

# New Harpacticoida (Crustacea, Copepoda) from the North Atlantic Ocean. VI. Eight New Species of the Genera *Paranannopus* Lang and *Cylindronannopus* Coull (Cletodidae)

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*Paranannopus trisetosus* sp.n., *P. singulosestosus* sp.n., *P. denticulatus* sp.n., *P. uniarticulatus* sp.n., *P. variabilis* sp.n., *P. kunzi* sp.n. and *Cylindronannopus bispinosus* sp.n. are described and classified to the three evolutionary groups within the genus *Paranannopus*. *P. variabilis*, *P. kunzi* and *P. hicksi* belong to the first evolutionary group with Enp P2–P4 3:3:2-segmented. All three species differ from each other and the closely related species in the setation of the swimming legs P1–P5 and to some extent in the segmentation of the A1. *P. trisetosus* belongs to the second group with Enp P2–P4 2-segmented, and it differs from the closely related *P. atlanticus* Coull in the setation of the segment 2 Exp P1, P4 and of the P5. *P. singulosestosus*, *P. uniarticulatus* and *P. denticulatus* represent the third evolutionary group with at most 1-segmented Enp P2–P4. They differ from each other in the segmentation of the Enp P2–P4 and the setation of the swimming legs P2–P4 and to some extent in the segmentation of the Exp A2. *Cylindronannopus bispinosus* differs from the closely related species *C. elongatus* (Becker *et al.*) comb.n. in the setation of the P5. Updated keys are given for both genera. All species were collected at the Iceland–Faroe Ridge from depths between 435 and 2500 m.

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## Introduction

This paper is the sixth in a continuing series on Harpacticoida from the North Atlantic Ocean. Seven new species of the genus *Paranannopus* Lang, 1936, *P. trisetosus* sp.n., *P. singulosestosus* sp.n., *P. denticulatus* sp.n., *P. uniarticulatus* sp.n., *P. variabilis* sp.n., *P. kunzi* sp.n., *P. hicksi* sp.n., and one species of *Cylindronannopus* Coull, 1973, *C. bispinosus* sp.n., are described here.

With the description of these new species all *Paranannopus* and *Cylindronannopus* species from the material so far collected from the Iceland–Faroe Ridge have been described.

## Material and methods

The eight species were collected in 1966 during cruise 98 of F.R.V. *Anton Dohrn* at the Iceland–Faroe Ridge by Dr Hj. Thiel of the

University of Hamburg. A description of the investigations in that area and the first results on the meio- and macrofauna are given by Thiel (1971) and further information about material and methods is presented by Schriever (1982). The nomenclature and descriptive terminology adopted are those of Lang (1948, 1965) and Wells (1976). The illustrations of the harpacticoids were prepared with the aid of a drawing tube. Type specimens are deposited in Zoologisches Museum Kiel (ZMK). The investigation area is shown in Fig. 1, the stations are listed in Table I.

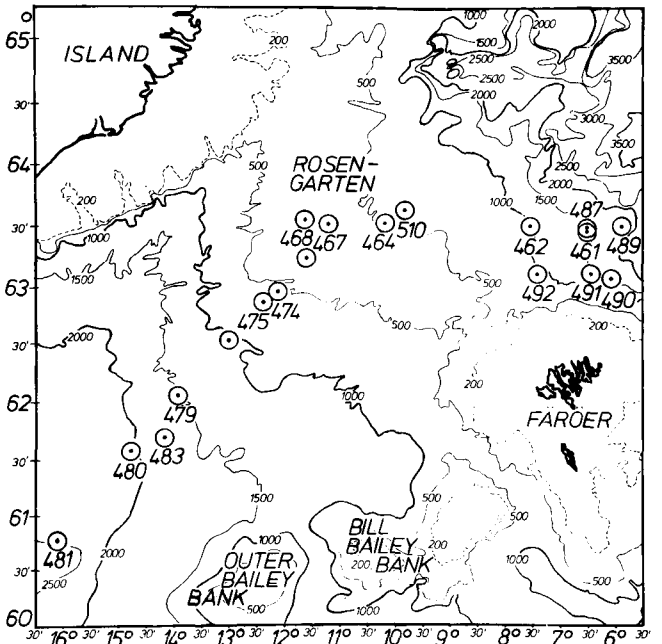
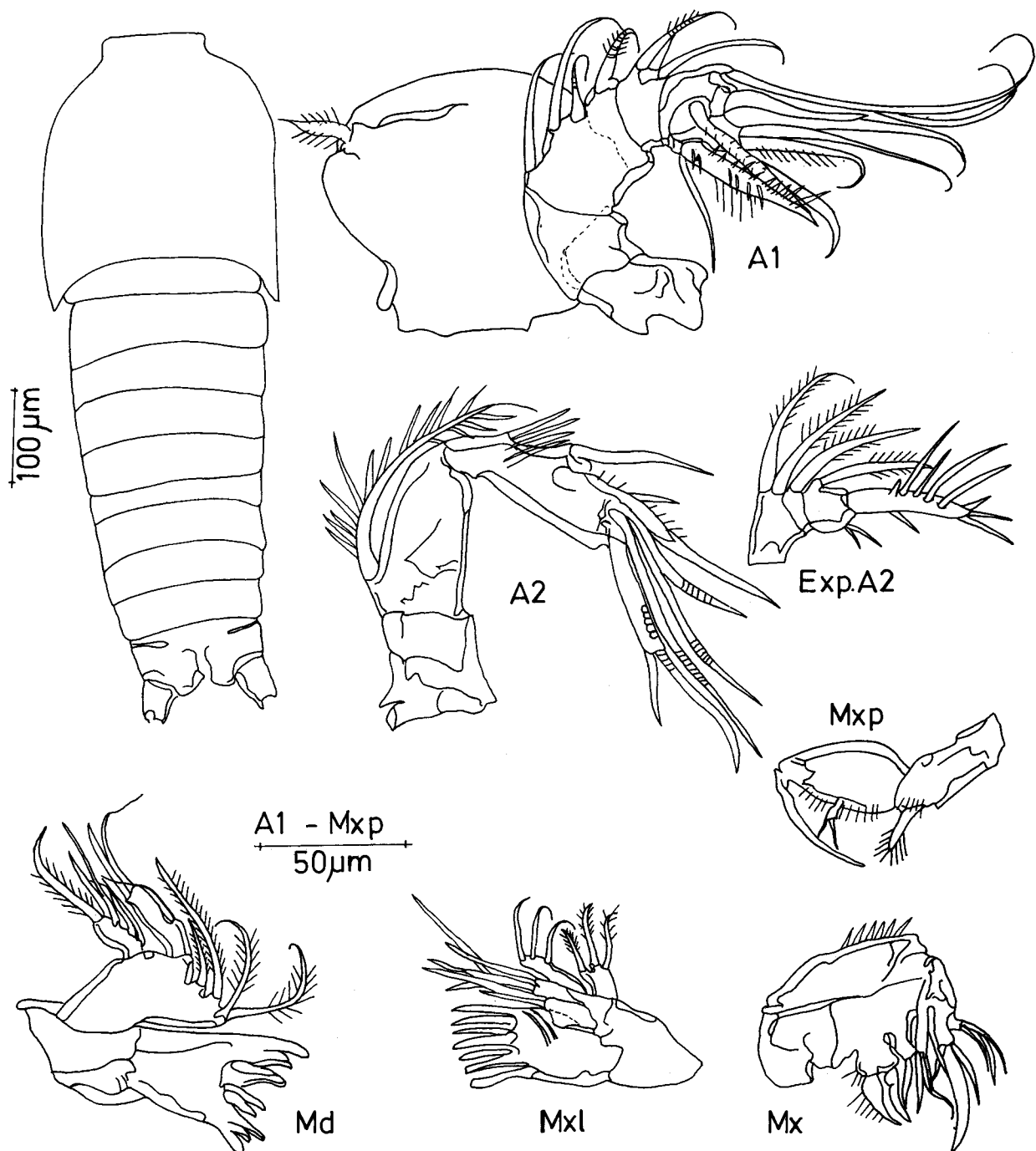


Fig. 1. Stations of F.R.V. *Anton Dohrn* cruise 98, 1966 (from Thiel 1971).

Table I. Stations of F.R.V. *Anton Dohrn*, cruise 98, 1966

Sta. no	Lat. (N)	Long. (W)	Depth (m)	Date
461	63°26'	06°32'	1570	1 July
462	63°30'	07°34'	1000	2 July
479	62°04'	13°56'	1555	6 July
481	60°46'	16°06'	2500	9 July
486	63°14'	11°37'	435	16 July
487	63°29'	06°31'	1510	17 July
490	63°04'	06°05'	1685	19 July
491	63°06'	06°27'	1540	20 July
492	63°06'	07°25'	985	21 July

Fig. 2. *Paranannopus trisetosus* sp.n.

## Descriptions

### *Paranannopus trisetosus* sp.n. (Figs. 2–3)

*Type locality.* Iceland–Faroe Ridge, 63°04'N, 06°05'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 490, depth 1685 m; leg. Thiel, 19 July 1966.

*Material.* 1 ♀ Sta. 490, 2 ♀♀ Sta. 462. Holotype, dissected ♀ on slide, A1-Fu, ZMK Cop. No. 1328. Paratype, 2 ♀♀ dissected on slides, A1-Fu, ZMK Cop. No. 1329 and 1330.

*Etymology.* The specific name *trisetosus* refers to the 3 setae on the distal segment Enp P1–P3.

### *Description of the female* (male unknown)

Based on an ovigerous female, length 650 µm. Body short, stout as normal for the genus. Rostrum large, as figured, with 1 seta on each side of the rounded apex. Ventral edges of the abdominal somites with a row of

spines. Caudal rami slightly longer than wide, with 2 terminal setae.

A1 6-segmented, short with several plumose setae, 6th segment very small (Fig. 2). Aesthetasc not visible. A2 with allobasis, setation as figured. A2-Exp 3-segmented, with 2 plumose setae on segment 1 and 3 and 1 plumose seta on segment 2. Md praecoxa with bidentate pars incisiva. Coxa basis irregular with 4 plumose setae and 1-segmented Enp and Exp with 5 setae. Mx1 arthrite of praecoxa with 7 terminal claw-like setae and 2 accessory surface setae. Coxa and basis with 3 setae each. Enp and Exp 1-segmented, with 3 setae each, Exp setae plumose. Mx syncoxa with 3 endites, with 2 setae each. Enp 1-segmented, with 3 setae. Mxp basis with a strong plumose seta at the outer distal corner. Enp with a row of fine hairs

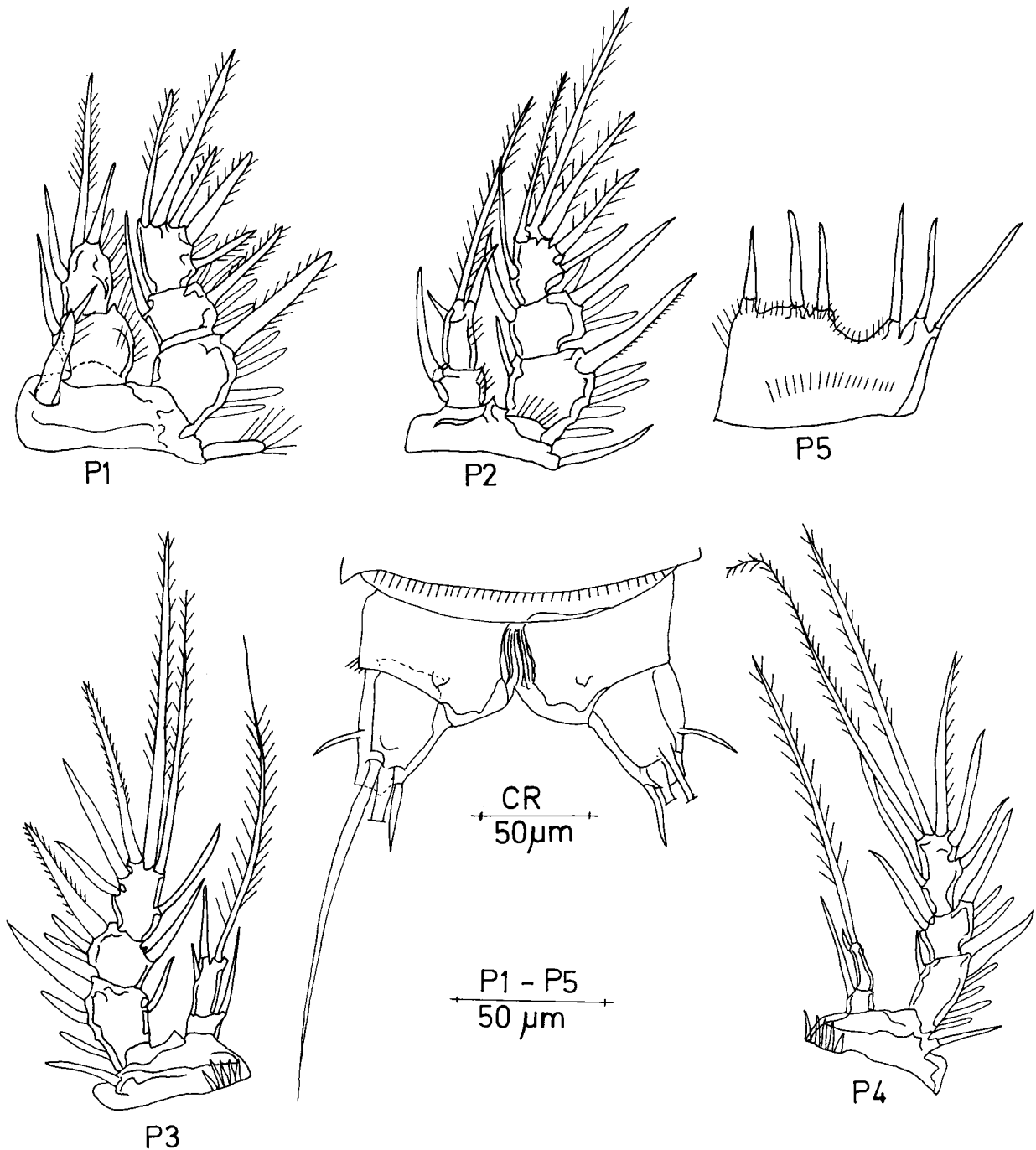


Fig. 3. *Paranannopus trisetosus* sp.n.

and a short, plumose spine at the outer edge, terminating in a strong claw, prehensile. P1 Exp 3-segmented, Enp 2-segmented. Basis with a strong plumose seta at both outer and inner margins. Setation as figured and listed below. P2–P4 all Exp 3-segmented, Enp 2-segmented. All Exp-segments supplied with accessory spines. Setation as figured and listed below.

Spine and setal formula

	Exp	Enp
P1	0.1.023	1.120
P2	1.1.123	1.120
P3	1.1.123	1.120
P4	1.1.123	1.110

P5 Benp and Exp fused into a single plate with 6 setae in all. Both Benp separate.

#### Remarks

Comments on the relationships of the species within the genus *Paranannopus* are presented by Becker *et al.* (1979). *P. trisetosus* sp.n. is closely related to *P. bahusiense* Por, *P. sarsi* Lang and *P. truncatus* Becker *et al.* All species show 3 outer setae on segment 3 Exp P1–P4 and bear 2-segmented Enp P1–P4. From *P. bahusiense* the new species differs in the Exp A2 segmentation, from *P. sarsi* in the A1 segmentation and from all species it differs in the setation of the swimming legs. These different characters justify the recognition of *P. trisetosus* as a new species. Wells' keys (1976, p. 154) can be amended to include *P. trisetosus* by adding the following codon: 3:2/3:3:3/2:2/6:6:6/3:1.

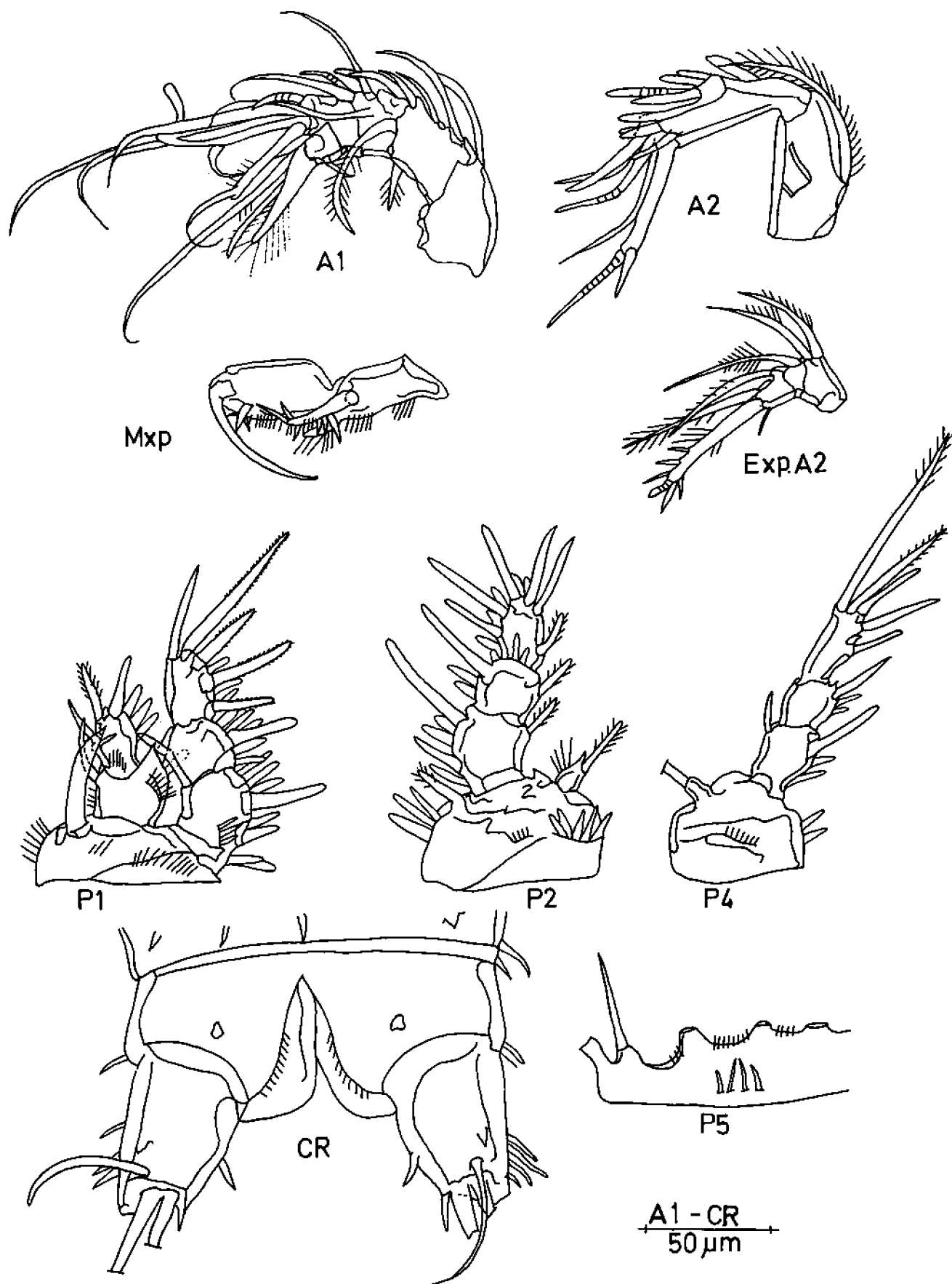


Fig. 4. *Paranannopus singulosestosus* sp. n.

***Paranannopus singulosestosus* sp. n. (Fig. 4)**

*Type locality.* Iceland–Faroe Ridge, 63°14'N, 11°37'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 486, depth 435 m; leg. Thiel, 16 July 1966.

*Material.* 1 ♀ Sta. 486, 1 ♀ Sta. 462. Holotype, dissected ♀ on slide,

A1–Fu, ZMK Cop. No. 1331. Paratype, undissected ♀ with attached spermatophore, glycerin preparation, ZMK Cop. No. 1332.

*Etymology.* The specific name *singulosestosus* refers to the single seta at the Enp P2–P4.

*Description of the female* (male unknown)

Based on an ovigerous female, length 550  $\mu\text{m}$ . Body short, stout as normal for the genus. Abdominal somites with a row of spinules ventrally. Rostrum large, broad and plate like with 1 seta on each side of the rounded apex. Caudal rami little longer than wide, with 2 terminal setae.

A1 5-segmented with several plumose setae. Aes-thetasc on segment 4. A2 with allobasis, bearing a 3-segmented Exp, with 2 setae on segment 1, 1 seta on segment 2 and 3 setae on segment 3. Terminal Enp-segment with 6 setae, one os heavily spined. Md, Mx1 and Mx are as figured and described for *P. trisetosus*. Mxp basis with 2 strong spinulose setae, one lateral and one at the outer distal corner. Enp with a row of hairs and a spine at the outer edge, terminating in a strong claw, prehensile, P1 Exp 3-segmented, Enp 2-segmented. All Exp segments supplied with accessory spines. Basis spinulose with a strong basis seta on the inner margin. Setation as figured and listed below. P2–P4 Exp 3-segmented supplied with accessory spines. Enp 1-segmented. Setation as figured and listed below.

## Spine and setal formula

	Exp	Enp
P1	0.1.023	1.120
P2	1.1.123	010
P3	1.1.123	010
P4	1.0.023	010

P5 Benp and Exp fused. Also both Benp fused into a small elongate plate with 10 setae in all (only one side with 5 setae figured).

*Remarks*

*P. singulosestosus* sp.n. differs from its closely related species *P. atlanticus* Coull in the P5, which in *P. singulosestosus* is a small, fused elongated plate with five setae in all on each side and in the setation of segment 2 Exp P1 and P4 as well as in the setation of the Enp P2–P4. The new species differs from *P. minutus* Smirnov in the segmentation of the Exp A2 and also in the setation of the swimming legs P1–P5. These different characters justify the recognition of *P. singulosestosus* as a new species. Wells' keys (1976, p. 154) can be amended by adding the following codon: 3:2/3:3:3/1:1/6:6:5/1:1.

*Paranannopus denticulatus* sp.n. (Fig. 5)

*Type locality.* Iceland–Faroe Ridge, 60°46'N, 16°06'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 481, depth 2500 m; leg. Thiel, 9 July 1966.

*Material.* 1 ♀ Sta. 481. Holotype, dissected ♀ on slide, A1-Fu, ZMK Cop. No. 1333.

*Etymology.* The specific name *denticulatus* refers to the dentiform projections that represent the Enp P2–P4.

*Description of the female* (male unknown)

Based on an ovigerous female, length 570  $\mu\text{m}$ . Body short and stout as normal for the genus. Rostrum large, broad and plate like with 1 seta on each side of the rounded apex. Genital segment dorsally partly divided. Abdominal somites dorsally and ventrally with a row of fine hairs. Caudal rami little longer than wide, with 2 terminal setae.

A1 5-segmented with several plumose setae. Aes-thetasc on segment 3. A2 with allobasis, bearing an

internal seta. Exp 3-segmented with 2 setae on segments 1 and 3 and 1 seta on segment 2. Enp-segment with 6 setae of which 2 are heavily spined. Md praecoxa with bidentate pars incisiva. Coxa basis irregular with 4 setae. Enp and Exp 1-segmented, Enp with 5 setae, Enp with 4 fine hairs, setae probably lost during preparation. Mx1 as described for *P. trisetosus* sp.n. Mx syncoxa with 3 endites, all with 2 setae. Enp 1-segmented with 4 setae. Mxp small, basis with a strong plumose seta at the outer distal corner. Enp with a row of fine hairs at the outer edge, terminating in a strong claw, prehensile, P1 Exp 3-segmented, Enp 2-segmented. Basis spinulose with a strong basis seta on each side. All segments supplied with accessory spines. Setation as figured and listed below. P2–P4 Exp 3-segmented, supplied with accessory spines. All Enp reduced to a small dentiform projection as described by Soyer (1964) for *P. caheti* Soyer. Setation as figured and listed below. Only P2 is figured.

## Spine and setal formula

	Exp	Enp
P1	0.1.023	0.120
P2	1.1.123	—
P3	0.1.123	—
P4	0.1.123	—

P5 Benp and Exp fused to a plate with 6 setae in all. Both Benp separate.

*Remarks*

*P. denticulatus* sp.n. differs from *P. abyssi* (Sars), *P. caheti* and *P. plumosus* Schriever in the segmentation of the Exp A2, the setation of the Exp and Enp P1, Exp P2–P4 and in shape and setation of the P5. *P. denticulatus* is most closely related to *P. caheti* showing the same dentiform projection at the site of the former Enp P2–P4. The different segmentation of the Exp A2, the setation of the swimming legs P1–P4 and the differences in both segmentation and setation of the P5 justify the recognition of *P. denticulatus* as a new species. Wells' keys (1976, p. 154) can be amended by the addition of the following codon: 3:2/3:3:3/0:0/6:6:6/na:na.

*Paranannopus uniarticulatus* sp.n. (Fig. 6)

*Type locality.* Iceland–Faroe Ridge, 63°04'N, 06°05'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 490, depth 1685 m; leg. Thiel, 19 July 1966.

*Material.* 2 ♀ Sta. 490, 1 ♀ Sta. 479, 1 ♀ Sta. 461. Holotype dissected ♀ on slide, A1-Fu, ZMK Cop. No. 1334. Paratype dissected ♀ on slide, A1-Fu, ZMK Cop. No. 1335, ♀ undissected, glycerin preparation, ZMK Cop. No. 1336, ♀ undissected, glycerin preparation, ZMK Cop. No. 1337.

*Etymology.* The specific name *uniarticulatus* refers to the 1-segmented Exp P2–P4.

*Description of the female* (male unknown)

Based on an ovigerous female, length 330  $\mu\text{m}$ . Body more elongate than normal for the genus, the abdominal somites together much shorter than the thoracic region as described by Becker *et al.* (1979) for *P. longithorax* Becker *et al.* and *P. reductus* Becker *et al.* All segments without ornamentation. Rostrum large, broad with 1 seta on each side of the rounded apex. Caudal rami 2.5 times as long as broad, with 2 terminal setae as figured.

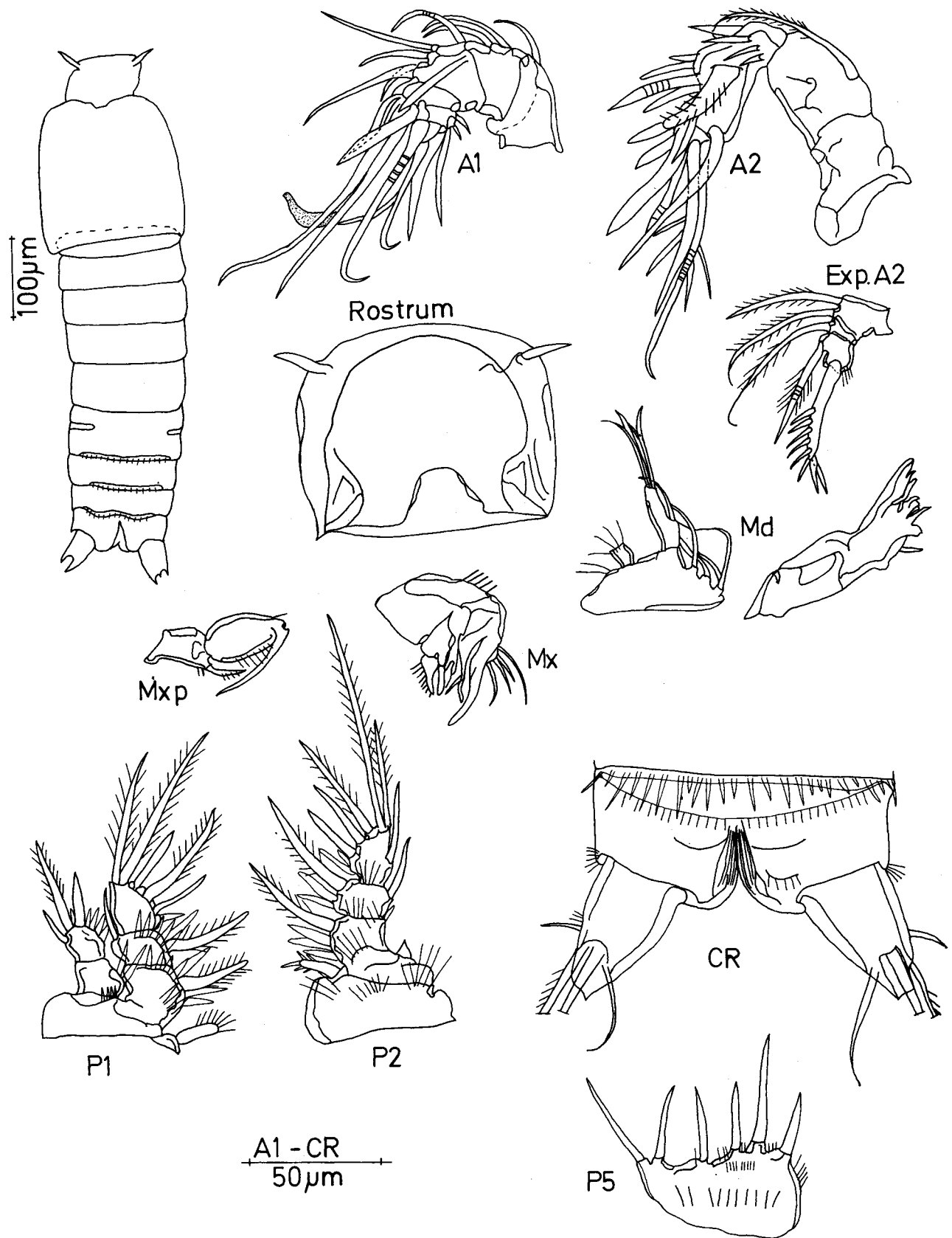


Fig. 5. *Paranannopus denticulatus* sp. n.

A1 6-segmented with several plumose setae. Aes-thetasc on segment 5. A2 with allobasis, bearing a 3-segmented Exp. Segment 1 with 1 seta, segment 2 with 2 and segment 3 with 3 setae. Md praecoxa with bidentate pars incisiva. Coxa-basis irregular with 4 setae. Enp and Exp 1-segmented, with 4 and 2 setae, respectively. Exp

not figured. Mx1 lost during preparation. Mx damaged during preparation, probably 3 endites, with 1-segmented Enp, with 3 setae. Mxp small, basis with a strong plumose seta at outer distal corner. Enp with a small seta at the inner edge where it terminates in a strong claw, prehensile. P1 Exp 3-segmented, Enp 2-segmented. Basis with

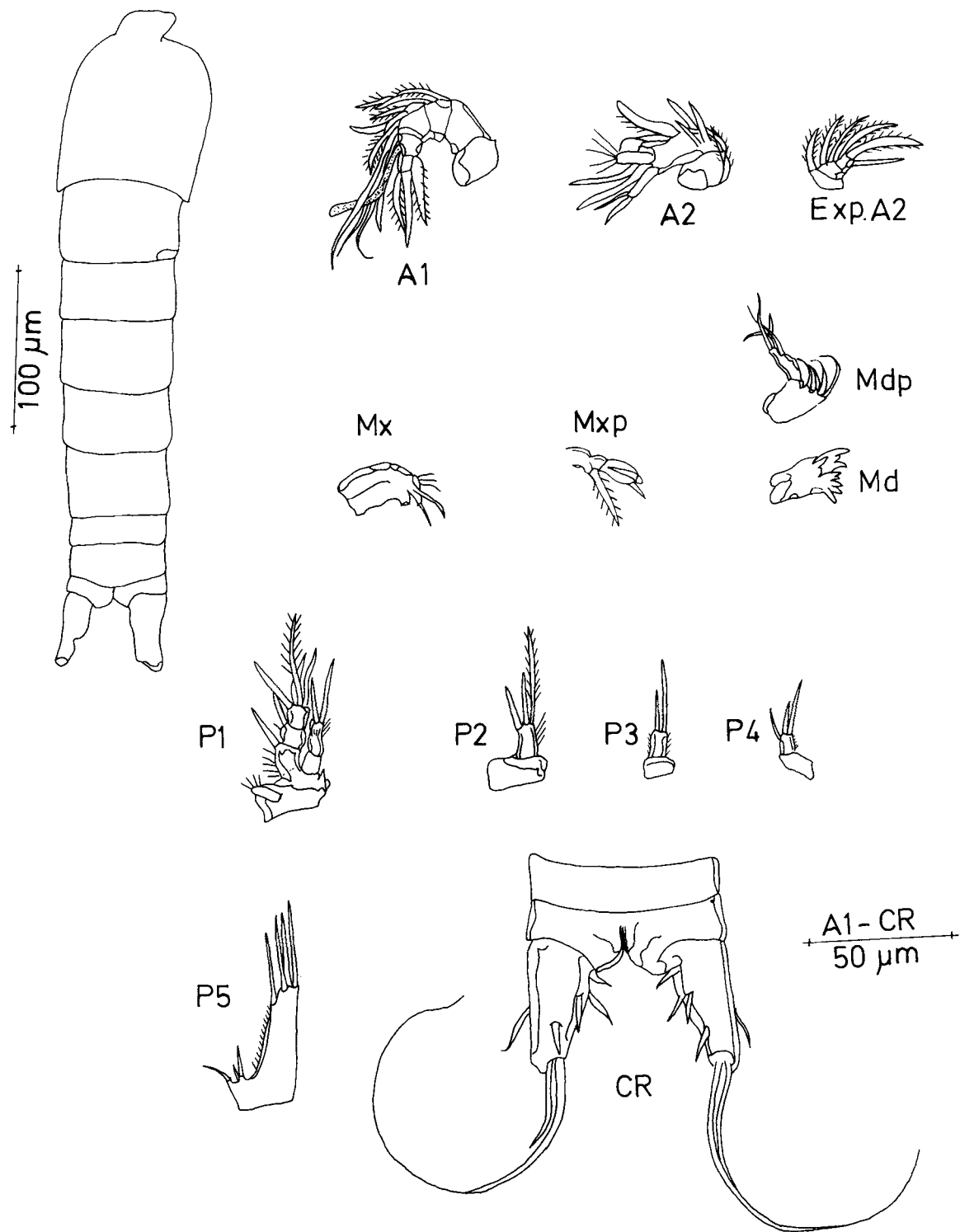


Fig. 6. *Paranannopus uniarticulatus* sp.n.

strong basis seta on each side, inner one not figured. Setation as figured and listed below. P2–P4 all Exp 1-segmented, decreasing in length from P2 to P4. All Enp completely reduced. Setation as figured and listed below.

Spine and setal formula

	Exp	Enp
P1	0.0.022	0.110
P2	021	—
P3	020	—
P4	021	—

The setation of the Exp P3 varies between 1 and 2

terminal setae in the dissected specimens. P5 Benp fused to a triangular plate. Benp prominent with 4 setae. Exp is represented by 2 small setae, inserting close to the outer Benp seta.

Remarks

The much shorter abdominal segments relative to the thoracic region, the reduced Exp segmentation, the shape of the P5 and the length/width ratio of the caudal rami show the close relationship of *P. uniarticulatus* sp.n. to *P. longithorax* and *P. reductus*. The differences in the segmentation of the A1 and P2–P4 as well as the setation of

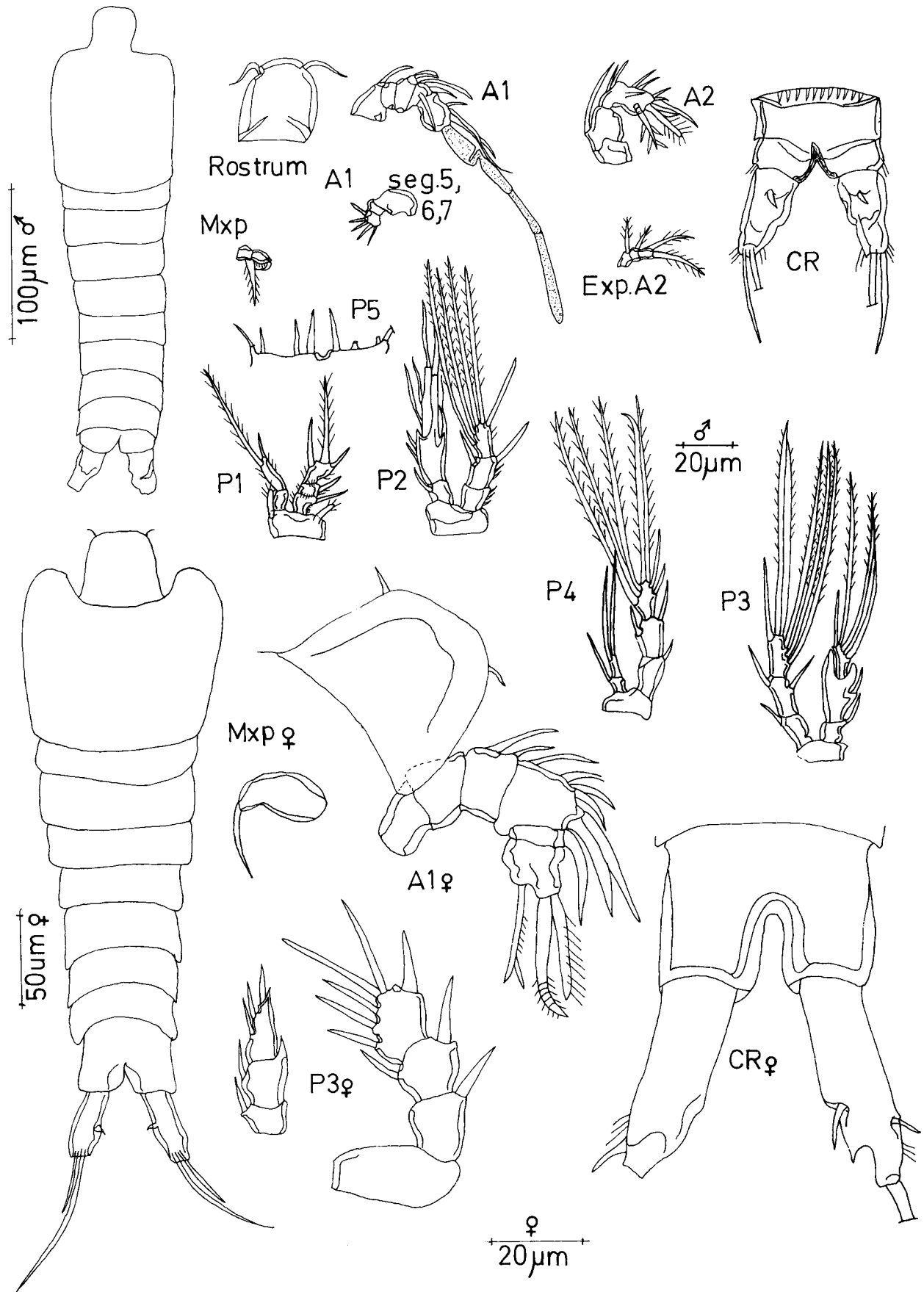


Fig. 7. *Paranannopus variabilis* sp.n.

the swimming legs justify the recognition of *P. uniauriculatus* as a new species. Wells' keys (1976, p. 154) can be amended by the addition of the following codon: 3:2/1:1:1/0:0/3:2(3):3/na:na.

***Paranannopus variabilis* sp.n. (Fig. 7)**

*Type locality.* Iceland–Faroe Ridge, 63°29'N, 06°32'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 487, depth 1510 m; leg. Thiel, 17 July 1966.

*Material.* 1 ♂, 1 ♀ Sta. 487. Holotype dissected ♂ on slide, A1-Fu,



ZMK Cop. No. 1353. Allotype dissected ♀, incomplete, A1, A2, Mxp, P3 and caudal rami, ZMK Cop. No. 1354.

*Etymology.* The specific name *variabilis* refers to the different segmentation of the left Enp P2 of the allotype female and the variation in the number of the outer setae between the P2, P3 and P4 of the male.

#### Description of the male

Based on a male, length 265 µm. Body short, stout as normal for the genus. Rostrum large, quadratic, as figured. Caudal rami little longer than wide, with 2 terminal setae.

A1 7-segmented, subchirocerate, bearing 1 long aesthetasc on segment 5. A2 as figured. Mxp very small, basis with a strong plumose seta at the outer distal corner. Enp with a row of fine hairs at the outer edge, terminating in a claw, prehensile, P1 Exp 3-segmented, Enp 2-segmented. Basis with strong plumose seta at the outer and inner margins. Setation as figured and listed below. P2–P4 all Exp 2-segmented, Enp P2 and P3 3-segmented, modified, Enp P4 2-segmented. Setation as figured and listed below.

Spine and setal formula

	Exp	Enp
P1	0.0.111	0.110
P2	0.1.221	1.mod2.210
P3	0.1.321	1.mod1.220
P4	0.1.322	1.020

P5 Benp and Exp fused to a small plate with 8 setae in all.

#### Description of the female

Based on a female, length 270 µm. Body short and stout as normal for the genus. Rostrum large, quadratic with 1 seta on each side of the rounded apex (as figured). Ventral side of abdominal somites with a row of spines. Caudal rami 2 times longer than wide, with 2 terminal setae. The number of Enp P2 segments differ on both sides between 2 and 3 segments respectively. (After dissection P1, P2 and P4 were lost and could not be figured.)

A1 6-segmented with several plumose setae. A2 with basis and 3-segmented Exp as in male. Mxp Enp small, prehensile. P1 Exp 3-segmented, Enp 2-segmented. Basis with a strong plumose seta at the outer and inner margins. Setation as figured below. P2–P4 all Exp 2-segmented, Enp P2 2-segmented on one side and 3-segmented on the other, Enp P3 3-segmented, Enp P4 2-segmented. Setation as figured for P3 and listed below.

Spine and setal formula

	Exp	Enp
P1	0.1.022	1.111
P2	0.1.221	1.1.210
P3	0.1.321	1.1.210
P4	0.1.321	1.120

P5 Benp and Exp fused to a single plate with 6 setae in all.

#### Remarks

Comments on the relationships of *P. variabilis* sp.n. and the following two new species within this genus will be presented under the remarks for *P. hicksi* sp.n. below. Wells' keys (1976, p. 154) can be amended to include *P.*

*variabilis* by adding the following codons: ♂ 3:2:3:3:3/3:2/4:6:7/3:2 and ♀ 3:2/3:3:3/3(2):2/3:3.

#### *Paranannopus kunzi* sp.n. (Figs. 8–9)

*Type locality.* Iceland–Faroe Ridge, 63°30'N, 07°34'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 462, depth 1000 m; leg. Thiel, 2 July 1966.

*Material.* 1 ♂, Sta. 462. Holotype dissected ♂ on slide, A1–Fu, ZMK Cop. No. 1355.

*Etymology.* This species is named in honour of Dr Helmut Kunz, Bischmisheim, F.R.G., for his enthusiastic work on harpacticoids covering 50 years.

#### Description of the male (female unknown)

Based on a male, length 530 µm. Body short and stout as normal for the genus. Rostrum large, with 1 seta on each side of the rounded apex. Ventral edges of abdominal somites with a row of spines. Caudal rami little longer than wide.

A1 7-segmented, with several spines, only 2 of which are plumose. Long aesthetasc on segment 5. A2 with basis, Exp 3-segmented, with 1 seta on segments 1 and 2 and 3 setae on segment 3. Mx1 arthrite of praecoxa with 5 terminal claw-like setae. Coxa and basis with 2 setae each. Exp and Enp 1-segmented. Mx syncoxa with 3 endites, Enp 1-segmented, with 3 fine setae. Mxp as figured. P1 Exp 3-segmented, Enp 2-segmented. Basis with a strong plumose seta at the outer and inner margins. Setation as figured and listed below. P2–P4 all Exp 3-segmented and supplied with accessory spines. Enp P2 and P3 3-segmented, Enp P4 2-segmented. Setation as figured and listed below.

Spine and setal formula

	Exp	Enp
P1	0.1.023	1.020
P2	1.1.223	1.2.220
P3	1.1.323	1.1.220
P4	1.1.323	1.220

P5 Benp and Exp fused to a small plate, both Benp fused, with 8 setae in all.

#### Remarks

Comments on the relationships of *P. kunzi* sp.n. within the genus will be presented under the remarks for *P. hicksi* sp.n. below. Wells' keys (1976, p. 154) can be amended to include *P. kunzi* by adding the following codon: 3:2/3:3:3/3:2/7:8:8/4:4.

#### *Paranannopus hicksi* sp.n. (Figs. 10–11)

*Type locality.* Iceland–Faroe Ridge, 63°29'N, 06°32'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 487, depth 1510 m; leg. Thiel, 17 July 1966.

*Material.* 1 ♂, Sta. 487. Holotype dissected ♂ on slide, A1–Fu, ZMK Cop. No. 1356.

*Etymology.* This species is named in honour of Dr G. R. F. Hicks, National Museum of New Zealand, Wellington, for his valuable work on harpacticoids.

#### Description of the male (female unknown)

Based on a male, length 450 µm. Body short and stout as normal for the genus. Rostrum large, with 1 seta on each side of the rounded apex. Ventral edges of abdominal somites with a row of spines. Caudal rami little longer than wide, as figured.

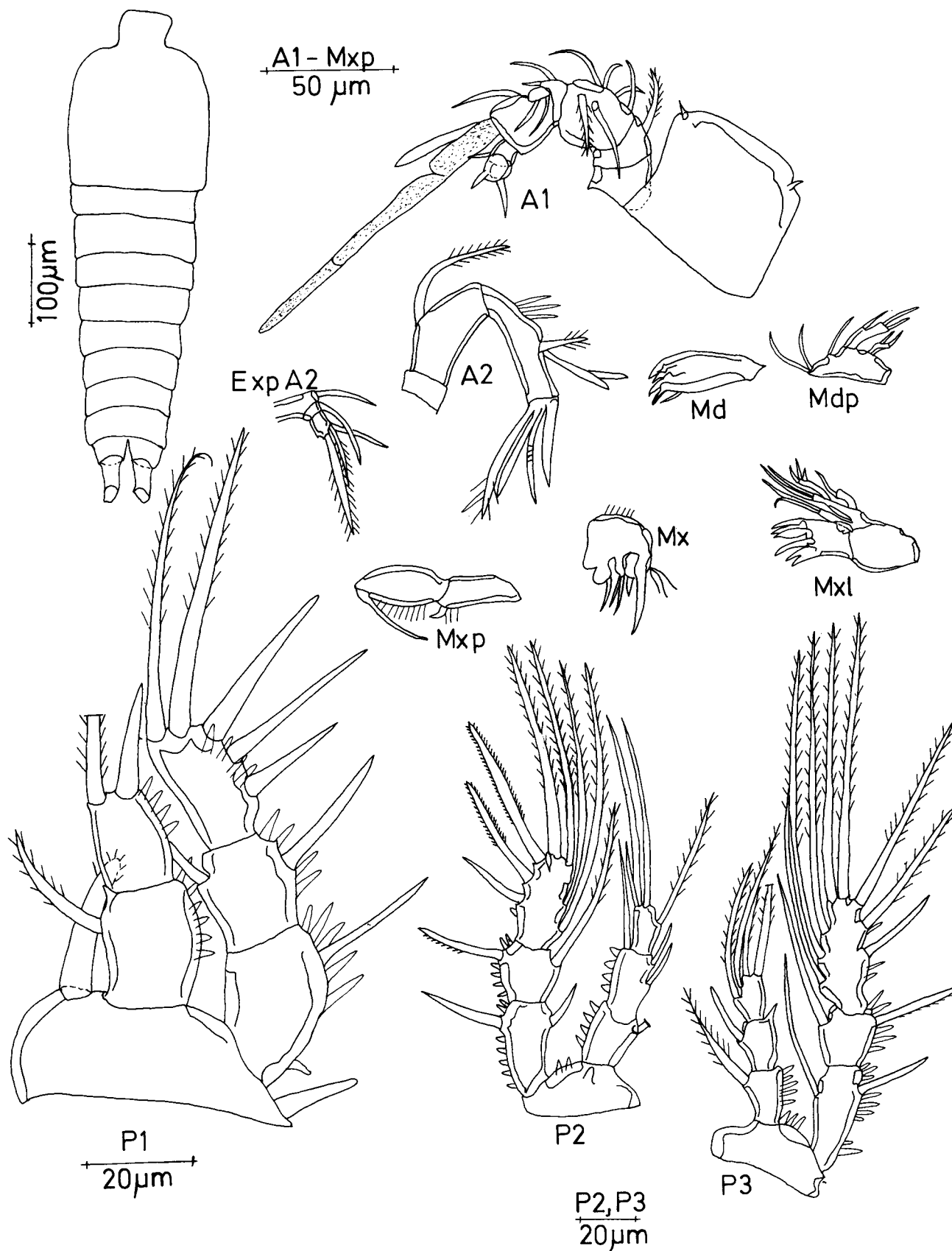


Fig. 8. *Paranannopus kunzi* sp.n.

A1 7-segmented, sub-chirocerate, with several spines, only 2 of them plumose. Long aesthetasc on segment 5. A2 with basis, Exp 3-segmented, with 2 setae on segment 1, 1 seta on segment 2 and 3 setae on segment 3. Mouthparts Md, Mx1, Mx and Mxp as figured. P1 Exp 3-segmented, Enp 2-segmented. All segments supplied with

accessory spines. Basis with a strong plumose seta at the outer and inner side. Setation as figured and listed below. P2-P4 all Exp 3-segmented, supplied with accessory spines. Enp P2 and P3 3-segmented, segment 2 Enp P2 modified; Enp P4 2-segmented. Setation as figured and listed below.

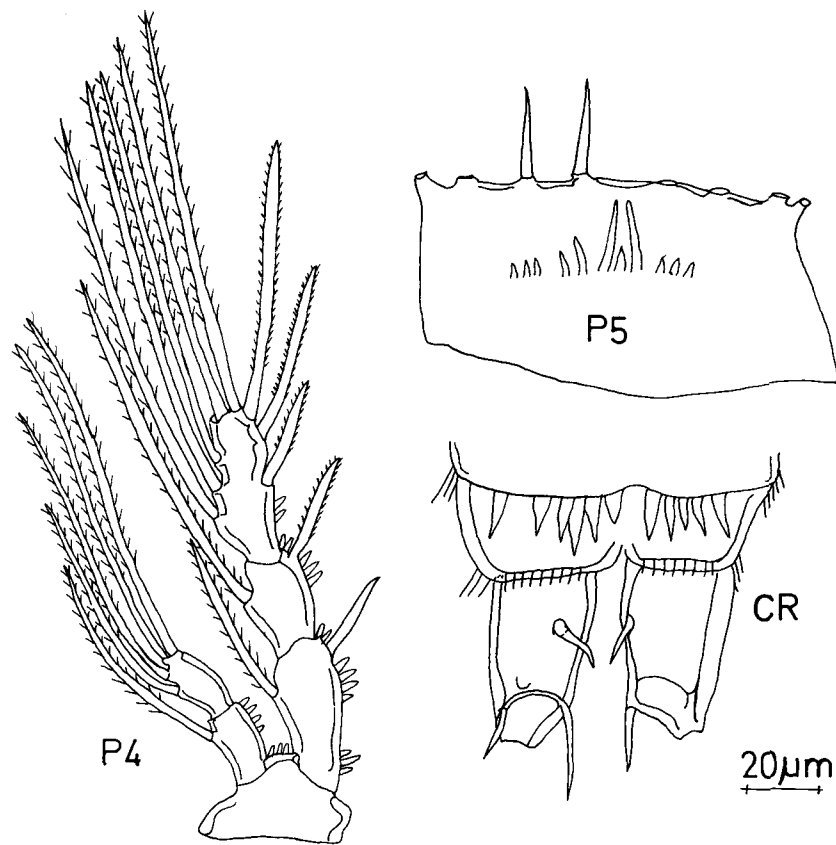


Fig. 9. *Paranannopus kunzi* sp.n.

#### Spine and setal formula

	Exp	Enp
P1	0.1.023	1.220
P2	1.1.223	1.mod2.221
P3	1.1.323	1.1.221
P4	1.1.323	1.220

P5 Benp and Exp fused to a small plate with 10 setae in all. P6 small, with 2 setae each.

#### Remarks

*P. hicksi* sp.n. is closely related to *P. langi* Wells, *P. wellsi* Soyer, *P. variabilis* sp.n. and *P. kunzi* sp.n., all representing 3-segmented Enp P2 and P3 and 3-segmented Exp A2. The species differ from each other in the setation of swimming legs P1–P5 and to some extent in the segmentation of the A1. Wells' keys (1976, p. 154) can be amended to include *P. hicksi* by adding the following codon: 3:2/3:3:3/3:2/7:8:8/5:4.

#### Discussion

Since comments on the relationships of the species within the genus *Paranannopus* based on Becker (1972) were presented by Becker *et al.* (1979), eight new species and the female of *P. langi* have been described (Schriever 1983, present paper).

There are three different characters in all 22 species that divide these species into three evolutionary groups [for further information see Becker (1972) and Becker *et al.* (1979)]. These three groups and their representatives are presented in Table II.

Since Coull (1973) presented a key to the ten known species of *Paranannopus*, five new species have been reported in Bodin's (1979) catalogue and Wells' (1981) third amendment to his keys. One of these new species, *P. elongatus* Becker *et al.*, should be transferred to *Cylindronannopus* (see below). In the meantime Schriever

Table II. The three evolutionary groups of the genus *Paranannopus* and their representatives

Character	Group 1 Enp P2–P4 3:3:2-segmented	Group 2 Enp P2–P4 2-segmented	Group 3 Enp P2–P4 at most 1-segmented
Species	<i>P. langi</i> Wells, 1965 <i>P. wellsi</i> Soyer, 1976 <i>P. variabilis</i> sp.n. <i>P. kunzi</i> sp.n. <i>P. hicksi</i> sp.n.	<i>P. sarsi</i> Lang, 1936 <i>P. bahusiense</i> Por, 1964 <i>P. triarticulatus</i> Wells, 1965 <i>P. truncatus</i> Becker <i>et al.</i> , 1979 <i>P. trisetosus</i> sp.n.	<i>P. abyssi</i> (Sars, 1920) <i>P. echinipes</i> Smirnov, 1946 <i>P. minutus</i> Smirnov, 1946 <i>P. philistinus</i> Por, 1964 <i>P. caheti</i> Soyer, 1964 <i>P. reductus</i> Becker <i>et al.</i> , 1979 <i>P. longithorax</i> Becker <i>et al.</i> , 1979 <i>P. atlanticus</i> Coull, 1973 <i>P. plumosus</i> Schriever, 1983 <i>P. singulosoetosus</i> sp.n. <i>P. uniarticulatus</i> sp.n. <i>P. denticulatus</i> sp.n.

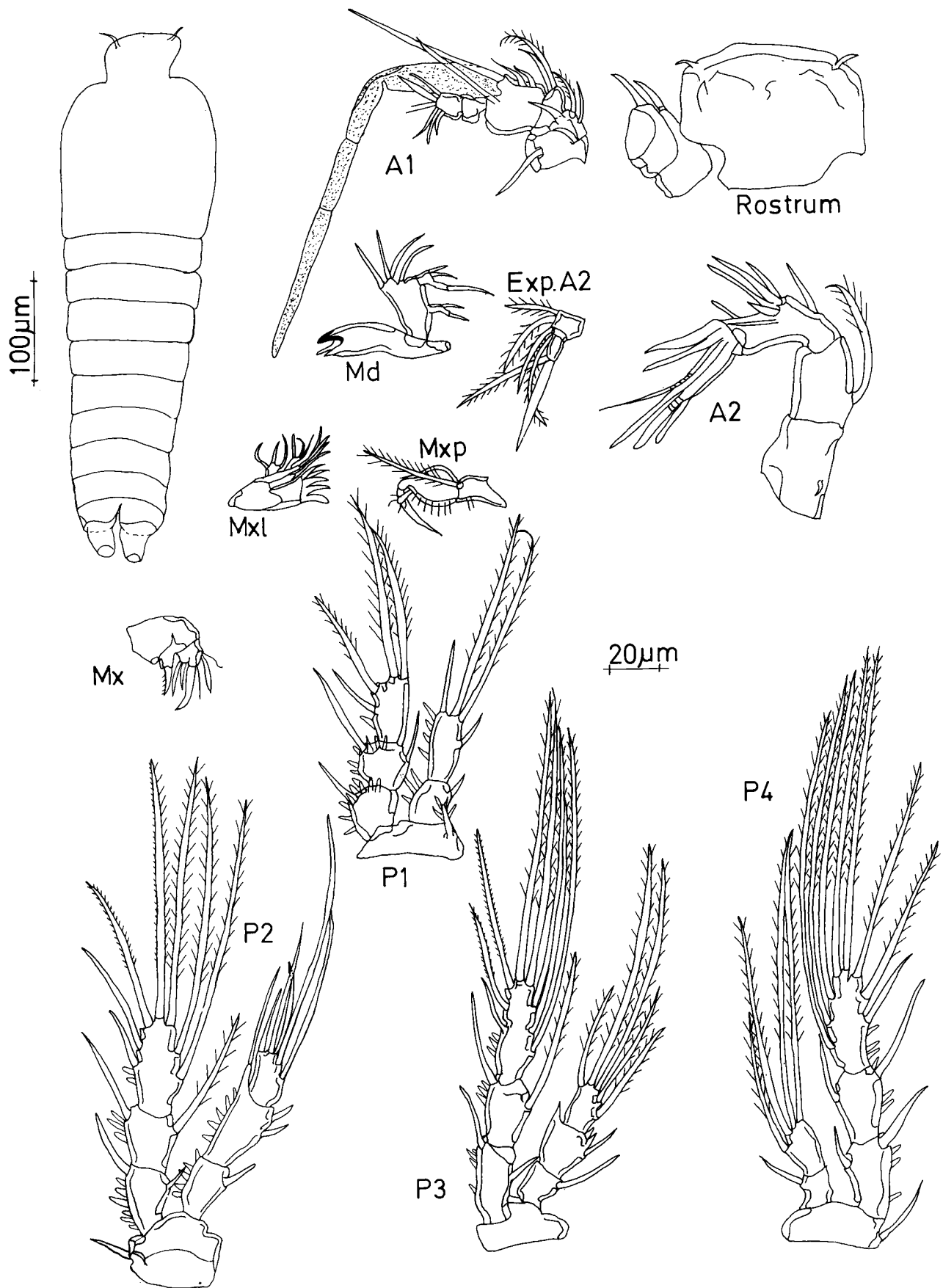


Fig. 10. *Paranannopus hicksi* sp. n.

(1983) has described *P. plumosus* and the female of *P. langi* and thus, including the seven new species dealt with in this paper, 22 species of *Paranannopus* are now known. A new key to this genus (updated after Coull 1973) is given below.

**Key to the species of *Paranannopus***

1. Enp P2-P4 absent  
    Enp P2-P4 3:3:2-segmented  
    Enp P2-P4 all 2-segmented  
    Enp P2-P4 all 1-segmented

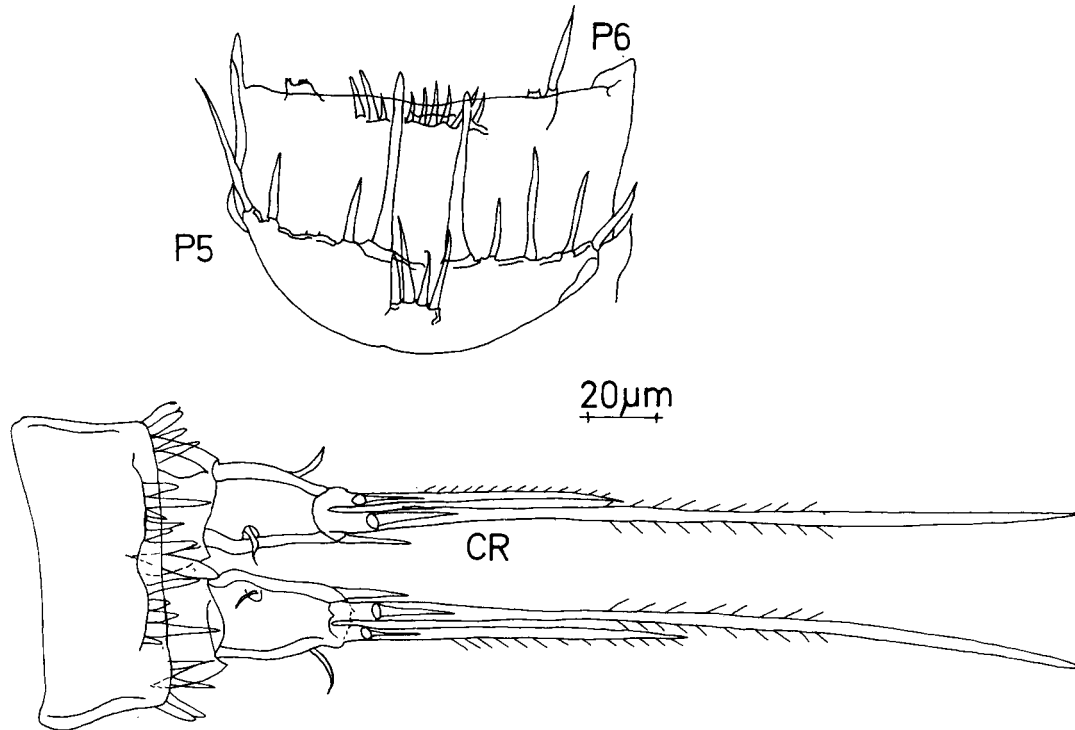


Fig. 11. *Paranannopus hicksi* sp.n.

- |  |                                 |
|--|---------------------------------|
| 2. Exp A2 2-segmented                                | 3                               |
| Exp A2 3-segmented                                   | 4                               |
| Exp A2 1-segmented, Benp & Exp P5 separate           | <i>P. abyssi</i>                |
| 3. Terminal segment Exp P3 with 6 setae              | <i>P. caheti</i>                |
| Terminal segment Exp P3 with 5 setae                 | <i>P. plumosus</i>              |
| 4. Exp P2–P4 all 3-segmented                         | <i>P. denticulatus</i> sp.n.    |
| Exp P2–P4 with 2:2:1 segments                        | <i>P. reductus</i>              |
| Exp P2–P4 1-segmented                                | <i>P. uniarticulatus</i> sp.n.  |
| 5. A1 7-segmented                                    | 6                               |
| A1 6-segmented, terminal segment Enp P4 with 6 setae | <i>P. wellsi</i>                |
| A1 6-segmented, terminal segment Enp P4 with 3 setae | <i>P. variabilis</i> sp.n.      |
| A1 6-segmented, terminal segment Enp P4 with 4 setae | <i>P. langi</i>                 |
| 6. Terminal segments Enp P2–P4 with 4 setae each     | <i>P. kunzi</i> sp.n.           |
| Terminal segments Enp P2–P4 with 5:5:4 setae         | <i>P. hicksi</i> sp.n.          |
| 7. Exp A2 3-segmented                                | 8                               |
| Exp A2 1-segmented                                   | <i>P. sarsi</i>                 |
| Exp A2 2-segmented                                   | <i>P. bahusiense</i>            |
| 8. Terminal segment Enp P4 with 1 seta               | <i>P. trisetosus</i> sp.n.      |
| Terminal segment Enp P4 with 2 setae                 | <i>P. triarticulatus</i>        |
| Terminal segment Enp P4 with 3 setae                 | <i>P. truncatus</i>             |
| 9. A1 5-segmented                                    | 10                              |
| A1 6-segmented                                       | <i>P. philistinus</i>           |
| 10. Enp P3 with 1 seta                               | 11                              |
| Enp P3 with 2 setae                                  | 12                              |
| Enp P3 with 3 setae                                  | <i>P. atlanticus</i>            |
| 11. Benp & Exp fused, triangular, Benp prominent     | <i>P. longithorax</i>           |
| Benp & Exp fused to a small plate                    | <i>P. singulosestosus</i> sp.n. |
| 12. Terminal segment Exp P4 with 7 setae             | <i>P. minutus</i>               |
| Terminal segment Exp P4 with 5 setae                 | <i>P. echinipes</i>             |

### *Cylindronannopus bispinosus* sp.n. (Figs. 12–13)

*Type locality.* Iceland–Faroe Ridge, 62°04'N, 13°56'W, F.R.V. *Anton Dohrn* cruise 98, Sta. 479, depth 1555 m; leg. Thiel, 6 July 1966.

*Material.* 2 ♀♀, Sta. 479. 2 ♀♀, 1 ♂ Sta. 491, 2 ♂♂, 1 ♀ Sta. 492. Holotype dissected ♀ on slide, A1-Fu, ZMK Cop. No. 1338. Allotype dissected ♂ on slide, ZMK Cop. No. 1339. Paratypes 2 ♀♀ dissected on slides, A1-Fu, ZMK Cop. Nos. 1340, 1341; 1 ♀ undisseminated, glycerin preparation, ZMK Cop. No. 1342; 2 ♂♂, undisseminated, glycerin preparation, ZMK Cop. No. 1343.

*Etymology.* The specific name *bispinosus* refers to the two large spines of the P5.

### *Description of the female*

Based on a ovigerous female, length 500 µm. Body narrow

and elongate, tapering in form as characteristic of the family Cylindropsyllidae (see Coull 1973). Abdominal somites 2–4 much longer than last one, with ornamentation. Caudal rami little longer than broad ( $C/R_L = 30 \mu\text{m}$ ,  $C/R_B = 20 \mu\text{m}$ ).

A1 4-segmented, aesthetasc on segment 3; strong and heavily spinulose as figured. A2 with allobasis, Enp laterally and terminally with strong spinulose setae. Exp A2 3-segmented, segment 1 and 2 with 1 spatulate seta each, segment 3 with 3 spinulose seta. Md praecoxa with tridentate pars incisiva and four dentate lacinia. Coxa basis with 4 setae. Enp with 3 setae, single seta which represents the Exp lost during preparation. Mx1 arthrite of praecoxa with 4 terminal claw-like setae. Coxa terminating in 1 claw-like seta and 3 small setae. Basis with 4 setae, Exp missing, Enp 1-segmented with 2 plumose setae. Mx basis with claw, syncoxa with 3 indistinct endites. Distad one with 2 spinulose setae. Enp 1-segmented with 4 setae. Mxp inner edges of basis and Enp with a row of fine hairs. Basis with 2 setae at the inner distal corner. Enp 1-segmented, terminating in a strong plumose seta, a slender naked seta inserts nearby at the outer edge. P1 Exp 3-segmented, Enp 2-segmented, All segments and setae plumose as figured and listed below. P2 Exp and Enp 3-segmented. All segments and spines plumose as figured and listed below. P3, P4 Exp 3-segmented, Enp 2-segmented, all segments and spines plumose as figured and listed below.

### Spine and setal formula

	Exp	Enp
P1	0.0.121	0.020
P2	0.1.111	0.0.010
P3	1.1.111	0.010
P4	1.1.111	0.010

P5 Benp and Exp fused into a small single plate on each side with 2 terminal strong naked setae each.

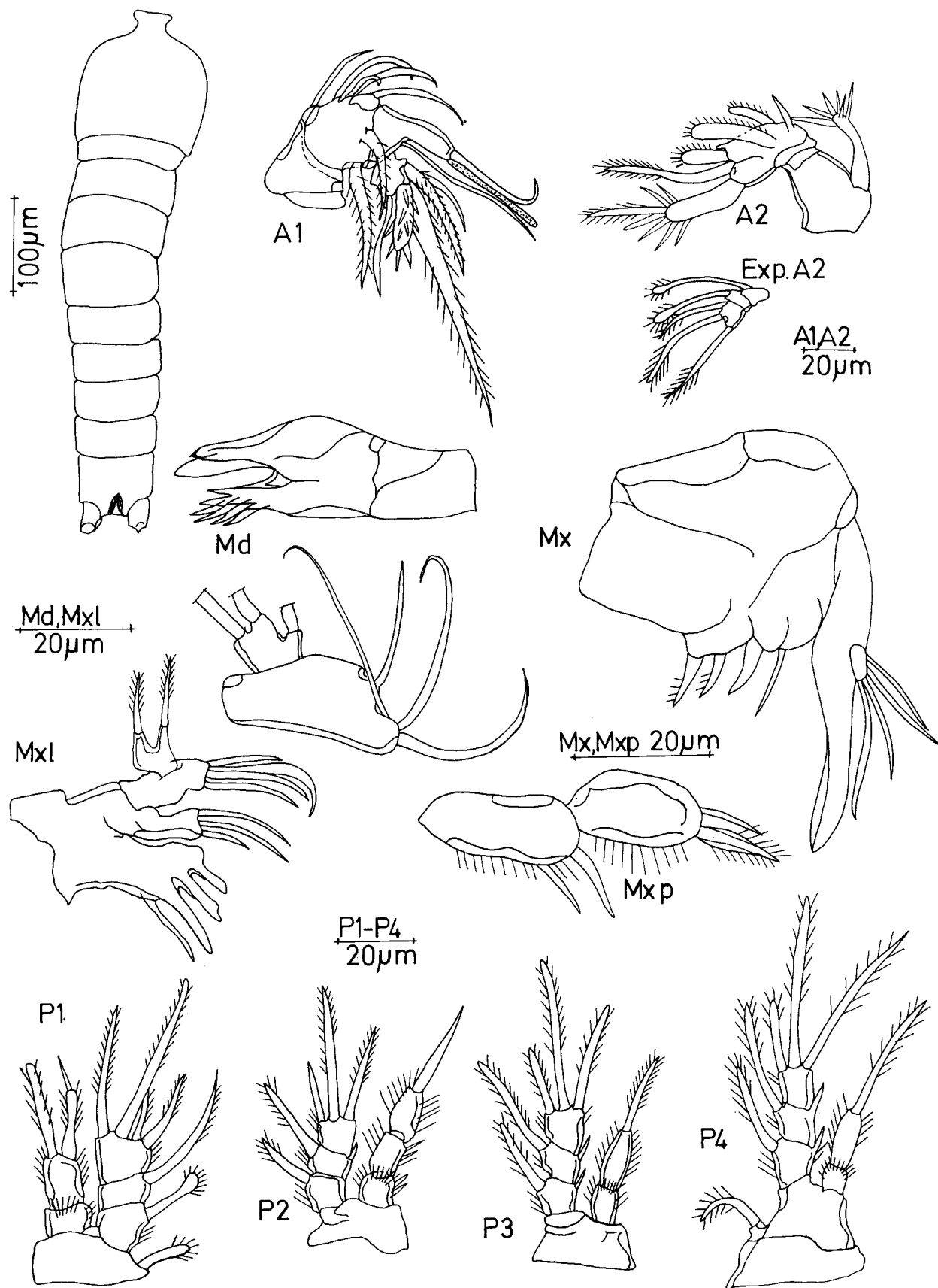


Fig. 12. *Cylindronannopus bispinosus* sp.n.

#### Description of the male

Body length 480 µm, with spermatophore. Body shape exactly the same as in the female. Only the differences from the female are figured and reported.

Md the same as female, but coxa basis with 1-segmented Exp with 1 seta. P3 Exp and Enp 3-segmented. Enp segment 2 modified into a claw-like outer extension. Segment 3 with 1 plumose seta as figured.

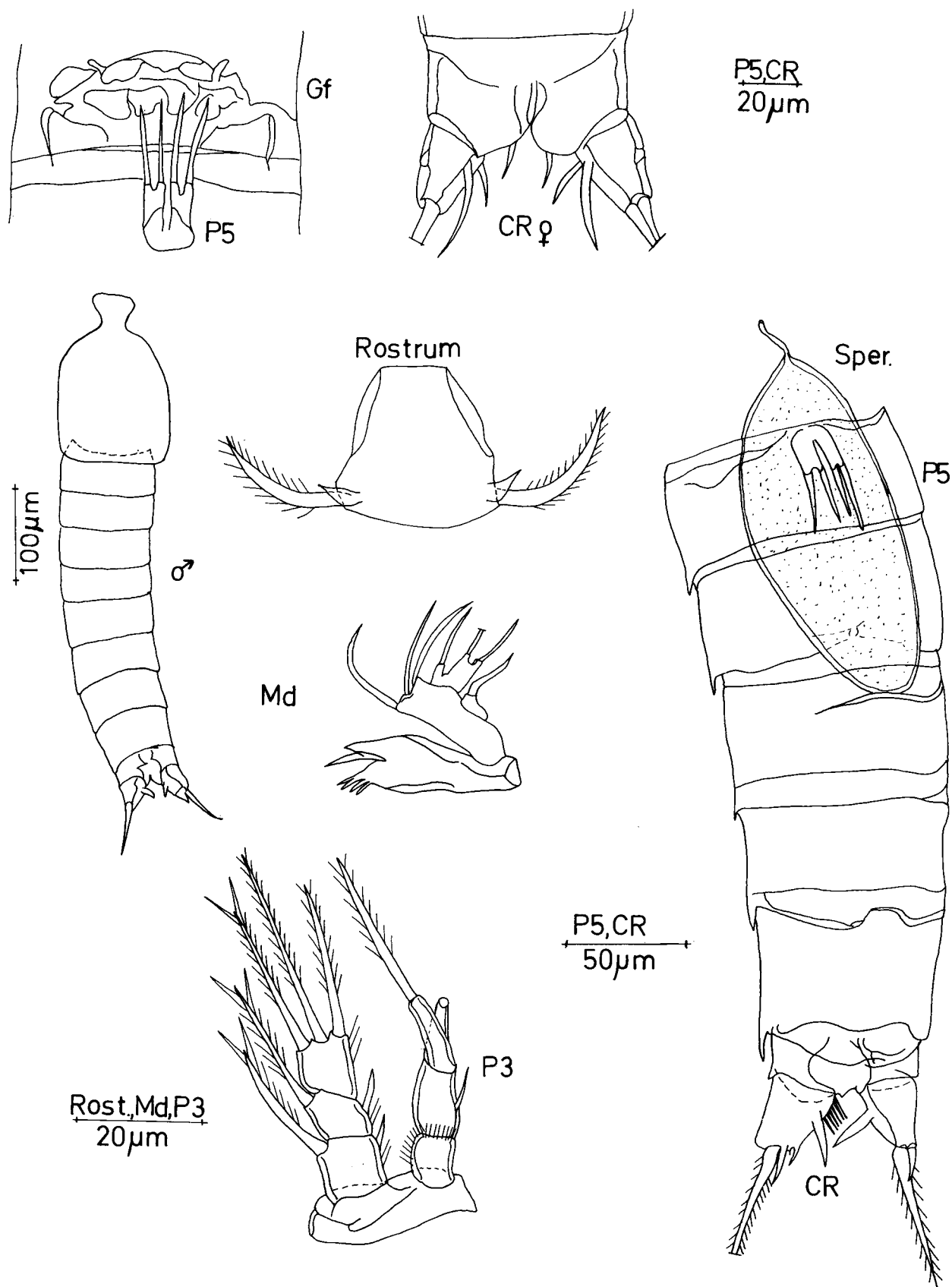


Fig. 13. *Cylindronannopus bispinosus* sp.n.

Spine and setal formula

	Exp	Enp
P1	0.0.121	0.011
P2	0.1.111	0.0.010
P3	1.1.111	0.mod1.010
P4	1.1.111	0.010

Abdominal somites, caudal rami and spermatophore as figured.

Remarks

The genus *Cylindronannopus* was erected by Coull (1973) partly on the basis of its body shape, but also because the P5 and the Enp segmentation of the P2–P4 also differed

from those of *Paranannopus*. In his thesis Becker (1972) described *Paranannopus elongatus*, which is very closely related to *C. primus* Coull. Becker stated that the differences between *P. elongatus* and the other known *Paranannopus* species did not justify the establishment of a new genus. Comparing the description of *P. elongatus* Becker *et al.* and *C. primus*, Becker thought the species were synonymous, but did not give his reasons. Therefore *P. elongatus* was published by Becker *et al.* (1979) and the different characters were discussed.

*Cylindronannopus bispinosus* sp.n., which is closely related to *C. primus*, differs from the latter in the segmentation of the A1, Exp A2, Enp P3 and in the setation of the Exp P2–P4.

During a visit by G. Hicks (National Museum of New Zealand) to the Zoologisches Museum Kiel in the summer of 1983, the taxonomic problems within this group were discussed. We consider the genus *Cylindronannopus* to be valid and that *Paranannopus elongatus* should be transferred to it, becoming *Cylindronannopus elongatus* (Becker *et al.*, 1979) comb.n. In contradiction to Wells (1981, p. 8) *C. elongatus* requires the following codon: 3:2/3:3:3/3:2/3:3:3/1:1. This codon, presented for *C. primus* in Wells' keys (1976, p. 156), is valid for all three known species.

#### Key to the species of *Cylindronannopus*

- |                     |                             |
|---------------------|-----------------------------|
| 1. A1 4-segmented   | 2                           |
| A1 5-segmented      | <i>C. primus</i>            |
| 2. P5 with 3 spines | <i>C. elongatus</i> comb.n. |
| P5 with 2 spines    | <i>C. bispinosus</i> sp.n.  |

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