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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

BULLETIN 206

The Fauna of the Ross Sea

Part 8

Pelagic Copepoda

by

JANET M. BRADFORD

Cumacea

by

N. S. JONES

New Zealand Oceanographic Institute
Memoir No. 59

1971

THE FAUNA OF THE ROSS SEA

PART 8

Photo: J. J. Whalan

Euchaeta antarctica: male (upper) and female (lower).

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FOREWORD

EACH summer season since 1956–57 the New Zealand Oceanographic Institute has undertaken one or more research cruises in the Antarctic, initially as part of the International Geophysical Year programmes and their extensions, and latterly as part of the New Zealand Antarctic Research Programme.

The major efforts of the 1958–59 and 1959–60 seasons were devoted to an oceanographic survey of the Ross Sea in which, as well as associated hydrological information, sediment samples, plankton, and fish, substantial collections of benthic animals were obtained.

Each of these expeditions was led by J. S. Bullivant. In 1958–59 he was assisted by D. G. McKnight and A. G. Macfarlane of the Institute staff and N. A. Powell of Antarctic Division, DSIR; John Reseck, jun. (Long Beach State College, California) and Dr R. K. Dell (Dominion Museum, Wellington) were co-workers. In 1959–60, G. A. Harlen and E. C. French of Antarctic Division, DSIR, assisted. Further small collections were made in 1960–61 by G. A. Harlen, A. E. Gilmour, and S. C. Watts of the Institute staff and C. E. Devine, D. W. Farmer, and M. R. Gregory of Antarctic Division, DSIR.

The co-operation of the New Zealand Naval Board and of the Commanding Officer and ship's company of HMNZS *Endeavour* is gratefully acknowledged. The Antarctic Division has materially assisted the field and laboratory work by the secondment of staff and provision of equipment.

The biological material has been sorted and preserved under the supervision of J. S. Bullivant. The preliminary technical editing of the manuscript has been carried out by Dr D. E. Hurley.

Further results of examinations of these collections will be published as studies of other groups are concluded.

J. W. BRODIE,
Director,
N.Z. Oceanographic Institute.

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PELAGIC COPEPODA

by

JANET M. BRADFORD

New Zealand Oceanographic Institute, DSIR, Wellington

ABSTRACT

COLLECTIONS of Ross Sea Copepoda from the Transantarctic Expedition 1956–58 and the New Zealand Oceanographic Institute cruise in the summer of 1958–59 were analysed and faunal lists of the area prepared. Eighteen species, not including two obvious strays or contaminants from temperate waters, were added to the Ross Sea fauna. A new species of *Chiridiella* is described along with males of *Aetideopsis antarctica* and *Haloptilus ocellatus*. The males of *Ctenocalanus vanus* and *Racovitzanus antarcticus* are discussed.

Although the fauna generally is an extension of the circumpolar Antarctic fauna, yet a region of distinct faunal differences shows in the south-western part of the Ross Sea, where Antarctic Circumpolar Water is absent, where no copepod species associated with Antarctic Circumpolar Water occur and where the two "neritic" species are found.

INTRODUCTION

Although a number of expeditions have entered Antactic seas, only two have reported on plankton samples from the Ross Sea. Wolfenden's (1908) report on the Copepoda from the National Antarctic Expedition 1901–04 does not usually specify exactly where his specimens came from, so his distributional records have only general value. The British Antarctic (*Terra Nova*) Expedition 1910 made extensive collections in the Ross Sea and Farran's (1929) report is a valuable record.

The Transantarctic Expedition (T.A.E.) provided an opportunity for New Zealand scientists to sample the Ross Sea plankton in 1956–58. Plankton samples taken by this expedition in the south-west part of the Ross Sea were later augmented by a more extensive survey in 1958–59 undertaken by the New Zealand Oceanographic Institute.

A general account of the collections and full details of stations are given by Bullivant and Dearborn (1967).

This paper reports on the Copepoda from these two expeditions.

THE ROSS SEA ENVIRONMENT

TOPOGRAPHY

The Ross Sea is a triangular body of water lying between Cape Colbeck and Victoria Land, Antarctica (Figs 1 and 2); it is bounded in the north by the continental slope and in the south by the Antarctic Continent, though the Ross Ice Shelf forms the southern boundary for the upper 200 m of water column. Several small ice shelves fed by the glaciers of Victoria Land are present along the western boundary.

Kennett (1968) has described the main topographical features of the Ross Sea floor, summarised here. Unlike most parts of the Antarctic, where the shelf is narrow or absent, the Ross Sea has a wide but deep continental shelf. As is typical of the Antarctic shelf, the Ross Sea shelf break occurs at 800 m as a result of extensive carving action by outward-moving ice during the glacial maximum (Brodie 1965), and the shelf depths range from 100–1,000 m, averaging 550 m. Two troughs deeper than 900 m occur immediately north of Ross Island. The most conspicuous feature of the Ross Sea floor is the relatively shallow ridge which runs north-west from Cape Colbeck to the Pennell Bank, where it broadens considerably and reaches a minimum depth of 100 m. Taylor (1930) suggests that this bank represents a vast terminal moraine formed by a grounded ice shelf during a former glacial period. From this shallow rise near the outer shelf the surface slopes gradually inland so that the rise forms a brim to the basin-like depression to the south and south-west. The inland slope of this basin takes the form of several fairly narrow channels deeper than 550 m which converge near the Ross Ice Shelf to form a broad basin.

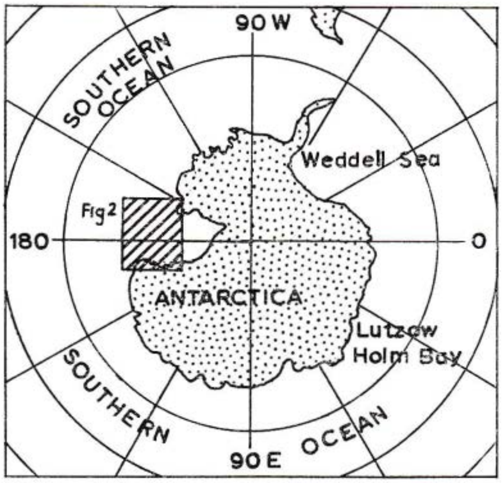


FIG. 1: Location map of study area.

HYDROLOGY

Hydrological conditions in the Ross Sea have been described by Countryman and Gsell (1966). The Ross Sea is subject to annual climatic changes — in winter there is continuous darkness and in summer continuous daylight and almost ice-free conditions. These conditions cause its hydrological regime to approach equilibrium in winter but to be unstable during summer.

Three water masses with definable characteristics are present in the Ross Sea in summer (Figs 3a and 3b):

(1) *Antarctic Upper Water*, in which two types of water are distinguishable in summer.

(a) *Antarctic Surface Water* warmed by solar radiation and diluted by melt water; temperature – 1·75–1·50°C, salinity 33·50–34·50$^{0}/_{00}$. The degree of warming and dilution depends on proximity to the ice shelf, the presence of ice cover, and the time of the season.

(b) *Winter Water* found below Antarctic Surface Water retains characteristics acquired during winter: temperature – 1·70– – 1·90°C, salinity 34·15–34·45$^{0}/_{00}$.

(2) *Antarctic Circumpolar Water*, temperature 1·50–0·50°C, salinity 34·60–34·75$^{0}/_{00}$. This is a southward extension of the Deep Warm Water (Antarctic Deep Water) from 2,000 m, which, as it moves over the Ross Sea shelf, is modified from above by mixing with Winter Water and from below by mixing with cold, saline Shelf Water. The amount and extent of Circumpolar Water in the Ross Sea varies from month to month and year to year, but a general pattern of distribution may be derived from the 1963, 1964, and 1967 summer situations (Fig. 4) (Countryman and Gsell 1966; Car 1967). It is apparent (Fig. 3b) that Antarctic Circumpolar Water mainly modifies the subsurface Winter Water.

(3) *Shelf Water*, temperature – 1·80– – 2·05°C, salinity 34·75–35·00$^{0}/_{00}$. This is the coldest, most saline, densest water mass of the Ross Sea. It is present mainly in the south-western part of the sea and is believed to originate during winter when the formation of sea ice increases salinity in the surface layers resulting in mixing. The occurrence of Shelf Water in all depressions, some close to the shelf edge, indicates that it probably spills over the slope in winter. It must flow mainly northward between Pennell Bank and Victoria Land where two troughs, separated by a broad ridge, form a natural path for the outflow of Shelf Water.

Countryman and Gsell (1966) leave unresolved the problem of whether Shelf Water controls the presence of Antarctic Circumpolar Water or vice versa. The shelf in the north-west slopes much more gradually seaward and is wider than in the east. Thus it is probable that the inflow of Antarctic Circumpolar Water is deflected

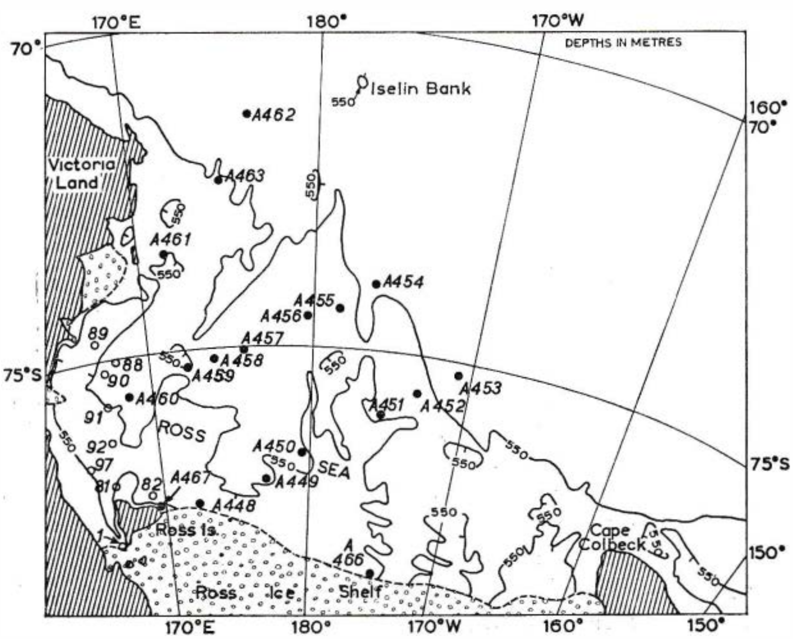


FIG. 2: Bathymetry and station positions in the Ross Sea. ● New Zealand Oceanographic Institute Stations; ○ Transantarctic Expedition Stations.

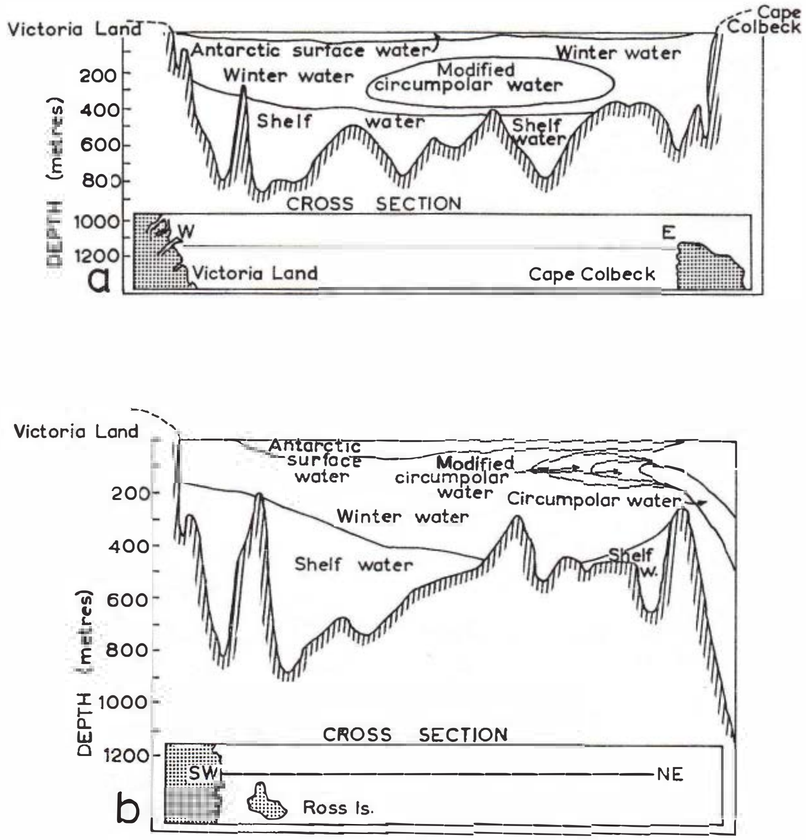


FIG. 3: Generalised relationships of water masses in the Ross Sea (from Countryman and Gsell 1966): (a) east-west section from Cape Colbeck to Victoria Land, (b) north-east-south-west section from Ross Island.

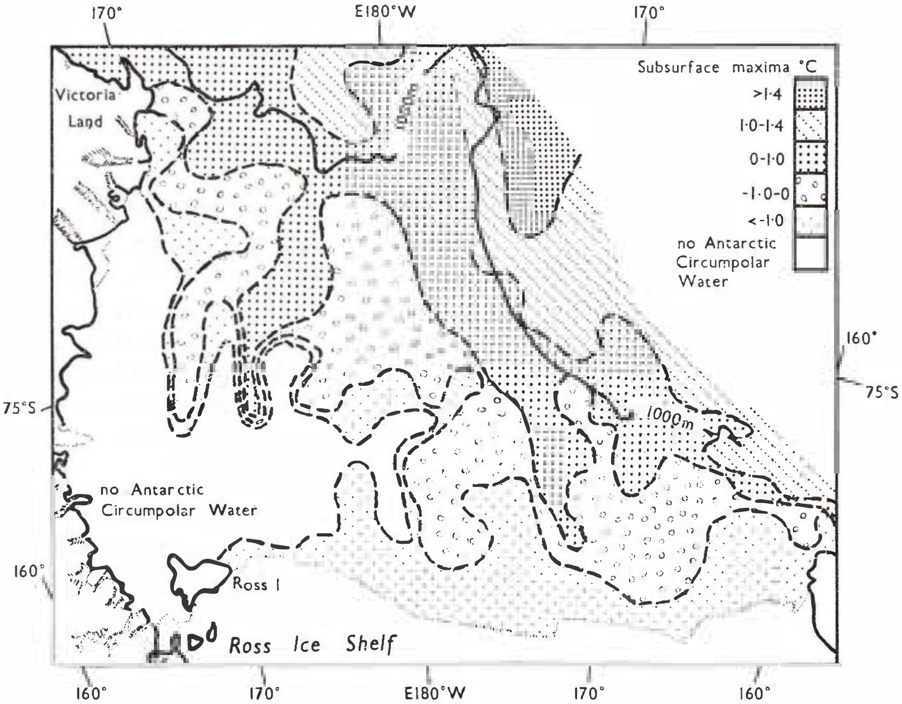


FIG. 4: Temperature at the subsurface maximum representing Antarctic Circumpolar Water and its influence during summer (from data of Countryman and Gsell 1966; Car 1967).

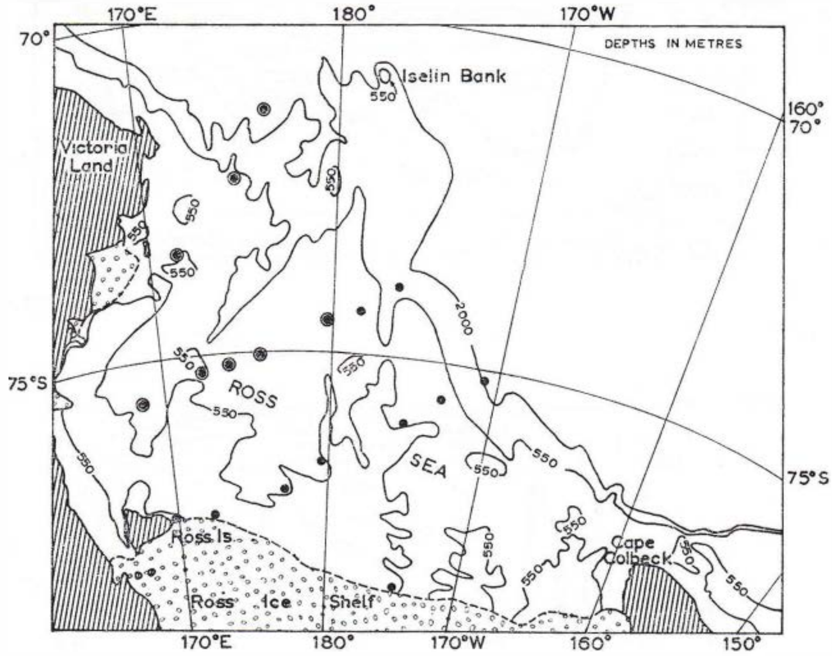


FIG. 5: Stations, circled in black, at which the diatom *Corethron criophilum* was dominant in the N70 net samples.

southward by the topography, confining Shelf Water to the south-west. This conclusion has been reached also by Car (1967), who found that the summer 1°C isotherm follows the 1,000 m isobath and that the core of Circumpolar Water in the Ross Sea centres on 174°W (Fig. 4).

PHYTOPLANKTON

Some of the New Zealand Oceanographic Institute Ross Sea N70 samples taken in mid January were dominated by the large diatom *Corethron criophilum.* The stations at which this occurred were all in the western Ross Sea (Fig. 5). Cassie (1963) also noted the dominance of this species during December 1957 in the same area, but no samples were taken in the eastern Ross Sea.

It is difficult to say whether this phenomenon is connected with the hydrological difference between the east and west Ross Sea, especially as Hart (1942) does not mention any anomalies in the *Discovery II* stations occupied in the Ross Sea during January 1936.

METHODS

Plankton samples were taken at all stations, using an N70 plankton net (Kemp *et al.* 1929) (Fig. 2). At NZOI stations samples were taken vertically from near the bottom to the surface. T.A.E. plankton hauls were either vertical from various depths or horizontal surface samples (see station list).

Large species which were not very numerous were recorded individually. Species which occurred in large numbers or were very small and difficult to see in the sample were recorded on the following scale of abundance: 0–20, few; 20–500, some; more than 500, many.

Specimens were usually dissected and mounted in Kaiser's glycerine jelly (Gatenby and Painter 1937). Specimens that proved to be undescribed were mounted unstained in Euparal and examined under the microscope using phase contrast.

LIST OF SPECIES

Order **CALANOIDA**

Family CALANIDAE

Nannocalanus minor (Claus, 1863)
Calanus propinquus Brady, 1883
Calanoides acutus (Giesbrecht, 1902)

Family EUCALANIDAE

Rhincalanus gigas Brady, 1883

Family PSEUDOCALANIDAE

Microcalanus pygmaeus (Sars, 1900)
Ctenocalanus vanus Giesbrecht, 1888
Farrania frigida (Wolfenden, 1911)

Family SPINOCALANIDAE

Spinocalanus magnus Wolfenden, 1904
Spinocalanus abyssalis Giesbrecht, 1888

Family AETIDEIDAE

Aetideopsis minor (Wolfenden, 1911)
Aetideopsis antarctica (Wolfenden, 1908)
Chiridiella megadactyla n. sp.

Gaidius tenuispinus (Sars, 1900)

Family EUCHAETIDAE
Euchaeta antarctica Giesbrecht, 1902
Euchaeta similis Wolfenden, 1908

Family PHAENNIDAE
Onchocalanus magnus (Wolfenden, 1906)
Onchocalanus wolfendeni Vervoort, 1950

Family SCOLECITHRICIDAE
Racovitzanus antarcticus Giesbrecht, 1902
Scolecithricella dentipes Vervoort, 1951
Scolecithricella glacialis (Giesbrecht, 1902)
Scaphocalanus brevicornis (Sars, 1900)
Scaphocalanus subbrevicornis (Wolfenden, 1911)

Family METRIDIIDAE
Metridia curticauda Giesbrecht, 1889
Metridia gerlachei Giesbrecht, 1902
Pleuromamma gracilis (Claus, 1893)

Family LUCICUTIIDAE
Lucicutia macrocera Sars, 1920
Lucicutia ovalis (Giesbrecht, 1889)

Family HETERORHABDIDAE
Heterorhabdus austrinus Giesbrecht, 1902
Heterorhabdus farrani Brady, 1918
Heterorhabdus pustulifer Farran, 1929
Heterostylites major (F. Dahl, 1894)

Family AUGAPTILIDAE
Haloptilus ocellatus Wolfenden, 1905
Haloptilus oxycephalus (Giesbrecht, 1889)

Family CANDACIIDAE
Candacia maxima Vervoort, 1957

Family ACARTIIDAE
Paralabidocera antarctica (I. C. Thompson, 1898)

Order **CYCLOPOIDA**
Family OITHONIDAE
Oithona frigida Giesbrecht, 1902
Oithona similis Claus 1866

Family ONCAEIDAE
Oncaea conifera Giesbrecht, 1891
Oncaea curvata Giesbrecht, 1902

STATION LIST

New Zealand Oceanographic Institute Collection 1959

Sta. A 448, 10 Jan, 77°27′S, 172°22′E, 600–0 m.

Calanus propinquus
Calanoides acutus
Ctenocalanus vanus
Euchaeta antarctica
Metridia gerlachei
Oithona similis

Sta. A 449, 11 Jan, 77°05′S, 177°12′E, 0840–0850, 362–0 m (touched bottom).

Calanoides acutus
Ctenocalanus vanus
Metridia gerlachei
Oithona frigida
O. similis
Oncaea curvata

Sta. A 449a, 11 Jan, 77°05′S, 177°12′E, 0855–0910, 340–0 m.

Calanoides acutus
Ctenocalanus vanus
Euchaeta antarctica
Metridia gerlachei
Lucicutia ovalis
Oithona similis

Sta. A 450, 11 Jan, 76°36′S, 179°53′E, 2200–2210, 256–0 m.

Ctenocalanus vanus
Oithona similis

Sta. A 451, 12 Jan, 75°55′S, 175°22′W, 0920–0950, 523–0 m (touched bottom).

Calanus propinquus
Calanoides acutus
Microcalanus pygmaeus
Ctenocalanus vanus
Metridia gerlachei
Oithona frigida
O. similis

Sta. A 452, 12 Jan, 75°35′S, 173°18′W, 2145–2230, 1300–0 m.

Calanus propinquus
Calanoides acutus
Rhincalanus gigas
Spinocalanus abyssalis
Gaidius tenuispinus
Scolecithricella dentipes
Scaphocalanus subbrevicornis
Metridia curticauda
M. gerlachei
Heterorhabdus austrinus
Oithona frigida
O. similis
Oncaea conifera

Sta. A 453, 13 Jan, 75°09′S, 171°00′W, 1715–1745, 1,000–0 m.

Calanus propinquus
Calanoides acutus
Rhincalanus gigas
Ctenocalanus vanus
Farrania frigida
Spinocalanus abyssalis
S. magnus
Aetideopsis minor
Gaidius tenuispinus
Onchocalanus magnus
O. wolfendeni
Racovitzanus antarcticus
Scolecithricella glacialis
Metridia curticauda
Metridia gerlachei
Lucicutia macrocera
L. ovallis
Heterorhabdus austrinus
H. farrani
H. pustulifer
Heterostylites major
Haloptilus ocellatus
H. oxycephalus
Candacia maxima
Oithona frigida
O. similis
Oncaea conifera

Sta. A 454, 14 Jan, 73°56′S, 176°30′W, 0015–0030, 700–0 m.

Calanus propinquus
Calanoides actus
Rhincalanus gigas
Ctenocalanus vanus
Euchaeta antarctica
Racovitzanus antarcticus
Metridia curticauda
M. gerlachei
Oithona frigida
O. similis
Oncaea conifera
O. curvata

Sta. A 455, 15 Jan, 74°22′S, 178°35′W, 0550, 300–0 m.

Calanus propinquus
Calanoides acutus
Rhincalanus gigas
Ctenocalanus vanus
Spinocalanus abyssalis
Racovitzanus antarcticus
Scolecithricella dentipes
Metridia curticauda
M. gerlachei
Lucicutia ovalis
Heterorhabdus austrinus
Oithona frigida
O. similis

Sta. A 456, 15 Jan, 74°30′S, 179°40′W, 1730–1740, 200–0 m.

Rhincalanus gigas
Ctenoclanus vanus
Metridia gerlachei
Oithona similis

Sta. A 457, 16 Jan, 75°02′S, 175°50′E, 0815–0820, 400–0 m.

Calanoides acutus
Ctenocalanus vanus
Oithona frigida
O. similis

Sta. A 458, 16 Jan, 75°10′S, 174°00′E, 1715–1725, 255–0 m.

Metridia gerlachei
Oithona similis

Sta. A 459, 16 Jan, 75°17′S, 172°20′E, 0350–0400, 500–0 m.

Calanus propinquus
Calanoides acutus
Rhincalanus gigas
Microcalanus pygmaeus
Ctenocalanus vanus
Spinocalanus abyssalis
Euchaeta antarctica
Metridia gerlachei
Pleuromamma gracilis
Oithona frigida
O. similis
Oncaea curvata

Sta. A 460, 17 Jan, 75°38′S, 168°32′E, 1515, 400–0 m.

Calanoides acutus
Ctenocalanus vanus
Metridia gerlachei
Paralabidocera antarctica
Oithona similis

Sta. A 461, 18 Jan, 73°32′S, 171°22′E, 550–0 m

Calanoides acutus
Euchaeta antarctica
Metridia gerlachei
Paralabidocera antarctica
Oithona similis

Sta. A 462, 20 Jan, 71°15′S, 176°30′E, 1000–0 m.

Calanus propinquus
Calanoides acutus
Rhincalanus gigas
Microcalanus pygmaeus
Ctenocalanus vanus
Spinocalanus abyssalis
Chiridiella megadactyla n. sp.
Gaidius tenuispinus
Onchocalanus wolfendeni
Racovitzanus antarcticus
Scolecithricella dentipes
Scaphocalanus subbrevicornis
Metridia curticauda
M. gerlachei
Lucicutia ovalis
Heterorhabdus farrani
Haloptilus ocellatus
Oithona frigida
O. similis
Oncaea conifera
O. curvata

Sta. A 463, 21 Jan, 72°20′S, 174°50′E, 1315–1325, 425–0 m.

Calanus propinquus
Calanoides acutus
Microcalanus pygmaeus
Ctenocalanus vanus
Racovitzanus antarcticus
Metridia curticauda
M. gerlachei
Haloptilus oxycephalus
Oithona frigida
O. similis
Oncaea curvata

Sta. A 466, 24 Jan, 78°26′S, 174°50′W, 2105–2100, 550–0 m.

Nannocalanus minor
Calanus propinquus
Calanoides acutus
Ctenocalanus vanus
Euchaeta antarcica
Metridia gerlachei
Oithona frigida
O. similis
Oncaea curvata

Sta. A 467, 26 Jan, 77°25′S, 169°28′E, 1040–1100 (surface horizontal).

Calanoides acutus
Metridia gerlachei

TRANSANTARCTIC EXPEDITION COLLECTIONS 1957, 1958

Sta. 1, 29 Jan 1957, Ice Harbour, McMurdo Sound, 549–0 m.

Calanus propinquus
Calanoides acutus
Ctenocalanus vanus
Euchaeta antarctica
Metridia gerlachei
Oithona similis
Oncaea curvata

Sta. 81, 9 Feb 1958, 77°00′S, 167°12′E, 2020–2030 (surface horizontal).

Calanoides acutus
Oithona similis

Sta. 82, 10 Feb, 77°16·5′S, 167°12′E, 0009–0025 (surface horizontal).

Calanoides acutus
Ctenocalanus vanus

Sta. 86, 10 Feb, 75°42′S, 172°00′E, 2025–2040, 400–0 m.

Calanoides acutus
Euchaeta antarctica
Metridia gerlachei
Oithona similis
Oncaea curvata

Sta. 88, 11 Feb, 75°04′S, 168°10′E, 0018–0027, 350–0 m.

Calanoides acutus
Ctenocalanus vanus
Euchaeta antarctica
Metridia gerlachei
Oithona similis

Sta. 89, 11 Feb, 74°48′S, 167°00′E, 0423–0435, 500–0 m.

Calanus propinquus
Calanoides acutus
Aetideopsis antarctica
Euchaeta antarctica
Metridia gerlachei
Oithona similis

Sta. 90, 11 Feb, 75°14′S, 167°15′E, 0813–25, 300–0 m.

Calanoides acutus
Euchaeta antarctica
Metridia gerlachei
Oithona similis
Oncaea curvata

Sta. 91, 11 Feb, 75°46′S, 167°30′E, 1210–1200, 300–0 m.

Calanus propinquus
Calanoides acutus
Metridia gerlachei
Oithona similis
Oncaea curvata

Sta. 92, 11 Feb, 76°46·5′S, 165°48′E, 0420–0435, 500–0 m.

Calanus propinquus
Calanoides acutus
Ctenocalanus vanus
Aetideopsis antarctica
Euchaeta antarctica
E. similis
Metridia gerlachei
Paralabidocera antarctica
Oithona frigida
O. similis
Oncaea curvata

Sta. 97, 12 Feb, 76°46·5′S, 165°48′E, 0420–0435, 500–0 m.

Calanus propinquus
Calanoides acutus
Ctenocalanus vanus
Euchaeta antarctica
E. similis
Metridia gerlachei
Oithona similis
Oncaea curvata

SYSTEMATICS

Nannocalanus minor (Claus, 1863) (Fig. 6)

MATERIAL EXAMINED

NZOI Sta. A 466, 1 ♀ 1·75 mm.

DISCUSSION

Brodsky (1967) figured the southern limit of this species somewhere north of the Subtropical Convergence. The specimen recorded here was damaged anteriorly, with antenna 1, antenna 2, and mandibular palp missing, but the remainder of the animal was in fairly good condition. This specimen is considered to be a stray into the Antarctic environment (Tanaka (1964) found a specimen of *N. minor* as far south as 55°22′S).

Calanus propinquus Brady, 1883 (Figs 8, 9)

Synonymy: *See* Vervoort (1957)

1960. *Calanus propinquus:* Tanaka, pp. 10–12, pl. 1, figs 1–8, pl. 2, figs 1–2.
1964. *C. propinquus:* Tanaka, p. 5.
1966. *C. propinquus:* Brodsky, p. 210–23.

MATERIAL EXAMINED

NZOI Sta. A 448, 1 ♀, 1 copepodite; A 451, some copepodites; A 452, 1 ♀ 6·1 mm, some copepodites; A 453, 16 ♀ ♀ 4·95–5·6 mm, some copepodites; A 454, many ♀ ♀ 5·3–5.4 mm; A 455, some copepodites; A 459, 2 copepodites; A 462, ♀ ♀ 5·0–5·5 mm; A 463, 1 ♀ 5·15 mm, 3 copepodites; A 466, 1 ♀ 5·2 mm, some copepodites.

T.A.E. Sta. 1, few ♀ ♀; 89, few ♀ ♀; 91, few ♀ ♀; 92, some ♀ ♀, 1 ♂; 97, few ♀ ♀, 1 ♂.

DISCUSSION

The size of these specimens and the large distal setae on antenna 1 distinguish them from other calanids. Adult female *Calanus propinquus* occurred in greatest numbers in NZOI samples at stations seaward of the 500 m isobath. One female was recorded at Sta. A 448 and A 466 against the Ross Sea Shelf, and a few females were taken in the T.A.E. samples in the south-western part of the Ross Sea. A little is known of the life history of *Calanus propinquus*. Vervoort (1965) interpreted the increase in copepodite numbers at localities near the Antarctic Convergence as suggesting reproduction in Antarctic surface layers during summer when the animals are gradually transported northwards. He postulated that eggs and larvae are carried south in the warm deep current.

This species belongs exclusively to the Antarctic region, existing in temperatures ranging from − 1·8° to 5°C. It may become as large as 6·1 mm but is usually just over 5·7 mm (Brodsky 1967). Vervoort (1951) recorded the capture of male specimens from December to March in the Atlantic Sector of the Antarctic, whereas only two were taken in the Ross Sea at the end of February in the T.A.E. samples.

Calanoides acutus (Giesbrecht, 1902) (Fig. 7)

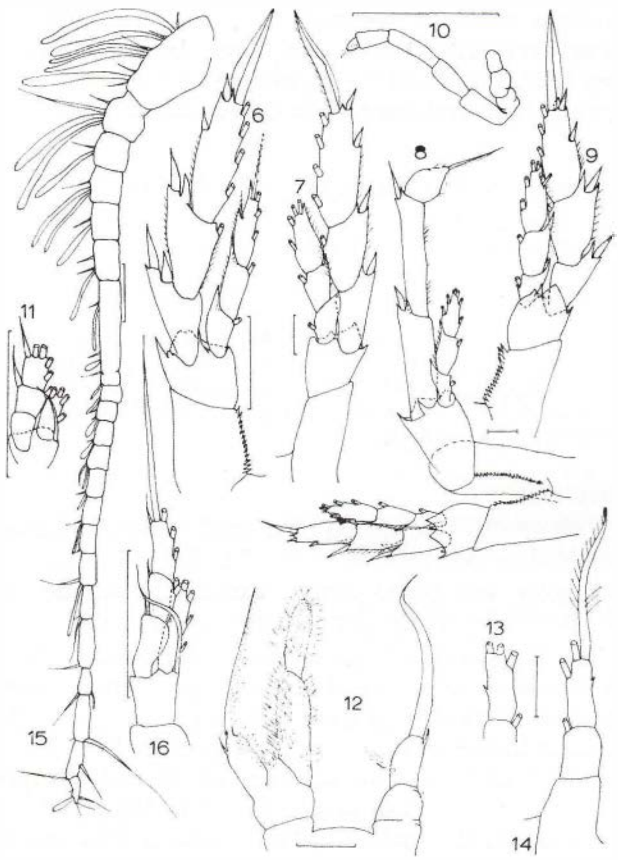
Synonymy: *See* Vervoort (1957)

1960. *Calanoides acutus:* Tanaka, pp. 14–16, pl. 3, figs 1–9
1966. *Calanus acutus:* Brodsky, pp. 224–33, fig. 28

MATERIAL EXAMINED

NZOI Sta. A 448, some ♀ ♀ 4·7–5·3 mm, some copepodites; A 449, 2 ♀ ♀ 4·8, (damaged) 4·65 mm, 9 copepodites; A 451, 1 copepodite; A 452, 9 ♀ ♀ 4·8–5·7 mm, 1 copepodite; A 453, many ♀ ♀ 4·9–5·5 mm, many copepodites; A 454, 14 ♀ ♀ 4·8–5·5 mm, many copepodites; A 455, 7 ♀ ♀ 4·7–5·4 mm, 24 copepodites; A 457, 1 copepodite; A 459, 3 copepodites; A 460, 2 ♀ ♀ 4·5, 4·6 mm, many copepodites; A 461 1 ♀ (damaged) 4·3 mm, some copepodites; A 462, many ♀ ♀ 4·6–5·5 mm, some copepodites; A 463, 1 ♀ (damaged) 5·0 mm, 13 copepodites; A 466, 1 ♀ 4·6 mm, some copepodites; A 467, some copepodites.

T.A.E. Sta. 1, some ♀ ♀, many copepodites; 81, very many copepodites; 82, few ♀ ♀, some copepodites; 86, few copepodites; 88, few copepodites; 89, few ♀ ♀, some copepodites; 90, few ♀ ♀, some copepodites; 91, many copepodites; 92, some ♀ ♀, many copepodites; 97, few ♀ ♀, few copepodites.



FIGS 6–16: *Nannocalanus minor* (6) female leg 5; *Calanoides acutus* (7) female leg 5; *Calanus propinquus* (8) male leg 5, 9-female leg 5; *Microcalanus pygmaeus* (10) male leg 5, (11) female leg 1; *Rhincalanus gigas* (12) male leg 5, (13, 14) female leg 5; *Ctenocalanus vanus* (15) male antenna 1, (16) male leg 1. Scale mark represents 0·1 mm.

DISCUSSION

This copepod is easily recognised by its size and conical head shape. *Calanoides acutus* females occurred in greatest numbers at stations seaward of the 500 m isobath with a few specimens at Sta. A 448 and at the

T.A.E. stations in the deeper basin near Ross Island. The life history of *Calanoides acutus* is quite well known from the work of Andrews (1966). He showed that an over-wintering population of stages IV and V copepodites ecdyse to stages V and VI, which are almost entirely females with dark sperm masses in their spermathecal sacs. Vervoort (1955) suggested that the male is very short-lived, as only a few have ever been found. Vervoort (1951) took one male in February. Mature females in egg-laying condition were recorded from October to March in the upper water layers. Younger copepodites reached maximum abundance in December. There is pronounced seasonal variation in distribution — *C. acutus* migrates downwards deeper than 250 m in winter, but during summer the highest population density occurs in the upper 250 m. Copepodite stages V and VI migrate diurnally in summer, but there is no evidence of much movement in winter. This substantiates Vervoort's (1965) conclusions about the life history of *C. acutus* and the importance of the Warm Deep Current in returning stocks to the Antarctic.

Rhincalanus gigas Brady, 1883 (Figs 12–14)

Synonymy: *See* Vervoort (1957)
1960. *Rhincalanus gigas:* Tanaka, pp. 21–2, pl. 5, figs 1–6

MATERIAL EXAMINED

NZOI Sta. A 452, 1 ♀ 8·2 mm; A 453, 28 ♀♀ 7·5–8·5 mm, 4 copepodites; A 454, 37 ♀♀ 7·7–8·6 mm, 2 ♂♂ 6·9 mm, some copepodites; A 455, 1 ♂ 6·9 mm; A 456, 1 ♀ (damaged) 7·9 mm; A 459, 1 copepodite; A 462, 23 ♀♀ 7·9–8·9 mm, 1 ♂ 7·0 mm, 15 copepodites.

DISCUSSION

This species is identified by a small external spine on the third exopod segment of the female leg 5. *Rhincalanus gigas* was found almost exclusively outside the 500 m contour, except for a copepodite at A 459.

The life history of this species is quite well known. Ommanney (1936) noted that *R. gigas* makes strong seasonal vertical migrations. The species spends the summer in the surface 100 m, then descends to below this level at the end of summer (at the end of April specimens were out of range of the 250–100 m net). It reappears in the surface 250 m in spring. This species probably has two spawning periods: one during summer in Antarctic surface waters and another probably in late May and June when the summer generation descends to the Warm Deep Water, reaches sexual maturity and spawns. This would produce the over-wintering population which reappears in the surface 250 m. The stages of the spring surface population vary with the temperature of the water, thus Subantarctic Water specimens are stages V and VI, but Antarctic Water specimens are stages IV and V. As spawning did not take place in the Weddell Sea Ommanney postulated that temperatures below 0° or –1°c prevent spawning. The optimum spawning temperature he thought to be between 1.0 and 4.0°c.

Grice and Hulsemann (1967) found *R. gigas* in the Indian Ocean in deep hauls (0–3,140 m) as far north as 29°29′S, 48°43′E.

Microcalanus pygmaeus (Sars, 1900) (Figs 10, 11)

Synonymy: *See* Vervoort (1957)
1960. *Microcalanus pygmaeus:* Tanaka, pp. 35–6, pl. 13, figs 1–9.

MATERIAL EXAMINED

NZOI Sta. A 451, 1 ♀ 0·7 mm; A 459, 1♂; A 462, 2 ♂♂ 0·85, 0·8 mm; A 463, 1 ♀ 0·65 mm.

DISCUSSION

These specimens have only the first leg intact, so it is impossible to determine from the number of internal exopod setae on legs 3 and 4 whether they are Pseudocalanidae or Spinocalanidae. Nevertheless, the only genus of Spinocalanidae into which the present specimens could fit (because of the number of external exopod spines on leg 1) is *Mimocalanus*, but this genus has no rostral fialments like those of the Ross Sea specimens. Thus the Ross Sea specimens are deduced to be the pseudocalanid genus, *Microcalanus*. The males agree with Tanaka's (1960) description of *Microcalanus pygmaeus* and may be distinguished from *Ctenocalanus* males, which they superficially resemble, by the smaller size and the 20-segmented first antenna, which has the last two segments fused in *Microcalanus pygmaeus*.

This small species, which may have escaped capture or have been overlooked when the Ross Sea samples were sorted, was recorded at a few of the more seaward stations.

Vervoort (1957) summarised the Arctic and Antarctic occurrence of *Microcalanus pygmaeus*. The records of Grice and Hulsemann (1967) from north of the equator in deep hauls approximately (1,000–3,000 m) from the Indian Ocean, Grice and Hulsemann (1965) in deep hauls (100–2,500 m) between 30°–60°N in the north-east Atlantic, and Johnson (1963) in a high Polar Basin north of Alaska indicate the cosmopolitan nature of this species as presently defined.

Ctenocalanus vanus Giesbrecht, 1888 (Figs 15–20)

Synonymy: *See* Vervoort (1957)
1960. *Ctenocalanus vanus:* Tanaka, p. 35.
1964. *C. vanus:* Tanaka, p. 7.

MATERIAL EXAMINED

NZOI Sta. A 448, many ♀♀; A 449, 2 ♀♀ 1·25, 1·2 mm; A 449a, some ♀♀; A 450, 5 ♀♀; A 451, 22 ♀♀; A 453, many ♀♀; A 454, many ♀♀; A 455, many ♀♀, 1♂; A 456, 8 ♀♀; A 457, 2 ♀♀; A 459, many ♀♀, few ♂♂; A 460, 1 ♀; A 462, some ♀♀, some ♂♂; A 463, some ♀♀; A 466, some ♀♀.

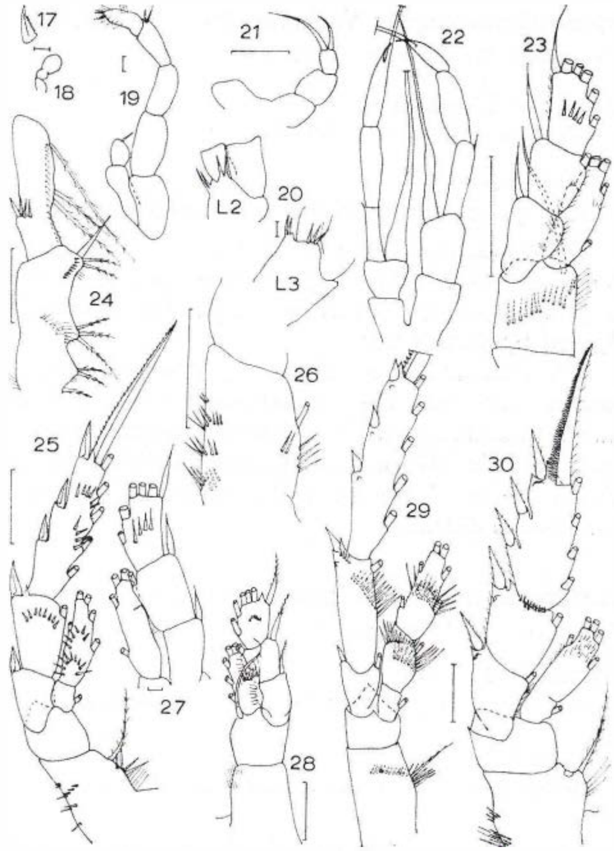
T.A.E. Sta. 1, some ♀♀; 82, few ♀♀; 83, few ♀♀; 92, few ♀♀; 97, some ♀♀.

DISCUSSION

Ctenocalanus was found at all stations outside the 500 m isobath and at many stations on the shelf. At A 459 it was particularly abundant. Males were recorded at A 455, A 459, A 462.

Female specimens were recognisable at *Ctenocalanus* by the comb-like external exopod spines on leg 3 (Fig. 17), but in male specimens the exopods of legs 3 and 4 were always missing, so it was not possible to check the identification positively. The number of inner setae on leg 2 third exopod segment agrees with the definition of Pseudocalanidae. As recorded by Unterüberbacher (1964) the male always has an extra segment on the right fifth leg (Fig. 19). The distal posterior spines on legs 2 and 3 second basipod were not mentioned by Wolfenden (1904). Female leg 5 always has an expanded distal segment in the Ross Sea specimens. There may be more than one species in this genus, as small differences have been noted in the female; but as the male of *C. vanus* has never been adequately defined, the Ross Sea specimens remain *Ctenocalanus vanus*.

Ctenocalanus vanus is a regular and common component of the epiplankton recorded from all seas round the Antarctic continent (Vervoort 1951). Outside the Antarctic the species is decidedly bathypelagic (Grice and Hulsemann 1967; De Decker and Mombeck 1965); nevertheless, it is not found exclusively in deep water, as it is capable of extended diurnal movements which may bring it near the surface at night in temperate oceanic regions (Grice and Hulsemann 1965; De Decker 1964).



FIGS 17–30: *Ctenocalanus vanus* (17) female leg 3 exopod external spine, (18) female leg 5, (19) male leg 5, (20) male legs 2 and 3 (L2, L3) basipod 2; *Farrania frigida* (21) female leg 5; *Spinocalanus abyssalis* (22) male leg 5, (23) female leg 1, (24) female maxilliped basipods 1 and 2, (25) female leg 2, (26) male leg 4 basipod 1, (27) male leg 1; *Spinocalanus magnus* (28) female leg 1, (29) female leg 4; *Aetideopsis minor* (30) female leg 2. Scale mark represents: 0·01 mm on Figs 17–20, 27; 0·1 mm on the rest.

Farrania frigida (Wolfenden, 1911) (Fig. 21)

Synonymy: *See* Vervoort (1957)

MATERIAL EXAMINED

NZOI Sta. A 453, 2 ♀♀ 2·85 mm, few copepodites.

DISCUSSION

This species is easily recognised from Vervoort's (1951) description. Vervoort (1957) classified *Farrania frigida* as a characteristic Antarctic deep-water form known from the Atlantic, Indian, and Pacific sectors.

Spinocalanus abyssalis Giesbrecht, 1888 (Figs 22–27)

Synonymy: *See* Vervoort (1957)

1960. *Spinocalanus abyssalis:* Tanaka, pp. 36–7.

MATERIAL EXAMINED

NZOI Sta. A 452, 2♀♀ 1·0, 1·9 mm; A 453, 3 ♀♀ 1·7, 1·75, 2·0 mm; A 455, 1♀ 1·8 mm; A 459, 1 ♀; A 462, 2 ♀♀ 1·0, 1·75 mm, 1♂ 1·9 mm.

DISCUSSION

There is no doubt about the identity of the female specimens, as they agree with all definitions in having a transverse row of spines on the maxilliped second basipod and a double row of spinules on the third endopod segment of legs 2–4 and second endopod segment of legs 3 and 4. Leg 1 has on the third exopod segment 4–7 spines on the posterior surface not shown by Giesbrecht (1892). The male specimen, although incomplete, appears to belong to *S. abyssalis.* Leg 1 as seen from a whole mount has thick external exopod spines, and the leg 4 first basipod has an arrangement of spinules similar to that of the female leg 4. Leg 5 has broken terminal spines and both third exopod segments have a small spine where the segments narrows, not figured by Sars (1903).

Two female specimens of *S. abyssalis* var. *pygmaeus* Farran, 1926 were recorded at Sta. A 455 and A 459.

Vervoort (1957) considered this species to be entirely bathypelagic. Recent records from the Arctic (Johnson 1963), north-east Atlantic (Grice and Hulsemann 1965) and Indian Ocean (Grice and Hulsemann 1967) confirm its world-wide distribution.

In the Ross Sea, apart from Sta. A 459, *Spinocalanus abyssalis* was collected about or seaward of the 500 m isobath.

Spinocalanus magnus Wolfenden, 1904 (Figs 28, 29)

Synonymy: *See* Vervoort (1957)

MATERIAL EXAMINED

NZOI Sta. A 453, 7 ♀♀ 2·35–2·6 mm.

DISCUSSION

This species was found only at the easternmost station.

These specimens agree with *S. magnus* as discussed by Vervoort (1949, 1957). Leg 1 third exopod segment has a patch of small spinules on the posterior surface not figured by Sars (1925).

Spinocalanus magnus shows a greater preference for deeper water than does *S. abyssalis*, although it occasionally occurs above 500 m. Recent records from north-east Atlantic (Grice and Hulsemann 1965) and the Arctic north of Alaska (Johnson 1963) confirm its world-wide distribution.

Aetideopsis minor (Wolfenden, 1911) (Fig. 30)

Synonymy: *See* Vervoort (1957)

MATERIAL EXAMINED

NZOI Sta. A 453, 3 ♀♀ 2·9 mm, 1 ♂ copepodite.

DISCUSSION

Aetideopsis minor was found at the easternmost station.

These specimens are undoubtedly *A. minor* as redescribed by Vervoort (1951), who did not mention some details. The endopods of legs 2–4 have very fine spinules on their anterior surface, distally. The exopods of legs 2–4 have one anterior surface glandular pore on each segment at the base of the terminal lateral spine (Fig. 30). The pores on legs 3 and 4 tend to open directly laterally. Leg 1 second exopod segment bears a patch of spines on the anterior surface. The surface of the metasome is not pitted as stated by Vervoort (1951) but covered with raised chitinous lumps or prickles as in *A. antarctica* although not as long. They are present on the urosome also but are so small as to be almost indistinguishable.

Aetideopsis minor is characteristic of the Southern Ocean and is found in the intermediate and deep water bordering the Antarctic continent (Vervoort 1957, 1965).

Aetideopsis antarctica (Wolfenden, 1908) (Figs 31–48)

Synonymy:

1908. *Faroella antarctica* Wolfenden, pp. 39–41, pl. 11, figs 1–4.
1911. *F. antarctica:* Wolfenden, p. 214.
1929. *Chiridius antarcticus:* Farran, p. 230.

MATERIAL EXAMINED

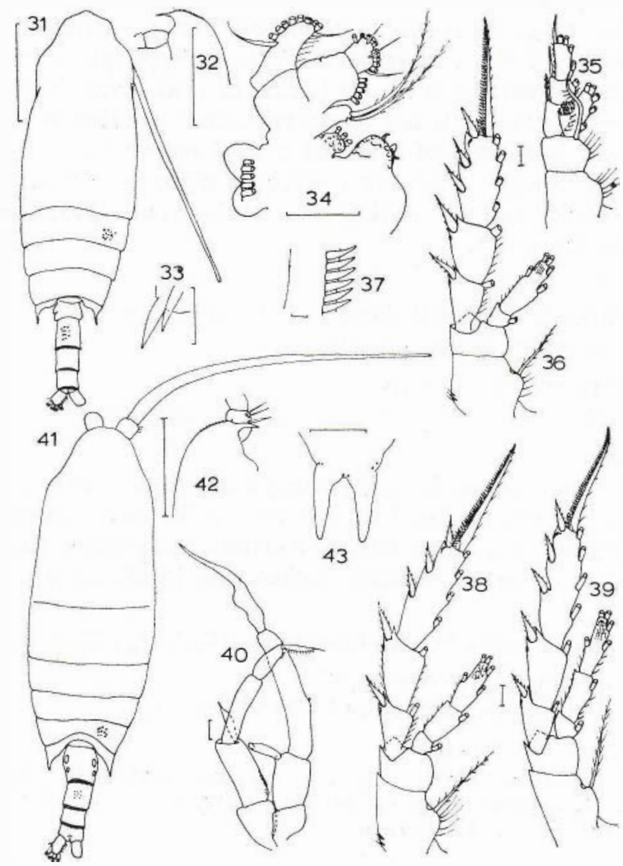
T.A.E. Sta. 1, 1 ♀ 4·4 mm, 1 ♂ 3·7 mm; 89, 1 ♀ 4·5 mm; 92, 4 ♀♀ 4·4, 4·3, 4·6 mm.

DISCUSSION

Wolfenden's (1908) description does not tally with the present specimens in every respect, but the "prickle covered" integument and size are enough to identify these as the same species. A redescription of a female and description of a male from T.A.E. Sta. 1 in the Ross Sea is given.

FEMALE: 4·4 mm. Body (Fig. 41) very heavily built with all integument covered with blunt chitinous knobs except for anal segment and furca. Thoracic segment 1 and head incompletely fused. Rostrum heavy (Figs 42, 43) with non-diverging points. Thoracic segments 4 and 5 separate, posterior points reaching $\frac{2}{3}$ down genital segment. Total length 3·7 times length of abdomen. Posterior of abdominal segments 1–3 bordered by fine weak teeth.

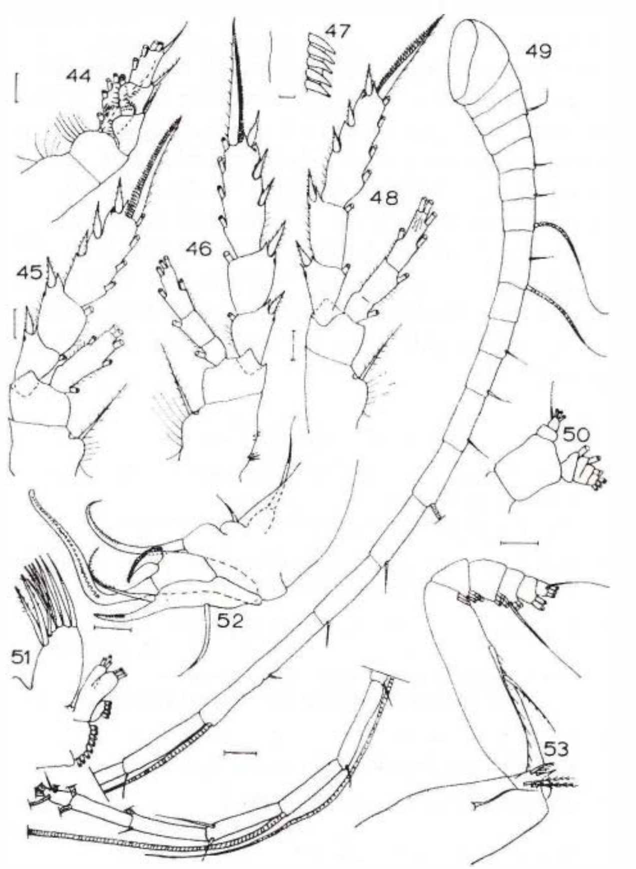
Antenna 1 at right angles to body but not reaching past posterior border of fourth thoracic segment. Antenna 2 exopod longer than endopod. Mandible like that of *A. tumorosa* (Bradford 1969) with two setae on the first exopod segment and second basipod. Maxilla 1 and 2, maxilliped like those in *A. tumorosa* and *A. carinata*.



FIGS 31–43: *Aetideopsis antarctica* male (31) dorsal view, (32) lateral view of head, (33) oblique view of rostrum, (34) maxilla 1, (35) leg 1, (36) leg 2, (37) part of leg 4 terminal spine, (38) leg 3, (39) leg 4, (40) leg 5; female (41) dorsal view, (42) lateral view of head, (43) rostrum. Scale mark represents: 0·01 mm on Fig. 37; 1·0 mm on Figs 31–2, 41–2; 0·1 mm on the rest.

Legs (Figs 44–48) of general *Aetideopsis* type with large external edge exopod spines and glandular pores on legs 2–4. Leg 1 external edge exopod spines on first and second segments both reach past base of next spine. Endopod has patch of inner bristles on anterior surface besides spinules on external protuberance. Leg 2 endopod segments fused on posterior surface, but line of fusion visible on anterior surface. Distal part of endopod anterior surface with patch of very fine spinules as noted by Wolfenden (1908). First and second exopod segments both with one glandular pore right on lateral margin just below external edge spine, 49 teeth on terminal spine. Leg 3 and 4 with first two endopod segments incompletely separated and with distal anterior patch of fine spinules. Glandular pores in same position on leg 2. Leg 3 with 51 teeth on terminal spine, leg 4 with 45 teeth on terminal spine. Teeth tall narrow, curving towards spine apex. Leg 4 narrower than leg 3.

MALE: 3·7 mm (Fig. 31). Like female in general shape with integument covered (except for anal segment and furca) with chitinous blunt knobs. Thoracic segment and head completely fused. Rostrum (Figs 32, 33) much smaller and less heavily chitinised than in female. Thoracic segments 4 and 5 separate, posterior points directed backwards past first abdominal segment border. Genital aperture on left of genital segment. Total length 3·8 times total abdominal length. Posterior borders abdominal segments 2–4 lined with small weak teeth.



FIGS 44–53: *Aetideopsis antarctica* female (44) leg 1, (45) leg 2, (46) leg 3, (47) leg 4 terminal spine, (48) leg 4; *Chiridiella megadactyla* n. sp. female (49) antenna 1, (50) mandible palp, (51) maxilla 1, (52) maxilla 2, (53) maxilliped. Scale mark represents: 0·01 mm on Fig. 47; 0·1 mm on the rest.

Antenna 1, 24-segmented, of *Aetideopsis* type (see *A. tumorosa*, *A. carinata* Bradford 1969) reaches hind border of third thoracic segment. Antenna 7 exopod and endopod of equal length. Mandible endopod with two setae (one very small), basipod 2 with one seta. Maxilla 1 (Fig. 34) is only mouthpart which appears to have diagnostic features. Compared with *A. tumorosa* and *A. carinata* there are slightly different numbers of seta on most lobes, but these may be damaged; main difference appears to be presence of three weak setae on second inner lobe in *A. antarctica*. Maxilla 2 very reduced. Maxilliped reduced compared with that of female but like that of *A. tumorosa* and *A. carinata*.

Leg 1 (Fig. 35) like that of female but slightly smaller. Outer edge first exopod segment spine reaches past base of second exopod segment spine which does not quite reach base of third exopod segment spine. Leg 2 (Fig. 36) more slender than in female, endopod two-segmented, segments separate. Anterior distal surface with patch of spines. Glandular pores placed as in female and terminal spine with more (63) teeth. Leg 3 and 4 (Figs 38, 39) as in female but more slender; first endopod segment distinctly separate from second. Terminal spine leg 3 with 54, leg 4 with 56 teeth. Teeth long and narrow (Fig. 37) directed towards apex of spine. Leg 5 (Fig. 40) right leg tip reaches tip of furca; form of this limb hardly different from any other known male *Aetideopsis*.

Aetideopsis antarctica and *A. minor* appear to be related, as both have chitinous "prickles" covering the integument and a distal anterior patch of spinules on the endopods. The main points of difference are the size and the less obvious "prickles" on the urosome and the diverging rostral points (Vervoort 1951) in *A. minor*.

All specimens of this species have been caught near the Antarctic continent, although Wolfenden (1908) does not give a location, so it could be considered an Antarctic "neritic" species.

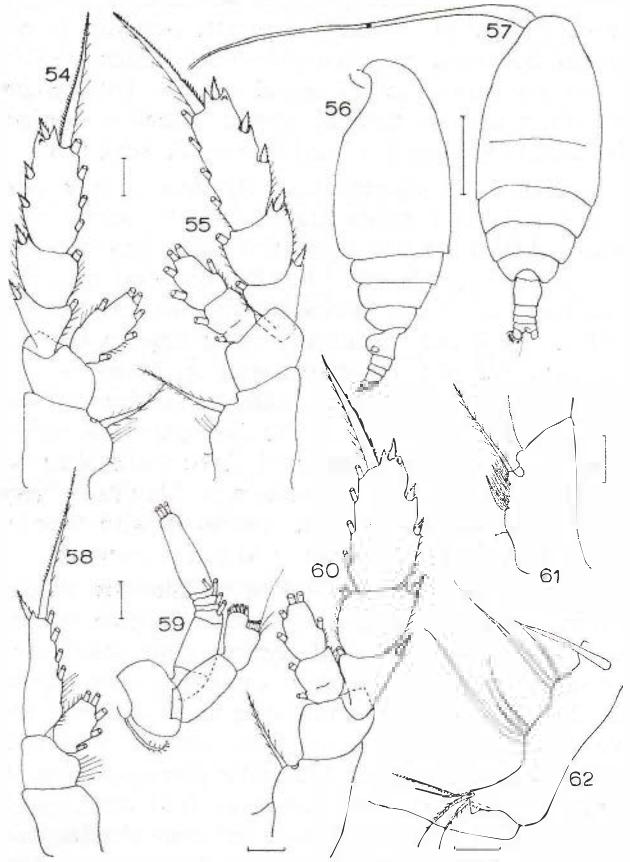
Chiridiella megadactyla n. sp. (Figs 49–60)

MATERIAL EXAMINED

NZOI Sta. A 462, 1 ♀ 4·10 mm.

DESCRIPTION

FEMALE: 4·1 mm. First thoracic segment and head incompletely fused, thoracic segments 4 and 5 fused with posterior borders broadly rounded. No trace of rostrum. Total length 5·6 times abdomen length. Genital segment laterally slightly swollen but ventrally greatly extended (Figs 55, 57).



FIGS 54–62: *Chiridiella megadactyla* female (54) leg 2, (55) leg 3, (56) lateral view, (57) dorsal view, (58) leg 1, (59) antenna 2, (60) leg 4; *Gaidius tenuispinus* female (61) leg 4 basipod 1, (62) maxilliped basipod 1. Scale mark represents: 1·0 mm on Figs 56–7; 0·1 mm on the rest.

Antenna 1, 23-segmented (8 and 9, 17 and 18 fused) reaches past furca, furnished with elongate annulate setae on segments 7, 8, 13, 16, 19, 21, 22, 23 (Fig. 49). Antenna 2 endopod over half length of exopod. Exopod 7-segmented, 1 and 2 without setae (Fig. 59). Mandibular palp endopod (Fig. 50) bears four setae on terminal segment and six setae on exopod. Basipod segments without setae. Maxilla 1 with setation on first inner lobe strongly developed, second inner lobe apparently absent, third inner lobe with three setae. Endopod with three setae, exopod with four. First outer lobe with eight setae (Fig. 51). Maxilla 2 with five lobes. Two proximal lobes with single seta each, while three distal lobes have enlarged spine-like setae — third lobe with one spine, fourth with two spines, one shorter and thicker, fifth lobe bears one spine carrying two setae (Fig. 52). Maxilliped first basipod segment with one median seta, distal corner has one terminal spine-like expansion, a short thickly plumose seta and two ordinary setae. Remainder of setation as in Fig. 53.

Leg 1 rami one-segmented. Exopod with one external spine. Terminal setae with external small teeth and internal border of hairs (Fig. 58). Leg 2 endopod one-segmented, exopod three-segmented. Terminal spine with approximately 60 very small external teeth. Third exopod segment with one "glandular pore" on anterior surface in distal external corner (Fig. 54). Leg 3 rami three-segmented, although joint between first and second endopod segments appears to be immovable. "Glandular pores" on distal-external corners of second and third exopod segments. Terminal spine with approximately 60 teeth (Fig. 55). Leg 4 almost identical with leg 3 (Fig. 60). Exopod a little broader. External exopod spines of legs 2–4 bordered by a row of small bristles.

Type Locality

The only specimen was captured at the north-westernmost NZOI station A 462 71°15′S, 176°30′E.

Habitat

One female specimen was caught in a vertical haul 1,000–0 m.

Holotype

The holotype is deposited in the collection of the N.Z. Oceanographic Institute, Wellington, New Zealand, registered number 51.

Discussion

The present species differs from all others in that the seta on the maxilla 2 (Mx2) third lobe is also enlarged and spine-like and antenna 1 reaches past the furca. Seven species have so far been described: *C. macrodactyla* Sars, 1907; *C. atlantica* Wolfenden, 1911; *C. brachydactyla* Sars, 1925; *C. abyssalis* Brodsky, 1950; *C. pacifica* Brodsky, 1950; *C. reducta* Brodsky, 1950; *C. subaequalis* Grice and Hulsemann, 1965. Three workers have doubtfully attributed female specimens to existing genera. All these are included in the following key to females.

Key to *Chiridiella* Females

1 Mx2 fourth lobe with 1 short and 1 long spine arranged as pincers 4
Mx2 fourth lobe without pincer arrangement 2

2 Mx2 lobes 3,4,5 with enlarged setae .... **C. subaequalis**
Mx2 lobes 3,4 with enlarged setae 3

3 Leg 1 endopod with 1 external edge spine .... **C. brachydactyla**
Leg 1 endopod with 2 external edge spines .... **C. brachydactyla** (Grice and Hulsemann, 1965)

4 Mx2 with 4 or 5 lobes 5
Mx2 with less than 4 lobes 8

5 Mx2 lobes 3,4,5 with enlarged setae .... **C. megadactyla** n. sp.
Mx2 lobes 4,5 with enlarged setae 6

6 Mx2 lobe 5 with 2 setae at base of enlarged spine 7
Mx2 lobe 5 with 1 seta removed some distance from base of enlarged spine .... **C. atlantica**

7 Legs 3, 4 endopods 3-segmented .... **C. macrodactyla**
Legs 3, 4 endopods 1-segmented .... **C. abyssalis** (Johnson, 1963)

8 Mx2 with 2 seta-bearing lobes 9
Mx2 with>2 seta-bearing lobes 10

9 Legs 3, 4 endopods 1-segmented .... **C. pacifica**
Legs 3, 4 endopod 3-segmented ....
.... **C. macrodactyla** (Tanaka, 1957)

10 Legs 2, 3 exopod segment 1 without outer edge spine
.... **C. reducta**
Legs 2, 3 exopod segment 1 with outer edge spine ....
.... **C. abyssalis**

It is difficult to evaluate the uncertain species identifications when the variability in the structure of the second maxilla and degree of fusion in rami of legs 2–4 is not known and the accuracy of some drawings is suspect. Nevertheless, in my opinion, specimens assigned to *C. abyssalis* by Johnson (1963) fit into *C. macrodactyla* because of the maxilla 2 form, although he shows that legs 3 and 4 endopod segments are fused, contrary to the described condition for the latter species. Also the specimen assigned to *C. macrodactyla* by Tanaka (1957) has the second maxilla more like that of *C. pacifica*, but there is less fusion between swimming leg segments.

Brodsky (1950) described a male of *C. reducta*, and Tanaka (1957) described a male he attributed to *C. brachydactyla* although it is not clear on what grounds. Apparently the mouthparts are very much modified compared with those of the female, as according to Brodsky (1950) the first maxilliped (maxilla 2) is a "small unsegmented rudiment". These male specimens of *Chiridiella* firmly establish this genus in the Aetideidae.

Gaidius tenuispinus (Sars, 1900) (Figs. 61–63)

Synonymy: *See* Vervoort (1957)

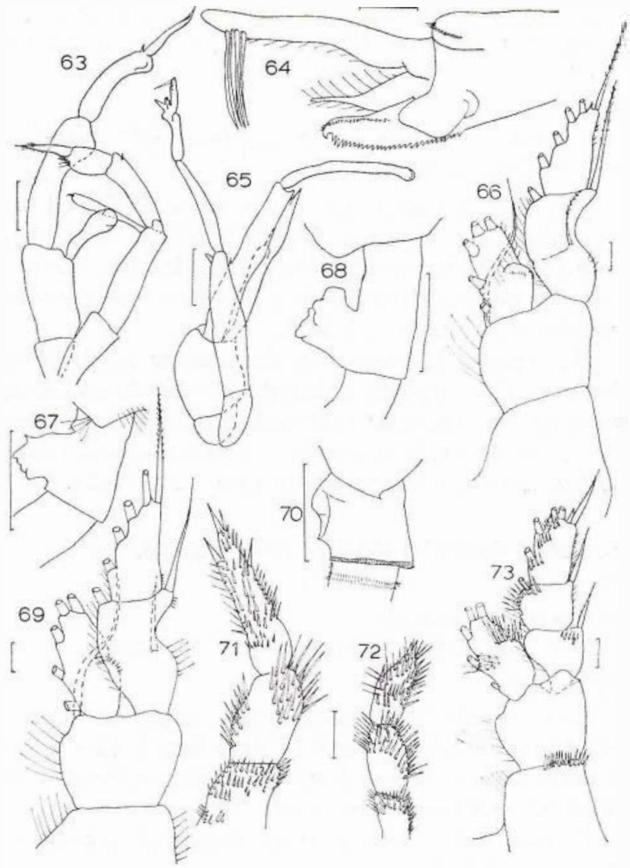
Localities

NZOI Sta. A 452, some copepodites; A 453, some ♀♀ 3·1–3·5 mm, 1 ♂ 2·9 mm, 9 copepodites; A 462, 1 ♀ 3·15 mm, 2 ♂♂ 2·95, 3·1 mm, 1 copepodite.

Discussion

Gaidius tenuispinus was found at the two easternmost stations and the most seaward western station. Males were found at the most seaward stations.

The size of females is within the measurements taken by Vervoort (1957), and all characters agree with *G. tenuispinus* as against *G. pungens*, except that it is difficult to see more than two rows of bristles on leg 4 first basipod. The distal corner of the maxilliped first basipod is as Tanaka (1957) describes it (Fig. 62). Male specimens have posterior thoracic borders extended into narrow spines which reach midway down the second abdominal segment. The fact that Sars (1903) and Tanaka (1957) drew shorter spines may be accounted for by their having broken being of a delicate nature. Leg 5 agrees in proportions with that of Sars (1903), but a little more detail was seen in the present specimens (Fig. 63). Tanaka's male has a shorter left endopod.



Figs 63–73: *Gaidius tenuispinus* male (63) leg 5; *Euchaeta antarctica* male (64) terminal joints of left leg 5, (65) leg 5; female (66) leg 1, (67) lateral view of genital segment; *Euchaeta similis* female (68) lateral view of genital segment, (69) leg 1; *Onchocalanus magnus* female (70) lateral view of genital segment, (71) leg 5; *Onchocalanus wolfendeni* female (72) leg 5, (73) leg 1. Scale mark represents: 1·0 mm on Figs 65, 67–8, 70; 0·1 mm on the rest.

This species is widely distributed in the Pacific, Indian, and Atlantic Oceans, where it has been taken at bathypelagic depths. It has been caught at the surface in Arctic and Antarctic localities (Vervoort 1957). Recent records from deep hauls are: Grice and Hulsemann (1967), Indian Ocean; Grice and Hulsemann (1965), North Atlantic; Johnson (1963), Polar Basin north of Alaska.

Euchaeta antarctica Giesbrecht, 1902 (Figs 64–67)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 448, 2 ♀♀ 9·5 mm; A 449, 1 ♀ 9·2 mm; A 454, 1 ♀ 9·7 mm; A 459, 1 ♀ 9·2 mm; A 461, 1 ♀ 9·4 mm with spermatophore; A 466, 5 ♀♀ 9·0, 9·2, 9·5, 9·3, 9·6 mm, 1 ♂ 7·1 mm.

T.A.E. Sta. 1, 4 ♀♀ 9·4, 9·6, 9·4, 9·6 mm, 1 ♂ 7·3 mm; 86, 5 ♀♀ 9·0, 8·8, 8·9, 9·2, 9·4 mm, 1 ♂ 7·8 mm; 88, 1 ♀ 8·6 mm; 89, 7 ♀♀ 9·1–9·2 mm, 5 ♂♂ 6·8, 7·2, 7·4, 7·5, 7·mm; 90, 1 ♀ 8·2 mm; 92, 5 ♀♀ 9·6, 9·3, 10·4, 9·9, 9·4 mm, 2 ♂♂ 7·5 mm; 97, 2 ♀♀ 9·3, 9·4 mm, 2 ♂♂ 7·4, 7·3 mm.

Discussion

Greatest numbers of male and female *E. antarctica* were found near the Ice Shelf.

Female genital segments' shape, male leg 5, and size distinguish this copepod from all others. Specimens were generally larger than those recorded by Vervoort (1957); one very large female (10·4 mm) was recorded from just north of Ross Island.

This species is present in deep water south of the Antarctic Convergence, although it is occasionally swept north in the Antarctic Intermediate Current (Vervoort 1957). In Antarctic waters it is a characteristic inhabitant of the Deep Warm Water (Vervoort 1965).

Euchaeta similis Wolfenden, 1908 (Figs 68, 69)

Synonymy: *See* Vervoort (1957)

Material Examined

T.A.E. Sta. 92, 1 ♀ 10·2 mm; 97, 1 ♀ 10·0 mm.

Discussion

Two female specimens were captured outside McMurdo Sound north-east of Ross Island. This species is characteristic of the Southern Ocean, especially the Deep Warm Current (Vervoort 1965).

Female genital segment shape and total size identify this copepod with certainty.

Onchocalanus magnus (Wolfenden, 1906) (Figs 70, 71)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 453, 1 ♀ 8·75 mm.

Discussion

Onchocalanus magnus was found only at the most seaward eastern station. This specimen agrees with Vervoort's (1950) description of *O. magnus*, as it has no crest, has the genital segment swollen anteriorly, a backward directing flap on the genital tubercle, and triangular pointed postero-lateral thoracic margins (Fig. 70).

Vervoort (1965) describes *O. magnus* as an Antarctic inhabitant of the Deep Warm Current, but records from as far north as 12°11′S, 64°11′E in the Indian Ocean in hauls from 225–1,930 m (Grice and Hulsemann 1967) indicate a wider distribution.

Onchocalanus wolfendeni Vervoort, 1950 (Figs 72, 73)

Synonymy: *See* Vervoort (1951)

Material Examined

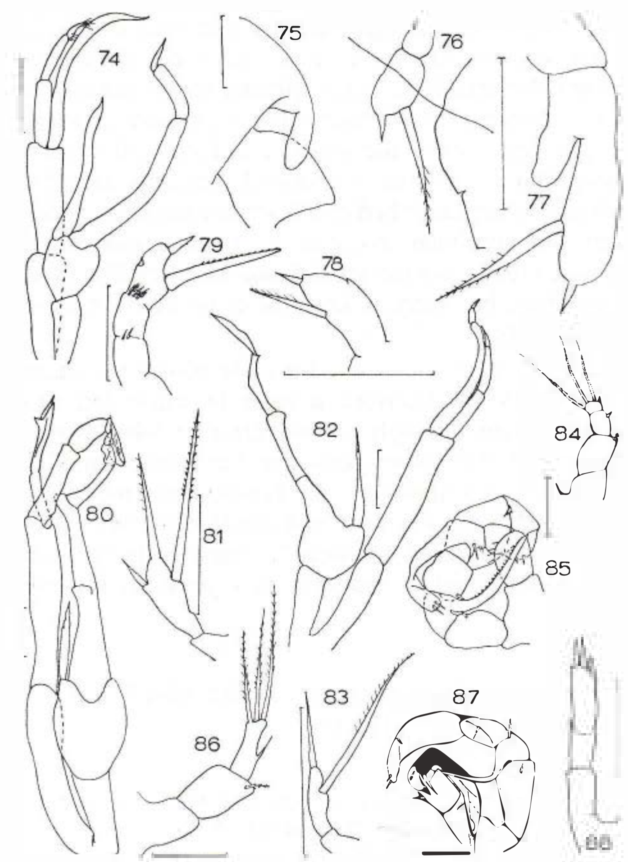
NZOI Sta. A 453, 1 ♀ 6·2 mm; A 462, stage V copepodite 5·0 mm.

Discussion

Onchocalanus wolfendeni was caught only at the two most seaward stations.

Vervoort (1950) erected this species for an Onchocalanid which is related closely to *O. magnus* and *O. trigoniceps*. This specimen undoubtedly belongs to this species, as it has no crest, has a short terminal segment on leg 5 (Fig. 72), a slightly swollen genital segment, rounded postero-lateral thoracic borders, and an increased number of spines on the posterior surface of leg 1 (Fig. 73).

This species is a characteristic inhabitant of the Deep Warm Current (Vervoort 1965).



Figs 74–88: *Racovitzanus antarcticus* male (74) leg 5, (75) anterior head; female (76, 77) leg 5; *Scolecithricella glacialis* female (78) leg 5; *Scolecithricella dentipes* (79) female leg 5, (80) male leg 5; *Scaphocalanus brevicornis* (81) female leg 5 (82) male leg 5; *Scaphocalanus subbrevicornis* (83) female leg 5; *Metridia curticauda* (84) female leg 5, (85) male leg 5; *Metridia gerlachei* (86) female leg 5, (87) male leg 5; *Pleuromamma gracilis* (88) female leg 5. Scale mark represents 0·1 mm.

Racovitzanus antarcticus Giesbrecht, 1902 (Figs 74–77)

Synonymy: *See* Vervoort (1957)

1957. *Racovitzanus erraticus:* Vervoort, pp. 99–101, figs 85–7 (male).

not *R. antarcticus:* Vervoort, 1957, pp. 97–9, figs 81–4 (male).

1960. *R. antarcticus:* Tanaka, pp. 41–2, pl. 17, figs 1–7.

Material Examined

NZOI Sta. A 453, 1 ♀ 2·4 mm; A 454, 1 ♂ 1·7 mm; A 455, 1 ♀ 2·2 mm; A 462, 1 ♂ 2·0 mm; A 463, 1 ♀.

Discussion

No specimens of *R. antarcticus* were found inside the 500 m isobath.

Both types of female leg 5 (Figs 76, 77) were recorded in the Ross Sea. In all other respects the specimens agreed with Giesbrecht's (1902) description, especially the spination on the posterior surface of legs 2 and 3.

Because of the swimming leg spinulation pattern, I suggest that Vervoort (1957) has assigned male specimens incorrectly — one to *R. antarcticus*, the other to a new species, *R. erraticus*. In the Ross Sea two male specimens of *Racovitzanus* were captured which agree with *R. erraticus* Vervoort, 1957, but which are in fact males of *R. antarcticus*. A new name must therefore be given to Vervoort's (1957) male *R. antarcticus* which appears to differ from all other species of the genus by the large number of small spinules on leg 2 and 3 third exopod segments, also in having a leg 1 external spine in the first exopod segment. Tanaka (1961) also found the swimming legs of male and female *R. levis* to be almost identical.

Racovitzanus antarcticus is a common epiplanktonic Antarctic species occasionally found north of the Antarctic Convergence (Vervoort 1957). Grice and Hulsemann (1965) also found it in the north-east Atlantic between 200–500 m.

Scolecithricella dentipes Vervoort, 1951 (Figs 79,80)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 452, 1 ♀ 2·75 mm; A 455, 1 ♂ 2·7 mm; A 462, 1 ♀ 2·5 mm.

Discussion

Scolecithricella dentipes was seaward of the 500 m isobath. The Ross Sea specimens agree quite well with Vervoort's (1951, 1957) descriptions. Small differences occur in the posterior surface spination of the swimming legs, and the lamellae which Vervoort (1957) mentions on the male left leg 5 third exopod segment but does not figure was very obvious, but the terminal spine was not present on the Ross Sea male specimen. The left leg 5 endopod has a distally expanded first segment which almost hides the very small final segment.

Vervoort (1965) considers this species an Antarctic inhabitant of the Warm Deep Current,but Grice and Hulsemann's (1967) record from 1,000–2,000 m in the Indian Ocean at 35°09′S, 69°59′E may indicate that it is more widely spread at depth.

Scolecithricella glacialis (Giesbrecht, 1902) (Fig. 78)

Synonymy: *See* Vervoort (1957)

1960. *Scolecithricella glacialis:* Tanaka, pp. 40–1, pl. 16, figs 1–8.

1964. *S. glacialis:* Tanaka, p. 8.

Material Examined

NZOI Sta. A 453, 1 ♀ 1·3 mm.

Discussion

Scolecithricella glacialis was caught only at the easternmost station. The present single specimen agrees with Giesbrecht's original description. Vervoort (1951) discussed it with respect to the closely related *S. minor*.

This species is characteristic of Antarctic surface water, and in areas north of the Antarctic Convergence it usually occurs in intermediate bodies of water (Vervoort 1957).

Scaphocalanus brevicornis (Sars, 1900) (Figs. 81, 82)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 454, 1 ♀ 2·5 mm, 1 ♂ 2·75 mm.

Discussion

Scaphocalanus brevicornis was caught only once at one of the seaward stations. These specimens agree with Vervoort's (1957) drawings and measurements.

This species occurs in deep water in all oceans (Vervoort 1965). Grice and Hulsemann (1965, 1967) recently recorded it at depth in the north-east Atlantic and Indian Oceans respectively, and Johnson (1963) found it in the Polar Basin north of Alaska.

Scaphocalanus subbrevicornis (Wolfenden, 1911) (Fig. 83)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 452, 1 ♀ 1·6 mm; A 462, 1 ♀ 1·6 mm, 1 stage V ♂.

Discussion

Scaphocalanus subbrevicornis was caught only at two seaward stations. The two specimens agreed with Vervoort's (1951) description of the female.

Vervoort (1965) describes this species as Antarctic, living in the Warm Deep Water, although Grice and Hulsemann's (1965, 1967) records from deep hauls from the north-east Atlantic and Indian Oceans indicate it is a widespread bathypelagic species.

Metridia curticauda Giesbrecht, 1889 (Figs 84, 85)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 452, 3 ♂ copepodites; A 453, 1 ♀ 2·4 mm; A 454, 1 ♂ 2·1 mm; A 455, 1 ♀ 2·4 mm; A 462, 2 ♀♀ 2·5 mm; A 463, 1 ♂ 2·0 mm.

Discussion

Metridia curticauda was caught at all stations seaward of the 500 m isobath.

Specimens from the Ross Sea almost agree with Vervoort's (1951) description. Female leg 5 bears small external spines on all three segments, whereas Vervoort (1951) does not figure the terminal segment spine and Giesbrecht does not figure the penultimate segment spine. Male leg 5 also has more spines on various segments than Vervoort's (1951) figures, but the Ross Sea specimens agree with those figured by Tanaka (1963) from deep water off the Izu region, Japan. The present females were of the smaller size mentioned by Vervoort (1957).

This species seems to inhabit both the Deep Warm Water and Antarctic Bottom Water (Vervoort 1965), hence its wide distribution.

Metridia gerlachei Giesbrecht, 1902 (Figs 86, 87)

Synonymy: *See* Vervoort (1957)

1960. *Metridia gerlachei:* Tanaka, pp. 49–51, pl. 22, figs 1·8.
1964. *M. gerlachei:* Tanaka, p. 9.

MATERIAL EXAMINED

NZOI Sta. A 448, many ♀♀ 3·65–4·3 mm, some copepodites A 449, 10 ♀♀ 3·9 mm, 3 ♂♂ 2·35, 2·45, 2 copedodites; A 449a, 6 ♀♀, 1 copepodite; A 451, some copepodites; A 452, 36 ♀♀ 3·7–4·2 mm, few ♂♂ 2·7 mm, some copepodites; A 453, many ♀♀; A 454, many ♀♀, 1 ♂; A 455, 12 ♀♀, 1 ♂, many copepodites; A 456, 1 ♀, 1 copepodite; A 458, few copepodites; A 459, 17 ♀♀, few copepodites; A 460, 8 ♀♀, 1 ♂; A 461, 2 ♀♀, 1 ♂; A 462, some ♀♀, some copepodites; A 463, some ♀♀, some copepodites, 1 ♂; A 466, many ♀♀, 4 ♂♂, some copepodites; A 467, 9 ♀♀.

T.A.E. Sta. 1, many ♀♀; 86, many ♀♀; 88, many ♀♀; 89, many ♀♀; 90, many ♀♀; 91, many ♀♀, few ♂♂; 92, many ♀♀, few ♂♂; 97, many ♀♀.

DISCUSSION

Metridia gerlachei was captured in greatest numbers seaward of the 500 m isobath and near the ice shelf. Specimens were always plentiful and agreed with Giesbrecht's (1902) description. They were generally larger than those recorded by Vervoort (1957).

Vervoort (1965) summarises what is known of their distribution and biology: largest number of individuals both during day and night occur between 250–100 m. They are abundant in the West Wind Drift and in the Weddell Sea. Spawning appears to take place at the end of the southern summer, but the number of generations is unknown. There is some suggestion that the bathymetric and horizontal distribution in higher latitudes is governed by the – 1°C isotherm.

Pleuromamma gracilis (Claus, 1893) (Fig. 88)

MATERIAL EXAMINED

NZOI Sta. A 459, 1 ♀ 1·8 mm, forma *maxima*.

DISCUSSION

The occurrence of this one battered specimen is anomalous, although Farran (1929) recorded it as far south as 52°S.

Lucicutia macrocera Sars, 1920 (Fig. 89)

Synonymy: *See* Hulsemann (1966)

MATERIAL EXAMINED

NZOI Sta. A 453, 1 ♂ 3·8 mm.

DISCUSSION

Lucicutia macrocera was found only at the easternmost seaward station. The only specimen, a male, agreed with Hulsemann's (1966) diagnosis.

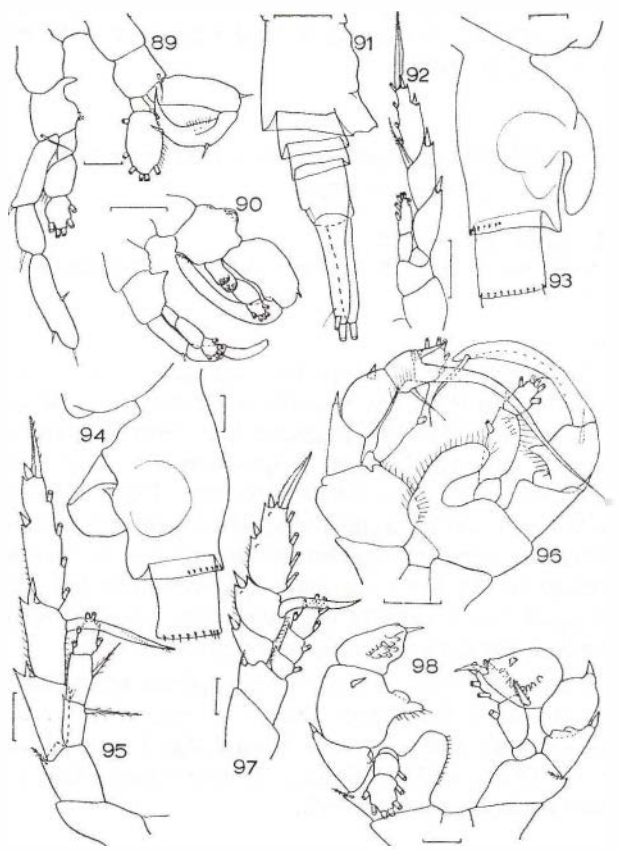
This species occurs occasionally in deep hauls in the North Atlantic, Western Pacific, and Indian Ocean, but is comparatively abundant in Antarctic waters (Vervoort 1957; Hulsemann 1966).

Lucicutia ovalis (Giesbrecht, 1889) (Figs 90–92)

Synonymy: *See* Hulsemann (1966)

MATERIAL EXAMINED

NZOI Sta. A 499a, 1 ♂ 1·4 mm; A 453, 2 ♀♀ 1·5, 1·55 mm,



FIGS 89–98: *Lucicutia macrocera* (89) male leg 5; *Lucicutia ovalis* male (90) leg 5; female (91) lateral view of abdomen, (92) leg 5; *Heterorhabdus austrinus* female (93, 94) lateral views of genital segment, (95) leg 5; male (96) leg 5; *Heterorhabdus farrani* (97) female leg 5, (98) male leg 5. Scale mark represents 0·1 mm.

2 ♂♂ 1·8, 1·85 mm; A 455, 1 ♂ 1·4 mm; A 462, 3 ♀♀ 1·5, 1·4 mm, 1 ♂ 1·3 mm, few copepodites.

Discussion

All records of *Lucicutia ovalis* are outside the 500 m isobath except that from Sta. A 449. These specimens agree with Hulsemann's (1966) diagnosis.

L. ovalis moves between Deep Warm and Antarctic Bottom Water with no apparent preference for either (Vervoort 1965), which explains its wide distribution (Hulsemann 1966).

Heterorhabdus austrinus Giesbrecht, 1902 (Figs 93–96)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 452, 1 ♀♀ 3.55 mm, 1 ♂ 3·1 mm; A 453, 2 ♀♀ 3·6, 3·7 mm, 2 ♂♂ 3·2, 2·9 mm; A 455, 1 ♀ 3·8 mm.

Discussion

Heterorhabdus austrinus was captured outside the 500 m isobath but not at the north-westerly station. The female specimens agree in every way with the drawings of Giesbrecht (1902). There is evidence in some specimens that the shape of the genital segment is formed by the closure of a flap which is found pointing ventrally in some specimens (Fig. 94). Male specimens agree with Farran's (1929) and Vervoort's figures (1957). There is considerable variation in length of the left leg 5 terminal spine as noted by Vervoort (1957).

The relationship of this species to all others in *Heterorhabdus*, which have an elongate median seta on the maxilliped first joint, is confused. Nine such species have been described: *H. norvegicus* (Boeck, 1872), *H. abyssalis* (Giesbrecht, 1892), *H. spinifrons* (Claus, 1863), *H. papilliger* (Claus, 1863), *H. clausi* (Giesbrecht, 1889), *H. austrinus* Giesbrecht, 1902, *H. pustulifer* Farran, 1929, *H. tanneri* Giesbrecht, 1895, *H. pacificus* Brodsky, 1950. Of these *H. spinifrons, H. papilliger, H. pustulifer,* and *H. clausi* are quite distinct. All the others, taking into account variation in the Ross Sea specimens, appear to be similar enough to belong to one species. Grice and Hulsemann (1967) record *H. norvegicus* from deep water of the Indian Ocean. As *H. austrinus* inhabits the Deep Warm Current and is probably widespread outside Antarctic waters, it seems likely that *H. norvegicus, H. abyssalis*, and *H. austrinus* (large and small forms) are the one species which probably also includes *H. pacificus* and *H. tanneri.* Until specimens from various regions are compared it is not possible to test this hypothesis.

This species commonly occurs in Antarctic waters, usually below 100 m with a distinct preponderance between 500 and 1,000 m. It is distributed round the whole continent and is also taken in Antarctic Intermediate Water north of the Antarctic Convergence (Vervoort 1957).

Heterorhabdus farrani Brady, 1918 (Figs 97–100)

Synonymy: *See* Vervoort (1957)

1960. *Heterorhabdus farrani:* Tanaka, pp. 52–4, pl. 23, figs 1–6.

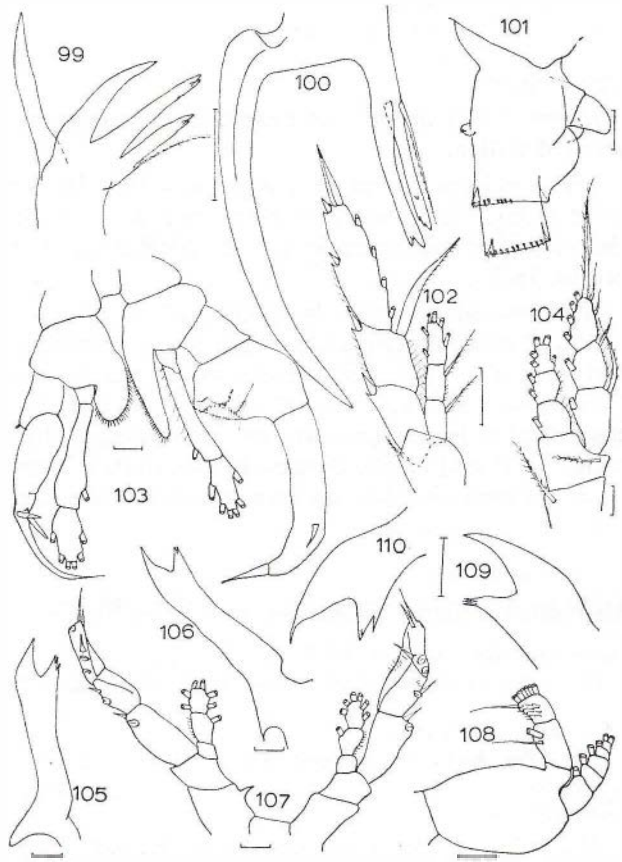
Material Examined

NZOI Sta. A 453, 1 ♀ 3·8 mm, 1 ♂ 3·6 mm; A 462, 1 stage V ♀ copepodite.

Discussion

Heterorhabdus farrani was captured at the two deepest stations. Ross Sea specimens agree very well with Vervoort's (1951, 1957) descriptions, although I have given a little more detail of the mandibular plates. *Heterorhabdus farrani* appears to be very like *H. robustus* Farran, 1908, but Sars's (1925) drawings show *H. robustus* without the prominent pegged spine on the inner proximal surface of the left leg 5 third exopod segment.

This species is characteristic of the southern oceans and inhabits the Deep Warm Current (Vervoort 1965)



Figs 99–110: *Heterorhabdus farrani* female (99) right mandible, (100) left mandible; *Heterorhabdus pustulifer* female (101) lateral view of genital segment, (102) leg 5; *Heterostylites major* male (103) leg 5; *Haloptilus ocellatus* male (104) leg 1, (105) left mandible, (106) right mandible, (107) leg 5, (108) mandible palp; female (109) left mandible, (110) right mandible. Scale mark represents 0·1 mm.

but also occurs north of the Antarctic Convergence in small numbers (Vervoort 1957).

Heterorhabdus pustulifer Farran, 1929 (Figs 101, 102)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 453, 1 ♀ 3·2 mm.

Discussion

Heterorhabdus pustulifer was found at the easternmost seaward station. Vervoort (1957) points out that this species, apart from the dorsal lump on the genital segment, is almost indistinguishable from *H. austrinus*.

The species has been recorded only from the Antarctic (Vervoort 1957).

Heterostylites major (F. Dahl, 1894) (Fig. 103)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 453, 1 ♂ 4·5 mm.

Discussion

Heterostylites major was caught at the easternmost seaward station.

This specimen agrees with those described by Vervoort (1951, 1957), which he points out may well be a deep-water or cold-water form of *H. longicornis* (Giesbrecht, 1889).

Heteorostylites major is distributed in Antarctic waters at moderate depths, although it may come to the surface at night. It is also found north of the Antarctic Convergence and at scattered deep-water localities in the Atlantic, Indian (new record in Grice and Hulsemann 1967) and Pacific Oceans. In the Atlantic it penetrates far north, but has not been recorded in the Arctic proper.

Haloptilus ocellatus Wolfenden, 1905 (Figs 104–19)

Synonymy: *See* Vervoort (1957)

1960. *Haloptilus ocellatus:* Tanaka, p. 54, pl. 24, figs 1–5.

Material Examined

NZOI Sta. A 453, 1 ♂ 4·1 mm; A 462, 1 ♀ 8·3 mm.

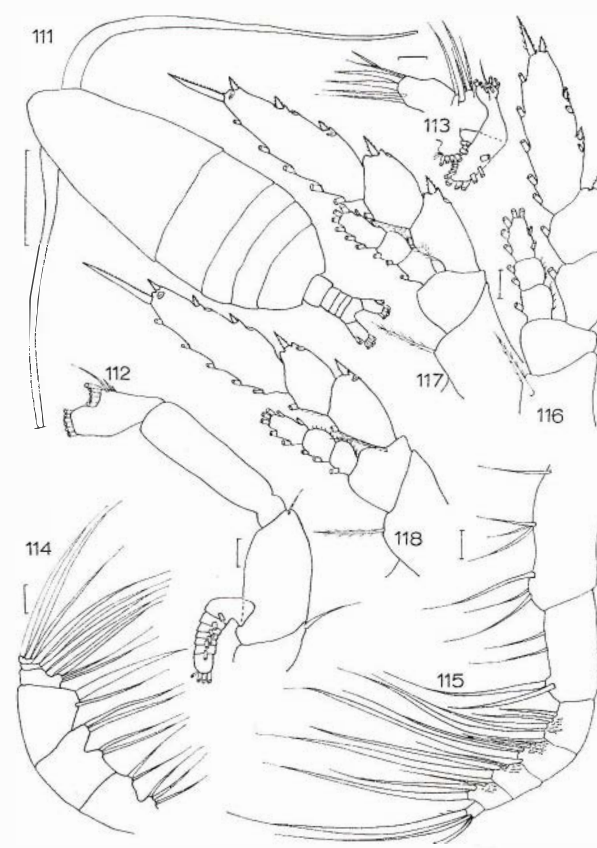
Discussion

Haloptilus ocellatus was caught at the two deepest stations. The pointed head, large size, and patch of black pigment on the dorsal surface distinguishes the female of this species from all others. The large male *Haloptilus* is very like *H. oxycephalus* (Vervoort, 1957).

Male: 4·1 mm. Head rounded, abdomen 5-segmented, about 1/5 of total length (Fig. 111). First thoracic segment separate, thoracic segments 4 and 5 fused. Right antenna 1, 25-segmented, reaches anal segment. Left antenna 1 incomplete, 17 segments remaining (Fig. 111). Almost all segments of antenna 1 bear, as well as ordinary plumose setae, sensory appendages which are especially long on proximal segments (Fig. 119). Antenna 2 (Fig. 112) with small 7-segmented exopod attached near base basipod 2. This limb not quite as slender as in *H. oxycephalus* (Vervoort, 1957).

Mandible with strong anterior tooth and 2–3 weaker posterior teeth arranged as in Figs. 105, 106. Left mandible of *H. oxycephalus* differs in having a shorter anterior tooth. Palp (Fig. 108) with 2 setae on endopod segment 1, 7 setae and patch of hairs on second endopod segment. Maxilla 1 very like that of *H. oxycephalus* (personal observation) and not as in Vervoort's (1957) Fig. 129. Only observable difference was in number of setae on terminal part of endopod: *H. oxycephalus* has 3 large and 2 small setae, whereas *H. ocellatus* bears 3 small and 1 large setae (Fig. 113). Maxilla 2 and maxilliped (Fig. 114) very like that of *H. oxycephalus*.

Legs 1–4 (Figs 104, 116–8) like those of *H. oxycephalus*. "Glandular pores" (also present in *H. oxycephalus*) occur on swimming legs. Extra pore on a



Figs 111–118: *Haloptilus ocellatus* male (111) dorsal view, (112) antenna 2, (113) maxilla 1, (114) maxilla 2, (115) maxilliped, (116) leg 2, (117) leg 3, (118) leg 4. Scale mark represents: 1·0 mm on Fig. 111; 0·1 mm on the rest.

second exopod segment of leg 3 and a third exopod segment of leg 4. Terminal exopod spine in *H. ocellatus* proportionally shorter with respect to third exopod segment than in *H. oxycephalus*. All exopod external spines bordered with minute teeth. Leg 5 similar to that of *H. oxycephalus* with small differences. Exopod segments 2 and 3 considered together have an extra "glandular pore" in *H. ocellatus* (Fig. 107) compared with *H. oxycephalus* (Fig. 124).

The mandibular plate of the female *H. ocellatus* (Figs 109, 110) is very like that in the male and from this and the general similarities of the swimming legs I attribute this male to *H. ocellatus*.

This species inhabits the Deep Warm Current but is characteristic of the Southern Ocean (Vervoort 1965).

Haloptilus oxycephalus (Giesbrecht, 1889) (Figs. 120–4)

Synonymy: *See* Vervoort (1957)

Material Examined

NZOI Sta. A 453, 1 ♀ 3·1 mm, 1 ♂ 2·85 mm; A 463, 1 ♀ copepodite 2·7 mm.

Discussion

Haloptilus oxycephalus was found at the most seaward eastern station, and a copepodite was caught at a westerly seaward station. The discovery of what appears to be a male *H. ocellatus* which was very like the *H. oxycephalus* male means that *H. oxycephalus* has to be examined more closely. The tips of the female and male mandibular plates are figured (Figs 120–3). Male leg 5 is as Vervoort (1957) figures it, but I have included details of "glandular pore" position which is at the base of every exopod spine. Vervoort's (1957) figure of maxilla 1 appears not to include all the setae on the endopod and exopod. The number is almost the same as for *H. ocellatus* (Fig. 113). The shape of the female head distinguishes this species.

The species is not confined to the Antarctic, although it is regularly found in Antarctic and subantarctic plankton. At tropical and temperate localities it is a deep-water form (Vervoort 1957).

Candacia maxima Vervoort, 1957 (Fig. 125)

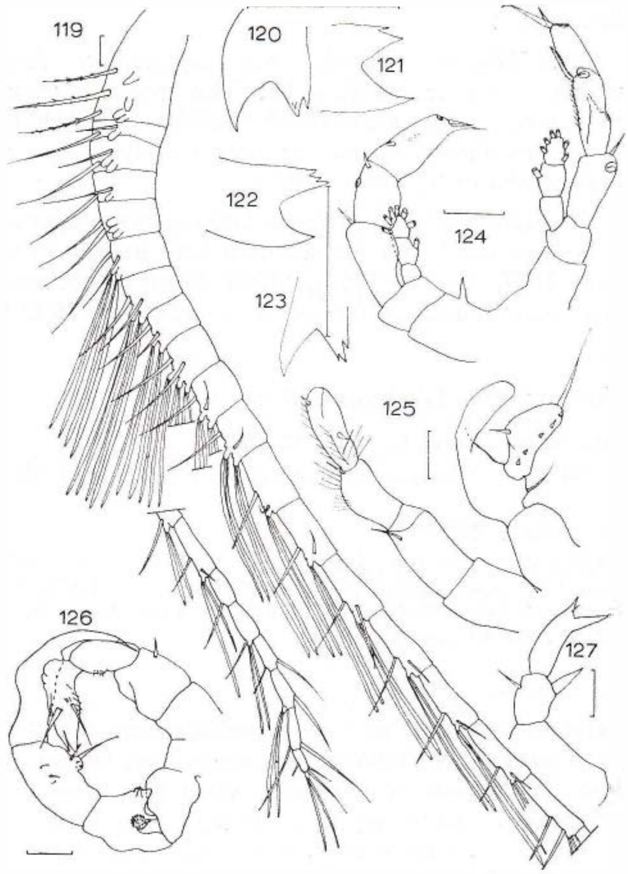
Synonymy: *See* Grice (1963)

Material Examined

NZOI Sta. A 453, 1 ♂ 3·6 mm.

Discussion

Candacia maxima was found only at the easternmost seaward station. From Grice's key (1963) this male specimen was identified as *C. maxima*, as the left posterior thoracic border is pointed, the second abdominal segment asymmetrical, and there is no process on the



Figs 119–127: *Haloptilus ocellatus* male (119) right antenna 1; *Haloptilus oxycephalus* female (120) right mandible, (121) left mandible; male (122) left mandible, (123) right mandible, (124) leg 5; *Candacia maxima* (125) male leg 5; *Paralabidocera antarctica* (126) male leg 5, (127) female leg 5. Scale mark represents 0·1 mm.

genital segment. The fifth legs are essentially like those figured by Vervoort (1957), although the third right leg segment bears two extra small spines and the third and fourth left leg segments bear patches of long hairs.

From the occurrence of a large number of specimens outside the Antarctic Convergence Vervoort (1957) deduced that the species is a subantarctic form occasionally transported south of the Antarctic Convergence in intermediate water masses.

Paralabidocera antarctica (I. C. Thompson, 1898) (Figs 126, 127)

Synonymy: *See* Vervoort (1957)

1964. *Paralabidocera antarctica:* Tanaka, pp. 10–1, pls 3, 4.

Material Examined

NZOI Sta. A 460, 2 ♀♀ 2·0, 2·1 mm; A 461, 1 ♀ 1·9 mm, 1 ♂ 1·5 mm.

T.A.E. Sta. 92, 1 ♀ 2·05 mm.

Discussion

Paralabidocera antarctica was captured at three stations in the western Ross Sea. This species is recognised as being the same as the *Paralabidocera* figured by Wolfenden (1908) which has been synonymised with *P. antarctica* by Vervoort (1957).

The capture of this species in large numbers appears to be associated with the southern land masses (Vervoort 1957, Tanaka 1964), although stray specimens have been found as far north as 42°06′S, 175°13′E

Oithona frigida Giesbrecht, 1902

Antarctic synonymy: *See* Vervoort (1957)

1960. *Oithona frigida:* Tanaka, pp. 58–9, pl. 25, figs 8–10.

Material Examined

NZOI Sta. A 449, 1 ♀; A 451, 1 ♀; A 452, some ♀♀; A 453, some ♀♀; A 455, some ♀♀; A 457, few ♀♀; A 459, few ♀♀; A 462, many ♀♀; A 463, few ♀♀; A 466, few ♀♀.

T.A.E. Sta. 92, few ♀♀.

Discussion

Greatest numbers of *Oithona frigida* were found at the more seaward stations. This species was recognised from the formula of external exopod spines on legs 1–4 — leg 1: 1,1,3; leg 2: 1,1,3; leg 3: 1,0,1; leg 4: 0,0,1. This does not agree with Rosendorn (1917) who states that leg 2 has two spines on the third exopod segment, whereas Giesbrecht's (1902) drawings agree entirely with the present specimens. No males as described by Rosendorn (1917) were discovered.

Oithona frigida is considered to be a surface-living Antarctic species (Vervoort 1965).

Oithona similis Claus, 1866

Antarctic synonymy: *See* Vervoort (1957)

1960. *Oithona similis:* Tanaka, pp. 62–4, pl. 26, figs 1–9.

1964. *O. similis:* Tanaka, pp. 13–4.

Material Examined

NZOI Sta. A 448, few ♀♀; A 449, some ♀♀; A 449a, some ♀♀; A 450, few ♀♀; A 451, 1 ♀; A 452, few ♀♀; A 453, few ♀♀; A 454, many ♀♀; A 455, few ♀♀; A 456, few ♀♀; A 457, few ♀♀; A 458, few ♀♀; A 459, many ♀♀; A 460, many ♀♀, many ♂♂; A 461, few ♀♀; A 462, few ♀♀; A 463, few ♀♀; A 466, few ♀♀.

T.A.E. Sta. 1, many ♀♀; 81, many ♀♀; 86, many ♀♀; 88, many ♀♀; 89, many ♀♀; 90, many ♀♀; 91, many ♀♀, few ♂♂; 92, many ♀♀, few ♂♂; 97, many ♀♀, few ♂♂.

Discussion

Oithona similis was caught at nearly all stations, usually quite abundantly. This species was identified from Rosendorn's (1917) key by the following characteristics: flat head with rostrum not visible from the dorsal surface; formula of external exopod spines — leg 1: 1,1,2; leg 2: 1,0,1; leg 3: 1,0,1; leg 4: 0,0,1. The present specimens agree with Tanaka's (1960) figures. Vervoort (1957) found this species to be not as plentiful as *O. frigida*, whereas in the Ross Sea the opposite appears to be true.

This species seems to have an almost world-wide distribution, but prefers the Warm Deep Water in the Antarctic. North of the Antarctic Convergence it occurs in superficial waters in slightly increased numbers (Vervoort 1957).

Oncaea conifera Giesbrecht, 1891

Antarctic synonymy: *See* Vervoort (1957)

1960. *Oncaea conifera:* Tanaka, pp. 66–7, pl. 29, figs 1–8.

Material Examined

NZOI Sta. A 452, few ♀♀, few ♂♂; A 453, few ♀♀; A 454, few ♀♀; A 462, few ♀♀, few ♂♂.

Discussion

Oncaea conifera was found at the seaward stations. These specimens agree with Giesbrecht's (1902) drawings. The larger size (1·2 mm), the dorsal projection of the second thoracic segment, and the distal conical process on the fourth leg endopod distinguish this species from *O. curvata.*

O. conifera has a world-wide distribution from the Arctic to Antarctic Oceans (Vervoort 1951).

Oncaea curvata Giesbrecht, 1902

Antarctic synonymy: *See* Vervoort (1957)

1960. *Oncaea curvata:* Tanaka, pp. 68–9, pl. 30, figs 1–11; pl. 31, figs 1–3.

1964. *O. curvata:* Tanaka, p. 14.

Material Examined

NZOI Sta. A 449, few ♀♀; A 454, many ♀♀; A 459, many ♀♀; A 462, few ♀♀, few ♂♂; A 463, few ♀♀; A 466, few ♀♀.

T.A.E. Sta. 1, some ♀♀; 86, some ♀♀; 90, some ♀♀; 91, few ♀♀; 92, some ♀♀; 97, many ♀♀

Discussion

Oncaea curvata was found at a number of stations and was abundant at three stations from McMurdo Sound to the open sea. The specimens agree with Giesbrecht's (1902) description. *O. curvata* may be distinguished from the other *Oncaea* species in this collection by its small size (0·8 mm) and lack of terminal conical process on leg 4 endopods.

O. curvata is an Antarctic form occurring in the Deep Warm Current and Antarctic Bottom Water. Only occasionally is it taken north of the Antarctic Convergence (Vervoort 1957).

RELATIONSHIPS OF THE ROSS SEA FAUNA

All copepod records in or near the Ross Sea have been tabulated (Table 1). Even though Wolfenden (1908) does not usually state where his specimens come from, because most of his samples came from "Winter Quarters" in the Ross Sea, most of his records have been accepted. Three species have been omitted: *Calanus simillimus* which must have been found north of 70°S, *Calanus tonsus* which he states was caught at 56°31′S, 156°19′30″E, and *Clausocalanus arcuicornis* which, although recorded from the Ross Sea, is obviously a stray from temperate regions and could possibly be mistaken for *C. laticeps* Farran, 1929.

The present study adds 18 species to those known from the Ross Sea, although 11 of these were known from very close by (Farran 1929). Farran also recorded 22 other species near the Ross Sea which were not found in the present samples (Table 1).

A few species were caught at almost every station: *Calanoides acutus, Ctenocalanus vanus, Metridia gerlachei, Oithona similis*, and to a lesser extent *Calanus propinquus*. These species make up the bulk of the Ross Sea planktonic copepods and are, in the summer at least, surface-dwelling Antarctic species which extend into the Ross Sea.

The bulk of the remaining species caught in the Ross Sea are associated with Antarctic Deep (Circumpolar) Water. Some of these species appear to be limited to Antarctic waters, while a number (*Microcalanus pygmaeus, Spinocalanus abyssalis, S. magnus, Gaidius tenuispinus, Scaphocalanus brevicornis, S. subbrevicornis, Metridia curticauda, Lucicutia ovalis, Heterostylites major*) are widespread at bathypelagic depths, several being recorded from Arctic waters.

Notable amongst the records are *Nannocalanus minor* and *Pleuromamma gracilis* which are strays from much further north. These examples are perhaps not surprising if one considers Farran's (1929) records of *Oncaea media, Corycaeus inuncus*, and *Corycella gracilis* in the Ross Sea and *Corycaeus flaccus, C. furcifer*, and *Ratania atlantica* nearby. Either southern ocean samples have been contaminated by samples from temperate regions, which is not the case of the 1958–59 samples, or stray specimens of temperate species are occasionally swept into Antarctic seas.

Conspicuously absent from the 1958–59 samples are *Stephus longipes* and *S. antarcticum*. Farran (1929) records *S. longipes* as usually being found under the ice and, since most of the National Antarctic Expedition's samples were taken through the ice at the "Winter Quarters", this is also the likely habitat of *S. antarcticum.*

Although Vervoort (1965) describes *Drepanopus pectinatus* as the only Antarctic littoral copepod, it has yet to be recorded in the Ross Sea. As he uses the adjective "littoral" to describe species occurring in neritic waters above the continental shelf, there are other species that would probably fall into this group: *Stephus longipes, S. antarcticum, Paralabidocera antarctica*, and *Aetideopsis antarctica.*

Examination of the present material extends our knowledge of Antarctic and in particular of Ross Sea copepods. It is clear that the Ross Sea copepod fauna is more or less similar to the circumpolar Antarctic fauna. Despite the general similarity between the copepod faunas in the Ross Sea and in the circum-Antarctic region, there are distinct differences between the fauna of the inner and outer Ross Sea. The outer Ross Sea (northern and north-eastern part) has many faunal elements that can be associated with Antarctic Circumpolar Water which here penetrates into areas otherwise occupied by Winter Water. NZOI Sta. A 453, which is situated in the region of strong Antarctic Circumpolar Water intrusion (Figs 2 and 4), has the greatest number of deep-water species. However, in the south-western corner of the Ross Sea these elements are conspicuously absent from the fauna. This area encompasses all the Transantarctic Expedition stations and NZOI Sta. A 448–50, A 460–1, A 466–7 (Fig. 2). It has been clearly shown (Fig. 4) that Antarctic Circumpolar Water is entirely absent from this area. This inner area, devoid of Antarctic Circumpolar Water influence, is also the only place where the possibly "neritic" species *Paralabidocera antarctica* and *Aetideopsis antarctica* were taken.

The term "neritic" refers to that part of the pelagic environment that lies above the continental shelf. The maximum depth of this region is usually 200 m. It is difficult to classify the Ross Sea as either oceanic or neritic. The shelf break occurs at 800 m and the sea itself is a deep basin with a seaward lip. The fact that the Ross Sea is a massive embayment of the Antarctic continental coastline means that it is isolated from the general circumpolar Antarctic circulation and has its own hydrological regime. Nevertheless, almost the total copepod fauna is related either to Antarctic surface water or to the Antarctic Deep (Circumpolar) water, but it is significant that the only "neritic" species caught were found in the south-western part of the Ross Sea not influenced by Antarctic Circumpolar Water.

Certain conditions appear to be necessary for an endemic neritic fauna to exist: (a) the coastal regime must be free from wholesale advection of oceanic water so that the neritic fauna can maintain its position over the continental shelf, (b) the coastal environment must be inimical to oceanic species. The influence of Antarctic Circumpolar Water is extensive enough to ensure that neither of the above conditions for the development of a neritic fauna are met in the Ross Sea, except in the extreme south-west.

TABLE 1: Copepod Records in or near the Ross Sea.

Species	Ross Sea (Farran 1929)	Sta. 271–92 (Farran 1929)	Ross Sea? (Wolfenden 1908)	Ross Sea (1958–59)
**Nannocalanus minor*				x
Calanus propinquus	x	x	x	x
Calanoides acutus	x	x	x	x
Rhincalanus gigas	x	x	x	x
Ctenocalanus vanus	x		x	x
Microcalanus pygmaeus	x			x
M. pusillus			x	
Farrania frigida		x		x
Stephus longipes	x		x	
S. antarcticum			x	
Spinocalanus abyssalis		x		x
S. magnus		x		x
S. spinosus		x		
Aetideopsis antarctica	x		x	x
A. minor		x		x
Chiridiella megadactyla				x
Gaidius intermedius		x		
G. tenuispinus		x		x
Pseudochirella notocantha		x		
Gaetanus antarcticus		x	x	
Euchirella hirsuta		x		
E. rostromagna		x		
Euchaeta antarctica	x	x	x	x
E. erebi	x			
E. farrani		x		
E. rasa		x		
E. similis	x		x	x
Onchocalanus magnus				x
O. wolfendeni			x	x
Xanthocalanus antarcticus			x	
Scolecithricella dentipes				x
S. glacialis		x		x
S. incisa	x			
S. ovata		x		
S. polaris		x		
S. robusta		x		
S. valida		x		
Scaphocalanus affinis		x		
S. brevicornis		x		x
S. subbrevicornis		x		x
Racovitzanus antarcticus	x	x		x
Amallophora altera		x		
Cephalophanes frigidus		x		
Metridia curticauda		x		x
M. gerlachei	x	x	x	x
M. lucens		x		
M. princeps			x	
**Pleuromamma gracilis*				x
Lucicutia curta		x		
L. macrocera				x
L. magna		x		
L. ovalis				x
Heterorhabdus austrinus		x		x
H. compactus		x		
H. farrani				x
H. pustulifer		x		x
H. robustus		x		
Heterostylites major		x	x	x
Haloptilus ocellatus		x	x	x
H. oxycephalus	x	x		x
Euaugaptilus laticeps		x		
Candacia falcifer		x		
C. maxima				x
Paralabidocera antarctica	x		x	x
Oithona frigida	x		x	x
O. similis	x		x	x
Oncaea conifera	x			x
O. curvata	x		x	x
**O. media*	x			
**Corycaeus flaccus*		x		
**C. furcifer*		x		
**C. inuncus*	x			
**Ratania atlantica*		x		
**Corycella gracilis*	x			

* Strays or contaminants

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CUMACEA

by

N. S. JONES

Marine Biological Station, Port Erin, Isle of Man

ABSTRACT

FIFTY specimens distributed among nine species collected by expeditions in HMNZS *Endeavour* in 1959 and 1960, the Transantarctic (New Zealand) Expedition of 1956–58, and a Stanford University team in 1958–60 are discussed. Three species are described as new—*Procampylaspis meridiana, Paralamprops rossi*, and *Makrokylindrus inscriptus*. A key is included to all the known species of Antarctic and Subantarctic Cumacea, which at present number 41. Of the species 93% are endemic.

INTRODUCTION

The cumaceans discussed in this report were collected during the cruises of HMNZS *Endeavour* in 1959 and 1960, the Transantarctic (New Zealand) Expedition of 1956–58, and by John H. Dearborn during a Stanford University biological programme, 1958–60. Full details of these expeditions may be found in Bullivant and Dearborn (1967).

Nine species of Cumacea were taken at 16 stations (Fig. 1). Three are described as new and one was too badly damaged for positive identification or description.

Previous collections of Cumacea from the Antarctic region are summarised by Lomakina (1968) who gives charts showing the known distributions of the species found by the Soviet Expedition to the Antarctic. At the time of writing 28 species, including those described here, have been recorded from the Antarctic and a further four species collected but not fully described; 12 other species have been found off the subantarctic islands. Four of the species listed in Jones (1969) are considered by Lomakina to be synonyms: *Leucon septemdentatus* Zimmer is thought to be a synonym of *L. vanhoffeni* Zimmer; *Eudorella sordida* Zimmer and *E. fallax* Zimmer, synonyms of *E. splendida* Zimmer; and *Diastylopsis dentifrons* Zimmer synonymous with *D. annulata* Zimmer.

Collections including at least one cumacean have been made by the following expeditions off the Antarctic continent or the islands of Kerguelen or South Georgia:

1. The *Challenger* Expedition 1873–76 (Sars 1887).
2. The Hamburg Museum Expedition 1882–83 (Zimmer 1902).
3. The voyage of the *Belgica* 1897–99 (Hansen 1908).
4. The German Deep-Sea *Valdivia* Expedition 1898–99 (Zimmer 1908).
5. The German Antarctic Expedition in *Gauss* 1901–04 (Zimmer 1907, 1913).
6. The Swedish Antarctic Expedition in *Antarctic* 1901–03 (Zimmer 1907, 1909).
7. The British Antarctic Expedition in *Discovery* 1901–04 (Calman 1907).
8. The British Antarctic Expedition in *Nimrod* 1907 (Calman 1918).
9. The French Antarctic Expedition in *Pourquoi Pas* 1908–10 (Calman 1917b).
10. The British Antarctic Expedition in *Terra Nova* 1910 (Calman 1917a).
11. The Australasian Antarctic Expedition in *Aurora* 1911–14 (Calman 1918).
12. The British, Australian and New Zealand Antarctic Expedition in *Discovery II* 1929–32 (Hale 1937).
13. The Japanese Antarctic Expedition in *Soya* 1957–58 (Gamô 1959).
14. The Soviet Antarctic Expeditions in *Prince Garaltra* 1956–58, 1963 (Lomakina 1968).

In the Ross Sea 10 species have now been found: *Cyclaspis gigas, Leucon antarctica, Eudorella splendida, E. gracilior, Campylaspis antarctica, Procampylaspis meridiana, Cumella australis, Paralamprops rossi, Diastylis helleri* and *Makrokylindrus inscriptus*.

STATION LIST

For full details consult Bullivant and Dearborn (1967).

NEW ZEALAND OCEANOGRAPHIC INSTITUTE COLLECTIONS 1957–61

Sta. A448, 10 Jan 1959, 77°27′S, 172°22′E, 752 m, mud, small Agassiz trawl, – 1·8°C.

Cyclaspis gigas Zimmer, 6 ♀♀ (1 ovigerous)
Leucon antarctica Zimmer, 1 ♀
Eudorella gracilior Zimmer, 1 ♀

Sta. A449, 11 Jan 1959, 77°05′S, 177°12′E, 362 m, mud, small Agassiz trawl, – 1·7°C.

Cyclaspis gigas, 1 ♀
Campylaspis antarctica Calman, 4 ♀♀

Sta. A 455, 15 Jan 1959, 74°22′S, 178°35′W, 322–340 m, stones, muddy sand, naturalist's dredge, – 1·0°C.
Campylaspis antarctica, 1 ♀

Sta. A 456, 15 Jan 1959, 74°30′S, 179°40′W, 238–201 m, stones, gritty mud, small Agassiz trawl, – 1·3°C.
Cumella australis Calman, 1 ♀

Sta. A 468, 26 Jan 1959, 76°59′S, 167°36′E, 110 m, small Agassiz trawl.
Leucon antarctica, 3 ♀ ♀
Campylaspis antarctica, 2 ♀ ♀
Procampylaspis meridiana sp. n., 1 subadult ♂, 1 juvenile
Cumella australis, 12 ♀ ♀, 5 juv.

Sta. A 469, 29 Jan 1959, 77°50′S, 166°30′E, 68 m, gritty mud, orange peel grab.
Campylaspis antarctica, 1 ♀

Sta. A 471, 6 Feb 1959, 77°37′S, 166°20′E, 165–69 m, small Agassiz trawl.
Leucon antarctica, 1 ♀
Cumella australis, 2 ♀ ♀, 1 juv.

Sta. A 537, 17 Feb 1960, 77°30′S, 165°12′E, 574–543 m, mud and gravel, Devonport dredge, – 1·8°C.
Diastylis sp., 1 ♀ (damaged)

TRANSANTARCTIC EXPEDITION COLLECTIONS 1957–58

Sta. 1, 24 Jan 1957, 77°46·3′S, 166°26′E, 583 m, mud, snapper grab.
Cumella australis, 2 ♀ ♀

Sta. 79, 5 Feb 1958, 77°51′S, 166°34′E, 122–162 m, beam trawl.
Campylaspis antarctica, 1 immature ♂

Sta. 98, 12 Feb 1958, 76°07′S, 168°10′E, 186–190 m, beam trawl.
Campylaspis antarctica, 1 ♀

Sta. 100, 23 Feb 1958, 77°38′S, 166°20′E, 108 m, beam trawl.
Campylaspis antarctica, 1 ♀, 2 imm. ♂ ♂

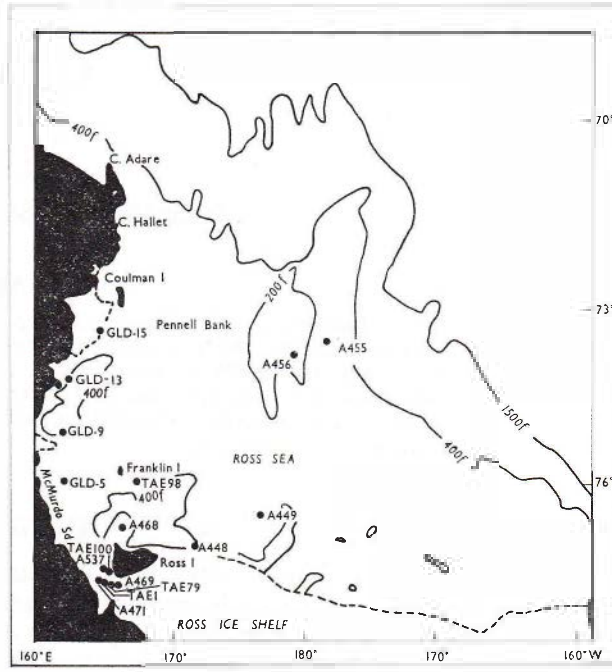

FIG. 1: Bathymetry and station positions.

STANFORD UNIVERSITY COLLECTIONS 1958

Sta. GLD-5, 27 Nov 1958, 76°11·6′S, 164°46′E, 695 m, sponge-gorgonacean complex, triangular dredge.
Paralamprops rossi, sp. n., 1 ♀

Sta. GLD-9, 29 Nov 1958, 75°15′S, 165°55′E, 808 m, ring net.
Makrokylindrus inscriptus sp. n., 1 ♀ (ovig.)

Sta. GLD-13, 30 Nov 1958, 74°39′S, 165°52′E, 165 m, sponge-coelenterate complex, 4 ft Blake trawl.
Cyclaspis gigas, 1 ♀
Campylaspis antarctica, 1 imm. ♂

Sta. GLD-15, 1 Dec 1958, 73°58·5′S, 168°29′E, 366 m, gravel and pebbles, some mud, triangular dredge.
Cyclaspis gigas, 1 ♀ (ovig.)

SYSTEMATICS

KEY TO THE SPECIES OF ANTARCTIC AND SUBANTARCTIC CUMACEA[1]

1 A free telson present 2
No free telson 20

2 Telson with 3 (exceptionally 2) or more apical spines. Males have 3 pairs of pleopods or none 3
Telson with 2 apical spines. Males have 2 pairs of pleopods 9

3 Telson with 5 apical spines .... **Lamprops (?) comata** Zimmer, 1907
Telson with not more than 3 apical spines 4

4 Antennae 1 long, at least half length of carapace. Carapace with at least 7 longitudinal carinae 5
Antennae 1 short, not more than a quarter length of carapace. Carapace with less than 7 longitudinal carinae 7

5 Telson reaching nearly to end of uropod peduncle 6
Telson much shorter than uropod peduncle .... **Paralamprops serratocostata** Sars, 1887

[1] Based on that in Lomakina (1968) with some alterations and additions.

6 Longitudinal carinae on carapace serrated .... **Paralamprops rossi** sp. n.
Longitudinal carinae not serrated .... **Paralamprops aspera** Zimmer, 1907

7 Pereopod 2 with rudimentary exopodite .... **Platysympus brachyurus** (Zimmer), 1907
Pereopod 2 with well developed exopodite 8

8 Basal segment of exopod of uropod much shorter than distal segment .... **Hemilamprops mawsoni** Hale, 1937
Basal segment of exopod of uropod little shorter than distal segment .... **Hemilamprops pellucida** Zimmer, 1908

9 Pereopods 2 and 3 widely separated. Pereonite 4 long dorsally 10
Pereopods 2 and 3 not widely separated. Pereonite 4 not elongated 4

10 Carapace with transverse slanting lines and notches on frontal area .... **Diastylopsis annulata** Zimmer, 1902
Carapace with 1 slanting line and 2 notches on eyelobe only .... **Diastylopsis diaphanes** Zimmer, 1907

11 Telson short, not longer than pleonite 6 12
Telson longer than pleonite 6 13

12 Front of carapace limited on each side by slanting line (heart-shaped when viewed from above). Uropod peduncle longer than pereonite 5 .... **Leptostylis antipa** Zimmer, 1907
Carapace without slanting lines. Uropod peduncle not longer than pereonite 5 .... **Leptostylis crassicauda** Zimmer, 1907

13 Telson not very long, proximal portion equal to or shorter than postanal portion, latter usually with numerous lateral spines 14
Telson long, proximal portion usually cylindrical and longer than postanal portion 19

14 Pereopods 3 and 4 of ♀ with rudimentary exopods. Carapace may have holds but not projections 15
Pereopods 3 and 4 of ♀ without rudimentary exopods. Carapace has projections, teeth or tubercles 17

15 Carapace smooth. Telson shorter than pleonite 5, with 2 or 3 pairs of slender lateral spines .... **Diastylis inornata** Hale, 1937
Carapace with transverse folds. Telson as long as or longer than pleonite 5, postanal part with 5–9 pairs of lateral spines 16

16 Carapace with 10 folds. Telson shorter than uropod peduncle, with 8 or 9 pairs of lateral spines .... **Diastylis anderssoni** Zimmer, 1907
Carapace with 3 folds on hind part. Telson nearly as long as uropod peduncle, with 5 or 6 lateral spines .... **Diastylis mawsoni** Hale 1937

17 Carapace with trough-shaped depressions and numerous projections .... **Diastylis horrida** Sars, 1887
Carapace without trough-shaped depressions, with large projections and small teeth or tubercles 18

18 Teeth and projections on carapace mainly in longitudinal rows, becoming smaller towards rear .... **Diastylis corniculata** Hale, 1937
Projections and teeth irregularly distributed, sometimes replaced by tubercles or bulges .... **Diastylis helleri** Zimmer, 1907

19 Pseudorostrum long, with projections along upper edge. Postanal part of telson without lateral spines .... **Makrokylindrus baceskei** Lomakina, 1968
Pseudorostrum short, without dorsal projections. Postanal part of telson with 5 pairs of lateral spines .... **Makrokylindrus inscriptus** sp. n.

20 ♂ with 2–5 pairs of pleopods. ♀ with exopods on pereopod 1 only or on pereopods 1–3 21
♂ without pleopods. ♀ with exopodites on pereopods 1 and 2 32

21 Mandibles with base widened. ♂ with 2 pairs of pleopods 22
Mandibles with base not widened. ♂ with 5 pairs of pleopods 28

22 Pseudorostrum prominent. ♀ carapace serrated along mid-dorsal line 23
Pseudorostrum reflexed. ♀ carapace without serrations 26

23 Serrations confined to front part of carapace. Frontal area not toothed 24
Serrations extend to rear of carapace. Frontal area toothed 25

24 Eyelobe small but visible. Pereopod 2 with 7 segments .... **Leucon kerguelensis** Zimmer, 1908
Eyelobe rudimentary. Pereopod 2 with 6 segments .... **Leucon sagitta** Zimmer, 1907

25 Serrations on carapace uninterrupted. Frontal area with 1 tooth on each side, also 1 tooth on each side of pseudorostral lobes and 1 on dorsal side of carapace .... **Leucon antarctica** Zimmer, 1907
Serrations on carapace with a break near hind end. Frontal area with 3 teeth on either side along lower edge .... **Leucon assimilis** Sars, 1887

26 Subrostral indentation in ♀ is complex, with a depression in upper portion and a protuberance in middle 27
Subrostral indentation in ♀ is simple, without a depression or protuberance .... **Eudorella gracilior** Zimmer, 1907

27 Protuberance in subrostral indentation with distinct teeth. Lower edge of carapace serrated anteriorly .... **Eudorella** aff. **truncatula** (Bate), 1856
Protuberance in subrostral notch and lower edge of carapace without distinct teeth .... **Eudorella splendida** Zimmer, 1907

28 Only pereopod 1 with an exopodite 29
Pereopods 1–3 with exopodites in ♀ 30

29 Carapace with 4 tubercles, 1 each side of frontal area and 1 on each lateral face of carapace .... **Cyclaspis quadrituberculata** Zimmer, 1907
Carapace with 2 tubercles on each side of front part and a dorso-lateral fold .... **Cyclaspis gigas** Zimmer, 1907

30 Last pleon somite projecting well beyond bases of uropods. Pseudorostral lobes separated in front .... **Gaussicuma vanhoffeni** Zimmer, 1907
Last pleonite not projecting much backwards. Pseudorostral lobes meeting in front 31

31 Upper part of carapace with 2 oblique serrated carinae, behind which is group of small teeth .... **Vaunthompsonia meridionalis** Sars, 1887
Carapace without serrated carinae or teeth .... **Vaunthompsonia inermis** Zimmer, 1909

32 Mandibles normal, with thick short incisor process. Dorsal side serrated or has carina 33
Mandibles massive, with fine dagger-shaped incisor process. No serrations or carina on mid-dorsal line 34

33 Pseudorostrum short and truncated. Eyelobe without teeth. Dorsal side of carapace with teeth along entire length .... **Cumella australis** Calman, 1907
Pseudorostral lobes not meeting in front of eyelobe, which has teeth. Dorsal side of carapace without teeth .... **Cumella molossa** Zimmer, 1907

34 Maxilliped 2 of unusual shape, with segment 6 placed at an angle in relation to segment 5 35
Maxilliped 2 of normal shape, segment 6 being a continuation of 5. Terminal segment of maxilliped 2 is rake-like with prominent teeth 40

35 Carapace covered with tubercles 36
Carapace traversed by folds 39

36 Tubercles on carapace form more or less clearly defined carinae .... **Campylaspis maculata** Zimmer, 1907
Tubercles on carapace irregularly scattered 37

37 Maxilliped 3 with merus extended distally like a triangle .... **Campylaspis frigida** Hansen, 1908
Maxilliped 3 with merus not extended, its width less than its length 38

38 Lateral faces of the carapace depressed. Pleon somites with sharp teeth on dorsal and lateral faces. Dactylus of pereopod 2 much longer than carpus .... **Campylaspis antarctica** Calman, 1907
Lateral faces of carapace not depressed. Pleon somites without teeth. Dactylus of pereopod 2 about equal in length to carpus .... **Campylaspis nodulosa** Sars, 1887

39 Lateral faces of carapace with 2 folds bifurcating in middle; of these 4 branches 3 are united. Dactylus of pereopod 2 considerably longer than carpus and propodus together .... **Campylaspis quadriplicata** Lomakina, 1968
Lateral faces of carapace with 2 long slanting folds not bifurcating, connected at top hind end. Dactylus of pereopod 2 only a little longer than carpus and propodus together .... **Campylaspis johnstoni** Hale, 1937

40 Carapace with 2 tubercles, each carrying a pair of teeth, on dorsal side and 2 teeth on eyelobe .... **Procampylaspis compressa** Zimmer, 1907
Carapace with smooth tubercle dorsally on each side about $\frac{2}{3}$ along from anterior. Eyelobe without teeth .... **Procampylaspis meridiana** sp. n.

Family BODOTRIIDAE

Genus **Cyclaspis** G. O. Sars, 1865

Cyclaspis gigas Zimmer, 1907

Zimmer, 1907b, p. 367; 1913, p. 441, figs 1–3, text-figs 1, 2; Hansen, 1908, p. 15, pl. III, fig. 1, a–g as *C. glacialis*; Stebbing, 1913, p. 38; Calman, 1917a, p. 146; 1918, p. 5; Hale, 1937, p. 40, fig. 1; Lomakina, 1968, p. 121, fig. 14.

Distribution

Previously recorded from the Ross Sea by Calman (1917a), the species is circumpolar. Bathymetric range: 163–752 m.

Material Examined

NZOI Sta. A 448, 752 m, 6 ♀♀ (1 ovig.); A 449, 362 m, 1 ♀.
GLD-13, 165 m, 1 ♀; GLD-15, 366 m, 1 ♀ (ovig.).

Family LEUCONIDAE

Genus **Leucon** Kröyer, 1846

Leucon antarctica Zimmer, 1907

Zimmer, 1907a, p. 227; 1913, p. 448, and as *L. sagitta*, figs 28–35; Calman, 1907, p. 1, figs 1–3, as *L. australis*; Stebbing, 1913, p. 68, and p. 66 as *L. australis*.

Distribution

The species is circumpolar and also occurs off the subantarctic islands. It has previously been recorded from the Ross Sea. Bathymetric range: 69–752 m.

Material Examined

NZOI Sta. A 448, 752 m, 1 ♀; A 468, 110 m, 3 ♀♀; A 471, 165–69 m, 1 ♀.

Genus **Eudorella** Norman, 1867

Eudorella gracilior Zimmer, 1907

Zimmer, 1907a, p. 228, text-figs 2, 3; 1909, p. 12, 13, figs 53–68; 1913, p. 449; Stebbing, 1913, p. 77; Lomakina, 1968, p. 119.

Distribution

Previously recorded by Zimmer from South Georgia, from 66°2′S, 89°38′E, and by Lomakina from 65°39′S, 113°05·2′E, this species is circumpolar. Bathymetric range: 75–752 m.

Material Examined

NZOI Sta. A 448, 752 m, 1 ♀.

Family NANNASTACIDAE

Genus **Campylaspis** G. O. Sars, 1865

Campylaspis antarctica Calman, 1907

Calman, 1907, p. 5, text-fig. 4, figs 14–16, as *C. verrucosa* var. *antarctica;* Zimmer, 1907b, p. 370; 1913, p. 454, as *C. verrucosa* var. *antarctica*; Stebbing, 1913, p. 199; Calman, 1917a, p. 155, fig. 9; Lomakina, 1968, p. 129, fig. 19.

Distribution

Previous records are by Calman, 77°50′S, 166°45′E and 77°46′S, 166°8′E, by Zimmer, 66°2′S, 89°38′E, and by Lomakina, 66°15·6′S, 94°26′E. Bathymetric range: 110–540 m.

Material Examined

NZOI Sta. A 449, 322–340 m, 1 ♀; A 468, 110 m, 2 ♀♀; A 469, 277 m, 1 ♀.
T.A.E. Sta. 79, 122–162 m, 1 imm. ♂; 98, 186–190 m, 1 ♀; 100, 108 m, 1 ♀, 2 imm. ♂♂.
GLD-13, 165 m, 1 imm. ♂.

Genus **Procampylaspis** Bonnier, 1896

Procampylaspis meridiana sp. n. (Fig. 2)

DESCRIPTION

Subadult ♂. Carapace (Fig. 2a) smooth, somewhat vaulted behind, with low rounded projection dorsally on each side about two-thirds along from anterior; shallow median excavation in front of these tubercles may be result of damage to specimen. Eyelobe fairly prominent with several indistinct lenses. Antennal notch shallow. Pereon with all five somites visible from above.

Antenna 1 (2c) with first segment a little longer than other two segments of peduncle together; main flagellum has three segments, together about one-and-a-half times as long as last segment of peduncle; accessory flagellum very small.

Maxilliped 1 (2d) with five segments. Maxilliped 2 (2e, f) dactylus ending in falcate spine, with shorter blunt spine near its end, and on inner edge three flattened spines, most distal about as long as end spine, others shorter, basal one bifid. Maxilliped 3 (2g) with basis a little shorter than remaining segments together; ischium short; merus widened distally, where greatest breadth is more than half length; carpus and propodus about equal in length, each somewhat shorter than merus but a little longer than dactylus.

Pereopod 1 (2h) with basis little more than two-thirds as long as rest of appendage; ischium only a little shorter than merus and about as long as carpus or propodus, each of which is distinctly longer than dactylus. Pereopod 2 (2i) with basis fairly broad, about four-fifths as long as remaining segments together; ischium short; merus longer than carpus; dactylus nearly twice as long as carpus and about three times as long as short propodus.

Uropod (2b) with peduncle about twice as long as last somite, with about 10 short spines externally; one-segmented endopod rather longer than two-segmented exopod, which is about half as long as peduncle; endopod has two inner spines and three end spines, one of which is long; exopod has similar arrangement of end spines but otherwise unarmed.

Length of holotype subadult ♂ 3·7 mm.

TYPE LOCALITY

Ross Sea, 76°59′S, 167°36′E, 110 m.

MATERIAL EXAMINED

NZOI Sta. A 468, 110 m, 1 subadult ♂, 1 juvenile.

REMARKS

This species clearly belongs to *Procampylaspis*, with its rake-like dactylus on the second maxilliped and the exceptional length of the ischium of the first pereopod. It also has the typical appearance of species in the genus.

Hale (1945) provides a key to seven species of *Procampylaspis*. Since then one other, *P. bacescoi*, has been described (Reyss and Soyer 1966). From most other species *P. meridiana* may be separated by the presence of the two tubercles on its carapace. *P. compressa* Zimmer is recorded from the Antarctic and has two tubercles, but they are differently placed and some teeth are present on the carapace. Only *P. bituberculata* Hansen of those previously described also has two dorsal tubercles placed one on each side, but this differs in the shape of its eyelobe, which is narrow and not tuberculiform as in *P. meridiana*. In *P. bituberculata* the tubercles on the carapace have spines on them, the dactylus of the second maxilliped is rather different in shape, and the uropods are more slender.

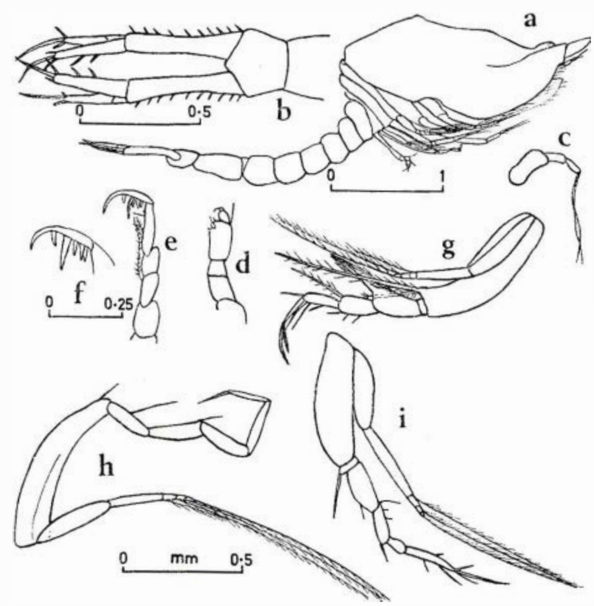

FIG. 2: *Procampylaspis meridiana* sp. n., subadult male holotype; (a) lateral view; (b) pleonite 6 and uropods from above; (c) antenna 1; (d) maxilliped 1; (e, f) maxilliped 2; (g) maxilliped 3; (h) pereopod 1; (i) pereopod 2.

Genus **Cumella** G. O. Sars, 1865

Cumella australis Calman, 1907

Calman, 1907, p. 4; text-figs 7–13; Zimmer, 1907b, p. 369; 1913, p. 451, fig. 38; Stebbing, 1913, p. 179; Hale, 1937, p. 43.

DISTRIBUTION

Earlier records were by Calman, 77°50′S, 166°45′E, Zimmer, 66°2′S, 89°38′E, and Hale, Commonwealth Bay, King George V Land. Bathymetric range: 45–583 m.

MATERIAL EXAMINED

NZOI Sta. A 456, 238–201 m, 1 ♀; A 468, 110 m, 12 ♀ ♀, 5 juv.; A 471, 165–69 m, 2 ♀ ♀, 1 juv.
T.A.E. Sta. 1, 583 m, 2 ♀ ♀ (1 ovig.).

Family LAMPROPIDAE

Genus **Paralamprops** G. O. Sars, 1887

Paralamprops rossi sp. n. (Fig. 3)

DESCRIPTION

♀. Carapace (Fig. 3a, b, c) broad and flattened

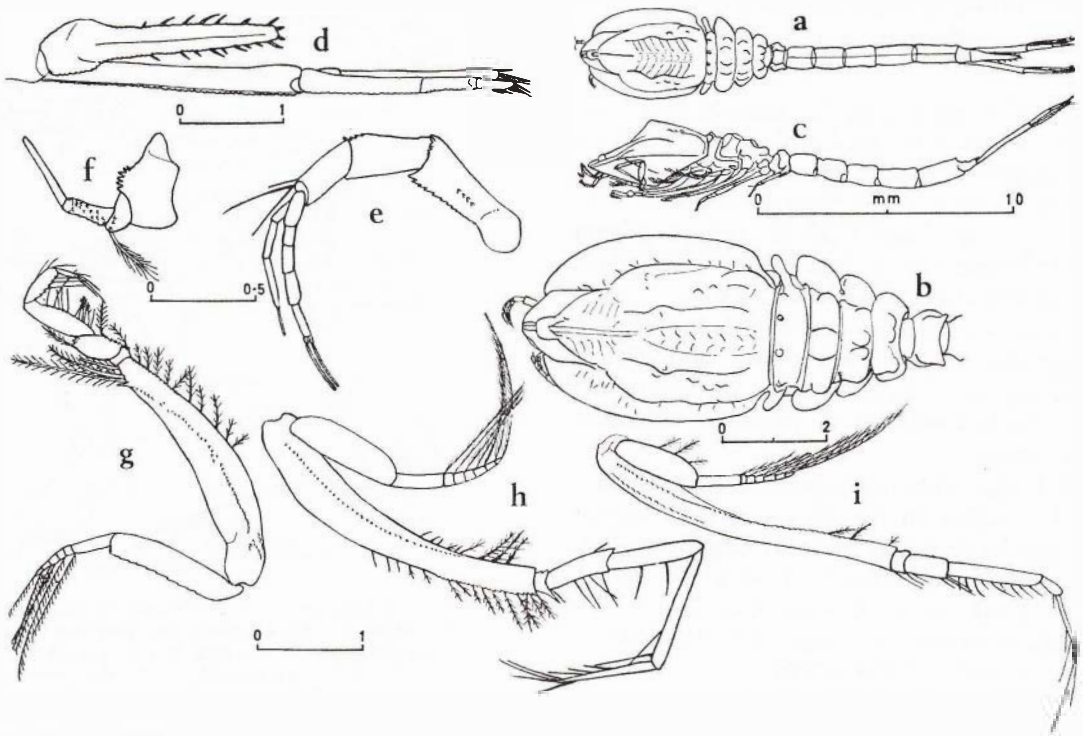

FIG. 3: *Paralamprops rossi* sp. n., adult female holotype; (a) dorsal view; (b) dorsal view of carapace and pereon; (c) lateral view; (d) telson and left uropod from above; (e) antenna 1; (f) antenna 2; (g) maxilliped 3; (h) pereopod 1; (i) pereopod 2.

anteriorly but abruptly elevated at about middle, with series of ridges not serrated, and low tubercles dorsally, and with scattered hairs but without spines or scales; a mid-dorsal carina extending from eyelobe to about one-third of carapace length from anterior; pair of somewhat undulating dorso-lateral ridges running from near hind end of mid-dorsal ridge to hind end of carapace, with area between excavated; outside these are two pairs of lateral carinae, upper pair extending backwards from sides of frontal region, with an interruption further back, to posterior, and lower pair extending right round sides of carapace. Eyelobe small and fairly narrow, without lenses.

Pereon somites 1–4 broad, first with a row of dorsal tubercles, following each with two pairs of dorso-lateral and a pair of lateral ridges.

Pleon somite 1 with two mid-dorsal longitudinal ridges set close together and a pair of dorso-lateral ridges; remaining somites except last with one mid-dorsal and pair of dorso-lateral ridges. Telson a little shorter than last two somites together; base widened and serrated at sides; about nine spines on either side and in holotype apparently only two short end spines.

Antenna 1 (3e) with first segment of peduncle slightly longer than second and third together; first and second have rows of serrations; main flagellum has five segments and is longer than last two segments of peduncle together; accessory flagellum has three segments and reaches to end of fourth segment of main flagellum.

Antenna 2 (3f) with four segments, first broad, second short, third about twice as long as second and shorter than slender fourth; first three segments have numerous blunt teeth or serrations.

Maxilliped 3 (3g) with basis much longer than remaining segments together, with rows of serrations along outer and distal upper and lower edges; ischium short; carpus longer than merus, both with serrations along lower edge and merus also at its upper distal end; propodus about as long as merus and twice as long as dactylus.

Pereopod 1 (3h) with basis shorter than remaining segments together, serrated in same way as basis of maxilliped 3; ischium short; carpus about one-and-a-half times as long as merus and about as long as dactylus but shorter than propodus. Pereopod 2 (3i) with basis much longer than remaining segments together, upper edge serrated; merus less than half as long as carpus but nearly twice as long as short propodus, which is about two-fifths as long as dactylus. Pereopods 3 and 4 with no trace of exopods.

Uropod (3d) with peduncle only slightly longer than telson; outer edge faintly serrated and two rows of about nine longer and seven shorter spines respectively internally; exopod is two-segmented and about four-fifths as long as peduncle; outer edge serrated and has at least 12 fairly long and slender spines on inner edge; endopod is three-segmented and distinctly shorter than peduncle; a little longer than exopod, which reaches to middle of third segment; outer edge serrated and with about 15.8.3 slender unequal spines on inner edge, two stronger end spines and one seta.

Length of holotype adult ♀ 17·3 mm.

TYPE LOCALITY

Ross Sea, 76°11·6′S, 164°46′E, 695 m.

MATERIAL EXAMINED

Sta. GLD-5, 695 m, 1 ♀.

REMARKS

The absence of rudimentary exopods from the third and fourth pereopods of the female would place *P. rossi* outside *Paralamprops* and possibly in *Platysympus* Stebbing, 1912, according to the tables in Zimmer (1913) and Fage (1929), but its general appearance is so like that of the other species of *Paralamprops* that it should undoubtedly be placed in this genus. *Hemilamprops mawsoni* Hale, 1937 also lacks rudimentary exopods on pereopods 3 and 4 in the female and this character does not seem to be very reliable taxonomically.

Paralamprops rossi approaches most nearly to *P. aspera* Zimmer, 1907, also from the Antarctic, in the comparative length of its telson and uropod. In the latter the telson reaches to the end of the uropod peduncle, while in *P. rossi* it reaches nearly to the end. In the remaining five species of the genus (see key in Jones 1969) the telson is quite distinctly shorter than the peduncle. It also approaches *P. aspera* in the distribution of the ridges on its carapace, but it lacks the serrations on these ridges and the denticles between them typical of *P. aspera*. The latter was described from two young males, and as most of the appendages were damaged, Zimmer did not provide figures of them. Possibly the differences between *P. rossi* and *P. aspera* are a matter of sex and age, but this is unlikely.

Family DIASTYLIDAE

Genus **Makrokylindrus** Stebbing, 1912

Makrokylindrus inscriptus sp. n. (Fig. 4)

DESCRIPTION

Adult ♀. Carapace (Fig. 4a, b) more than one-and-a-half times as long as high, with some short transverse rows of spines on and to sides of frontal area; behind are several spines followed by two serrated ridges one behind the other, each in an arc across carapace behind frontal area; behind these again on each side are numerous short ridges of irregular outline. Eyelobe longer than broad, without lenses but with two forwardly directed spines. Pseudorostrum moderately long, not sharply pointed, with prominent spines on sides. Antennal notch well defined and infero-lateral border serrated.

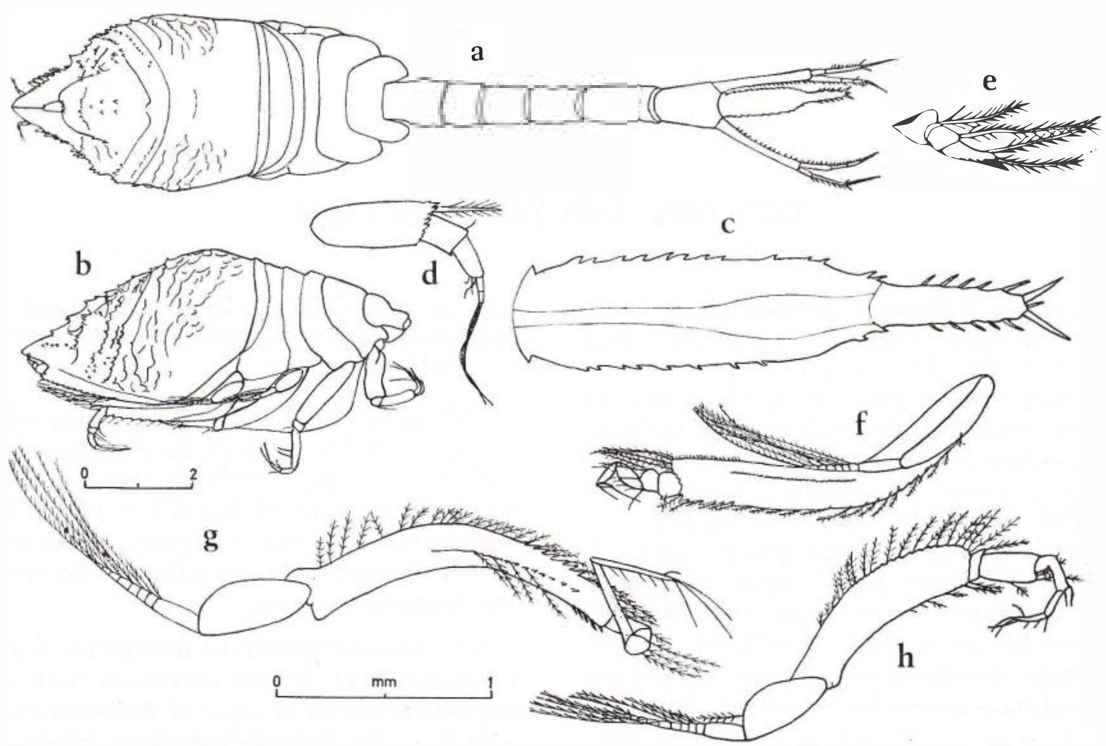

FIG. 4: *Makrokylindrus inscriptus* sp. n., ovigerous female holotype; (a) dorsal view; (b) lateral view of carapace and pereon; (c) telson from above; (d) antenna 1; (e) antenna 2; (f) maxilliped 3; (g) pereopod 1; (h) pereopod 2.

All pereon somites well defined dorsally. Marsupium containing 30–40 eggs.

Sternites of pleonites 2 and 3 each with pair of backwardly directed setae. Telson (4c) nearly twice as long as last pleon somite and much longer than peduncles of uropods; proximal part fairly wide and serrated laterally; distal part about half as long as proximal, narrow, with 5 short spines on each side, 2 stronger end spines, and a short ventral spine between.

Antenna 1 (4d) with first segment of peduncle robust, much longer than second and third segments combined, distal end with several spines and one long plumose seta; main flagellum two-segmented, with two long aesthetascs; accessory flagellum very small.

Antenna 2 (4e) with four segments, first broad, second very short with one plumose seta, third longer also with one plumose seta, and fourth about twice as long as third, narrowed distally, with lower edge serrated, bearing two distal plumose setae.

Maxilliped 3 (4f) with basis more than three times as long as remaining segments together, curved at about middle, with lower distal edge and distal end serrated and with serrated ridge along part of outer distal side; ischium well developed, slightly longer than merus, with ventral spine; carpus fairly broad, serrated ventrally, a little longer than ischium; propodus narrow, shorter than carpus and about twice as long as dactylus.

Pereopod 1 (4g) with basis shorter than remaining somites combined, with spine rows on upper, lower and outer distal edges; ischium longer than merus; propodus and dactylus about equal in length and each a little longer than carpus, which is about twice as long as merus.

Pereopod 2 (4h) with basis longer than rest of appendage; ischium short; merus broad and about five times as long as ischium, with distal end somewhat excavated; carpus narrow and only a little more than half as long as merus but longer than subequal propodus or dactylus. No trace of exopods on pereopods 3 and 4.

Uropods (4a) with peduncle about one-and-a-half times as long as last pleonite, with about 17 short spines internally; endopod a little longer than exopod (without end spines) and with about 7.5.4 internal spines on its three segments and two long end spines; exopod with 8–10 external spines and three end spines, central one very long.

Length of holotype ovigerous ♀ 15·6 mm.

Type Locality

Ross Sea, 75°15′S, 165°55′E, 808 m.

Material Examined

Sta. GLD-9, 808 m, 1 ovigerous ♀.

Remarks

In the key to the species of *Makrokylindrus* in Jones (1969) *M. inscriptus* would run out with *M. costatus* (Bonnier, 1896) or *M. neptunius* N. S. Jones, 1969, but the sculpturing of its carapace is quite unlike that of either of these and it is not to be confused in this respect with any known species.

ECOLOGY AND DISTRIBUTION

Lomakina (1968) includes a thorough discussion of the geographical distribution and relationships, both faunal and taxonomic, of the Antarctic Cumacea which need not be repeated here. Records are still so few that any conjecture is certain to be much modified in future. Her main conclusion is that the cumacean fauna is highly endemic. From the Antarctic littoral, South Georgia and Kerguelen, of 41 species known (including the three species described in the present work) 38 (93%) are endemic. There are, however, no endemic genera. Of the endemic species 17 are High Antarctic species, whose habitat is south of 60°S, 11 are Low Antarctic species, distributed only in South Georgia and Kerguelen, and seven species are common to both.

The paucity of the cumacean fauna is probably more apparent than real. As Lomakina points out, it may be due partly to the predominance of unfavourable bottom deposits, but it is likely that the main cause of the comparative scarcity of individuals in collections is the lack of suitable gear.

Perhaps the only remark worth adding to Lomakina's discussion is that some of the Antarctic species from shallow depths appear to be circumpolar and others will no doubt prove to be, but this is only to be expected because of the absence of barriers and the rather similar regime of temperature and salinity at most points around the Antarctic continent.

No particular pattern of distribution is apparent on comparing that of the cumaceans with the bottom deposits as shown in fig. 5 of Bullivant and Dearborn (1967), except the usual correlation between the occurrence of cumaceans and fine deposits. Much more intensive collecting would be needed to show more than this.

ADDENDUM

Since the foregoing went to press I have examined a collection of Cumacea from Chile Bay, Greenwich Island, South Shetlands, 62°29′S, 59°40′W, sent to me by Dr V. A. Gallardo of the University of Concepcion, Chile. This contained specimens from 33 samples taken by 0.1 m² Petersen grab on soft deposits. The following eight species were present: *Vaunthompsonia meridionalis,* 363 individuals, depth range 33–228 m; *V. inermis,* 70, 33–228 m; *Leucon antarctica,* 44, 54–355 m; *Eudorella gracilior*, 539, 33–274 m; *Campylaspis maculata,* 27, 61–347 m; *Diastylis helleri,* 32, 54–90 m; *Diastylopsis annulata,* 4, 93–355 m; *Leptostylis crassicauda,* 12, 123–252 m.

Only three of these species have been found so far in the Ross Sea. Two, *Leucon antarctica* and *Leptostylis crassicauda,* have been recorded previously from the sector between 60° and 115°E, and *L. antarctica* also between 135° and 170°E (Lomakina, 1968), while the other six have been recorded from South Georgia, and *Diastylis helleri* also from Graham Land. In several cases the samples from Greenwich Island extend their known vertical distribution.

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