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New species of *Lucicutia* and taxonomic status of *L. grandis* (Copepoda, Calanoida, Lucicutiidae)

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Abstract

Calanoid copepod specimens attributable to *Lucicutia grandis* (Giesbrecht, 1895), *L. bradyana* Cleve, 1904, *L. wolfendeni* Sewell, 1932, and *L. rara* Hulsemann, 1966) were studied from antarctic and subantarctic waters collected during RV *Eltanin* cruises 4–11 and 23, and RV *Ob* cruises 1 and 3. In addition, identified specimens from the Pacific and Indian Oceans deposited in the systematic collections of the National Museum of Natural History, Smithsonian Institution (Washington, DC, USA) and the Zoological Institute, Russian Academy of Sciences (St Petersburg) were also examined. Both sexes of a new species are described from the eastern tropical Pacific Ocean, *L. hulsemannae*. *Lucicutia hulsemannae* is distinguished from *L. grandis*, *L. bradyana* and *L. wolfendeni* by the morphology of the rostrum, genital complex, including plug, and leg 5 of both sexes. *Lucicutia bradyana* is not found outside the Southern Hemisphere but *L. grandis* is recorded from the Arabian Sea, the Bay of Bengal, tropical Indian Ocean, as well as its type locality in the eastern tropical Pacific Ocean. *Lucicutia wolfendeni* is found in all oceans except the Arctic Ocean. The status of *L. bradyana*, previously rejected as a separate species by Hulsemann (1966), is restored. *Lucicutia rara* is considered a junior synonym of *L. bradyana*.

Keywords: *Calanoida*, *distribution*, *Lucicutia*, *new species*, *taxonomy*

Introduction

The genus *Lucicutia* includes 44 nominal species (Hulsemann 1966; Heptner 1971; Razouls 1995; Bradford-Grieve 1999). Despite a recent taxonomic revision of *Lucicutia* (Hulsemann 1966), identification of specimens attributable to species like *L. grandis* (Giesbrecht, 1895), *L. wolfendeni* Sewell, 1932 and *L. bradyana* Cleve, 1904 remained problematical. For example, in recent studies of calanoid copepods collected in the oxygen minimum zones of the Arabian Sea and the eastern tropical Pacific Ocean, *L. grandis* was reported to have similar ecology and feeding activity from both regions (Gowing and Wishner 1998; Wishner et al. 2000), while differing in morphology (Gowing and Wishner 1998; Wishner et al. 2000). The present taxonomic study shows clear morphological differences between the eastern tropical Pacific Ocean specimens of *L. grandis* and those from the Arabian Sea associated with the oxygen minimum zone. Specimens from the

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eastern tropical Pacific Ocean are described here as a new species, *L. hulsemannae*. *Lucicutia grandis*, *L. wolfendeni* and *L. bradyana* are redescribed. Synonyms are given for each of the species for publications in which descriptions and illustrations permit specimens in question to be verified unequivocally.

Material and methods

Specimens of *Lucicutia* were examined from samples collected during RV *Eltanin* cruises 4–11 and 23, south of 55°S in the Atlantic and Pacific sectors of the Southern Ocean (Table I), and specimens identified by Hulsemann (1966) as *Lucicutia grandis* and *Lucicutia rara* from *Anton Bruun* cruises 2 and 6 deposited in the National Museum of Natural History (NMNH), Smithsonian Institution, Washington, DC, USA. Specimens from Volcano 7 in the eastern tropical Pacific Ocean (Wishner et al. 1995) and from the Arabian Sea (Wishner et al. 1998) were also observed. Lucicutiids from the Zoological Institute, Russian Academy of Sciences, St Petersburg, Russia, collected in the north-western Pacific Ocean and during RV *Ob* cruises 1 and 3 to the Indian Ocean, the south-western and south-eastern Pacific Ocean (Tables II, III) were also studied.

Institutions in which specimens, including type specimens of the new species, are deposited are abbreviated as follows: NMNH, National Museum of Natural History, Smithsonian Institution, Washington, DC; ZISP, Zoological Institute, Russian Academy of Sciences, St Petersburg. First pair of swimming legs is abbreviated as P1, fifth pair of swimming legs as P5. All figures have been prepared using camera lucida.

Taxonomy

Family LUCICUTIIDAE Sars, 1902

Genus *Lucicutia* Giesbrecht, 1898

Lucicutia grandis (Giesbrecht, 1895)

(Figures 1, 2)

Leuckartia grandis Giesbrecht 1895, p 258, Plate 4, Figure 2.

Lucicutia grandis: Giesbrecht and Schmeil 1898, p 111; Hulsemann 1966, p 724, Figure 101; S. Ali-Khan and J. Ali-Khan 1982, p 268–269, Figures 19–22.

Lucicutia challengerii Sewell 1932, p 290–294, Figure 95; 1947, p 174.

Female

Total length 4.7–4.9 mm. Prosome 1.7–1.8 times longer than urosome. Cephalosome with pointed protrusions (Figure 1A–C). Rostrum not divergent; rami closely spaced (Figure 1D). Genital double-somite with conical plug (Figure 1G, I, J). Anal somite nearly as long as two preceding somites together (Figures 1E–J), with dorsal side strongly swollen (Figure 1G–J). Caudal rami in dorsal view 1.0–1.3 times longer than anal somite and about five times longer than wide (Figure 1E, F). Antennule exceeding body length by distal segment. Medial seta at exopodal segment 2 of P5 attenuate, thin at tip (Figure 1K).

Male

Total length 4.1–4.6 mm. Prosome 1.65–1.80 times longer than urosome. Cephalosome with pointed protrusions (Figure 2A). Rostrum not divergent, with closely spaced rami. Antennule exceeding body length by about two segments; of 21 articulated segments,

Table I. RV *Eltanin* stations where *Lucicutia bradyana* and *L. wolfendeni* were found.

Cruise	Station	Date	Localities (S, W)	Depth (m)	Species (deposited in NMNH)
4	123	28 July 1962	57°09', 63°43'	2439	<i>L. bradyana</i> (1 female, 1 male CV)
	141	10 August 1962	59°56', 65°15'	915	<i>L. wolfendeni</i> (1 male)
	142	10 August 1962	60°01', 65°25'	1830	<i>L. wolfendeni</i> (5 females), <i>L. bradyana</i> (1 male)
	143	10 August 1962	60°01', 65°25'	609	<i>L. wolfendeni</i> (1 male)
	149	12 August 1962	58°31', 65°17'	2105	<i>L. wolfendeni</i> (3 females, 1 male)
5	262	19 October 1962	62°26', 67°45'	2428	<i>L. bradyana</i> (1 female)
	282	24 October 1962	67°04', 75°19'	1830	<i>L. wolfendeni</i> (2 males)
	285	25 October 1962	66°31', 66°29'	708	<i>L. wolfendeni</i> (1 male)
6	359	6 December 1962	56°19', 58°10'	708-842	<i>L. bradyana</i> (10 females, 4 males, 3 CV females)
	364	8 December 1962	57°34', 59°06'	619-849	<i>L. bradyana</i> (1 female, 1 male)
7	466	12 February 1963	55°03', 44°38'	3348-3596	<i>L. wolfendeni</i> (1 male)
8	575	17 April 1963	55°29', 24°18'	1867	<i>L. bradyana</i> (1 male)
	580	21 April 1963	57°23', 23°11'	3074	<i>L. wolfendeni</i> (1 female)
	605	5 May 1963	58°28', 22°20'	1812	<i>L. wolfendeni</i> (3 females)
9	687	26 August 1963	55°24', 37°57'	2214	<i>L. wolfendeni</i> (2 females)
	703	31 August 1963	58°51', 37°22'	1111	<i>L. bradyana</i> (1 male)
10	867	23 November 1963	59°25', 78°27'	2776	<i>L. wolfendeni</i> (1 female)
	868	25 November 1963	57°06', 78°56'	997-1230	<i>L. bradyana</i> (7 females, 7 males)
	874	27 November 1963	56°06', 79°04'	1491	<i>L. wolfendeni</i> (1 female, 1 male), <i>L. bradyana</i> (1 female)
11	891	4 January 1964	59°50', 114°53'	1347-1702	<i>L. wolfendeni</i> (1 female)
	900	7 January 1964	62°03', 115°07'	860-874	<i>L. bradyana</i> (1 female, 1 male)
	911	12 January 1964	64°45', 114°22'	344	<i>L. wolfendeni</i> (1 female, 1 male)
	917	15 January 1964	66°34', 115°36'	580	<i>L. wolfendeni</i> (1 male)
	922	17 January 1964	70°04', 115°03'	-	<i>L. wolfendeni</i> (1 female)
	944	24 January 1964	69°06', 95°02'	3029	<i>L. wolfendeni</i> (1 female, 1 male)
23	1634	14 April 1966	62°20', 101°01'	900-1025	<i>L. wolfendeni</i> (1 female), <i>L. bradyana</i> (1 female, 1 male)
	1641	16 April 1966	61°18', 101°31'	750-850	<i>L. wolfendeni</i> (1 female)
	1645	18 April 1966	59°29', 101°51'	875-975	<i>L. bradyana</i> (2 females)
	1678	1 May 1966	62°26', 115°05'		<i>L. bradyana</i> (1 male)

segment 18 longest (Figure 2D, E). The first exopodal segment of right P5 slightly shorter than segment 2 (Figure 2H, J, K); endopodal segment 2 without surface spinulation (Figure 2I). Medial distal part of basipod of left P5 with saw-like, toothed margin; exopodal segment 3 oval-rounded (Figure 2F, G).

Remarks

The following combination of characters distinguishes the females of *L. grandis* from *L. bradyana*: anal somite swollen dorsally in lateral view (swollen ventrally in *L. bradyana*;

Table 11. The list of specimens of *Lucicutia grandis* from collections of NMNH and ZISP.

Vessel and cruise	Station	Date	Localities	Depth layer (m)	Collection number	Number of specimens
<i>Anton Bruun</i> cruise 2	108-549	-	13°50'N, 70°07'E	2000-1000	WHOI 3367 NMNH	9 females, 4 males
<i>Anton Bruun</i> cruise 2	112-580	-	05°48'N, 70°03'E	2000-1000	WHOI 1918 NMNH	1 female
<i>Anton Bruun</i> cruise 6	330	-	13°35'N, 65°02'E	2000-1000	WHOI 2219 NMNH	5 females, 2 males
<i>Anton Bruun</i> cruise 6	332	-	10°N, 65°E	1000-500	WHOI 2607 NMNH	2 females, 2 males
<i>Anton Bruun</i> cruise 6	340	-	06°01'S, 65°05'E	2000-1000	WHOI 3636 NMNH	1 female
<i>Anton Bruun</i> cruise 6	342	-	10°07'S, 64°27'E	1000-500	WHOI 2961 NMNH	1 female
<i>Thomas Thompson</i> TN050	Moc311	8 September 1995	17°14'N, 59°49'E	1001-903	ZISP	4 females, 4 males
<i>Ob</i> cruise 1	142	2 June 1956	05°05'S, 57°35'E	1250-0	90723	2 females (?)

Figure 4D-F); genital-double somite with conical plug (rounded in *L. bradyana*; Figure 4D-F); medial seta at the exopodal segment 2 of female P5 attenuate and thin at the tip (in *L. bradyana* this seta robust; Figure 4G-I); rostral rami closely spaced (divergent in *L. bradyana*; Figure 4A-C). *Lucicutia grandis* differs from *L. wolfendeni* as follows: large anal somite swollen dorsally (anal somite of *L. wolfendeni* only slightly swollen dorsally; Figure 8D-F); genital double-somite of *L. grandis* with a conical plug (*L. wolfendeni* with an elongate-oval plug; Figure 8D-F); caudal rami of *L. grandis* are 1.0-1.3 times longer than anal somite (2.9-3.1 times longer than anal somite of *L. wolfendeni*; Figure 8C, D); rostral rami of *L. wolfendeni* are divergent (Figure 8G-I) and not closely spaced as in *L. grandis*. Females of *L. grandis* are smaller than *L. wolfendeni* and *L. bradyana*. Total length of *L. grandis* females studied here is 4.7-4.9 mm; published records of females: 5.54 mm after Sewell (1932); 4.4-6.5 mm after Hulsemann (1966); and 3.8-4.0 mm after Ali-Khan and Ali-Khan (1982). However, larger sizes given by Hulsemann (1966) are for specimens identified here as *L. bradyana* (see below).

The left P5 basipod of males of *L. grandis* which is not elongate medially-distally (Figure 2F, G) differs from both *L. bradyana*, in which there is an elongate medial-distal projection with varying number of terminal teeth (Figures 6B, D, 7A²-C²), and *L. wolfendeni* in which the projection is present but less pronounced (Figure 9F). The third exopodal segment of the left P5 of *L. grandis* is oval-rounded, while for *L. bradyana* it is elongate-oval and for *L. wolfendeni* it is elongate-triangular (Figures 2F, G, 6B, D, 7A²-C², 9F). The second endopodal segment of the right P5 of *L. grandis* is unarmed (Figure 2I, K), while that of *L. bradyana* is densely hirsute. The inner margin of the right basipod of *L. grandis* has a small tooth-like indentation which differs from the distinct, proximal-facing lobe of *L. wolfendeni* (Figure 9G). Sizes of males of *L. grandis* here are smaller than the male studied by Giesbrecht (1895), 6.0 mm, and larger than those of Ali-Khan and Ali-Khan (1982), 3.0-3.6 mm, but similar to those recorded by Sewell (1932), 3.9-4.60 mm, and Hulsemann (1966), 3.9-4.9 mm.

Lucicutia grandis was described originally by Giesbrecht (1895) from a single damaged male from the Eastern Tropical Pacific (1°N, 83°W); only the P5 was illustrated. Because

Table III. Specimens of *Lucicutia wolfendeni* and *L. bradyana* from the collections of ZISP and NMNH.

Vessel and cruise	Station	Date	Localities	Layer (m)	Collection number	Species	Place of disposal
<i>Severnyi Polyus</i>	1	25 July 1946	Pacific Ocean, Kamchatka, 90 miles SE of Shipunsky	4000-1000	40915	<i>L. wolfendeni</i> (2 females, 3 males)	ZISP
<i>Vijaz</i>	162	11 October 1949	44°55'N, 52°24'E	8500-0	40916	<i>L. wolfendeni</i> (9 females, 8 males)	ZISP
<i>Gagara</i>	9	30 July 1952	46°22'N, 145°54'E	3000-0	46179	<i>L. wolfendeni</i> (female)	ZISP
<i>Ob, cruise 1</i>	48	22 March 1956	63°18'S, 135°13'E	3600-0	61338	<i>L. wolfendeni</i> (1 female)	ZISP
<i>Ob, cruise 1</i>	57	1956	64°03'S, 161°59'E	2000-0	61394	<i>L. wolfendeni</i> (1 female, 2 males)	ZISP
<i>Ob, cruise 1</i>	36	11 March 1956	62°56'S, 118°52'E	3700-0	61425	<i>L. wolfendeni</i> (1 female)	ZISP
<i>Ob, cruise 1</i>	83	15 April 1956	37°31'S, 163°59'E	1200-0	-	<i>L. bradyana</i> (1 female)	ZISP
<i>Ob, cruise 1</i>	111	12 May 1956	64°24'S, 92°52'E	2700-0	64370	<i>L. wolfendeni</i> (1 male)	ZISP
<i>Ob, cruise 1</i>	129	25 May 1956	31°20'S, 66°04'E	2200-0	90729	<i>L. bradyana</i> (3 females, 1 male)	ZISP
<i>Ob, cruise 1</i>	135	29 May 1956	19°09'S, 63°07'E	-	90726	<i>L. bradyana</i> (1 female)	ZISP
<i>Ob, cruise 3</i>	439	18 May 1958	31°39'S, 80°43'W	4015-0	90728	<i>L. bradyana</i> (1 female, 1 male)	ZISP
<i>Dalhevostochnik</i>	67	14 September 1932	59°14'N, 173°35'E	2500-0	64587	<i>L. wolfendeni</i> (2 females, 1 male)	ZISP
<i>Anton Braun</i> cruise 2	134-762	-	27°31'S, 80°06'E	2000-1000	WHOI 2014	<i>L. bradyana</i> (1 female)	NMNH
<i>Anton Braun</i> cruise 6	348A	-	24°03'S, 65°00'E	3500-0	WHOI 3293	<i>L. bradyana</i> (1 female)	NMNH
<i>Anton Braun</i> cruise 6	349B	-	26°24'S, 65°02'E	1470-0	WHOI 3313	<i>L. bradyana</i> (1 female)	NMNH
<i>Anton Braun</i> cruise 6	353A	-	37°59'S, 64°56'E	2394-0	WHOI 3387	<i>L. bradyana</i> (2 females)	NMNH
<i>Anton Braun</i> cruise 6	354A	-	40°48'S, 65°03'E	1650-0	WHOI 2725	<i>L. bradyana</i> (1 female)	NMNH
<i>Anton Braun</i> cruise 6	355C	-	29°29'S, 48°43'E	3410-0	WHOI 3367	<i>L. bradyana</i> (1 female)	NMNH

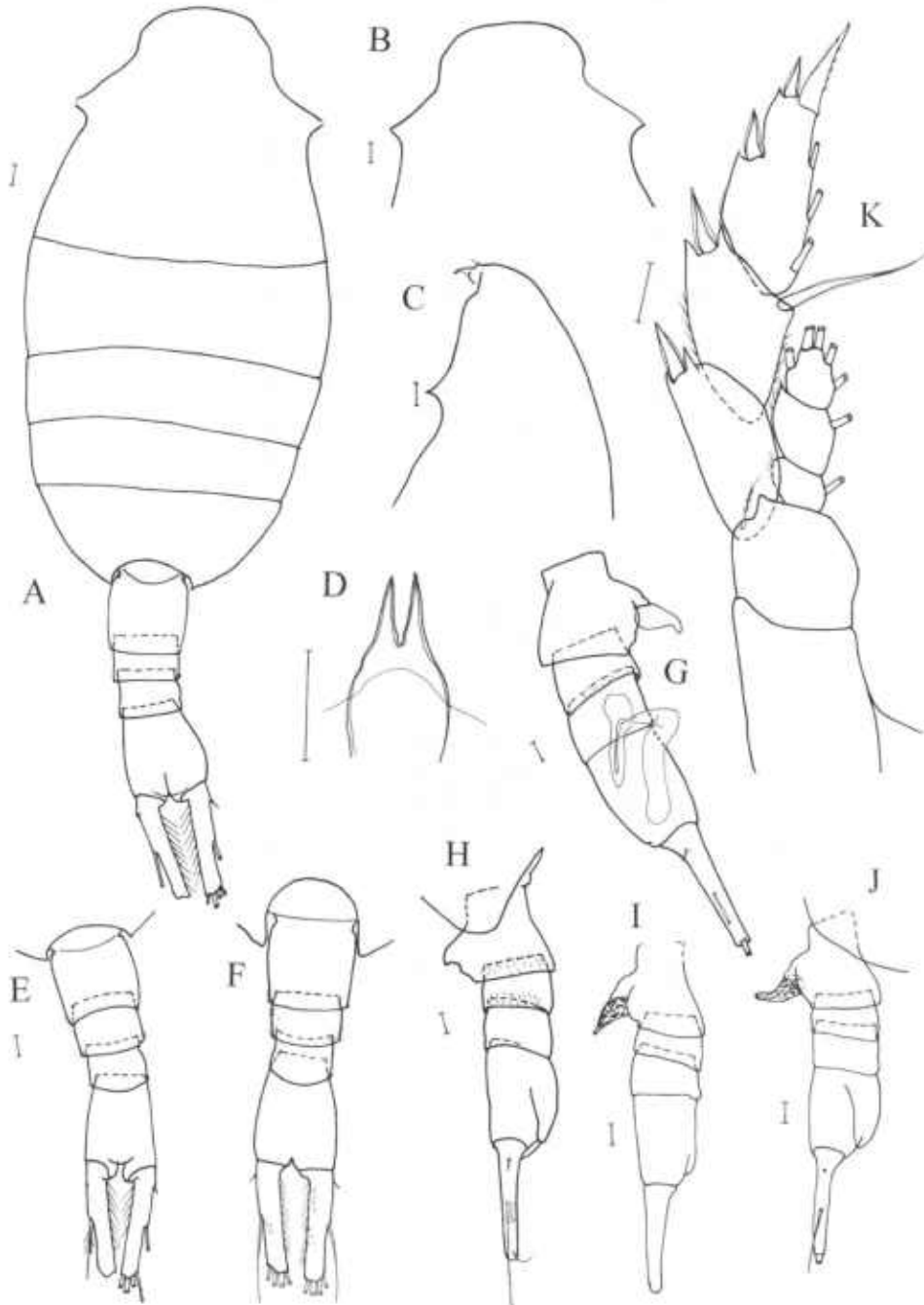


Figure 1. *Lucicutia grandis*. Female. (A) Habitus, dorsal; (B) anterior part of cephalon, dorsal; (C) same, left lateral; (D) rostrum, anterior; (E, F) urosome, dorsal; (G) same, right lateral; (H, I, J) same, left lateral; (K) P5. (A, B, D, E, G, I, J) Arabian Sea, *Thomas Thompson* cruise TN050; (C, F, H, K) tropical Indian Ocean, *Ob* cruise I, station 142. Scale bars: 0.1 mm.

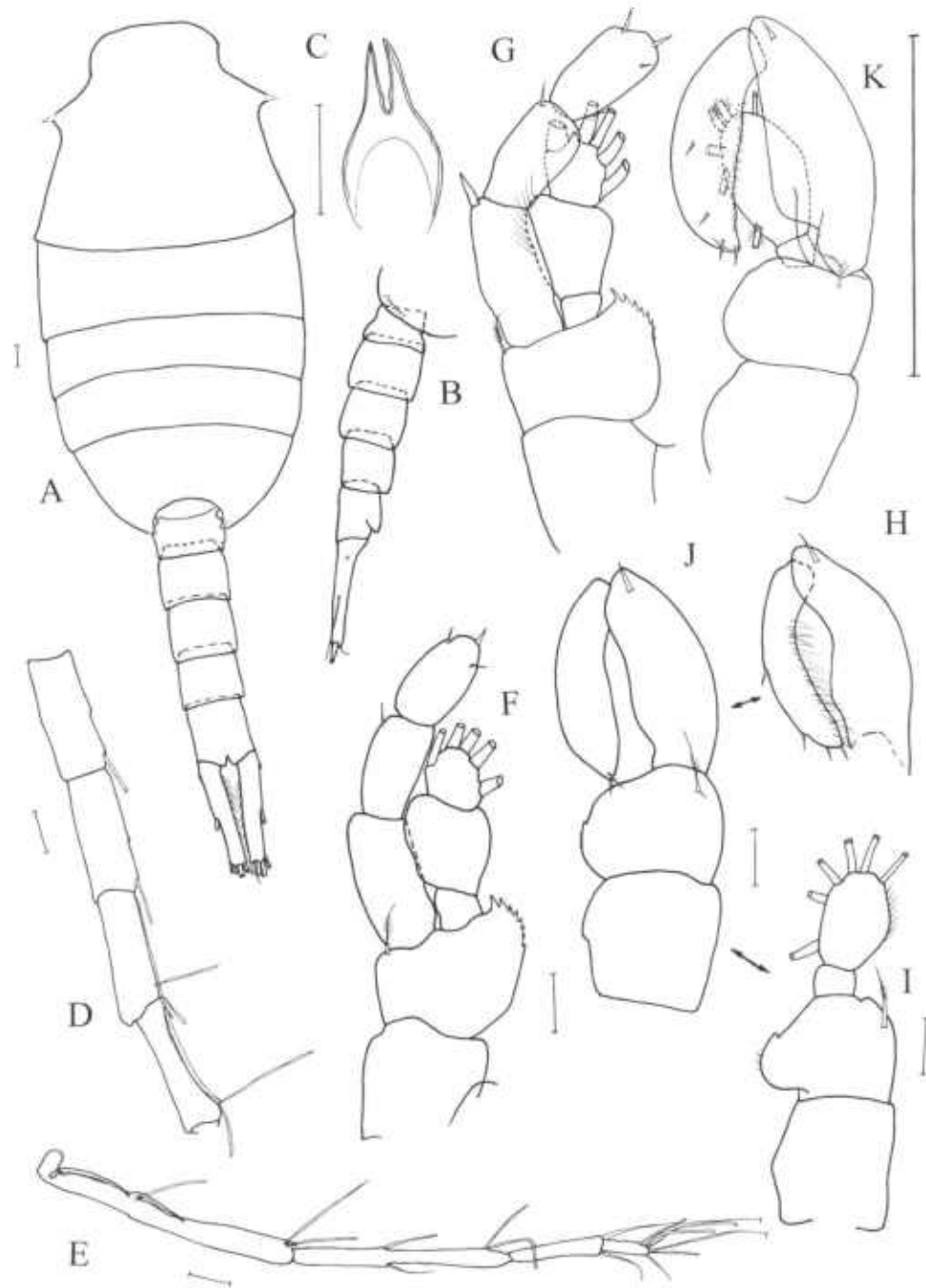


Figure 2. *Lucicutia grandis*. Male. (A) Habitus, dorsal; (B) urosome, left lateral; (C) rostrum, anterior; (D) 14–17 articulated segments of antennule; (E) 18–21 articulated segments of antennule; (F, G) P5 left; (H) P5 right exopod; (J, K) P5 right; (I) P5 right coxopod, basipod and endopod. (A–F, H–J) Arabian Sea, *Thomas Thompson* cruise TN050; (G, K) Arabian Sea, *Anton Braun* cruise 2, station 108-549. Scale bars: 0.1 mm (A–F, H–J); 0.5 mm (G, K).

the description of species is based on an incompletely illustrated male, the identification of *L. grandis* has remained problematical. In a revision of the genus, Hulsemann (1966, p 719) mentioned "None of the many subsequent records of *Lucicutia grandis* seems to be this species. Sewell (1932, p 289) proposed to establish for these records a new species, *L. wolfendeni*". In the same publication several nominal species of *Lucicutia* were placed in synonymy with *L. grandis*, including *L. bradyana* Cleve, 1904. That is a decision we reconsider here. *Lucicutia bradyana* Cleve, 1904 is recognized as a separate species based on the differences between the two groups of specimens enumerated above. However, we accept Hulsemann's conclusion that *L. challengerii* Sewell, 1932 is a junior synonym of *L. grandis*. Sewell (1932, Text-Figure 95h, j) illustrates the female P5 with a thin medial seta on the second exopodal segment and the shape of male P5 typical for *L. grandis* observed here.

Distribution

Lucicutia grandis is found in the eastern tropical Pacific Ocean at 1°N, 83°W (Giesbrecht 1895) and in the Indian Ocean north from 10°07'S. Specimens identified as *L. grandis* by Hulsemann (1966, p 717) from *Anton Bruun* stations 134, 348A, 349B, 353A, 354A, and 355C are *L. bradyana*. However, specimens from stations 108, 112, 330, 332, and 342 (see Figure 2K) are *L. grandis* (Hulsemann 1966, p 717). Specimens from *Discovery* cruise III station 5251, *Anton Bruun* station 328 and John Murray Expedition station 76 were not re-examined here. Based on records from the existing literature (Sewell 1932; Hulsemann 1966; Ali-Khan and Ali-Khan 1982) and data here, *L. grandis* is distributed in the northern part of the Indian Ocean, in the Arabian Sea and in the Bay of Bengal. The southernmost finding is 10°07'S (Hulsemann 1966); the northernmost is 24°09', 64°27'N (Ali-Khan and Ali-Khan 1982). Records from the Atlantic Ocean are ambiguous and date from Wolfenden (1911). However, Wolfenden's Figure 60 for *L. grandis* appears to be an illustration of *L. bradyana*. Björnberg (1973, p 343) recorded *L. grandis* from the southeastern Pacific Ocean between 07°S and 58°S without providing descriptions or illustrations.

Lucicutia bradyana Cleve, 1904

(Figures 3–7)

Lucicutia bradyana Cleve 1904, p 204–206, Plate 6, Figures 33, 34.

Lucicutia flavicornis (non Claus 1863): Brady 1883, p 50–51, Figure 1 (female only)

Lucicutia maxima (non Steuer 1904): Wolfenden 1911, p 318, Figure 60.

Lucicutia grandis (non Giesbrecht 1895): Bradford-Grieve 1999, p 100, Figure 66 (A–E).

Lucicutia rara Hulsemann 1966, p 735–736, Figures 45, 46, 103 (new syn.).

Female

Total length 5.5–6.1 mm. Prosome 1.45–1.60 longer than urosome. Cephalosome with slightly angular or rounded protrusions (Figure 3A–C). Rostral rami divergent and widely spaced (Figure 4A–C). Genital double-somite with rounded plug (Figure 4D–F). Anal somite nearly as long as, or slightly longer than two preceding somites together (Figure 3A, B, D), with ventral side significantly swollen (Figure 4D–F). Caudal rami in dorsal view 1.25–1.50 times longer than anal somite (Figure 3A, B, D) and about 5.8–6.6 times longer

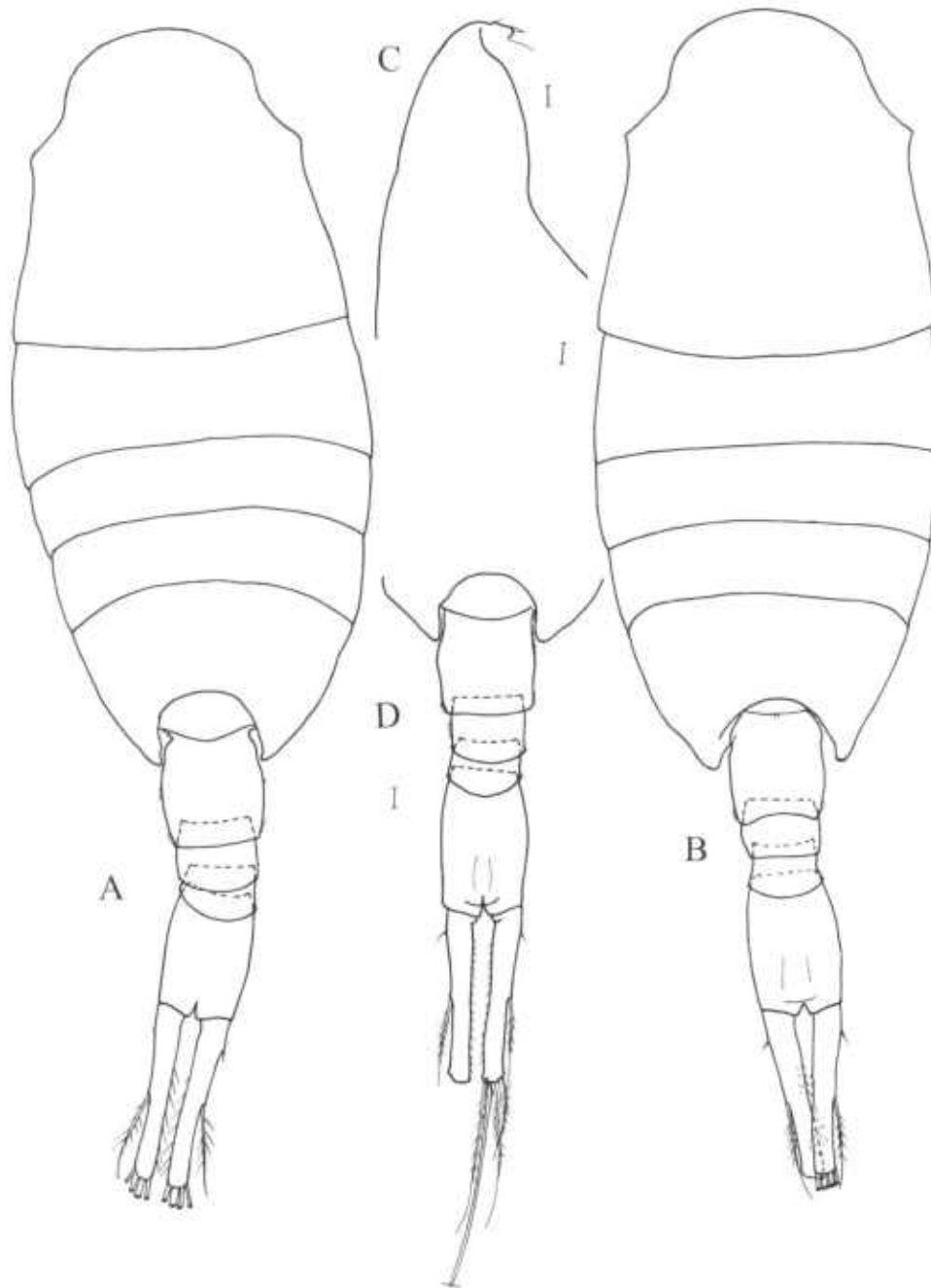


Figure 3. *Lucicutia bradyana*. Female. (A, B) Habitus, dorsal; (C) anterior part of cephalosome, right lateral; (D) posterior corners of prosome and urosome, dorsal. (A) South-western Pacific Ocean, *Ob* cruise 1, station 83; (B) Indian Ocean, *Ob* cruise 1, station 129; (C, D) south-eastern Pacific Ocean, Eltanin cruise 10, station 868. Scale bars: 0.1 mm.

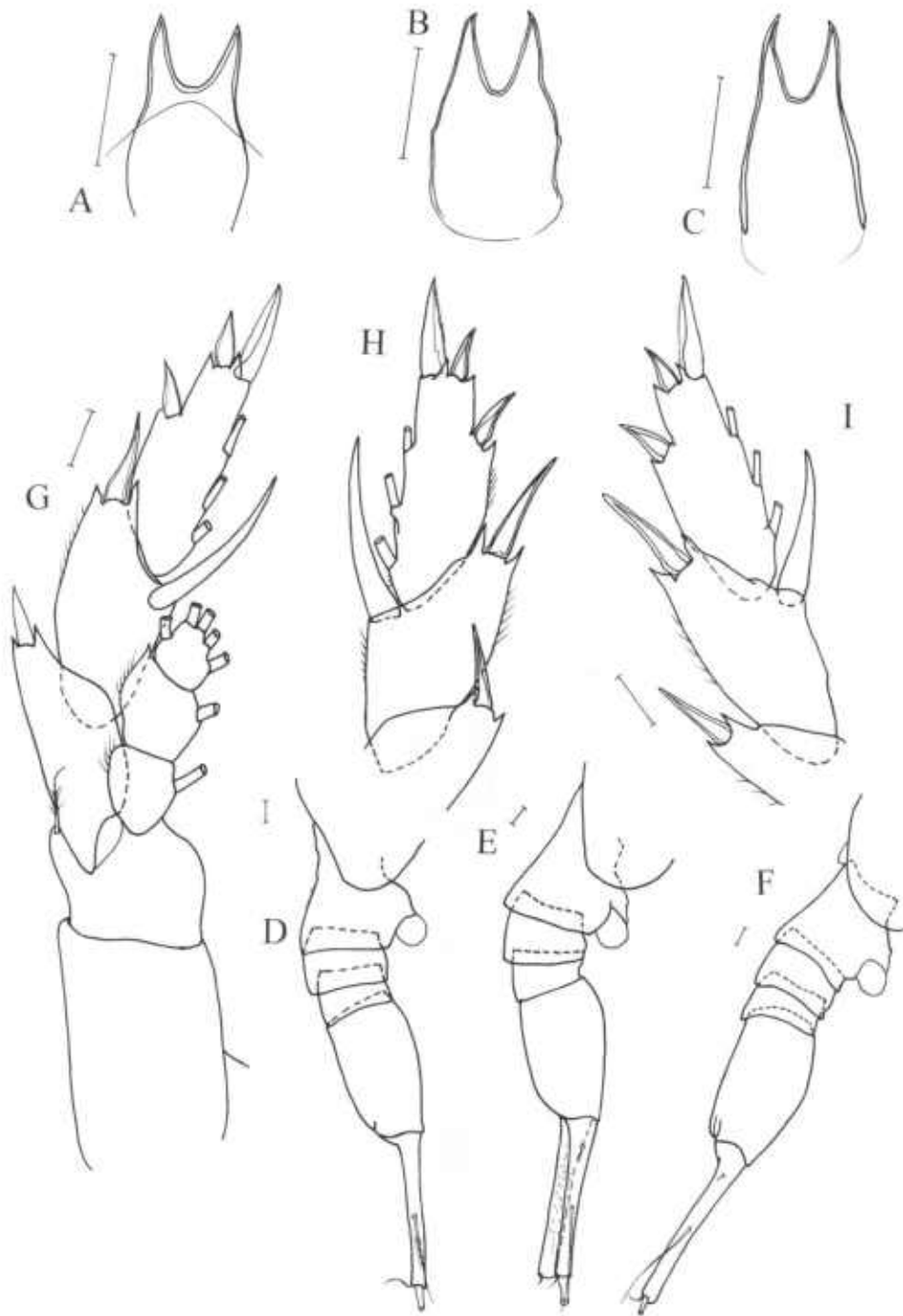


Figure 4. *Lucicutia bradyana*. Female. (A–C) Rostrum, anterior; (D–F) posterior corners of prosome and urosome, right lateral; (G) P5; (H, I) second and third exopod segments of P5. (A, F, H) South-eastern Pacific Ocean, Eltanin cruise 10, station 868; (B, E, G) Indian Ocean, *Ob* cruise 1, station 129; (C, D, I) south-western Pacific Ocean, *Ob* cruise 1, station 83. Scale bars: 0.1 mm.

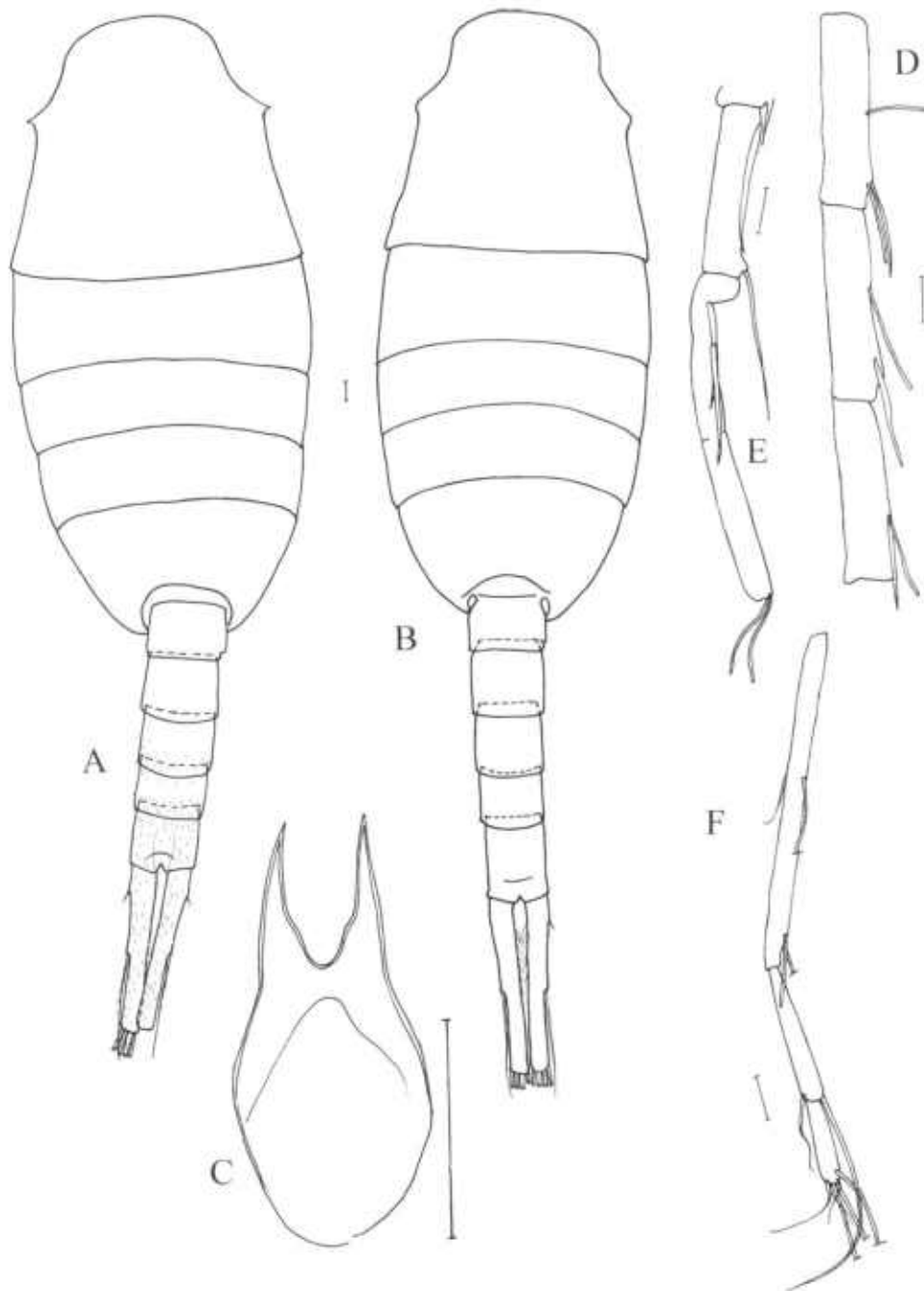


Figure 5. *Lucicutia bradyana*. Male. (A, B) Habitus, dorsal view (different specimens); (C) rostrum, anterior; (D) 14-16 articulated segments of antennule; (E) 17-18 articulated segments of antennule; (F) 19-21 articulated segments of antennule. (A, C) Indian Ocean, *Ob* cruise 1, station 129; (B, D-F) south-eastern Pacific Ocean, Eltanin cruise 10, station 868. Scale bars: 0.1 mm.

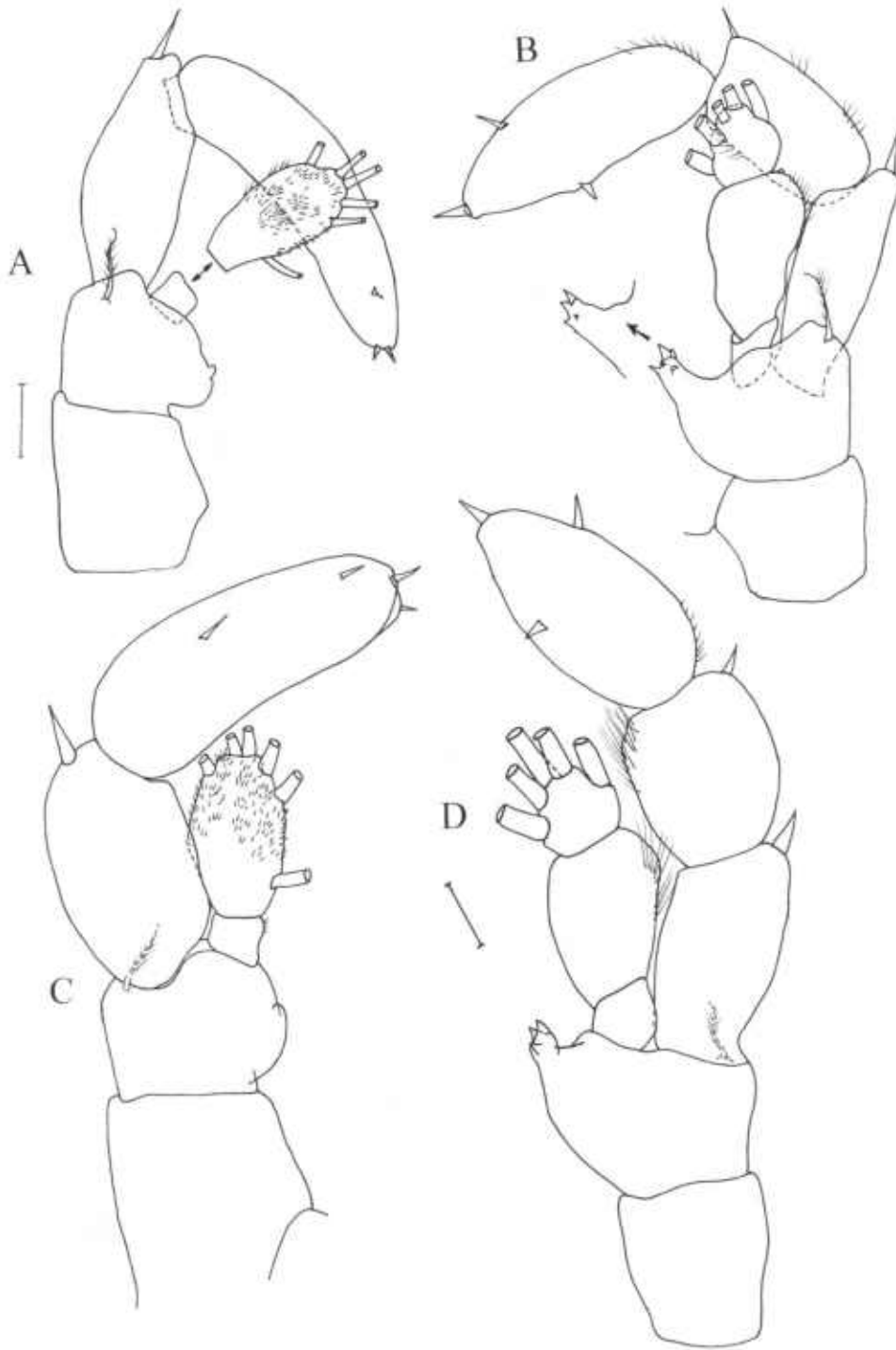


Figure 6. *Lucicutia bradyana*. Male. (A, B) P5, specimen identified by Hulsemann (1966) as *Lucicutia rara*, Indian Ocean, *Anton Bruun* cruise 6, station 355C: (A) right, (B) left legs; (C, D) P5, holotype of *Lucicutia rara*, NMNH 113545. Scale bars: 0.1 mm.

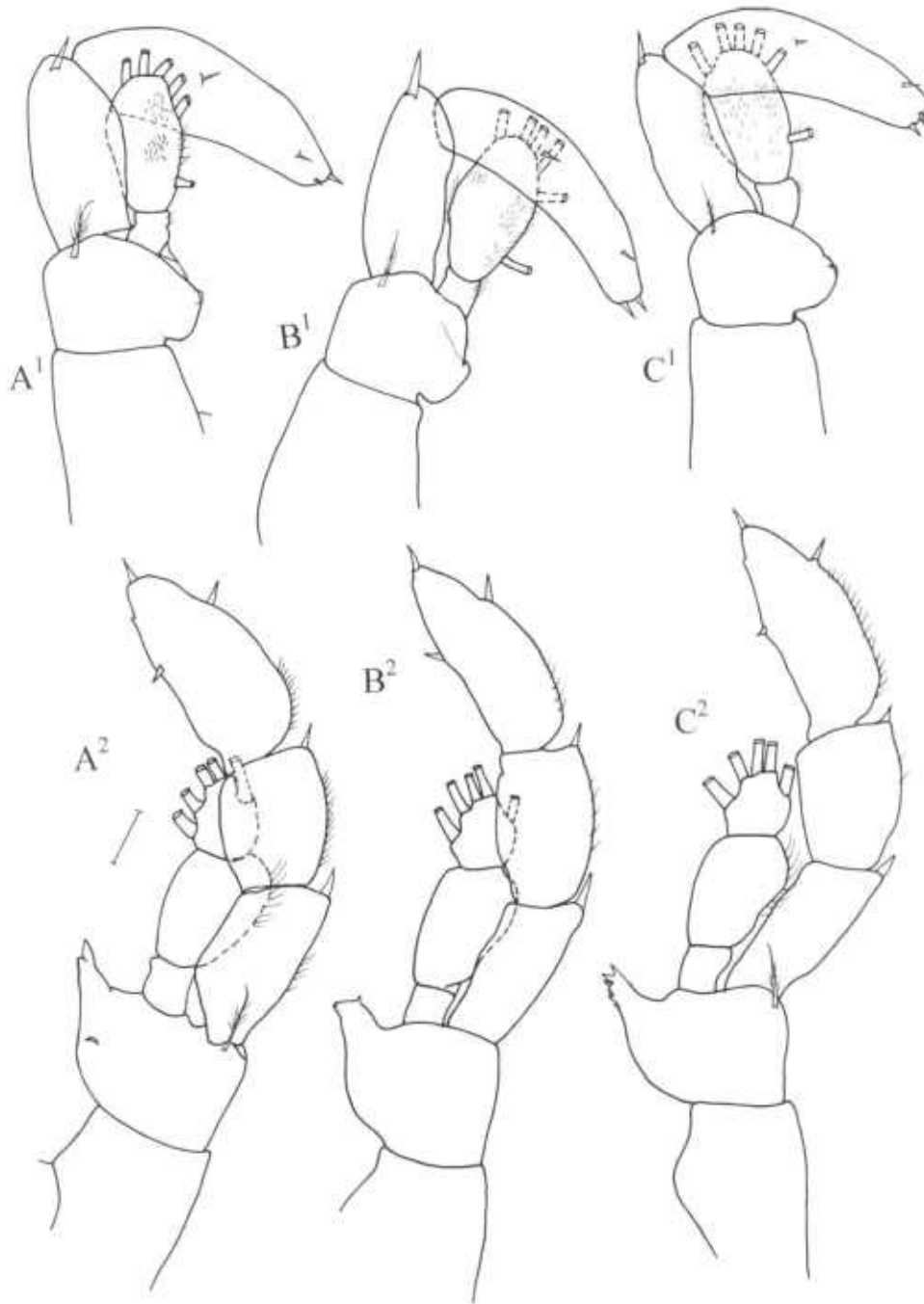


Figure 7. *Lucicutia bradyana*. Male. P5: (A¹-C¹) right P5, (A²-C²) left P5. (A¹, A²) specimen from Indian Ocean, *Ob* cruise 1, station 129; remaining figures, specimens from south-eastern Pacific Ocean, *Eltanin* cruise 10, station 868. Scale bars: 0.1 mm.

than wide. Antennule exceeding body length by about two to three segments. Medial seta on exopodal segment 2 of P5 robust (Figure 4G-I).

Male

Total length 5.1–5.2 mm. Prosome 1.28–1.30 times longer than urosome. In some specimens urosome somites distinctively hirsute (Figure 5A). Cephalosome with triangular or rounded protrusions (Figure 5A, B). Rostrum of moderately divergent, nearly parallel rami (Figure 5C). Caudal rami 6.2 times longer than wide. Antennule of 21 articulated segments reaching about the middle length of caudal rami, an indication of a subdivision is visible in segment 18 (Figure 5E, F). Length of exopodal segment 1 of right P5 shorter than second. Surface of endopodal segment 2 hirsute. Basipod with knob at mid-length of medial margin; shape of knob variable (Figures 6A, C, 7A¹–C¹). Shape of exopodal segment 3 of left P5 elongate, oval-triangular; medial distal part of basipod with elongate projection with variable number of teeth at the tip (Figures 6B, D, 7A²–C²).

Remarks

Total length of the type specimen is 5.7 mm (Cleve 1904); largest recorded size of a female is 6.2 mm (Wolfenden 1911, as *Lucicutia maxima*); smallest 5.0–6.15 mm (Bradford-Grieve 1999, as *Lucicutia grandis*). Total length published for males: 5.2 mm (Cleve 1904); 4.7–5.45 mm (Bradford-Grieve 1999, as *Lucicutia grandis*). The characters distinguishing *L. bradyana* from *L. grandis* are given above in the remarks for *L. grandis*. Hulsemann placed *L. bradyana* in synonymy with *L. grandis* but mentioned that it “is doubtfully included in this synonymy”, and “*L. bradyana* Cleve which is doubtfully referred to *L. grandis* in this paper...” (Hulsemann 1966, p 717, 721, 736). In the present study, significant variability in P5 structure of males suggests those doubts were justified. Shape of the left and right basipod of male P5 distinguishes *L. bradyana* from *L. grandis*, but those shapes vary within a species. Among specimens of *L. bradyana* studied here is a male whose P5 (Figure 7A²) is similar to that illustrated by Cleve (1904, Figure 34) in the original description of *L. bradyana*. Despite this variability, the left basipod of all specimens of *L. bradyana* has an elongate projection medially with teeth on the tip; right basipod has a distinct knob at mid-length. The medial distal edge of the basipod of the left P5 of *L. grandis* has a saw-like, toothed margin; the medial edge of the basipod of the right P5 has a small bump.

Lucicutia rara was described from the male gender only, and its similarity to *L. bradyana* noted (Hulsemann 1966, p 735–736, Figures 45, 46, 103). The holotype of *L. rara* (NMNH 113545) and two males identified as *L. rara* by Hulsemann from *Anton Bruun* station 355C were re-examined (Figure 6C, D) and compared with *L. bradyana*. That comparison shows that these specimens are conspecific.

Distribution

The type locality of *L. bradyana* Cleve, 1904 is east of South Africa in the Agulhas Current. The species is recorded from the South Atlantic Ocean between 10°S and about 35°S (as *L. maxima*) by Wolfenden (1911); from the south-western Pacific Ocean (as *L. grandis*) by Bradford-Grieve (1999), and now from the Indian Ocean between 19°S and 40°S

(Table III). *Lucicutia bradyana* is common in the South Atlantic Ocean and the South Pacific Ocean between 55°S and 62°S (Table I).

***Lucicutia wolfendeni* Sewell, 1932**

(Figures 8, 9)

Lucicutia wolfendeni Sewell 1932, p 289; Tanaka 1963, p 46–49, Figure 171; Vervoort 1957, p 130–131, Figure 120, 121; Hulsemann 1966, p 738, Figures 50, 51, 73, 78, 102; Heptner 1971, p 146, Figure 30; 1986, p 53–54.

Lucicutia grandis (Giesbrecht, 1895): Wolfenden 1911, p 315–316, Figure 58; Sars 1924–25, p 208, Plate 56; Brodsky 1950, p 328–329, Figure 227; Vervoort 1957, p 131; Hernández and Suárez-Morales 1994, p 169, Figure 89.

Female

Total length 6.5–7.7 mm. Cephalosome with small triangular or rounded lateral protrusions; sometimes lateral sides are nearly smooth (Figure 8A). Rostral rami widely spaced, tapering at tips; tips occasionally convergent (Figure 8G–I). Genital double-somite of female with oval-elongate plug (Figure 8D, E). Anal somite shorter than two preceding somites together (Figure 8B, C), dorsal side only slightly swollen (Figure 8D, E). Caudal rami in dorsal view 2.9–3.1 times longer than anal somite and eight times longer than wide (Figures 8B, C). Antennule exceeding caudal rami by two to three segments. Medial seta of exopodal segment 2 of P5 attenuate, very thin at tip (Figure 8J).

Male

Total length 5.7 mm. Lateral sides of cephalosome without pointed protrusions (Figure 9A). Antennule of 21 articulated segments, segment 18 is the longest (Figure 9D, E). First exopodal segment of right P5 as long as or slightly longer than the second exopodal segment. Second endopodal segment without hairs; basipod with medial projection (Figure 9G). Basipod of left P5 medial-distally with a moderate projection with marginal teeth; exopodal segment 3 elongate oval-triangular (Figure 9F). P5 of males from the north-western Pacific Ocean and Southern Ocean identical in structure.

Remarks

Published size of females: 8.2 mm (Sars 1924); 7.65–8.75 (Heptner 1986). Published size of males: 6.0–8.0 (Brodsky 1950) and 7.00–7.50 mm (Heptner 1986). Females of *L. wolfendeni* are distinguished from both *L. grandis* and *L. bradyana* by a shorter anal somite which is not swollen; a large oval-elongate plug of the genital double-somite; the usually smoothly rounded or low-triangular lateral sides of the cephalon and larger sizes; males differ in the structure of left and right basipods and left endopod of P5 as discussed for *L. grandis* (Figures 2F–K, 6, 7, 9F, G), and larger size. One female specimen had asymmetrical caudal rami. In other diagnostic character states, this specimen corresponds to *L. wolfendeni*. A specimen with asymmetrical caudal rami was reported earlier (Wolfenden 1911, as *L. grandis*) but correctly considered to be *L. wolfendeni* by Heptner (1971).

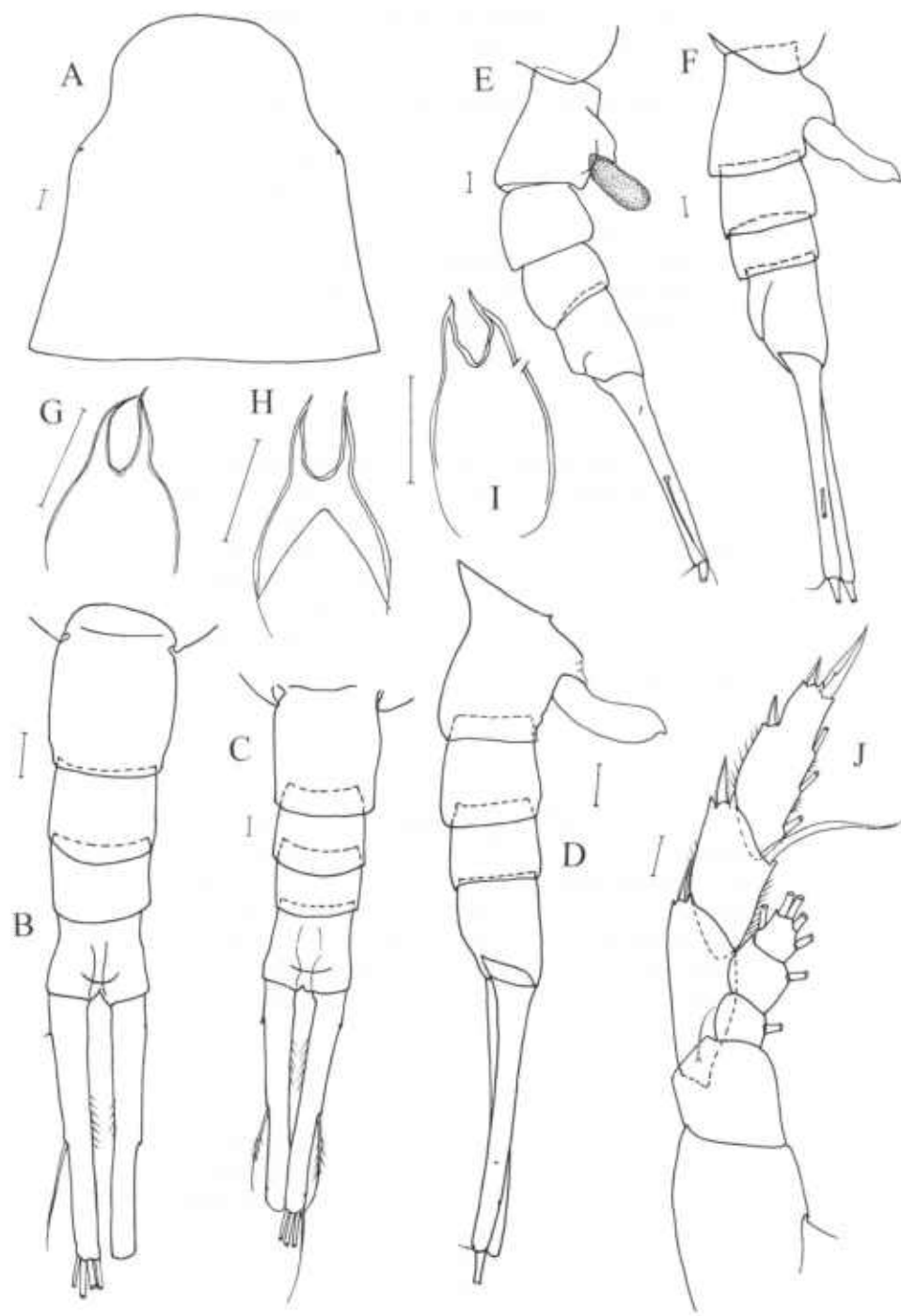


Figure 8. *Lucicutia wolfendeni*. Female. (A) Anterior part of cephalosome, dorsal; (B, C) urosome, dorsal; (D-F) urosome, right lateral; (G-I) rostrum, anterior; (J) P5. (A, C, F, I, J) south-eastern Pacific Ocean, Eltanin cruise 10, station 868; (B, D) north-western Pacific Ocean, off Kamchatka, *Severnyi Polyus* station 1; (E, H) south-eastern Pacific Ocean, Eltanin cruise 11, station 911; (G) south-eastern Pacific Ocean, Eltanin cruise 10, station 874. Scale bars: 0.1 mm.

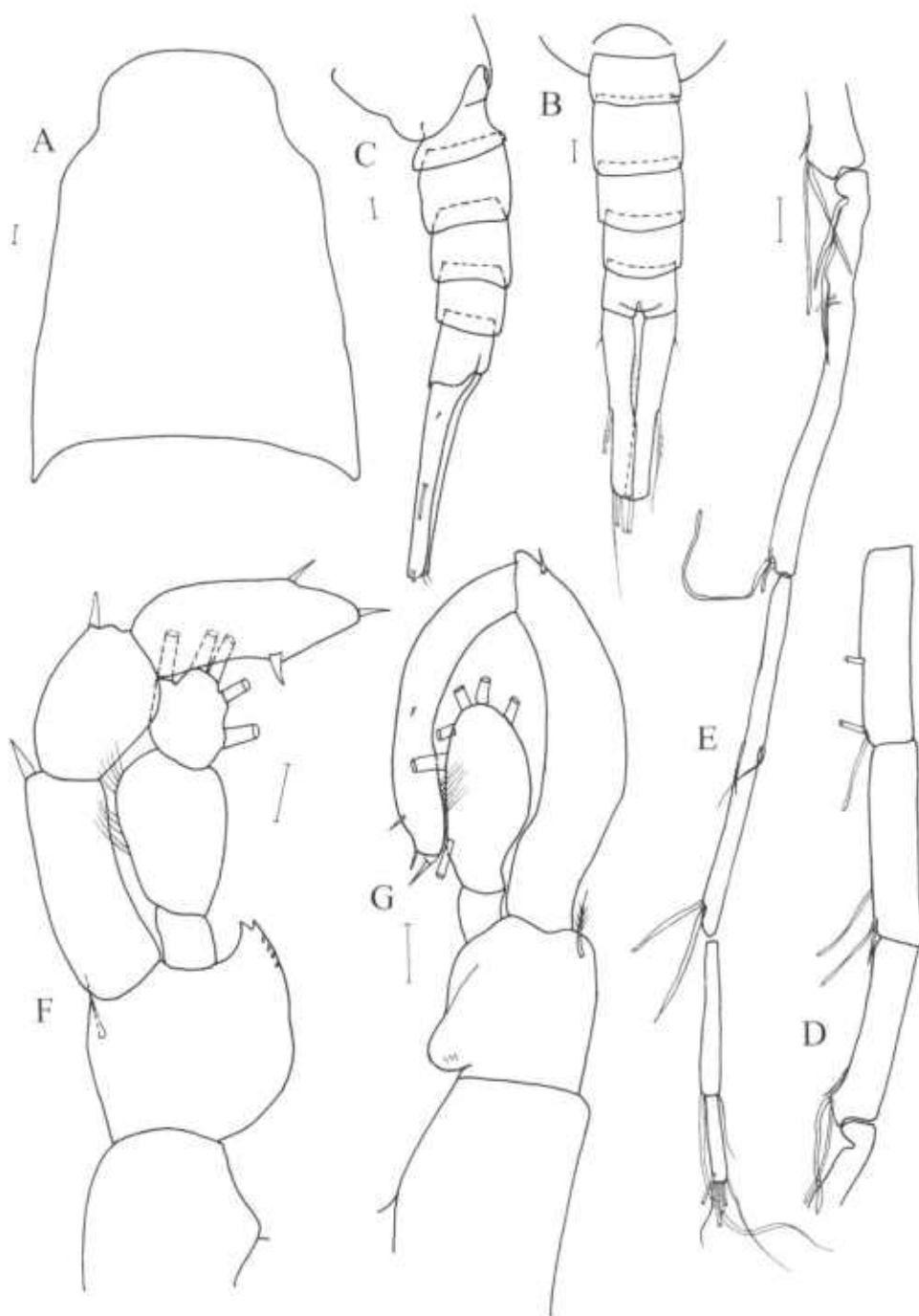


Figure 9. *Lucicutia wolffendeni*. Male. (A) Anterior part of cephalosome, dorsal; (B) posterior corners of prosome and urosome, dorsal; (C) same, left lateral; (D) 15-17 articulated segments of antennule; (E) 18-21 articulated segments of antennule; (F) left P5; (G) right P5. (A-E) South-eastern Pacific Ocean, Eltanin cruise 10, station 868; (F, G) north-western Pacific Ocean, off Kamchatka, *Severnyi Polyus* station 1. Scale bars: 0.1 mm.

Distribution

Lucicutia wolfendeni is found in all oceans except the Arctic Ocean (Hulsemann 1966, p 738; Heptner 1986, Tables 1–3).

***Lucicutia hulsemannae* sp. nov.**
(Figures 10–12)

Material examined

One female, holotype (only P5 dissected), N 90741 (ZISP). Total length 6.3 mm. Prosome urosome ratio: 1.67. Locality: eastern tropical Pacific Ocean near Volcano 7, 13°22'N, 102°07'W, collected 25 November 1988, depth 693–790 m. Paratypes: one female (6.30 mm, prosome/urosome ratio 1.80), N 1011361 (NMNH), the same label data as for holotype; one female (6.25 mm, prosome/urosome ratio 1.70) and one male (6.00 mm, prosome/urosome ratio: 1.5) (ZISP N90742), same locality data except depth, 791–985 m; three males (5.95 mm, 5.80 mm, 5.90 mm, prosome/urosome ratio: 1.4, 1.6 and 1.5, respectively), N 1011362 (NMNH), same locality data except depth, 791–985 m.

Female

Total length 6.25–6.30 mm. Prosome 1.67–1.80 times longer than urosome. Cephalosome with a pair of low triangular protrusions (Figure 10A). Rostral rami divergent from a swollen base (Figure 10D). Genital complex symmetrical with irregular, conical plug (Figure 10C). Second urosome somite 1.37 times wider than urosome somite 3 in dorsal view and 1.31 times wider than urosome somite 3 in lateral view. Third urosome somite longer than adjacent somites: 1.1–1.2 times longer than urosome somite 2 and 1.2–1.4 times longer than anal somite. Anal somite not swollen dorsally (Figure 10C). Caudal rami in dorsal view nearly three times longer than anal somite and 5.5 times longer than wide (Figure 10A). Antennule reaching the end of caudal rami. P1 with large pore on basipod; inner seta of basipod originating on the outer, posterior wall of pore (Figure 10E); both states shared among species of the family. P5 with three-segmented rami. Medial seta on exopodal segment 2 of P5 attenuate and thin toward its tip (Figure 10F).

Male

Total length 5.80–6.00 mm. Prosome 1.44–1.55 longer than urosome. Cephalosome laterally with pointed protrusions (Figure 11A, B). Rostrum with rami nearly parallel (Figure 11E). Caudal rami 5.8 times longer than wide. Antennule of 21 articulated segments, 18th the longest (Figure 11F–H). Right P5 with exopodal segment 1 shorter than 2 and with a thin sclerotized lamella at mid-length; exopodal segment 2 with broad medial hirsute lobe. Basipod of right P5 basipod variable in shape, usually with knob along medial margin (Figure 12A, B). Third exopodal segment of left P5 elongate, oval-rectangular; basipod with a medial projection pointed distally, with varying number of teeth at tip (Figure 12A, C).

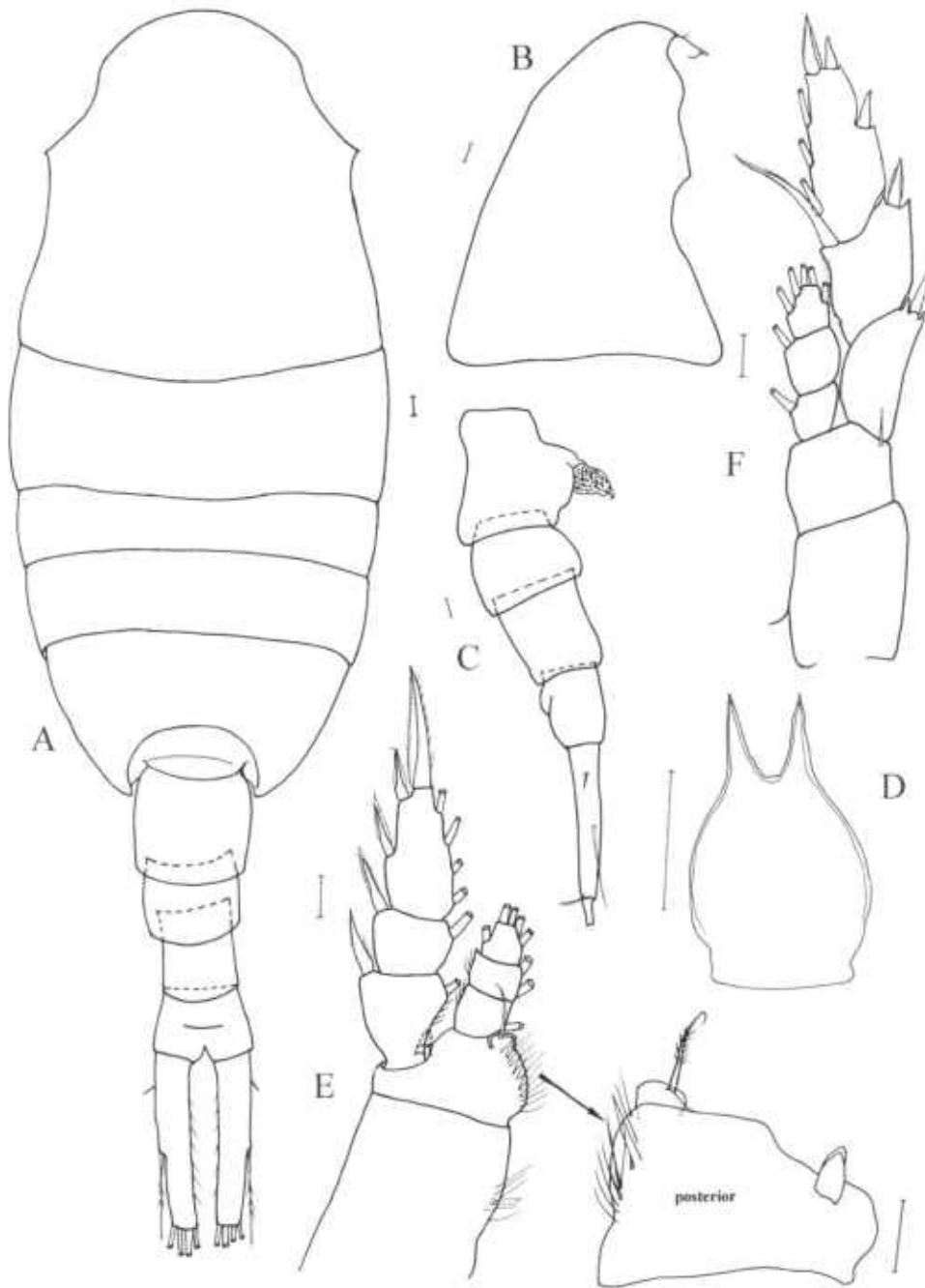


Figure 10. *Lucicutia hulsemannae* sp. nov. Female, paratype. (A) Habitus, dorsal; (B) anterior part of cephalosome, right lateral; (C) urosome, right lateral; (D) rostrum, anterior; (E) P1; (F) P5. Scale bars: 0.1 mm.

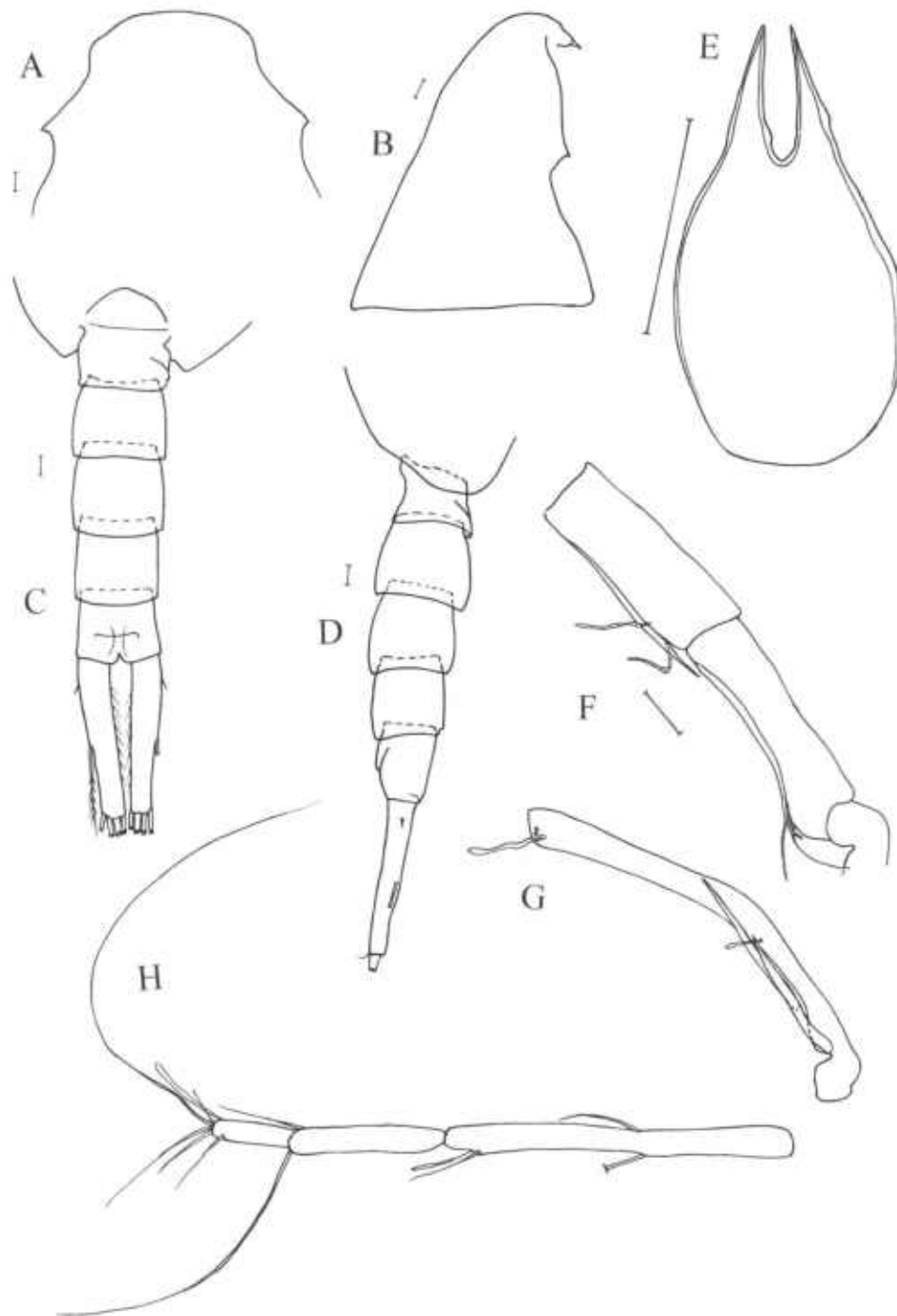


Figure 11. *Lucicutia hulsemannae* sp. nov. Male, paratype. (A) Anterior part of cephalosome, dorsal; (B) same, right lateral; (C) posterior corners of prosome and urosome, dorsal; (D) posterior corners of prosome and urosome, right lateral; (E) rostrum; (F) 16-17 articulated segments of antennule; (G) 18 segment of antennule; (H) 19-21 articulated segments of antennule. Scale bars: 0.1 mm.

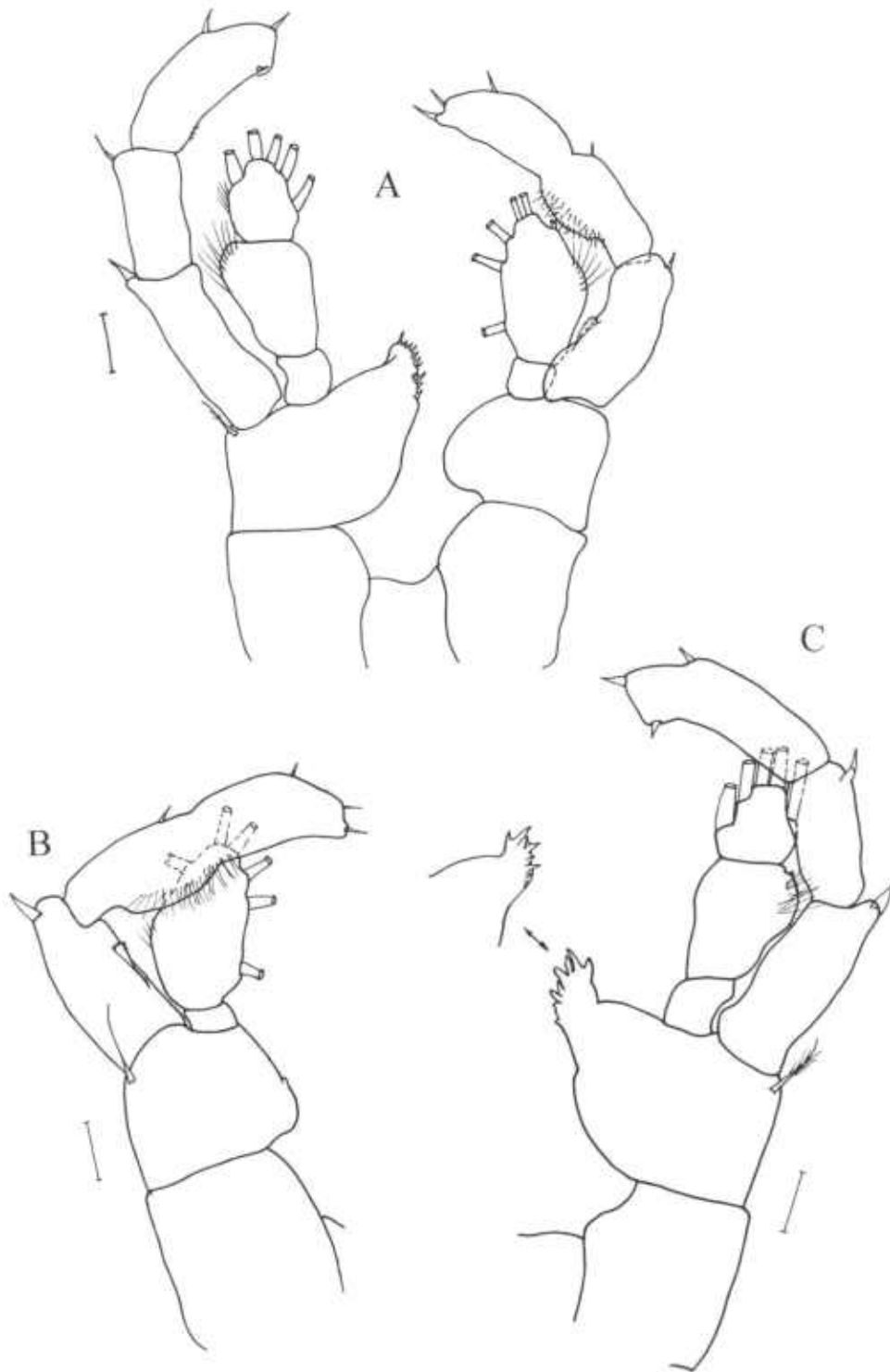


Figure 12. *Lucicutia hulsemannae*. Male, paratype. (A, B) P5 of different specimens. Scale bars: 0.1 mm.

Remarks

The following characters distinguish females of *L. hulsemannae* sp. nov. from other species of *Lucicutia* analysed here: females with urosome somite 2 significantly wider than 3, and urosome somite 3 longer than urosome somite 2 and anal somite (females of *L. grandis*, *L. bradyana* and *L. wolfendeni* with urosome somite 2 not significantly wider than urosome somite 3, and urosome somite 3 not longer than 2 or the anal somite; Figures 1A, E–J, 3A, B, D, 4D–F, 8B–F). The anal somite of *L. hulsemannae* is not swollen dorsally or ventrally (in *L. grandis* and *L. bradyana*, it is large and swollen dorsally or ventrally, respectively; Figures 1H–J, 4D–F). The rostral rami of *L. grandis* do not diverge (Figure 1D) while those of *L. hulsemannae* diverge from the base. The medial seta on the second exopod of P5 of *L. hulsemannae* is thin toward its tip while the tip of *L. bradyana* is robust (Figure 4G–I). The plug of the genital double-somite of *L. hulsemannae* is irregularly conical, but round in *L. bradyana* or oval in *L. wolfendeni* (Figures 4D–F, 8D–F).

Males of *L. hulsemannae* differ from those of *L. grandis*, *L. bradyana* and *L. wolfendeni* in having a low chitinous lamella at about mid-length of the first exopodal segment of the right P5 (there is no lamella on the other three species); the second exopodal segment of *L. hulsemannae* has a hirsute medial lobe (this lobe absent in *L. grandis*, *L. bradyana* and *L. wolfendeni*). The shape of P5 left basipod is similar to that of *L. bradyana*; however, in other features the leg differs: exopodal segment 3 is rectangular distally, while in *L. bradyana* it is obtuse-triangular (Figure 7A², B², C²).

Distribution

Lucicutia hulsemannae is known from the eastern tropical Pacific Ocean.

Etymology

The species honours Dr Kuni Hulsemann who has contributed significantly to the taxonomy of calanoid copepods, and particularly to the genus *Lucicutia*.

Discussion

Seven species of *Lucicutia* previously have been listed by Razouls (1994, 1995) from antarctic and subantarctic waters: *L. clausi* (Giesbrecht, 1889), *L. curta* Farran, 1905, *L. flavicornis* (Claus, 1863), *L. macrocera* Sars, 1920, *L. magna* Wolfenden, 1903, *L. ovalis* (Giesbrecht, 1889), and *L. wolfendeni* Sewell, 1932. Among lucicutiids found in samples collected during RV *Eltanin* cruises 4–11 and 23 from the Southern Ocean and studied here, *L. flavicornis* and *L. clausi* were not represented. Hulsemann (1966) noted that Giesbrecht (1902) did not include *L. flavicornis* in a list of antarctic calanoids and that the southernmost locality for *L. flavicornis* was 40°S. Later, the species was collected at 46°S in the SW Pacific by Bradford-Grieve (1999). Thus *L. flavicornis* should not be considered an inhabitant of antarctic waters. A similar conclusion holds for *L. clausi* whose southernmost locality, documented by description and illustrations, is the Straits of Magellan (Mazzocchi et al. 1995). The present study of samples collected during RV *Eltanin* cruises 4–11 and 23 south of 55°S in the South Atlantic Ocean and eastern South Pacific Ocean recovered six species of *Lucicutia*: *L. bradyana*, *L. curta*, *L. macrocera*, *L. ovalis*, *L. wolfendeni*, and *Lucicutia* cf. *intermedia*. Although *L. intermedia* Sars, 1905 has not been recorded previously from antarctic waters, one female and three males which were very similar to *L. intermedia*

were found south of 56°S; they are identified here as *Lucicutia* cf. *intermedia*. *Lucicutia intermedia* occurs north of 22°S. Because species of the genus usually exhibit great variability, a series of specimens is needed to determine this variability before the presence of *L. intermedia* in antarctic waters can be verified. *Lucicutia bradyana* is quite common in the samples and is a new record and the sixth species of lucicutiid recorded from antarctic waters. All species of *Lucicutia* recorded in antarctic waters show broad distributions throughout the oceans of the world (Hulsemann 1966). Our results demonstrate the absence of a specific lucicutiid fauna in antarctic waters.

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References

- Ali-Khan S, Ali-Khan J. 1982. Seven new records of the family Lucicutiidae from Pakistan (Copepoda, Calanoida). *Crustaceana* 43(3):265–270.
- Björnberg TKS. 1973. The planktonic copepods of the Marchile I Expedition and of the "Eltanin" Cruises 3–6 taken in the SE Pacific. *Boletim de Zoologia e Biologia Marinha* (n. ser.), Sao Paulo 30:245–394.
- Bradford-Grieve JM. 1999. The marine fauna of New Zealand: pelagic calanoid Copepoda: Bathypontiidae, Arietellidae, Augaptilidae, Heterorhabdidae, Lucicutiidae, Metridinidae, Phyllopodidae, Centropagidae, Pseudodiaptomidae, Temoridae, Candaciidae, Pontellidae, Sulcanidae, Acartiidae, Tortanidae. NIWA Biodiversity Memoir 111:1–268.
- Brady GS. 1883. Report on the Copepoda collected by H.M.S. "Challenger" during the years 1873–76. Report of the Scientific Results of the Voyage of H.M.S. Challenger during the years 1873–76, *Zoology* 8:1–142.
- Brodsky KA. 1950. Oar-footed crustaceans calanoida of the USSR Far-eastern Seas and Polar basin. *Opredeliteli po faune SSSR* 35:1–442. (Rus).
- Cleve C. 1904. The plankton of the South African Seas. I. Copepoda. *Marine Investigations in South Africa* 3:177–210.
- Giesbrecht W. 1895. Die pelagischen Copepoden. In Report on the dredging operations off the West coast of Central America to the Galapagos, to the West coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U. S. Fish Commission Steamer "Albatross" during 1891, XVI. *Bulletin of the Museum of Comparative Zoology at Harvard College* 25(12):243–263.
- Giesbrecht W. 1902. Copepoden. In: *Expédition Antarctique Belge, Résultats du voyage du S.Y. Belgica en 1897–1899, Rapports Scientifiques, Expédition Antarctique Belge, (Zoologie)*. 49 p.
- Giesbrecht W, Schmeil O. 1898. Copepoda, I, Gymnoplea. *Tierreich* 6:1–169.
- Gowing MM, Wishner KF. 1998. Feeding ecology of the copepod *Lucicutia* aff. *L. grandis* near the lower interface of the Arabian Sea oxygen minimum zone. *Deep-Sea Research II* 45:2433–2459.
- Heptner M. 1971. To the fauna of oar-footed (Copepoda, Calanoida) from the Kurile-Kamchatka Trench. Families Euchaetidae, Lucicutiidae, Heterorhabdidae. *Trudy Instituta okeanologii* 92:146. (Rus).
- Heptner M. 1986. Fauna of the oar-footed crustaceans (Copepoda, Calanoida) from the Kurile-Kamchatka Trench. II. Vertical and geographical distribution of the Euchaetidae and Lucicutiidae species. *Sbornik Trudov Zoologicheskogo museya (MGU) XXIV*:3–58. (Rus).
- Hernández AC, Suárez-Morales E. 1994. Copépodos pelágicos del Golfo de Mexico y Mar Caribe, I. *Biología y Sistemática. CIQRO, Mexico*, 353 p.
- Hulsemann K. 1966. A revision of the genus *Lucicutia* (Copepoda: Calanoida) with a key to its species. *Bulletin of Marine Science* 16(4):702–747.

- Mazzocchi MG, Zagami G, Ianora A, Guglielmo L, Crescenti N, Hure J. 1995. Copepods. In: Guglielmo L, Ianora A, editors. Atlas of marine zooplankton, Straits of Magellan. Springer: New York. 279 p.
- Razouls C. 1994. Manuel d'identification des principales espèces de copépodes pélagiques antarctiques et subantarctiques. Annales de L'Institut Oceanographique, n.s 70(1):1-203.
- Razouls C. 1995. Diversite et repartition géographique chez les copépodes pélagiques. Annales de l'Institut Oceanographique, n.s 71:81-404.
- Sars GO. 1924-1925. Copépodes particulièrement bathypélagiques provenant des campagnes scientifiques du Prince Albert 1er de Monaco. Resultats des Campagnes Scientifiques accomplies par le Prince Albert I 69. (Atlas, 1924, 127 plates; text, 1925, 408 p).
- Sewell RBS. 1932. The Copepoda of Indian Seas. Memoirs of the Indian Museum 10:223-407.
- Sewell RBS. 1947. The free-swimming planktonic Copepoda, systematic account. Scientific Report John Murray Expedition (Zoology) 8(1):1-303.
- Tanaka O. 1963. The pelagic copepods of the Izu region, middle Japan. Systematic account IX. Families Centropagidae, Pseudodiaptomidae, Temoridae, Metridiidae and Lucicutiidae. Publications of the Seto Marine Biological Laboratory 9(1):7-55.
- Vervoort W. 1957. Copepods from Antarctic and sub-antarctic plankton samples. British Australian and New Zealand Antarctic Research Expedition, Reports, Series B (Zoology and Botany) 3:1-160.
- Wishner KF, Ashjian CJ, Gelfman C, Gowing MM, Kann L, Levin LA, Mullineaux LS, Saltzman J. 1995. Pelagic and benthic ecology of the lower interface of the eastern tropical Pacific oxygen minimum zone. Deep-Sea Research I 42:93-115.
- Wishner KF, Gowing MM, Gelfman C. 1998. Mesozooplankton biomass in the upper 1000 m in the Arabian Sea: overall seasonal and geographic patterns, and relationship to oxygen gradients. Deep-Sea Research II 45:2405-2432.
- Wishner KF, Gowing MM, Gelfman C. 2000. Living in suboxia: ecology of the Arabian Sea oxygen minimum zone copepod. Limnology and Oceanography 45(7):1576-1593.
- Wolfenden RN. 1911. Die marinen Copepoden der Deutschen Südpolar-Expedition 1901-1903. Deutsche Südpolar-Expedition, 1901-1903 (Zoologie, 4) 12:181-380.