult to distinguish; it is long and slender, with last joint uncurred.

**Pereopods.** The first four very slender and apparently rather equal in length. Prps. V-VII much longer and more slender than usual; BEDDARD's figs. 9 and 10 show prps. V and VI respectively, and are correct but for carpus in prp. VI being drawn too short. Prp. VII is shaped almost as VI.

**Male pleopods 1** (60b-c) have been pushed to one side during mounting. They seem to be unusually short, broad and vaulted, with the apex more or less rounded interiorly and with a hook-shaped outer lobe. – **Pleopod 2** probably twice as long as plp. 1 and very thin; no copulatory organ visible.

**Uropod** not 5-jointed as stated by BEDDARD, but definitely only 2-jointed. BEDDARD's wrong interpretation is due to the fact that the appendage has been bent in three places during mounting (see Fig. 60d), but a careful examination shows that there are no articulations here and no setae, such as are found at the one true articulation in the uropod.

**Size:** Including the spines, the specimen is 7.7

mm long and 2.3 mm broad. Without the terminal spine it is 5.1 mm long.

#### Occurrence:

Antarctic Indian Ocean (50°01'S, 123°04'E), 3290 m, 0.8°C.

*Acanthocope acutispina* Beddard, 1885  
(Pl. IV D; Text-figs. 61-62)

*Acanthocope acutispina* Beddard, 1885, p. 923;  
BEDDARD 1886b, p. 82, pl. VIII, 1-5.

#### Additional description:

**Body** (Pl. IV D) 2.6 times longer than broad (excl. of spines).

**Head** with a distinct, truncate, frontal part which is presumably bent upwards to some degree, has a slightly concave anterior margin, and is somewhat convex from side to side (Fig. 61a); thus, in some respects, resembling the collar-shaped frontal margin of *spinicauda*. The two pairs of spines shown on BEDDARD's fig. 1 (but not mentioned in the text) are not present.

**Pereonites.** The actual appearance of the lateral margin of prns. 1-4 and 5-7 is given in Fig. 61c-d. Not only are the large spines on 1-4 coxal (as in *spinicauda*), in contradiction to BEDDARD's statement and his fig. 1, but prns. 3 and 4 have additionally, a small antero-lateral spine on the segment itself, as so often found in *Storthyngura*. The "short, transversely arranged spines," mentioned by BEDDARD (p. 83) should rather be described as setae, only a few in fact being strong enough to be called

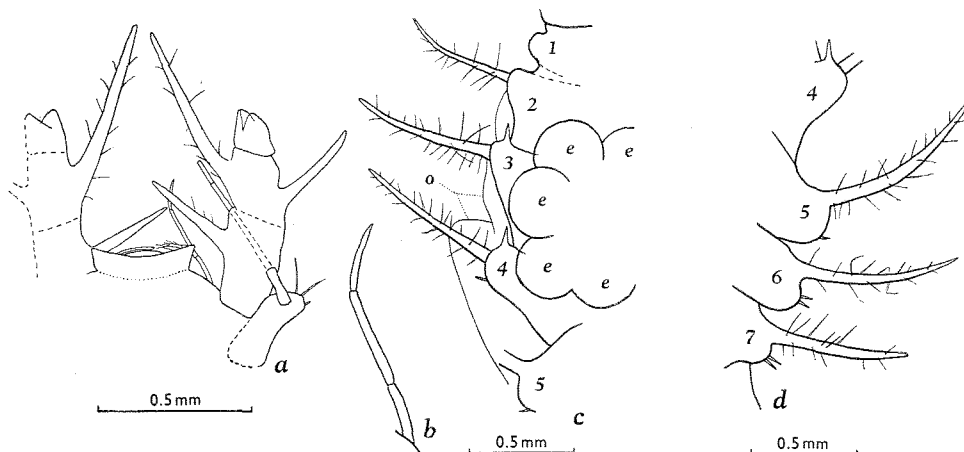
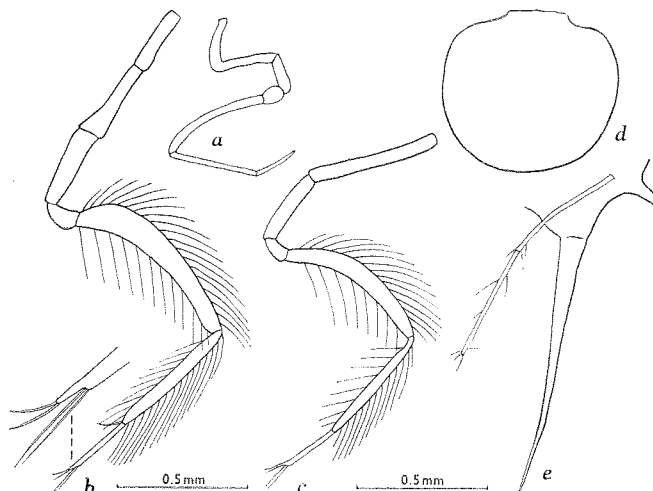


Fig. 61. *Acanthocope acutispina* Beddard, ♀ holotype; a, frontal margin, right antennula and antenna; b, visible part of palp of mandible; c, left pereonites 1-5 from above (e, eggs; o, oostegites); d, right pereonites 4-7.

Fig. 62. *Acanthocope acutispina* Beddard; a, pereopod I; b-c, pereopods V and VII (all setae on carpus and propodus are feathered); d, operculum (median spine(s) omitted); e, terminal spine and uropod.



spines. The presence of similar setae on the dorsal surface of body and head can no longer be ascertained owing to the specimen's lack of transparency. For the same reason it is impossible to make out the presence or absence of dorsal spines on the pereonites. The female has about twelve large eggs in the marsupium (61c). Prns. 5-7 seem to be immovably fused both with each other and pleon.

**Pleon.** It is impossible to distinguish whether or not one or more vestigial pleonites are present in front of pleotelson. The terminal spine is actually one-fifth longer than the four lateral spines. The ventral spine-pair emerges in the same place as in *spinicauda* (BEDDARD's fig. 11), but turns considerably more outwards than in that species; they have been omitted in his fig. 1.

**Antennula** (61a) – as also stated by BEDDARD – is impossible to draw in detail. The outer part of flagellum seems to have been broken off. – Joints 2-4 of antenna slender and with very long spines on the second and third joint (61a).

**Mouthparts** impossible to study, except for the mandibular palp which is 3-jointed, extremely slender, and with a simple distal joint as in *spinicauda*, but apparently without a row of short setae (61b).

**Pereopods** are also very slender in this species. Prp. I (62a) has the usual shape of the family. It is about one-fifth shorter than prp. II, which is again about one-fourth shorter than III; the length of prp. IV could not be measured. In prp. II (and probably also III and IV) dactylus is more than two-thirds of propodus. Prps. V-VII are even more slender than in *spinicauda* and have four slender setae distally on dactylus (62b-c).

**Female operculum** (62d) subcircular, about as broad as long and with, at least, one long, slender

spine which probably emerges medianly, near the proximal end.

**Uropod.** In this species also there is no indication of more than two joints in this appendage (62e); the proximal part is obscure and could possibly be jointed, although such a likelihood is highly improbable.

**Size:** Including the spines, this adult female is 4.2 mm long and 2.6 mm broad; without spines the length is 3.9 and the width 1.5 mm only.

#### Occurrence:

S.E. Pacific Ocean (42°43'S, 82°11'W), 2650 m, 1.9°C.

#### *Acanthocope galathea* n. sp.

(Text-figs. 63-65)

#### Material:

*Galathea* St. 726, Gulf of Panama (5°49'N, 78°52'W), 3270-3670 m, 13 May 1952. Bottom: clay. Bottom temp.: c. 2.0°C. – 1 female.

#### Description:

**Body** (Fig. 63a-b) elongated, with almost parallel sides; when disregarding the spine-armature, the body is three times longer than wide (across pereonite 5). Integument transparent, the alimentary canal, muscles, etc. being clearly visible.

**Head** evenly vaulted and bent downwards (63b), as wide as pereonite 1. Frontal margin slightly convex. Antennulae and antennae inserted dorsally.

**Pereonites 1-4** (63a) slightly increasing in width backwards; their length moderate and almost equal. Prn. 1 unarmed, rounded laterally, prns. 2-4 each with a long and slender, slightly compressed, forward-curved spine medianly, and on each side a similar spine directed outwards, forwards and some-

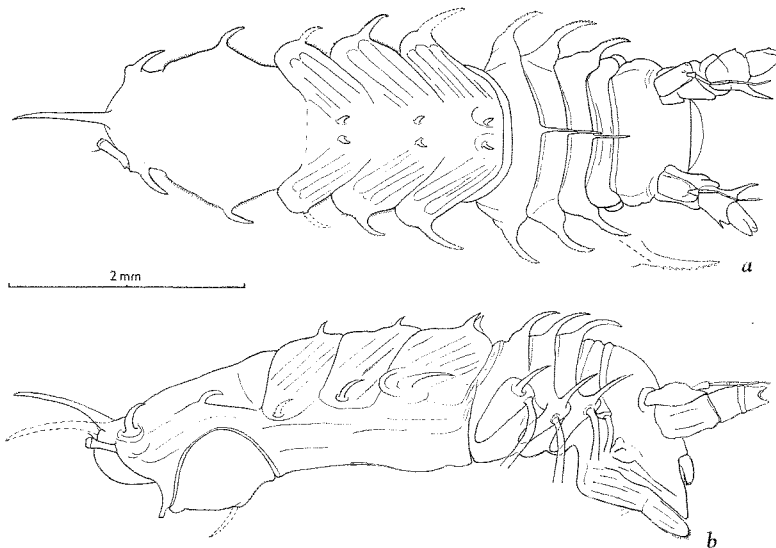


Fig. 63. *Acanthocope galathea* n. sp.,  
♀ holotype.

what upwards, with a row of rounded teeth along the outer margin. No coxal spines are found. Developing oostegites present on coxae of pereopods I-IV.

*Pereonites* 5-7 a little longer than head + prns. 1-4 and only slightly decreasing in width backwards. Their postero-lateral corners rounded; at a somewhat more anterior position a curved spine emerges, which on prns. 6 and 7 is directed not only outwards and forwards, but also considerably upwards (63 b). Each segment with a pair of short, curved spines dorsally.

*Pleon* with a very inconspicuous impression anteriorly (63 b), probably indicating the separation between pleotelson and one anterior pleonite. Pleon considerably longer than usual, being about one-third the total length of the body (excl. of the posterior spine), and about one-fifth longer than broad when disregarding the spines; general shape ovate. The lateral margins of the anterior two-thirds are sharp ridges which are curved somewhat upwards in the middle and project. The projection is furnished with a forward-curved spine, pointing outwards and upwards. The postero-lateral part of pleon appears as rounded convexities with a curved spine, emerging dorsally, pointing forwards and upwards (and slightly outwards). A long and almost straight spine emerges from what is probably the dorsal part of the back of pleon. Due to the spine being slightly damaged, it is impossible to tell whether it originally pointed directly backwards or more or less upwards. Ventrally, the almost circular branchial cavity is separated from the semi-circular anal doors by a tongue-shaped projection directed downwards (63 b).

*Antennula* (64 a) reaches only a little further than

joint 4 of the antenna. Joint 1 large, twice as long as broad, and almost as thick as broad; the underside deeply excavated and with many very fine, transversal lines in the integument (64 b); several sensory setae. Joint 2 emerges from a low excavation far from the distal end of joint 1 and is about twice as long as broad. Joint 3 much narrower, three times as long as broad and about two-thirds of joint 5. Joint 4 only a little longer than broad. What appears to be joint 6 of the peduncle, elongated, only half as wide as joint 5. Flagellum short, less than one-eighth of entire antennula; the joints cannot easily be distinguished, but their number is probably limited to about four.

*Antenna* (64 c) with only the four proximal joints preserved. The separation between joints 1 and 2 untraceable. Joint 3 with a long, strong, somewhat downward-pointing spine on the inner margin and a spine-shaped, unarticulated squama.

*Left mandible* with two small teeth in incisive part (64 f) which otherwise has a broad and sharp edge (64 e). In profile the movable lacinia resembles a pointing hand (64 d), having one strongly projecting tooth and two somewhat shorter (64 e). Spine-row with three short and three larger, faintly serrated spines. Molar process strong, truncate, obliquely cut off distally. No palp. Right mandible not dissected.

*Maxillula* (64 g) with 12 spines on the outer endite, the interior ones being more or less serrated. – *Maxilla* (64 h) with four setae on each of the outer lobes and four serrated spines and many fine setae on the inner. – *Labium* (64 j) with two tufts of fine setae distally.

*Maxilliped* (64 k) with very narrow sympod and endite and three coupling hooks (left mxp.). Palp

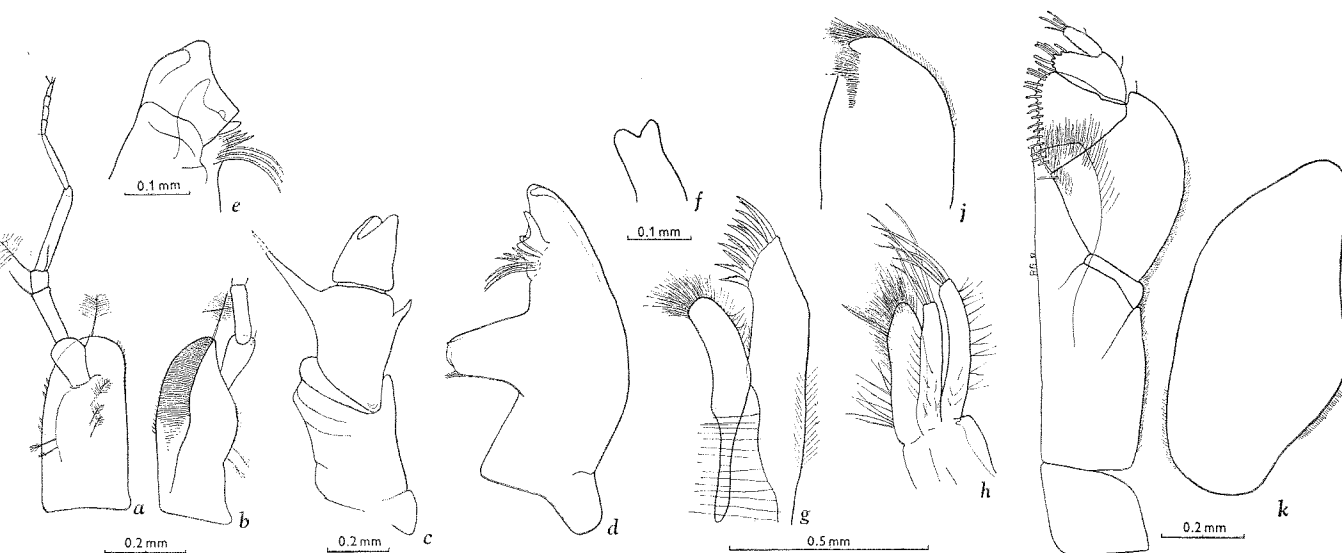


Fig. 64. *Acanthocope galathea* n.sp.; a, right antennula from above; b, seen a little obliquely from the inner side; c, four proximal joints of right antenna; d-f, left mandible; d, from the side; e, incisive part, movable lacinia and spine-row from outside; f, incisive part from in front; g, maxillula; h, maxilla; j, labium; k, left maxilliped.

with joint 1 small, joint 2 large and curved, longer than broad; joint 3 small and triangular, with short thick setae on the inner margin, joint 4 unusually large. Epipod rounded distally, with a moderate convexity on the outer margin.

*Pereopods I-IV* (65b-c) slender and of almost equal length, prp. IV being one-tenth longer than III, which is again one-twelfth longer than prp. II; the latter again, one-fifteenth longer than prp. I. The latter (65b) differs from the other three by the considerably curved carpus and the relatively short dactylus. In prps. II and III the relative joint length is equal, but in prp. IV propodus is as long as carpus. No distinct claw present.

*Pereopods V-VII* (65d-e) narrow, but feathered setae well developed on carpus and propodus. Carpus of all three pereopods considerably curved, more

or less sickle-shaped and in prps. V and VI somewhat longer; in VII as long as the very slender propodus. Dactylus of prps. V and VI is remarkable in being bent slightly backwards; distally, it has two short setae and additionally on prp. VII, a short claw.

*Operculum* (63b, 65f) v-shaped in section, the angle being about  $100^\circ$ . In frontal view almost circular, one-tenth broader than long. Median keel rounded; a median spine may have been present.

*Pleopod 3* (65g) with two feathered setae apically on the 2-jointed, narrow exopod.

*Uropod* inserted behind the postero-lateral projection (63a). It is broken, but the preserved first joint and fragment of the second indicate that it was originally one-branched (65a).

*Size*: Greatest length (including the posterior

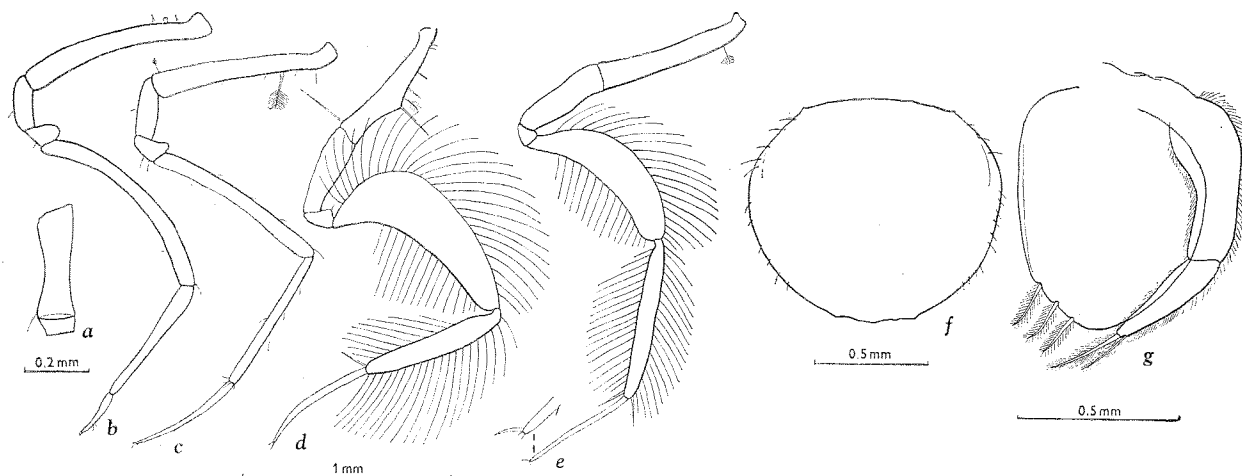


Fig. 65. *Acanthocope galathea* n.sp.; a, uropod; b-e, pereopods I, II, V, and VII; f, operculum; g, pleopod 3.



spine) 6.0 mm, without spine 5.7 mm; greatest width (across pereonite 5, at base of spines) 1.8 mm.

**Remarks:**

This species is unique in having the dorso-lateral position of the spines on pleon, a postero-lateral emergence of the uropods and lack of mandibular palp.

**Occurrence:**

Gulf of Panama, 3270-3670 m, c. 2°C.

**Syneurycopinae** nov. subfam.

**Diagnosis:**

Body slender. Frontal margin not projecting. Pereonites 1-4 movable, prns. 5-7 generally (always?) fused. Coxal plates rounded, those on prns. 2-4 visible from above. Pleotelson elongated, somewhat swollen proximally, without spines. Antennulae inserted at the front end of head, with joint 1 cylindrical or conical, joint 2 either a little or much longer, and joint 3 even longer. Antennae without squama, with joint 4 rather long and cylindrical. Mandibles almost as in *Eurycope*. Maxillipeds with proximal joints of palp expanded, the third (also the second in *multispina*) with denticles on the inner margin; epipod very large. Pereopods I-IV increasing in length posteriorly, but basipodites of about equal length and width; prp. I prehensile. Prps. V-VII natatory, but with narrow carpus and propodus which decrease both in width and number of setae and distally, on propodus, a long and stout spine; dactylus more than half as long as propodus, with apical setae and one or two claws. Pleopods only about half as long as pleotelson, first pair in the male totally fused proximally, and sympod of pleopod 2 narrow. Uropods small, biramous, with a tiny exopod.

**Remarks:**

When considering the systematic status of *Acanthocope* and *Bathyopsurus*, I realized that *Syneurycope* also differed from the remaining genera to such an extent that it would be natural to distinguish it from Eurycopinae. The reasons for establishing a separate subfamily are given above (p. 109).

The genus was established by HANSEN (1916, p. 130), and the only species (*S. parallela*), was well described and figured. BARNARD (1920, p. 414) described a new genus and species (*Ilychthonos capensis*), but himself admitted that the genus was "per-

haps congeneric with *Syneurycope*". With the description of a third species (*S. hanseni*), MENZIES (1956b, p. 5) cancelled *Ilychthonos*. This is certainly in order, since *capensis* seems to differ from the other two only in the globular shape of the head, a possible lack of fusion of pereonites 5-7 (pl. XVII, 14), and the conical first joint of antennula. In 1962b MENZIES diagnosed two more species (*heezeni* and *multispina*).

In his first diagnosis of the genus *Syneurycope* MENZIES (1956a) stated: "Pleon consisting of one somite, with lateral incisions of two partly fused somites." This only applies to *hanseni*. In *parallela* (and the later described species *heezeni* and *multispina*), the first pleonite is separated both from pereon and pleotelson. Both in his description of the genus and of the species (*capensis*), BARNARD (1. c.) stated: "Pleon consisting of one segment only." He may have overlooked a vestigial pleonite in front of pleotelson, but we have no definite knowledge of this. Thus, the number of pleonites has not been mentioned in my above diagnosis.

In his (corrected) diagnosis of *Syneurycope* (1962b), MENZIES stated that pereonites 5-7 are "fused into a solid piece". According to BARNARD's fig. 14 (pl. XVII), they seem to be separated in *capensis*.

BARNARD recorded the uropods as uniramous. Since the exopod, particularly of *parallela*, is very tiny I presume that he has overlooked it and regard the uropods in this genus as biramous.

The fact that there is a cleft in operculum in *capensis* stretching to one-fourth of its length, is perhaps an indication of its origin from the paired pleopods 2 in the primitive Asellota. The same applies to the operculum of *Ilyarachna quadrispinosa* (NORDENSTAM 1933, fig. 77).

MENZIES (1956b) enumerated as distinguishing characters between *parallela* and *hanseni*, the clear distinction between pereonite 7 and pleon in the former, presence or absence of the (very inconspicuous) coupling hooks on the maxillipeds, the (probably variable) number of denticles on the inner margin of the "second" joint (misprint for third joint) of the palp, and the (perhaps variable) number of joints in the flagellum of the "second" antenna (misprint for first antenna). A more obvious difference is found in the surface of the head and pereonites 1-4, which in *hanseni* (according to MENZIES' clear fig. 2 A), are evenly rounded, whereas in *parallela* they have "the median dorsal area raised and irregularly sculptured" (HANSEN, l. c.).

### Key to the species of *Syneurycope* (Syneurycopinae)

1. Head globular. Anterior half of pleon globular, much narrower posteriorly, with parallel margins. Joint 1 of antennula conical..... *capensis* (Barnard, 1920)
1. Head squarish. Pleon subtriangular, with the lateral margins tapering towards the apex. Joint 1 of antennula cylindrical..... 2
2. Head fused with pereonite 1. Distance between antennulae almost one-third the width of the head. Body with lateral setae..... *heezeni* Menzies, 1962b
2. Head free. Antennulae close together. Body without lateral setae..... 3
3. Head as long as pereonites 1-3, with two longitudinal rows of spines... *multispina* Menzies, 1962b
3. Head shorter than prns. 1-2 and devoid of spines..... 4
4. Prn. 7 and pleon clearly separated. Dorsal surface of head and prns. 1-4 having a raised area medianly..... *parallela* Hansen, 1916
4. Prn. 7 and pleon only separated by lateral incisions. Dorsal surface of head and prns. 1-4 evenly rounded..... *hanseni* Menzies, 1956a

### **Eurycopinae** nov. subfam.

#### Diagnosis:

Frontal margin often projects. Pereonites 5-7 free or immovably fused, more or less depressed, and usually without lateral spines. Pleon with one or more segments, greatly varying in shape. Antennulae inserted behind (above) antennae, with joint 1 plate-shaped and several joints in flagellum. Mandibles normal or occasionally with reduced molar process and with palp missing. Inner margin of maxillipedal palp without denticles. Pereopod I shorter or much shorter than prps. II-IV, more or less prehensile; prps. III and IV often very long and slender; prps. V-VII almost always with carpus and propodus considerably expanded and dactylus rather short and without apical setae and claw. Female operculum

almost always circular or oval, with a median keel. Uropods ventral, biramous, with an oblong or thick peduncle (except in *Lipomera*).

#### Remarks:

The systematic position of *Lipomera* and the validity of *Munnopsurus* and *Munneurycope* are discussed later (pp. 149 and 154). A somewhat altered key is given below. This is in place of MENZIES' keys (1956b, p. 5 and 1962b, p. 138), as e.g. the presence of dorsal, spine-like projections on the pereon in *Storhyngura* cannot be used as the only distinguishing character against *Eurycope* (*S. truncata* is devoid of dorsal spines on the pereon). Moreover, it does not include *Lipomera* and the re-established genus *Munneurycope*.

### Key to the genera of Eurycopinae

1. Uropods form a broad lamellar plate which is folded over longitudinally, is sparsely furnished with setae and has (probably) two rami. Pleon and female operculum triangular..... *Lipomera* Tattersall, 1905 (p. 118)
1. Uropods with rod-like or short and thick peduncle and two rami. Very occasionally, female operculum triangular..... 2
2. Pereonites 5-7 immovably fused with each other and often with pleon. Dorsal spines on most or all pereonites (except in *S. truncata*, which has, however, a pair of tubercles on pleotelson). Pleotelson with, at least, two pairs of lateral spines or processes; apex not rounded (except in *S. intermedia*)..... *Storhyngura* Vanhöffen, 1914 (p. 118)
2. At least prn. 7 and pleon free and movable. No dorsal spines or processes on pereonites or pleotelson. The latter always devoid of postero-lateral spines or processes; apex rounded..... 3
3. Frontal projection almost always present. First four pereonites and basipodites of pereopods of about equal length. First joint of antennula with distinct inner projection..... *Eurycope* G.O. Sars, 1864 (p. 143)

3. No frontal projection. Prn. 1 (occasionally prn. 2), and basipodites of prp. I distinctly longer than the three (two) following segments and legs. First joint of antennula without distinct inner projection..... 4
4. Prn. 1 (occasionally prn. 2) longer than the three (two) following segments. Molar process of mandibles well defined and with the end cut off and excavated. Anterior margin of joint 2 of palp of maxillipeds transverse..... *Munneurycope* Stephensen, 1913 (p. 154)
4. Prn. 1 shorter than the three following. Molar process a strong, terminally rounded process. Anterior margin of joint 2 of palp of mxp. oblique... *Munnopsurus* Richardson, 1912a (p. 149)

#### Genus *Lipomera* Tattersall, 1905

It is a curious fact that the rather aberrant genus *Lipomera*, with the only species *lamellata* (TATTERSALL 1905, pp. 32 and 75, pl. VIII, 1-14), seems to have been completely neglected since its description. TATTERSALL placed it in the Munnopsidae which, at that time however, contained all Asellota with natatory pereopods V-VI or V-VII. He ranged it immediately after *Eurycope*, thus indicating its affinity with that genus.

In two respects *Lipomera* differs strikingly from Eurycopinae. Pereopods VII are rudimentary, even in adults, and the uropods are very different.

The significance of the feebly developed pereopods VII (and pereonite 7) has already been discussed (p. 20), and it was suggested that with regard to the taxonomy, not too much emphasis should be placed on this feature. According to TATTERSALL (l. c., p. 34), the uropods consist of "a broad lamellar plate, which *in situ* is folded on itself longitudinally, has its dorsal edge tipped with three or four short setae, and bears on its ventral edge a plumose stout spine and a uniarticulate appendage tipped with a long fine seta." Figs. 11 and 12 (pl. VIII) seem to indicate that the "plumose spine" is not actually a spine but the greatly reduced endopod, carrying a distal seta. The "uniarticulate appendage" should then be the exopod. In all cases, these uropods are – apart from the longitudinal folding – very close to those in Ilyarachnidae, although considerably larger. In addition, the shape of the body is rather similar to that of certain species of *Ilyarachna*. However, in all other respects (notably the dorsal position of antennulae and antennae, shape of mandibles, and similarity in shape of pereopods I-IV), *Lipomera* is a typical eurycopid genus. For the time being I consider it convenient to range it with the Eurycopinae, in spite of the very aberrant uropods. Perhaps in the future it will be necessary to establish a new family, especially if other species or genera become known.

#### Genus *Storthyngura* Vanhöffen, 1914

Synonymy – see MENZIES 1962b, p. 145.

#### Diagnosis:

Body oblong, at least twice as long as broad. Head considerably vaulted longitudinally, without distinct rostrum, but generally with a frontal seam. Pereonites 1-4 short and broad, increasing in width from 1 to 4 and usually with a median, forward-directed spine. Coxal spines or projections always present on pereopods I-IV and visible from above. Prns. 5-7 strongly convex, immovably fused with each other (and quite often also with pleon), and with the antero-lateral corners projecting in a spine which is directed outwards and forwards. There are usually two paired spines dorsally on each segment. At the lateral position, pleon has spines or triangular projections. Joint 1 of antennula large, more or less plate-shaped, joint 2 much smaller, inserted interiorly on the upper side of joint 1, somewhat behind its front margin. Squama on joint 3 of antenna not set off by an articulation. Mandibles as in *Eurycope*, but with several spines in the spine-row. Epipod of maxilliped with outer margin emarginate or with a distinct, usually subacute process. Pereopods V-VII with carpus and propodus only moderately expanded, at least twice as long as broad. Male pleopods 1 narrower in the middle than the distal part. Pleopod 2 probably always has a rather short and stout copulatory organ. Uropod biramous, with three elongated joints.

#### Remarks:

The recent addition of hadal and abyssal species, obtained by the *Vitjaz* and the *Vema* (BIRSTEIN 1957 and MENZIES 1962b), and the new species and subspecies described below have increased the number of species of *Storthyngura*. The total number is now twenty-eight, two being represented by altogether, five subspecies. The above diagnosis of this remarkable deep-sea genus has been brought about by my

having studied in detail, seventeen of these twenty-eight species.

In his diagnosis to *Storthyngura*, MENZIES (1962b, p. 145) stated i.a.: "Dorsum of body provided with spines" and "Pleon separated from peraeon". In actual fact, the body of *truncata* Richardson is completely devoid of spines (there are two tubercles posteriorly on pleotelson) and pleon is immovably fused with pereon in, at least, *pulchra* (Hansen), *atlantica* (Beddard), *chelata* Birstein, *benti* and *furcata* Wolff, and *vemae* Menzies. The latter instance is according to MENZIES' fig. 39 A and the others according to personal study. In *bicornis* and *herculea* Birstein, pleon is only very slightly movable.

*Storthyngura atlantica* (Beddard) was transferred to *Acanthocope* by MENZIES (1956a). Earlier the same year I considered it belonged to *Storthyngura* (1956a, p. 112), and listed it accordingly. MENZIES (1962b, p. 145) subsequently stated that this move was not correct and added: "This error was continued by Birstein (1957)." In neither of the two papers did MENZIES give any valid reasons for transferring *atlantica* to *Acanthocope*. According to his diagnosis (1962b, p. 152), this genus differs from *Storthyngura* in the following characters: (1) Coxal plates on pereonites 2-4 not visible from above; (2) pleon completely fused with pereon and (3), consisting of one segment; (4) uropods uniramous. As is shown above, pleon is also in *Storthyngura* very often fused with pereon. Of the three remaining characters, BEDDARD (1886b) did not make any statements in his text regarding the coxal plates or the number of pleonites. It is true that his only illustration (pl. IX, 13) showed one pleonite only and no coxal plates but as I have already pointed out (1956a), BEDDARD's figures are not very reliable. BEDDARD's comment on the number of rami in the uropods was: "I did not observe the uropods to be biramous, but do not wish to speak with certainty on the point".

However, I have studied the holotype in London and re-describe it below. There is no doubt that the coxal plates are clearly visible from above (Fig. 69a), pleon consists of two segments (p. 125), and the uropods are biramous (Fig. 69j). Moreover, joint 1 of the antennula has a strong inner spine which is present in a great many species of *Storthyngura* but always absent in *Acanthocope*. Pereopod I is apparently much shorter than prps. II-IV, and carpus and propodus of prps. V-VII are wider than in *Acanthocope*, and their dactyli have no terminal setae. Thus, *atlantica* definitely belongs to *Storthyngura*.

MENZIES (1956a, but not 1962b), also referred *Storthyngura intermedia* to *Acanthocope*. However, the uropods are biramous (BEDDARD 1886b, p. 71), and the apex of pleotelson is rounded, etc.

In addition, MENZIES (l. c.) prepared a key to the species of *Storthyngura*. He left out *Eurycope spinosa* Beddard which I referred to *Storthyngura* (1956a, p. 112) – albeit with some hesitation, owing to the presence of no less than three long spines dorsally on each of pereonites 1-4, which were otherwise unknown in the genus. However, a similar spine armament occurs in two of MENZIES' new species (*tripispinosa* and *digitata*), and accordingly, *spinosa* belongs without doubt to *Storthyngura*.

A few comments to MENZIES' key appear to be necessary. According to couplet 5, *chelata* Birstein has three spines on the head; there are actually only two. It seems impossible to separate *vemae* and *digitata* Menzies (couplet 10): in the former, apex of pleon is "indented", in the latter "rounded". In actual fact, apex is bilobed and indented in the former, rounded and indented in the latter. With regard to *magnispinis* Richardson, MENZIES writes (couplet 11): "apex of pleon incised medially"; RICHARDSON described it as truncate. According to couplet 14, *herculea* Birstein has no dorsal spines on pleon; there is a distinct median spine anteriorly. Regarding couplet 16: the two subspecies of *tenuispinis* cannot be separated by the number of dorsal spines on pleon since they have both four. Finally, it seems inadvisable to base the key almost entirely on presence or absence of dorsal spines. As an example, for *novae-zelandiae* (Beddard) MENZIES states that there are "no spines on pleon". However, two tubercles are present, which may in other specimens prove to be large enough to be termed spines.

In order to draw up the following key to the genus I found it necessary – during a stay in London – to study in detail the *Challenger* species of this genus, described by BEDDARD and kept in the British Natural History Museum. The result of the study is given below; it includes a re-description of *S. atlantica* and *novae-zelandiae* as well as a description of two new species previously referred to *S. fragilis*. In addition, a fragmentary specimen and two unidentifiable juveniles from the *Challenger* have been studied and figured. Two species from the recent Russian deep-sea investigations have been examined, *S. pulchra* has been thoroughly revised and split up into three subspecies, and two new abyssal species from the *Galathea* have been described.

### Key to the species of *Storhyngura*

1. Pereonites 1-4 with one median spine and another dorsal spine on each side, about half way between the median one and the antero-lateral corners; at least prn. 4 has one spine on the antero-lateral corners ..... 2
1. Prns. 1-4 at most with one median and a pair of antero-lateral spines each. .... 4
2. Lateral spines on prn. 1 coxal. No spine on second, three on third joint of antenna ..... *spinosa* (Beddard, 1885)
2. Lateral spines on prn. 1 emerging from the segment proper. One spine on second, one or two on third joint of antenna ..... 3
3. One pair of spines on head. Antero-lateral corner of prns. 2 and 3 with spines. Pleon with three pairs of spines ..... *triplispinosa* Menzies, 1962b
3. Two pairs of spines on head. Antero-lateral corner of prns. 2 and 3 rounded. Pleon with two pairs of spines ..... *digitata* Menzies, 1962b
4. Pleotelson evenly rounded posteriorly and not produced, with a deep and narrow incision near the postero-lateral corners. Prns. 1-4 with one median spine, 5-7 with two each (paired), and head and pleon without spines ..... *intermedia* (Beddard, 1885)
4. Pleotelson posteriorly produced, with one or two spines, or truncate. If somewhat rounded posteriorly, pleotelson has a median spine anteriorly and the incisions are broad. .... 5
5. Pleotelson with one terminal spine or pointed process which is sometimes bent considerably downwards near apex ..... 6
5. Pleotelson posteriorly with two terminal spines or truncate, with a straight or slightly convex or concave hind margin. .... 19
6. Pleotelson with four lateral spines or processes on each side and dorsally, with three median and two posterior paired spines. Two spines on head and one on inner corner of first joint of antennula. .... *robustissima* Monod, 1925
6. Pleotelson at most with three lateral spines or processes on each side and dorsally at most with two median spines. .... 7
7. Antennula with a large, interior spine on first joint. One pair of spines on head and a median spine on at least prns. 2-4, but no lateral spines on prn. 3. Pleon with two median spines or processes. .... 8
7. Antennula without interior spine. Pleon at most with one median spine. .... 10
8. Pleotelson with three lateral spines on each side. Carpus and propodus of pereopods V-VII only as broad as basis and ischium. .... *benti* Wolff, 1956a
8. Pleotelson with two lateral spines on each side. Carpus and propodus of prps. V-VII somewhat broader than basis and ischium. .... 9
9. Spine present medianly on prn. 1 and on inner, distal corner of third antennal joint. Postero-lateral spines on pleotelson directed outwards ..... *abyssalis* n. sp. (p. 139)
9. No spine present on prn. 1 and a triangular process only on inner, distal corner of third antennal joint. Postero-lateral spines on pleotelson directed obliquely backwards. .... *atlantica* (Beddard, 1885) (p. 125)
10. Pleotelson somewhat triangular in shape with a small, triangular process on each side, near the posterior end. The antero-lateral corners of pleotelson and prn. 7 have no distinct spines. No dorsal spines or tubercles on head, prn. 1, and the pleonite immediately in front of pleotelson ..... *novae-zelandiae* (Beddard, 1885) (p. 122)
10. Pleotelson shield-shaped. Prn. 7 and anterior part of pleotelson with distinctly set off, lateral spines. At least a median tubercle on pleotelson or on the pleonite immediately in front of pleotelson ... 11
11. Prns. 2-4 each with a long spine medianly, followed by a tubercle. Medianly on prns. 5-7, a longitudinal impression, limited by spines and low keels (*pulchra*). .... 12
11. Prns. 2-4 with only one long spine medianly. Prns. 5-7 with paired spines only – no conspicuous impression, limited by keels. .... 14

12. Head with a median spine near the posterior margin. Proximal joint of exopod of pleopod 3 almost three times as broad as the distal..... *pulchra pulchra* (Hansen, 1897) (p. 138)
12. Head without a median spine. Proximal joint of exopod of plp. 3 at most twice as broad as distal ..... 13
13. Paired processes posteriorly on pleotelson directed outwards-backwards. Longitudinal keels on inner side of male plps. 1 not visible from outside. Proximal joint of exopod of plp. 3 twice as broad as the distal..... *pulchra kermadecensis* n. subsp. (p. 139)
13. Paired posterior processes directed outwards and slightly forwards. Distal half of keels on inner side of male plps. 1 visible from outside. Exopod of plp. 3 equally narrow throughout..... *pulchra caribbea* (Benedict, 1901) (p. 138)
14. Postero-lateral margins of pleotelson almost straight and terminal spine broad and directed straightly backwards; thus, the shape of pleotelson almost regularly triangular (except for the broad posterior spine-pair which distally, are curved somewhat forwards). Small spine on central, vaulted area of first antennular joint. Peduncle of uropod longer than the endopod..... *gordoniae* n. sp. (p. 130)
14. Postero-lateral margins of pleotelson convex, and terminal spine either narrow or bent considerably downwards distally. No central spine on first antennular joint. Peduncle of uropod shorter than (or rarely as long as) the endopod ..... 15
15. Pleotelson with a deep notch in front of the long postero-lateral spines which are directed outwards and somewhat forwards. No spines on head or prn. 1 ..... 16
15. Pleotelson without the notch in front of the postero-lateral spines or processes; these are either strong, triangular processes directed outwards-backwards, or rounded projections directed outwards. A more or less conspicuous spine on prn. 1 ..... 17
16. Distal half of terminal spine bent vertically downwards. Squama insignificant, not projecting. Inner margin of carpus of prp. I sharp, finely serrated and with a row of setae..... *fragilis* (Beddard, 1885) (p. 126)
16. Terminal spine pointing obliquely downwards, but without an abrupt downward bend. Squama projecting, spine-shaped. Inner margin of carpus of prp. I rounded and with scattered setae..... *challengeri* n. sp. (p. 128)
17. Head without spines. Antero-lateral spines on pleotelson directed forwards. Posterior margin of pleotelson produced as a rounded process, the downward-bent terminal spine not visible in dorsal view..... *symmetrica* Menzies, 1962b
17. Head with a pair of spines or tubercles. Antero-lateral spines on pleotelson directed outwards. Apex of pleotelson pointed, the terminal spine visible in dorsal view..... 18
18. Terminal spine-like process pointing directly backwards. In front of its base are rounded convexities which are immediately posterior to the hind margin of the two vaulted lateral parts of pleotelson. Apexes of male plps. 1 well separated and pointed..... *chelata* Birstein, 1957 (p. 133)
18. Terminal spine-like process bent strongly downwards. The two triangular, subacute processes are well separated from the hind margin of the two lateral parts. Apexes of male plps. 1 close together and with setae on the margin..... *bicornis* Birstein, 1957 (p. 133)
19. Terminally, pleotelson has two distinct, closely set, spine-like processes directed somewhat outwards..... 20
19. Pleotelson truncate terminally, with a straight, slightly convex or concave posterior margin .... 24
20. Head much broader than prn. 1. One median spine anteriorly on the dorsal side of pleotelson and one spine-pair posteriorly..... *brachycephala* Birstein, 1957
20. Head not broader than prn. 1. Dorsally, pleotelson without posterior spine-pair ..... 21
21. No median spine on prn. 1 and no process anteriorly on pleotelson. No keel between branchial cavity and terminal face. Interior spine on first joint of antennula..... *elegans* Vanhöffen, 1914
21. Median spine on prn. 1, median process anteriorly on pleotelson, and a keel separating branchial cavity and terminal face. No interior spine on first joint of antennula..... 22

22. Pleotelson with only two lateral spines. Uropods reach far beyond terminal processes. Female operculum with central spine..... *furcata* Wolff, 1956a (p. 139)
22. Pleotelson with three lateral spines or processes (besides the terminal ones). Uropods reach only a short distance beyond end of terminal processes..... 23
23. Median spines on pereonites vertical or almost vertical. No paired tubercles posteriorly on pleotelson. Female operculum without central spine..... *herculea* Birstein, 1957
23. Median spines directed obliquely forwards. A pair of tubercles posteriorly on pleotelson. Female operculum with a small central spine..... *vitjazi* Birstein, 1957
24. No median spine on any of the pereonites, or anteriorly on pleotelson. First joint of mandibular palp longer than second. Inner spine present on first joint of antennula..... *truncata* (Richardson, 1908)
24. A median spine on, at least, prns. 2-4. First joint of mandibular palp shorter than second (not mentioned in MENZIES' three species)..... 25
25. Lateral projections blunt (especially on prns. 5-7 and pleotelson). Apex of pleotelson bilobed and spinulate on margin. Head with two spines..... *vemae* Menzies, 1962b
25. Lateral projections acute. Apex of pleotelson not bilobed and without denticles ..... 26
26. At posterior position, head considerably broader than prn. 1 (excl. of the lateral spines). A median spine on both pleotelson and the vestigial pleonite in front (*tenuispinis*)..... 27
26. Posteriorly, head narrower than prn. 1. At most one median spine on pleon (either on pleotelson or on the vestigial pleonite)..... 28
27. Margin of pleotelson, between anterior and posterior lateral spine, rounded. Uropods reach far beyond posterior margin..... *tenuispinis tenuispinis* Birstein, 1957
27. Margin between anterior and posterior lateral spine projecting in an acute process. Uropods hardly reach posterior margin..... *tenuispinis kurilica* Birstein, 1957
28. A conspicuous inner spine on joint 1 of antennula. Postero-lateral corners of pleotelson (behind postero-lateral spines) rounded or subangular, without outward-directed processes ..... 29
28. No inner spine on joint 1 of antennula. Postero-lateral corners of pleotelson with distinct, outward-directed processes..... 30
29. Prns. 6-7 with a dorsal spine-pair. Pleon with a median spine anteriorly. Apex of pleotelson truncate or slightly concave ..... *magnispinis* (Richardson, 1908)
29. Prns. 6-7 and anterior part of pleon without dorsal spines. Apex of pleotelson convex..... *snanoi* Menzies, 1962b
30. Prn. 1 without median spine. Pleotelson with three pairs of lateral spines or processes and with the lateral margins more or less serrated; surface of posterior part of pleotelson granulated..... *serrata* n. sp. (p. 141)
30. Prn. 1 with a median spine. Pleotelson with only two pairs of lateral spines or processes and with uncerrated lateral margins; surface of posterior part of pleotelson not granulated ..... 31
31. No spines on head. Posterior margin of pleotelson distinctly convex... *birsteini* Menzies, 1962b
31. Two strong spines on head. Posterior margin of pleotelson between postero-lateral processes straight in dorsal view, since the terminal spine-like process is bent abruptly downwards..... *bicornis* Birstein, 1957 (p. 133)

*Storhyngura novae-zelandiae* (Beddard, 1885)  
(Pl. IV G-H; Text-figs. 66-68)

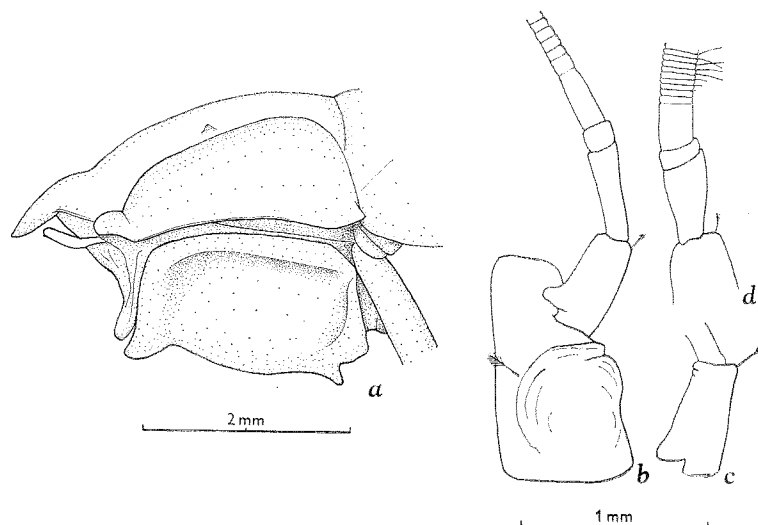
*Eurycope novae-zelandiae* Beddard 1885, p. 918;  
BEDDARD 1886b, p. 61, pl. IX, 1-7.

*Storhyngura novae-zelandiae* (Beddard), VANHÖF-  
FEN 1914, p. 584; WOLFF 1956a, pp. 121, 142,  
149, fig. 37a-j.

#### Material:

*Challenger* St. 168, E. of New Zealand (40°28'S,  
177°43'E), 2012 m, 8 July 1874. Bottom: blue  
mud. Bottom temp.: 2.8°C. – 6 females (one with  
marsupium containing embryos, one with fully  
developed oostegites, three with developing ooste-  
gites and one juvenile); 3 males (one without  
head).

Fig. 66. *Storthyngura novae-zelandiae* (Beddard); a-c, ♀ lectotype; a, pleon and operculum from the side; b, antennula (first joint in frontal view); c, second joint in frontal view; d, distal end of peduncle and proximal end of flagellum of antennula of ♂.



#### Additional description:

**Body** (Pl. IV H) rather broad, only 2.5 times longer than wide. Original colour probably pure white.

**Head** not smooth, as stated by BEDDARD, but has identical, paired, raised areas behind the antennulae, an oblique furrow behind the raised areas, and the same frontal seam as e.g. in *S. fragilis*. Additionally, the posterior triangular area on the head (between the oblique furrows), is subdivided by a transversal, somewhat convex seam.

**Pereonites 1-4.** Prn. 2 considerably longer than, in particular, prns. 1 and 4. The median spine is significant only on prn. 2 (apically rounded); on prn. 3 there is a triangular process in its place, and on prn. 4 a small rounded tubercle only, much smaller than that illustrated in BEDDARD's fig. 1 (pl. IX). On all three segments these features emerge from the anterior margin. Lateral spines on prns. 3 and 4 somewhat varying in length. Coxal plates with triangular projections rather than actual spines, two on prns. 2-4, one on prn. 1 (dorsal view). The female lectotype (with developing oostegites) has practically no median keel at the ventral position, while the male has a rather faint one.

**Pereonites 5-7** with less pronounced lateral spines than in any other species of *Storthyngura* and faint, longitudinal convexities in place of the usual, paired, dorsal spines. These convexities are almost invisible on prn. 7. Medianly, prn. 7 is the longest, 5, the shortest. Prn. 5 is without a spine or projection on the ventral side, but has the usual, interrupted keel further posteriorly.

**Pleon** with two transverse furrows anteriorly, indicating two vestigial segments in front of pleotelson. The latter about one-fourth broader than long when

seen exactly from above and with more convex margins than in BEDDARD's fig. 1. Posteriorly, the shape is quite close to that of several other species: there is a posterior spine, but the usual postero-lateral spines are substituted by two very small, triangular, subacute processes. Posterior spine rather hook-shaped (Fig. 66a). Halfway on the median, longitudinal, convex part of pleotelson is a pair of low tubercles (66a). Terminal face (Pl. IV G) roughly quadratic in frontal view and without an incision in the anterior chest to receive the distal end of the male pleopods 1, as in e.g. *S. chelata* and *S. pulchra kermadecensis* (Pl. VI C and F).

**Antennula** (66b) with a very thick first joint, almost as thick as long, and with the distal part almost straightly cut and somewhat excavated on the underside. Beneath the insertion of the second joint there is a low keel. Joint 2 is narrow in the proximal part, but a conspicuous process is to be found on the exterior margin, not far from the proximal corner (66c). Joint 3 long and narrow, joint 4 short. Flagellum multi-jointed. In the male, antennula is a little larger, joints 3 and 4 and flagellum considerably broader and the latter with much shorter joints (66d). Flagellum in female broken, in male unusually long, reaching backwards to, at least, the hind margin or pereonite 5.

**Antenna** lacks spines on the four proximal preserved joints; a small, triangular process is present only on the inner, lower, distal corner of joint 3.

**Mandibles** stout. Incisive part of left md. (67b) with two blunt teeth and a somewhat less projecting cutting edge; in right md. there are two terminal teeth and, further proximally, two short, blunt teeth (67e). Movable lacinia with five teeth (67b). Spine-



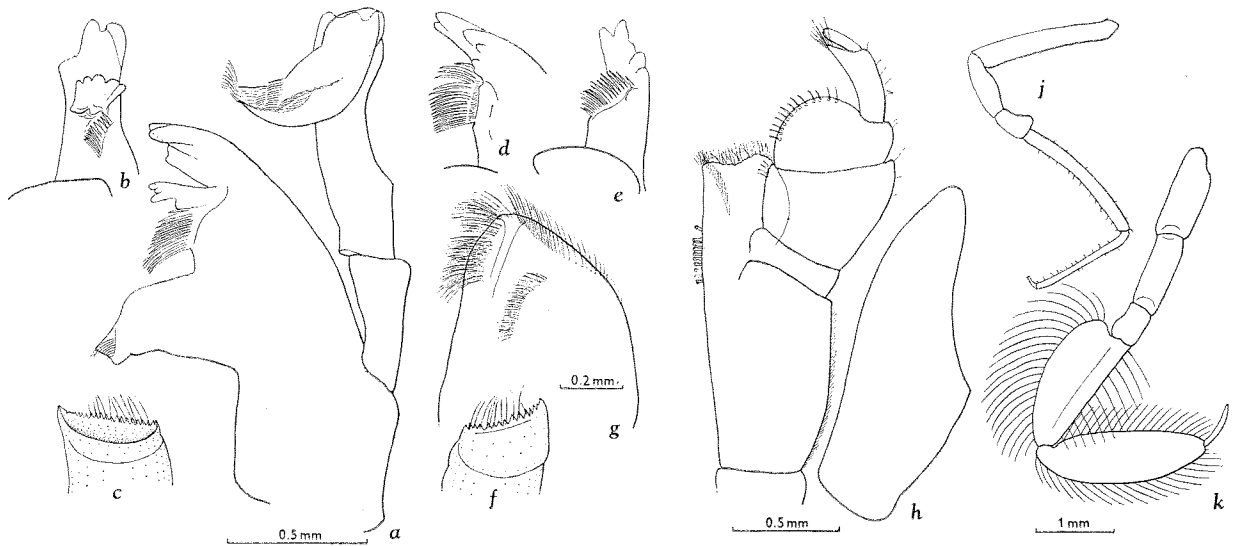


Fig. 67. *Storthingura novae-zelandiae* (Beddard), ♂; a-c, left, and d-f, right mandible; a and d, from the side; b and e, distal end from inside; c and f, apex of molar process; g, labium; h, left maxilliped; j and k, pereopods I and V.

row with about 18 spines of almost equal length (67a, d). Molar process stout; lower, distal corner projects strongly (67a), and the edge is serrated and has setae. Apex in both mandibles obliquely cut off (67c, f), and in left md. rather deeply excavated. Palp (67a) short and stout, with a long and curved third joint.

*Labium* (67g) with a very dense growth of setae.

*Maxilliped* (67h) has probably ten coupling hooks; first three joints of palp broad, joint 4 narrow, unusually long and with subparallel margins. Number and length of all setae, reduced. Epipod narrow, with the insignificant projection placed at a rather proximal position on the outer margin.

*Pereopod I* (67j) non-prehensile and with a very

short dactylus. Prp. II almost twice as long as I and very slender, propodus being as long as merus + carpus, and dactylus about one-fourth of propodus. Prps. III and IV missing. Prps. V-VII according to Fig. 67k, and about as long as I.

*Female operculum* with a narrow, median keel stretching two-thirds of the distance to the posterior margin, which is slightly concave. Proximally, the keel has a low, spine-like process (66a).

*Male pleopods 1* (68a) twice as broad at base as in the middle and somewhat widened towards the distal end, which is straightly cut off. The distal part of the lateral keels or folds in the middle (km) visible from outside. At a more distal point along the dilated margins another pair of folds are found

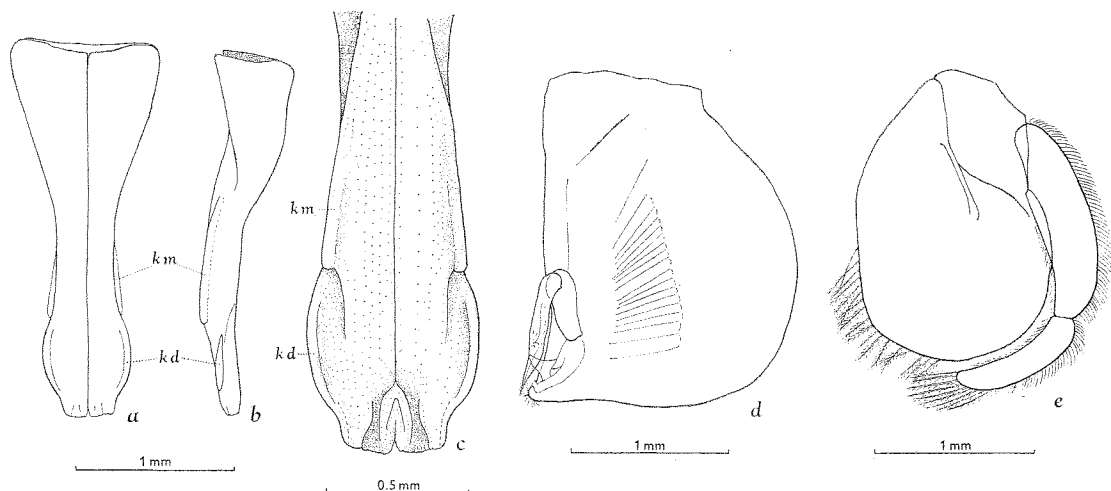


Fig. 68. *Storthingura novae-zelandiae* (Beddard); a-c, male pleopods 1; a, from outside; b, from the side; c, outer end from inside; d-e, male pleopods 2 and 3.

(kd), which are very conspicuous in side view (68b). Distally, on the inner side of each pleopod there is a short furrow which receives the stylet of pleopod 2 (68c).

*Pleopod 2* (68d) is one-fourth longer than broad, has the distal margin at a right angle to the interior one, and many very short setae on the interior, distal corner. Stylet very short and placed at an extremely distal point. *Pleopod 3* as shown in Fig. 68e.

*Uropod* according to BEDDARD's description.

*Size*: The female lectotype is 14.4 mm long and 5.7 mm broad. Another female with embryos in the marsupium is also 14.4 mm. The described male is 14.0 mm.

*Types*: As lectotype the best preserved female (with developing oostegites) was selected. This specimen, as well as the described male, are in the British Museum (Nat. Hist.), London.

*Development*: Description of embryos, see WOLFF 1956a, p. 121.

#### Remarks:

This species is easily recognizable by the broad, subtriangular pleon and the very insignificant lateral spines on pleon and pereonites 5-7. In addition, the shape of joint 2 of the antennula and joint 4 of the palp of the maxilliped is unique.

#### Occurrence:

As yet only found east of New Zealand, 2012 m depth, 2.8°C.

#### *Storthyngura atlantica* (Beddard, 1885) (Text-fig. 69)

*Eurycope atlantica* Beddard, 1885, p. 919; BEDDARD 1886b, p. 66, pl. IX, 13.

*Storthyngura atlantica* (Beddard), VANHÖFFEN 1914, p. 584; WOLFF 1956a, pp. 116, 142, 149.

#### Additional description:

The holotype and only specimen (a male), is in quite good condition.

*Body* about 2.8 times longer than broad, originally probably pure white in colour.

*Head* not only with the two conspicuous, hook-shaped spines (each being placed on a raised area), but also with a seam which is easily seen behind the antennae and antennulae (Fig. 69c), but becomes obscure in the middle part.

*Pereonites 1-3* have rounded lateral corners and one conspicuous coxal spine in front and a subacute

process behind (69a). – *Prn. 4* with a large spine on the antero-lateral corner and the same arrangement on the coxae as above – although the spine here is shorter (69a). The median spine on prns. 2-4 emerge from the anterior margin. The armament of the low, median, ventral keel is unusual and is shown in Fig. 68b.

*Pereonites 5-7* fused with each other and with pleon. Lateral spines more flattened at base than usual, and spines on prn. 5 somewhat twisted – becoming broadest in lateral view. The very sturdy, paired spines found dorsally on prns. 5 and 6 are placed on a raised area. Two similar, but much fainter, raised areas present on prn. 7, but appear to be devoid of spines. The fact that these two spines are missing, in contradiction to almost all other species of *Storthyngura*, might be explained by supposing that this was a juvenile specimen with prn. 7 not yet fully developed. However, I personally consider this specimen to be mature for three reasons: (1) Prn. 7 is apparently, in all other features, as fully developed as 5 and 6; (2) only the basipodites of pereopods VII are present, but they are as those of prps. V and VI; (3) the pleopods indicate that it is a mature or almost mature male.

*Pleon*. Between the anterior, slightly convex margin of pleotelson and the concave, posterior margin of prn. 7 is a vestigial pleonite. Its anterior margin is, however, not so convex as that indicated in BEDDARD's fig. 13. The anterior, lateral spines are rather broad, and there is a low and indistinct furrow across the median part behind the anterior median spine. This furrow probably indicates the separation between two segments – as in the other species of this genus. The posterior spine-pair and the terminal spine are now broken. The terminal face corresponds to that of several other species (e.g. *S. pulchra*, p. 135).

*Antennula* (Fig. 69c) has a very elongated first joint, more than twice as long as broad, with a curved inner spine and a flattened, tongue-shaped distal part. Joint 2 much smaller and with an antero-interior process. Joint 3 about twice as long as broad and joint 4 very short. Flagellum with a great many very short joints, but its distal part is broken off in both antennulae.

*Antenna* with joints 1 and 2 unarmed, joint 3 with a stout triangular, inner process and a strong, somewhat curved outer spine. Only the first four joints are preserved.

*Mouthparts* could not be dissected. The mandibles each seem to have two rather projecting teeth in the

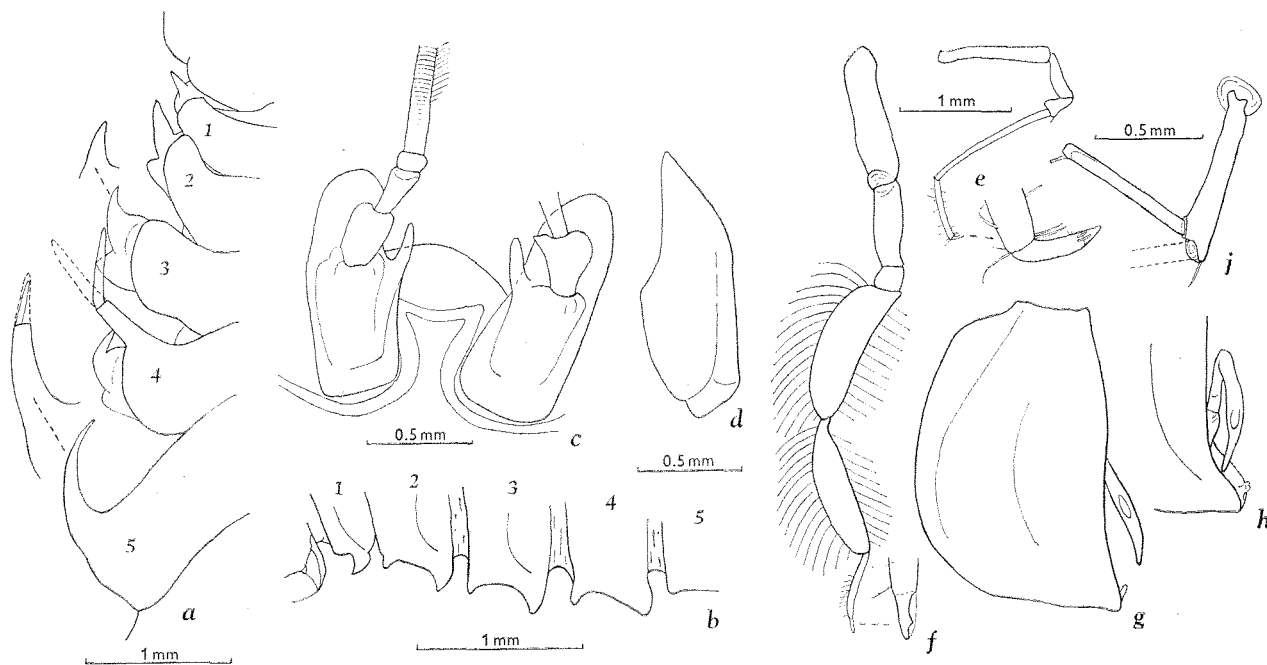


Fig. 69. *Storthyngura atlantica* (Beddard), ♂ holotype; a, left side of pereonites 1-5 from above; b, ventral margin of pereonites 1-5; c, frontal seam and antennulae, the left one seen directly from above; d, epipod of right maxilliped; e-f, pereopods I and V; g-h, pleopod 2; g, in frontal view; h, apex from inside, seen at a slightly oblique angle; j, uropod.

incisive part. Palp of the usual shape of the genus, with joint 2 three times as long as joint 1. Maxillipeds broader than usual, with the endite straightly cut off distally, and joints 2 and 3 in the palp very broad. Joints 4 and 5 are very narrow and joint 4 has an almost spine-like inner projection. Epipod according to Fig. 69d, with a conspicuous, longitudinal furrow close to the inner margin.

*Pereopod I* (69e) very slender and apparently much shorter and fainter than prps. II-IV, judging from the size of the preserved basipodites of the latter. — *Pereopod V* (69f) with carpus and propodus narrow and dactylus long and rather strong.

*Male pleopod 2* (the first pair of pleopods missing) narrow and with the copulatory stylet not even reaching to the somewhat projecting distal corner (69g, h).

*Uropod* (69j). The long and narrow exopod is present (on one of the uropods), and the shape of the peduncle and a conspicuous hole at the point where the endopod is inserted indicate that the species has biramous uropods.

*Size*: Length about 9.7 mm, greatest width about 3.5 mm.

#### Remarks:

MENZIES (1956a, 1962b) referred the species to *Acanthocope*. On p. 119 the reasons for retaining *atlantica* in *Storthyngura* are given.

#### Occurrence:

Atlantic Ocean off the Azores (38°11'N, 27°09'W), 1646 m, 4.4°C.

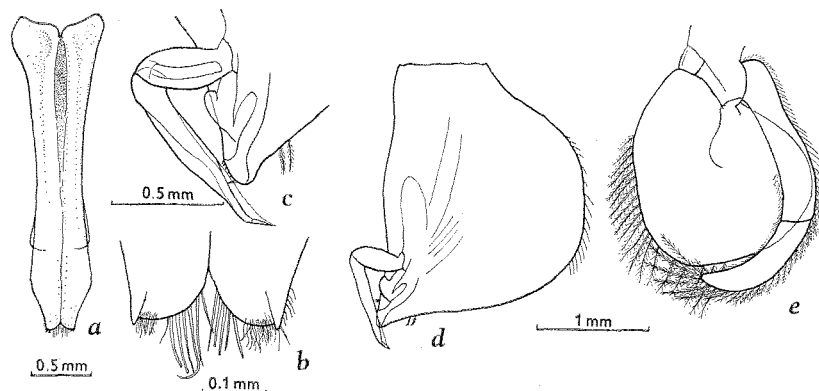
#### *Storthyngura fragilis* (Beddard, 1885)

(Pls. IV E-F, V A-B; Text-figs. 70-73)

Whilst engaged in a revision at the British Museum (London) of BEDDARD's "*Eurycope fragilis*", I found in the collection only the three males from St. 237, the female from St. 152 and the specimen from St. 158 (BEDDARD 1886b, p. 66). A re-description and preliminary dividing of the species was undertaken on this material during my stay in London. At a later date, the missing female from St. 147 was found and sent to me, together with the above mentioned specimens. However, the best preserved male from St. 237, which I had designated as the lectotype of "*Eurycope fragilis*", could not be borrowed. Consequently, part of the following description etc. of *fragilis* could not be based on the type.

A very thorough comparison of the existing material has convinced me that specimens from three of the localities differ in so many respects that it is impossible to keep them together in one species or to regard them as subspecies. The specimen from St. 158 is a fragmentary female, lacking the posterior part of pleon, and thus, impossible to refer to any of the following three species. The total length

Fig. 70. *Storthyngura fragilis* (Beddard); a-b, pleopods 1 of ♂ lectotype; a, from outside; b, apex; c-e, pleopods 2 and 3 of ♂ without head.



of this specimen (from south of Australia, 3290 m depth), was originally about 17 mm.

There is no doubt that BEDDARD's description and figures (l. c., pl. IX, 8-12), primarily refer to the three males from St. 237.

#### Material:

*Challenger* St. 237, E. of Japan (34°37'N, 140°32'E), 3429 m, 17 June 1875. Bottom temp.: 1.8°C. – 1 complete male (lectotype), 1 male without head and 1 male without pleon.

#### Additional description:

Features not mentioned by BEDDARD (1886b), are described in the following:

*Body* (Pl. IV E-F) rather elongated, being 3.5 times longer than broad (excl. of the lateral spines). The colour is yellowish, but was most certainly a pure white originally.

*Head* (Fig. 72a) long, narrower than pereonite 1, with a frontal and two shallow, anteriorly convergent (Λ-shaped) furrows in the middle and two low convexities behind the antennulae.

*Pereonites 1-4* somewhat varying in length, prn. 2 being the longest and 1 and 4 the shortest. Dorsal spine on prn. 2 present, and the three dorsal spines (on prns. 2-4) are longer than the pereonites medianly and are slender throughout. Antero-lateral corners of prns. 1 and 2 rounded, those of 3 and 4 with a conspicuous spine. There is one coxal spine on prn. 1, two (a large and a small) on the remaining ones, i.e. also on prn. 2 – in contradiction to BEDDARD's statement. A keel and a forward-directed spine on the anterior end of each segment are found ventrally.

*Pereonites 5-7* of the usual shape with distinct, although coalesced separations between the segments. In addition to the lateral spines, a conspicuous tubercle is found on the postero-lateral corner of each segment – as e.g. in *bicornis*. Dorsal spines

very slender. The ventral, interrupted keel straight, i.e. shaped as in *pulchra* (Pl. VII D, F) and ending anteriorly in a large, compressed spine which is directed downwards (Fig. 71b).

*Pleon* consists of a vestigial segment followed by pleotelson. The proximal part of the latter is considerably vaulted and furnished with a median spine. Slightly posterior to the antero-lateral corners (not directly on the corner as shown by BEDDARD on pl. IX, 8), is a moderately large spine. Halfway on the median, vaulted part is a pair of small nodules. The posterior part of pleon is not quite as in BEDDARD's fig. 8 – which is more reminiscent of *challengeri* n. sp. The curvature of the spine-pair and the considerable convexity of the postero-lateral curve of the two lateral parts of pleotelson give the impression of a deep incision in front of the spine-pair. The proximal part of the terminal spine points backwards, the distal part – after a sudden bend – vertically downwards (Pl. V A). There is a conspicuous, longitudinal furrow on the upper (dorsal) side of the spine. The keel separating the terminal face from the branchial cavity projects strongly and is directed downwards (Pl. V A, B); the terminal face thus being considerably broader than long when viewed directly from below (Pl. V B).

*Antennula* (Fig. 72a) with a large, flattened and, at the distal position, straightly cut off first joint; the distal part of which being only a little more than half as wide as the proximal. Joint 2 bent somewhat backwards; in frontal view almost rectangular (72b), with the insertion of the preceding and succeeding joints at diametral corners. Joint 3 elongated, joint 4 short, and flagellum multi-jointed, reaching backwards to the hind margin of pereonite 2.

*Antenna* (72a) has distally, on the outer corner of joint 3, a small, knob-shaped squama with a tiny spine and a subacute projection on the inner distal corner. Only first four joints preserved.

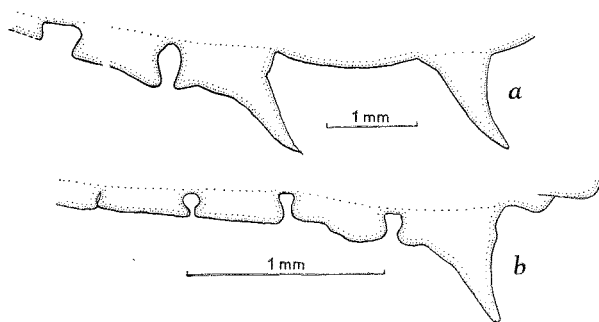


Fig. 71. Anterior part of ventral keel on pereonites 5-7: a, *Storhyngura challengerii* n.sp.; b, *S. fragilis* (Beddard).

*Mouthparts* not dissected.

*Pereopod I* (73a) with propodus three-fifths of carpus; the inner margin of the latter is rounded and has scattered setae. Dactylus short.

*Pereopods II-IV*. Prp. II more than twice as long as I, and prps. III and IV still larger – thus longer than the body. They are very slender, and prps. III and IV have a row of conspicuous setae along the outer margin of dactylus; claw short. Developing oostegites almost rectangular.

*Pereopods V-VII* (73e) a little longer than prp. I. Propodus rather slender and only a little longer than carpus. Dactylus long, a little less than half as long as propodus.

*Male pleopods I* (70a) long and slender, broadest at base and with a pair of very conspicuous keels on the inner side. Apex rounded, with a barely visible minute tip on the outer branch; two close tufts of setae are present on apex, those in the median position being the longer (70b).

*Pleopod 2* (70c-d) broad, with inner distal corner somewhat projecting and with a keel on the dorsal (inner) side of the corner. Copulatory organ short, protruding very close to the distal corner; a small tuft of setae is found on the interior margin beyond the exopod (not shown in Fig. 70c).

*Pleopod 3* (70e) with endopod rounded, and exopod 2-jointed and of almost equal width throughout.

*Uropod* (73k) with endopod about one-fourth longer than exopod (in contradiction to BEDDARD's fig. 8), and somewhat broader. Peduncle broad and short, about three-fourths of endopod.

*Size*: The lectotype 11.0 mm long, the two other specimens about 12 and 10 mm respectively.

#### Remarks:

The affinities of the species are discussed on p. 131.

#### Occurrence:

Off Japan at a depth of 3429 m and a temperature of 1.8°C.

#### *Storhyngura challengerii* n. sp.

(Pl. V C-D; Text-figs. 71-73, 75)

*Eurycope fragilis* Beddard, 1885, p. 920 (pars); BEDDARD 1886b, p. 63 (pars).

#### Material:

*Challenger* St. 152, Antarctic Indian Ocean (60° 52'S, 80°20'E), 2300 m, 11 February 1874. Bottom temp.: c. 0.4°C. – 1 somewhat mutilated female.

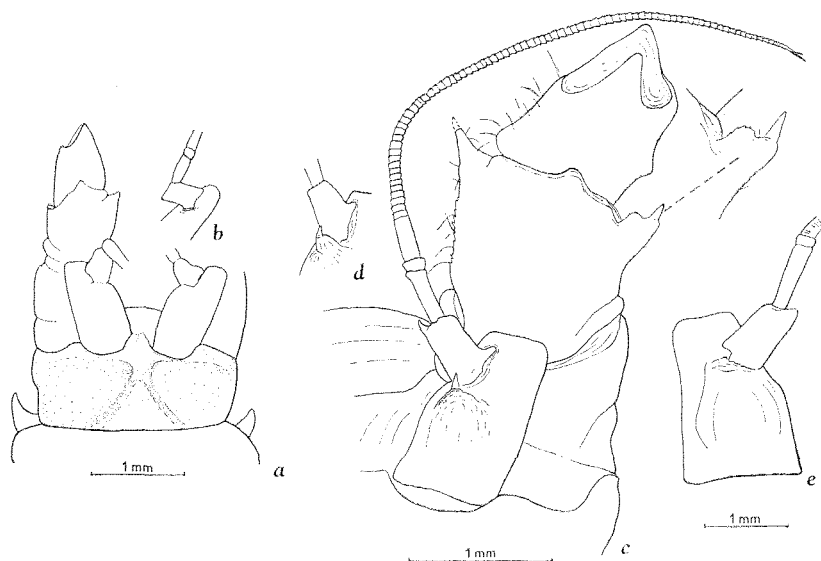


Fig. 72. a, head, antennulae and left antenna of *Storhyngura fragilis* (Beddard), ♂ lectotype; b, frontal view of second joint of antennula; c, right antennula and antenna of *S. gordonae* n. sp., ♀ holotype; d, insertion of second joint of antennula in oblique view; e, left antennula of *S. challengerii* n. sp., ♀ holotype.

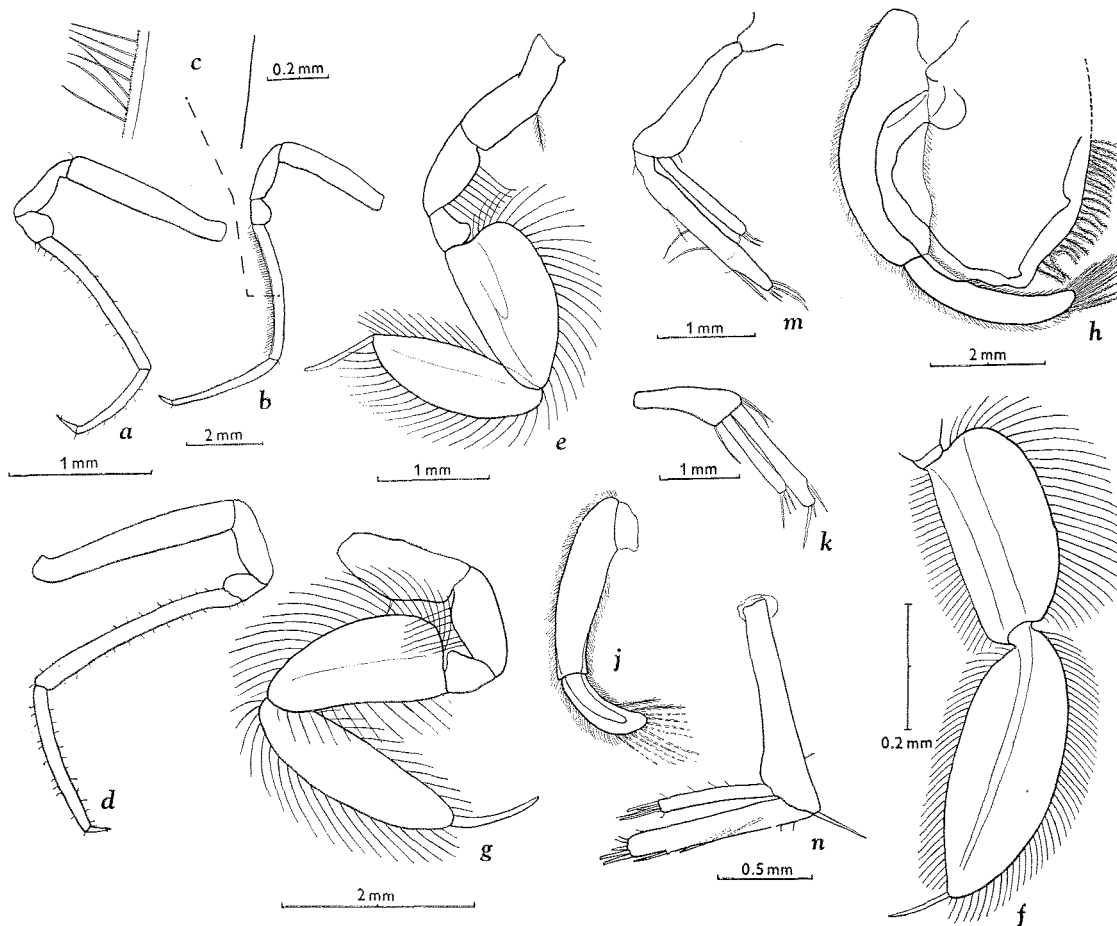


Fig. 73. a-d, pereopod I; a, of *S. fragilis* (♂ lectotype); b-c, of *S. challengeri*; d, of *S. gordonae*; e-g, pereopod V; e, of *S. fragilis* (♂ lectotype); f, of *S. challengeri*; g, of *S. gordonae*; h, pleopod 3 of *S. challengeri*; j, exopod of pleopod 3 of *S. gordonae*; k-n, uropod; k, of *S. fragilis* (♂ without head); m, of *S. challengeri*; n, of *S. gordonae*.

#### Description:

*Body and head* as in *fragilis*, but the frontal seam very inconspicuous medianly, whereas the two convexities are more distinct.

*Pereonites 1-4* as in *fragilis*, but the dorsal spines a little longer and with a much sturdier base. The ventral keel has a small, rounded projection at the anterior and posterior end on each segment.

*Pereonites 5-7* as in *fragilis*, but lateral, and especially dorsal spines, sturdier and longer, and ventral keel very different. It has an anterior, isolated, conical spine and the anterior end of the partly adjoining keel-fragments projects forwards into a spine (in the middle of Fig. 71 a).

*Pleon* resembles that of *fragilis*, but pleotelson is less vaulted dorsally, and the posterior part is rather different. The direction of the posterior spine-pair is probably much the same,<sup>1</sup> but they are much nar-

rower at base and emerge more abruptly from the median part (Pl. V C-D, and BEDDARD's fig. 8, pl. IX). The terminal spine is straight throughout (Pl. V C)<sup>1</sup> and points obliquely downwards; there is a faint dorsal furrow. The keel between the terminal face and the branchial cavity is broad and directed obliquely forwards. Thus, the terminal face is almost as long as broad, flattened and "open", i.e. quite different from that of *fragilis*.

*Antennula* (Fig. 72e) with a large, flattened and, at the distal position, straightly cut off first joint, the distal part not being much narrower than the proximal. Joint 2 shaped as a parallelogram and with the proximal insertion somewhat narrower than the total width. Joints 3 and 4 and flagellum as in *fragilis*, but joint 3 more slender and flagellum reaching backwards to hind margin of pereonite 4.

*Antenna* very damaged on both sides, but squama

1. The integument of this specimen is practically without calcification and is, therefore, very soft and becomes rather easily deformed.

1. The slight upward bend in the outermost end may be due to the softness of the integument.

seems to be spine-shaped, as is the opposite corner of joint 3.

*Mouthparts* were not dissected. A study of the left mandible *in situ* seems to indicate that the incisive part, lacinia and spine-row are almost exactly as in *gordonae*. However, the distal teeth of right mandible (75j) appear rather different and project much less than in *gordonae*. The maxilliped shows the following differences from that of *gordonae*: Fifteen coupling hooks, denser growth of setae on joint 3 of palp and joint 4 more elongated (75k); shape of epipods equal (75h).

*Pereopod I* (73b) with a long propodus (four-fifths of carpus); the latter has a continuous row of setae and a sharp edge with minute teeth on the inner margin (73c).

*Pereopods V-VII* (73f) a little longer than prp. I. Propodus as broad as carpus and one-fourth longer. Dactylus short, only one-fourth of propodus.

*Female operculum* as long as broad and somewhat excavated along the hind margin. On the proximal third is a low rounded keel, ending in a downward-to backward-directed spine.

*Pleopod 3* (73h) has a rather squarish inner branch with a somewhat raised margin. Outer branch long and joint 1 about three times as wide as joint 2.

*Uropod* (73m) very slender. Exopod about two-thirds of endopod and the latter one-fourth longer than peduncle. This seems to be inserted on a small projection on pleotelson.

*Size*: About 31 mm long.

#### Remarks:

The affinities of the species are discussed on p. 131.

#### Occurrence:

Antarctic Indian Ocean at 2300 m depth and c. 0.4°C.

#### *Storthingura gordonae* n. sp.

(Pl. V E-J, Text-figs. 72-75)

*Eurycope fragilis* Beddard, 1885, p. 920 (pars);  
BEDDARD 1886b, p. 63 (pars).

#### Material:

*Challenger* St. 147, off Marion Island (46°16'S, 48°27'E), 2925 m, 30 December 1873. Bottom: diatom ooze. Bottom temp.: 1.2°C. – 1 female.

#### Description:

*Body and head* (Pl. V E-F) as in *fragilis*, but the two convexities on head are very distinct.

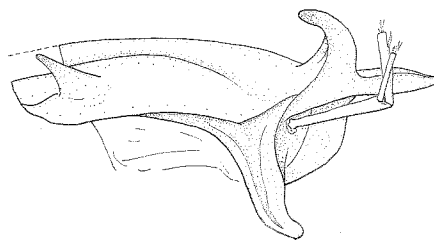


Fig. 74. *Storthingura gordonae* n. sp.; pleon from the side.

*Pereonites 1-4* as in *fragilis*, but the dorsal spines are shorter than the pereonites and with stouter base (although not as stout as in *challengeri*). Additionally, the antero-lateral corner of prn. 2 has a minute spine. Ventral keel as in *challengeri*.

*Pereonites 5-7* as in *fragilis*, but with stouter dorsal spines, and the ventral keel ending anteriorly in a rounded projection in place of a compressed spine.

*Pleon* anteriorly as in *fragilis* and *challengeri*. Pleotelson with the two subanterior spines directed somewhat upwards, and a moderately vaulted dorsal surface with the two usual nodules (Pl. V G, J). The postero-lateral margins are very slightly convex, which in conjunction with the broad and short, backward-directed terminal spine, gives pleotelson a triangular shape. The terminal spine has no dorsal furrow. Proximally, the posterior spines are very broad and point backwards a little, but distally they are curved forwards and somewhat upwards (Fig. 74). The terminal face rather flattened, with a downward-pointing and moderately projecting keel anteriorly (Pl. V H and Fig. 74).

*Antennula* (72c) with the distal, straightly cut off margin of joint 1 almost as broad as the proximal. The considerably vaulted area proximal to the insertion of joint 2 furnished with a small spine (72d). Joint 2 has a proximal outer and a distal inner (lower) spine-like projection. Joints 3 and 4 and shape and length of flagellum as in *fragilis*.

*Antenna* (72c) with a spine-shaped squama on a stout, almost square projection, and inner corner of the same joint with a conspicuous spine.

*Left mandible* has three stout teeth in the incisive part and a shorter, broad tooth between two of them (75c). Movable lacinia (75c) with four almost equally large teeth and a fifth somewhat smaller one. Spine-row (75b) consists of about 15 spines, none of which being particularly serrated. Molar process (75a) rather short and strong. Joint 2 of the palp (75d) not much longer than joint 1 and with a row of short setae; joint 3 of the usual complicated shape, rolled, and with a dense row of setae (75e).

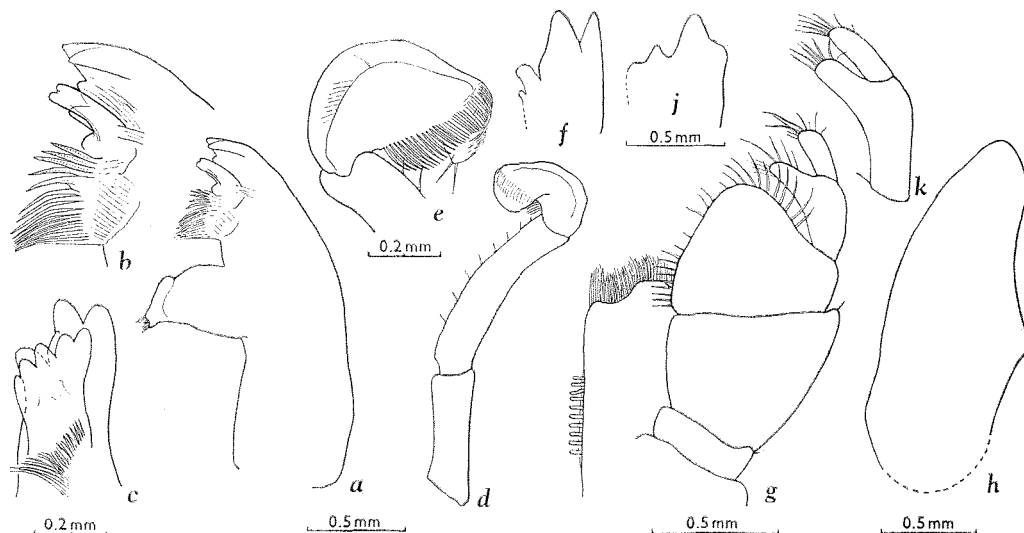


Fig. 75. a-h, *Storthyngura gordonae* n.sp.; j-k, *S. challengerii* n.sp.; a-e, left mandible; a-b, side view; c, incisive part and movable lacinia from inside; d, palp from outside; e, joint 3 of palp from opposite side; f and j, incisive part of right mandible from outside; g, endite and palp of left maxilliped; h, epipod; k, joints 4 and 5 of left maxilliped.

Only the incisive part of *right mandible* was studied (from outside); the rather peculiar shape of the teeth is shown in Fig. 75f.

*Maxilliped* (75g) with ten rather long coupling hooks and a moderately broad palp. *Epipod* (75h) very narrow, with only a faint projection placed rather proximally on the outer margin.

*Pereopod I* (73d) as in *fragilis*, except that propodus is a little longer. — *Prps. V-VII* (73g) only as long as prp. I. Propodus slender and one-fourth longer than carpus. Dactylus between one-third and one-fourth of propodus.

*Operculum* not preserved. — Only the outer branch of *pleopod 3* was present (73j); joint 2 almost as broad as joint 1.

*Uropod* (73n) with endopod one-fourth longer and almost twice as broad as exopod. Peduncle slender and long, one-sixth longer than endopod.

*Size*: Total length 18.4 mm, 5.4 mm at the greatest width (across pereonite 4) excl. of lateral spines.

#### Remarks:

BEDDARD (l. c., p. 63) admitted that the specimens of his "*Eurycope fragilis*" (especially the large one from St. 152) were rather divergent. Nevertheless, he decided to regard them as one species, not least on account of the damaged condition of some of the specimens. This damage does not, however, veil any essential characters when the animals are carefully studied and stretched.

Agreement in *fragilis*, *challengerii* and *gordonae* is found to be particularly obvious in the following respects:

(1) General shape of body, except posterior part of pleon.

(2) Lack of spines on head and dorsal spine on pereonite 1.

(3) Presence of median spine on vestigial pleonite immediately in front of pleotelson.

(4) Shape of left mandible in *challengerii* and *gordonae* (not studied in *fragilis*) and to some extent of maxilliped in all three species.

Differences in the three species are first and foremost found in the shape of pleotelson and its posterior spines. I regard these differences as being sufficiently important to separate the specimens into three species, but in addition, a large number of minor differences can also be enumerated:

(1) Disagreement in all three species: Dorsal spines on pereonites; joint 2 of antennula; joint 3 of antenna; incisive part of right mandible (not studied in *fragilis*); propodus and dactylus of pereopods V-VII; uropod.

(2) Agreement in *fragilis* and *challengerii*, disagreement in *gordonae*: Antero-lateral corner of pereonite 2; proximal part of joint 1 of antennula.

(3) Agreement in *fragilis* and *gordonae*, disagreement in *challengerii*: Frontal seam; ventral keel on pereonites 5-7; length of flagellum of antennula; carpus of pereopod I.

(4) Agreement in *challengerii* and *gordonae*, disagreement in *fragilis*: Ventral keel on pereonites 1-4; distal part of joint 1 of antennula.

*S. fragilis* in particular, seems to be rather close to *S. bicornis* Birstein.



This species is named after Dr. ISABELLA GORDON of the British Museum, in appreciation of her un-failing help and advice regarding the collection of Crustacea from the *Challenger*, in addition to other carcinological problems.

Occurrence:

Subantarctic Indian Ocean at 2925 m depth and 1.2°C.

*Storthyngura* sp.

(Pl. VI A; Text-fig. 76)

I also re-examined in London the fragmentary specimen described by BEDDARD as *Eurycope* sp. (1886b, p. 68). The specimen probably belongs to *Storthyngura*, judging by the general shape, spine armament and total coalescence of the preserved pereonites. However, the pereonites lack any trace of the ventral, median, partly interrupted keel which is characteristic of most other species of *Storthyngura*. For this reason, and owing to a marked difference in the direction of lateral spines on pereonite 5 (cf. Fig. 69a, p. 126), together with the presence of dorsal spines on prn. 7, I have to exclude the possibility of this fragment belonging to *atlantica*, as proposed by BEDDARD. In addition, there are two vestigial pleonites in front of pleotelson as opposed to one. The posterior one was formerly furnished with a spine (Pl. VI A). One more spine was found situated on a raised area of pleotelson, and traces of another in the rupture line of pleotelson. If this species has antero-lateral spines on pleotelson, they must have been placed rather far from its anterior corners. Finally, the lateral parts of pereonites as well as pleotelson have many small tubercles, each with a thin seta. The shape of the only preserved pereopod (VII), which is very slightly extended, appears from Fig. 76.

The size of the fragment is considerable; it measures 10.4 mm in length. In almost all species of *Storthyngura* the length of head + pereonites 1-4 is greater (usually one-fourth) than the length of prns.

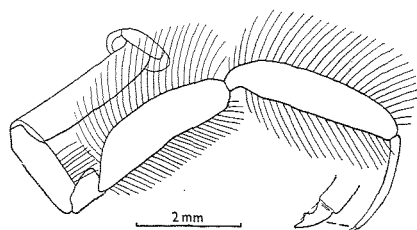


Fig. 76. *Storthyngura* sp. from *Challenger* St. 147; pereopod VII; all setae are feathered.

5-7 + the vestigial pleonite(s). If in this case we consider the two lengths equal, and the missing part of pleotelson three-fifths of the preserved one, the total length was at least 25 mm, and probably nearer 28 mm.

It is impossible to refer the fragment to any known species. In view of the size and some of the features mentioned above, I consider it probable that it belongs to a yet undescribed species.

*Storthyngura* sp. juv.

(Text-fig. 77)

In his report on the *Challenger* Isopoda, BEDDARD mentions (1886b, p. 65) that at St. 168 a number of small individuals of *Storthyngura* (*Eurycope*) were caught. At the same station *S. novae-zelandiae* was obtained. BEDDARD expresses doubt as to the affinity of the specimens, since they were not taken from the marsupium of any female of that species.<sup>1</sup> He suggests that they must belong to one of the following species: *S. fragilis*, *S. novae-zelandiae* or *S. atlantica*.

Two of the specimens were preserved and are kept in the British Museum, London. They are in good condition but are mounted on a slide.

A study of them both shows that they agree with BEDDARD's fig. 2 (pl. IX) except in the following respects: (1) Pereonites 5-6 and pleon are fused, and there is, at least, one vestigial pleonite between prn. 6 and pleon. (2) The lateral spines on prns. 1-4 are all coxal. (3) Dorsal spines on prns. 2-4 emerge close to the anterior margin. (4) The two posterior spines on pleotelson curve slightly backwards. (5) Antennula and antenna very different to BEDDARD's illustration and in accordance with my Fig. 77: Joint 1 of antennula short, broad and evenly rounded anteriorly. Joint 2 unusually large and with an outer, distal projection. Joint 3 less than twice as long as broad. Flagellum not yet differentiated, but will probably become multi-jointed. - Joint 3 of antenna on the inner margin having a characteristic, somewhat backward-pointing spine with a subapical seta and a very minute squama on the outer margin.

In my opinion, the specimens do not belong to any of the species suggested by BEDDARD for the following reasons:

They differ from *fragilis* (and *challengeri* and *gordanae*) in having an oval pleotelson and quite another spine shape and spine direction.

1. Their size (3.0 mm long) and appearance indicate that they are definitely postmarsupial.

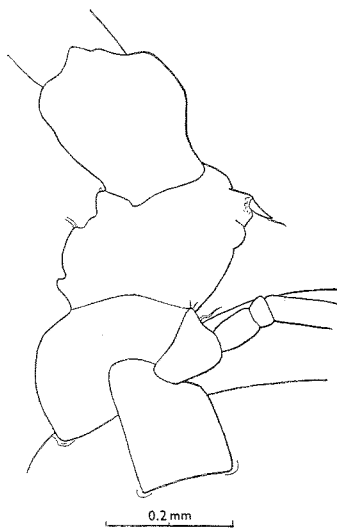


Fig. 77. *Storthyngura* sp. juv. from Challenger St. 168; basal joints of left antennula and antenna.

From *novae-zelandiae* they differ i.a. in the same respects.

From *atlantica* (in which pleotelson looks much the same) they differ in the shape of joints 1 and 2 of antennula (cf. Fig. 69c, p. 126), lacking e.g. the prominent inner spine. Moreover, they have no lateral spine on pereonite 4 or dorsal spines on pleon.

Since the specimens cannot be referred to *atlantica*, which is the only known species of *Storthyngura* with the same shape of pleon, these juveniles should, for the time being, be regarded as unidentifiable.

#### Occurrence:

Off New Zealand (40°28'S, 177°43'E) at 2012 m depth and 2.8°C.

#### *Storthyngura chelata* and *S. bicornis* Birstein, 1957 (Pl. VI B-E; Text-fig. 78)

While preparing the above key I encountered some difficulty in distinguishing *S. chelata* from *bicornis*. BIRSTEIN (1957, p. 984), mentions the following features: "*S. bicornis* differs from the previous species by the presence of 2 spines on the head, form of the pleotelson, broader 1st joint of the 1st antenna, less specialized peraeopod, narrower carpus and propodus of the last peraeopod, structure of the pleopods."

As Professor BIRSTEIN very kindly made an exchange of hadal isopods with me, I was able to make a study of both the male and female of these two species. A comparison showed that *chelata* has two

conspicuous, subacute processes on the head whereas *bicornis* has spines. Since development of tubercles, processes or spines is a very variable factor in most Asellota, I made a study of the other differences listed above in order to judge their potential use in a key and found two of them suitable.

(1) Shape of posterior part of the pleotelson. Although difficult to describe, this seems to be an excellent dividing character. In *chelata* (Pl. VI B), the strongly vaulted, median part of pleotelson continues posteriorly as a directly backward-pointing, spine-like process. The latter has a longitudinal furrow which, anteriorly, ends in a small depression, the whole process thus closely resembling the outer part of an ordinary fountain-pen. In front of the base of the terminal process the median, vaulted area of pleotelson has a widening on each side, immediately posterior to the hind margin of its two vaulted lateral parts. Accordingly, the terminal face has rounded lateral corners (Pl. VI C).

In *bicornis* (Pl. VI D) the less vaulted median part ends posteriorly in a rounded furrow. Situated laterally to this furrow is a triangular, subacute process on each side, well separated from the hind margin of the two lateral, vaulted areas of pleotelson. Terminally, there is a process (or spine) which points downwards and has a slight longitudinal furrow. The postero-lateral processes are also distinct in the terminal face (Pl. VI E).

(2) Shape of male pleopods 1. In *chelata* the outer ends are bent somewhat downwards (Fig. 78a), and the apices very pointed (78b) and well separated. They may either point straightly backwards or curve somewhat outwards (BIRSTEIN, l. c., fig. 2; the fact that the apex on the right side curves almost forwards is, however, certainly due to some

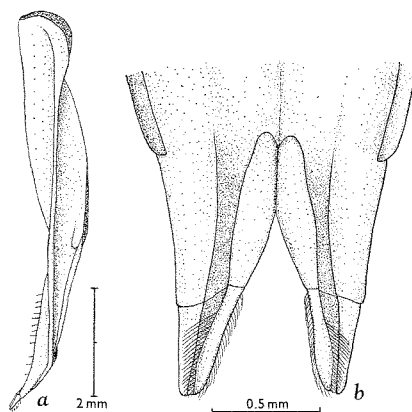


Fig. 78. *Storthyngura chelata* Birstein from Vitjaz St. 3457; male pereopods 1; a, from the left side; b, apex from the inner side.

damage). An object resembling a link which probably provides some movability is found not far from the distal end. The longitudinal furrow on the inner side is very long and narrow and partly covered by a row of setae on the interior, distal margin (78b).

In *bicornis* (BIRSTEIN's fig. 3) the apexes are close together and rounded, except for a tiny terminal process on the low ridge which forms the outer margin of the longitudinal, rather short furrow on the inner side. Setae are placed only on the distal margin of the apexes.

As is further discussed below (p. 138), *bicornis* is considerably closer to *pulchra* than to *chelata*.

Intestine contents of *chelata* are given in Table 17 (p. 240).

#### Subspecies of *Storthyngura pulchra* (Hansen, 1897) (Pls. VI F-J, VII A-F, VIII A-D; Text-figs. 79-81)

The general revision of several species of this genus and the fact that I was able to borrow type material from the U.S.A. prompted me to also re-consider *S. pulchra* (previously treated by WOLFF 1956a). Direct comparison with a rather large amount of material has now led me to split up the present species into three subspecies.

#### Material:<sup>1</sup>

*S. pulchra pulchra* (Hansen, 1897), pp. 97-100, pl. I, 1a-i: 1 female and 1 male from *Albatross* St. 3361 (by courtesy of Dr. E. DEICHMANN, Museum of Comp. Zoology, Harvard); 3 males from *Galathea* St. 716; 1 female from *Galathea* St. 724.

*S. pulchra caribbea* (Benedict), in: RICHARDSON 1901, pp. 558-560, fig. 29: 4 males from *Albatross* St. 2751 (by courtesy of Dr. E. BOWMAN, U.S. National Museum).

*S. pulchra kermadecensis* n. subsp., WOLFF 1956a, pp. 116-118, fig. 34a-b: 5 females (1 juvenile) and 3 rather damaged males from *Galathea* St. 650.

#### Comparison:

Those features which were aptly described by HANSEN, BENEDICT and WOLFF are only summarily repeated (or not referred to at all) in the following. In some cases only differences are listed. The three subspecies are mentioned under their subspecies name only. If not otherwise stated, *pulchra* applies to the specimens from all three localities in the Gulf of Panama (Sts. 3361, 716 and 724).

1. Regarding type material see p. 138.

*Head. S. pulchra*: – as description (HANSEN), but the median process is a distinct spine and the paired processes are acute; slight hair on head (and rest of body) of ♀ from St. 724. *S. caribbea*: – no median spine, and the paired processes (= BENEDICT's "tubercles") more flattened. *S. kermadecensis*: – no median spine and the paired processes not acute, but rounded; juv. = adult.

*Pereonite 1. S. pulchra* = *kerm.*; median process in *caribbea* very small.

*Pereonites 2-4. S. pulchra* from St. 3361: – anterior, median spines slender almost all the way down and not compressed; in specimens from Sts. 716 and 724, laterally compressed; lateral spines on prns. 3-4 in St. 3361 = *kerm.*, but in St. 716 much longer than usual. *S. caribbea*: – anterior, median spines compressed and coxal spines very long, as in *pulchra* from St. 716; median spine on prn. 4 short; lateral spines on prns. 3-4 well developed and bent slightly outwards; on prn. 2 a very tiny lateral spine is present (in addition to the long coxal ones). *S. kermadecensis*: – in all respects = *pulchra* from St. 3361, but juvenile specimen = *pulchra* from St. 716 and *caribbea*.

*Pereonites 5-7. Dorsal spines and keels, lateral spines and the "protuberant, rounded processes"* equal throughout, except that in *kerm.* the dorsal spines point in a more upward direction. In *caribbea* the keels are less pronounced, and the lateral spines on prn. 5 turn slightly upwards distally. Lateral spines of juv. *kerm.* proportionally longer and more slender.

*Ventral armament on pereonites 1-7.* As I have pointed out previously (l. c., p. 117), the spine armament (hyposphenians) and keels on sternum from material available at that time (from the *Galathea*), showed considerable variation. In order to obtain a clear picture of this variation I have studied all the present material and give details in Table 6. It is readily seen that there is, generally, at least as much variation in specimens from the same locality or area as in the three subspecies. It is worth noting that the female of *pulchra* from St. 724 has a combination of developing oostegites on pereonites 2-5, and spines (and keels) on sternum of the same segments. The same combination was demonstrated in *Apsuodes galathea* and *gracillimus* (WOLFF 1956b, pp. 198 and 205) and in *A. africana* (TATTERSALL 1925). The fact that such spines are found only in some females with developing oostegites is probably explained by the spines only being present in the first of several pre-egg-bearing stages. These stages

Table 6. Spine armament and keels on sternum –  
from the complete material of subspecies of *Storthyngura pulchra* available.

Specimens	Pereonites	1	2-4	5	6 and 7
<b>Females</b>					
<i>pulchra</i> , St. 3361 (w. mars.)		0	0	0	kl with transv. grooves
<i>kermadecensis</i> (w. dvl. oost.)		0	0	0	– – – –
– (– – –)		0	0	0	– – – –
– (– – –)		0	0	0	– – – –
<i>pulchra</i> , St. 724 (w. dvl. oost.)		Sp < Kl	Sp < Kl	Sp kl	– – – –
<i>kermadecensis</i> (no oost.)		sp ↙ no kl	sp kl	cn sp ↘ kl	– – – –
– (juv.)		–	–	–	– – – –
<b>Males (adult)</b>					
<i>pulchra</i> , St. 3361		?	Sp < Kl	cp Sp ↙ Kl	Kl – – –
<i>caribbea</i>		sp ↙ Kl	sp < Kl	–	– – – –
* –		Sp < Kl	Sp < Kl	cp Sp ↘ Kl	– – – –
–		–	–	–	– – – –
–		–	–	–	– – – –
† <i>pulchra</i> , St. 716		–	–	cp Sp ↙ Kl	– – – –
– , –		Sp ↙ Kl	–	sl Sp ↙ Kl	– – – –
– , –		?	Sp ↙ Kl	cp Sp ↙ Kl	– – – –
<i>kermadecensis</i>		sp ↙ no kl	sp kl	cn Sp ↘ kl	kl – – –
–		Sp ↙ kl	Sp Kl	–	– – – –
–		sp ↙ no kl	sp kl	?	? ? ? ?

*Explanation of abbreviations, etc.*: w. mars., with marsupium; w. dvl. oost., with developing (rudiments of) oostegites; Sp, prominent spine; sp, small spine; 0, no spine; Kl, conspicuous keel; kl, faint keel; <, spine directed forwards; ↙, spine directed somewhat downwards; ↘, spine directed downwards; cn, conical; cp, compressed; sl, slender. The specimen marked \* is shown on Pl. VII F and Pl. VIII D; the specimen marked † on Pl. VII D.

are all characterized by the presence of lamellar developing oostegites in contradistinction to the foliaceous oostegites of the marsupial stage.

*Pleon.* The first pleonite is not quite as short in *kerm.* as in the other two subspp. The proximal part of pleotelson, which probably represents a separate pleonite, has only an inconspicuous median process or none at all in *kerm.* The three terminal acute processes: *S. pulchra*: – the median process rather short and its upper surface slightly excavated, the two paired processes directed outwards-backwards and broad at base; *kerm.*: – all three processes = *pulchra*, but the median not excavated above; *caribbea*: – all three processes somewhat longer, the median excavated, the paired ones directed outwards and a little forwards. The terminal face: The material now available of females and males from the same locality has revealed that HANSEN (in his description of *pulchra*) was not correct in claiming “the oblique terminal face ... is quite similar in both sexes.” In the males (Pl. VI F-G), the proximal part of the terminal face is longer than in the females (Pl. VI H-J), and dis-

tinctly cleft (to receive the distal end of pleopods 1). The antero-lateral margins of female *pulchra* are somewhat convex, although less so than is shown in Pl. VI J. In the juvenile *kerm.* the anal doors fill almost the entire terminal face.

*Antennulae and antennae.* Absolutely equal; the first joints of the multi-jointed flagellum of the antennula are not yet distinguishable in the juvenile *kerm.* and the flagellum is not quite as long as in the adults.

*Right mandible.* In addition to the two terminal teeth, the incisive part in *kerm.* has (Fig. 79a-b) one low, inconspicuous tooth or keel, which is slightly incised in *pulchra* (79d) and still more so in *caribbea* (79f). *Left mandible.* In *kerm.* (79c) the two terminal teeth project more than those in *caribbea* (79g), and in *pulchra* (79e) one of the terminal teeth and the proximal tooth are somewhat irregular. In all other respects the mandibles are quite equal, as are the proportionate length of the palp joints.

*Labium.* A little narrower in *kerm.* than in the others.

*Maxilliped.* Approximate number of coupling

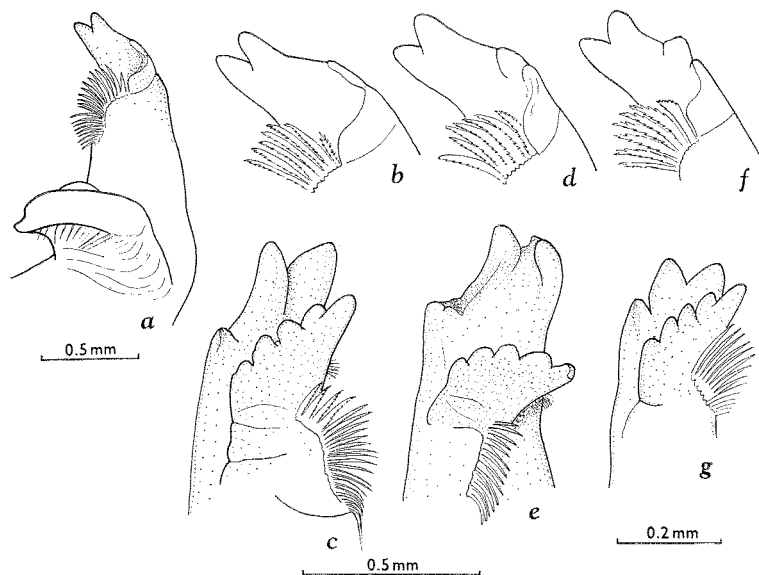


Fig. 79. a-c, *Storthingura pulchra kermadecensis* n. subsp., ♀ holotype; d-e, *S. p. pulchra* (Hansen), ♂ lectotype; f-g, *S. p. caribbea* (Benedict), ♂ lectotype; a, distal half of right mandible; b, d, and f, right md. – inside view of incisive part and distal end of spine-row; c, e, and g, left md. – inside view of incisive part, movable lacinia and distal end of spine-row.

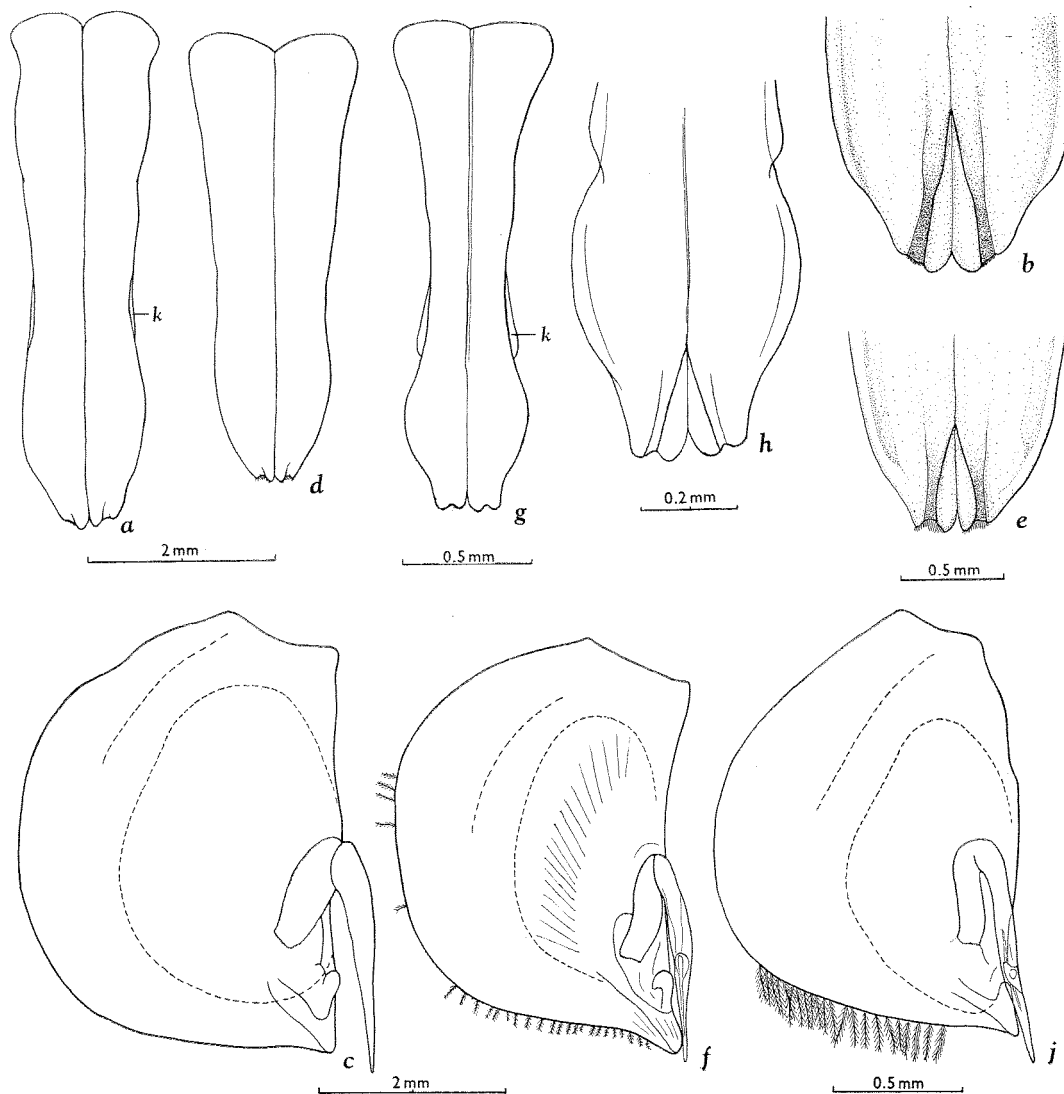
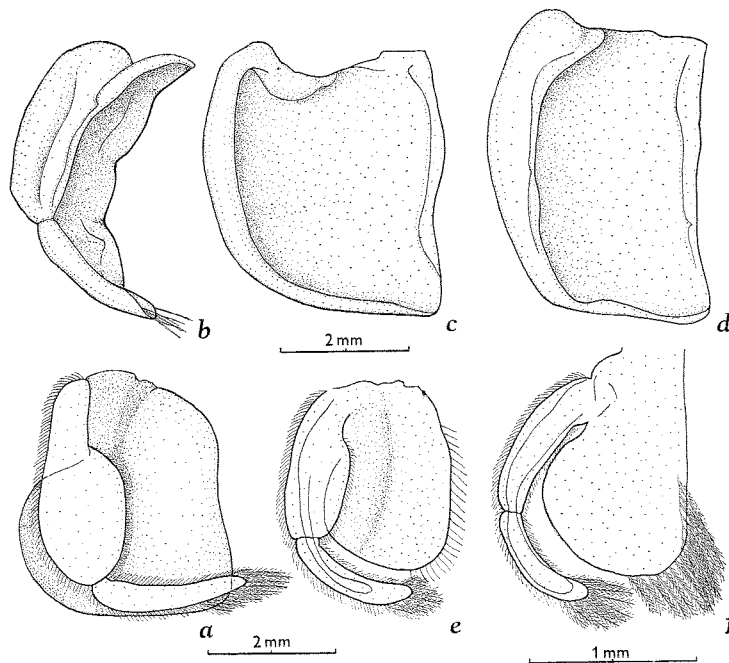


Fig. 80. a-c, *Storthingura p. pulchra* (Hansen), ♂ lectotype; d-f, *S. p. kermadecensis* n. subsp., ♂ allotype; g-j, *S. p. caribbea* (Benedict), ♂ lectotype; a, d, and g, pleopods 1 from outside (k, visible part of inside keel); b, e, and h, apex from inside; c, f, and j, pleopod 2.

Fig. 81. a-d, *Storthingura p. pulchra* (Hansen); e, *S. p. kermadecensis* n. subsp.; f, *S. p. caribbea* (Benedict); a, e, and f, ♂ pleopod 3; b-c, exopod and endopod of ♂ pleopod 4; d, ♂ pleopod 5.



hooks in *pulchra* 17, in *kerm.* 15, and in *caribbea* 10. The acute outer angle on the epipod slightly larger in *kerm.*

*Pereopod I* somewhat more slender in *caribbea* and with a less curved propodus; equal in other respects.

*Male pleopods 1.* The only really significant difference between the subspecies is to be found in this appendage. *S. caribbea* (80g): – much broader at base and near the distal end than in the middle part. The distal portion of the two keels on the inner side (visible in fig. 34b, WOLFF 1956a), can be clearly seen from outside (k in Fig. 80g). The distal end of each pleopod has a ventral, slightly oblique furrow (80h). *S. pulchra*: – of a much more equal width throughout (80a). The inner keels only faintly visible from outside (k). The ventral part of the distal end as in *caribbea*, but the postero-lateral corners project less and there are some very short setae present (80b). *S. kerm.*: – broader in the middle than in *pulchra* and *caribbea* (80d). Inner keels not visible from outside. Distal end is between *caribbea* and *pulchra* in shape, but with addition of conspicuous setae (80e).

*Pleopod 2.* *S. caribbea* (80j): – interior, distal corner of the sympod somewhat projecting, distal margin with feathered setae, copulatory organ slender; *pulchra* (80c): – interior, distal corner does not project, no setae on margin, copulatory organ strong; *kerm.* (80f): – interior, distal corner projects considerably, margin with short feathered setae, copulatory organ rather strong.

*Pleopod 3.* *S. pulchra* (81a): – endopod with a concave outer half (to receive the exopod), the inner rather vaulted; no setae on the inner margin; exopod with a very broad proximal and long and narrow distal joint; *kerm.* (81e): – outer half of endopod only slightly depressed compared with the inner; short setae on the inner margin and proximal part of exopod only about twice as wide as distal; *caribbea* (81f): – endopod flattened, with long, feathered setae on the interior distal corner; exopod almost equally narrow throughout.

*Pleopod 4:* Almost equal in all subspp. The endopod (81c) is very concave as the outer margin is considerably raised; the outer part of the endopod fits into the deeply excavated exopod (81b) which is shaped like a canoe and has a few setae at the distal end. – *Pleopod 5* (81d) a little less concave than pleopod 4.

#### Remarks:

As will be evident from the comparison above and the summary given in the following diagnoses, the three subspecies are very close to each other. Moreover, it must be remembered that in *all* other features than those listed above the specimens seem to be absolutely identical. As could be expected from the geographical distribution, *p. pulchra* from the eastern Pacific stands between *p. caribbea* from the western Atlantic and *p. kermadecensis* from the eastern Pacific Ocean – at least with regard to what is, in my opinion, the main distinguishing feature, viz. the shape of the male pleopods 1 and 2.

The comparison above has shown once again how little taxonomic significance can be applied to the length, shape and direction of spines and hypophenians. In this respect, the greatest difference was found between the otherwise perfectly identical specimens of *pulchra* from the three various stations in the Gulf of Panama.

The species most closely related to *pulchra* is without doubt, *S. bicornis* Birstein. In general shape of body and legs, of female operculum, of male pleopods 1 and 2, as well as of pleopod 3 and uropods, they are almost perfectly identical; the male pleopods, in particular, resembling those of *p. kermadecensis*. The following differences are significant: In *bicornis*, presence of a median spine on pereonite 1 and lack of a tubercle behind the median spine on pereonites 2-4; in *bicornis*, lack of low keels behind the paired median spines on pereonites 5-7 and the paired, posterior processes are placed more distally. Further, in *pulchra* the first joint of antennula is edged, rounded in *bicornis*; inner margin of propodus and carpus of pereopod I almost smooth in *pulchra*, but with conspicuous setae in *bicornis*.

The intestine contents of *p. pulchra* are given in Table 17 (p. 240).

***Storhyngura pulchra pulchra* (Hansen, 1897)**  
(Pls. VI J, VII A-D; Text-figs. 79d-e, 80a-c, 81a-d)

*Eurycope pulchra* Hansen, 1897, p. 98, pl. I, 1a-i.

*Storhyngura pulchra* (Hansen), HANSEN 1916, p. 132; WOLFF 1956a, p. 116.

Diagnosis: Head with one median spine, two paired, acute processes and a ^-shaped furrow. Pereonites 2-4 both having medianly a long anterior spine with a small tubercle behind it. On median part of pereonites 5-7, paired spines with a low keel behind them. Ventrally on, at least, pereonites 6-7 a median ridge, separated by transversal grooves. Pleotelson having anteriorly a short, subacute process on each side, posteriorly, two similar paired processes directed outwards-backwards and with the terminal process directed downwards. Female operculum with one spine situated almost in the centre. Male pleopods 1 as broad subterminally as at base, keels on inner side faintly visible from outside; apexes only very slightly emarginate and emargination with very short setae. Interior, distal cor-

ner of sympod of pleopod 2 does not project; copulatory organ short. Proximal joint of exopod of pleopod 3 more than three times as broad as distal. Exopod of pleopod 4 deeply excavated.

Size: Largest male 26.0 mm, largest female 25.4 mm long.

Type material: The only male collected at Albatross St. 3361 has been designated as lectotype. Unfortunately, this specimen is broken. The female which has also been described is from the same station. Both are kept in the Museum of Comparative Zoology, Harvard, U.S.A.

Distribution: Off Central America (9°23'N, 89°32'W), 3570 m, c. 1.9°C.; Gulf of Panama at 6°10'N, 83°06'W, 2690 m (type locality) and at 5°44'N, 79°20'W, 2950-3190 m, c. 2.0°C.; north of Galapagos Is. (2°34'N, 92°06'W), 2490 m, c. 2°C.

***Storhyngura pulchra caribbea* (Benedict, 1901)**  
(Pls. VI F, VII E-F, VIII D; Text-figs. 79f-g, 80g-j, 81f)

*Eurycope caribbea* Benedict, in: RICHARDSON 1901, p. 559, fig. 29; RICHARDSON 1905, p. 493, fig. 548.

*Storhyngura caribbea* (Benedict), VANHÖFFEN 1914, p. 584; HANSEN 1916, p. 132.

*Storhyngura pulchra* (Hansen), WOLFF 1956a, p. 116.

Diagnosis: Head with two paired, flattened processes and a ^-shaped furrow. Pereonites as in *S. p. pulchra*. Anterior part of pleotelson with a short, subacute process on each side; posteriorly, two paired, more slender processes or spines, directed outwards and a little forwards, and with the terminal spine directed downwards. Male pleopods 1 almost twice as broad subterminally and at base as in the middle; distal half of keels on inner side visible from outside; apexes only slightly emarginate and emargination without setae. Interior, distal corner of pleopod 2 slightly projecting; copulatory organ short. Joints of exopod of pleopod 3 almost equally narrow. Pleopod 4 as in *p. pulchra*.

Size: Largest male c. 15 mm, largest female 15.8 mm long.

Type material: The undamaged male taken at Albatross St. 2751 has been selected as lectotype. It measures 13.5 mm and is kept in the U.S. National Museum, Washington.

Distribution: Off Windward Is. in the West Indies, 1260 m, c. 4.9°C.

*Storthyngura pulchra kermadecensis* n. subsp.  
(Pls. VI G-H, VIII A-C; Text-figs. 79 a-c, 80 d-f,  
81 e)

*Storthyngura pulchra* (Hansen), WOLFF 1956a, p. 116, fig. 34 a-b.

Diagnosis: Head with two paired, rounded processes and a ^-shaped furrow. Pereonites and pleotelson as in *S. p. pulchra*. Female operculum with one almost central spine. Male pleopods 1 broadest at base, keels on inner-side not visible from outside; apices only slightly emarginate and emargination with moderately long setae. Interior, distal corner of pleopod 2 projects considerably; copulatory organ short. Proximal joint of exopod of pleopod 3 twice as broad as distal. Pleopod 4 as in *p. pulchra*.

Size: Largest male about 22 mm, largest female about 27 mm long.

Holotype: Female in best state of preservation from *Galathea* St. 650.

Distribution: Kermadec Trench NE of New Zealand (32°20'S, 176°54'W), 6620-6730 m, 1.3°C.

*Storthyngura furcata* Wolff, 1956  
(Text-fig. 82)

A very damaged female, not previously recorded, and with developing oostegites, was found to belong to this species. This reference is due to the presence of four median spines on the anterior part of pereonites 1-4, lack of spine and keel ventrally on prns. 5-7, shape of pereopods V-VII and of pleopod 3 (Fig. 82b) and finally, shape of antennula (82a). In addition to the details given in my description (1956a, p. 119), the antennula in both the previously recorded material and in the present female, pos-

sesses a small but distinct spine on the first joint, situated at the base of joint 2.

The present female was collected at *Galathea* St. 650 in the Kermadec Trench (32°20'S, 176°54'W) at 6620-6730 m, thus falling within the previously recorded depth range of the species: 5850-6770 m.

The intestine contents are given in Table 17 (p. 240).

*Storthyngura abyssalis* n. sp.  
(Pl. IX A; Text-figs. 83-84)

Material:

*Galathea* St. 601, Tasman Sea (45°51'S, 164°32'E), 4400 m, 14 January 1952. Bottom: Globigerina ooze. Bottom temp.: c. 1.1°C. - 1 entire female + anterior half of 1 female, both with fully developed oostegites.

Description:

Both females were caught while in moult. The posterior half of the type is still quite uncalcified (Pl. IX A), and therefore, very difficult to study. The presence of new teeth, setal rows, etc. in the interior of the transparent mouthparts, clearly shows that the anterior half of both females had not yet moulted.

Head a little broader than the first pereonite and with two prominent spines (Fig. 83a).

Pereonites 1-4 all with a strongly curved spine

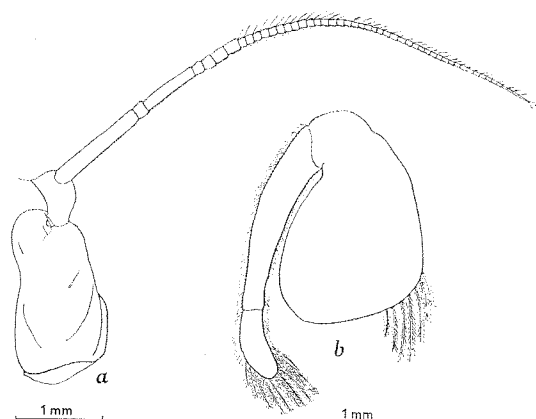


Fig. 82. *Storthyngura furcata* Wolff, ♀ from *Galathea* St. 650; a, right antennula; b, pleopod 3.

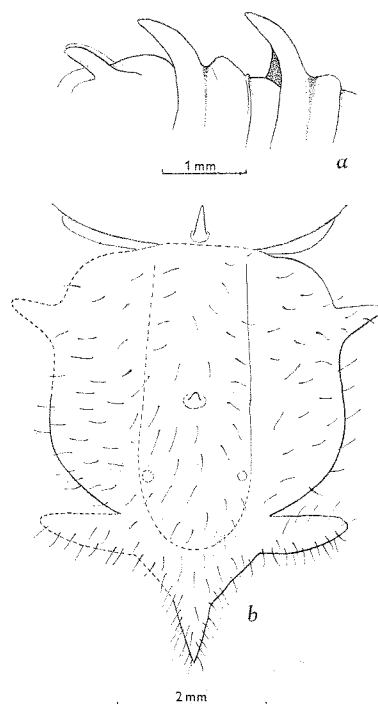


Fig. 83. *Storthyngura abyssalis* n.sp., ♀ holotype; a, dorsal part of head and pereonites 1-2 from the left side; b, pleon (dotted lines indicate non-preserved margins, etc.).



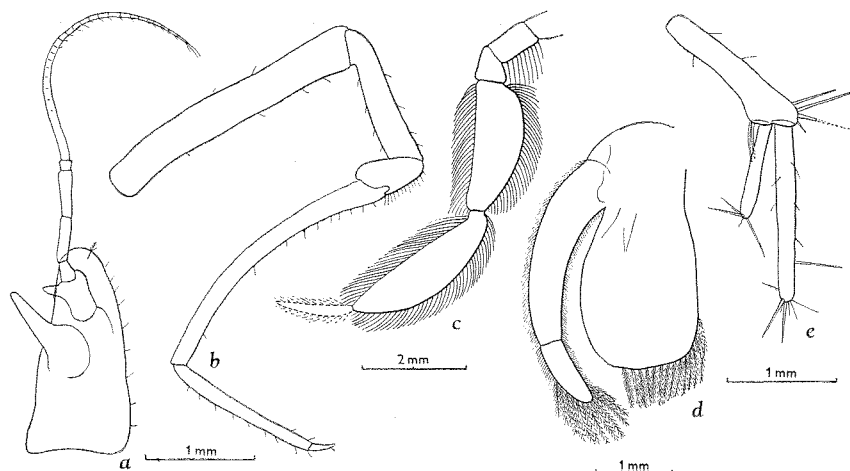


Fig. 84. *Storthyngura abyssalis* n. sp.; a, right antennula; b, pereopod I; c, pereopod VI (all setae are feathered); d, pleopod 3; e, uropod.

rising immediately from the anterior margin and deeply excavated in front (83a). The antero-lateral corners of prns. 1-3 are rounded, but in prn. 4 they are furnished with a long and slender spine (Pl. IX A). Posteriorly, prn. 4 has an unusually deep concavity to receive the anterior margin of prn. 5. All coxal spines are very long, slender and are curved somewhat upwards.

*Pereonites 5-7* difficult to study, but apparently of the typical shape of the genus with forward-outward-directed lateral spines which are long and slender, and with two paired spines on each segment.

*Pleon* could be stretched, when carefully handled, but nevertheless, some features remained obscure; e.g., the separation between pleotelson and the vestigial pleonites in front of it could not be traced.<sup>1</sup> Consequently, it is not possible to make out whether the slender, median spine found in this area (83b)

1. This is also impossible in the closely related *S. benti* Wolff.

originates from the anterior part of pleotelson or from the pleonite in front. The approximate shape of pleotelson is shown in Fig. 83b. In addition to four very prominent lateral spines or processes, two paired tubercles are found towards the posterior end of the median convexity, and a somewhat larger, rounded process is situated almost in the centre of pleotelson. Another median process may be present, situated at a more anterior position on pleotelson, but it is more probable that the small spine-like object found in this area is rather due to the still quite soft integument being damaged. This very dubious process should not be confused with the above mentioned, distinct spine in front. The entire surface of pleotelson, and especially the posterior processes, are covered with rather long hairs.

*Antennula* (84a) with a slender joint 1 which is evenly rounded distally and has a prominent interior spine. Joint 2 also with an interior spine distally, joints 3 and 6 short, joints 4 and 5 elongated. Fla-

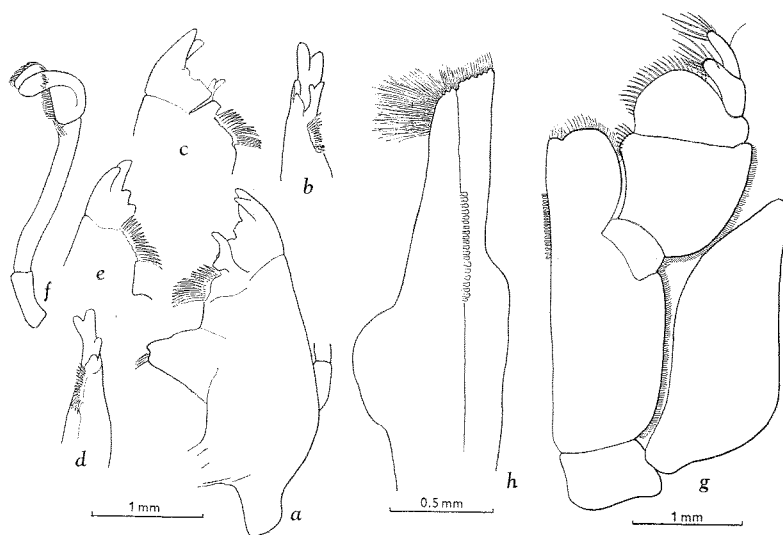


Fig. 85. *Storthyngura abyssalis* n. sp.; a-c, left mandible; a, from the posterior side; b, distal part from inside; c, distal part seen obliquely from outside; d-e, right mandible, distal part from inside and from the posterior side; f, palp; g, maxilliped; h, maxilliped seen from the interior edge.

gellum multi-jointed, rather short (shorter than the peduncle).

*Antenna* (Pl. IX A) closely resembling that of *S. benti* (WOLFF 1956a, fig. 31), although with somewhat shorter spines. Only the four proximal joints were preserved.

*Mandibles* very similar in shape to those of *benti*. Left mandible with a compressed and deep incisive part with two distinct terminal teeth (85b); at a more proximal position there is an edge consisting of two indistinct teeth (85c). Movable lacinia with one long, projecting arm (85b), which is forked distally (85a). There are about 15 spines in the spine-row; in right mandible the proximal teeth are narrower and more distinct (85d-e). Joint 2 of palp (85f) almost three times longer than joint 1.

*Maxilliped* (85g) with a long and broad palp and about twenty coupling hooks. A cluster of closely bunched, fine setae on the inner, distal corner of endite (85h). Epipod almost rhomboid.

*Pereopod I* (84b) very slender and unarmed except for a few scattered, short setae. – *Pereopods V-VII* (84c) with moderately slender carpus and propodus, furnished with feathered setae (as is also ischium); dactylus long.

*Female operculum* apparently subcircular and with a slender, distinctly set off spine near the centre; otherwise impossible to study. – *Pleopod 3* (84d) with an oblong endopod with distal, feathered setae, exopod two-jointed, slender. – *Uropod* (84e), has the endopod slightly longer than the peduncle and almost twice as long as the exopod.

*Size*: Holotype about 21 mm long and 6.3 mm broad (across pereonite 4, excl. of the spines). The other female must have been about 29 mm long.

#### Remarks:

The present species can be distinguished by the presence of interior spines on both first and second joints of the antennula. It is without doubt very close to *S. benti* Wolff from the Kermadec Trench, differing only in the number of lateral spines on pleotelson (and direction of the posterior pair), presence of an inner spine on joint 2 of antennula, width of carpus and propodus of pereopods V-VII, and length of distal joints of uropod. Like *benti* it is rather closely related to the Antarctic *robustissima* Monod (see WOLFF 1956a, p. 116).

#### Occurrence:

Known only from the type locality in the Tasman Sea at 4400 m depth and *c.* 1.1°C.

#### *Storhyngura serrata* n. sp.

(Pl. VIII E-F; Text-figs. 86-88)

#### Material:

*Galathea* St. 724, Gulf of Panama (5°44'N, 79°20'W), 2950-3190 m, 13 May 1952. Bottom: dark clay and stones. Bottom temp.: *c.* 2.0°C. – 1 rather damaged female.

#### Description:

*Head* (Pl. VIII E) apparently somewhat wider than the first pereonite. Although damaged, there is almost no doubt that spines are *not* present (or at least, no paired spines).

*Pereonites 1-4* with a long and slender, median spine (except on prn. 1), and rounded antero-lateral corners (except on prn. 4 which has a short spine at this position). Coxae with one long, slender spine and a short one behind it. Ventrally, pereonites 2-4 have a median spine, directed downwards. No oostegites are present.

*Pereonites 5-7* with rather broad and flattened lateral spines, and the paired dorsal spines very long and slender. There are, apparently, no median spines or keels at the ventral position.

*Pleotelson* (Fig. 86) with a small, semi-circular, anterior section which is divided from the major part by a low furrow and does not reach the lateral margins of pleotelson. Anteriorly, it has a large spine, directed forwards, which emerges from a somewhat raised area. The remaining part of pleotelson consists of three vaulted sections, the middle one being

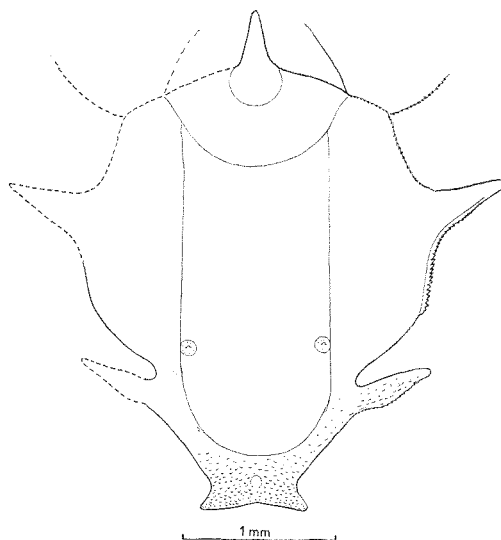


Fig. 86. *Storhyngura serrata* n. sp., ♀ holotype; pleon (dotted lines indicate non-preserved margins, etc.). Uropods not shown.

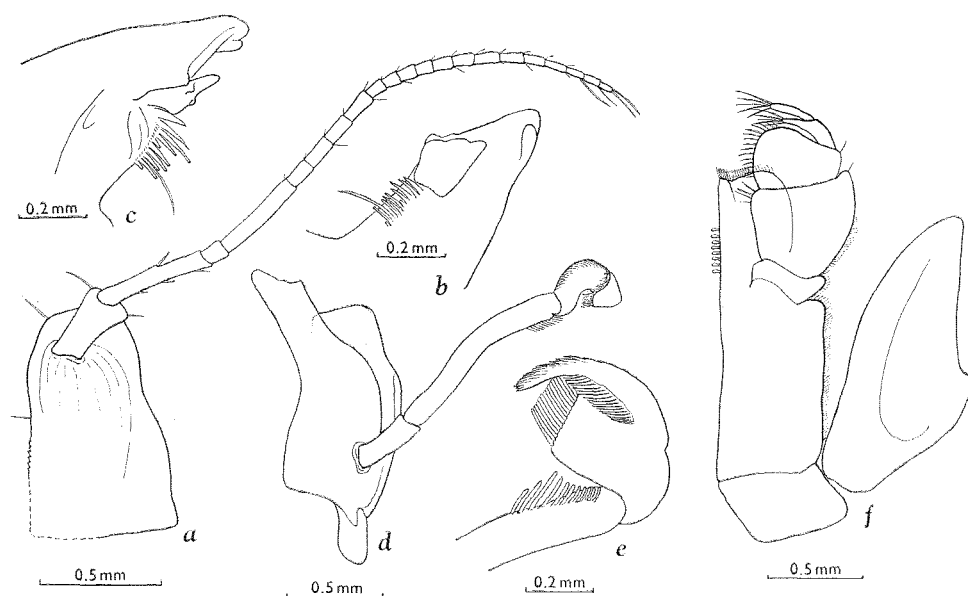


Fig. 87. *Storthyngura serrata* n.sp.; a, left antennula; b-e, left mandible; b, distal part from inside; c, distal part from the anterior side; d, frontal view of palp; e, distal part of palp; f, left maxilliped.

the broadest. This section ends in front of the posterior margin – which is truncate and has two blunt processes bent somewhat downwards. Lateral margin armed with a stout spine in the middle, and at a more posterior position has a similarly large spine which also points outwards and a little forwards. Lateral margins more or less serrated (the same applies to part of the lateral margins of the pereonites). The surface of the truncate hind end is granulated. Slightly in front of the base of the posterior lateral spines are two low, rounded dorsal tubercles. – Terminal face (Pl. VIII F) almost entirely occupied by the anal doors.

*Antennula* (Fig. 87a) with joint 2 emerging near the distal, rounded margin of joint 1, which is almost as thick as broad. Joint 3 only a little longer than joint 2. Flagellum with a limited number of joints (about 17). – *Antenna* with spines on joint 3 only (one on each side).

*Left mandible* has only one small tooth at each side of the oblique, chisel-shaped incisive part (87b). Movable lacinia small and almost rectangular in frontal view (87b). Spine-row with ten simple spines (87c). Molar process short and very broad, palp long and slender (87d) with joint 1 not much more than one-third of joint 2. The latter has a row of rather short, but very strong setae distally. Joint 3 unusually broad (87e).

*Maxillula, maxilla, labium and maxilliped* of the typical shape. The latter (87f) with a moderately large palp, eight coupling hooks and a subacute

epipod which has a rather prominent outer process.

*Pereopods V-VII* slightly narrower (especially propodus) than in *S. furcata*. Ischium, carpus and propodus with long, feathered setae.

*Female operculum* so damaged that it was impossible to ascertain whether a central spine had been present or not. – *Pleopods 3 and 4* according to Fig. 88a-b.

*Uropod* (88c) reaches far beyond the truncate hind margin. Endopod considerably longer than peduncle and almost twice as long as exopod.

*Size*: About 10.7 mm long.

#### Remarks:

This species is well characterized by the truncate hind part of pleotelson, in connexion with the some-

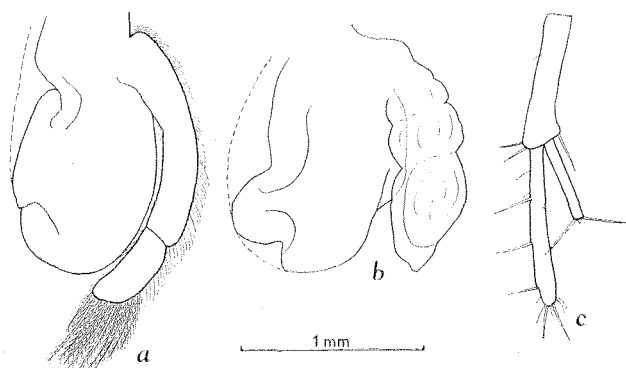


Fig. 88. *Storthyngura serrata* n.sp.; a-b, pleopods 3 and 4; c, uropod.

what forward-directed posterior lateral spines. In many respects it resembles *S. furcata* Wolff, differing however, in the lack of a median spine on pereonite 1 and of distinct terminal processes on pleotelson. It also differs in having a true dorsal spine on the anterior part of pleon, paired tubercles on the posterior, partly serrated lateral margins, and differently shaped mandibles. Finally, it is of a much smaller size. With regard to the modest size compared to most other species of *Storthyngura*, it is evident that although this specimen is not juvenile, it might not yet have reached maturity and could, conceivably, have attained a somewhat greater length.

#### Occurrence:

Gulf of Panama, 2950-3190 m, c. 2°C.

#### Genus *Eurycope* G.O.Sars, 1864

*Eurycope* G.O.Sars, 1864, p. 4 (208); G.O.SARS 1899, p. 144; RICHARDSON 1905, p. 490; HANSEN 1916, p. 137; WOLFF 1956a, p. 123; MENZIES 1962b, p. 139.

#### Diagnosis:

Body usually depressed and oval (rarely oblong), without lateral and dorsal spines or processes. Head almost always with a sharply limited frontal area (at least on the sides). Pereonites 1-4 of nearly the same length, short and broad, increasing in width from prns. 1-4. Prns. 5-7 free or fused, but the connexion between prn. 7 and pleon always free and movable. Laterally, pereonites 5-7 rarely found to have projections directed forwards. Apex of pleotelson rounded. First joint of antennulae large, plate-shaped with an inner projection. Squama on third joint of antenna marked off by a suture or articulation. Mandibles normal, generally with rather few spines in spine-row. Molar process fairly thick and last joint of palp lamellar, extremely curved, or rolled into a cornet-like shape. Epipod of maxilliped with outer margin rounded or with a rounded or subacute projection. Pereopods V-VII with carpus and propodus strongly expanded. Male pleopods 1, at most, very moderately narrowed at the middle. Uropod biramous, with the three joints generally short.

#### Remarks:

*Eurycope laevis* Richardson, 1909 has been transferred to *Munnopsurus* by GURJANOVA (1936) and *E. fusiformis* Barnard, 1920 to *Ilyarachna* by the present writer (1956a, p. 123). *E. atlantica* Bonnier, 1896 lacks the movable lacinia on the left mandible, has a feebly developed spine-row and is furnished with a large, rounded molar process (1. c., pl. 34, 2c-e). This species must, therefore, also be transferred to *Munnopsurus*. The reasons for referring *E. murrayi* (Walker, 1903) and *E. nodifrons* Hansen, 1916 to *Munneurycope* are given below (pp. 154 and 155).

Since there is great need for a key to all the species of *Eurycope*, I have worked out the following.<sup>1</sup> This has taken considerable trouble owing to several insufficient descriptions.

MENZIES (1962b, p. 139) prepared a key to the abyssal and bathyal-abyssal species. He left out *spinosa* Beddard, *abyssicola* Beddard, *sarsi* Beddard, and *galathea* Wolff, considering them too little known. The first was earlier transferred to *Storthyngura* after a study of the type (WOLFF 1956a, p. 112), the second is transferred to *Bathyopsurus* in this paper (p. 176) and the third mentioned below (p. 147). The fourth lacks the head and although it is included in my key, has some deficiencies. MENZIES left out *pellucidus* Beddard, *incisa* Gurjanova, *cornuta* G.O. Sars, and *brevirostris* Hansen without comment. In this paper the first is referred to a new genus (*Paropsurus*) (p. 181), and the second to *Munneurycope* (p. 161); the remaining two belong to *Eurycope* (*cornuta* is even the type species). On the other hand, he included *gaussi* Wolff which is known only from a depth of 385 m.

It seems unnecessary to discuss MENZIES' key in detail. It should perhaps be pointed out that couplet 2 to *antarctica* says: "Discrete frontal area lacking from cephalon", but VANHÖFFEN's fig. 121 and MENZIES' fig. 33 A show an exceptionally well developed frontal projection (especially in the male), and it is also mentioned in the authors' text. On the other hand, *murrayi* is ranged under species with "Frons of cephalon well defined", although it is (correctly) stated in the diagnosis of the species that the frontal area is probably obsolete.

1. *Eurycope laktionovi*, *neupokoevi* and *ratmanovi* (GURJANOVA 1946) are not included in the key.

### Key to the species of *Eurycope*

1. Pleotelson as long as broad. Lateral projection on epipod of maxilliped large and broad. Distal lobes of male pleopods 1 truncate and of equal length. Exopod of uropod one-fourth of endopod..... *galathea* Wolff, 1956a
1. These characters not combined..... 2
2. Medianly, frontal margin not even visible as a faint seam. Pleon oval and longer than pereonites 5-7. The body distinctly scabrous..... *scabra* Hansen, 1897
2. Frontal margin visible, although not always conspicuous. Pleon very rarely oval or longer than prns. 5-7. Body never distinctly scabrous..... 3
3. One or two tubercles on head or frontal projection..... 4
3. No tubercles present..... 5
4. A small tubercle situated on each side near the lateral margins of the frontal projection, which is concave distally and has acute corners. Exopod of uropod half as long as endopod..... *nobili* Richardson, 1911a
4. One median tubercle only, situated in the middle of the head. Frontal projection strongly produced and distally rounded..... *sulcifrons* Barnard, 1920
5. Frontal projection quadrangular and broader than long. Prn. 7 almost as long as 5+6. Pleon as long as broad. Male pleopods 1 almost equally broad throughout, plps. 2 apically truncate..... *quadrata* Barnard, 1920
5. These characters not combined..... 6
6. Frontal projection does not reach as far as joint 1 of antennulae..... 7
6. Frontal projection reaches further than joint 1 of antennulae..... 20
7. Frontal projection more or less convex, distally rounded, and always broader than long..... 8
7. Frontal projection distally acute, truncate and concave; lateral margins near its apex concave (except in *spinifrons* and *nodosa*)..... 12
8. Prn. 7 much shorter than prns. 5 or 6. Head about as broad as prn. 1. Apex of male plps. 1 broadly truncate..... *frigida* Vanhöffen, 1914
8. Prn. 7 about as long as prns. 5 or 6..... 9
9. Frontal projection large, somewhat squarish. Prns. 5-7 with a median, longitudinal impression. Separation between prns. 5 and 6 distinct. Pleon almost twice as broad as long..... *pavlenkoi* Gurjanova, 1933a
9. Frontal projection evenly rounded..... 10
10. A strong, forward-directed process on the antero-lateral corners of prns. 5-7, and a lateral tubercle near the postero-lateral corners. Pleon with two longitudinal grooves dorsally..... *sarsi* Beddard, 1885 (p. 147)
10. Without lateral forward-directed processes or tubercles on prns. 5-7. Pleon evenly vaulted dorsally..... 11
11. Frontal margin only moderately convex. Separation between prns. 5 and 6 distinct. Antero-interior corner of fourth joint of palp of maxilliped not produced..... *crassa* Vanhöffen, 1914
11. Frontal margin distinctly convex. Separation between prns. 5 and 6 only conspicuous laterally. Antero-interior corner of fourth joint of palp of mxp. strongly produced..... *antarctica* Vanhöffen, 1914, ♀
12. Frontal projection lancet-shaped, pointed, with a few short, subterminal spines on each side. Prns. 1-4 rather long medianly, three-fifths of prns. 5-7. Pleon 1.5 times broader than long, with a small postero-lateral projection on each side..... *spinifrons* Gurjanova, 1933a
12. Frontal projection distally truncate or more or less concave, with concave antero-lateral margins (margins convex in *nodosa*). Pleon evenly rounded in dorsal view..... 13
13. From the groove-shaped outer end of the frontal projection a median ridge continues vertically downwards to the epistome, at right angles to the horizontal projection. Epipod of mxp. uniformly triangular. Exopod of uropod as long as endopod..... *gaussi* Wolff, 1956a
13. No median ridge connecting apex of frontal projection and the epistome. Exopod of uropod shorter than endopod (except in *cornuta*)..... 14

14. Frontal projection with two small, triangular and acute processes distally, separated by a rounded incision. Epipod of mxp. with a large, almost semi-circular process on the outer margin. Male plp. 2 with the inner, distal margin deeply concave and a spine-like apex. Peduncle of uropod much broader than long. .... *complanata* Bonnier, 1896 (p. 147)
14. Epipod of mxp. with a subacute, lateral process (except in *vicarius*; unknown in *nodosa*). Apex of male plp. 2 not spine-like. Peduncle of uropod about as broad as long or narrower ..... 15
15. Frontal projection reaches about as far as joint 1 of antennula; apex deeply concave, with one short stout seta on each corner. Prn. 1 twice as long as prns. 2 or 3. .... *nodosa* Menzies, 1962b
15. Frontal projection does not at all reach as far as the distal end of joint 1 of antennula; no setae on apex. Prn. 1 about as long as prns. 2 or 3. .... 16
16. Frontal projection curved downwards distally towards the epistome (when viewed somewhat from the side), without a freely-protruding end. Female operculum with the keel stretching from the front to the hind margin. .... 17
16. Frontal projection horizontal with a freely-protruding end, when seen in side view. .... 18
17. Epipod of mxp. with a moderately large, subtriangular and slightly forward-pointing process on the outer margin. Keel on female operculum narrow, somewhat swollen posteriorly and devoid of setae. Male plp. 2 almost triangular, with a subacute apex. .... *inermis* Hansen, 1916
17. Epipod of mxp. with a very large, rounded, and outward-directed process on the outer margin. Keel on female operculum broad, with an obliquely cut off, oval area posteriorly and feathered setae. Male plp. 2 semi-circular, with rounded apex. .... *vicarius* Vanhöffen, 1914
18. Inner corner of joint 1 of antennula strongly produced forwards, thus the inner margin of the joint is slightly longer than its total width. Keel on female operculum continues to the hind margin. Male plps. 1 rounded distally. .... *hanseni* Ohlin, 1901
18. Inner corner of joint 1 of antennula only a little more produced than the outer. Keel on female operculum ends in front of the hind margin. Male plps. 1 truncate distally. .... 19
19. Head more than half as wide as prn. 5. Pleon four-fifths as wide as prn. 5. Male plps. 1 with distally, a small triangular tooth on the postero-lateral corner. .... *cornuta* G.O.Sars, 1864
19. Head less than half as wide as prn. 5. Pleon three-fifths as wide as prn. 5. Male plps. 1 without the tooth on the postero-lateral corner. .... *brevirostris* Hansen, 1916
20. Frontal projection with rounded anterior corners, and more or less convex medianly ..... 21
20. Frontal projection concave medianly or with a deep incision. .... 25
21. Frontal projection longer than broad. Prns. 1-4 medianly, at most, one-fourth as long as prns. 5-7. Uropods vestigial or with the exopod less than half as long as the endopod. .... 22
21. Frontal projection broader than long. Prns. 1-4 about half as long as prns. 5-7 medianly. Exopod of uropod more than half as long as endopod. .... 23
22. Inner corner of first joint of antennula greatly projecting. Uropods vestigial. .... *gibberifrons* n. sp. (p. 147)
22. Inner corner of first joint of antennula does not project further than the outer. Uropods well developed. .... *parva* Bonnier, 1896
23. Prns. 5-7 with a median, longitudinal impression. Separation between prns. 5 and 6 distinct. Pleon almost twice as broad as long. .... *pavlenkoi* Gurjanova, 1933a
23. Prns. 5-7 without a median impression. Separation between prns. 5 and 6 only clearly visible laterally. .... 24
24. Epipod of mxp. about twice as long as broad, pointed distally. Outer lobe of male plps. 1 projects less than the inner. .... *antarctica* Vanhöffen, 1914
24. Epipod of mxp. about as long as broad, obtusely truncate distally. Outer lobe of male plps. 1 projects equally as much as inner. .... *mutica* G.O.Sars, 1864
25. Width of prns. 1-4 less than two-thirds that of prns. 5-7. Outer margin of joint 1 of antennula dentate. Uropods small. .... *beddardi* Bonnier, 1896
25. Prns. 1-4 as broad (or almost as broad) as prns. 5-7. Outer margin of joint 1 of antennula not dentate. .... 26
26. Pleon with a distinct concavity at insertion of the uropods. Peduncle of uropods more than

- four times as long as broad. Frontal projection somewhat broader than long, with concave anterior margin..... *ovaloides* Menzies, 1962b
26. Pleon without a postero-lateral concavity. Peduncle of uropods at most twice as long as broad.. 27
27. Frontal projection about as long as broad, with concave anterior margin and a short, strong seta on each corner. Prn. 1 twice as long as prns. 2 or 3. Peduncle of uropods with a row of strong setae on the inner margin..... *nodosa* Menzies, 1962b
27. These characters not combined..... 28
28. Frontal projection about as long as broad, the lateral parts raised and broader than the median part between them, projecting as large, triangular teeth in front of the median part. Peduncle of uropods twice as long as broad..... 29
28. Lateral margins of frontal projections are, if raised, much narrower than the median part. Peduncle of uropods, at most, as long as broad..... 30
29. Pleon 1.5 times broader than long. Mandible with a strong process at the insertion of the palp. Distal end of epipod of mxp. regularly rounded..... *madseni* Wolff, 1956a
29. Pleon as broad as long. Mandible without process. Distal end of epipod of mxp. with incision near apex..... *ovalis* Vanhöffen, 1914
30. Antero-lateral corners of prns. 5-7 produced forwards; those of pleon projecting outwards as spine-like processes. Prns. 5 and 6 separated, prn. 5 twice as long as 6. *acutitelson* Menzies, 1962b
30. Antero-lateral corners of prns. 5-7 and pleon not produced forwards or outwards. If separated, prn. 5 is about as long as 6..... 31
31. Frontal projection as broad as long or broader than long. Prns. 5 and 6 fused medianly..... 32
31. Frontal projection longer than broad..... 35
32. Frontal projection with antero-lateral corners rounded, and with several short spines on them. Exopod of uropod three-fourths as long as endopod..... *latirostris* G.O.Sars, 1882
32. Frontal projection with antero-lateral corners acute, devoid of spines. Exopod of uropod, at most, two-thirds as long as endopod..... 33
33. Frontal projection about as long as broad. Pleon about as long as broad, sub-quadrangular..... *picardi* Amar, 1957
33. Frontal projection broader than long. Pleon considerably broader than long, evenly rounded or subtriangular..... 34
34. Lateral margins of frontal projection subparallel (although somewhat concave). Epipod of mxp. truncate distally..... *pygmaea* G.O.Sars, 1870
34. Lateral margins of frontal projection divergent. Epipod of mxp. long and narrow distally..... *curta* Vanhöffen, 1914
35. Pleon about as long as prns. 5-7. Prn. 7 less than half as long as 5 or 6. Outer, distal corner of second joint of palp of mxp. produced as a process..... *megalura* G.O.Sars, 1872
35. Pleon much shorter than prns. 5-7. Prn. 7, at least, as long as 5 or 6. Second joint of palp of mxp. not produced as a process..... 36
36. Joint 1 of antennula almost square. Pereopods II-IV more than twice as long as body. Exopod of uropod a little longer than endopod. Frontal projection narrow distally..... *phalangium* G.O.Sars, 1864<sup>1</sup>
36. Joint 1 of antennula with inner projection. Prps. II-IV, at most, a little longer than body. Exopod of uropod never equals length of endopod..... 37
37. Prp. IV much shorter than body. Outer margin of epipod of mxp. evenly rounded. Male plps. 1 almost straightly cut off distally..... *furcata* G.O.Sars, 1870
37. Prp. IV longer than body. Outer margin of epipod with a process. Male plps. 1 obliquely cut off..... *producta* G.O.Sars, 1868

1. In his first description (1864), Sars spelt the specific name *phalangium*, but by 1866 he had altered it to *phallangium* and used this spelling in all later references. But in his monograph (1899) he wrote (p. 147): "The specific name refers to the excessively elongated inferior antennae and ambulatory legs". Thus, there can be no doubt that he called the species after the generic name of the common harvestman, *Phalangium*, and the original spelling should therefore be re-introduced.

*Eurycope sarsi* Beddard, 1885

In order to ascertain whether BEDDARD's species (1886b, p. 58, pl. XI, 1-12) really belongs to *Eurycope* and not to *Storothyngura* (which it resembles in general body shape), I studied the type material of *sarsi* in London.

There is no doubt that *sarsi* is a true *Eurycope*, having all pereonites and pleonites distinctly separated. For the rest, I shall merely enumerate the existing material of this species, since BEDDARD's data appear somewhat incomplete:

St. 146, off Marion I. (46°46'S, 45°31'E), 2514 m, 29 December 1873; bottom temp.: 1.2°C.

1. Female (with developing oostegites) 25.5 mm long, 12.8 mm broad. I have selected this specimen as lectotype since it has been used in, at least, BEDDARD's fig. 2 on pl. XI (1. c.).
2. Female (with fully developed oostegites) 24.8 mm long.
3. Male (complete, but broken in two) c. 24 mm long.

St. 147, off Marion I. (46°16'S, 48°27'E), 2926 m, 30 December 1873; bottom temp.: 1.2°C.

4. Female (complete, but broken in two, with developing oostegites) 30.0 mm long.

All specimens are in good condition, but almost all maxillipeds are missing. In addition, the male lacks the pleopods, which were neither described nor figured by BEDDARD.

*Eurycope complanata* Bonnier, 1896

*Eurycope complanata* Bonnier, 1896, p. 601, pl. 34, 1a-p; HANSEN 1916, p. 145, pl. XIII, 4a-e; MENZIES 1962b, p. 141, fig. 34 H-L.

Material:

*Galathea* St. 771, Bay of Biscay (47°48'N, 8°26'W), 1920 m, 18 June 1952. Bottom: stiff clay. Bottom temp.: c. 3.4°C. - 1 male.

The descriptions given by BONNIER and HANSEN facilitate referring the present male to this species. There are only a few added comments:

*Frontal projection* of this male in all details according to BONNIER. Inner margin of joint 1 of *antennula* not concave distally as in BONNIER's fig. 1b (pl. 34), but alternatively, not nearly so convex as in HANSEN's fig. 4a (pl. XIII) and MENZIES' fig. 34 H. Flap

gellum preserved, reaching backwards beyond the hind margin of pereonite 5. *Squama* on antenna as figured by HANSEN, but always (as also in the *Ingolf* material), with a rather sturdy seta on the outer side, near apex. The distal, slender projection on *pleopod* 2 as in HANSEN's fig. 4d, i.e. curved a little inwards. Finally, exopod of the *uropod* of present male a little more than half as long as the endopod (as in MENZIES' specimen). No other disparities were found. The male is 4.3 mm long.

A study of the *Ingolf* material of *complanata* (from the North Atlantic), showed the female operculum to be actually closer to BONNIER's fig. 1o than to HANSEN's fig. 4e. It has two low, diverging, lateral keels, identical to those in the female from the Bay of Biscay. The median, distal seta is, however, not present in the *Ingolf* female.

Distribution:

Davis Strait (HANSEN), Bermuda (MENZIES), and Bay of Biscay (BONNIER, WOLFF), 950-5779 m and between c. 1.5 and 9.5°C.

*Eurycope gibberifrons* n. sp.

(Text-figs. 89-91)

Material:

*Galathea* St. 639, off New Zealand (37°31'S, 177°08'E), 213 m, 26 January 1952. Bottom: black sand. Bottom temp.: c. 14.7°C. - 1 male.

Description:

*Body* (Fig. 89a) oval, a little more than half as broad as long. Colour yellowish, surface smooth.

*Head* very short laterally and with forward-directed antero-lateral corners. Frontal projection large, almost rectangular, protruding a little further than antennulae; slightly convex distally and furnished with spine-like setae.

*Pereonites* 1-4 of about equal length, with a forward convexity and increasing in width from prn. 1 to 4. Lateral margins rounded, but difficult to see. There is one coxal spine on prn. 1, two on prns. 2-4; the latter are broad.

*Pereonites* 5-7 much longer and somewhat broader than the preceding segments. Prn. 5 as long as 1-4, prn. 6 about one-fourth longer than 5, and prn. 7 one-fifth longer than 6. The muscles are partly visible through the integument. Lateral margin sharp and slightly excavated on the ventral side.

*Pleon* twice as broad as long and evenly rounded. On the dorsal side, not far from the apex, is a pair



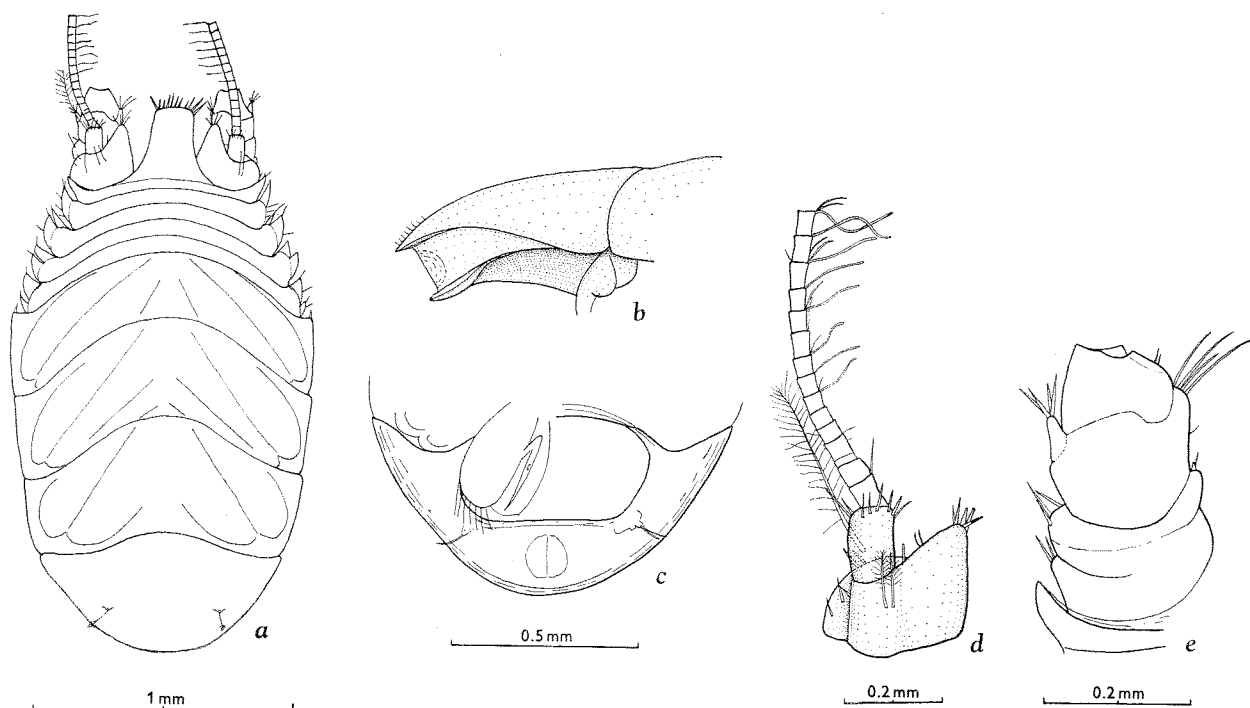


Fig. 89. *Eurycope gibberifrons* n.sp., ♂ holotype; a, from above; b, pleon from the right side; c, pleon from below; d, left antennula; e, left antenna.

of very small and low convexities with a finely-feathered distal seta. Pleon is flattened and somewhat concave ventrally, with projecting margins. Branchial cavity rather rectangular and considerably broader than long (89c). Between the cavity and the terminal face is a long, sharp ridge (89b).

*Antennula* (89d) with joint 1 very broad, i.e. as broad as high. Outer corner low and rounded and inner one with a very strong process, crowned with some spine-like setae. There are more similar setae near the outer margin and two feathered setae on the upper surface. Joint 2 inserted exteriorly and three-fifths longer than broad, with a row of spine-

like setae distally and a very long, feathered seta emerging from the ventral side. Joints 3-4 smaller, subequal. Flagellum multi-jointed, but broken in both antennulae.

*Antenna* (89e) with a (probably) articulated squama on joint 3. Both squama, and most of the distal corners of all four preserved joints have several spine-like setae.

*Left mandible* (90a) rather slender. Four teeth in incisive part, and four on movable lacinia (90b). Molar process slender and projecting, obliquely cut off and furnished with a row of tiny teeth and longer spines inside the sharp edge (90c). Palp very large,

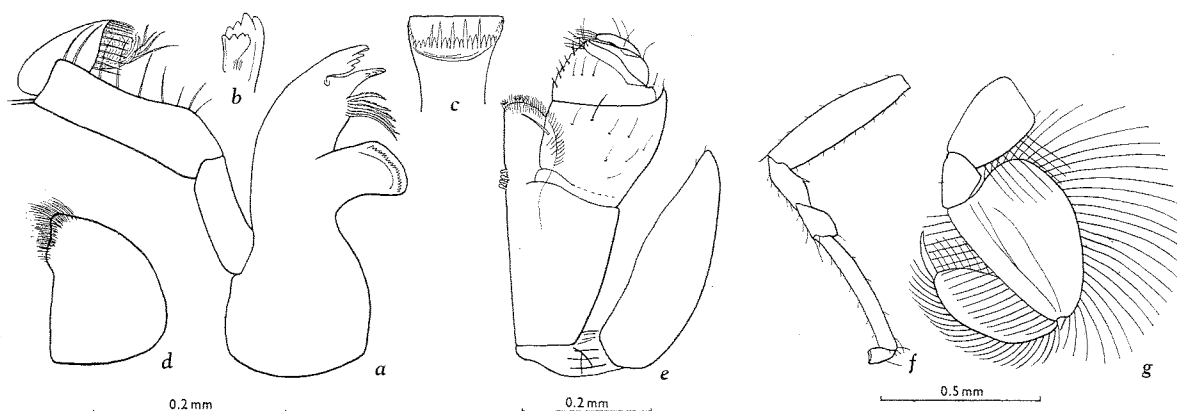


Fig. 90. *Eurycope gibberifrons* n.sp.; a-c, left mandible; b, incisive part and movable lacinia from inside; c, frontal view of edge of molar process; d, labium; e, left maxilliped; f, pereopod I; g, pereopod VI (all setae feathered).

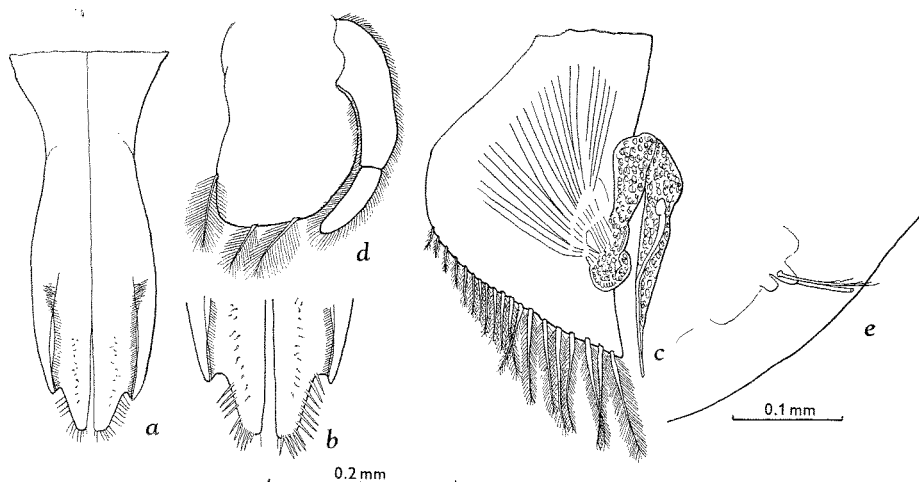


Fig. 91. *Eurycope gibberifrons* n.sp.; a-b, male pleopods 1; c-d, pleopods 2-3; e, vestigial uropod and margin of pleon.

joint 2 being much stronger than joints 1 and 3. Joint 3 is twisted and furnished with ordinary as well as serrated setae.

*Maxillula* slender, with about 14 unserrated spines on outer endite – which is very obliquely cut off; inner endite with two curved spines and many fine hairs. – *Maxilla* of the usual shape, with slender endites. – *Labium* (90d) almost semi-circular, with rather few setae.

*Maxilliped* (90e) with the sympod narrow at base and a slender, distally rounded endite. Four coupling hooks. Joints 2-4 of the palp exceptionally broad and large, and joint 2 with an outer, distal projection. Joint 4 remains partly covered by joint 3, even when the palp is flattened. Epipod slender, rounded, more than three times longer than broad.

*Pereopod I* (90f) only partly preserved; it is rather sturdy. Even basis of prps. II-IV not preserved. – *Pereopods V-VII* (90g) subequal, except that basis and ischium are largest in prp. VI, and carpus and propodus smallest in VII. Dactylus about two-fifths of propodus – which is oval in shape. The feathered setae on outer margin of carpus unusually long.

*Pleopods 1* (91a) broadest at base and with another widening beyond the middle. Outer lobes slightly projecting, with a dense row of short setae along the inner margin. Inner lobes project much further, with several spine-like setae (91b).

*Pleopods 2* (91c) somewhat triangular, with sub-acute distal corner, and distal half of the margin with a row of strong, feathered setae. Copulatory organ rather strong, reaching a little beyond distal corner. – *Pleopod 3* according to Fig. 91d.

*Uropod* (91e) extremely small, and owing to the size and opaqueness of the animal, very difficult to

distinguish. As far as could be made out, the uropods are somewhat reduced, since only two tiny projections (endopod and exopod?) could be discerned. One of these was probably furnished with a stiff, broken seta and one or more possibly finely feathered setae. It is impossible to discern whether these projections emerge from a large, rectangular convexity which (this being so) might be the broad peduncle.

*Size*: Total length 2.3 mm, greatest width 1.2 mm.

#### Remarks:

The only two species of *Eurycope* which have a similar rectangular, strongly projecting rostrum are *beddardi* Bonnier and *parva* Bonnier. However, pereonites 1-4 are much narrower in the former, prn. 7 is much shorter, pleon longer than broad, and joint 1 of antennula quite different, etc. *E. parva* is more elongated, pleon is as long as broad, male pleopods 1 very dissimilar, and the uropods large.

#### Occurrence:

Off New Zealand at 213 m depth and c. 14.7°C.

#### Genus *Munnopsurus* Richardson, 1912

*Munnopsurus* Richardson, 1912, p. 1; HANSEN 1916, p. 134; MONOD 1926, p. 23.

It was not without hesitation that HANSEN, in his great monograph maintained this genus. As the only distinguishing characters he mentioned the very differently shaped mandibles in *Munnopsurus* with their broad and simple, distally rounded molar process, blunt incisive part, simple third joint of the

palp, and lack of spine-row<sup>1</sup> and movable lacinia. He knew of no form with mandibles intermediate between this type and that of *Eurycope*. However, MONOD's description of *Munnopsurus australis* (1926) revealed intermediate mandibles in which presence of a simple molar process and a simple third joint of the palp is combined with the presence of a distinct spine-row and a movable lacinia. In spite of this MONOD also decided to maintain *Munnopsurus* as only *australis* possessed a movable lacinia (only two more species were, however, recognized at that time), the rest of the mandible (especially the palp) agreed with the generic characters, and finally because "le genre *Eurycope* atteint déjà des proportions suffisamment vastes."

I have, however, as mentioned below, transferred *Eurycope atlantica* Bonnier to this genus. In that species which is otherwise a very typical representative of *Munnopsurus* the third joint of the palp is not simple, but broad and twisted – as is usually found in *Eurycope*. Thus, the mandibles only exhibit one feature which is different from that of all species of *Eurycope*: The broad and simple molar process with one or two tufts of small spines.

In my opinion this single character could not justify the maintenance of *Munnopsurus*, especially in view of the marked variability of mandibles which I have found within one single genus, namely *Munnopsis* (p. 184). However, a close examination of all species referred to *Munnopsurus* has revealed a

1. Strangely enough HANSEN did not pay any attention to the fact that in TATTERSALL's original description of *longipes* he figures (but does not mention) a row of five small "spines" on the right mandible (1905, pl. X, 3).

number of supplementary characters in which it differs from *Eurycope*; the most essential of these are: Shape of anterior part of head, of pereonite 1 and joint 1 of antennula, shape of labrum and palp of maxilliped, length and width of basis of pereopod I compared to that of prps. II-IV, and shape of outer branch of pleopods 4. Together with the aberrantly shaped molar process of the mandibles these features must be considered reason enough for preserving *Munnopsurus*.

#### Diagnosis:

Head broad, vaulted posteriorly, with the frontal area descending abruptly and forming a somewhat concave, strongly calcified semi-circle with the triangularly raised epistome in the centre (SARS 1885, pl. 11, 4 and my Pl. IX C). Pereonites 1-4 loosely articulated and prns. 5-7 always free and movable; prn. 1 at most as broad as the head, and with the lateral parts shorter than prns. 2-4 and bent somewhat downwards. Apex of pleotelson more or less evenly rounded. First joint of antennula regularly rounded distally; no inner projection. Squama articulated, longer than broad. Molar process of mandibles broad and simple, distally rounded and with one or two tufts of small spines; palp present. Joint 2 of palp of maxilliped with oblique anterior margin. Pereopods I-IV long and slender, the three latter equally shaped; prp. I not prehensile and with basis considerably longer and narrower than that of prps. II-IV. Male pleopod 2 with short and strong copulatory organ, plp. 3 normal, and plp. 4 with exopod 1-jointed, broad and foliaceous. Uropod small, biramous, with short, 1-jointed rami.

#### Key to the species of *Munnopsurus*

1. Joints 2 and 3 of antennula of about equal size and neither of them produced inwards. Pereonite 1 as broad as the head, dactylus of pereopods V-VII almost as long as the width of propodus, and rami of uropods almost equally long..... *laevis* (Richardson, 1909) (p. 154)
1. Joint 2 of antennula larger than joint 3. The other characters not combined..... 2
2. Flagellum of antennula with less than twenty (ten?) joints. Pleon pentagonal. Dactylus of prps. V-VII as long as or longer than the width of propodus.... *minutus* Gurjanova, 1933a (p. 154)
2. Flagellum of antennula with more than twenty joints (except perhaps in *australis*). Pleon evenly rounded postero-laterally..... 3
3. Prn. 1 as broad as the head. Joint 2 of antennula produced inwards..... 4
3. Prn. 1 narrower than the head. Joint 2 of antennula not produced inwards..... 6
4. Three spines on joint 2 and one on joint 3 of antennula; one spine interiorly on joint 3 of antenna. Inner lobe of male pleopods 1 much larger than outer. Outer margin of sympod of plp. 2 concave distally..... *mimus* Barnard, 1914 (p. 153)
4. No spines on these joints (a few setae on joint 2 of antennula). Lobes of male plps. 1 equally large. Outer margin of plp. 2 convex throughout (*giganteus*)..... 5

5. Prns. 5-7 with a deep furrow medianly and each with a pair of rounded processes. Pleotelson hardly produced apically..... *g. giganteus* (G.O.Sars, 1879)
5. Prns. 5-7 with a slight furrow and no processes. Pleotelson considerably produced apically..... *g. ochotensis* Gurjanova, 1933a (p. 154)
6. Outer margin of joint 2 of maxillipedal palp more than twice as long as inner; 5-8 coupling hooks. Male plps. 1 almost twice as broad at the base as distally. *longipes* (Tattersall, 1905) (p. 151)
6. Outer margin of joint 2 less than twice as long as inner; 3-4 coupling hooks. Male plps. 1 as broad distally as at the base (unknown in *australis*)..... 7
7. Joint 3 of mandibular palp broad and twisted, with many setae. Peduncle of uropod as broad as long, and endopod one-fourth longer than exopod. Male plps. 1 equally broad throughout..... *atlanticus* (Bonnier, 1896)
7. Joint 3 of md. palp narrow and simple, with few setae. Peduncle of uropod longer than broad, and endopod almost twice as long as exopod. Left mandible with movable lacinia..... *australis* (Vanhöffen, 1914) (p. 153)

***Munnopsurus longipes* (Tattersall, 1905)**  
(Pl. IX B-C; Text-figs. 92-93)

*Eurycope longipes* Tattersall, 1905, p. 30, p. 75, pl. X.  
*Munnopsurus longipes* (Tattersall), HANSEN 1916, p. 136, pl. XII, 6a-6b; MONOD 1926, p. 21.

In order to try and arrange the rather confused state of the species within the genus *Munnopsurus* I have found it necessary to study in detail the large, well preserved male of the present species, found in this Museum and dealt with rather superficially by HANSEN. He considered TATTERSALL's description "elaborate" and gave only a few further details, stressing especially the difference between this species and *M. giganteus* (G.O.Sars). The latter has been so excellently described and figured by SARS (1885, p. 130, pl. 11, figs. 1-25) and by HANSEN (1887, p. 198, pl. XX, 3a-3m) that I, on the whole, intend to confine myself to reference of these illustrations in the following.

**Additional description:**

*Body* according to Pl. IX B. There is a reticulate pattern on the head (Pl. IX C). Pereonite 1 medianly a little longer than prns. 2-4 and laterally bent, not only downwards, but also forwards; prns. 2-4 longer laterally than medianly and with sharp antero-lateral corners; all four segments thus rather different from TATTERSALL's fig. 1. Prns. 5-7 also have more angular corners and a faint median furrow. Pleon consists of one short but distinct pleonite and the large pleotelson – which is clearly longer than broad, shield-shaped, with the lateral margins parallel anteriorly and furnished here with a row of small distinct setae. Branchial cavity about as large as in *giganteus* (SARS' fig. 24).

*Antennula* (Fig. 92a) with joint 1 one-fourth longer than broad, joint 2 almost circular, without projections, joint 3 a little longer than broad, joint 4 very short, and flagellum multi-jointed; in the male it is more than half as long as the body and more than five times as long as the peduncle, in the female

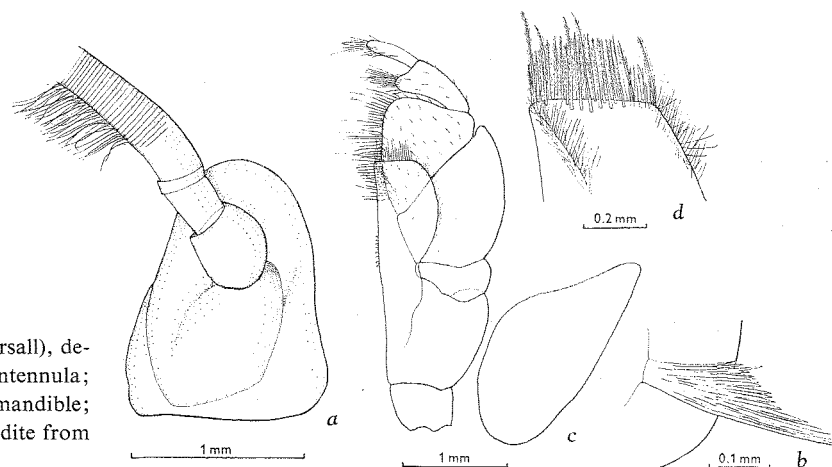


Fig. 92. *Munnopsurus longipes* (Tattersall), described ♂ from Ingolf St. 36; a, right antennula; b, bristles on molar process of right mandible; c, left maxilliped; d, distal part of endite from inside.

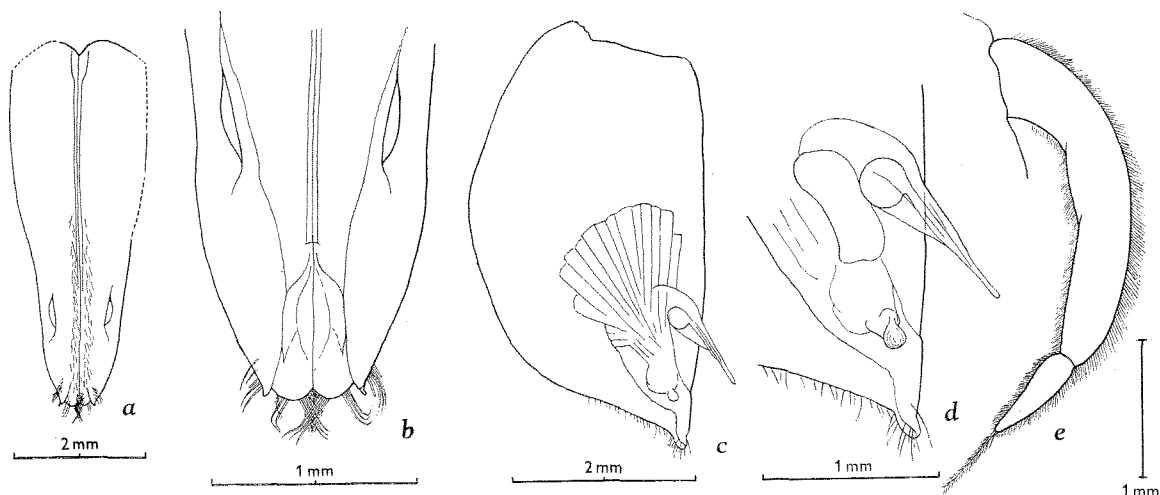


Fig. 93. *Munnopsurus longipes* (Tattersall), ♂ from Ingolf St. 36; a-b, pleopods 1 from outside and apex from inside; c-d, pleopod 2; e, outer branch of pleopod 3.

only about twice as long as the peduncle (according to TATTERSALL's fig. 2). – *Antenna* without inner spine on joint 3.

*Left mandible* not preserved, but figured by HANSEN (pl. XII, 6a); it seems to have a slightly bilobed incisive tooth. – *Right mandible* correctly figured by TATTERSALL (1. c.), although what he calls "a single small spiniform bristle" on the rounded molar process, was discovered to consist of (at any rate on the present male under high magnification) – several (almost twenty) very fine bristles, emerging from a common base (Fig. 92b). TATTERSALL figures, but does not mention the five short setae at the position of the spine-row; some extremely tiny setae also seem to be present in the male considered here.

*Labium, maxillula and maxilla* almost exactly as in *giganteus* (SARS' fig. 9 and HANSEN's figs. 3e and 3f), except that the inner lobes in labium are slightly unequal in size and the maxilla has longer setae and spines; twelve spines on the outer lobe of the maxillula.

*Maxilliped* (92c) with endite narrow, distally truncate and here furnished with about 23 slender, finely serrated spines (92d). Outer margin of joint 1 of palp rather long, joint 2 considerably longer than broad, and joint 4 with a distinct inner projection as in *giganteus*. Eight coupling hooks. Epipod also close to that of *giganteus* (HANSEN's drawing), but without terminal setae.

*Pereopod I* according to TATTERSALL's fig. 6, except that dactylus is only half as long. Basis of prp. I one-fourth longer than that of prps. II and III and two-fifths longer than that of prp. IV. It is about one-fourth narrower. One of the three succeeding

legs is also preserved, but detached (Pl. IXB). The dimensions are almost as in *giganteus*, but instead of propodus being less than twice as long as carpus it is in *longipes* almost two and a half times longer. The total length of the leg is almost twice that of the body.

*Male pleopods 1* (93a) are two-fifths broader proximally than distally before the apical tapering. The lobes are furnished with stronger setae along the margin (93b) and finer ones distally on the ventral (outer) side. Both pairs of lobes are bent somewhat downwards.

*Male pleopod 2* (93c) with sympod much more elongated than in *giganteus*, being twice as long as broad. Distally, the inner side is covered by a membrane which runs out into a funnel-shaped projection (93d). Copulatory organ (93d) short and thick, exopod small and indistinct.

*Pleopod 3* with a triangular inner and a narrow, 2-jointed outer branch (93e) which does not reach as far as the inner branch.

*Uropod* with peduncle narrower than in *giganteus* (SARS' fig. 22). Exopod half as wide as endopod and relatively longer than in TATTERSALL's fig. 7.

#### Remarks:

The differences between *longipes* and *giganteus* were pointed out by HANSEN (p. 136). Furthermore, *longipes* has no projection on joint 2 of the antenna, much longer propodus on pereopods II-IV and sympod of male pleopod 2 rather differently shaped.

MONOD (1926, p. 21) compared *longipes* to *australis* Vanhöffen and found differences in the relative

lengths of the inner and outer margins of joint 2 of the maxillipedal palp, in the number of coupling hooks, and in presence of a movable lacinia and a larger molar process (furnished with two or three distinct setae) in *australis*. In addition, *australis* differs in the following respects: (1) Pereonites 5-7 rounded laterally; (2) pleon only as long as it is broad; (3) epipod of maxilliped with lateral margins diverging proximally (instead of being almost parallel); exopod of uropod only slightly more than half as long as endopod.

As mentioned previously (p. 150), I have transferred *Eurycope atlantica* Bonnier, 1896 (p. 604, pl. XXXIV, 2a-2j) to *Munnopsurus* for obvious reasons. This species can be separated from *longipes* by the following characters: (1) Molar process of mandible narrower and with two feathered (serrated?) setae; (2) the palp with a broad, twisted third joint with several terminal, serrated setae; (3) inner margin of joint 2 of the maxillipedal palp more than half as long as the outer; (4) male pleopods 1 equally wide throughout, with the inner lobes narrower and less projecting and with very short, scattered setae on the outer lobes; (5) outer margin of sympod of pleopod 2 very much more convex and exopod considerably larger; (6) peduncle of uropod as broad as long.

In his list of isopods from depths greater than 2000 m, MENZIES (1962 b, p. 88) has referred *M. longipes* to species which are probably pelagic, without giving any reasons for this conception. The whole appearance and strong calcification of the species decidedly speak in favour of its being benthic.

#### Distribution:

Off Ireland, 640-830 m, SW of the Faroes, 872-950 m, and Davis Strait, 2702 m, 1.5°C.

#### *Munnopsurus mimus* Barnard, 1914

*Munnopsurus mimus* Barnard, 1914, p. 225, pl. XXI, B.

*Munnopsurus longipes* (Tattersall) (pars), MONOD 1926, p. 23.

BARNARD only compared this species to *M. arcticus* Richardson (= *M. giganteus* Sars). Besides the differences pointed out by BARNARD, these species disagree in most of the characters which I have enumerated below as distinguishing *mimus* from *longipes*. MONOD (1. c.) considered *mimus* as belonging to *longipes* because according to the de-

scriptions, they seemed to agree in the structure of the body, the mouthparts, the first pereopods, and the male pleopods. The only discernable difference, namely presence or absence of a posterior lobe on pleon, would not appear sufficient for a separation in species.

I am in full agreement with this, but re-examination of *longipes* has revealed that *mimus* differs from it in the following respects – which certainly justify the maintenance of *mimus* as a separate species: (1) Pereonite 1 is as broad as the head; (2) pleon evenly rounded posteriorly; (3) second joint of antennula strongly produced inwards and with three spines, and third joint with one spine; (4) strong spine on inner margin of joint 3 of antenna; (5) carpus of pereopods II-IV longer than propodus, and dactylus only one-fourth of the latter (instead of one-sixth); (6) dactylus of prps. V-VII as long as the width of propodus; (7) male pleopods 1 equally wide throughout; (8) outer margin of sympod of pleopod 2 strongly concave near the apex and the copulatory organ long and narrow.

For the distinction between *mimus* and the remaining species of *Munnopsurus* it should suffice to refer to the key on p. 150.

#### *Munnopsurus australis* (Vanhöffen, 1914)

*Eurycope gigantea* G.O.Sars f. *australis* n. f., VANHÖFFEN 1914, p. 585, fig. 115.

*Munnopsurus giganteus* (Sars) f. *australis* Vanhöffen, HANSEN 1916, p. 135.

*Munnopsurus australis* (Vanhöffen), MONOD 1926, p. 20, figs. 14-15.

VANHÖFFEN's description is very insufficient. MONOD supplied good illustrations but unfortunately, very little description. His fig. 14 of the general structure disagrees with VANHÖFFEN's fig. 115 in two main respects: The head is much narrower than pereonite 1 in MONOD's fig., much broader in VANHÖFFEN's, and prns. 3 and 4 are straight laterally in the former figure, but bent forwards in the latter. It is presumed that VANHÖFFEN's drawing is the more correct in both cases, partly because MONOD's specimen seems to be rather mutilated and partly because VANHÖFFEN's drawing agrees much more with other species of the genus.

MONOD enumerates some features in which *australis* differs from *giganteus* but not what is probably the most important difference: In *giganteus* the margins of the molar process are almost straight so

that the shape of the mandible is almost regularly triangular (SARS' fig. 10), whereas in *australis* the process is strongly projecting (MONOD's fig. 15 A-B); moreover, the latter species possesses a distinct spine-row on both mandibles and a movable lacinia on the left, and these are lacking entirely in *giganteus*.

The differences between *australis* and *longipes* were pointed out above, and the distinction between *australis* and the remaining species is listed in the key (p. 150).

*Munnopsurus laevis* (Richardson, 1909)

*Eurycope laevis* Richardson, 1909, p. 120, figs. 45-46.

*Munnopsurus laevis* (Richardson), GURJANOVA 1936, p. 60, fig. 24.

The description is very insufficient, but *laevis* seems to differ from all other species by the combination of characters given in the key. GURJANOVA transferred it correctly to *Munnopsurus*, but in addition to this her text (in Russian) adds no new information.

*Munnopsurus giganteus ochotensis* Gurjanova, 1933  
and *M. minutus* Gurjanova, 1933

Along with the description in Russian (1933a, p. 84), a short summary was given in English (pp. 90-91) which provides almost as much information as the Russian text. The text to the figures of the two forms (figs. 9 and 10) were mixed up. The Russian text was repeated in 1936 and no new information was added for *minutus* while one more locality<sup>1</sup> and 15 mm as maximum length was supplied for *g. ochotensis*.

Besides the differences between *ochotensis* and the typical form pointed out by GURJANOVA, her figure indicates that the molar process in the former seems to be more distinctly set off and that dactylus of pereopods V-VII is considerably longer.

In *minutus* the number of joints in flagellum of antennula is remarkably low (nine). Since six specimens were available for description it is probable that both males and females were represented, and that the number is therefore the same in the two sexes.

1. In 1933 the depth for *Heineman* St. 18 (57°52'N, 143°11'E) is given as 160 m, in 1936 as 80 m. Mrs. GURJANOVA has kindly informed me that the subspecies was taken at both depths, the latter referring to the locality stated, the former to "another station without exact data". Thus, the subspecies is known from a total of four localities.

Genus *Munneurycope* Stephensen, 1913

*Munneurycope* Stephensen, 1913, p. 99; STEPHENSEN 1915, p. 23.

*Eurycope* G. O. Sars, HANSEN 1916, p. 138.

When establishing *Munneurycope*, STEPHENSEN referred to this genus *Munnopsis* (= *Paramunnopsis*) *longicornis* (Hansen), *M. (P.) oceanica* (Tattersall), *Munnopsis (Eurycope) murrayi* (Walker), and the new species *Munneurycope tjalfiensis*. In 1915 he was quite correct in excluding the two former which belong to a separate family, and later HANSEN (1916) proved that *tjalfiensis* is a synonym of *murrayi*.

STEPHENSEN gave no diagnosis, but based his genus entirely on characters in which it differed from *Munnopsis* – thus not comparing it with *Eurycope* to which it is the most closely related by far.

In 1916 HANSEN cancelled *Munneurycope*, since he could see no essential differences between this genus and *Eurycope*. He found conformity in the shape of "body, antennulae, antennae, mandibles, maxillipeds, thoracic segments, and legs" and discussed the following relatively aberrant characters in *murrayi* (and *tjalfiensis*): (1) Joint 1 of antennula without inner projection, but "in this respect it agrees with the joint in *Eurycope nodifrons* n. sp."; (2) uropods with an extremely small uropod, "but in several species of *Eurycope* the exopod is somewhat or considerably shorter than the exopod" (misprint for endopod); (3) exopod of pleopod 4 broad and obtuse distally (instead of normally narrow and acute), but this appendage "is unknown in some species of *Eurycope*"; (4) one character seemed to HANSEN to be unique: the large coupling hook (the exopod) of the second male pleopod emerges from the truncate, almost transverse end of the sympod instead of, as is usual, from the distal part of its inner margin.

The fact that the *Galathea* collection contained two specimens of a new species (described below as *M. harrietae*) which in so many respects agrees with *murrayi* and disagrees with the ordinary appearance of species of *Eurycope* – has urged me to consider the generic status of these species very carefully. In spite of his detailed comparison of *murrayi* (*tjalfiensis*) with species of *Eurycope*, HANSEN strangely enough did not pay any attention to the marked difference between the basipodites of pereopods I-IV which are practically always preserved, even if the rest of the leg is lost. Table 7 shows that basis of prp. I in *murrayi* and *harrietae* is between twice and one and a half times longer than the three

Table 7. Length and width (in measuring units) of the basipodites in five of the species of *Munneurycope*.

Pereopods	<i>murrayi</i> ♂, Albr. St. 4793		<i>harrietae</i> ♂, holotype		<i>nodifrons</i> ♂, holotype		<i>menziesi</i> ♀, holotype		<i>elongata</i> ♀, holotype	
	Length	Width	Length	Width	Length	Width	Length	Width	Length	Width
I	87	9	80	7	81	15	87	14	—	—
II	44	15	42	9	66	21	73	18	—	—
III	53	16	52	11	48	24	43	20	46	15
IV	60	17	53	11	54	21	67	18	38	17
V	35	11	37	10	45	21	—	—	58	20
VI	47	11	47	11	63	24	79	23	70	17
VII	52	11	51	10	66	21	68	23	64	12

succeeding basipodites and is also somewhat, or considerably, narrower. HANSEN himself has – without doubt correctly – stressed the importance of the relative length of the proximal joints of pereopods I-IV to such an extent that he used this character as the main reason for dividing SARS' family Munnopsidae into three "groups" or families, Ilyarachnidae, Eurycopidae, and Munnopsidae (1916).

When going through all species of *Eurycope* I found that in the following 19 species basis of all four pereopods is equally long and wide, even if the entire prp. I is often much shorter than the others, as e.g. in *producta*; in some cases basis of prp. I may be shorter, but it is never longer. These species are: *brevirostris*, *complanata*, *cornuta*, *furcata*, *galathea*, *gaussi*, *hanseni*, *inermis*, *latirostris*, *madseni*, *megalura*, *mutica*, *ovalis*, *parva*, *phalangium*, *picardi*, *producta*, *pygmaea*, and *vicarius*. The mutual length of the basipodites is uncertain in *beddardi* and unknown in 18 species: *acutitelson*, *antarctica*, *crassa*, *curta*, *frigida*, *gibberifrons*, *laktionovi*, *neupokoevi*, *nobili*, *nodosa*, *ovaloides*, *pavlenkoi*, *quadrata*, *ratmanovi*, *sarsi*, *scabra*, *spinifrons*, and *sulcifrons*. Only in one species, *nodifrons*,<sup>1</sup> did I find basis of prp. I longer and narrower than of prps. II-IV (Table 7).<sup>2</sup> As mentioned above, the lack of an inner projection on joint 1 of the antennula in *nodifrons* also was one main reason why HANSEN could not accept *murrayi* (*tjalfensis*) as belonging to a separate genus.<sup>3</sup> In his

discussion of relationship to *nodifrons* (p. 140) HANSEN also stated that probably no species is closer to it than *murrayi*.

A probable consequence of the unequally long basipodites is the fact that in *murrayi*, *harrietae*, *nodifrons*, *menziesi* and *incisa* the first pereonite is distinctly longer than the three succeeding. In all species of *Eurycope* pereonites 1-4 are equally long, although of course, increasing in width from front to back. The only exception is *E. crassa* which I have previously referred to as being rather similar to *nodifrons* (1956a, p. 125), mainly because of its very long prn. 1. Both VANHÖFFEN's fig. 120 (1914) and MONOD's fig. 12A (1926) seem to show the first joint of the antennula as being evenly rounded distally and without inner projection, but unfortunately neither of them mention this feature or the length of the basipodites. For this reason it is preferred to retain *crassa* in *Eurycope*, but it is probable that it will have to be moved in the future.

Besides the greater length of prn. 1 and basis of prp. I and lack of inner projection on joint 1 of antennula, the said species differ from all species of *Eurycope* in yet one more character: lack of a rostral projection. Only *E. scabra* is also without a distinct projection, but in this species both the antennula and the mutual length of the basipodites are unknown so that it is at present impossible to judge its position.

Further, there are a few more characters in which the four former species seem to differ from practically all species of *Eurycope* (the mouthparts are unknown in *incisa*): (1) mandibles with many spines in the spine-row and the molar process having a strongly excavated end which is heavily serrated along the proximal margin, with elaborate spines and stiff setae; (2) epipod of maxilliped elongated; (3) male pleopod 2 with a very robust stylet on the endopod; on the other hand, the character pointed out by HANSEN for *murrayi* – the exopod emerging

1. The material of this has below been divided into two separate species, *nodifrons* and *menziesi*.

2. Also in *incisa* (cf. p. 161) is basis of prp. I much longer than that of prps. II-IV, but since exact measurements could not be made, this species was not included in Table 7 although it, without doubt, belongs to *Munneurycope*.

3. A square, elevated area on joint 1 of the antennula in *nodifrons* and *menziesi* (Fig. 102b-c, p. 164) reaches a little beyond the inner margin of the distally rounded joint; joint 2 is inserted upon it. This elevation should not be mistaken with the ordinary inner projection which is at the same level as the main body of the joint.



from the truncate, almost transverse end of the sym-pod – is met with in only this species. In my opinion this is of no importance, since so many transitions are to be found between this type and the exopods emerging from the interior lateral margin proper (e.g. in *M. harrietae*, Fig. 101 d).

It is evident from the following descriptions that *murrayi* and *harrietae* on one side and *nodifrons* and *menziesi* on the other, are closest related. In the two former the coxal plates are rounded, in the two latter the plates are acutely triangular; the former have pleotelson considerably swollen and without the distinct lateral margins which are conspicuous in the latter; labium of the former with five hooked or bifid spines which are lacking in the latter; basis of pereopod I much longer in the former than in the latter; the female operculum of *murrayi* rather different from that of *menziesi*. On the other hand, *harrietae* and *nodifrons* have both very short and broad joints in the flagellum of the antennula, which in *murrayi* are more or less elongated, and the male pleopods 1 of the two former are rather similar and quite different from those of *murrayi* (both flagellum of antennula and male pleopods are unknown in *menziesi*). The relationship of the

rather imperfectly known *incisa* is discussed on p. 161.

As further discussed below (p. 24) it was found natural enough to include the new species *elongata* in *Munneurycope*, although it disagrees with the other species in a few of the characters which have been pointed out above: Pereonite 2 is even longer than prn. 1, and there are only a few spines in the spine-row.

#### Diagnosis:

Head with no sharply defined frontal area or rostral projection. Pereonite 1 (rarely prn. 2) distinctly longer than prns. 2-4 (3-4). Prns. 5-7 free and movable and usually with a median furrow. Joint 1 of antennula distally rounded, without inner projection, and usually longer than broad. Mandibles as in *Eurycope*, but generally having many spines in the spine-row; distal end of molar process very excavated and its proximal margin serrated and armed with spines and stiff setae. Epipod of maxilliped elongated. Basis of pereopod I longer and narrower than those of pips. II-IV. Male pleopods 1 at most very moderately narrowed in the middle; plp. 2 with the stylet of the endopod very robust. Uropod biramous, with three joints.

#### Key to the species of *Munneurycope*

1. Pereonite 2 longer than prn. 1 which is again longer than prns. 3 and 4. Squama on joint 3 of antenna very small or lacking. Mandibular palp absent. . . . . *elongata* n. sp. (p. 167)
1. Prn. 1 longer than the equally long prns. 2-4. Squama large and distinct. Mandibular palp present 2
2. Prn. 7 medianly much longer than any of the other segments. Pleotelson rectangular, almost twice as broad as long and with a large incision posteriorly . . . *incisa* (Gurjanova, 1946) (p. 161)
2. Prn. 7 about as long as prns. 5 and 6. Pleotelson rounded, about as broad as long and without incision posteriorly. . . . . 3
3. Coxae on prns. 1-4 ring-shaped, rounded. Pleotelson without distinct lateral margins. Basis of pereopod I about twice as long as that of prp. II. . . . . 4
3. Coxal plates on prns. 1-4 triangular, acute. Pleotelson with distinct lateral margins. Basis of prp. I only about one-fifth longer than that of prp. II. . . . . 5
4. Joint 3 of antennula several times longer than broad and joints of flagellum at least as long as broad. Uropods visible from above, with the exopod extremely small. Inner lobes of male pleopods 1 evenly rounded . . . . . *murrayi* (Walker, 1903) (p. 157)
4. Joint 3 of antennula hardly longer than broad and joints of flagellum very short and broad. Uropods not visible from above, with the exopod almost half as long as the endopod. Inner lobes of male plps. 1 transversely protruding, one covering the other . . . *harrietae* n. sp. (p. 161)
5. Joint 1 of antennula a little broader than long. Mandibular spine-row with 8 spines. Apex of epipod of maxilliped rounded, without setae. . . . . *nodifrons* (Hansen, 1916) (p. 165)
5. Joint 1 of antennula a little longer than broad. Mandibular spine-row with 15-20 spines. Apex of epipod with a slight concavity with short setae. . . . . *menziesi* n. sp. (p. 166)

*Munneurycope murrayi* (Walker, 1903)

(Pl. IX D; Text-figs. 94-97)

*Munnopsis*? *Murrayi* Walker, 1903, p. 227, pl. XVIII, 1-6.

*Munnopsis Murrayi* Walker, TATTERSALL 1905, p. 24, p. 73, pl. V, 8.

*Munnopsis murrayi* Walker, TATTERSALL 1911, p. 190, figs. 8-14, VANHÖFFEN 1914, p. 581.

*Munnopsis* n. sp., RICHARDSON 1909, p. 119.

*Munneurycope Tjalfiensis* Stephensen, 1913, p. 99, figs. 6-8; STEPHENSEN 1915, p. 23, figs. 12-13.

*Eurycope Murrayi* Walker, HANSEN 1916, p. 137, pl. XII, 7a-7b; MENZIES 1962b, p. 141, fig. 34M.

*Eurycope murrayi* (Walker), GURJANOVA 1932, p. 72, pl. XXVI, 105; STEPHENSEN 1936, p. 11, fig. 4; BARNARD 1936, p. 188, fig. 18; TCHINDONOVA 1959, p. 173, fig. 1, 4.

During the revision of the genus *Munnopsis* I borrowed – through the courtesy of Dr. T. E. BOWMAN – all the specimens which were referred to a new species of this genus by RICHARDSON (1909), but not described owing to their mutilated condition.

However, several of the specimens were well preserved and were identified as *Munneurycope murrayi*. A much needed additional description and more illustrations have been included here, and comparison has been made, partly with specimens from *Thor* St. 76, off Ireland (originally described as *Munneurycope tjalfiensis* by Stephensen (1913, 1915)), and partly with specimens from *Godthaab* St. 1, SW of Iceland (STEPHENSEN 1936). HANSEN (1916) has very convincingly shown that STEPHENSEN's *tjalfiensis* is a synonym of *murrayi*.

New material:

U.S. *Albatross* St. 4765, Bering Sea (53°12'N, 171°37'W), 2226 m, 29 May 1906. Gear: 8 foot sledge (Agassiz) trawl. – 1 male, 3 females (U.S. Nat. Mus. 39899).

U.S. *Albatross* St. 4766, Bering Sea (52°38'N, 174°49'W), 550 m (depth to bottom: 3230 m), 31 May 1906. Gear: 5½ foot ring trawl (tow net). – 2 males (U.S. Nat. Mus. 39900).

U.S. *Albatross* St. 4793, Bering Sea (54°48'N, 164°54'W), 550 m (depth to bottom: 4940 m), 16 June 1906. Gear: see St. 4766. – 3 males, 1 female (U.S. Nat. Mus. 39897).

U.S. *Albatross* St. 4800, at the Kurile Is. on the border of the Sea of Okhotsk and the Pacific (49°06'N, 153°06'E), 550 m (depth to bottom:

1830 m), 22 June 1906. Gear: see St. 4766. – 1 male, 1 female (U.S. Nat. Mus. 39898).

Further material kept in the Copenhagen Museum: *Dana* St. 4687, Denmark Strait (62°36'N, 32°48'W), 2000 m wire (depth to bottom: 2940 m), 16 August 1933. – 1 male.

Additional description (based on a male from St. 4793):

*Head*. Just behind the antennulae is a deep and broad, transverse furrow in the *Thor* and (especially) the *Godthaab* specimen, but it is much less pronounced in the *Albatross* material. The same applies to the so-called triangular "projection" (WALKER 1903) which is actually a more or less vaulted area enclosed laterally by two converging furrows and posteriorly by the front margin of pereonite 1. No trace of WALKER's tubercle has been found on this triangular area (among the material available), but in some specimens there is a darkish spot below the integument which may have been mistaken by WALKER for a tubercle on the surface. On the other hand, it is possible that the tubercle is visible in fresh material.

*Pereonites 1-4* each with a transverse furrow. The front margin of prn. 1 (m in Fig. 94) is, in the *Albatross* specimens, much less conspicuous than the deep, concave furrow; it ends laterally in a low crest. All coxae rounded and in all specimens visible from above.

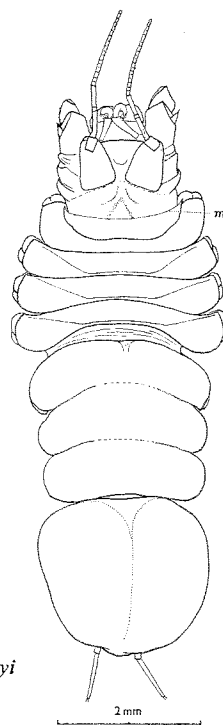


Fig. 94. *Munneurycope murrayi* (Walker), ♂ from *Albatross* St. 4793.

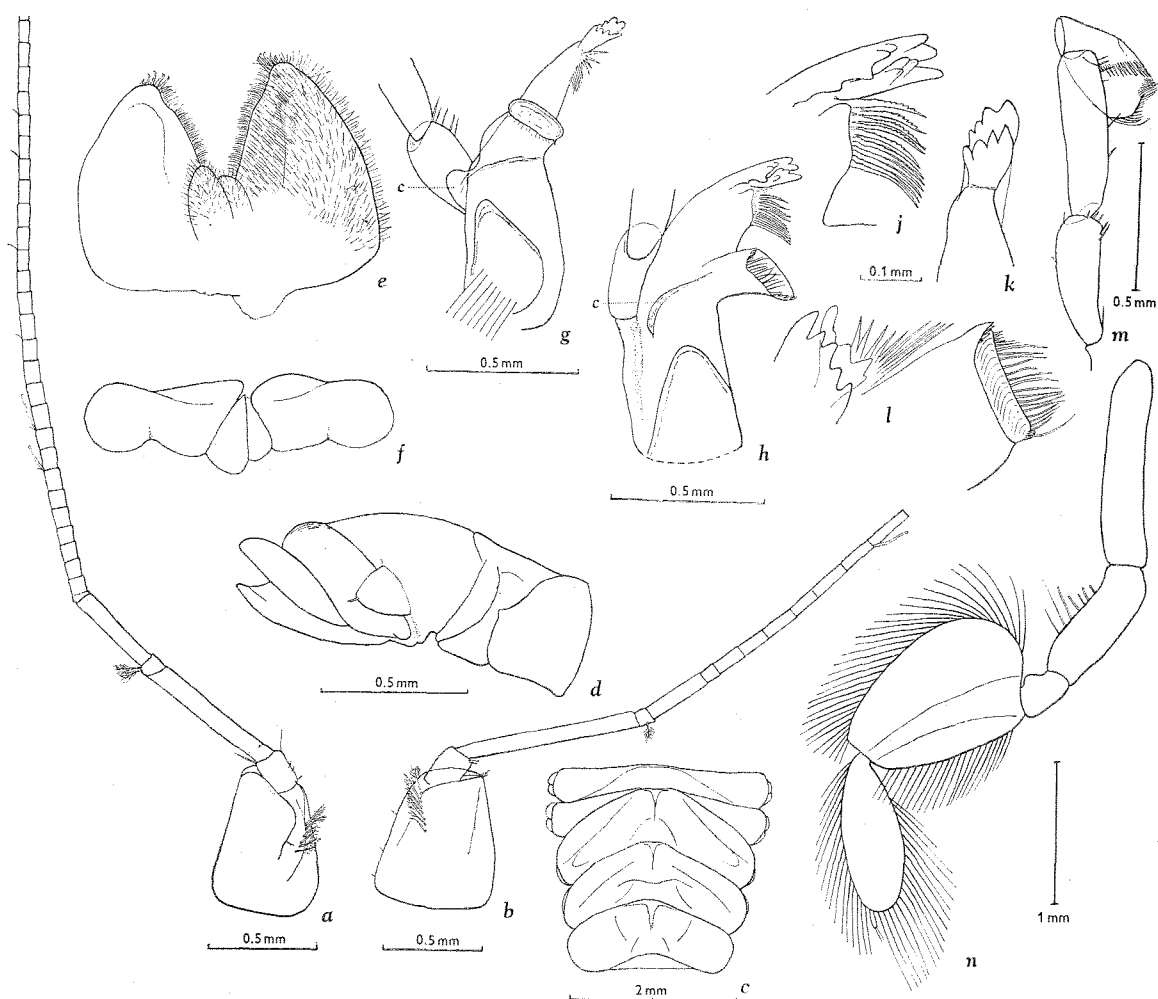


Fig. 95. *Munneurycope murrayi* (Walker); a and d-n, ♂ from Albatross St. 4793; b, ♀ from Albatross St. 4793; c, ♂ from Albatross St. 4800; a, right antennula (♂); b, left antennula (♀); c, pereonites 3-7; d, joints 1-4 of left antenna from outside; e, labium in frontal view; f, labium seen from the distal end (setae omitted); g-m, left mandible; k, incursive part and movable lacinia in frontal view; l, molar process, incursive part, etc. seen at a slightly oblique angle from above; m, palp; n, pereopod VI (setae not shown as feathered).

*Pereonites 5-7* very often mutilated, but in well preserved specimens close to STEPHENSEN's fig. 6 (1913) and to HANSEN's description (l. c., p. 139), although the "badly defined blunt keel or oblong tubercle" on each side of the depression may be too low to observe (Fig. 95c).

*Pleon* with a minute pleonite in front of the large, vaulted pleotelson, which is a little broader than prn. 7 and more straightly cut off anteriorly than in WALKER's fig. 1 – although generally not quite as much as in STEPHENSEN's fig. 6 (1913) and my Fig. 94. The shape more circular than cordate. Laterally the surface bends round and continues without distinct lateral margins (Pl. IX D) to the branchial cavity which, except posteriorly, occupies the entire ventral side of pleotelson.

*Antennula* (95a) with joint 1 nearly rectangular,

almost one-third longer than broad. Distal margin with rounded corners, but protruding a little on the inner corner. A row of six feathered setae which are very difficult to see are indicated in STEPHENSEN's fig. 7 (1913) which is, however, incorrect in showing the elongated joint 1 divided into two. STEPHENSEN's fig. 13 (1915) shows a very short joint of the same width proximal to the long joint 3, but in no specimens have I been able to find more than, at most, a narrowing at this point (95a), and many specimens (both male and female) showed no narrowing at all. *Godthaab* females have more setae on joints 2 and 3 than *Albatross* females (95b). All males with two, all females with one feathered seta on joint 4 and the females have slightly fewer, and on the whole, more elongated joints in flagellum. STEPHENSEN (1915) gives the entire length of the

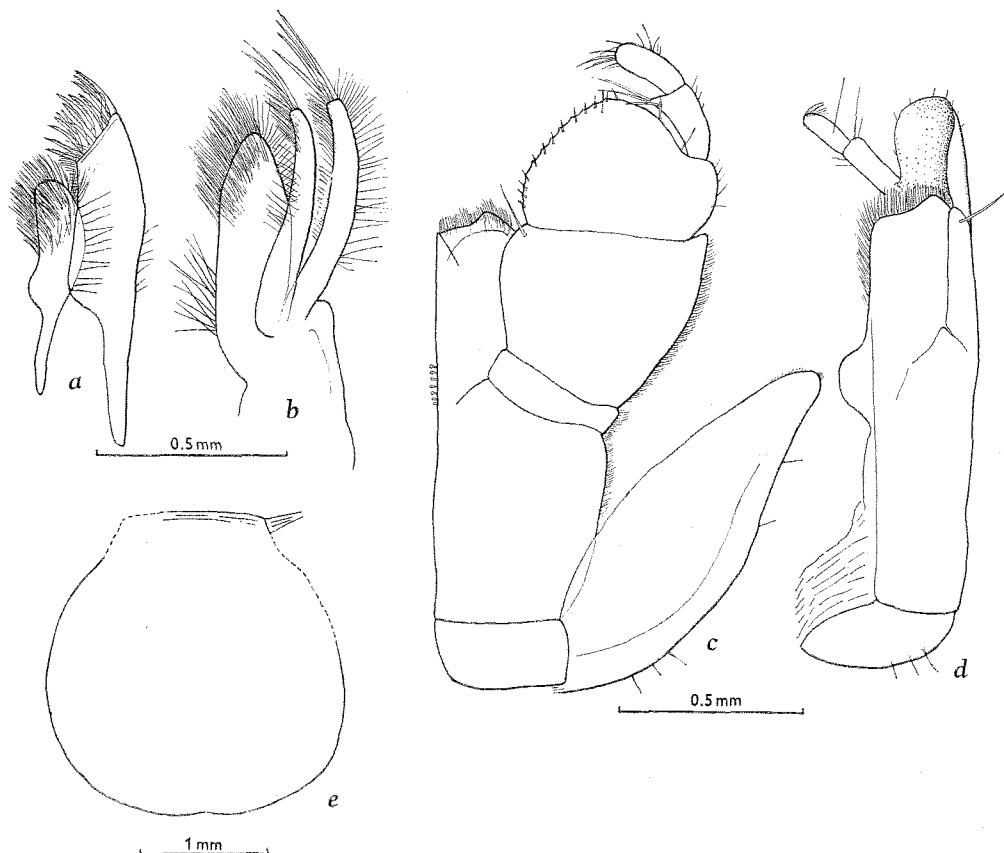


Fig. 96. *Munneurycope murrayi* (Walker); a-d, ♂ from St. 4793; e, ♀ from St. 4793; a-b, left maxillula and maxilla; c-d, left maxilliped from below and from the inner edge; e, operculum.

male antennula as half the length of the body, but one antennula in an *Albatross* male reaches backwards to the anterior end of pleon and is even broken off distally; in the female it reaches backwards to prn. 3. – *Antenna* with a large squama, as long as broad, and with a tiny terminal spine (95d).

*Left mandible* (95h) about equally broad throughout. Incisive part with five teeth, movable lacinia with four (95k), and eleven spines in the spine-row (95j) (twelve in *Thor* specimens). Molar process strong, with distal end truncate and excavated (95l) and one of its margins serrated and setiferous; the “small warty protuberances” (STEPHENSON 1915) only visible under high magnification. On the upper side of the mandible, between molar process and base of palp, is a short, rather high crest (c in Fig. 95g). Joint 1 of palp compressed and about one-fifth shorter than joint 2. Joint 3 curved and twisted (95 m). – *Right mandible* with four teeth in the incisive part (shaped as in *harrietae*, Fig. 99j) and twelve spines (thirteen in *Thor* specimens).

*Labium* with outer lobes triangular (95e) or more squarish (STEPHENSON’s fig. 13, 1915), with a great many setae and distally, five hooked spines. Inner

lobes small and unequal and only clearly visible when viewed from the distal end of labium (95f).

*Maxillula and maxilla* according to Fig. 96a-b. Fourteen more or less serrated teeth on outer endite of maxillula; one is s-curved.

*Maxilliped* very much curved in the transverse plane (96d). Joints 2 and 3 of palp broader than the basipod, joint 2 as broad as or broader than long, this and joint 3 almost unarmed; joint 3 always with convex median margin. Inner corner of joint 4 more or less projecting. Endite of *Thor* specimens somewhat narrower than shown in my Fig. 96c and HANSEN’s fig 7a (pl. XII); its distal margin somewhat serrated. Number of coupling hooks varies between five and seven. Epipod very slender, three times longer than broad and in the distal part evenly rounded.

*Pereopods I-IV*. Length and width of the preserved basipodites are given in Table 7 (p. 155). – *Pereopod I* correctly figured by STEPHENSON (1915, figs. 12 and 13), although in the *Albatross* specimens ischium is almost as long as basis and carpus; entire leg about one-third longer than the body. – *Pereopod II* with ischium to propodus somewhat stronger than indi-

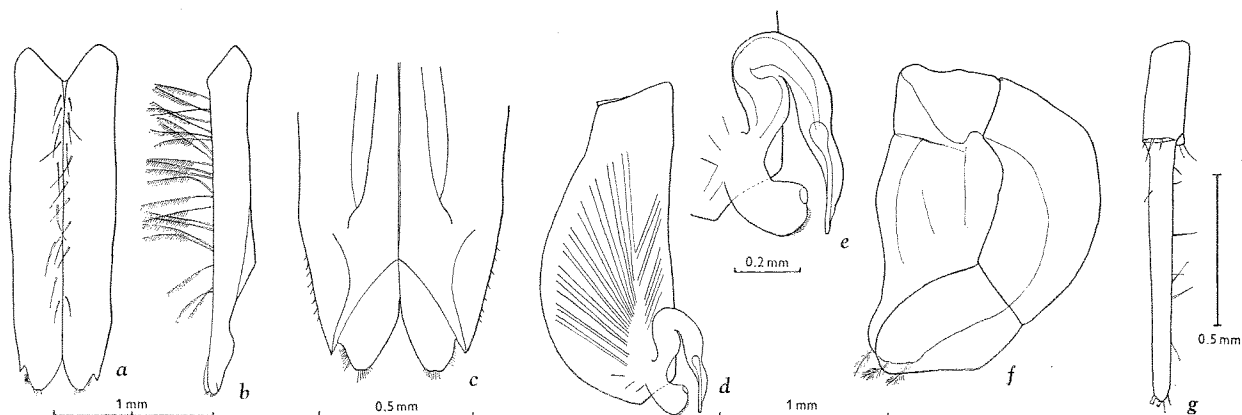


Fig. 97. *Munneurycope murrayi* (Walker), ♂ from St. 4793; a-c, male pleopods 1 from outside, from the edge, and apex from inside; d-f, left pleopods 2 and 3; g, left uropod.

cated by STEPHENSEN in his otherwise correct fig. 12. One *Albatross* specimen had this leg preserved, though it was broken towards the end of propodus.

*Pereopods V-VII* (95n) with basis increasing in length from front to back (Table 7). Carpus and propodus moderately broadened and dactylus very small.

*Male pleopods 1* (97a) rather strong and with almost parallel margins; outside (ventral) surface with many long, unilaterally feathered setae (97b). Apex with short, pointed, outer lobes; inner lobes rounded, broad and flattened, with a row of short setae distally and exteriorly. The *Albatross* material (97c) differs from the *Thor* and *Godthaab* specimens in having the outer lobes a little shorter and the interior margin of the inner lobes convex, not concave as shown in STEPHENSEN's fig. 13 (1915). The specimen from the Bay of Bengal (BARNARD 1936, fig. 18) has the inner lobes more truncate and slightly serrated on the outer margin.

*Pleopod 2* (97d) narrow and with subparallel margins. Inner distal corner obliquely cut off. Copulatory organ shorter in the *Albatross* material – thus hardly reaching beyond the sympod. Exopod large (97e).

*Female operculum* almost circular when mounted on a slide (96e), but extremely foliaceous so that its shape *in situ* is difficult to discern. It seems to be only moderately vaulted and with a low median keel – along which is a dense row of setae as long as those on the male pleopods 1 and also unilaterally feathered.

*Pleopod 3* (97f) with the broad exopod definitely 2-jointed (not shown in STEPHENSEN's fig. 13 (1915), which also lacks the three feathered setae on the endopod). In the *Thor* specimen the outer joint of the exopod is unusually large.

*Pleopods 4-5* shaped as in STEPHENSEN's fig. 13, but the exopod of plp. 4 has one feathered seta distally.

*Uropod* (97g) with peduncle less than twice as long as broad and about one-third as long as endopod. Exopod even smaller in the *Thor* and *Godthaab* specimens than indicated in Fig. 97g.

*Size*: STEPHENSEN (1915) records females as being about 7 mm and the largest male a little over 8 mm long. The *Albatross* males conform to this, but the largest female is 10.3 mm.

#### Variation:

The East Atlantic (*Thor*), the West Atlantic (*Godthaab*) and the *Albatross* specimens from the Bering Sea and the NW Pacific agree in all major respects. Careful comparison only revealed the following differences: (1) The *Thor* specimens with 12 and 13 spines in the spine-row (instead of 11 and 12), narrower endite on maxilliped, and a larger distal joint on exopod of pleopod 3. (2) The *Albatross* specimens with less pronounced furrows on the head, outer lobes of labium more triangular, ischium of pereopod I comparatively longer, interior margin of inner lobe of male pleopods 1 convex, and copulatory organ of pleopod 2 shorter.

There is, however, no doubt that all specimens belong to the same species.

#### Remarks:

The differences between *murrayi* and its closest relative, *harrietae*, as well as the other species of *Munneurycope* were dealt with in the discussion and key on p. 156.

Intestine contents are recorded in Table 17 (p. 240).

#### Distribution:

Taken at a total of about 45 stations.<sup>1</sup> In the Atlantic from off Gibraltar to SW of Iceland and W and SW of South Greenland (see map in STEPHENSEN 1936, p. 10). Taken also at 7 stations in the Central and South Atlantic Ocean and in the South Indian Ocean (VANHÖFFEN 1914), in the Bay of Bengal (BARNARD 1936), and in the NW Pacific and southern Bering Sea (TCHINDONOVA 1959 and this paper). Depth between some 550 and 3000 m and no doubt mainly occurring pelagically (cf. pp. 245 and 247).

#### *Munneurycope incisa* (Gurjanova, 1946)

*Eurycope incisa* Gurjanova, 1946, pp. 278 and 295, figs. 10-10a; MENZIES 1962b, p. 143, fig. 35F-L.

GURJANOVA (1. c.) found that *E. incisa* should probably be united with *E. murrayi* in the genus *Munneurycope* for the following reasons: (1) Coxal plates lacking on pereonites 1-4; (2) joint 1 of the antennula rather narrow and evenly rounded distally; (3) carpus and propodus of pereopods V-VII rather narrow and oval and of almost equal length; (4) dactylus of prps. V-VII strongly reduced, worm-like; (5) endopod of uropod several times longer than exopod. MENZIES regarded it as belonging to *Eurycope*.

I have transferred this species to *Munneurycope*, partly because of the shape of joint 1 of the antennula and partly because of lack of rostrum, the greater length of prn. 1,<sup>2</sup> and the much elongated basis of prp. I (according to fig. 10 more than twice as long as basis of prps. II-IV). Unfortunately, GURJANOVA did not describe or figure the mouthparts or the male pleopods 2.

Some of the other characters listed by GURJANOVA are not generic, some are possibly: coxal plates are absent in *incisa*, *murrayi*, and *harrietae*, present in *nodifrons*, *menziesi*, and *elongata*; carpus and propodus of prps. V-VII are rather narrow, oval and of almost equal length in *incisa*, but in *murrayi* carpus is broad, not oval, and considerably longer than propodus (Fig. 95n); dactylus of prps. V-VII is very small in *incisa* and *murrayi*, but unknown in the remaining species. Finally, the endopod of the uropods is much longer than the exopod in *incisa* and *murrayi*, twice as long in *harrietae*, only a little

longer than the exopod in *menziesi*, and unknown in *nodifrons* and *elongata*.

There is no doubt that *incisa* is most closely related to *murrayi* and *harrietae* from which it primarily differs in the extraordinary shape of prns. 5-7 and pleon. As also pointed out by GURJANOVA, it resembles *nodifrons* (and *menziesi*) in the fact that the frontal part is bent downwards.

#### *Munneurycope harrietae* n. sp.

(Pl. IX E; Text-figs. 98-101)

#### Material:

*Galathea* St. 601, Tasman Sea (45°51'S, 164°32'E), 4400 m, 14 January 1952. Bottom: Globigerina ooze. Bottom temp: c. 1.1°C. – 2 males.

#### Description of ♂ holotype:

*Body* (Pl. IX E, Fig. 98a) very mutilated owing to the extremely thin, semitransparent integument.

*Head* considerably broader than long and somewhat vaulted behind the antennulae. Between the antennae are two short furrows in the shape of an hour-glass.

*Pereonites 1-4* probably not very far from the reconstruction presented in Fig. 98a. Thus, the segments are all broad and short, increasing in width and decreasing in length from front to back.

*Pereonites 5-7* convex-concave (prn. 7 with almost straight hind margin); prn. 6 certainly somewhat longer than the equally long prns. 5 and 7, but their shape rather uncertain due to the mutilated condition. At least the two last segments with a fine, median furrow.

*Pleon* pressed somewhat out of shape in the holotype and missing in the other male. A very inconspicuous pleonite in front of the large pleotelson – which seems to be about as broad as long and more spherical than in *murrayi*; branchial cavity therefore correspondingly much smaller in comparison with the maximum length, and especially width, of pleotelson. Uropods inserted on the ventral side, very close to the almost directly downward-pointing, triangular anal face.

*Antennula* (98b) with joint 1 devoid of setae, evenly rounded distally and rather broad at base, the length being less than one-fifth greater than the width. Joint 2 somewhat longer than broad, joint 3 short and joint 4 very short. Proximal part of the thick flagellum with very faint rings, indicating the numerous, extremely short joints in which the flagellum is divided further distally. All flagella

1. Exclusive of the unpublished data on the occurrence in the Kurile-Kamchatka area (TCHINDONOVA 1959).

2. According to GURJANOVA's text – but not her fig. 10 – it is twice as long as prn. 2.

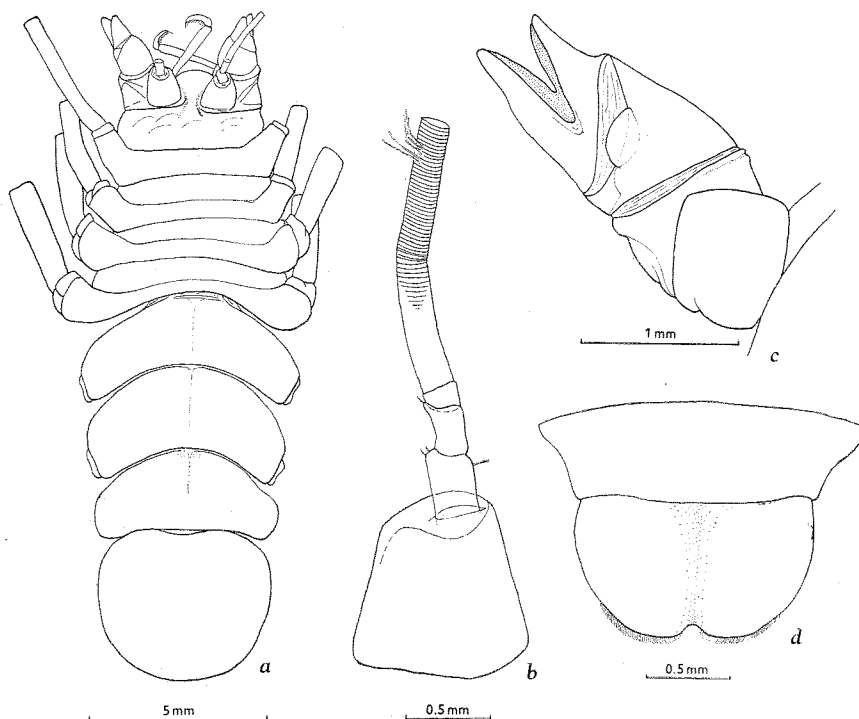


Fig. 98. *Munneurycope harrietae* n. sp.; a, whole animal reconstructed after both specimens, but not quite reliable as to size and shape of pereonites; b-d, ♂ holotype; b, right antennula (with only a few of the sensory hairs shown); c, joints 1-4 of left antenna from outside; d, labrum.

broken. Broad sensory hairs present in both specimens. – *Antenna* (98c) with a large, low and broad squama.

*Labrum* (98d) a little more than half as long as broad, almost semi-circular and with a median notch and short setae.

*Left mandible* (99b) narrow. Incisive part (99d) with three large and two smaller teeth, movable lacinia (99e) with four pointed teeth. Thirteen equally

long, serrated spines in the spine-row. Of the two cutting margins of the molar process the distal is sharp, as in *murrayi*, but the proximal combed as in *menziesi* (99f), each tooth carrying one or two short setae and one longer seta (99g). The crest at the base of the molar process (99b, h) squarish and rather low. Palp with joint 1 compressed (99c) and joint 2 almost twice as long and with many fine hairs on one margin, scattered setae on the other

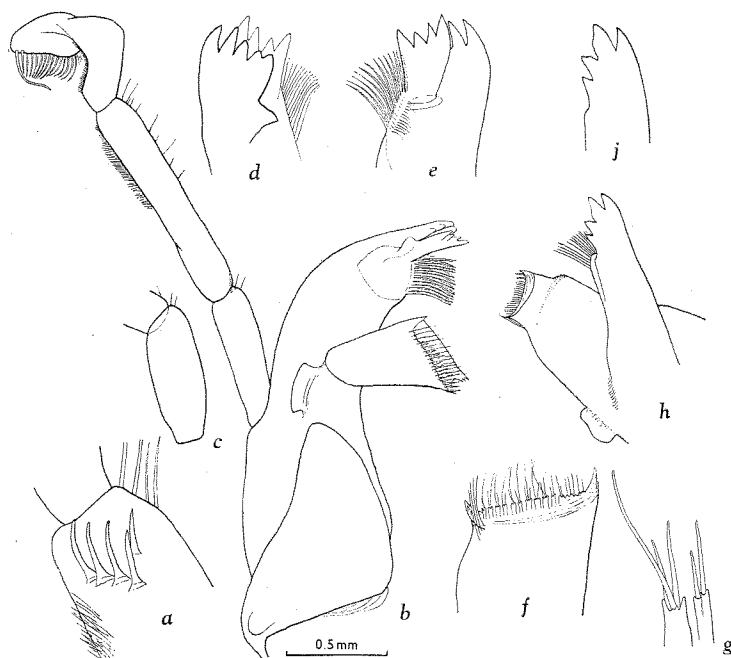
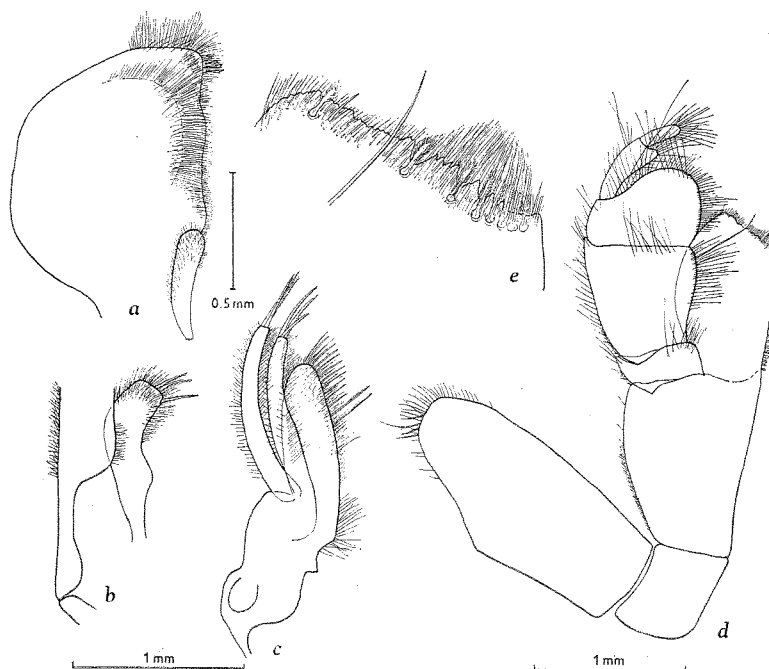


Fig. 99. *Munneurycope harrietae* n. sp.; a-g, left mandible; h-j, right md.; a, spines distally on lower side of joint 2 of palp; b, md. from above; c, joint 1 of palp; d, incisive part; e, movable lacinia; f, frontal view of molar process; g, two teeth of its comb; h, shape of crest; j, incisive part.

Fig. 100. *Munneurycope harrietae* n.sp., a, labium; b-c, right maxillula and maxilla; d, right maxilliped; e, margin of endite.



and five strong spines distally (99a); joint 3 twisted and setiferous. – *Right mandible* with incisive part much narrower and with only four conspicuous teeth (99j); sixteen almost equal spines in the spine-row.

*Labium* (100a) with lateral margin of outer lobes rounded so that the shape of each lobe is semi-circular. Setae are situated distally only on and near the median margin; five forked spines on the distal corner; inner lobes very small, longish.

*Maxillula* (100b) had the right outer endite torn off (the left not dissected); it seems to be close to that of *murrayi*. Inner endite angular and with three stiff spines. – *Maxilla* according to Fig. 100c, i.e. with three spines only on the outer endites and

several serrated, spine-like setae on the inner; the two proximal ones being rather strong.

*Maxilliped* (100d) more flattened than in *murrayi*, with the first joints of the palp less expanded and with all joints much more abundantly furnished with setae, even on joint 1. Eight coupling hooks on right mxp. and endite irregularly serrated distally (100e), with eight leaf-like, serrated spines and a great many setae of unequal length. Epipod somewhat rectangular, with a slight projection on outer margin.

*Pereopods* all broken, only the basipodites being extant. Their length and width are given in Table 7 (p. 155).

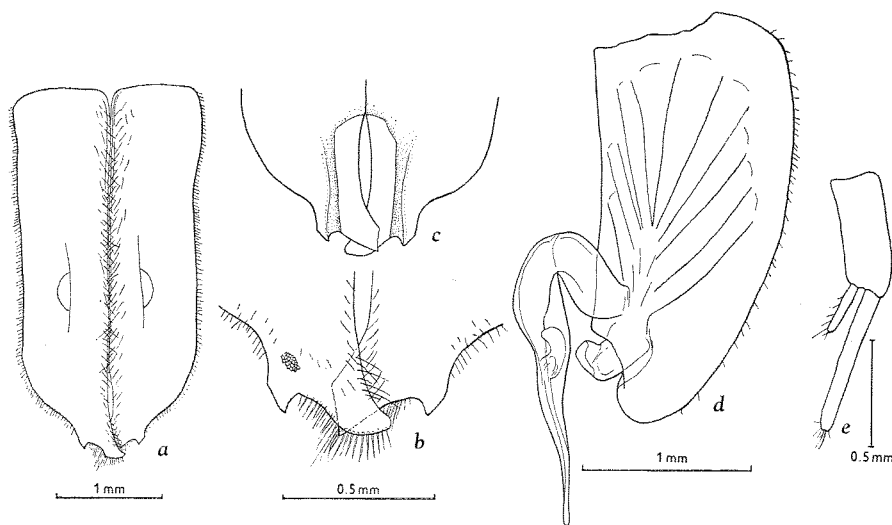


Fig. 101. *Munneurycope harrietae* n.sp.; a-b, male pleopods 1 from outside; c, from inside; d, pleopod 2; e, uropod



*Pleopods 1* (101a) almost equally broad throughout and each a little more than four times longer than broad. Distally, the shape is rather unique – the inner lobes protrude transversely, one partially covering the other; both furnished with setae along the distal margin. Outer lobes slightly angular processes. The integument has a fine, net-like pattern as indicated on Fig. 101b. On the inner side the furrow for the copulatory organ is clearly visible (101c).

*Pleopod 2* (101d) has the sympod twice as long as broad, a rounded apex and a concavity where the rather large exopod is inserted. The stylet is moderately long, being more than two-thirds of the sympod.

*Pleopods 3-5* in a poor condition, but seem to have been close to those of *murrayi*.

*Uropod* (101e) with peduncle almost three times broader and one-fifth shorter than the endopod – which is again twice as broad and more than twice as long as the exopod.

*Size*: Male holotype about 18 mm long and 6 mm broad, the other male equally large.

#### Remarks:

This species can be mistaken only with *M. murrayi* from which it i.a. differs in the features listed in the key (p. 156). It has been named after Mrs. HARRIET JØRGENSEN in appreciation of her help during and after the *Galathea* Expedition.

#### Occurrence:

Tasman Sea, 4400 m and 1.1°C.

*Munneurycope nodifrons* (Hansen, 1916)  
and *M. menziesi* n. sp.  
(Text-figs. 102-104)

In the report on the hadal isopods (WOLFF 1956a, p. 123) I stressed the great similarities between the

only existing male of *M. nodifrons* from the North Atlantic and the single female from 7000 m depth in the Kermadec Trench, procured by the *Galathea*. All the differences which could be found were listed, but they were not regarded as being significant enough to justify a separation into two species.

At a later date Dr. R.J. MENZIES expressed (in a letter to me) the opinion that the two specimens belonged to different species, pointing out the variation in number of spines in the mandibular spine-row, the number of coupling hooks, and the shape of apex of the epipod of the maxilliped. He also asked for further details on how the maxilliped (and in particular, the endite) is furnished with setae and spines.<sup>1</sup>

On account of these objections a renewed comparison of the two specimens has been undertaken. The result is given below, and although only a few more differences of minor importance were discovered, it has been decided to separate the two specimens, especially in view of the fact that they are not of the same sex, that both are completely without legs, and that one lacks the uropods.

On account of their relationship and my previous detailed comparison, they are treated simultaneously below.

Apart from the differences listed on the following page, I found almost perfect agreement in all other features which could be compared. These have been summarized previously (WOLFF 1956a, p. 125).

The following differences are found (the left mandible of *nodifrons* was mounted on a slide and could not be studied in detail):

1. Also in his *Vema* paper (1962b) he finds it "highly doubtful" that the hadal specimen belongs to *nodifrons*.

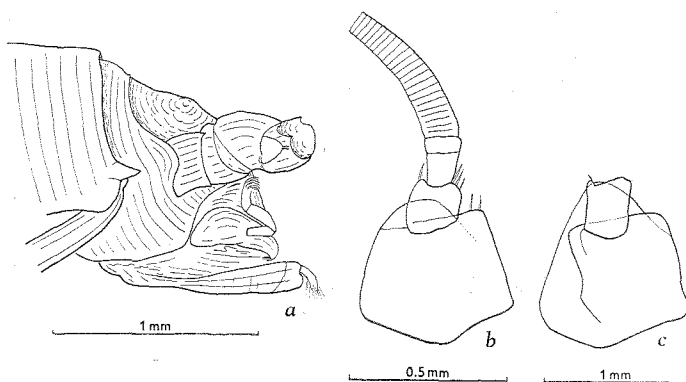


Fig. 102. a-b, *Munneurycope nodifrons* (Hansen), ♂ holotype; c, *M. menziesi* n. sp., ♀ holotype; a, head from right side (antennula removed); b-c, left antennula.

	<i>M. nodifrons</i> (Hansen)	<i>M. menziesi</i> n. sp.
Pereonite 1	One-third longer than prn. 2	(WOLFF's fig. 38a). One fourth longer than prn. 2
Pereonite 7	(HANSEN 1916, pl. XIII, 1a). Twice as broad as long	(WOLFF's fig. 38a). Almost three times as broad as long
Antennula	(Fig. 102b). Joint 1 broader than long, not reaching as far as joint 2, and without any distinct squarish elevation. Joint 2 as broad as long, with setae	(Fig. 102c). Joint 1 longer than broad, reaching as far as joint 2, and with a distinct squarish elevation on which joint 2 is inserted. This is longer than broad, without setae
Antenna	(Fig. 102a; HANSEN's fig. 1b). Squama with two short setae	Squama without setae
Epistome and labrum	(103a-b). Epistome rather convex, rectangular; labrum bilobed	(103c-d). Epistome flattened and with a low, rounded process medianly on the front margin; labrum lost
Mandibles	Dorsal crest rounded as in <i>M. murrayi</i> (95 g)	Dorsal crest angular as in <i>M. harrietae</i> (99 h)
Right mandible	(103e-h). Spine-row with five short, serrated and three long, simple spines (e). Edge of molar process with about nine forked spines, each with a strong seta (h); distal part of process thick in side view (g)	(Fig. 103j-k and t-u; WOLFF's fig. 38c). Spine-row with ten short, serrated and ten long, simple spines (j). Edge of molar process with about twenty low processes, each with a stiff seta (u); distal part of molar process rather slender in side view (t)
Left mandible	(103l). Incisive part with five teeth. Spine-row with four serrated and four simple spines	(103o-s). Incisive part with six teeth (p). Spine-row with five finely serrated and ten simple spines (o)
Endite of maxilliped	(104a-b). Narrow distally, becoming much broader proximally; distal margin with one thick, finely serrated and three double serrated (down-like) spines. Six (left) and five (right) coupling hooks	(104c-d). Almost equally wide throughout; distal margin with nine strong setae and six double serrated (down-like) spines. Eleven (left) and ten (right) coupling hooks
Palp of maxilliped	(Fig. 104e; HANSEN's fig. 1c). Joint 2 with fine setae on outer margin; joint 3 almost triangular, with many setae; joint 4 longer than broad	(Fig. 104f; WOLFF's fig. 38d). Joint 2 without setae on outer margin; joint 3 almost semi-circular, with rather few setae; joint 4 broader than long
Epipod of maxilliped	(HANSEN's fig. 1c). Apex rounded, without setae	(WOLFF's fig. 38d). Apex with a slight concavity, with four small setae
Pereopods	Probably relatively shorter and thicker	Probably relatively longer and more slender
Size	♂: 5.1 mm	♀: 13-13.5 mm

***Munneurycope nodifrons* (Hansen, 1916)**

(Text-figs. 102-104)

*Eurycope nodifrons* HANSEN 1916, p. 140, pl. XIII, 1a-d; WOLFF 1956a, p. 123 (pars).

**Diagnosis:** Body rather elongated. Head without frontal projection and considerably vaulted between the antennulae and the antennae. Pereonite 1 the longest of the first four pereonites; coxal plates conspicuous. Prns. 5-7 with median impression. Pleon about as long as broad. Antennula with joint 1 broader than long, distally rounded; flagellum multi-jointed. Antenna with well set off squama. Labrum bilobed. Mandibles short and strong, with distinctly articulated incisive part which has five

(left) and four (right) teeth; movable lacinia large; spine-row with eight spines; molar process thick, with an elaborate armament with spines and setae along the outer margin. Maxilliped with a distally narrow, proximally broad endite and six (left) and five (right) coupling hooks; joint 4 of palp slender and apex of the narrow epipod rounded. Male pleopods 1 with divergent outer lobes and many short setae distally on the inner lobes. Plp. 2 semi-circular, stylet reaching a little further than body.

**Additional description:** *Head* is shown from the side in Fig. 102a. The medianly straight, inconspicuous frontal seam has a convexity at the outer base of the antennae which in dorsal view gives the

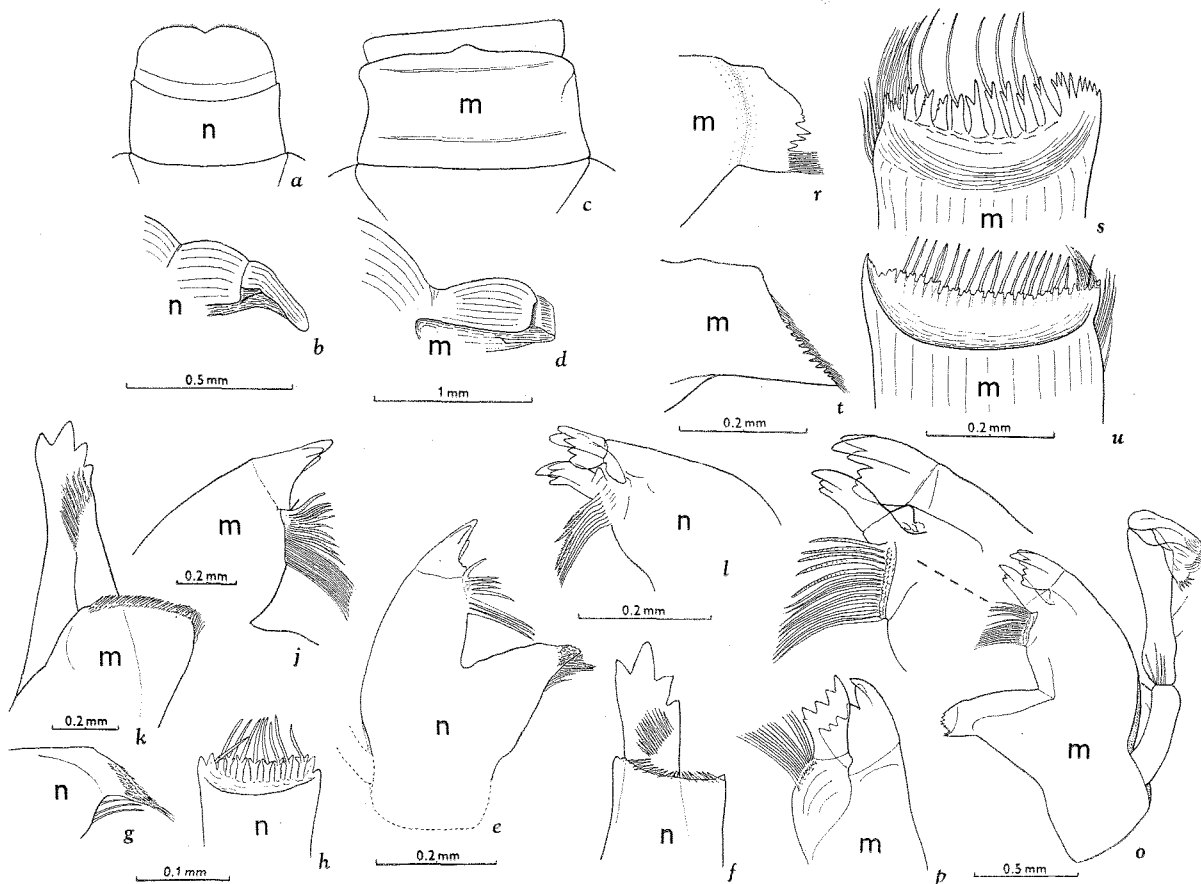


Fig. 103. n, *Munneurycope nodifrons* (Hansen); m, *M. menziesi* n. sp.; a and c, epistome (and labrum) from above; b and d, epistome (and labrum) from the right side; e-k and t-u, right mandible; e and j, lateral view; f and k, incisive part from inside; g-h, apex of molar process seen from the side and in frontal view; l and o-s, left mandible; l and o, lateral view; p, incisive part and movable lacinia in frontal view; r-u, apex of molar process in lateral and frontal view.

impression of a sharp corner (HANSEN, fig. 1 b). – *Antennula* with the distal part of the peduncle as shown in Fig. 102 b, i.e. considerably broader than in HANSEN's fig. 1 b. The very short joints of the flagellum (which is broken) difficult to see. – *Pleopod 2* (104 g) with a semi-circular sympod, a moderately long stylet with the vesicle placed in a rather distal position, and a strong exopod; some feathered setae distally. – *Pleopod 3* (104 h) with one joint only in the exopod.

Affinities: See WOLFF 1956a, p. 125.

Occurrence: Davis Strait, 2702 m, 1.5°C.

*Munneurycope menziesi* n. sp.  
(Text-figs. 102-104)

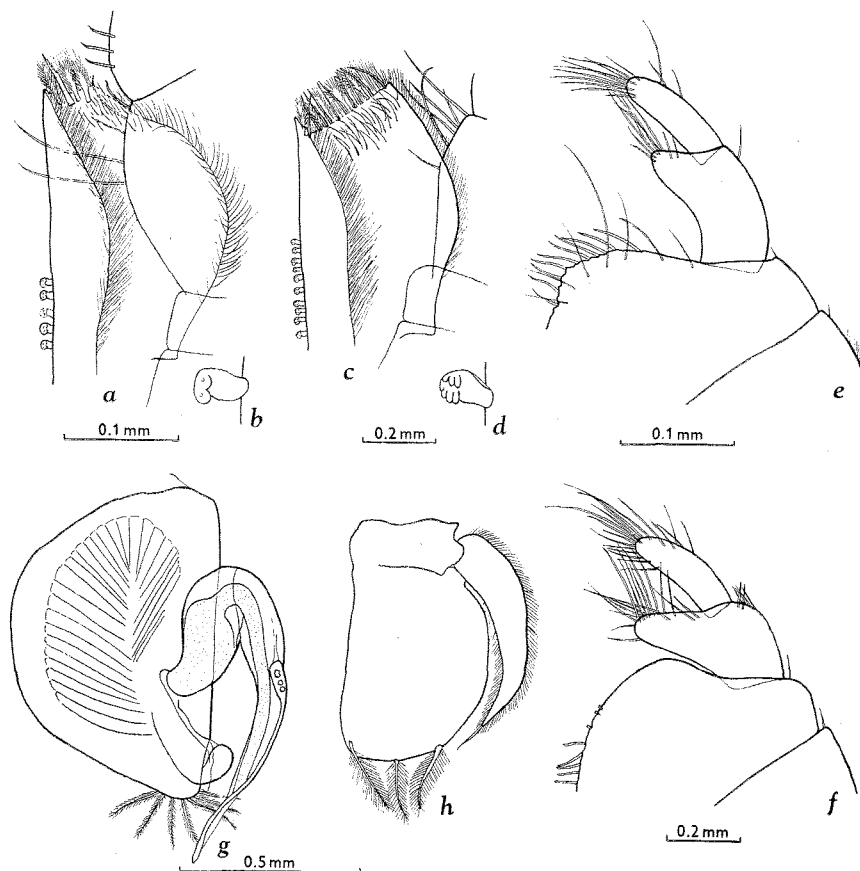
*Eurycope nodifrons* Hansen, WOLFF 1956a, p. 123, fig. 38 a-f (pars).

Diagnosis: Body rather elongated, pereonites and pleon as in *nodifrons*. Antennula with first joint

longer than broad, distally rounded, and with a conspicuous square elevation. Antenna with well set off squama. Mandibles short and strong, having distinctly articulated incisive part, with six (left) and four (right) teeth; large movable lacinia; spine-row with fifteen (left) and twenty (right) spines; molar process thick, with an elaborate armament with spines and setae along the outer margin. Endite of maxilliped almost equally wide throughout; eleven (left) and ten (right) coupling hooks; joint 4 of palp broad and apex of the narrow epipod with a slight concavity, furnished with small setae. Operculum longer than broad, with a median keel ending in a rounded protuberance. Uropod with peduncle somewhat longer than broad and endopod a little longer than exopod.

Additional description: *Head* as in *nodifrons* (102 a), although perhaps somewhat more bent downwards. – *Left mandible* with four almost uniform teeth and one much smaller tooth in the movable lacinia (103 p); outer edge of molar process

Fig. 104. a-b, e, and g-h, *Munneurycope nodifrons* (Hansen); c-d and f, *M. menziesi* n.sp.; a and c, endite of maxilliped from inside; b and d, coupling hook; e-f, joints 4 and 5 of palp of mxp.; g-h, pleopods 2 and 3.



with only about half as many spines and stiff setae as in the right mandible (103s), but the spines larger and bifurcated and the setae longer; the excavation of the outer end of the process is also less sharply confined in the left mandible, and it is considerably thicker in side view (103r, t). Thus, the left molar process resembles the right molar process of *nodifrons* much more than the right molar process of the other mandible of the same specimen.

*Labium* has the inner, distal corners projecting and is without distinct spines. – Exopod of *pleopod* 4 almost as narrow as in *E. phalangium* (SARS 1899, pl. 66).

Affinities: See above.

Occurrence: Kermadec Trench NE of New Zealand, 6960-7000 m, 1.3°C.

*Munneurycope elongata* n. sp.  
(Text-figs. 105-107)

There is in this Museum a female asellote isopod which was collected by the *Ingolf* Expedition, but not treated by HANSEN in his monograph (1916).

He had, however, labelled it as follows (translated from the Danish): “*Ilyarachna* n. sp. Perhaps a young after moult.” In order to include the reference in the zoogeographical study of this genus I examined the specimen and found that it could not belong to *Ilyarachna* and not even to *Ilyarachnidae*, but had to be placed within the *Eurycopidae* (see discussion below).

Material:

*Ingolf* St. 38, South of Davis Strait (59°12'N, 51°05'W), 3521 m, 30 July 1895. Bottom temp. 1.3°C. – 1 female without oostegites.

Description:

*Body* (Fig. 105a) rather elongated, a little more than three times longer than broad. Surface smooth and integument not very calcified.

*Head* a little narrower than pereonite 1, with a large and low excavation medianly; this is laterally limited by the somewhat raised margins which anteriorly, form a high and narrow keel (k in Fig. 105b). No eyes.

*Pereonites* 1-4 of rather identical shape, but prn. 2 by far the broadest and longest and prn. 1 also

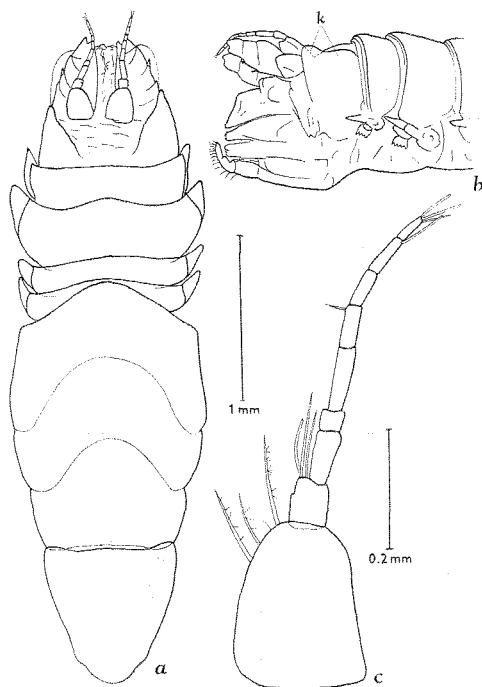


Fig. 105. *Munneurycope elongata* n.sp.; ♀ holotype; a, from above; b, head and first pereonites from left side; c, right antennula.

considerably longer than 3 and 4. All four coxal plates large and pointed, broad in dorsal view (105a) and narrow in lateral view (105b).

*Pereonites 5-7 and pleon* shaped much as in *Ilyarachna*, slightly decreasing in width, and movable. Frontal margin of all three pereonites strongly convex. Pleon triangular, a little longer than broad and with a slight emargination at the location of the uropods. The vaulted lateral margins continue round

on the ventral side as a flat plate separating the lateral margin from the branchial cavity; it has neither a keel, nor the inner row of setae as found in *Ilyarachna*. The anal opening is also subterminal, not in connexion with the branchial cavity. A low, inconspicuous concavity (y in Fig. 106a) runs from the distal end of the branchial cavity beyond the low and flat knob at the insertion of the uropods, to the lateral margin. The feathered setae of pleopods 3 and 4 fill in the proximal end of the concavity.

*Antennula* (105c) with joint 1 large, with rounded distal corners, one-fourth longer than broad. The three following joints short, the five joints in flagellum considerably longer than broad.

*Antenna* has only the four proximal joints preserved. Together, these form a conical body which is placed dorso-terminally on the head. The separation between the four joints is very difficult to trace and the squama is, if present at all, very inconspicuous.

*Mandibles* rather elongated and a little curved. Molar processes thick, strongly truncate at the tip and with a row of sturdy, flat spines. Incisive part of *left mandible* (106c) with four to five teeth and movable lacinia with five small teeth. Three spines only in the spine-row (106b), all more or less serrated. Incisive part of *right mandible* (106e) more pointed and six spines in the spine-row, one simple and the others serrated (106d). No palp.

*Maxilliped* (106f) very narrow, especially the endite where the distal end is abruptly cut off and furnished with one long and one short down-like spine and a great number of very fine setae (106g).

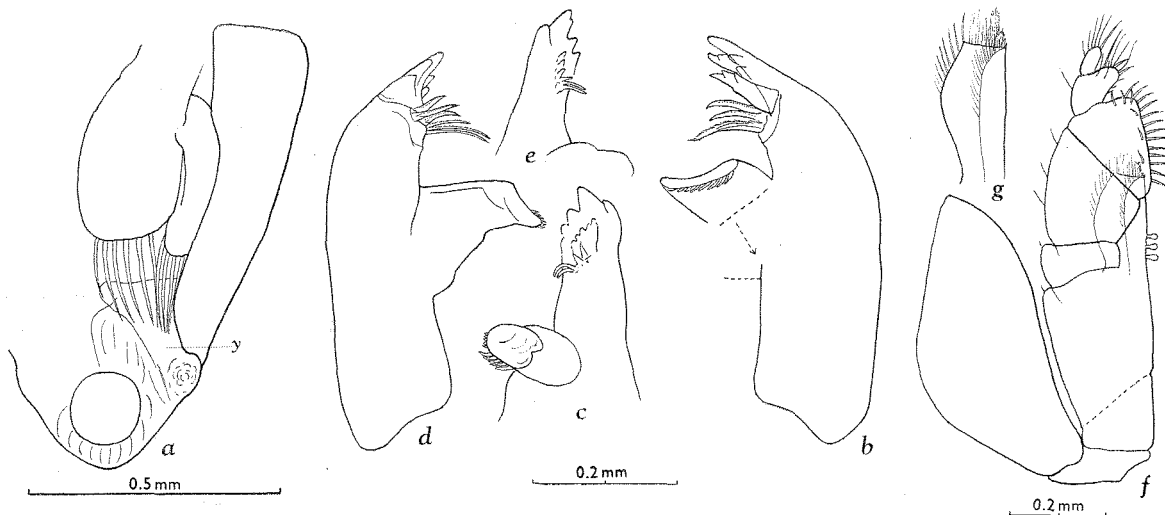


Fig. 106. *Munneurycope elongata* n.sp.; a, pleon from below, with pleopod 3 shown in the right place (y, low concavity); b-c, left mandible; c, incisive part and movable lacinia from inside; d-e, right mandible; e, incisive part from inside; f, right maxilliped; g, endite of mxp.

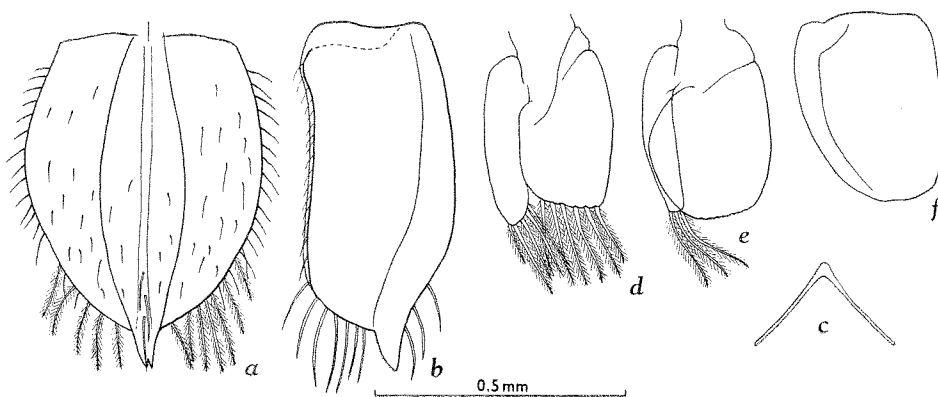


Fig. 107. *Munneurycope elongata* n.sp.; a-c, operculum; a, from outside; b, lateral view; c, section; d-f, pleopods 3-5.

Three coupling hooks. Palp peculiar in having inner margin of joint 3 parallel with that of the sympod; it is furnished with short, strong setae. Joints 4-5 well developed. Epipod rather narrow, subacute distally.

*Pereopods.* Unfortunately, only basis of prps. III-VII is present. Table 7 (p. 155) shows the length and width of these joints.

*Female operculum* broadly egg-shaped (107a), with a median, rounded keel which continues beyond the apex as a beak (107b) and is faintly bifurcate. Several rather long, feathered setae on the postero-lateral margins and many fine setae all over the outer surface. In section, the operculum is v-shaped (107c).

*Pleopods 3-5* according to Fig. 107d-f. Exopod in plps. 3 and 4 seems to consist of one joint only.

*Uropods.* As mentioned above, a low knob is found at the presumed point of insertion, but it is impossible to ascertain whether they have been broken off and lost or were never developed at all.

*Size:* Length 3.9 mm, maximum width 1.2 mm.

#### Remarks:

The fact that all pereopods are lost and that the only specimen available is a female has made it rather difficult to place it correctly.

The thickness of the preserved basipodites of pereopods V-VII suggests that these legs were natatory. The shape of the antennula is also indicative of families with this type of leg.

The shape of the body (but not the head) is reminiscent of Ilyarachnidae, but for the following reasons it is obvious that the species does not belong to this family: (1) Anus situated almost terminally, not in direct connexion with the branchial cavity; (2) mandibles slender, without a keel, and with well

developed incisive part, movable lacinia and molar process; (3) mandibular epipod rather slender; (4) basis of pereopods III and IV not very short; (5) female operculum v-shaped.

It differs from Munnopsidae (or Munnopsini) which has the same shape of antennulae, in lack of frontal area and shape of the pereonites (except *Paramunnopsis*), the strong molar process in the mandibles, and the comparatively long basipodites of pereopods III and IV.

Thus, only Eurycopidae remains. With this family the species conforms in the shape of both dorsal and ventral side of pleon, shape of antennulae, shape of mandibles and maxillipeds, and in having generally, a v-shaped female operculum. It disagrees in one feature (judging by what can be examined in the present, rather fragmentary specimen), viz. lack of mandibular palp which otherwise seems to be found in all Eurycopidae (except *Acanthocope galatheae*).

Within Eurycopidae it must be placed either in *Eurycope* or *Munneurycope*. It is in disagreement with the former and in agreement with the latter in lack of frontal projection, pereonites 1-4 not equally long, and first joint of antennula evenly rounded and without inner projection. I have, therefore, chosen to refer it to *Munneurycope*, even though the length of basis of pereopods I and II is unknown. It differs from the other species of this genus in the following major characters: Pereonite 2 longer than prn. 1 (which may mean that basis of prp. II is the longer), lack of mandibular palp and fewer spines in the spine-row, and joint 3 of the palp of the maxillipeds and the female operculum rather aberrant. At a later date, when males and specimens with preserved legs (and uropods?) are available it may become necessary to refer *elongata* to a new genus.

The lack of mandibular palp, the lateral keels on head, and the large pereonite 2 clearly separate this species from all others.

**Occurrence:**

South of Davis Strait, 3521 m, 1.3°C.

**Bathyopsurinae** nov. subfam.

**Description:**

The body is divided into two parts or sections, the posterior consisting of the enormous pereonites 5-7 and pleon; this part at least three times longer than the anterior one, considerably swollen, about as high as broad, and oval in overall shape. The integument of the body transparent and of a rather parchment-like consistency. Head free and without rostrum; anterior margin of the head straight and somewhat raised above epistome and labrum. No coxal spines. Pleon consists of two segments: a very short, ring-shaped one and the huge pleotelson. This is evenly rounded posteriorly, owing to the anal face being drawn somewhat forwards and downwards. Thus, the branchial cavity only covers a minor part of the ventral side of pleotelson.

Antennulae dorsal, but inserted between the antennae. Joint 1 longer than broad and proximally, almost as thick as broad; outer, distal corner produced and rounded. Joint 2 short, joint 3 long, joint 4 very short, and flagellum with numerous very short joints. Antenna with a small squama; joints 5 and 6 of peduncle very elongated. Mandibles with a large, triangular crest on the dorsal side; molar process missing or extremely vestigial; palp lacking. Left mandible with well developed incisive part which is more or less bent around the large movable lacinia. Right mandible flattened distally, with several teeth and the spine-row continuing on the dorsal side of the base of the posterior tooth. Maxillula and maxilla of the typical shape, although rather broadened. Endite of maxilliped curved inwards, with many small coupling hooks; a foramen for insertion of the muscles on the inner (dorsal) side of the basipodite; palp not very expanded, at most as broad as the sympod.

Pereopod I slender, not prehensile; basis of prp. I about three times as long as basis of II-IV; some (or probably all) of the latter with carpus and propodus exceedingly elongated. Prps. V-VII certainly natatory, but missing in most species; it is not known whether dactylus is extant or not, but in any case, basis of prp. VII is somewhat or much smaller

than basis of V and VI. Prp. V is inserted much higher on the body than prps. VI and VII, when viewed from the side. Male pleopods 1 broadest at base, more or less triangular. Plps. 2 with broad sympod and a short, strong copulatory organ. Female operculum broader than long, with almost parallel front and hind margins. Uropods missing or very small, biramous, and inserted ventro-laterally on the rounded pleotelson.

**Diagnosis:**

Posterior section of body by far the larger and considerably swollen. Anal face drawn somewhat forwards and the hindmost part of pleon spherically rounded. Antennulae inserted between the antennae, with outer, distal corner of joint 1 produced and rounded. Mandibles with a large, dorsal crest and without molar process (or perhaps with an extremely vestigial one) and without palp; spine-row of right mandible extended on the dorsal side along the base of the teeth of the incisive part. Palp of maxilliped not very expanded. Pereopod I slender, not prehensile; basis of prp. I much longer than that of prps. II-IV, some (or probably all) of which are extremely elongated. Prp. V inserted more dorsally than VI and VII; prp. VII somewhat or much smaller than V and VI. Male pleopods triangular, broadest at base. Female operculum broader than long, with almost parallel front and hind margins. Uropods missing or very small, biramous, inserted ventro-laterally.

**Remarks:**

NORDENSTAM (1955) primarily established the genus *Bathyopsurus* for the new species *nybelini* on the lack of molar process and palp of the mandibles. As other features of probable generic value, he mentioned shape of epipod and palp of maxillipeds, shape of labium, very feeble basipodite of pereopods VII, and shape of male pleopods 1.

A further, very careful study of the entire original material of *nybelini* and supplementary material from the *Galathea*, of two species from the *Challenger*, and of a new species from the *Galathea*, has added several important characters: Lack of rostrum; shape of pereonites 5-7, and especially of pleon; insertion point of antennulae and pereopods V-VII and shape of joint 1 of the former; extraordinary length of basis of prp. I, compared to that of the three succeeding basipodites; triangular male pleopods 1; more or less rectangular shape of the female operculum. Among the characters pointed

out by NORDENSTAM, the shape of the mandible and of the palp of the maxillipeds are also significant.

A few of these characters are also found in *Munneurycope*: Lack of rostrum, joint 1 of antennula rounded distally and without inner projection, and basis of prp. I longer than the following basipodites.

Since, however, all the remaining characters are present in the said four species and are not met with in any genus of Eurycopinae, it was found feasible to establish a new subfamily for them. The fact that the four species will have to be referred to two separate genera (which are united by the said characters) also speaks in favour of establishing a subfamily. I have little doubt that it is most closely related to *Munneurycope* within Eurycopinae.

As yet nothing is known regarding the appearance of ischium and merus of prps. II-IV. If they

prove to be very short it will certainly be necessary to remove the subfamily entirely from Eurycopidae and to establish a separate family in its stead.

NORDENSTAM (1. c.) did not consider the two dubious species from the *Challenger*, described by BEDDARD (1885, 1886b) as *Eurycope abyssicola* and *E. pellucida*. There is, however, no doubt that they belong to this subfamily. As also mentioned by BEDDARD, the holotype and only specimen of each of them is in a very bad state of preservation. During a visit to the British Museum (Nat. Hist.) I studied both species, but unfortunately, lack of time prevented both a sufficiently careful examination and the opportunity to produce good illustrations, this being of course especially time-consuming with regard to specimens in poor condition. A supplementary description is given below (pp. 176 and 181).

#### Key to the genera and species of Bathyopsurinae

1. Inner margin of joint 3 of palp of maxilliped as long as outer margin; joint 4 elongated, much narrower than joint 3; epipod short, rounded. Basis of pereopod VII less than half as long and broad as basis of prps. V and VI..... *Bathyopsurus* 2
1. Inner margin of joint 3 of palp of mxp. longer than outer; joint 4 oval or broadly triangular, at least half as broad as joint 3; epipod diamond-shaped. Basis of prp. VII almost as long and broad as basis of prps. V and VI..... *Paropsurus* 3
2. Joint 2 of antenna longer anteriorly than posteriorly. The five teeth in the incisive part of left mandible placed at an angle of about 90°..... *B. nybelini* Nordenstam, 1955 (p. 171)
2. Joint 2 of antenna of about equal length anteriorly and posteriorly. The five teeth in left md. arranged in a semi-circle..... *B. abyssicolus* (Beddard, 1885) (p. 176)
3. Five teeth in incisive part of left md. Joint 4 of palp of mxp. oval or regularly triangular. Inner and outer lobes of male pleopods 1 rounded, and the latter slightly excavated ventrally..... *P. giganteus* n. sp. (p. 177)
3. Seven teeth on left md. Joint 4 of palp of mxp. with the outer corner strongly projecting. Male plps. 1 with the distal end curved strongly upwards and somewhat outwards, and cut straightly off to form a flat plate..... *P. pellucidus* (Beddard, 1885) (p. 181)

Genus *Bathyopsurus* Nordenstam, 1955

#### Diagnosis:

Four anterior pereonites of about equal length, the first one reaching no further down laterally than the others. Joint 2 of antennula almost quadratic in shape. Joint 4 of palp of maxilliped elongated, with parallel margins and much narrower than joints 1-3; epipod broadly oval and shorter than basipodite. Basis of pereopod VII less than half as long and broad as basis of prps. V and VI. Pleopods 3 and 4 are split up into several gauze-like pieces.

*Bathyopsurus nybelini* Nordenstam, 1955

(Pl. X A-F; Text-figs. 108-110)

*Bathyopsurus nybelini* Nordenstam, 1955, p. 205, figs. 1-3.

#### Material:

*Galathea* St. 601, Tasman Sea (45°51'S, 164°32'E), 4400 m, 14 January 1952. Bottom: Globigerina ooze. Bottom temp.: c. 1.1°C. – 1 female.  
*Galathea* St. 654, Kermadec Trench (32°10'S, 175°54'W), 5850-5900 m, 18 February 1952. Bottom: brown clay with pumice. Bottom temp.: 1.2°C. – Head of 1 male.



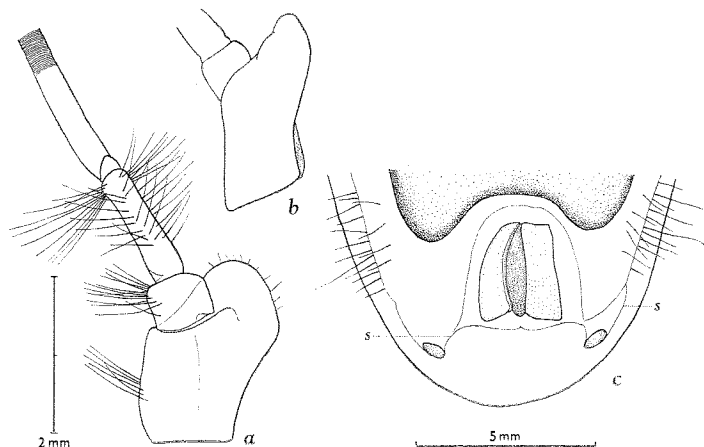


Fig. 108. *Bathypsirus nybelini* Nordenstam, ♀ from *Sw. Exp. St. 371*; a-b, antennula in frontal view and from the outer edge; c, posterior end of pleotelson with anal face (s, seam).

In order to undertake a careful comparison between material of this species and of related species I have – through Professor O. NYBELIN of the Gothenburg Museum – borrowed the entire collection (including types) of *B. nybelini* from the Swedish Deep-Sea Expedition (in the following abbreviated *Sw. Exp.*). It was found necessary to give first a supplementary description, based on those specimens in the best state of preservation. Unfortunately, the male and female type specimens selected by NORDENSTAM are in a very poor condition, e.g. the male lacking most of the pleon and all the pleopods. The mouthparts of the two types are untouched; thus, the drawings in NORDENSTAM's fig. 2 must have been made from a third specimen from the type locality, St. 371. However, the male pleopods in fig. 3 most certainly originate from the (male) type specimen.

As indicated above, I have referred two specimens from the *Galathea* to this species. The results of a very thorough comparison between these specimens and the *Sw. Exp.* material is given after the description of the latter.

#### Additional description (*Sw. Exp.* material):

*Head* (Pl. X A) almost quadratic when seen directly from above.

*Pereonites 5-7* (Pl. X B-C). The coxae of prn. 5 are also drawn quite some distance backwards, and are situated more dorsally than the coxae of the two following segments. Medianly on prn. 5 and on the anterior part of prn. 6 is a fine, longitudinal furrow.

*Pleon* could not be studied satisfactorily by NORDENSTAM owing to its poorly preserved state in all specimens available. Comparison with other species and a detailed examination of his material has enabled me to give the following description: It con-

sists of one very narrow, ring-shaped pleonite followed by the huge pleotelson. Seen from above (Pl. X C) it is evenly rounded posteriorly, between one-fourth and one and a half times longer than broad. The approximate shape in lateral view is shown on Pl. X B: Posterior end of pleon bent downwards and somewhat forwards, the anal face pointing forwards at an angle of about  $45^\circ$ , thus very similar to *Bathypsirus* ("*Eurycope*") *pellucidus* (BEDDARD 1886b, pl. XIV, 1). Maximum height of pleotelson only about one-fifth less than the length; the height of its anterior part a little less than half the total height. Seen from below (Fig. 108c) the anal face covers the posterior part of the branchial cavity; the original shape of the latter is impossible to make out but it seems to have been somewhat longer than broad. Immediately behind the anal face is a very fine seam or ridge (s in Fig. 108c) which runs upwards and slightly backwards to a low, circular concavity at the point where the missing uropods were inserted, whence the ridge bends sharply forwards and continues to the front margin of pleotelson, running parallel to the margin of the branchial cavity; this stretch furnished throughout with a large number of thin setae.

*Antennula* (108a) has joint 1 considerably more elongated than in NORDENSTAM's fig. 2A; it is at least twice as long as broad. In lateral view the joint resembles a shoe (108b). Joint 2 broader than long and with a circular row of setae – such as those situated distally on joint 3, but shorter. Joint 3 a little more than twice as long as second. Scattered hairs on flagellum in the male, but not in the female.

*Antenna*. Squama broader than long. In place of NORDENSTAM's indistinct photograph of the outer end of the antenna, a drawing of this is given (110j). Joints 5 and 6 of about equal length, extremely slender and with numerous very short, scattered

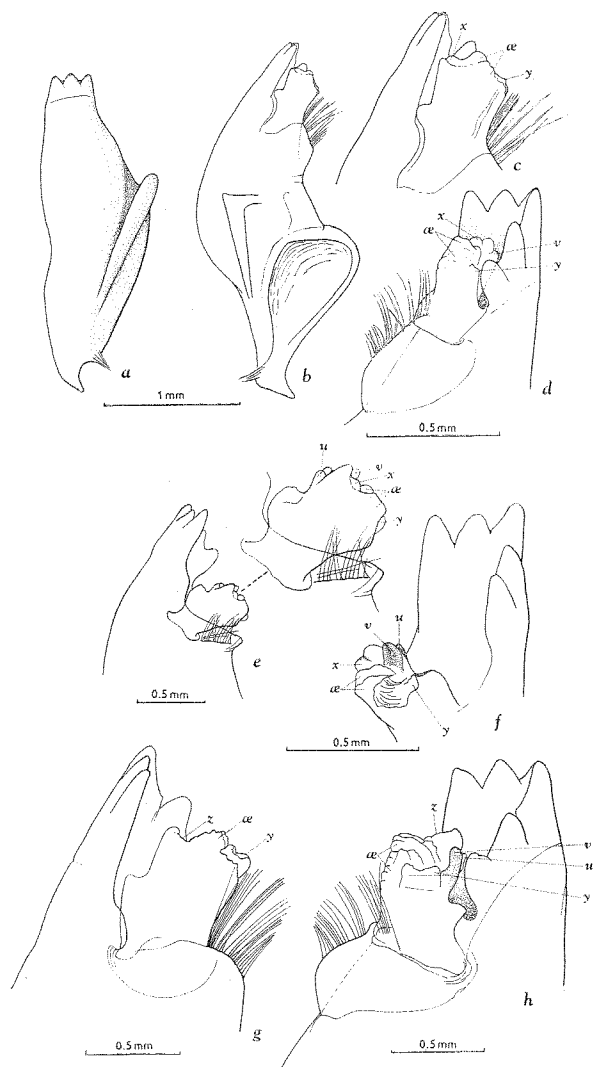


Fig. 109. *Bathypsurus nybelini* Nordenstam; left mandible; a-d, ♀ from *Sw. Exp.* St. 371; e-f, ♀ from *Galathea* St. 601; g-h, ♂ from *Galathea* St. 654; a, seen from outside (in front); b, c, e, and g, seen from above; d, f, and h, seen obliquely from the lower (inner) edge (u, v, x, y, z, and æ, teeth on movable lacinia – compare with text.)

setae. Preserved part of flagellum still more slender, devoid of setae and with the joints being, on an average, twice as long as broad.

**Labrum** 2.5 times broader than long, with a median small convexity on the front margin and a dense growth of short setae.

**Left mandible** with the five teeth in the incisive part placed at an angle about  $80^\circ$  towards each other (Fig. 109d), the middle one having at the same time, a deep, longitudinal excavation on the inner side. Movable lacinia very strong and squarish, with the distal part irregularly knotty (109c-d).<sup>1</sup> Twenty long and slender spines or setae in spine-row; four are placed on the base of the lacinia (109d).

1. The various teeth and knobs are considered in detail below.

**Right mandible** has five rounded teeth placed in a pointed arch and one chisel-shaped tooth at the opening of the arch (t in Fig. 110d). Spine-row (110a) consisting of a number of free spines (ten) and an equal number emerging from the base of the tooth (t); they are, therefore, easily overlooked. The three upper of these spines, also observed by NORDENSTAM, are thicker and with an uneven surface distally; one is broken. Three lowermost spines are rather short and slender and emerge well below (proximal to) the others. These three spines are perhaps part of an extremely vestigial molar process (cf. right mandible in *P. giganteus* – p. 179).

**Labium** (110e) somewhat more squarish than that drawn by NORDENSTAM. Inner lobes small and spherical and partly covered by two longitudinal formations of unequal length. Only a moderate portion of outer lobes covered with setae.

**Maxillula** with eleven spines in three rows, two or three quite small.

**Maxilliped** (110g) with joints 1-3 of the palp even more slender than in NORDENSTAM's fig. 2G. Joint 5 has three stout spines distally and one on the middle of the dorsal surface. Basipodite on the dorsal (interior) surface with a dense, oblique row of feathered setae. Endite with a row of ten rather weak spines distally. Epipod almost regularly drop-shaped. Nine coupling hooks.

**Pereopods I-VII.** Since all the basipodites are present in this species as well as in the others belonging to the subfamily, their length and width have been compared (Table 8). Basis of prp. I is consistently much longer than basis of the three following legs, and basis of prp. VII is likewise always shorter and narrower than basis of the two preceding legs. The latter difference is, however, much more pronounced in *Bathypsurus* than in *Paropsurus*. Moreover, in the former genus the basipodites of prps. II-IV are not broader than basis of prp. I, while in the latter they are not only broader, but also increase in width backwards.

The two fragments of legs illustrated by NORDENSTAM (fig. 3A-B) are unfortunately, no longer part of the material. They were probably both from the first pair of legs. The joints are more slender than in prp. I of *B. abyssicolus*, but not as slender as in *P. giganteus*. The two fragments most certainly consist of carpus, propodus, and dactylus; thus the segmentation of propodus shown in fig. 3A-B can hardly be correct.

Fragments of three other legs are still extant, but were not mentioned by NORDENSTAM. They are prac-

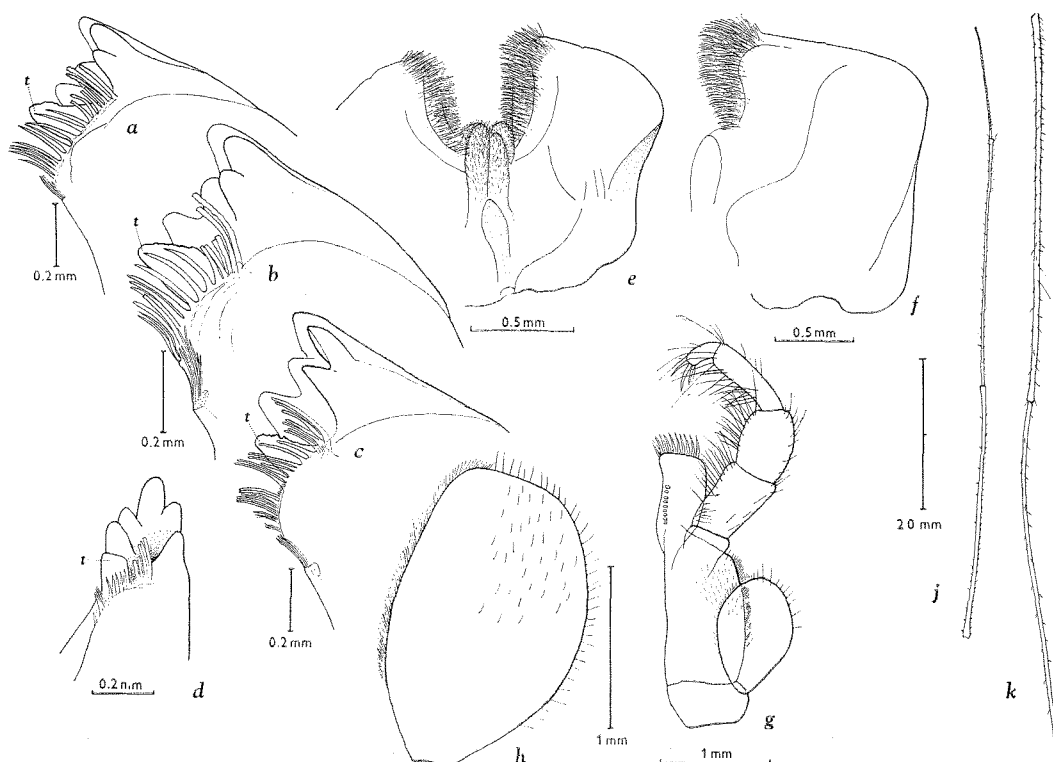


Fig. 110. *Bathypsirus nybelini* Nordenstam; a-c, incisive part and spine-row of right mandible (a, ♀ from *Sw. Exp. St.* 371; b, ♀ from *Galathea St.* 601; c, ?♂ from *Galathea St.* 654); d, the same seen from the edge (*St.* 371); e, labium (*St.* 371); f, the same (*St.* 654); g, left maxilliped (*St.* 371); h, epipod (*St.* 654); j, joints 5-6 and fragment of flagellum of antenna (♀ from *Sw. Exp. St.* 370); k, carpus, propodus and fragment of dactylus of pereopod III or IV (♀ or ♂ from *St.* 371).

tically equal and one is shown in Fig. 110k; they represent carpus, propodus, and a fragment of dactylus. They must belong to prps. II, III or IV which must therefore be enormously elongated, and probably at least twice as long as the body.

*Male pleopods 1-3* unfortunately no longer present on the only male (the type) and could therefore, not be re-examined.

*Pleopods 3-5* have both branches split up into several pleated, extremely hyaline pieces which are

connected only at their base; thus, each pleopod resembles a fragment of torn and damaged gauze.

*Female operculum* is shaped according to NORDENSTAM's fig. 3F, when stretched and mounted on a slide. When *in situ* it is considerably vaulted in the centre, being thus not much broader than long in direct frontal view.

*Uropods.* As mentioned above, a groove for the insertion of the uropods is present in all specimens with preserved pleon (Fig. 108c). At the bottom of

Table 8. Relative length and width (given in measuring units) of the basipodites of all pereopods in *Bathypsirus* and *Paropsirus*.

Pereopod	<i>Bathypsirus nybelini</i> ( <i>Sw. Exp. St.</i> 371; ♀)		<i>Bathypsirus nybelini</i> ( <i>Gal. St.</i> 601; ♀)		<i>Bathypsirus abyssicolus</i> (♀ holotype)		<i>Paropsirus giganteus</i> ( <i>St.</i> 601; ♀)		<i>Paropsirus giganteus</i> ( <i>St.</i> 716; ♂ holotype)		<i>Paropsirus pellucidus</i> (♀ holotype)	
	Length	Width	Length	Width	Length	Width	Length	Width	Length	Width	Length	Width
I	84	10	87	11	90	10	85	8	83	8	88	12
II	33	9	32	9	30	10	27	10	28	11	38	15
III	31	10	33	9	30	10	31	12	29	12	50	20
IV	31	10	34	10	30	10	34	13	34	13	50	22
V	138	22	144	19	135	19	74	14	61	12	95	19
VI	152	21	150	19	147	16	77	11	71	12	95	20
VII	63	7	71	8	65	9	63	8	58	9	90	12

this groove, placed somewhat anteriorly, is always (except in one groove) a small round hole in the extremely thin integument – often having what seems to be fragments of tiny muscles, attached to its margin either exteriorly or interiorly. This indicates that an, undoubtedly very tiny, uropod was certainly present in this species, but has now been torn off in all specimens.

#### Variation:

It is not without hesitation that I have referred the two specimens from the *Galathea* to *B. nybelini*, partly of course since only the head was available from one of them and the other was a female, and partly because of the enormous geographical separation (Atlantic Ocean and Tasman Sea-Kermadec Trench in the South West Pacific). However, the remarkable resemblance in all comparable features has convinced me that they (at least for the time being) must be recognized as belonging to one species.

#### 1. Female from *Galathea* St. 601:

*Body* (Pl. X D-E) not only with exactly the same shape of head and pereonites as in the *Sw. Exp.* material, but also with the same transparency and colour of the integument. The same applies to the muscles below it and even to the contents of the gut (yellow-brown fragments of algae – cf. p. 243). Pleon was torn off, but the first, ring-shaped segment is present.

*Antennulae* with slightly fewer, but relatively longer setae on joints 2 and 3; otherwise equal. The same applies to antennae, labrum, and labium.

*Left mandible.* The movable lacinia (Fig. 109e, f) has been forced out of its customary position close to the five teeth of the incisive part; this has led to the crest with the spine-row being so badly crushed that the number of spines cannot be stated. General shape of the lacinia the same as in the *Sw. Exp.* specimens, but there are minor differences in the relative size of some of the teeth on the knotty surface; in particular, the teeth marked u and v in Fig. 109c-f are somewhat larger in the *Galathea* female.

*Right mandible* (110b) with the six teeth a little more rounded. There would appear to be exactly the same number of spines in the main row (seventeen) and they are placed in the same pattern, but are, on the whole, a little stronger. In place of the usual three short, more proximally placed spines, there are seven very slender ones in this female.

*Maxillula* with twelve spines on the outer endite (instead of eleven), but placed in the same way. – *Maxilla* with three spines only on the outermost of the outer endites, which is also a little more slender proximally. – *Maxilliped* with distal joint of palp very slightly broader. Otherwise these mouthparts are also absolutely equal.

*Pereopods.* Basis of prps. V and VI more equal in length than in the *Sw. Exp.* material (Table 8). Otherwise the basipodites are equal, as are the opercula and the pleopods.

*Size:* In comparison with the *Sw. Exp.* material the original length of the female is estimated to about 35 mm.

#### 2. ? Male from *Galathea* St. 654:

Agrees perfectly with the *Sw. Exp.* specimens in general shape of the head and its incisions (Pl. X F), in antennulae,<sup>1</sup> antennae, labrum, and maxillae. The following small differences in the remaining mouthparts were found (in all other respects the mouthparts are quite equal):

*Left mandible* with a more pronounced cutting edge between the three lower teeth in the incisive part; movable lacinia with the main tooth (æ in Fig. 109g-h) and tooth y better developed, and an edge (z in 109g-h) instead of the tooth x (109c-f); about 24 spines in the spine-row instead of 20, and 8 of these emerge from the base of the lacinia, instead of only 4 in the *Sw. Exp.* specimens.

*Right mandible* with a more pronounced cutting edge on all teeth, the chisel-shaped tooth t (Fig. 110c) less projecting and with 29 spines in the spine-row – none of which have the slightly uneven surface distally found in three of the spines in the *Sw. Exp.* material and the female from *Galathea* St. 601 (110a-b).

*Labium* (110f) somewhat more squarish, with the outer corners almost forming a right angle.

*Maxilliped* comparatively larger and joint 3 of the palp more elongated. Epipod (110h) with a rounded angle on the inner, distal corner.

*Size:* When comparing the present head with that of the largest female from the *Sw. Exp.* (45 mm long) it was found to be slightly bigger; thus the entire length of the animal must be about 50 mm.

Intestine contents of specimens from *Sw. Exp.* St. 371 and *Galathea* St. 601 are recorded in Table 17 (p. 240).

1. The specimen is probably a male, since the antennular flagellum is rather strong and has a few scattered hairs.

### Distribution:

Known from three localities in and north of the Puerto Rico Trench at 7625-7900 m, 5500-5987 m, and 5850-5860 m depths; Kermadec Trench at 5850-5900 m; Tasman Sea at 4400 m. Temperature: c. 1.1-2.7°C.

### *Bathyopsurus abyssicolus* (Beddard, 1885)

(Text-fig. 111)

*Eurycope abyssicola* Beddard, 1885, p. 921; BEDDARD 1886b, p. 74, pl. XIV, 5-8; MENZIES 1962b, p. 138.

### Additional description of female holotype:

*Head* with the same triangular projection between the antennulae and thickened rim posteriorly as in *nybelini*.

*Pereonites 1-4* do not "increase progressively in length from before backwards", but are of equal length. They are shaped as in *nybelini* and thus, definitely differ from BEDDARD's fig. 5. There are hairs on the margins. Coxae rounded, and developing oostegites circular in shape, attached to all four pairs of legs; anterior pair half as large as the other three pairs.

*Pereonites 5-7* probably rather close to those of *P. pellucidus*, but this is difficult to ascertain; not shaped as in BEDDARD's drawing.

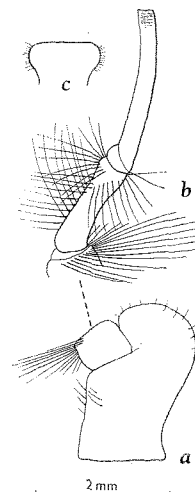
*Pleon.* As BEDDARD correctly maintains, the pleotelson is probably rather close to that of *pellucidus*; it is therefore also close to the two other species of the subfamily. No trace of uropods or their insertion could be found on the very damaged pleotelson.

*Antennula* with joints 1-4 very much as in *nybelini*, although joint 1 is more rectangular. Fig. 111a shows that joint 2 does not "arise from the tip of the first joint", as stated by BEDDARD. Both joints 2 and 3 (111b) have the same circular rows of long setae distally as *B. nybelini* and *P. giganteus*. Most of the flagellum broken off.

*Antenna* directed forwards and upwards but not backwards, as joint 2 is equally long anteriorly and posteriorly. Squama semi-circular, with two setae. BEDDARD's fig. 8 does *not* show the outer end of the antenna!

*Left mandible* with five strong, equally large teeth in the incisive part. They are placed in an arch (forming a little more than a semi-circle) around the movable lacinia, which is short and strong and has a knotty surface. About ten setae-like spines in the spine-row, placed on a similar triangular crest

Fig. 111. *Bathyopsurus abyssicolus* (Beddard), ♀ holotype; a, joints 1 and 2 of antennula in frontal view; b, distal joints from another angle; c, operculum.



as in *nybelini* (Fig. 109b). – *Right mandible* with six teeth placed in an oval; the two outer (anterior) and the inner (posterior) teeth the largest.

*Maxilla* with a broad, strongly setiferous inner lobe.

*Maxilliped* with the endite curved somewhat inwards and having distally the usual row of spines (ten) and long, fine hairs of uniform length inside them. There seems to be twelve small coupling hooks. Palp and epipod very much as in *nybelini*.

*Pereopods I-VII.* The relative length and width of the preserved basipodites are given in Table 8; they all have long, scattered setae. The majority of prp. V still preserved on one side, and was figured by BEDDARD (pl. XIV, 5-6). Distally on carpus is a distinct scar at the point of insertion of the missing propodus; this is not shown in BEDDARD's figure.

*Opereculum* approximately as in Fig. 111c, i.e. with the hind margin evenly cut off and devoid of setae but having a row of setae along the lateral margins.

*Size:* 40 mm long (according to BEDDARD).

### Remarks:

This species is probably rather close to *nybelini*, but has not yet been compared directly to it. The only differences which can as yet be given are those used in the key (p. 171).

### Occurrence:

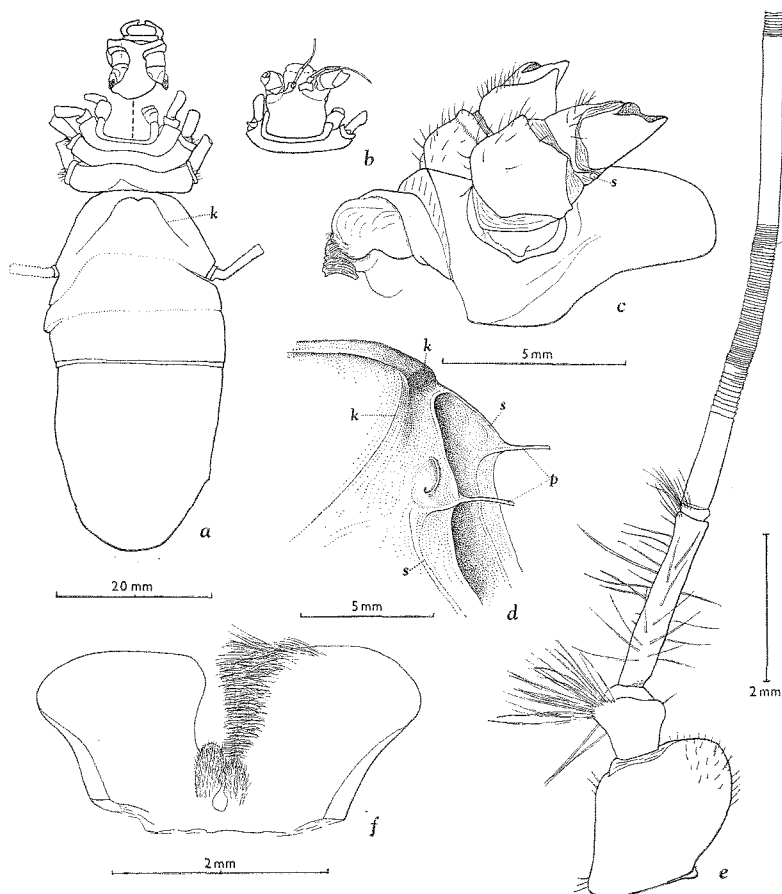
Off the Azores (38°03'N, 39°19'W), 3886 m, 2.3°C.

### *Paropsurus* n. gen.

### Diagnosis:

Pereonite 1 considerably shorter than prns. 2-4 and bent down laterally, with the result that pereopods I are inserted at a much lower level than prps.

Fig. 112. *Paropsurus giganteus* n.gen., n.sp.; a, c, and e-f, ♂ holotype; b, ♂ 3; d, ♀ from St. 601; a, from above; b, head and pereonites 1 and 2; c, upper part of head and preserved joints of the antennae (s, squama); d, anterior part of prn. 5 seen obliquely from in front (k, keel; s, seam; p, projection); e, right antennula; f, labium.



II-IV. Joint 2 of antennula narrow at base. Joint 4 of palp of maxilliped oval or triangular, more than half as wide as the preceding joints; epipod diamond-shaped and reaching beyond basipodite. Basis of pereopod VII almost as long and broad as basis of prps. V and VI. Pleopods 3-5 have the ordinary shape, with an almost circular inner branch and (in plps. 3 and 4) a very broad outer one.

Type species: *Paropsurus giganteus*.

*Paropsurus giganteus* n. sp.  
(Pl. XI A-J; Text-figs. 112-115)

Material:

*Galathea* St. 601, Tasman Sea (45°51'S, 164°32'E), 4400 m, 14 January 1952. Bottom: Globigerina ooze. Bottom temp.: c. 1.1°C. - 1 female.  
*Galathea* St. 716, East Pacific Ocean off Costa Rica (9°23'N, 89°32'W), 3570 m, 6 May 1952. Bottom: dark muddish clay. Bottom temp.: c. 1.9°C. - 3 males.

Description of male holotype (St. 716):

*Body* (Pl. XI A and Fig. 112a) with the integument of a more parchment-like consistency than in

*B. nybelini*. Thus, the original shape is easier to reconstruct. The length seems to be a little less than three times the width.

*Head* (Fig. 112a-b) squarish in front and with somewhat rounded posterior corners. Dorsal part evenly vaulted and no distinct seam forming a projection between the antennulae. The foremost upper part of head much raised over the epistome, being separated from it by an almost vertical "cliff" which is highest medianly (112c).

*Pereonites 1-4* (Pl. XI B-C, E-F) increasing in length backwards, prn. 1 being only one-fourth of prn. 4; prns. 2 and 3 almost equally long medianly and combined a little longer than prn. 4. Laterally, prns. 1-3 are about twice as long as they are medianly. The width of the four segments almost equal in view of the fact that the anterior ones are bent somewhat forwards laterally. In addition, prn. 1 is considerably curved downwards laterally, whereas the other segments are almost horizontal.

*Pereonites 5-7* seen from above in Fig. 112a, showing the best possible reconstruction of the posterior part (see also Pl. XI D, G-J). Anterior margin of prn. 5 probably shown almost correctly, while the posterior is more dubious. Prn. 7 seems

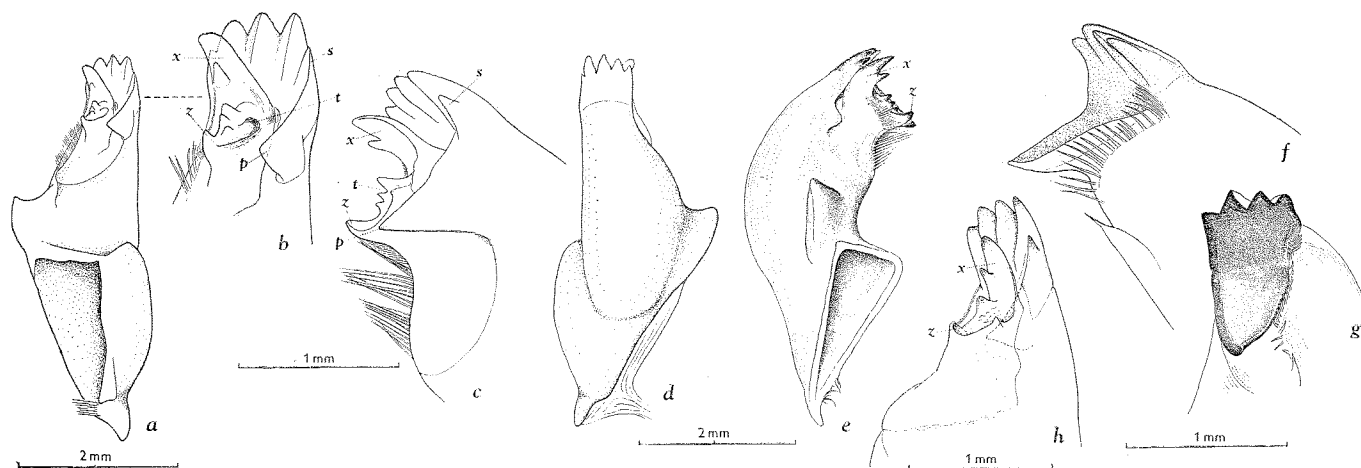


Fig. 113. *Paropsurus giganteus* n.sp.; a-e, left mandible of ♂ holotype; f-g, right md. of the same; h, left md. of ♂ 3; a-b and h, seen from inside; c, obliquely from below; d, from outside; e-f, from above; g, from apex.

about equally wide across in dorsal view. Anteriorly, on prn. 5 is a raised area which is separated from its surroundings by a low keel (k in Fig. 112a, d). In lateral view (Pl. XI A, D, H) it is evident that prn. 7, and to some extent prn. 6, reach much further down than prn. 5. Ventrally, no separation between the three segments can be distinguished. Front margin of prn. 5 stabilized by a very fine chitinous seam (s in Fig. 112d), more or less ring-shaped, but dorso-laterally, forming a plate-like shield with a rather complicated appearance. From this shield a branch of the seam (p) projects horizontally forwards into the preceding pereonite, thus propping the connexion between the two segments. A similar, but less distinct structure, is found in *B. nybelini*.

*Pleon* consists as usual of one very short, ring-shaped pleonite followed by the huge pleotelson. The shape of the latter difficult to ascertain, but seems rather close to that in Fig. 112a, thus being about one-eighth longer than broad. When viewed from the side, the maximum height of pleotelson is about one-seventh less than the length. Posterior end with the anal face drawn considerably less downwards (Pl. XI H) and branchial cavity much shorter than in *B. nybelini* and *P. pellucidus*. The height of the anterior part of pleotelson therefore, about two-thirds of the maximum height instead of about half the height as in the other species. Also in *giganteus* the original shape of the branchial cavity is difficult to ascertain, although the width seems to have been about one-third more than the maximum length. The anal face must have pointed almost directly downwards, and no ridges connect it with the point where the uropods were inserted.

*Antennula* (112e) with joint 1 a little broader than long and with scattered, short setae, especially on

the outer, distal part. Joint 2 comparatively large, almost half as long as joint 1. On the inner, distal corner is a heavy growth of long setae. Joint 3 longer than joint 1 and with many long setae. Joint 4 very short and ring-shaped, with an inner row of setae. Proximal part of flagellum unjointed; the very numerous joints being of different lengths and some of the longer ones partially divided into two.

*Antenna* (112c) with only the four proximal joints preserved. Joint 2 much longer anteriorly than posteriorly, causing a backward direction of the antenna. Squama (s in Fig. 112c) extremely small, almost circular in shape.

*Labrum* almost three times longer than broad, but the separation from the epistome indistinct. It is strongly vaulted (112c) and with a few low convexities. The almost straight front margin has a dense growth of comparatively long setae.

*Left mandible* with the six teeth in the incisive part (113b) placed at an angle of a little less than 90° towards each other. Of the four anterior teeth (113d), the dorsal is quite small and the next a little smaller than the last two – which on the inner side have each a sharp keel, making them triangular in section (113b). Of the two ventral teeth the anterior is small and pointed (s in Fig. 113b-c) whereas the posterior is very large and drawn out into a triangular plate (p). Movable lacinia not abruptly cut off distally as in the other species and much more compressed or antler-like (113e). Anterior branch (x) projects more than the posterior (z) and has two teeth. Both branches have a keel on the ventral side; these almost meet in the middle where the keel from (z) ends in a low, inwardly curved tooth (t). Finally, there are three small teeth in the centre and a row of extremely fine setae on the upper side of the la-

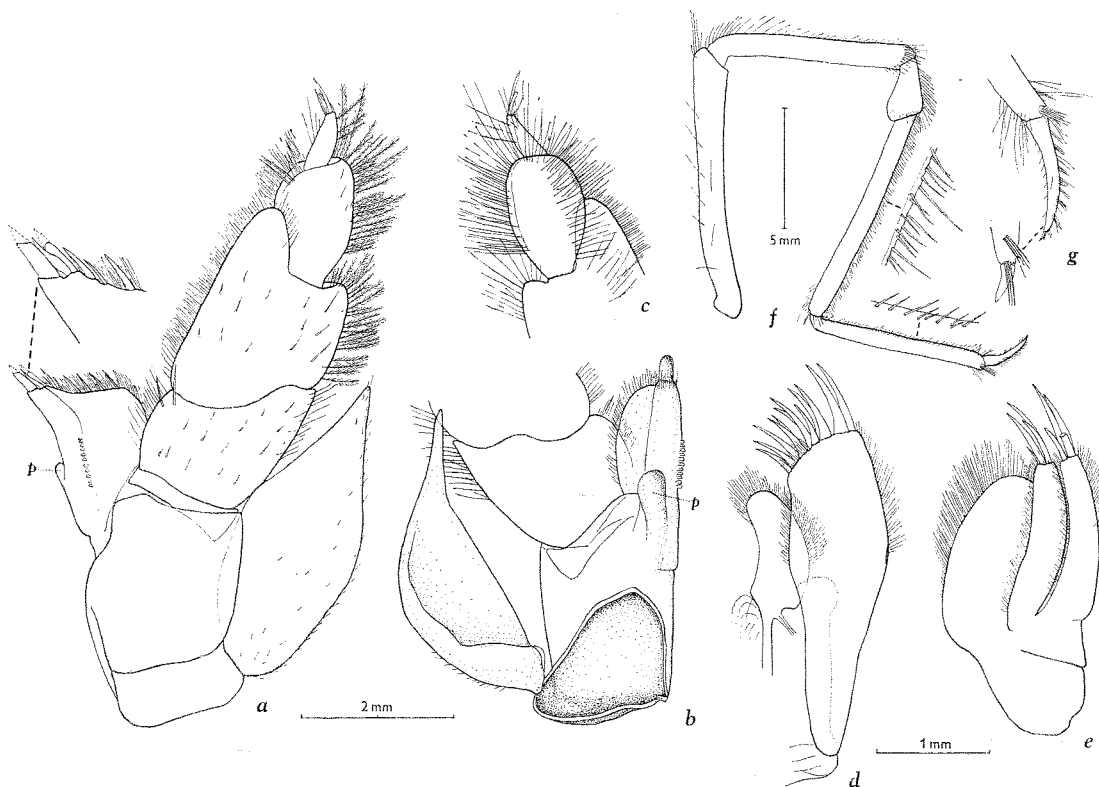


Fig. 114. *Paropsurus giganteus* n.sp.; a-c, ♂ holotype; f-g, ♀ from St. 601; a-c, left maxilliped from outside and inside; d-e, left maxillula and maxilla; f, left pereopod I; g, dactylus of same.

cinia, continuing in the spine-row (113b); due to their being so thin, it was impossible to see how they emerge proximally on the lacinia. Spine-row (113c) with 20 slender spines or setae which rise from a sharp crest.

*Right mandible* with one posterior and four triangular anterior teeth and a concave, triangular, smooth area between them (113g). Spine-row more regular than in the other species, consisting of 22 setae-like spines of almost equal length (113f). Proximal to the row is a small, sharply pointed projection which is perhaps, the vestigial molar process (cf. the proximally placed spines on right mandible of *B. nybelini*). Both mandibles have the usual upper crest and the foramen for insertion of the attached muscles; the foramen regularly triangular (113a, e).

*Labium* (112f) with a large, outer, rounded corner on the outer lobes - which are only moderately setiferous. Inner lobes small, cushion-shaped, with many short setae, and separated by a deep furrow.

*Maxillula* (114d) unusually broad and both endites triangular in section somewhat below the distal end. Spines on outer endite slender, twelve in number and in three rows - four in the upper, five in the middle, and three in the lower row. Inner endite obtusely rounded distally.

*Maxilla* (114e) also with broad endites, especially the inner. Three rather short, strong spines and one somewhat smaller spine on the outer endites.

*Maxilliped* (114a) with an extraordinarily short basipodite and large palp. Endite curved considerably inwards<sup>1</sup> and with an apically rounded projection on the inner margin (p in Fig. 114a-b). A small ridge, curved in frontal view, continues from the row of 14 small coupling hooks<sup>2</sup> to the distal end which projects considerably. On the distal margin are three strong, pointed spines very close to each other, six somewhat smaller spines and many fine setae. Joint 1 of the palp very short and partly covered by the basipodite, joint 2 with outer margin considerably longer than inner, joint 3 with outer margin much shorter than inner, joint 4 almost oval, three-fifths as broad as long, and with a distal, oblique slit from which the small joint 5 emerges. Rows of closely set setae along the margins, scattered and rather short setae on the ventral surface of joints 2 and 3, and dense growths of long

1. In Fig. 114a the maxilliped is mounted on a slide. When *in situ* the inner margin of the endite (with the row of coupling hooks) and of the basipodite, form together a straight line.

2. The three distal ones are almost invisible.



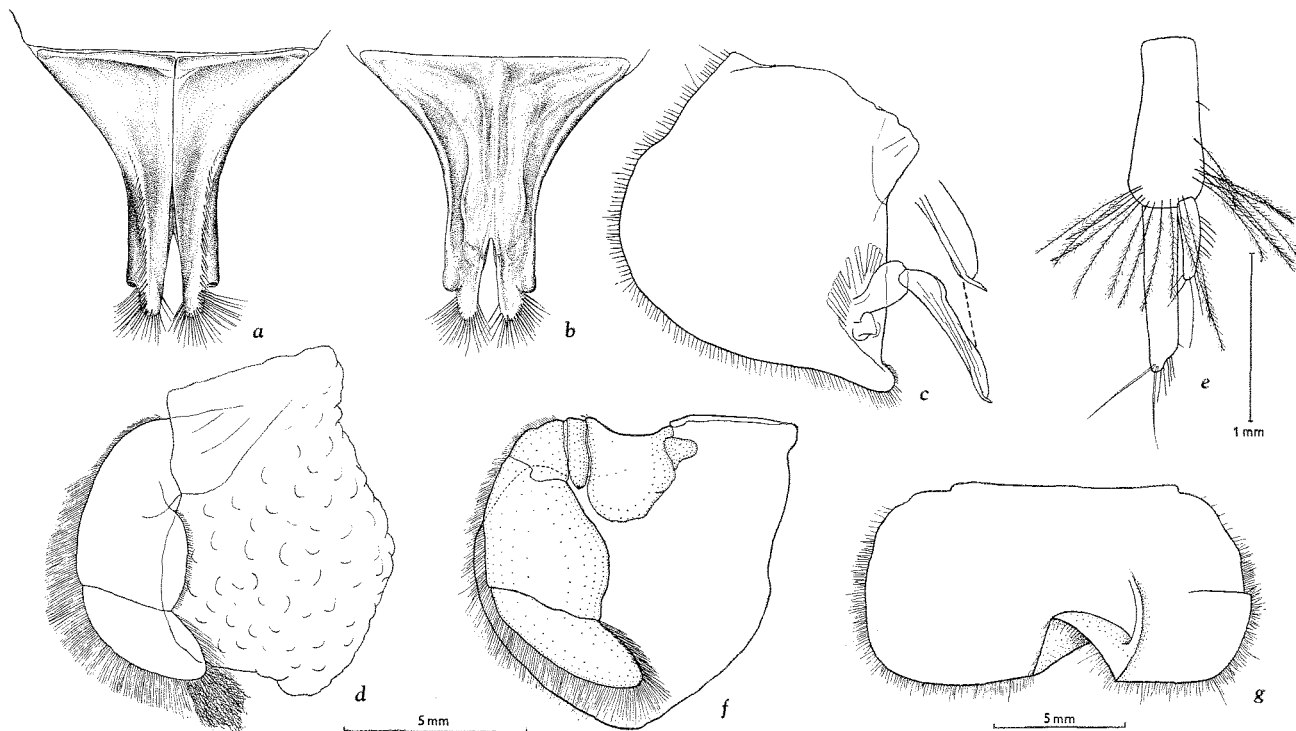


Fig. 115. *Paropsurus giganteus* n.sp.; a-e, ♂ holotype; f-g, ♀ from St. 601; a, male pleopods from outside; b, from inside; c, male pleopod 2; d and f, pleopod 3; e, left uropod; g, operculum.

setae on the inner half of the dorsal surface of joints 3 and 4 (114c); joint 5 with three strong spines and one somewhat weaker spine apically. Epipod acute, two and a half times longer than broad.

*Pereopods I-VII* have only the basipodites left. In Table 8 (p. 174) their length and width are recorded. Description of prp. I is given below.

*Pleopods 1* triangular, but with very concave outer margins. On the outer (ventral) surface (115a) a transverse keel runs along the base and a longitudinal one on the distal half; the latter being furnished with a row of long setae and ending near the thick, evenly rounded apex which is also closely covered with long setae exteriorly. The outer rami are the broadened, rather swollen distal continuation of the raised lateral margins of the pleopods (dorsal view, Fig. 115b). In addition, there are also, more medianly on the dorsal surface, the usual two keels or crests which are rather flattened.

*Pleopods 2* (115c) a little broader than long and rather squarish in shape, but the outer, distal corner is rounded and the inner, distal corner drawn out into a rounded projection. Exopod small and not reaching the margin, endopod rather short and with a very strong stylet on which the sperm duct continues in a short, oblique tip.

*Pleopod 3* (115d-f) with the inner branch extremely thin-walled (probably rather swollen origin-

ally); thus the shape cannot be given with certainty. Outer branch broad and 2-jointed as in *pelucidus*, but the apical, feathered setae not much longer than the outer, marginal ones.

*Pleopod 4* with both branches thin-walled and swollen, the inner somewhat broader than the outer.

*Uropod* inserted on the swollen, regularly rounded pleotelson, somewhat posterior to the anal face and more dorsal than the latter (Pl. XI A). Peduncle a little longer, about twice as broad as endopod (115e) and with most of its long setae finely feathered. Exopod half as long and about half as broad as endopod.

*Size*: The holotype about 60 mm long and about 22 mm broad across pereonite 6. The other males about 56 and 58 mm long. The female from St. 601 about 59 mm. Thus, *Paropsurus giganteus* is the largest asellote known.

#### Description of female:

As mentioned below, I regard the single female from St. 601 as belonging to the same species as the holotype - the description of which can be supplemented in two respects:

*Pereopod I* is preserved on one side (Pl. XI F and Fig. 114f). It is narrow throughout, basis is the longest joint, and carpus is a little longer than ischium. Most joints have setae of varying length

situated along the inner margin and distally; on dactylus, the same short, bunch-like setae (114g) as indicated by NORDENSTAM (1955, fig. 3 A) on the outer part of propodus of *B. nybelini*.

*Operculum* somewhat vaulted so that it could not be completely flattened (indicated by a fold on Fig. 115g). When flattened it is a little less than twice as broad as long, with parallel front and hind margins and with setae laterally and posteriorly.

#### Variation:

The two other males (2 and 3) from the type locality are different from the holotype in the following respects:

Pereonites 5-7 (Pl. XI D) seem to be of equal length dorsally in both. – At least joint 3 of the antennula shorter and a little stronger. – Left mandible in both specimens somewhat different; male 2 has the outer margin of the crest on the dorsal side more curved; only two teeth in the centre of the movable lacinia, and the keel on the ventral side which comes from the posterior tooth (z in Fig. 113c) does not end in a tooth like (t), but curves further round to one of the two central teeth. There are also a few additional spines in the spine-row. In male 3 (which was not dissected) the movable lacinia is seen from above in Fig. 113h. The keel (from z) on the ventral side is much higher so that (z) is not a real tooth but the posterior corner of this keel; the anterior corner of the keel is curved towards the small central tooth, the only one of the three in the holotype still remaining. Maxilliped in male 2 (not dissected in male 3) with 15-16 coupling hooks (14 in the holotype) and joint 4 very broad distally, thus being triangular in shape (instead of almost oval) and about four-fifths as broad as long.

The female from St. 601 is the best preserved specimen. Its general shape is shown on Pl. XI E-J. A very careful comparison showed a remarkable resemblance with the holotype, when the great distance between the localities is taken into consideration. Only the following few differences were found:

Pereonite 5-7 (Pl. XI G-J) a little different from the type, but very similar to those segments in males 2 and 3. – Joint 3 of antennula shorter than in the type, but longer than in the other two males. The proximal 5-6 joints of the flagellum (beyond the unjointed section) somewhat longer. – Shape of left mandible is between the type and males 2 and 3. The teeth of the incisive part a little more truncate. Instead of the type's three

central teeth on the movable lacinia there are only two, but the posterior is slightly cleft distally; keels on ventral side exactly as in the type. A few additional spines in the spine-row. Right mandible not dissected and therefore only superficially examined. – Maxilliped with 15 coupling hooks; also shape of joint 4 of the palp is between the type and male 2; five distal spines on joint 5.

#### Remarks:

I do not hesitate to include the female from St. 601 in this species, as it seems closer to the type specimen than the two other males from the type locality. Unfortunately, no males are available from St. 601; a comparison between the male pleopods could therefore not be made.

Intestine contents are recorded in Table 17 (p. 240).

#### Distribution:

Known from both sides of the Pacific Ocean (off Costa Rica in the East and in the Tasman Sea in the Southwest), at 3570 and 4400 m depth and c. 1-2°C.

#### *Paropsurus pellucidus* (Beddard, 1885)

(Pl. X G; Text-figs. 116-117)

*Eurycope pellucida* Beddard, 1885, p. 920; BEDDARD 1886b, p. 71, pl. XIV, 1-4.

#### Additional description of male holotype:

*Head* (Pl. X G) having dorsally a seam on each side which meet as a subacute projection between the antennulae. On top of the head a pair of low convexities. The hind margin of the head a little concave medianly and with a thickened rim.

*Pereonites 1-4.* Prn. 1 is a little longer in the middle than further laterally, where its front margin is concave, as described by BEDDARD. Prns. 2 and 3 shortest medianly and not particularly saddle-shaped. Prn. 4 a little longer than 2 and 3 together.

*Pereonites 5-7* totally fused with each other; ventrally, it is impossible to see any separation between the segments – such as indicated on BEDDARD's fig. 1 (pl. XIV).

*Pleon* consists of the huge pleotelson and in front of it only one additional pleonite – not two as claimed by BEDDARD; what he calls a ridge on the anterior margin of the abdominal shield is actually the anterior pleonite. This continues as a narrow ring down to just off the insertion of pereopods VII where it disappears and is, thus, invisible ven-

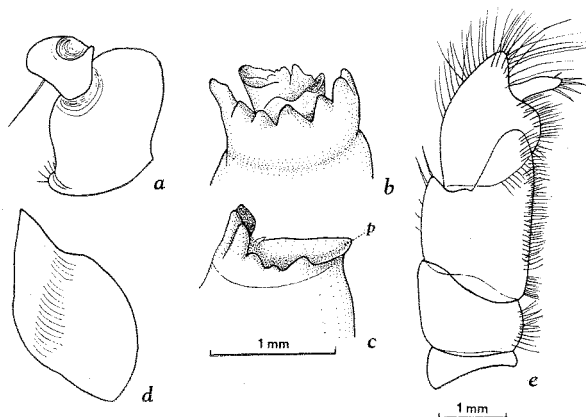


Fig. 116. *Paropsurus pellucidus* (Beddard), ♂ holotype; a, joints 1-2 of right antennula; b, apex of left mandible; c, apex of right md.; d-e, epipod and palp of maxilliped.

trally. Pleotelson approximately as shown in BEDDARD's fig. 1. Its original width impossible to ascertain with accuracy, but it is one-eighth longer than high when viewed from the side. Vertical distance from dorsal side down to upper margin of branchial cavity a little more than half the total height.

*Antennula* has only joints 1 and 2 preserved on the right side. My Fig. 116a shows that joint 2 is inserted much more distally on joint 1 than indicated in BEDDARD's fig. 3, and that joint 1 is less than 1.5 times longer than broad. Joint 2 is also considerably stronger (shaped almost as in *giganteus*) and with one long seta on the inner margin; it is not known whether there was originally a circular row of setae similar to that in the other species.

*Antenna* directed somewhat backwards, due to the anterior side of joint 2 being much longer than the posterior one. Squama small and triangular.

*Labrum* exactly as in *giganteus* (Fig. 112c).

*Mandibles* in general shape comparable to *giganteus*, but incisive part of left mandible having seven large, rounded teeth of approximately equal size, forming one-third of a circle round the movable lacinia (116b). This is triangular when seen from the end, with an inner (posterior), very sharp and partly crenellated margin and an outer (anterior) part with three or four teeth.

*Right mandible* also has seven teeth, but the dorsal-posterior one (p in Fig. 116c) is extended to a long and straight, sharp edge and the three ventral teeth are much smaller than the three anterior ones. Without dissection the spine-row could not be studied in detail; the spines are seta-like as in the other species.

*Labium* and *maxilla* as in *giganteus*, i.e. the latter with a very broad inner lobe, thus not at all as in

*Eurycope sarsi*, as stated by BEDDARD. — *Maxillula* as in *B. nybelini*.

*Maxilliped* almost as in *giganteus*. Endite curved somewhat inwards and furnished distally with the row of spines and the fine hairs mentioned by BEDDARD, but on the inner corner there are two teeth only. The palp (Fig. 116e) is copied from the one mounted on a slide and it undoubtedly belongs to this species. It differs from that of *giganteus* in having joint 4 still larger, with the outer, distal corner strongly projecting, and in being furnished with four spines on joint 5; there are also fewer setae, some of which are feathered. Epipod (116d) diamond-shaped and not reaching as far as joint 2 of the palp.

*Pereopods* completely missing, except for the basipodites. The relative length and width of these joints are given on p. 174.

*Pleopods 1* (117a) broadest at base and almost regularly triangular, with outer margins slightly concave, one and a half times longer than broad, and with setae ventrally along the inner margins. Their distal ends bent upwards (dorsally) at an angle of more than  $90^\circ$  (117c) and also bent somewhat apart from each other, terminating in two flattened, drop-shaped plates (117b), which are quite different from anything found in the other species of this subfamily. Dorsal keel on each pleopod for the attachment to pleopods 2 rather like that in *giganteus* (Fig. 115b).

*Pleopod 2* (117d) large, transparent, and some-

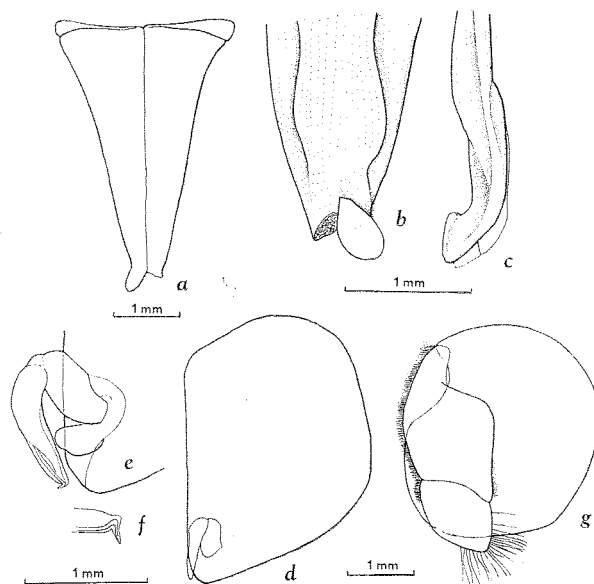


Fig. 117. *Paropsurus pellucidus* (Beddard); a-c, male pleopods 1 from outside and apex from inside and from the right margin; d, approximate shape of pleopod 2; e, copulatory organ; f, apex of stylet in side view; g, approximate shape of pleopod 3.

what diamond-shaped, with rounded corners and straight inner margin. Copulatory organ very small, only one-fourth of the length of the sympod. Stylet (117e) extremely strong and with the outer end bent at a right angle (117f).

*Pleopod 3* (117g) with inner branch circular and outer branch 2-jointed, very broad, and with many setae distally.

*Uropods* have probably been present. Contrary to BEDDARD's statement there are two small scars in exactly the same place where similar scars are found in *B. nybelini* and where the small uropods are inserted in *giganteus*.

*Size*: 45 mm long (according to BEDDARD).

#### Remarks:

*P. pellucidus* differs from *giganteus* in the following respects: Left mandible has seven teeth in a semi-circle instead of six arranged in an angle, and rather different movable lacinia; right mandible with three anterior and three ventral teeth (besides the large, posterior one) instead of four anterior and no ventral teeth; joint 4 of palp of maxilliped and male pleopods differently shaped – cf. the key p. 171.

#### Occurrence:

Off New Guinea (2°33'S, 144°04'E), 1957 m, 2.4°C.

### FAMILY MUNNOPSIDAE

Munnopsini Hansen, 1916, p. 152.

The establishment of two new species and a review of most of the known species (see below) have called for the following

#### Description:

Body rather oblong. Head free, eyes absent. First four pereonites – and in particular, almost always the third – somewhat or often very much broader than pereonites 5-7 and pleon, which are fused with each other. Coxae rounded, visible from above.

Antennulae dorsal, with joint 1 plate-shaped; flagellum with many joints. Antennae with fifth and sixth joints of the peduncle enormously elongated; squama small, more or less distinct. Mandibles with distal parts well developed or much reduced, molar process either slender conical, reduced or missing; palp well developed, reduced or missing. Inner endite of maxillulae and maxillae with one strong seta besides the ordinary fine ones. Joints 2 and 3 of palp

of maxillipeds very broad, joints 4 and 5 much smaller.

Pereopod I slender or strong, prehensile; basis and ischium long, and in particular merus and carpus with strong setae or spines. Prp. II similar, but longer, more slender, and with dactylus much longer. Prps. III and IV differ greatly from the two preceding legs in having very short basis and ischium; the enormous length of these legs is due to the extremely elongated carpus and propodus. Prps. V-VII natatory, carpus and propodus a little or greatly expanded, with marginal setae; dactylus missing. Male pleopods 1 broader distally than close to the proximal end; plps. 2 with a partial or almost total fusion along the median line. Uropods terminal or a little ventral, uniramous, 2-jointed, slender.

#### Diagnosis:

Body in two sections, pereonites 1-4 being somewhat or even much broader than prns. 5-7 and pleon, which are fused with each other. Antennulae dorsal, with joint 1 plate-shaped and with multi-jointed flagellum. Antennae much longer than body. Pereopods I and II more or less prehensile, with long basis and ischium; prps. III and IV with these joints very short, but with carpus and propodus enormously elongated. Prps. V-VII natatory, dactylus missing. Male pleopods 2 more or less fused together. Uropods uniramous, 2-jointed, slender.

#### Remarks:

This easily distinguishable family is based on *Munnopsis typica* described by M. Sars (1861). In 1905 TATTERSALL added the genus *Munnopsoides*, to which he referred *Munnopsis australis* Beddard and the new species *M. Beddardi*. Finally, HANSEN (1916) described two genera, *Paramunnopsis* and *Pseudomunnopsis* and transferred *beddardi* to the latter. These four genera have been adopted by all later authors.

The division was primarily based on the following features: (1) Width of pereonites 5-7 in relation to 1-4. (2) Pereonites 5-7 and pleon fused or movable. (3) Development of distal part of mandible and presence or absence of palp. (4) Width of distal joints of pereopods I and V-VII and presence of setae on the latter. (5) Shape of male pleopods 1. (6) Independent, or partial or almost total fusion of male plps. 2. (7) Length of uropods.

Both the study of the two new species of Munnopsidae in the *Galathea* collection and a thorough examination of available material of known species

have, however, convinced me that several of these features are completely erroneous or quite useless on the generic level. Of the above-named features this applies to the following:

(2) Movable or fused pereonites 5-7 and pleon. I am not of the opinion that these segments are really movable in *Paramunnopsis*, as originally claimed by HANSEN (1916, p. 153) and adopted by later writers. No doubt the dorsal incisions between pereonite 7 and pleon and especially between prns. 5 and 6, and 6 and 7 are considerably deeper and more conspicuous in *P. oceanica* (Tattersall) than in any of the three other species studied by HANSEN: *M. typica*, *M. eximius* Hansen and *Ps. beddardi*. However, in one of the species re-described below, *M. longiremis* Richardson, these incisions are at least as deep as in *P. oceanica*. What is more important, neither in *P. oceanica*, nor in *M. longiremis* has the slightest trace of a ventral incision between the four segments in question been found. This must indicate that they are fused, but the original division in separate segments is still more conspicuous dorsally than in other species of the family. It goes without saying that a significant segmentation was found also on the ventral side between pereonites 1-4 and prns. 4 and 5 in all species, including *oceanica* and *longiremis*. Regarding males (or females) of *typica* in this Museum, I have been unable to find any ventral incisions between the three posterior segments of the body corresponding to those indicated by G.O.SARS (1899, pl. 58).

(5) Shape of male pleopods 1. According to HANSEN (1916, p. 156) the genus *Munnopsis* (with the sole species *M. typica*), is well characterized by the shape of male pleopods 1 which are "moderately broad, feebly broader beyond the middle and then tapering considerably to the end." Thus, they differ from all other species where the first pleopods are much more elongated and twice as broad across the distal half as across the narrowest part close to the proximal end. However, as explained in detail below (p. 188), the first pleopods in *typica* have been found to vary considerably in shape. In males from e.g. Greenland, their general shape is much closer to that of other species of the family than to that described by HANSEN and figured by G.O.SARS (1899, pl. 58).

(6) Independence or partial fusion of male pleopods 2. The partial fusion of the second pleopods in *Paramunnopsis oceanica*, and the almost total fusion in *Pseudomunnopsis beddardi* was correctly considered by HANSEN (1916, p. 10) to be a

feature of great morphological interest. HANSEN based his new genus *Pseudomunnopsis* mainly on the fact that *Ps. beddardi* had the second pleopods almost totally fused, whereas in *Munnopsis* and *Munnopsoides* they were quite independent. He referred *australis* (Beddard) and his own species *eximius* to *Munnopsoides*, but of the former species only the female was known. Males of *australis* were, however, later described and figured by MONOD (1926, p. 26). According to his figure of the second pleopods (fig. 20C) they are fused almost half way along the median line. He does not, however, make mention of this fact, neither by including it in the differences he finds between his own specimens and *eximius* or by discussing the validity of the genus *Munnopsoides*.

I have now found that in addition to *oceanica*, *beddardi*, and *australis* the male pleopods 2 are also partly fused in *typica*, *eximius*, *latifrons*, *longiremis*, probably *gracilis*, and in the new species *bathyalis*.

This probably means that they are more or less fused in all species of *Munnopsidae*.

The remaining features listed above, and some others of possible generic value are compared in Table 9.<sup>1</sup> It appears that although the new species *mandibularis* is, with regard to the shape of the mandibles, intermediate between *M. typica* and the species of *Paramunnopsis* (*spinifer*, *longicornis*, and *oceanica*), these latter species are still rather well separated from all of the remaining ones. This is particularly evident in (1) the shape of the molar process and the total lack of a crest, (2) the very slender pereopods I, (3) the unique shape of the carpus of prps. V-VII, and (4) the great width of this joint compared to that of the propodus. These features fully justify the retention of the genus *Paramunnopsis*. However, in my opinion, neither *Munnopsoides* nor *Pseudomunnopsis* can be retained further, partly on account of the lack of separating characters such as shape of male pleopods 1 and independence or fusion of plps. 2 and partly since two of the three species described below link these two genera with each other and with *Munnopsis* in various other respects:

1. It has been endeavoured in the table to arrange the species of *Munnopsis* according to increased reduction of the mandibles. A natural succession could, however, not be obtained, since the presence of a movable lacinia often occurred together with absence of palp and *vice versa*. This arrangement also meant that *bathyalis*, with its greatly reduced mandibles, had to be separated from *gracilis* which has only partly reduced mandibles, but which is otherwise closely related to *bathyalis*.

Table 9. Separating characters of genera and species of Munnopsidae.

			<i>Paramunnopsis</i>			<i>Munnopsis</i>										
			<i>spinifer</i> (Vanh.)	<i>longicornis</i> (Hansen)	<i>oceanica</i> (Tatt.)	<i>mandibularis</i> n. sp.	<i>typica</i> M. Sars	<i>gracilis</i> Beddard	( <i>"Munnopsoides"</i> ) <i>eximius</i> (Hansen)	( <i>"Munnopsoides"</i> ) <i>australis</i> (Bedd.)	( <i>"Pseudomunnopsis"</i> ) <i>beddardi</i> (Tatt.)	<i>longiremis</i> Rich.	<i>latifrons</i> Beddard	<i>bathyalis</i> n. sp.		
Body:	{	♀ Width of prn. 5: width of broadest prn. <sup>1</sup>	Max. ....	?	?	?	2:3	1:2	?	2:5	2:5	4:7	?	?	3:4	
			Min. ....	?	?	?	2:5	3:8	?	2:7	1:4	3:8	?	?	1:2	
			♂ Width of prn. 5: width of broadest prn. <sup>1</sup>	Max. ....	?	4:5	6:7	?	3:4	1:2	2:5	2:7	1:2	4:5-2:3	3:4	3:4
			Min. ....	?	2:3	4:5	?	1:2	2:5	1:3	1:3	1:4	1:2-1:3	2:5	1:2	
Mandibles:	{	Number of teeth on incisive part .....	>4	>4	>4	1	2	3	1	1	1	1	1	1	1	
		Movable lacinia well developed (■), fairly well developed (▼), reduced (□) or absent (○) .....	■	■	■	▼	▼	□	□	□	□	○	○	○	○	
		Spine-row well developed (   ), reduced ( ) or absent (○) .....								○		○	○	○	○	
		Molar process conical (▲), reduced (△) or absent (○) .....	▲	▲	▲	△	○	?△	○	○	○	○	○	○	○	
		Crest on dorsal part of main body developed (■), reduced (□) or absent (○) .	?	?	○	■	□	?	□	?□	□	■	■	□	□	
		Palp with three joints (3), reduced ( ) or absent (○) .....	3	3	3		3	○	○	○	○	3	3	○	○	
Maxilliped:	{	Joint 3 of palp twisted (S), straight ( ) or absent (○) .....	S	S	S	○	S	○	○	○	○			○		
		Joint 2 of palp narrower than ( ), equal to (  ) or broader than (■) the basipod			■	■		■		■	■	■	■	■	■	
Prp. I:		Width of carpus : length of carpus .....	1:10	1:7	1:9	1:2	1:4	?	1:6	1:3	1:2	1:3	2:7	1:2		
Prps. V-VII:	{	Width of carpus : length of carpus .....	1:2	1:2	1:2	?	1:4	1:4	1:8	1:7	1:7	?	1:4	1:4		
		Shape of carpus and propodus equal (○○) or different (○●) .....	○●	○●	○●	?	○○	○○	○○	○○	○○	?	○○	○○		
♂ plps. 2:	{	Body of copulatory organ small (●), slender ( ), medium (○) or thick (●) . .	?	?		?	○	○	●	●	●	●	●	○		
		Stylet short (-), long (—) or very long (—) . . . . .	?	?	-	?	—	—	—	—	-	-	-	—		
Uropods:		1/10, 1/7, 1/2 of pleon, <sup>2</sup> as long as (1/1) or longer than pleon (>1/1) .....	>1/1	>1/1	1/1	?1/1	1/2	1/2	1/10	1/7	1/7	1/1	1/2-1/1	1/2		
Size:		Maximum length (in mm) <sup>2</sup> .....	3	4	7	14	18	12	9	8	6	15	17	20		
Occurrence:		Pelagic (□) or benthic (■) .....	□	□	□	?	■	?	■	?	■	■	■	■		

1. Usually pereonite 3.

2. Exclusive of postero-lateral spines.

(a) *M. longiremis* resembles *Munnopsis* in shape of body, in presence of palp on mandibles, and in great length of uropods, but agrees with *Munnopsoides* and *Pseudomunnopsis* in absence of movable lacinia (reduced in the two genera) and with *Pseudomunnopsis* in the male copulatory organ being small and its stylet short.

(b) *M. bathyalis* is also in agreement with *Munnopsis* in shape of body and length of uropods, but the mandibles are like those in *Munnopsoides* and *Pseudomunnopsis*.

Finally, MONOD has shown (l. c.) that carpus of pereopod I is actually quite strong in *australis* – which was referred to *Munnopsoides*; it is therefore quite different from the very slender carpus in *eximius*, the other species of this genus.

The only somewhat aberrant species is *M. mandibularis* n. sp. which has rather unique mandibles. Unfortunately, no males are known, and the shape of the mandibles do not seem, to me, ample justification for the erection of a new genus for this species.

Thus, apart from the three species belonging to *Paramunnopsis*, all the remaining ten species of the

family must be referred to one genus, viz. *Munnopsis*.

It is interesting to find that the three species of *Paramunnopsis* are undoubtedly pelagic, whereas those of the remaining species, which are known in several specimens, all seem to be benthic. The former have exclusively or often been taken in nets which never touched bottom, but none of the latter were ever captured in this type of gear. According to HULT (1941, p. 129) *M. typica* is definitely benthic. The fact that this species, as well as *longiremis*, *eximius*, *bathyalis* and *beddardi*, have been taken in numbers ranging from six to twenty specimens in one single haul with a small bottom trawl, certainly makes it much more likely that they were captured on or near the bottom rather than procured pelagically. In the intestine contents of a specimen of *beddardi* (Ingolf St. 36, Davis Strait, 2700 m) and of a specimen of *latifrons* (Albatross St. 4919, E. China Sea, 800 m), two sponge spicules were found in the first, and many in the second, indicating that both are benthic (cf. Table 17, p. 240). The presence of a molar process in the mandibles of the three species of *Paramunnopsis* may also indicate difference in choice of food (cf. discussion p. 245).

#### Key to the genera and species of Munnopsidae

1. Carpus of pereopod I at least seven times longer than broad. Carpus of prps. V-VII about half as broad as long, almost triangular and much broader than propodus. Mandible with at least four teeth in the incisive part and molar process slender, conical. . . . . *Paramunnopsis* 2
1. Carpus of prp. I at most six times longer than broad. Carpus of prps. V-VII at least four times as long as broad, more or less oval and about as broad as propodus. Incisive part with at most three teeth and molar process greatly reduced or missing . . . . . *Munnopsis* 4
2. Body without lateral and dorsal spines or processes. Peduncle of antennulae much longer than body. Joint 2 of palp of maxilliped broader than basipodite. . . . . *P. oceanica* (Tattersall, 1905)
2. Body with lateral and dorsal spines or processes. Peduncle of antennulae about half as long as body. Joint 2 of palp of mxp. narrower than basipodite. . . . . 3
3. No dorsal spines. Pereonite 6 and pleon with one and three lateral processes respectively. Joint 1 of uropods half as long as pleotelson. . . . . *P. longicornis* (Hansen, 1895)
3. Dorsal spines on prns. 5-7 and pleon. No lateral process on prn. 6. Joint 1 of uropods about as long as pleotelson. . . . . *P. spinifer* (Vanhöffen, 1914)
4. Postero-lateral corners of pleotelson with distinct spine-shaped processes. Mandibular palp almost always present. . . . . 5
4. Postero-lateral corners of pleotelson with at most a sharp angle. Md. palp rarely present. . . . . 7
5. Md. palp with two short joints only. A reduced movable lacinia on left md. . . . . *M. mandibularis* n. sp. (p. 203)
5. Md. palp with three joints. No movable lacinia present. . . . . 6
6. Carpus of prp. I as long as or longer than ischium. Uropods inserted close to the postero-lateral spines. Inner lobes of male pleopods 1 longer than the distance between the postero-lateral corners of the pleopods. . . . . *M. longiremis* Richardson, 1912b (p. 195)
6. Carpus of prp. I shorter than ischium. Uropods inserted half way between the median projection

- and the postero-lateral spines. Inner lobes of male plps. 1 shorter than the distance between the postero-lateral corners of the pleopods. . . . . *M. latifrons* Beddard, 1885 (p. 191)
7. Frontal margin of head with a row of stiff setae. Male plps. 2 fused three-fourths along the median line; stylet not reaching beyond the sympod. . . . . *M. beddardi* (Tattersall, 1905) (p. 188)
7. Frontal margin without setae. Male plps. 2 at most fused half way along the median line; stylet reaching beyond the sympod. . . . . 8
8. Md. palp present. Spine-row with several spines . . . . . *M. typica* M. Sars, 1861 (p. 188)
8. Md. palp absent. Spine-"row" with at most one spine. . . . . 9
9. Maximum width of prn. 5 more than half the width of prn. 3. Length of uropods more than half the maximum width of pleotelson. . . . . 10
9. Maximum width of prn. 5 less than half the width of prn. 3. Length of uropods less than half the maximum width of pleotelson. . . . . 11
10. Pleotelson evenly rounded posteriorly. One dorsal projection on prn. 5, two on each of prns. 6 and 7. Joints of uropods of almost equal length. . . . . *M. bathyalis* n. sp. (p. 200)
10. Pleotelson with two short projections posteriorly. No dorsal projections on prns. 5-7. First joint of uropods 1.5 times as long as second . . . . . *M. gracilis* Beddard 1885 (p. 199)
11. Carpus of prp. I about six times longer than broad. Basis of prp. II a little shorter than ischium. Uropods only one-tenth as long as pleotelson . . . . . *M. eximius* (Hansen, 1916) (p. 188)
11. Carpus of prp. I three times longer than broad. Basis of prp. II one-fifth longer than ischium. Uropods about one-seventh of pleotelson . . . . . *M. australis* Beddard, 1885 (p. 190)

#### Genus *Paramunnopsis* Hansen, 1916

*Paramunnopsis* Hansen, 1916, p. 154; GURJANOVA 1933b, p. 425.

#### Diagnosis:

Pereonites 1-4 not much broader than prns. 5-7 and pleon. Mandibles with at least four teeth in the incisive part, well developed movable lacinia and spine-row, a long and slender, conical molar process, no crest on the upper side, and a 3-jointed palp with third joint bent and twisted. Carpus of pereopod I at least seven times longer than broad. Carpus of pereopods V-VII about half as broad as long, almost triangular and much broader than propodus. Uropods at least as long as pleon.

#### Genus *Munnopsis* M. Sars, 1861

*Munnopsis* M. Sars, 1861, p. 84; BEDDARD 1886b, p. 51; G. O. SARS 1899, p. 132; VANHÖFFEN 1914, p. 581; HANSEN 1916, p. 156; GURJANOVA 1933b, p. 425; 1936, p. 64.

*Munnopsoides* Tattersall, 1905, p. 25; HANSEN 1916, p. 158; GURJANOVA 1933b, p. 426.

*Pseudomunnopsis* Hansen, 1916, p. 160; GURJANOVA 1933b, p. 426.

The reasons for the rejection of the genera *Munnopsoides* and *Pseudomunnopsis* are given above.

#### Diagnosis:

Pereonites 1-4 usually much broader than prns. 5-7 and pleon. Mandibles with at most three teeth in the incisive part, spine-row and molar process reduced or absent, and a vestigial crest present on the upper side, near the base. Carpus of pereopod I generally only two or three times longer than broad. Carpus of pereopods V-VII at least four times longer than broad, more or less oval, and about as broad as propodus.

#### Material:

In order to revise as many of the species of *Munnopsis* as possible I received on loan, through Dr. A. CAPART of the Royal Institute in Brussels, two males of *M. australis*, and through Dr. T. E. BOWMAN of the U.S. National Museum in Washington, the *Albatross* material of *M. latifrons* and some specimens identified as *Munnopsis* sp. by RICHARDSON (1909).<sup>1</sup> In addition, Dr. BOWMAN compared *Ga-thea* specimens of *M. longiremis* with the holotype. Of the *Challenger* material of *M. australis*, *gracilis*, and *latifrons* only the holotypes are known, and these could not be borrowed from the British Museum. Therefore, Dr. I. GORDON very kindly answered a number of questions and made some drawings at my request. However, at a later date I found an opportunity to visit the Museum myself and to study the three types in detail.

1. These have been referred to *Munneurycope murrayi* (p. 157).



*Munnopsis beddardi* (Tattersall, 1905), *M. eximius* (Hansen, 1916), and *M. typica* M. Sars, 1861 (Text-figs. 118-119)

For various reasons I have examined material of these three species in this Museum and have found omissions or errors in earlier descriptions or illustrations in the following examples: (1) Presence of crest on mandibles in all three species; (2) partial fusion of pleopods 2 in the two latter; (3) number of joints in antennula of *eximius*; (4) shape of pleopods 1 in *typica*; (5) setae on the head in *beddardi*.

(1) Crest on upper side of mandibles. A reduced crest was found in the three above-named species. In *beddardi* and *eximius* (Fig. 118a-b) it is somewhat similar to that in *mandibularis* (Fig. 136e) and *longiremis* (126c), but much smaller. In *typica* the crest has been transformed into a projecting, subacute, slightly upward-turning process which gives the mandible a subtriangular appearance when seen from outside, as in Fig. 118c (cf. HANSEN 1887, fig. 2a, pl. XX). It is interesting to observe that in *typica* a strongly reduced crest is combined with two teeth in the incisive part, a well developed movable lacinia, and a 3-jointed palp. But in *mandibularis* and *longiremis* a well developed crest is found together with a 1-toothed incisive part, a reduced (*mandibularis*) or absent movable lacinia (*longiremis*), and a reduced, 2-jointed palp (*mandibularis*).

(2) Partial fusion of pleopods 2.

(a) *M. typica*. In his otherwise excellent description of this species M. Sars (1868, p. 305) expressly states (translated from the Norwegian): "The male operculum consists of three, throughout their total length, totally separated pieces," and his fig. 107 (pl. VI) shows a single (left) pleopod 2. In his additional description of *typica*, HANSEN (1887) does not mention the pleopods; neither does G. O. Sars describe them in his monograph but his illustration on

pl. 58 of the first pleopods and the left pleopod 2 leaves no doubt that he considers the latter to be totally separated from the right one. Finally, HANSEN (1916) states (pp. 153 and 156) that "second pair of pleopods (are) free to the base" in *M. typica*. – It was therefore quite remarkable to find in all examined specimens of this species a distinct fusion of the second pleopods near the base, almost as pronounced as in *P. oceanica*. In Fig. 119e-f, the right pleopods 2 and part of the left can be seen in specimens from East Greenland and the Skagerrak. Fusion occurs in both cases, but is greater in the Greenland specimen. In addition, the sympod is a little broader distally, and the copulatory organ is considerably smaller and more slender than in the Skagerrak specimen. The exopods are equal.

(b) *M. eximius*. In his description (1916, p. 158) HANSEN wrote: "Second pair of pleopods quite independent to the base ...," as is also shown in his fig. 2n (pl. XIV). I have dissected one of the undissected males from *Ingolf* St. 36 and found pleopods 2 (Fig. 119g) fused to the same degree as in the East Greenland specimen of *typica*. The inner margin of the sympod proved to be slightly concave, the two lateral margins being thus rather parallel, and the whole sympod narrower.<sup>1</sup> The tip of the exopod protrudes.

(3) Number of joints in antennula of *M. eximius*. HANSEN's fig. 2f (pl. XIV) shows only three joints in the peduncle. In actual fact, the usual four joints in both sexes are present, joint 3 in fig. 2f being divided into two joints of which the proximal is the longer.

(4) Shape of pleopods 1 in *M. typica*. G. O. Sars (1899, pl. 58) figured the first pair of pleopods in the male as being considerably broader than in any other species and with almost parallel margins. HANSEN later (l. c., p. 156) used i. a., this feature to separate *Munnopsis* from *Munnopsoides* and *Pseudomunnopsis*.

While examining specimens of *typica* from East Greenland (*Godthaab* St. 84, *Dusénfjord*, 24 m depth), I discovered that the pleopods were as illustrated in Fig. 118c, i.e. very nearly twice as wide in the distal half as they are near the proximal end – in other words exactly the same as in the other species. It should be mentioned that a similar slenderness, but a not quite so pronounced difference in width in the proximal and distal parts, appear

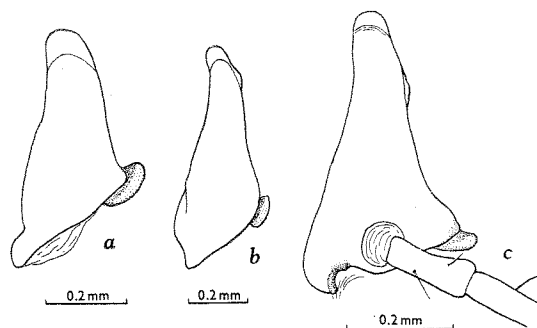
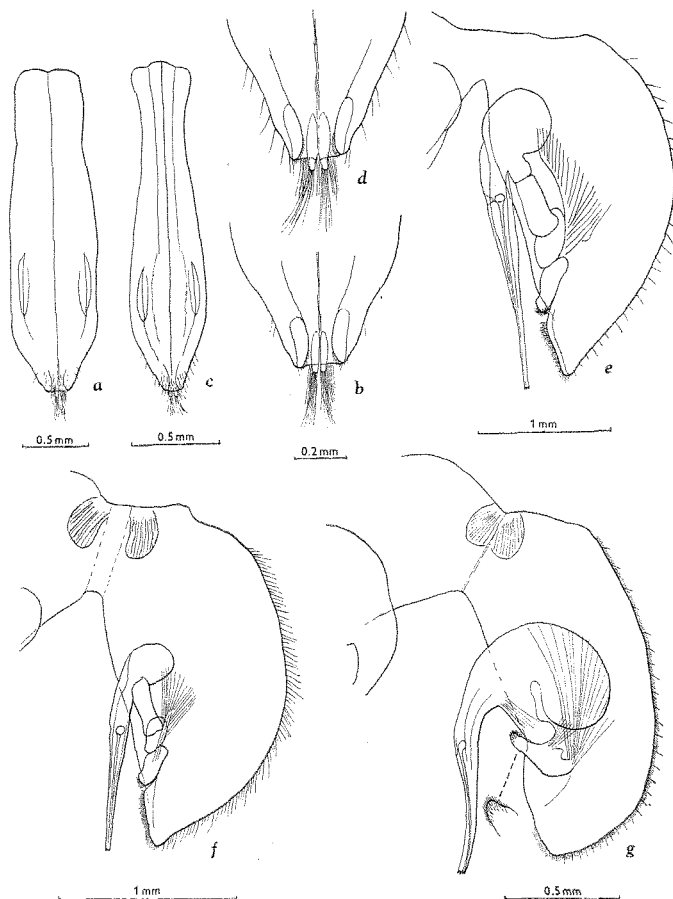


Fig. 118. Left mandible seen from outside; a, *Munnopsis beddardi* (Tattersall), ♀; b, *M. eximius* (Hansen), ♀; c, *M. typica* M. Sars, ♀.

1. The actual pleopod drawn by HANSEN has been examined; it is almost the same as in my Fig. 119g, although the outer margin is slightly more convex.

Fig. 119. a-b and e, *Munnopsis typica* from the Skagerrak; c-d and f, *M. typica* from East Greenland; g, *M. eximius*; a and c, male pleopods 1 from the ventral side; b and d, apex from the dorsal side; e-g, right pleopod 2 and base of left.



from M. Sars' old drawing (1868, pl. VI, 108), and he describes the pleopods as "narrow, almost spear-head-shaped". In order to make a comparison, I dissected a male from the Skagerrak (*Thor* St. 297 (1904), 29 sea-miles N.t.W. of the Scaw Lightship, 310 m depth); this locality is rather close to the Oslo Fjord where G.O. Sars' material originated. The pleopods (119a) are quite close to those figured by G.O. Sars (pl. 58). In spite of the remarkable disparity in general shape, the distal ends are almost exactly equal (119b, d). The slight differences in the second pleopods were pointed out above.

In addition, the Greenland specimens have true spines on the head and on pereonites 6 and 7 and pleon – in place of the rounded processes found in the Skagerrak material. Apart from this feature, and the differences in pleopods 1 and 2, no other diverse characters were found.

Although all other species of *Munnopsis* which I have studied had a 2-jointed exopod on pleopod 3, an examination of many specimens of *typica* showed that M. Sars (1868, pl. VII, 134) and G.O. Sars (1899, pl. 58) are correct in drawing the exopod in that species with one joint only.

(5) Setae on the head in *M. beddardi*. A considerable variation was found in this feature. The single male from *Ingolf* St. 36 (Davis Strait) had only the row of stiff setae at the base of the epistome, as mentioned by Tattersall and Hansen (but not by Barnard 1920), while all four specimens from *Thor* St. 99 (SW of the Faroes) had setae – as long as those in the front row – all over the upper part of the head. In a juvenile, a male and a female they were rather scattered,<sup>1</sup> but in another female they were so plentiful that the actual row of setae was indistinguishable.

Of the *Ingolf* material of *eximius* from St. 36, the well-preserved female described and figured by Hansen (p. 159, pl. XIV, 2a-2h) has been chosen as lectotype; all the drawn mouthparts and appendages are still kept (in alcohol). The dissected male and the figured appendages (pl. XIV, 2i-2w) have also been transferred to the type collection.

Intestine contents of *beddardi* are recorded in Table 17, p. 240.

1. This female is figured by Hansen (l. c., pl. XIV, 3b) with the head devoid of setae, except for the anterior row.

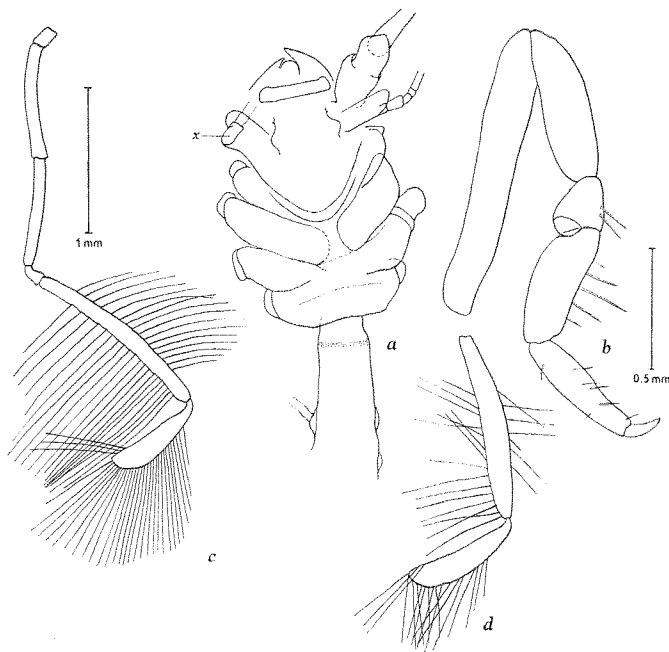


Fig. 120. *Munnopsis australis* Beddard; a-b and d, ♀ holotype; c, ♂ No. 656 from the *Belgica* Exp.; a, anterior two-thirds of body, drawn by Dr. I. GORDON (x, base of antenna); b, left pereopod I; c-d, prp. V, VI or VII.

***Munnopsis australis* Beddard, 1885**  
(Pl. XII A-B; Text-fig. 120)

*Munnopsis australis* Beddard, 1885, p. 917; BEDDARD 1886b, p. 53, pl. XIII, 1-11.

*Munnopsoides australis* (Beddard), TATTERSALL 1905, p. 25; MONOD 1926, p. 25, figs. 19-22.

In London, the two males of the *Belgica* material (MONOD, l. c.) were compared with the female holotype and only specimen from the *Challenger*. All material is, unfortunately, mounted on slides and not in a very good condition. As a supplement to BEDDARD's and MONOD's studies I shall give the following

**Additional description:**

*Pereonites 1-4.* The original shape of prns. 1-2 is difficult to ascertain; according to BEDDARD's drawing (pl. XIII, 1), the recent photograph of the type (Pl. XII A) and Fig. 120a, they are distinctly V-shaped, but may have become so when mounted on the slide (the specimen was already mounted when BEDDARD described it). It is probably true that prn. 1 was always only about half as long in the middle as it was laterally. A slide of one of the *Belgica* males (Pl. XII B) shows prn. 2 with a straight anterior and a rather convex posterior margin. In the female (120a), prns. 2 and 3 seem to be equally broad, while in the male, prn. 3 is definitely the broadest. It should be noted that great differences in the shape of prns. 1-4 in the two sexes are found in several other species, e.g. *M. bathyalis* n. sp. (Pl.

XIII B, D). The median keel shown in BEDDARD's fig. 1 does most decidedly not seem to be present in the holotype.

*Pereonites 5-7 and pleon* are so closely fused in both the female holotype and the two males that it was impossible to distinguish any separations, except a very faint one between prn. 7 and pleon in one of the males. Thus, the mutual length of prns. 5-7 could not be established. It is almost certain that the separations in BEDDARD's fig. 1 are incorrect; they are probably comparable to e.g. *bathyalis* (Fig. 130a). In the female, prns. 5-7 and pleon are very elongated, being almost five times longer than broad, whereas in the males they are less than four times longer than broad, and in pleon, comparatively narrower. There is no terminal process on pleotelson of the female as figured by BEDDARD.

*Antennula and antenna.* The actual shape of joint 1 of the female antennula could not be made out, since it was seen from the edge. Joints 2-4 of the peduncle are much the same as in the male. There is no doubt that the very long joint 5 of the antenna is bent and broken, and thus, does not consist of one long and one short joint as shown in BEDDARD's fig. 3. Additionally, it is less wide at the distal end than in his figure.

*Mandibles* of the female are in general shape as those of the male (MONOD's fig. 20 E), but it was impossible to see a movable lacinia. It would appear that a knob similar to that in *eximius* (Fig. 118b) is present.

*Maxillipeds* of the female are difficult to see, but seem very close to MONOD's fig. 19 F (thus differing

considerably from BEDDARD's fig. 9). – The remaining mouthparts of the males are also in accordance with MONOD's figures; those of the female could not be seen.

*Pereopod I* of the female (Fig. 120b) very similar to that of the male. MONOD has pointed out the misprints in BEDDARD's text; line 20 from below (p. 55) should read: "The first appendage is displayed in fig. 4; the second pair of appendages are more slender than the first ..."

*Pereopod II* of the female almost as in BEDDARD's fig. 5, but carpus is somewhat more slender, being almost six times longer than broad. Although MONOD's fig. 22 shows carpus in the male prp. II as being too slender, it is nevertheless more elongated in the male, being seven times longer than broad. The two succeeding pairs of legs are lost in all specimens.

*Pereopods V-VII* of the female have carpus and propodus according to my Fig. 120d, i.e. propodus is more than half as long as carpus. In the males (120c) propodus is less than half as long as carpus and the latter is also more slender. In both sexes propodus lacks setae along most of the anterior margin as well as along the proximal part of the posterior margin. The total length of each of the prps. V-VII is, in the female, somewhat less than that of prns. 5-7 + pleon, while in the males they are slightly longer.

*Male pleopods* exactly as in MONOD's fig. 20 A-C. – Length of *uropods* in both sexes between half and one-third the width of pleon. The two joints are of equal length, the first about twice as broad as the second.

#### Remarks:

This species is very close to *M. eximius*. A careful comparison of the type specimens showed that it differs from *eximius* in the following respects: (1) Carpus of pereopod I considerably stronger and with fewer but longer setae; (2) basis of prp. II longer than ischium; (3) distal end of male pleopods I quite truncate; (4) uropods comparatively longer. Several features could not be compared due to the rather poor state of preservation of *australis*; this applies especially to the shape of the pereonites.

#### Distribution:

Subantarctic Indian Ocean SE of South Africa (2926 m, 1.2°C.) and Antarctic Ocean SW of South Africa<sup>1</sup> (about 400 and about 500 m).

1. MONOD (1926, p. 25) gives the occurrence as "78°00'S, 88°48'W" which is a misprint for 70°00'S, 80°48'W (cf. 1. c., pp. 28, 32, 33, 38, and 43).

#### *Munnopsis latifrons* Beddard, 1885

(Pl. XII C-E; Text-figs. 121-124)

*Munnopsis latifrons* Beddard, 1885, p. 917; BEDDARD 1886b, p. 56, pl. X, 1-4; RICHARDSON 1909, p. 119, figs. 43-44; 1912b, p. 162.

A careful comparison between the female holotype and only specimen from the *Challenger* and the *Albatross* material (four specimens), has shown that the specimens are alike in all major respects studied, with the exception of the mandibular palp.

#### Material:

*Challenger* St. 232, West Pacific off Japan (35° 11'N, 139°28'E), 612 m, 12 May 1875. Bottom temp.: 5.1°C. – 1 female.

*Albatross* St. 4919, East China Sea (30°34'N, 129°19'30'E), 805 m. – 1 female, 2 males. (U.S. Nat. Mus. 39896).

*Albatross* St. 5082, West Pacific off Japan (34° 05'N, 137°59'E), 1211 m. – 1 male (U.S. Nat. Mus. 39895).

#### Additional description:

*Body* (Pl. XII C-D) about three-eighths as broad as long.

*Head* with antennulae and antennae set in a common socket, surrounded by a raised rim. Behind the socket is a large, slightly swollen, "eye-like" area with an even surface, i.e. without the minute "punctulations" (probably misprint for punctuations), stated by BEDDARD. However, it is possible to discern through the transparent skin many small, muscle-like nodules which are attached to the inner side of the skin and are probably part of vestigial eyes (Pl. XII C).

*Pereonites 1-4*. In dorsal view prn. 3 (*not* 4) is the longest laterally. Medianly, prn. 3 is the longest, 4 the shortest. Developing oostegites are present on the coxae of both the *Challenger* female and the only *Albatross* female, being subtriangular on prns. 1-3 and almost circular on 4.

*Pereonites 5-7* have the lateral parts bent even further backwards than in BEDDARD's fig. 1 (pl. X). Dorsally, prn. 7 is slightly longer than 6. The width decreases a little from prn. 5 to 7. Prn. 5 one-fourth narrower than 3.

*Pleon* according to Pl. XII C-D, thus, it is quite different posteriorly from BEDDARD's fig. 1. Although pleon was very mutilated in the *Challenger* specimen it was found to correspond exactly with the *Albatross* material. Anterior margin almost semi-

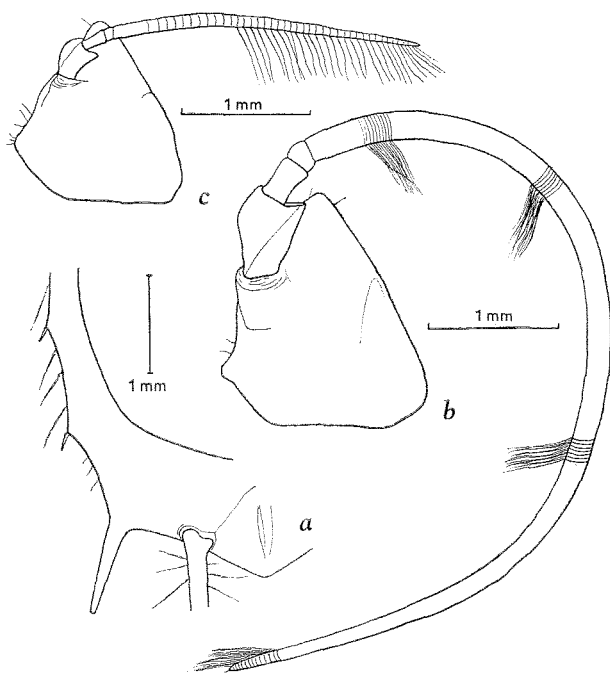


Fig. 121. *Munnopsis latifrons* Beddard from *Albatross* St. 4919; a, postero-lateral corner of pleotelson of described ♂, from below; b, left antennula of descr. ♂; c, left antennula of the equally large ♀ from the same station.

circular, lateral margins somewhat convex, broadest in the middle, and with two small projections, each armed with a tiny spine (which were overlooked by BEDDARD). Posterior margin decidedly not truncate, but with a triangular, median process (Fig. 121 a). Postero-lateral spines narrow at the base and directed almost straightly backwards. Dorsally, a considerably vaulted, oval area on each side and a median, T-shaped, less vaulted area which is two and a half times narrower than each of the vaulted ones (Pl. XII D).

The uropods are inserted ventrally, close to the posterior margin and half way between the spine and the median projection (121 a). There is a thickening at the posterior end of the branchial cavity, immediately before the almost diamond-shaped anal face; this thickening is very distinct in the male.

*Antennula* with joint 1 definitely not 2-jointed as figured by BEDDARD. It is triangular, with a regularly vaulted upper surface, except for an oblique ridge on the inner side. Joint 2 in the two females very small, only reaching a little more than half way to the distal end of joint 1 (121 c). In the males joint 2 is almost twice as large, reaching to the distal end of joint 1 (121 b); it has a sharp inner corner distally. Joint 3 in the females almost twice as long as broad, somewhat broader in the males. Joint 4 very small

in both sexes, but flagellum much stronger and about three times as long in the males.

*Antenna* as in *M. longiremis* (Fig. 125 c, g), i.e. with a small, but distinct triangular squama. The two distal joints of the peduncle and the flagellum of the *Challenger* specimen have been lost since BEDDARD described and figured them.

*Labrum* (122 e) less than three times as broad as long, with a small median projection.

*Mandibles* (122 c) equal in both sides, triangular and very broad, the outer margin being only one-fourth longer than the maximum width. One very broad, strong and rounded tooth distally. The crest as well developed as in *longiremis* (126 a-c), but projecting slightly less when seen from the outer edge of the mandible (126 c), and more rounded "anteriorly" (upper right in Fig. 122 c) when seen in frontal view. No movable lacinia, spine-row or molar process present. Palp reduced, but more so in the *Challenger* than in the *Albatross* specimens.

In the former, joint 2 is almost twice as long as joint 1 and joint 3 very short, being only about one-fifth of the second (122 a). Distally, on joint 2 are two rather short, strong spines. The entire palp is much shorter than the mandible, being less than three-fourths the length of the outer margin. In the *Albatross* specimens (122 b) the palp is one-seventh longer than the outer margin, i.e. more than one-third longer than in the *Challenger* specimen and somewhat thinner. Joint 1 of the palps of almost equal length but joint 2 considerably longer in the *Albatross* specimens (more than twice as long as joint 1), and furnished with a row of about ten long setae. Joint 3 much less reduced, being nearly as long as joint 1; it has a row of short setae and one long, terminal seta. It was not possible to find a palp on the right mandible of the *Challenger* specimen, but being unable to dissect the type I cannot state with certainty whether it was actually missing or just broken off.

*Labium* (122 d) has inner lobes of unequal length and very different in shape. Outer lobes of the usual shape.

*Maxillula* and *maxilla* according to Fig. 122 f-g, i.e. the former with the nine teeth on outer endite varying considerably in length (inner endite as in *longiremis*), and the maxilla with very slender endites and no pronounced seta on the inner one.

*Maxilliped* (122 h) with joint 2 of the palp much broader than the sympod and broader than long. Joint 3 more than twice as broad as long and joints 4 and 5 unusually large, joint 4 being even as long

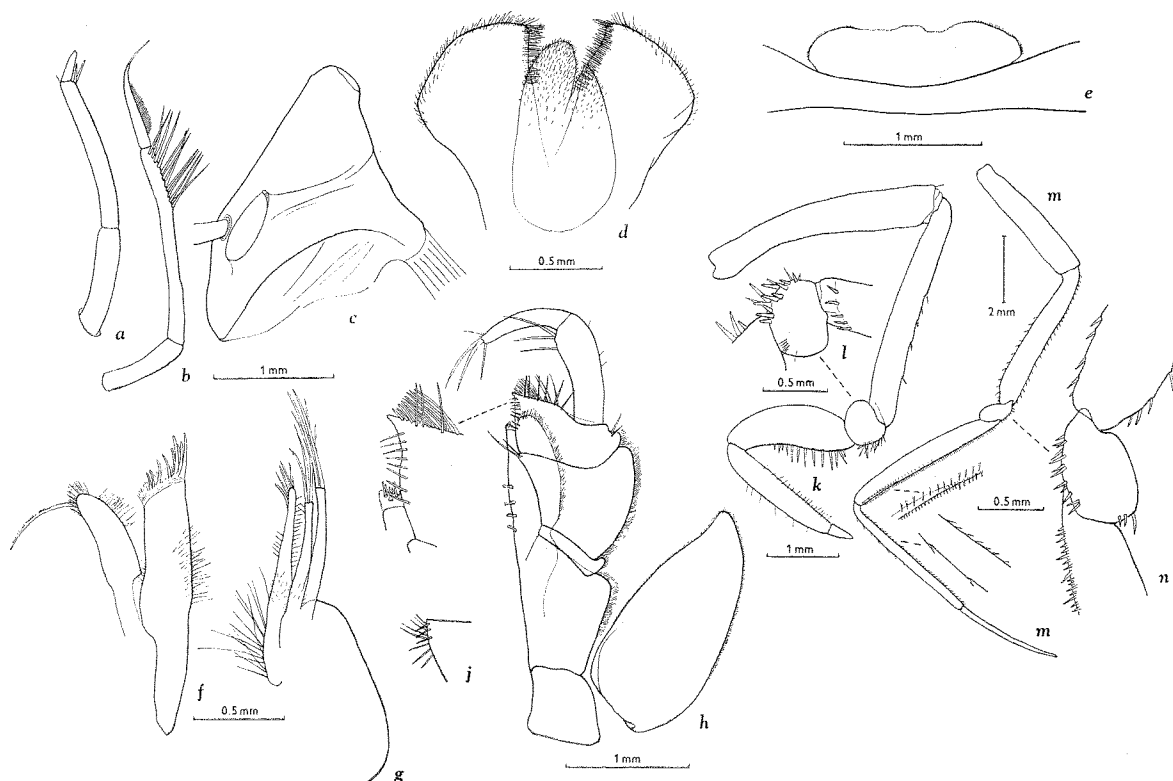


Fig. 122. *Munnopsis latifrons* Beddard; a and j, ♀ holotype; b-h and k-n, described ♂ from *Albatross* St. 4919; a-b, palp of left mandible; c, left md. from above; d, labium; e, labrum; f-h, left maxillula, maxilla and maxilliped; j, distal corner of joint 3 of palp of mxp.; k, left pereopod I from outside; l, merus of same from inside; m, left pereopod II from outside; n, merus of same from inside.

as the width of joint 2. Endite very narrow, with two coupling hooks on the right mxp., three on the left (in one *Albatross* male, four). The setae arrangement on inner margin of joint 3 of the palp stronger in the *Challenger* (122j) than in the *Albatross* specimens.

It should be noted that with regard to the mouthparts of the *Challenger* female, only the mandibular palp and the maxillipeds could be studied in detail.

*Pereopod I* (122k) with basis and ischium of equal length. Carpus only a little more than half as long as ischium and between one-third and one-fourth as broad as long. Propodus a little longer than carpus and slender. On ischium several rather short spines along the lower (posterior) margin and five distal spines (122l). Merus has eight short, strong spines (and a few weaker) on the margin and part of the inner surface (122l). Found on carpus is a row of 12-13 short and not very strong spines.

*Pereopod II* (122m) very slender and one-sixth longer than the body. Ischium longer than basis, and carpus and propodus still longer. Entire lower margin of most joints with numerous short, closely set spines (122n).

*Pereopods III and IV* preserved, but detached from the body. In one leg carpus is 64 mm, but the rest is broken off; in another, carpus is 57 mm, propodus 42 mm, the preserved part of dactylus 13 mm, the total length of the leg at least 116 mm. The body is only 16 mm; thus the remarkable length of these legs is more than seven times that of the body!

*Pereopods V-VII* are shown on RICHARDSON's fig. 44 which is fairly correct, although the distal end of carpus is more pointed and curves somewhat backwards, and the front margin of propodus is straight. Carpus almost four times longer than broad. The setae on carpus and propodus not very numerous or long.

*Male pleopods 1* (123a-b) exceedingly slender and not particularly widened distally; the length is more than eight times the maximum width. Seen from the side, the distal third is almost straight, but the proximal two-thirds is strongly curved in an angle approaching 90°. Outer, distal lobes have an almost right-angled corner. On the right side only of the *Albatross* holotype (but not in the other males), a conspicuous, slightly downward-pointing spine was found (s in Fig. 123c). In comparison with *longiremis*

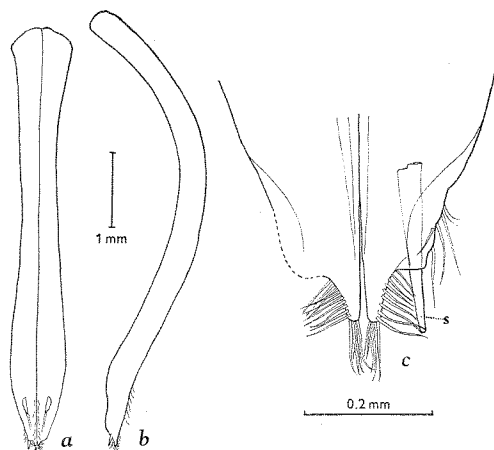


Fig. 123. *Munnopsis latifrons* Beddard; descr. ♂ from *Alb.* St. 4919; a, pleopods 1 from below; b, from the side; c, apex from inside.

(p. 197) it was found that this spine merely represents the outermost tip of the stylet on pleopod 2 which has been broken off. The two inner projections considerably shorter than the distance between the corners of the two outer lobes. A number of rather short setae cover the distal, ventral surface of the pleopods and the outer and distal margins of the two inner projections.

*Male pleopods 2* (124a) fused along almost two-thirds of the median line which forms a sharp, somewhat convex keel (in side view). The fused pleopods are shaped like a boat – and are almost exactly like the female operculum. Copulatory organ (124b) extremely small, being less than one-eighth as long as the sympod and hardly reaching beyond this. Long setae on the lateral margins of the sympod.

*Female operculum* of the usual boat-shape, with a sharp, convex keel medianly and a few, rather long setae laterally and postero-laterally.

*Pleopod 3* (124c) with an ovate endopod and a

narrow, 2-jointed exopod with long, feathered setae distally.

*Uropods* (124d) very slender and more than half as long as pleon. Joint 1 twice as long as joint 2 and with many long, thin setae. The uropods are now missing in the *Challenger* specimen; according to BEDDARD they were “almost as long as the caudal shield”.

*Size*: Female holotype *c.* 15 mm long. Largest male 16.8 mm long, 6.8 mm across pereonite 3.

#### Remarks:

No differences could be found in the *Albatross* specimens. With the exception of the mandibular palp (and armament with setae on the maxillipedal palp) they also agree with the *Challenger* female in all respects. The differences in the mandibular palps can be summarized as follows:

*Albatross* specimens: Palp longer than the mandible; joint 2 somewhat more than twice as long as joint 1 and two and a half times longer than joint 3; joint 2 with a row of about ten long setae, joint 3 with a row of short setae and one long, terminal seta.

*Challenger* specimen: Palp shorter than the mandible; joint 2 almost twice as long as joint 1 and five times longer than the reduced joint 3, which is devoid of setae; joint 2 with two distal spine-like setae.

Furthermore, it must be emphasized that the mouthparts of the *Challenger* female were not dissected, nor were there any preserved pereopods or any males in the *Challenger* material. A very necessary comparison between the male pleopods of the two forms could, therefore, not be undertaken.

In my opinion, it is not possible to establish a new subspecies or species based solely on the difference in the mandibular palp, the reduced palp in the *Challenger* specimen probably being abnormal. This supposition is borne out by the fact that the

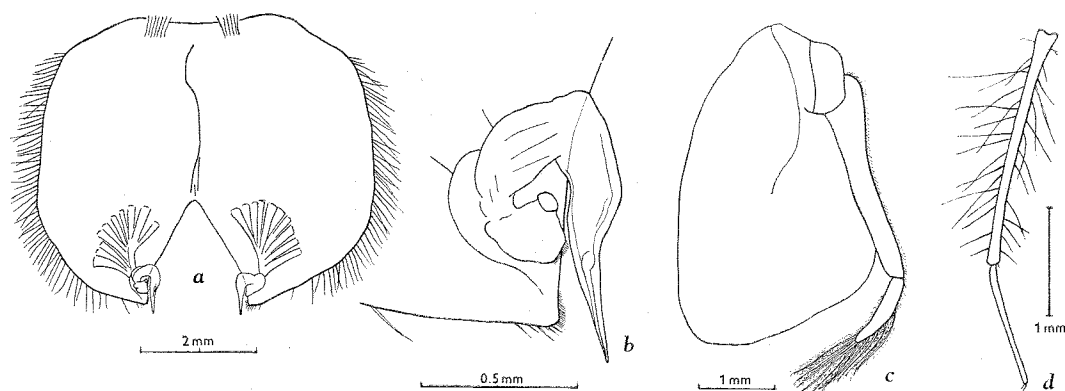


Fig. 124. *Munnopsis latifrons* Beddard from *Alb.* St. 4919; a-c, descr. ♂; a, pleopods 2; b, copulatory organ; c, pleopod 3; d, uropod of ♀.

two localities of the *Albatross* material are much further apart (one even inside the East China Sea), than are the Pacific Ocean localities of the *Albatross* and *Challenger* specimens, which are separated by a distance of less than 100 sea-miles. This excludes the possibility of subspecies being involved.

The said difference in the mandibular palps agrees well with the general extreme variation in the mandibles found in this genus (cf. Table 9). It also supports the view that not too much stress should be placed on the shape of the mandibles in taxonomic considerations and that presence or absence of palp – as has been repeatedly stated in this paper – is a matter of minor importance and should not be regarded as a distinguishing factor on the generic level (cf. p. 19).

The differences between *latifrons* and the closely related *longiremis* from the East Pacific are discussed on p. 198.

Intestine contents are recorded in Table 17, p. 240.

#### Distribution:

West Pacific, S. of Japan and East China Sea, 612-1211 m, *c.* 2.8-6°C.

#### *Munnopsis longiremis* Richardson, 1912

(Pl. XII F-G; Text-figs. 125-128)

*Munnopsis longiremis* Richardson, 1912b, p. 161, figs. 3-4.

#### Material:

*Galathea* St. 716, East Pacific Ocean off Costa Rica (9°23'N, 89°32'W), 3570 m, 6 May 1952. Bottom: dark, muddish clay. Bottom temp.: *c.* 1.9°C. – 1 entire male, fragments of 32 males and 4 females.

Dr. T.E. BOWMAN of the U.S. National Museum has kindly compared a male and a female of the *Galathea* material to the male holotype and only

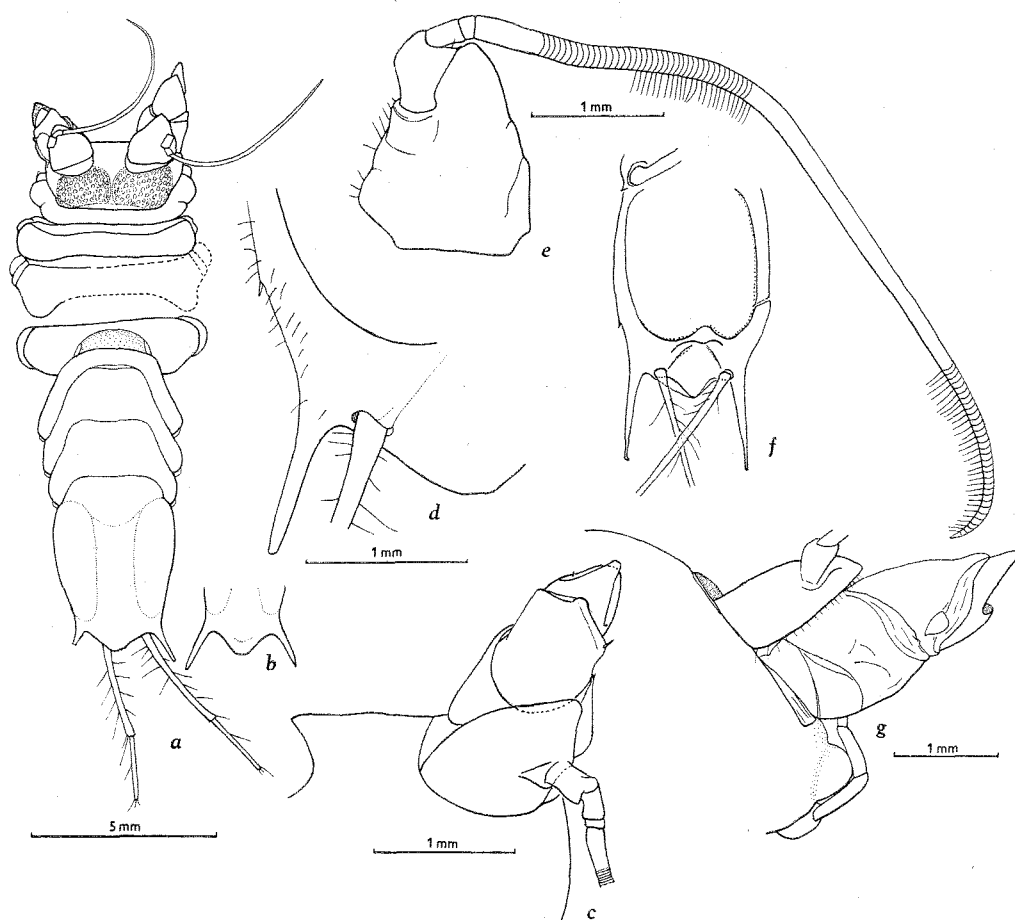


Fig. 125. *Munnopsis longiremis* Richardson; a, d-e and g, described ♂ from *Galathea* St. 716; c and f, ♂ holotype from *Albatross* St. 2807 (T.E. BOWMAN del.); a, dorsal view; b, posterior part of another *Galathea* ♂; c, anterior right corner of the head; d, right postero-lateral spine from below; e, left antennula; f, ventral view of pleon; g, proximal joints of antennula and antenna in side view.



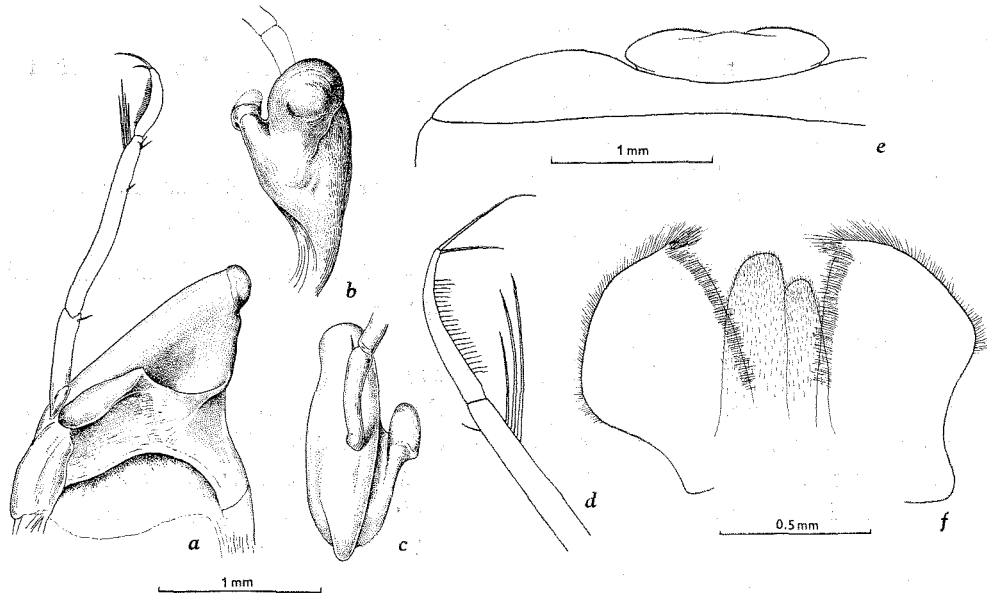


Fig. 126. *Munnopsis longiremis* Richardson; a-c and e-f, descr. ♂; d, ♂ holotype (T.E. BOWMAN del.); a, left mandible from above; b, from the apex; c, from outside; d, distal joints of palp (exact number of setae on inner margin of the last joint not shown); e, labrum; f, labium.

specimen in Washington. His replies in response to my questions and his figures of special features of the type leave no doubt that they belong to the same species. I would like to thank Dr. BOWMAN for his help and for permission to include his figures in the following

#### Additional description:

**Body** (Fig. 125a). Only one of the *Galathea* specimens had an unbroken body. However, it was so mutilated between pereonites 3 and 4 that it became broken here before a drawing and photograph of the entire animal could be made. In all the specimens the body appears quite hyaline as only the thin integument and the alimentary canal are preserved; the colour is light yellowish. The body is about two-fifths longer than broad.

**Head** exactly as in *latifrons* both in shape and in appearance – with regard to the spotted areas. Dr. BOWMAN points out that in the holotype the distance between the antennulae is considerably less than in RICHARDSON's fig. 3; the actual distance is shown in Fig. 125c.

**Pereonites 1-4** (125a), probably as in *latifrons*. Prn. 3 the broadest, but it is in such a mutilated condition that the length cannot be stated. The dorsal part of prn. 4 is so excavated from behind that it is the shortest pereonite in the *Galathea* material, but this is not so in the holotype.

**Pereonites 5-7** decrease somewhat in width posteriorly, and have moderately distinct separations

which are very truncate dorsally. The ratio of the width of prn. 5 to that of prn. 3 is about 4:6 in the holotype and 4:5 in the *Galathea* specimens. Laterally, the segments are of about equal length. Medially, this also applies to prns. 6 and 7, while prn. 5 is no longer in the middle than it is laterally.

**Pleon** (125a, f) with the front margin truncate and the lateral margins convex anteriorly, somewhat concave posteriorly (less so in the type than in the *Galathea* specimens). The posterior of the small lateral spines in *latifrons* is also present here, but considerably smaller (125d), while in the place of the anterior spine in *latifrons* only a rather thick seta (and no projection) is found in *longiremis*. The slender postero-lateral projections point backwards and slightly (holotype) or somewhat outwards; they are longest in the holotype. The posterior margin of pleon is convex, but somewhat truncate medially. The dorsal surface has two distinct lateral convexities which are each only little more than one-third of the width of pleon. Uropods inserted ventrally, much closer to the postero-lateral spine than to the median line (125d, f).

**Antennula** (125c, e) almost as in *latifrons*, but the oblique, inner ridge on joint 1 closer to the base, and flagellum less strong and longer in the male (not known in female); the setae also considerably shorter and less numerous.

**Antenna** (125c, g) with only joints 1-4 preserved. Squama small, but distinct, triangular in lateral view.

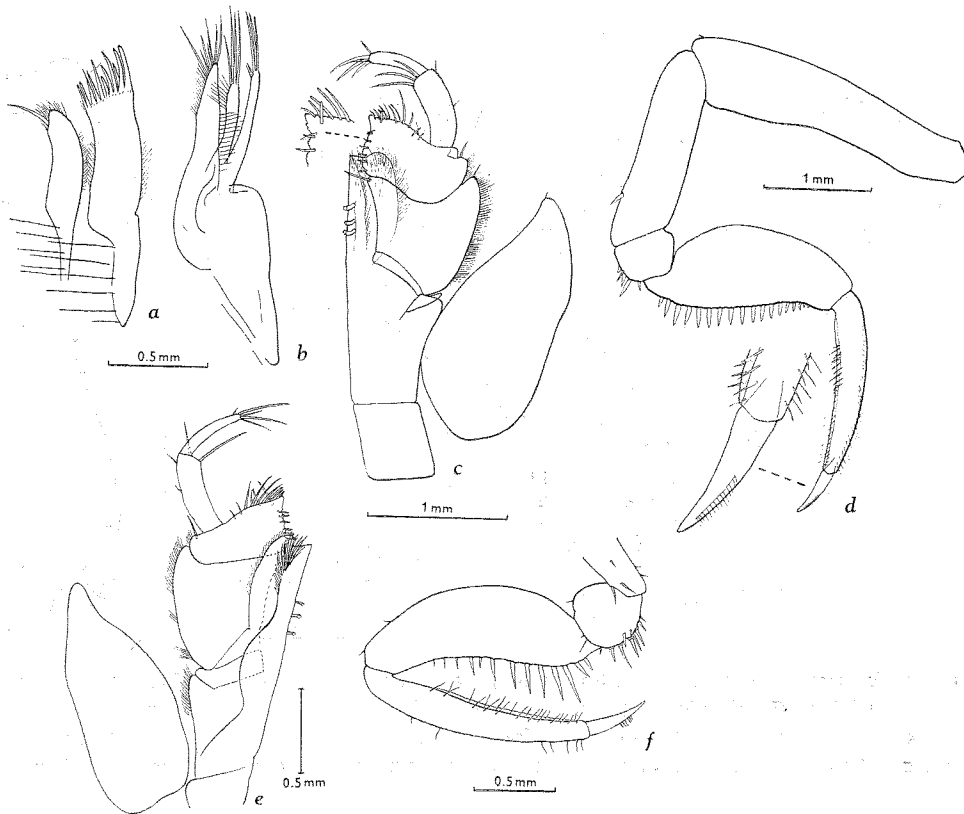


Fig. 127. *Munnopsis longiremis* Richardson; a-d, descr. ♂; e-f, ♂ holotype (T.E. BOWMAN del.); a-b, left maxillula and maxilla; c, left maxilliped from outside; d, right pereopod I from outside; e, left mxp. from inside; f, right prp. I from inside.

*Labrum* (126e) three times as broad as long; front margin with one median and two lateral convexities.

*Mandibles* practically identical in the holotype and the *Galathea* material. They are equal in both sides, triangular and somewhat more slender than in *latifrons*, the outer margin being one-third longer than the maximum width; the distal tooth also less strong (126a). The crest on the upper side well developed, high, rather long and with a distinct, swollen distal margin as in *M. mandibularis*; the swollen margin is visible both when the mandible is seen from the outer (anterior) edge (126c) and from the apex (126b). No movable lacinia, spine-row or molar process. Palp a little longer than the entire outer margin of the mandible. Joint 3 well developed and with two terminal setae; only three or four long setae on joint 2 (125a, d).

*Labium* (126f) with inner lobes of unequal size, both covered with many short setae.

*Maxillula* and *maxilla* according to Fig. 127a-b. Maxillula with twelve slender teeth on outer endite. The otherwise strong seta on inner endite of the maxilla not so significant in this species.

*Maxilliped* practically equal in the holotype and

the *Galathea* material (127c, e). It is also similar to that in *latifrons*, but there are three coupling hooks on each side; joints 4 and 5 of the palp smaller, although still unusually large. Endite narrow, fine hairs only present distally. Seen from the inner edge the endite and sympod are as in *bathyalis* (Fig. 131 e).

*Pereopod I* (127d, f) with ischium about as long as (holotype) or somewhat shorter than basis, and carpus as long as or slightly longer than ischium. Carpus three times longer than broad and propodus long and slender. Ischium furnished with one spine, two-thirds (holotype) or three-fourths (*Galathea* material) the distance from the proximal to the distal end. Merus with 6-10 spines and carpus with 13 spines of unequal length in the holotype (exactly as in *latifrons*), whereas in the *Galathea* material there are almost 20 spines of almost equal length; propodus with rows of short setae. Additional legs were not preserved in any specimens.

*Pleopods I* (128a-b) almost as slender and as strongly curved as in *latifrons*, being seven times longer than broad. The outer lobes not very conspicuous; they were at first thought to carry a spine (s in Fig. 128c-d) which would easily break off and

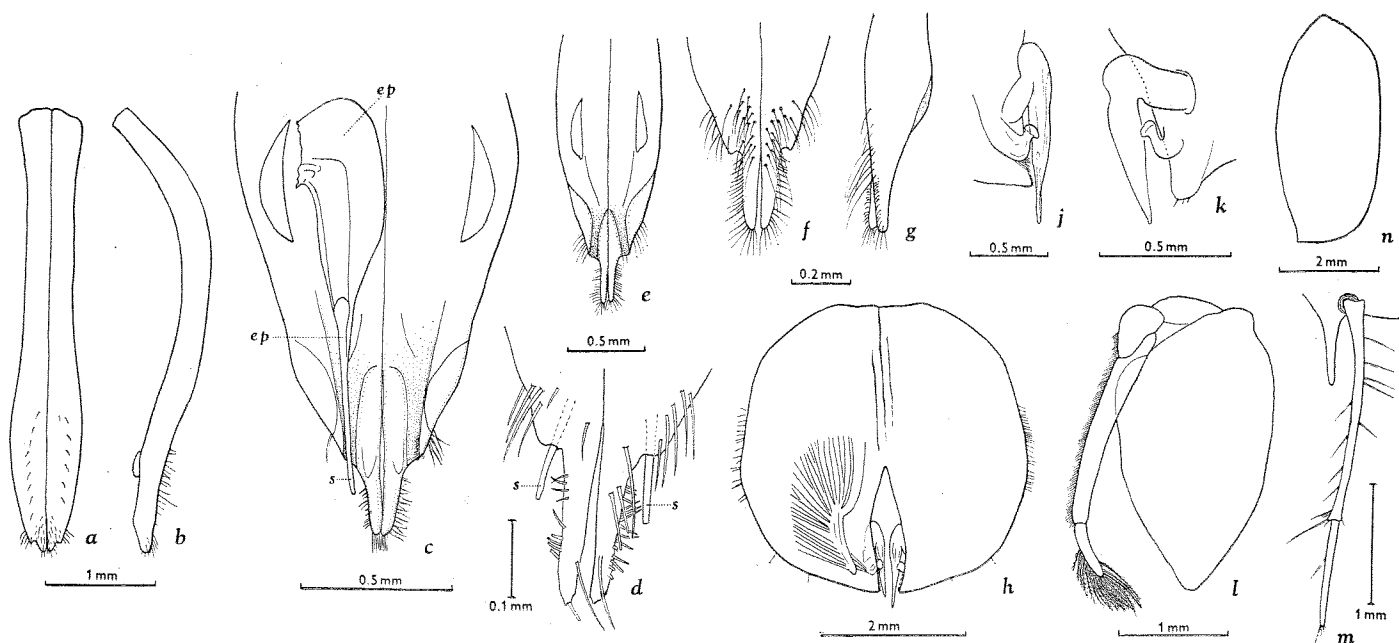


Fig. 128. *Munnopsis longiremis* Richardson; a-b, h-j and l-m, descr. ♂; d and k, ♂ holotype (T.E. BOWMAN del.); c, e-g and n, two other ♂♂ and a ♀ from *Galathea* St. 716; a-b, male pleopods 1 from outside and in side view; c and e, apex from inside; d and f, apex from outside; g, from the side; (ep, endopodite; s, tip of stylet of pleopod 2); h, pleopods 2 from outside; j-k, copulatory organ from inside; l, pleopod 3; m, right uropod; n, operculum from the left side.

therefore be absent or difficult to see in several specimens. When going through the many males and detaching pleopods 1 from the stylet of pleopods 2, it was found that the spine is simply the outermost tip of this stylet. It breaks off easily, but remains attached to the first pleopods owing to the fact that it fits into the dorsal sheath distally (cf. Fig. 128c in which the whole distal joint of the endopod (ep) of plp. 2 was detached). Inner lobes shaped as two very long, more or less narrow projections which are longer than the distance between the corners of the outer lobes (128c-e). Setae are almost only found distally, on the ventral surface and along the margins – especially of the inner projections (128d, f-g).

*Pleopods 2* (128h) fused along a little more than half the median line, which is present as a very faint keel. The outline of the pleopods is, when mounted on a slide, almost circular. Exopod (128j-k) with a button-shaped distal end. Copulatory organ very small (between one-third and one-fourth the length of the sympod), the stylet hardly reaching beyond the sympod.

*Pleopods 3* (128l) with a rather triangular endopod; exopod as in *latifrons*.

*Uropods* (128m) about as long as pleon (including the projections). Joint 1 twice as long as joint 2 and a little thicker.

*Size*: The holotype about 11 mm long (including the postero-lateral spines) and 3.5 mm wide. The maximum length of the *Galathea* specimens seems to be 15 mm.

#### Description of female:

The anterior end is not preserved. The posterior end resembles that of the male in shape, insofar as could be established from the very mutilated specimens. *Operculum* boat-shaped, with a sharp median keel; since it was mounted on a slide, it was only possible to obtain a lateral view (128n).

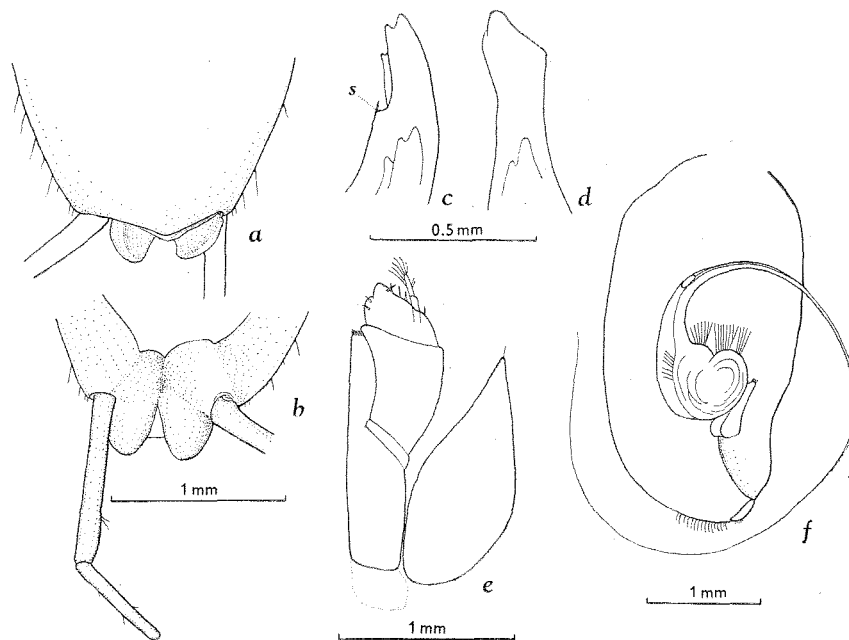
#### Variation (in *Galathea* specimens):

The only varying feature seems to be the length of the postero-lateral projections. Fig. 125b shows the longest ones in the *Galathea* material.

#### Remarks:

This species is very similar to *latifrons* in several respects – first and foremost in shape of head and pereonites, mandibles, maxillipeds, and male pleopods. The main differences from *latifrons* are: (1) The dorsal, oval areas of pleon narrower; (2) uropods inserted close to the postero-lateral spines; (3) mandibles more slender and the palp with two terminal setae and few setae on joint 2; (4) ischium of pereopod I at most as long as carpus and with one spine only on the inner margin; (5) male pleopods 1

Fig. 129. *Munnopsis gracilis* Beddard, ♂ holotype; a-b, apex of pleotelson from above and below; c-d, apex of left mandible from behind and from below; e, maxilliped; f, male pleopod 2 from inside.



having very elongate inner lobes distally; (6) copulatory organ larger in proportion to the sympod; (7) uropod about as long as pleon.

Intestine contents are recorded in Table 17, p. 240.

#### Distribution:

East Pacific off Chatham Island, Galapagos Islands at 1485 m depth and off Costa Rica at 3570 m and 1.9°C.

*Munnopsis gracilis* Beddard, 1885  
(Pl. XIII A; Text-fig. 129)

*Munnopsis gracilis* Beddard, 1885, p. 916; BEDDARD 1886b, p. 51, pl. XIV, 9-10.

#### Additional description of ♂ holotype:

*Head* quite small and bent vertically downwards, as aptly illustrated on BEDDARD's fig. 9. However, his fig. 10 is incorrect. Medianly, on the dorsal side, the specimen has a few transverse stripes and laterally, a few longitudinal, darker stripes.

*Pereonites 1-4* (Pl. XIII A) very unequal in size (as in several other males – cf. *M. bathyalis*). Prn. 1 very short both medianly and laterally and u-shaped, being bent around the posterior end of the head. Prn. 2 considerably raised, more than three times longer than prn. 1, almost equally long medianly and laterally, and with some rather irregular convexities. Prn. 3 laterally as long as prn. 4, but medianly somewhat shorter, although not as short as prn. 1.

*Pereonites 5-7* so thoroughly fused that the lines between them are almost invisible. They are of almost the same length medianly and the width is also about the same throughout; thus, BEDDARD's fig. 10 is very misleading. Prn. 5 about half as wide as prn. 2. There would seem to be no dorsal processes present.

*Pleon* now so badly damaged that only one margin and the posterior part are preserved. The two anal projections shown in BEDDARD's figures are present, but broader. When seen from the dorsal side (Fig. 129a) they are separated from the pleotelson proper by a low rim formed by the posterior margin of pleotelson. The outer margin of each projection is raised somewhat more than the inner. Ventrally, a cleft stretches forwards from the border of pleotelson and continues further forwards as a depression, but the latter feature may be due to a later injury (129b).

*Antennula* with joint 1 triangular in frontal view and one-fourth longer than wide. Joint 2 rather small, not reaching the distal end of joint 1. Joints 3 and 4 shorter than broad. Flagellum as in the other species. – *Antenna* with a tiny squama which proceeds into a spine distally.

*Mandibles* could only be studied *in situ*. Left one with an oblique, excavated cutting edge on the insicive part which has one angular tooth at one end and two at the other (Fig. 129c-d). There is a presumably well developed, spade-shaped movable lacinia, but apparently, only a greatly reduced spine-row (s in Fig. 129c). No palp.

*Maxilliped* (129e) with a comparatively broad sympod. Two coupling hooks on the right, three on left mandible. The endite has a great number of short, stiff setae distally. Joint 2 of the palp rather narrow and considerably longer than broad, joint 3 with unusually few and very short setae on the inner and distal margins. Joint 4 and 5 very small. The epipod more slender than usual.

*Pereopods* all now missing, but the basipodites are preserved in some legs. In prp. I it is 1.5 mm long and 0.2 mm broad, in prp. II 3 mm long and 0.4 mm broad, and in prps. III and IV only about 1 mm long and broad. Thus BEDDARD's fig. 9 is far from correct.

*Male pleopods* 1 torn off near the base; they are very narrow proximally. – *Pleopod* 2 is extant on one side. The basal part was studied very carefully, and it would seem that there was also in this species, a connexion between the two pleopods at a rather proximal position, although it was obviously very short. The general shape oval (129f), with a thickened narrow area near the apex. The body of the copulatory organ small, but the stylet long and slender. The exopod unusually small and partly hidden behind the body of the copulatory organ.

*Uropod* (129b) with joint 1 a little thicker and almost one and a half times longer than joint 2.

#### Occurrence:

So far recorded only from the type locality off New Zealand (40°28'S, 177°43'E) at 2012 m depth and a temperature of 2.8°C.

#### *Munnopsis bathyalis* n. sp.

(Pl. XIII B-E; Text-figs. 130-133)

#### Material:

*Galathea* St. 490, Bali Sea (5°25'S, 117°03'E), 545-570 m, 14 September 1951. Bottom: sand and clay. Bottom temp.: c. 6.5°C. – 2 females and 4 males.

#### Description of ♀ holotype:

*Body* (Pl. XIII B-C) four times longer than broad. Colour yellowish.

*Head* vaulted and smooth, but with a spotted pattern which gives impression of an uneven surface (Pl. XIII B). The pattern not "eye"-shaped as in *latifrons* and *longiremis*. Frontal margin rather narrow. An oblique, arched crest covers the inner base of antennulae and antennae (x in Fig. 130d-e); a lower crest (not arched) is found at their outer base (y in 130d, e). Two strongly vaulted convexities are positioned at the base of each mandible (z in 130e).

*Pereonites* 1-4 (Pl. XIII B-C) broader laterally

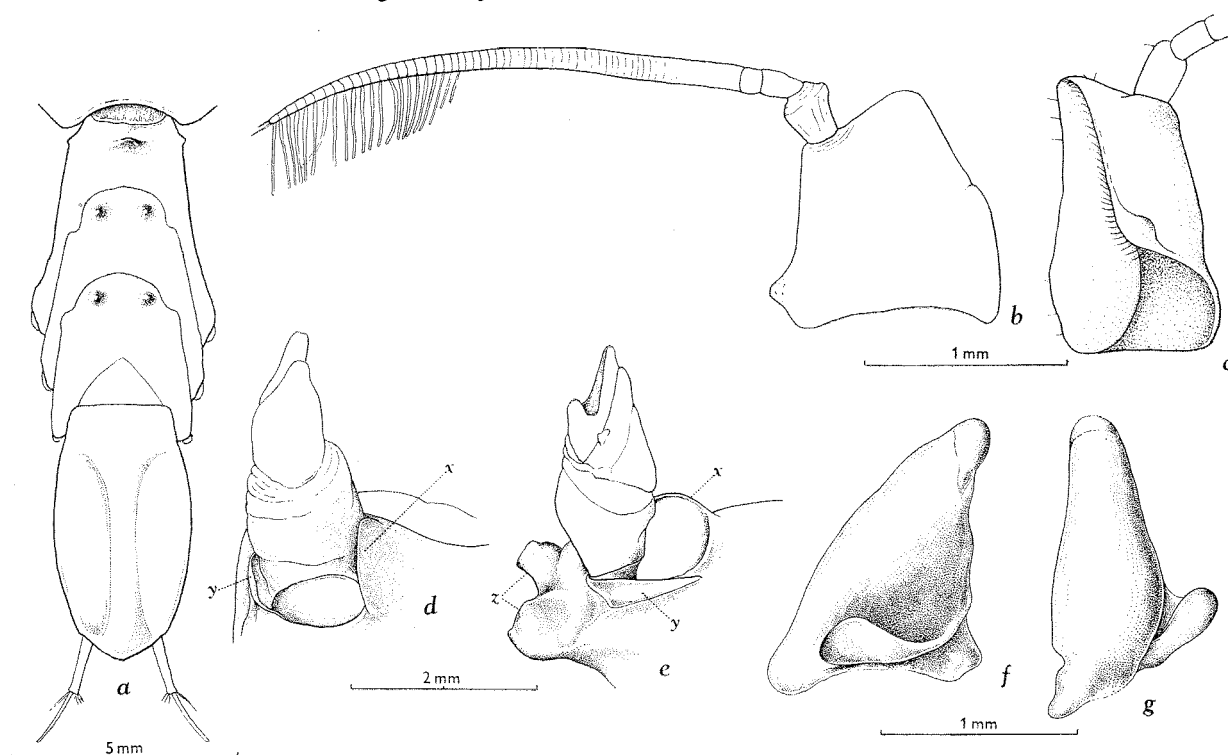


Fig. 130. *Munnopsis bathyalis* n. sp., ♀ holotype; a, pereonites 5-7 and pleon; b-c, left antennula from above and from outside; d-e, left antenna from above and from outside (antennula removed; x and y, inner and outer crest; z, convexities); f-g, left mandible from above and outside.

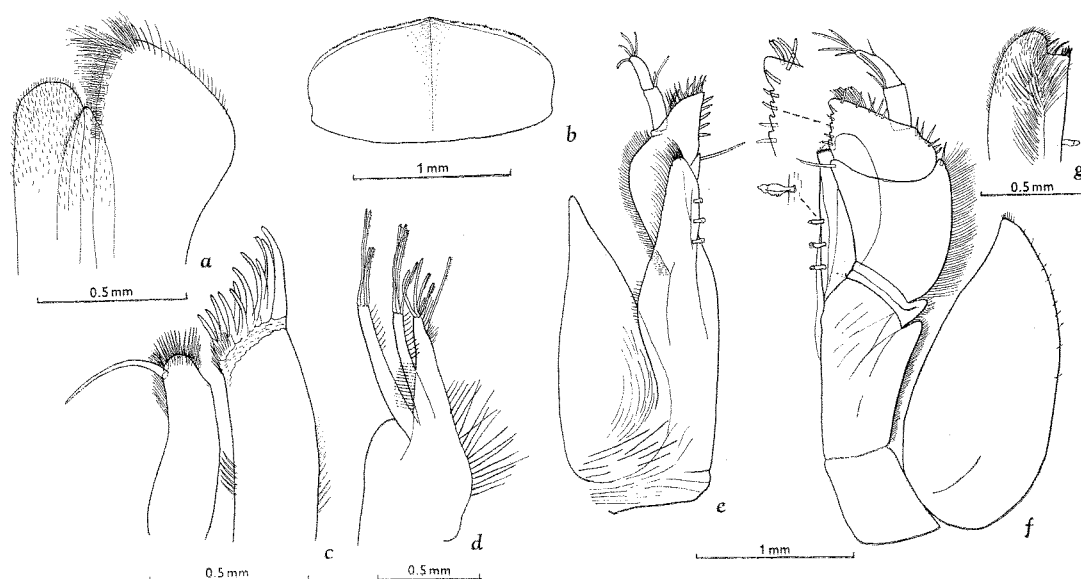


Fig. 131. *Munnopsis bathyalis* n. sp., ♀ holotype; a, labium; b, labrum; c-d, left maxillula and maxilla; e-f, left maxilliped seen obliquely from inside and from outside; g, endite from inside.

than dorsally. Prn. 1 about one-third as long as 2, 3 and 4 dorsally. Prn. 3 is slightly shorter and a little broader than 2 and 4.

*Pereonites* 5-7 (Fig. 130a) all longer than broad and of almost equal width; the separations difficult to trace dorsally. Prn. 5 one-fourth narrower than prn. 3. Anteriorly on prn. 5 is one median process which is considerably broader than long; prns. 6-7 both have two round, subacute processes anteriorly. The rounded coxae are visible from above on all seven pereonites.

*Pleotelson* suboval in shape, almost twice as long as broad and with a slight notch at the insertion of the uropods. Dorsal surface vaulted in both directions and with two low, longitudinal furrows (Fig. 130a). The operculum covers the entire ventral surface, except the backward-turning anal face, to which the uropods are inserted laterally.

*Antennula* (130b-c) with joint 1 as broad as long, rather thick and with the lower (ventral) side somewhat concave. There is a small convexity on proximal corner. Joint 2 very much smaller, a little longer than broad, joint 3 half as wide as 2, and joint 4 short and difficult to see. Only the distal joints in the flagellum have hairs.

*Antenna* (Fig. 130d-e) with only the four proximal joints preserved. Squama small and inconspicuous.

*Labrum* (Fig. 131b) very much as in *M. typica* (SARS 1899, pl. 57), although somewhat shorter. There is a slight median depression.

*Mandibles* (130f-g) equal on both sides, triangular, with one broad tooth distally. Proximally, on

the upper side is a crest which, although smaller than in *mandibularis* and *longiremis*, is not nearly so reduced as in *beddardi*, *eximius* and *typica* (Fig. 118). No trace of spine-row, movable lacinia or molar process.

*Labium* (131a) very much as in *latifrons*, i.e. with inner lobes of different lengths, one subacute, the other rounded. – *Maxillula* (131c) has on outer endite twelve spines, most of them being finely serrated; on inner endite, fine hairs and one strong seta. – *Maxilla* (131d) with all the strong setae very finely serrated (except the outer one on inner endite). The innermost seta not so significant as that of several other species.

*Maxilliped* (131e-f) with joint 2 of the palp much broader than the sympod; joint 3 almost twice as broad as long and with five inner and a large number of distal, short setae. Endite according to Fig. 131g. Three coupling hooks on each side. Epipod of the usual shape, with some short setae distally and some along the outer margin.

*Pereopod I* (132a) stout. Ischium longer than carpus and unarmed. Merus with one long and a few shorter spines, carpus with some ten spines of greatly varying lengths. Propodus with three rows of short setae.

*Pereopod II* (132b) twice as long as prp. I. Basis unusually short. The lower margins of ischium, merus, carpus, and propodus with a row of short, strong spines, placed at close proximity on the three latter joints and directed forwards on propodus. Merus with a few more spines and carpus with a

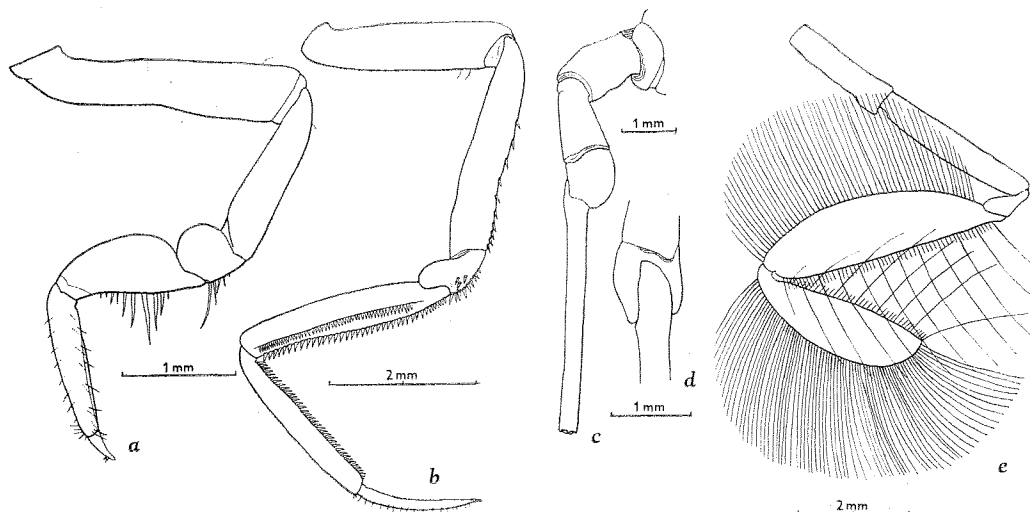


Fig. 132. *Munnopsis bathyalis* n.sp.; a-b and e, ♀ holotype; c-d, ♂ allotype; a-b, left pereopods I and II from outside; c, preserved part of pereopod IV from outside; d, merus from below; e, right pereopod V from outside (only every fifth feathered seta on the hind margins drawn in full length).

second row of somewhat smaller spines. Dactylus about two-thirds of propodus.

*Pereopods III and IV* have only basis preserved. It is almost as broad as long, slightly broader than basis of prp. II, but only between one-third and one-fourth as long. Part of prp. IV was present on one of the males. Fig. 132c shows the very short basis, ischium, and merus – as well as part of the extremely elongated carpus which is fixed to merus in the rather curious way (132d) characteristic of this family (cf. Sars 1899, pl. 58).

*Pereopods V-VII* (132e) with carpus and propodus three to four times longer than broad and a large number of long, feathered setae all along the margins.

*Operculum* (133e-f) boat-shaped, with a median arched keel devoid of setae, but with many setae along the lateral margins.

*Pleopod 3* (133g) with an oval inner branch and a two-jointed, very narrow, outer branch.

*Uropod* (130a) a little less than half as long as pleon, with the first joint one-seventh longer than the second and twice as broad.

*Size*: ♀ holotype 19.0 mm long, 4.5 mm wide across pereonite 3; the other female is 19.9 mm and the largest male 19.7 mm long.

#### Description of ♂ allotype:

The male differs in the following respects:

*Pereonites 1-2* (Pl. XIII D-E) very different in size: Prn. 1 extremely short medianly; prn. 2 longer medianly than laterally, about twice as long along the median line than any of the other three

pereonites, considerably raised when viewed from the side, and with two rounded convexities on each side between the median line and the lateral margins. Prns. 3 and 4 of about equal width. This sexual dimorphism, in the shape of prn. 2 in particular, corresponds to that found in *M. eximius* (HANSEN 1916, p. 159) and *beddardi* (1. c., pl. XIV, 3a-3b). Prns. 3 and 4 are shaped as in the female.

*Pereonites 5-7* of relatively the same width as in the female; the dorsal processes on prn. 7 rather inconspicuous.

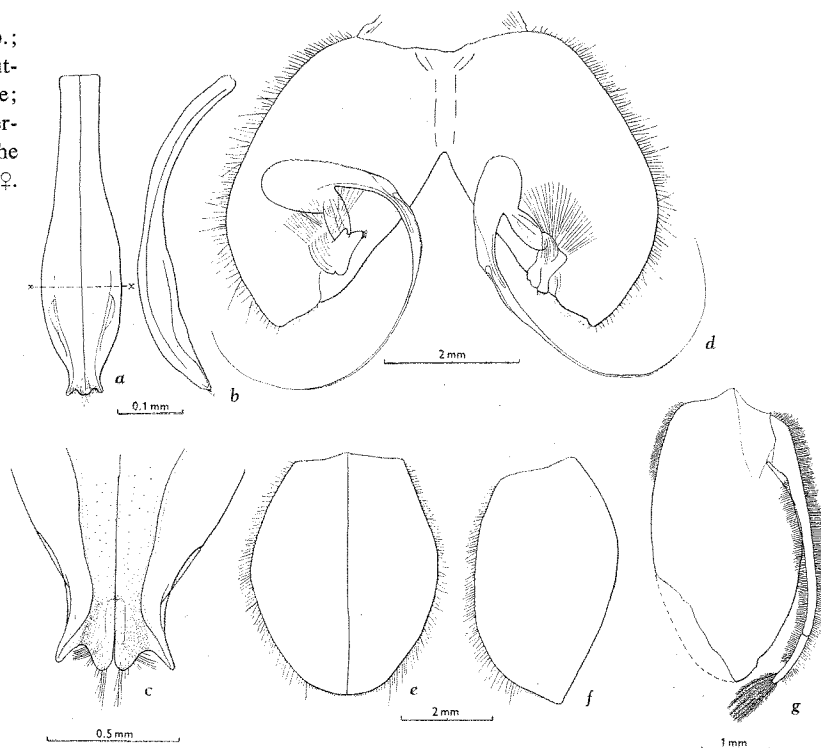
*Flagellum of antennula* almost twice as long as in the female and three-fourths of its length furnished with hairs.

*Pereopods I* equal in the two sexes. Of *pereopod II* only a fragment (basis to merus) is preserved in one of the males. Ischium comparatively larger, and on merus the spines are smaller but more numerous.

*Pleopods 1* (133a-c) considerably curved both longitudinally and transversely and with a median keel; a section along the line x – x in Fig. 133a thus looking very much like the section of a boat. The distal half twice as wide as the proximal. Distally, the outer lobes are more distinct than in most other species, and the inner lobes only extend a little beyond the outer ones (133c). On the dorsal side of the inner lobes are some rather long setae, some are directed backwards while others are curved towards the outer lobes.

*Pleopods 2* (133d) fused along part of the median line (between one-third and one-fourth). Exopod broad, copulatory organ more slender than is usual in the genus; the stylet long and very thin.

Fig. 133. *Munnopsis bathyalis* n.sp.; a-b, pleopods 1 of ♂ allotype from outside and the side; c, apex from inside; d, pleopods 2 of ♂ allotype; e-f, operculum of other ♀ from outside and the right side; g, pleopod 3 of the same ♀.



#### Remarks:

*M. bathyalis* is closest to *eximius*, *australis* and *gracilis*. From the two former it differs, amongst other things, in the considerable width of pereonites 5-7 compared to that of prn. 3, in the broad carpus of pereopods V-VII, and in the length of the uropods which almost corresponds to the width of pleon. From *gracilis* it seems to differ in the following respects: (1) processes extant on pereonites 5-7; (2) no anal projections; (3) no spine on squama; (4) mandible with one tooth only, and movable lacinia and spine-row completely lacking; (5) palp of maxilliped broader; (6) uropods with the two joints of almost equal length.

I have found no variation in the material of *bathyalis*.

Intestine contents are recorded in Table 17, p. 240.

#### Occurrence:

Only recorded from the Bali Sea at 545-570 m depth and c. 6.5°C.

#### *Munnopsis mandibularis* n. sp. (Pl. XIII F-G; Text-figs. 134-137)

#### Material:

*Galathea* St. 241, off Kenya (4°00'S, 41°27'E), 1510 m, 15 March 1951. Bottom: pure globigerina ooze. Bottom temp.: c. 3.2°C. — 1 female with developing oostegites.

#### Description:

**Body** (Pl. XIII F-G, Fig. 134) a little less than three times longer than broad. Colour yellowish brown, integument thin.

**Head** not particularly vaulted. There is a straight frontal seam at the base of the epistome, with a few short setae. Most of the head (up to a bilobed line

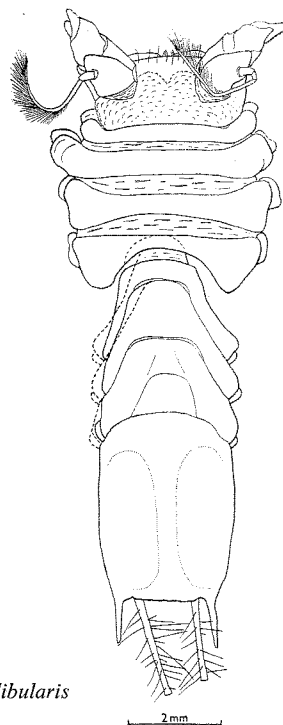


Fig. 134. *Munnopsis mandibularis* n.sp., ♀ holotype.



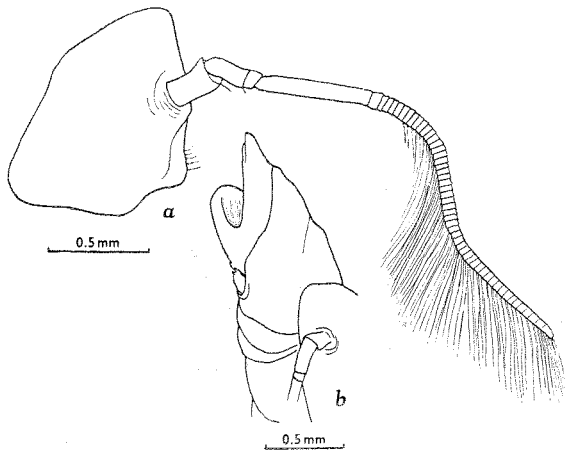


Fig. 135. *Munnopsis mandibularis* n.sp.; a, right antennula; b, left antenna with the squama.

between the antennae) covered with many thin nodules. There is a rather large cavity behind the base of the antennulae and there are the same crests on each side of antennulae and antennae as in *bathyalis*, but less significant.

*Pereonites 1-7* (134) of the usual shape, prn. 2 being the broadest, and longer than prns. 1, 3, and 4. Prn. 5 quite short dorsally, and the maximum width two-thirds that of prn. 2.

*Pleotelson* broader than in most other species and almost rectangular in shape, with two rather long, backward-directed projections postero-laterally. In the present specimen the hind margin is straight, but since pleotelson is a little mutilated it may have been slightly convex. The dorsal surface has a narrow median and two broad lateral, very indistinct

convexities. The branchial cavity covers almost the entire ventral part of pleotelson.

*Antennula* (135a) with joint 1 considerably longer than broad and almost oval in shape. Flagellum reaches backwards a little further than pereonite 2, and almost all the visible joints have sensory hairs.

*Antenna* (135b) with a small, but conspicuous squama, with two tiny projections distally. Only joints 1-4 preserved.

*Labrum* (136a) twice as broad as long, with a rather deep concavity in the middle of the anterior margin.

The *mandibles* show an extraordinary reduction in most features. The shape is triangular in frontal view (136d). On the upper side is a strong crest, rather similar to that in *M. longiremis* (Fig. 126a) and most other species of *Munnopsis*; distal margin of the crest swollen. In the inner, proximal corner on the lower side of the mandible there is a long projection which serves as an attachment for the musculus adductor, as plate p in HANSEN's fig. 3c (1916, pl. XIV). When viewed from the distal end (136b), a low keel (k) connecting this projection (p) with the crest (c) can be seen. — Only one strong tooth in the incisive part (136f) and the spine-row reduced to some seven small setae. Movable lacinia partly reduced to an almost squarish, bilobed, basal portion (136e), and partly to a more finger-shaped portion which is directed obliquely from the basal portion inwards towards the mandible body (136d-e). The reduction of the molar process has re-

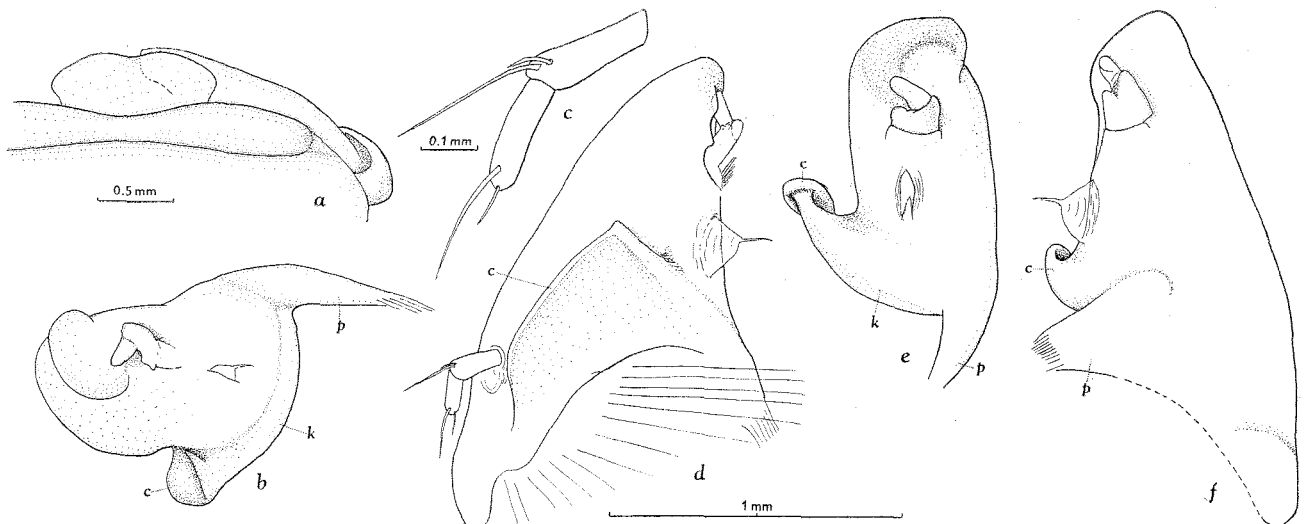


Fig. 136. *Munnopsis mandibularis* n.sp.; a, labrum and part of right mandible from above; b-f, left mandible (k, keel; p, projection; c, crest); b, seen from the distal end; c, palp; d, from above; e, seen obliquely from the distal end; f, frontal view of incisive part and movable lacinia.

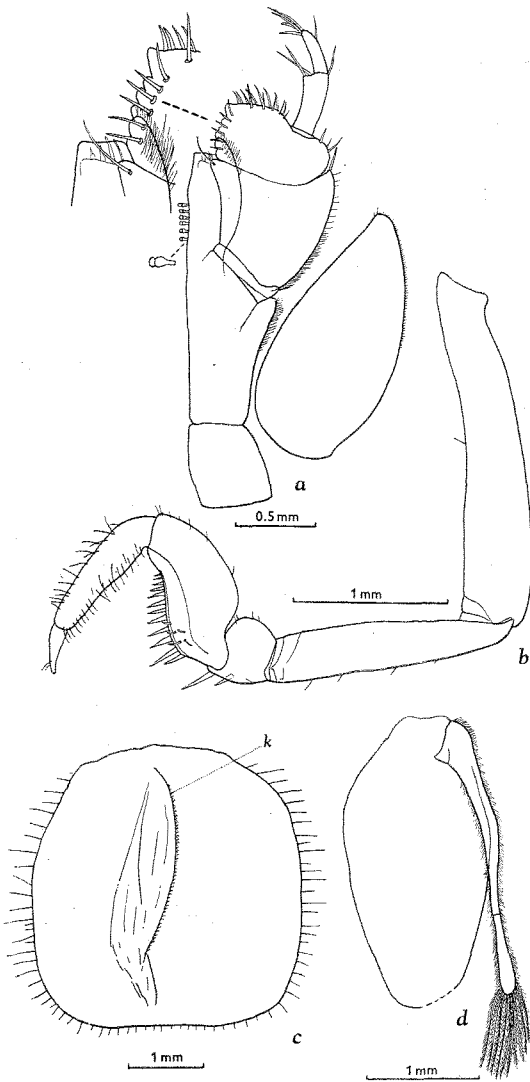


Fig. 137. *Munnopsis mandibularis* n.sp.; a, right maxilliped from inside; b, left pereopod I; c, operculum, mounted on a slide (k, keel); d, pleopod 3.

sulted in a thin, transparent, triangular plate with a slender spine distally. The palp (136c) consists of two joints only, both very small; the proximal is the longer. Each joint has a long and a shorter seta.

*Maxilliped* (137a) with a very narrow sympod and the second joint of the palp very broad, the latter being one-third broader than the former. Joints 4 and 5 of the palp rather long. Endite also

very narrow, lacking setae on the inner distal margin, but carrying a few spine-like setae a little further proximally. When seen from the edge the sympod and endite resemble those of *bathyalis* (Fig. 131e), but fine setae are only present distally on the endite. There are six coupling hooks and a rather broad epipod.

*Pereopod I* (137b) with particularly basis and ischium relatively longer than in the other species, except *latifrons*. Merus with two spines, carpus with twelve spines of almost equal length on the convex-concave inner margin, and propodus with two distinct rows of short setae.

*Pereopods II-VII* absent, except for the basipodite which in prp. II is one-fourth longer and somewhat thicker than in prp. I. In prps. III and IV basis is as broad as long, in prp. VI as long as in prp. II, but only a little more than half as thick, and in prps. V and VII a little shorter and longer, respectively.

*Operculum* about as broad as long when mounted on a slide (137c). Otherwise it is roof-shaped, longer than broad and rectangular in outline (as the pleotelson), since the posterior margin is cut straightly off. The median keel (k) finely serrated.

*Pleopod 3* (137d) with a very narrow outer branch which is a little widened towards the distal end. Inner branch also rather narrow.

*Uropods* (134). Only the first joints are preserved. They are very long, more than half as long as pleon (exclusive of the posterior spines), slender, and with many long setae.

*Size*: Length of the only female 13.9 mm, maximum width 4.7 mm.

#### Remarks:

This species is well characterized by the large pleotelson with long, backward-pointing projections, combined with the peculiar mandibles and shape of the first pereopods.

#### Occurrence:

Indian Ocean off Kenya, at 1510 m depth and c. 3.2°C.