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NEW ZEALAND
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH
BULLETIN 198

The Fauna of the Ross Sea

Part 7

Pycnogonida, 1

Colossendeidae, Pycnogonidae, Endeidae, Ammotheidae

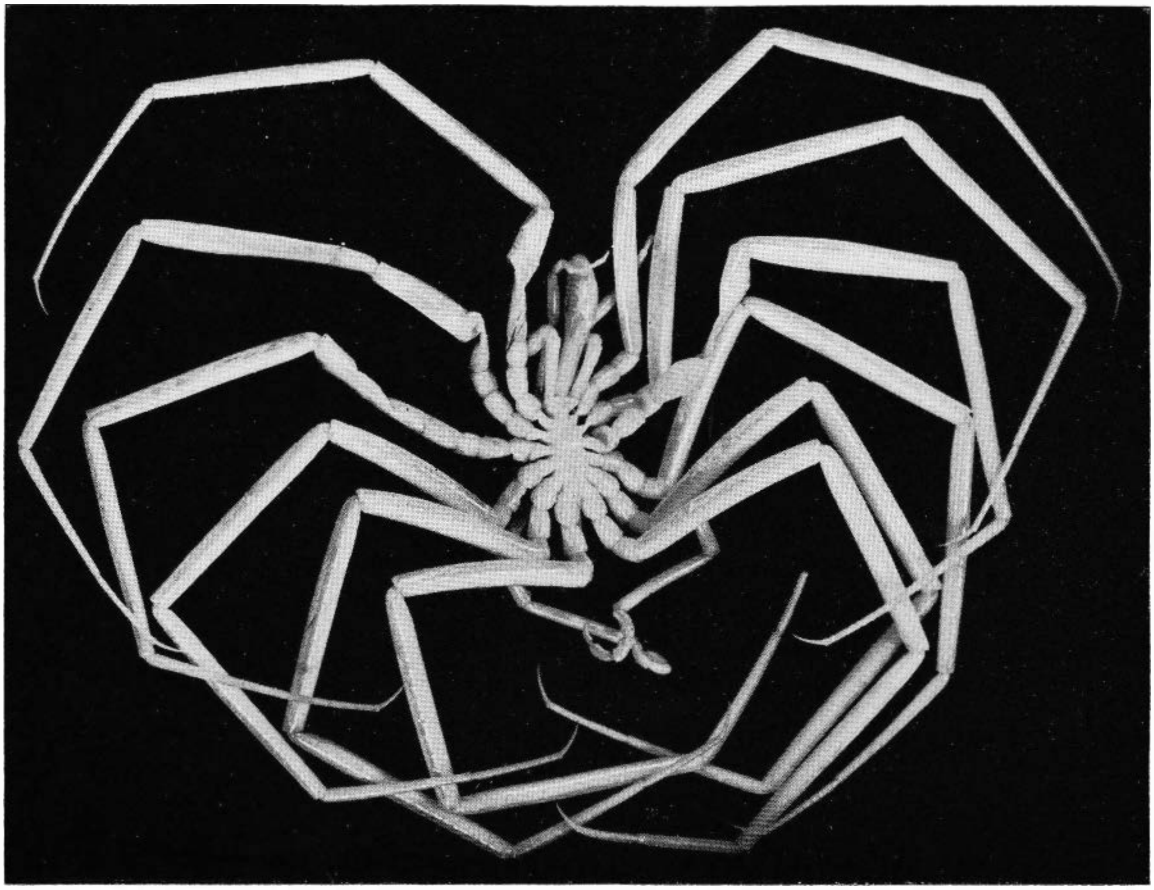
by

WILLIAM G. FRY AND JOEL W. HEDGPETH

New Zealand Oceanographic Institute
Memoir No. 49

1969

THE FAUNA OF THE ROSS SEA
PART 7
PYCNOGONIDA, 1



Photograph, J. Bahler, Fisheries Research Laboratory, Marine Department

There are more than 500 species of pycnogonids, most of which have eight legs. Several 10-legged and two 12-legged forms or species are known, mainly from Antarctic waters. The first 10-legged pycnogonid was collected as early as 1830 by James Eights on a voyage to the South Shetlands, and was described in 1835, but later naturalists considered it to be a mistake. However, Eights' species, and several others, were collected by various Antarctic expeditions in the early years of the century. Then, in 1933 the giant 12-legged form *Dodecolopoda mawsoni* was described by Calman and Gordon from the BANZARE collections. This is a photograph of the second known specimen of this strange form, collected by the NZOI Expeditions at station A459. A third specimen has been taken by m.v. *Eltanin* not far from the *Endeavour* station.

This phenomenon of additional somites and extra legs is unique; several of the extra-legged species closely resemble the more ordinary eight-legged species and it is possible that they may be the result of doubled chromosomes or unstable telogonic growth. While these polymerous forms are most common in the Antarctic (where a dodecolopodous species of *Nymphon* has recently been found), two have been found in the American tropical regions. They are unknown from any other part of the world.

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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, junior (Long Beach State College, California) and Dr R. K. Dell (Dominion Museum, Wellington) were co-workers, and 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 material considered by Mr Fry and Dr Hedgpeth in the present memoir includes additional collections by members of the Commonwealth Trans-Antarctic Expedition 1957–58; by zoologists of Stanford University operating under the United States Antarctic Research Programme; and by scientists participating in programmes under the auspices of the United States National Science Foundation particularly from USNS *Eltanin*. Their co-operation, and especially the assistance given by Mr John Dearborn, has enabled an effectively wider range of material to be examined.

Preliminary technical editing was carried out by Dr D. E. Hurley.

Further results of examinations of the collections will be published as studies of other groups are completed.

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

CONTENTS

The Fauna of the Ross Sea, Part 7

Pycnogonida, 1

Colossendeidae, Pycnogonidae, Endeidae, Ammotheidae

By WILLIAM G. FRY, M.SC.,
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Abstract

Although it was based originally on collections from the Ross Sea, this is the first of two reports on the whole Antarctic pycnogonid fauna. Some 4,000 specimens, collected by 10 ships and 4 shore parties between 1956 and 1965, form the basis for this work and approximately 600 specimens are dealt with in the first part. These were collected at 68 stations in the Ross Sea, 7 in the Weddell Sea, 6 off the coasts of Eastern Antarctica, and 37 in the Magellanic Region and off South America.

The first report (section 1) deals with 49 Antarctic and subantarctic species within 17 genera. Six genera, seven species, and one subspecies are described as new. The relationships of all taxa to those occurring in other parts of the world are stressed throughout. Strong emphasis is placed on taxonomic procedures, and three types of numerical assessment of resemblances have been used. It is concluded that the hierarchy of taxa above genus level in the Pycnogonida is highly unstable at present.

Fossil data on the history of the Antarctic pycnogonid fauna are totally lacking, but the patterns of resemblances amongst present-day forms indicate the existence of three weak links between the Antarctic continental shelf fauna and the faunas of northern shelves.

One link, established by direct migration across the deep ocean floor, is seen in the genus *Colossendeis*; another by migration via the Westwind Drift from the Magellanic region to Australasia, is seen in *Ammothea* species; and a third, by direct movement between the Magellanic region and southern South America, is seen in *Achelia* species.

INTRODUCTION

We have been able to examine all the pycnogonid material collected in Antarctic and subantarctic waters by New Zealand and United States scientists between 1956 and 1965. This is very extensive, probably equalling the total number of specimens previously collected in the same areas. As we have had access also to the excellent collections at the British Museum (Natural History) and have been able to borrow material from the U.S. National Museum, the Museum of Comparative Zoology, Harvard, and the Royal Scottish Museum we have taken the opportunity to make a thorough revision at the specific and generic levels of the Antarctic Pycnogonida. While this may appear to be far outside the scope of a report in a series on the Fauna of the Ross Sea, in fact no species of pycnogonids appear to be confined to the Ross Sea. By far the greater number of species are distributed over very large areas of the Antarctic continental shelf, and it is therefore difficult to discuss the Ross Sea fauna in isolation.

Critical re-examination of the Antarctic species and genera has confirmed that the classification of the higher taxa of Pycnognida is thoroughly unsatisfactory. While some "Families" such as the Endeidae, Pycnogonidae, and Colossendeidae can be characterised fairly readily and are easily acceptable as discrete entities, other taxa usually accorded familial rank, such as the Ammotheidae, Pallenidae, and Callipallenidae, consist of highly heterogeneous groups of genera. A re-examination of

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such groups as the Ammotheidae, Pallenidae, and Callipallenidae would require the revision of many genera on a world-wide basis. This is clearly beyond the scope of this report, and we have attempted no such re-examination. On the other hand, we have tended to regard the Ammotheidae and the pallenid "families" as no more than interim hypotheses, and have placed together in the text groups of genera which we consider may constitute less heterogeneous assemblages.

The size of the collections has enabled us to make detailed studies of certain variations such as relative proportions, propodal and ovigeral spination, proboscis shape, and palp musculature. These studies have forced us to reconsider some of the previously accepted taxonomic criteria and procedures, and the text contains much discussion of the taxonomic procedures employed. A more critical approach to procedures in pycnogonid taxonomy is urgently needed.

While emphasising the methods that we have used to produce classifications, keys, and descriptions, we have tried to present these conclusions in such a way that non-specialists can use the work with ease for the identification of specimens. Section 1 (this bulletin) contains a taxonomic key to the genera in that report, while Section 2 (in preparation) contains a key to all genera discussed in both reports. To ensure that these keys can be used successfully with the minimum of specialist knowledge, species have been extensively illustrated.

The station data are also divided into two lists. In Section 1 the station data listed concern only those specimens there discussed; the list in Section 2 concerns primarily the specimens discussed in Section 2, with the addition of more recently collected material discussed in the first section. The same procedure has been followed in preparing the index and the list of references in each report. Each report is therefore self-contained.

PREVIOUS WORK

Fifteen major expeditions have brought pycnogonids back from the Antarctic (Table 1), and all but two of these collections have contained new species. However, only 5 expeditions have made collections of pycnogonids from the Ross Sea and no new species have been reported from the area since Calman (1915b) listed 44 species from the western Ross Sea in his *Terra Nova* Expedition Report.

Although pycnogonids had been recovered from many points around the Antarctic continent before 1956, two large stretches of coastline had never been sampled (Fig. 1). These were the Amundsen Sea between 95° and 155°W and the Weddell Sea between 15° and 60°W. Collections made since 1956 (Fig. 2) have included some specimens taken well south in the Weddell Sea, but the Amundsen Sea has still not yielded any pycnogonids. If anything, the Amundsen Sea promises to be the more interesting region taxonomically, and, despite the difficulties of operating along this stretch of coastline, intensive sampling there would undoubtedly be most rewarding.

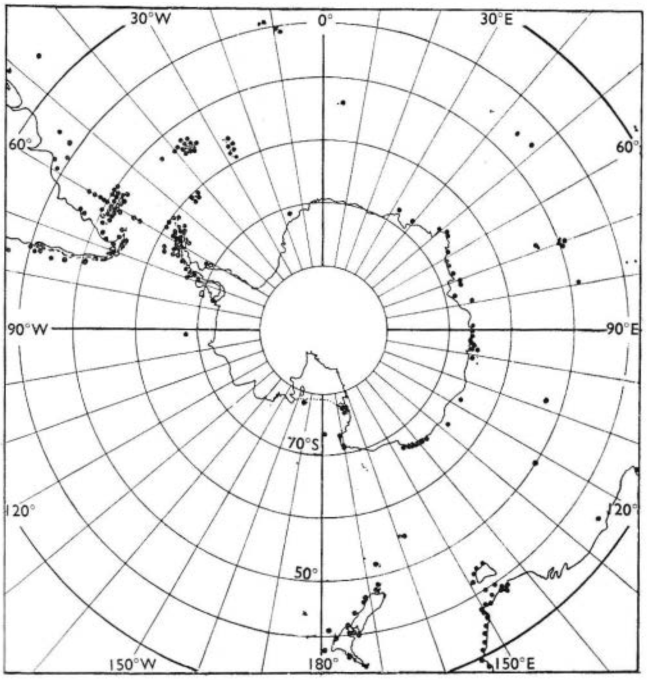

FIG. 1—Recorded stations in the Southern ocean at which Pycnogonida had been taken before this report. Some marks represent several stations in a small area. (Locality data of stations during recent Antarctic cruises of the *Ob* and *Vitiaz* which yielded pycnogonids are not available.)

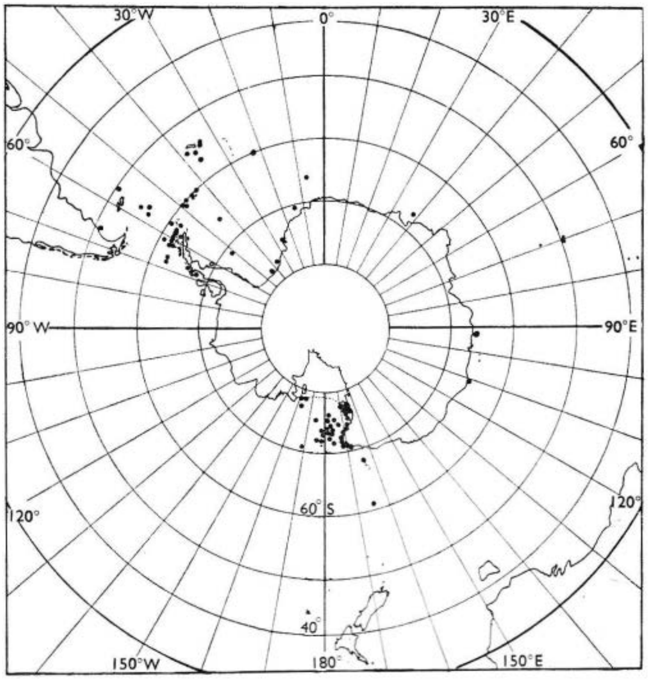

FIG. 2—Recent stations in the Southern ocean yielding pycnogonids discussed in this memoir.

Table 1—Previous Antarctic Expeditions

Expedition	Ross Sea Stations	Major Report	No. of Species Reported	No. New Species Described
Southern Cross 1898–1900	+	Hodgson, 1902	1	1
Gauss 1901–03	−	Hodgson, 1927	30	14
Swedish Antarctic 1901–03	−	Loman, 1923	32	5
Discovery 1901–04	+	Hodgson, 1907	26	23
Scottish National 1903–04	+	Hodgson, 1908	15	5
Francais 1903–05	−	Bouvier, 1905 & '06	8	6
Pourquoi Pas? 1908–10	−	Bouvier, 1913	28	12
Terra Nova 1910	+	Calman, 1915	44	11
Australian Antarctic 1911–14	−	Gordon, 1938	40	2
Discovery and *Discovery II* 1925–31	−	Gordon, 1932	65	15
Norwegian Antarctic 1927–28	−	Stephensen, 1947	17	. .
B.A.N.Z.A.R. 1929–31	−	Gordon, 1944	65	11
U.S. Antarctic Service 1939–41	−	Schmitt, 1945	1	. .
U.S. Navy 1947–48	+	Hedgpeth, 1950	22	1
Japanese Research	−	Utinomi, 1959	3	1

SCOPE

Approximately 4,000 specimens form the basis for this work, although this bulletin is concerned with only 600 of these. The specimens discussed herein were collected at 118 stations in Antarctic and subantarctic waters. Of these stations 68 were within the Ross Sea, 7 within the Weddell Sea, 6 around the coasts of Eastern Antarctica, and the remaining 37 off the Antarctic Peninsula, the southern coasts of South America, and the islands of the Scotia Arc (Fig. 2). Ten ships and four shore parties were concerned in making these collections between the beginning of 1956 and the end of 1964.

ACKNOWLEDGMENTS

We wish to express our thanks to the many people who have assisted us during the study of these collections and the preparation of this report. The authorities of the Museum of Comparative Zoology at Harvard, the U.S. National Museum, and the Royal Scottish Museum kindly allowed us to borrow material from their collections. Members of the staffs of these museums and Drs D. E. Hurley, J. H. Dearborn, M. David, and W. L. Tressler were most generous of their time in helping us to order and standardise the bewildering complexity of station data which had been accumulated in 9 years of Antarctic collecting.

We wish to thank also Dr P. Ehrlich and Mr S. Brophy of Stanford University, and Mr J. C. Gower of the Rothamsted Experimental Station, for advice on statistical procedures and for the use of computing facilities at these two institutions.

We owe an especial debt of gratitude to Dr Isabella Gordon for her kindness and help during our use of the extensive pycnogonid collections at the British Museum (Natural History), and for most generously allowing us to use her original drawings of B.A.N.Z.A.R.E. specimens. Dr P. M. Thomas of the Mawson Institute has given permission to reproduce some of these illustrations.

Miss S. M. K. Stone kindly prepared the index to the report, and Mr A. Eikenberry assisted us in the sorting and measuring of specimens at Pacific Marine Station.

Part of the research which forms the basis of this report was supported by National Science Foundation Grant number G—14107.

STATION DETAILS

(1) **New Zealand Oceanographic Institute Stations, HMNZS *Endeavour*, 1959–60**

ABBREVIATIONS: D.D., Devonport dredge, a modified naturalist's dredge; D.N., naturalist's dredge; G.D., Dietz - La Fonde grab; G.H.O., Hayward orange-peel grab; G.T.H.O., two G.H.O. together; G.T.O.S., small orange-peel twin grabs; T.A.S., small Agassiz trawl; T.P., pipe-frame Agassiz trawl; U.W.C., underwater camera.

Sta. A 449, 11 Jan 1959, 77°05′S, 177°12′E, Ross Sea, 362 m, T.A.S., G.T.O.S., bottom temp. −1.8°c, mud.

Colossendeis robusta
Pycnogonum gaini
Endeis australis
Ammothea (*Ammothea*) *glacialis*
Achelia (*Pigrolavatus*) *spicata*
Austroraptus polaris

Sta. A 450, 11 Jan 1959, 76°42′S, 179°44′E to 76°36′S, 179°53′E, Ross Sea, 472–318 m, G.T.O.S., G.H.O., T.A.S., muddy sand, bottom temp. −1.9°c.

Colossendeis lilliei
Pycnogonum gaini
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*
Achelia (*Pigrolavatus*) *spicata*
Achelia (*Pigrolavatus*) *communis*
Austroraptus juvenilis

Sta. A 451, 12 Jan 1959, 76°00′S, 175°25′W, to 75°50′S, 175°20′W, Ross Sea, 523 m, G.T.H.O., T.A.S., G.D., gritty mud, bottom temp. −1.8°c.

Decolopoda australis

Sta. A 454, 14 Jan 1964, 73°56′S, 176°30′W, Ross Sea, 914–828 m, T.A.S., G.H.O., bottom temp. 0.0°c, rocks.

Colossendeis lilliei

Sta. A 456, 15 Jan 1959, 74°30′S, 179°40′W, Pennell Bank, 238–201 m, G.T.H.O., T.A.S., stones gritty mud, bottom temp. −1.3°c.

Colossendeis robusta
Colossendeis lilliei
Colossendeis wilsoni
Ammothea (*Theammoa*) *clausi*
Achelia (*Pigrolavatus*) *spicata*
Achelia (*Pigrolavatus*) *communis*
Austroraptus polaris

Sta. A 459, 16 Jan 1959, 75°17′S, 172°20′E, Ross Sea, 534–549 m, G.T.H.O., T.P., soft mud, bottom temp. −1.9°c.

Colossendeis megalonyx megalonyx
Colossendeis robusta
Colossendeis drakei
Colossendeis lilliei
Dodecolopoda mawsoni
Pentapycnon charcoti
Endeis australis
Ammothea (*Mathoma*) *calmani*

Sta. A 460, 17 Jan 1959, 75°38′S, 168°32′E, Ross Sea, 415–430 m, G.T.H.O., G.D., T.P., gritty mud, bottom temp. −1.9°c.

Colossendeis lilliei
Ammothea (*Mathoma*) *calmani*

Sta A 461, 18 Jan 1959, 73°32′S, 171°22′E, Ross Sea, 578–567 m, G.T.H.O., T.P., sandy mud, bottom temp. −2.0°c.

Colossendeis megalonyx megalonyx
Colossendeis lilliei
Ammothea (*Homathea*) *longispina*

Sta. A 464, 22 Jan 1959, 73°20′S, 174°00′E, Ross Sea, 369-384 m, G.T.H.O., D.N., sand and pebbles, bottom temp. −1.1°c.

Colossendeis megalonyx megalonyx
Colossendeis robusta
Colossendeis tortipalpis
Colossendeis lilliei
Colossendeis australis
Ammothea (*Ammothea*) *glacialis*

Sta. A 465, 22 Feb 1959, 72°55′S, 175°30′E, Ross Sea, 399 m, G.D., D.C., barnacle plates, bottom temp. −0.5°c.

Colossendeis megalonyx megalonyx

Sta. A 467, 26 Jan 1959, 77°25′S, 169°28′E, off Cape Crozier, Ross Island, 88–183 m, D.N., rocks.

Colossendeis robusta
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*
Austroraptus juvenilis

Sta. A 468, 26 Jan 1959, 76°59′S, 167°36′E, Seamount, E of Beaufort Island, 110 m, T.A.S., U.W.C.

Colossendeis megalonyx megalonyx
Colossendeis lilliei
Colossendeis wilsoni
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*
Ammothea (*Theammoa*) *minor*
Achelia (*Pigrolavatus*) *spicata*

Sta. A 469, 29 Jan 1959, 77°50′S, 166°00′E, off Hut Point, Ross Island, 377 m, G.T.H.O., U.W.C., gritty mud, spicules.

Colossendeis megalonyx megalonyx

Sta. A 471, 6 Feb 1959, 77°37′S, 166°20′E, off Cape Evans, Ross Island, 165–169 m, T.A.S., U.W.C.

Colossendeis megalonyx megalonyx
Colossendeis robusta
Endeis australis
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*
Achelia (*Pigrolavatus*) *spicata*

Sta. A 520, 3 Feb 1960, 74°20′S, 179°30′E, Pennell Bank, 201–205 m, G.H.O., D.N., stones and sandy mud, dredge ⅓ full, abundant Polyzoa.

Achelia (*Pigrolavatus*) *spicata*
Achelia (*Pigrolavatus*) *communis*

Sta. A 521, 4 Feb 1960, 73°54′S, 177°44′W to 73°52′36″S, 177°46′W, Pennell Bank, 582–558 m, G.H.O., C.T.P., D.D., stones with mud, minute sample, living and dead solitary corals abundant, bottom temp. 0.0°c.

Pycnogonum gaini

Sta. A 526, 7 Feb 1960, 74°07′S, 177°41′W, Pennell Bank, 461–465 m, D.D., small sample corals, polyzoa, sponges, euphausids.

Pycnogonum gaini

Sta. A 528, 7 Feb 1960, 74°23′S, 179°26′W, Pennell Bank, 274–265 m, camera, D.D., patches of mud and stones, 3 black and white photographs, layer of mud and polyzoa over layer of stones.

Achelia (*Pigrolavatus*) *spicata*
Austroraptus juvenilis

Sta. A 529, 8 Feb 1960, 74°20′S, 179°55′W, Pennell Bank, 205–216 m, camera, D.D., on shallows and to north, samples of polyzoa, stones, and ophiuroids, 3 colour photographs.

Colossendeis lilliei
Achelia (*Pigrolavatus*) *spicata*

Sta. A 530, 8 Feb 1960, 74°03′30″S, 179°21′E to 74°05′S, 179°19′E, Pennell Bank, 271–267 m, D.D., muddy sand, no stones, two fish, and muddy worm tubes.

Ammothea (*Ammothea*) *carolinensis*
Ammothea (*Theammoa*) *minor*

Sta. A 531, 9 Feb 1960, 75°02′S, 178°10′E to 75°13′S, 178°14′E, Ross Sea, 358–357 m, muddy sand, D.D., small sample, polyzoa and crinoids.

Austroraptus polaris

Sta. A 533, 16 Feb 1960, 77°35′S, 166°10′E, Cape Barnes, 183–177 m, and 84–97 m, D.D., masses of sponge and red starfish.

Achelia (*Pigrolavatus*) *spicata*

(2) Trans-Antarctic (New Zealand) Expedition, 1956–58

Sta. 1, between 24 Dec 1956, and 28 Jan 1957, 77°46.3′S, 166°26.0′E, 6–7 miles north of Hut Point (ice edge), McMurdo Sound, other data uncertain.

Colossendeis robusta
Colossendeis spp.

Sta. 4, 3 May 1957, 77°46.3′S, 166°26.0′E, Cape Armitage, McMurdo Sound, under bay ice, 122 m, fish trap. Collection No. 324.

Colossendeis megalonyx megalonyx

Sta. 5, May 1957 or 1958, Backdoor Bay, Cape Royds, Ross Island, from HMNZS *Endeavour*, collection data uncertain, depth between 3 and 22 m.

Ammothea (*Theammoa*) *clausi*

Sta. 6, 20 Mar 1957, Pram Point, McMurdo Sound, 6.4 m, under pressure ice, fish trap, Collection No. 270.

Colossendeis megalonyx megalonyx
Ammothea (*Ammothea*) *glacialis*

Sta. 75, 22 or 26 Jan 1958, NW tip of Cape Evans, Ross Island, off HMNZS *Endeavour*, "Shore collections intertidal and foreshore", Collection No. 637, 640.

Colossendeis megalonyx megalonyx
Ammothea (*Ammothea*) *glacialis*

Sta. 78, 2 to 5 Feb 1958, Turtle Rock, Ross Island, other data uncertain, 0–148 m, Petersen grab or dip-net, from HMNZS *Endeavour*.

Ammothea (*Theammoa*) *clausi*

Sta. 79, 5 Feb 1958, 77°51′S, 166°34.0′E, ice edge McMurdo Sound, (Hut Point anchorage), from HMNZS *Endeavour*, 124–164 m, beam trawl, Collection No. 668.

Colossendeis megalonyx megalonyx
Colossendeis robusta
Endeis australis
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*

Sta. 98, 12 Feb 1958, 76°07′S, 168°10′E, Cape Roberts, Ross Island, off HMNZS *Endeavour*, 188–194 m, beam trawl, Collection No. 749.

Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*

Sta. 99, 15 Feb 1958, 77°01′S, 162°38′E, Botany Bay, Granite Harbour, McMurdo Sound, off HMNZS *Endeavour*, 73 m, beam trawl.

Ammothea (*Theammoa*) *clausi*

Sta. 100, 23 Feb 1958, 77°38′S, 166°20′E, Cape Evans, Ross Island off HMNZS *Endeavour*, 110 m, beam trawl, Collection No. 822.

Endeis australis
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*
Ammothea (*Theammoa*) *minor*

(2A) Dominion Museum (New Zealand) Stations, 1959

McMurdo Sound, Fish Trap, 5 Jan 1959, ice face in 439 m, coll. R. K. Dell.

Colossendeis megalonyx megalonyx

(3) USS *Atka* Stations, 1957 and 1958

Sta. 4, 20 Jan 1957, 78°10′S, 162°22′W to 78°09′S, 162°30′W, 610 m, beam trawl bottom sample, coll. R. Starr.

Colossendeis megalonyx arundorostris

Sta. 22a, 11 Jan 1958, 72°17.2′S, 170°19.3′E, 36 m, triangular dredge, coll. L. Wilson.

Colossendeis robusta
Colossendeis scotti
Ammothea (Ammothea) carolinensis
Ammothea (Theammoa) minor
Achelia (Pigrolavatus) spicata
Achelia (Pigrolavatus) communis

Sta. 23, 12 Jan 1958, 72°05.8′S, 172°15.2′E, 392 m triangular dredge, coll. L. Wilson.

Ammothea (Theammoa) minor
Achelia (Pigrolavatus) communis

Sta. 28, 27 Jan 1958, Deep Freeze III, 66°55.8′S, 110° 28.0′E, Vincennes Bay, Antarctica, 58.5 m, coll. L. Wilson.

Austroraptus juvenilis

Sta. 29, 27 Jan 1958, 66°17′35″S, 110°18′40″E, Vincennes Bay, Antarctica, near Wilkes Station, 74 fm, coll. L. Wilson.

Achelia (Pigrolavatus) spicata

(4) USS *Burton Island* Stations, 1958

Sta. 3, 13 Jan 1958, Deep Freeze III, 72°08′S, 172°10′E, McMurdo Sound off Cape Hallett, Sta. 3=Hydro Sta. 5, 433 m, Challenger-type dredge, surface temp. 0.29°c, coll. R. B. Starr.

Ammothea (Theammoa) clausi
Achelia (Pigrolavatus) communis

Sta. 5, 29 Jan 1958, Deep Freeze III, 66° 33′S, 93°01′E, Davis Sea, Russian Station, Mirny, 80 m, Sta. 5= Hydro Sta. 7, coll. R. B. Starr.

Ammothea (Theammoa) clausi
Achelia (Pigrolavatus) spicata

Sta. 8, 7 Feb 1958, Deep Freeze III, 67°59′S, 38°56′E, 30 m, observer R. Starr.

Colossendeis robusta

Sta. 13, Data uncertain, but marked as 15 Mar 1958, Deep Freeze III, 16° (*sic*) 23′S, 07°56′W, 19 m, coll. R. Starr.

Colossendeis robusta
Ammothea (Theammoa) clausi

Sta. 16, Data unknown.

Colossendeis megalonyx megalonyx

(5) USS *Staten Island* Stations 1956-57 and 1959

Sta. 17 (=Bio. 3), 27 Dec 1956, 71°18′S, 13°32′W, 368 m, orange-peel grab, coll. W. H. Littlewood.

Pycnogonum rhinoceros

Sta. 24, 20 Jan 1957, 77°21′S, 44°30′W, Weddell Sea, 464 m, orange-peel grab No. 9.

Achelia (Pigrolavatus) spicata

Sta. 1, 23 Jan 1959, 71°27.5′S, 169°55.5′E, Robertson Bay, Antarctica, Ocean Sta. No. 10, 439 m, beam trawl, coll. R. B. Starr.

Colossendeis robusta
Decolopoda australis
Achelia (Pigrolavatus) spicata
Austroraptus polaris

Sta. 3 (=Ocean Sta. 11), 26 Jan 1959, 67°23′S, 164°24′E, 2,495 m, Challenger-type trawl, coll. R. Starr.

Pycnogonum gaini

(6) USS *Northwind* Stations 1956–57 and 1959

Kainan Bay, Antarctica, 29 Jan 1956, Deep Freeze I, 640 m, bottom dredge haul, coll. J. Q. Tierney.

Colossendeis megalonyx megalonyx

Sta. 5, 11 Mar 1957, 77°51′S, 166°37′E, McMurdo Sound, depth?, coll. J. Q. Tierney.

Colossendeis megalonyx megalonyx
Colossendeis robusta

Sta. 8, 12 Jan 1959, 72°16′40″S, 170°18′00″E, Mowbray Harbour, near Hallett Sta., Antarctica, 133 m, coll. L. Wilson.

Colossendeis drakei
Pycnogonum gaini
Achelia (Pigrolavatus) spicata

Sta. 9, 15 Mar 1957, 67°15′S, 164°20′E, 380 m.

Austroraptus sicarius

Bay of Whales, no date, 78°, 30′S, 164°30′W, no depth.

Colossendeis robusta

(7) USS *Westwind* Stations 1958

Sta. 9, 26 Jan 1958, 62°24′S, 50°45′W, 167 m, No. 108 triangular dredge, coll. J. Q. Tierney.

Ammothea (Ammothea) carolinensis

(8) USS *Edisto* Stations 1956 and 1959

Sta. 6 (ED–6), 12 Feb 1956, 73°19′S, 169°15′E, 101 m.

Colossendeis species
Ammothea (Ammothea) glacialis
Achelia (Pigrolavatus) spicata
Achelia (Pigrolavatus) communis

Sta. 8 (ED–8), 18 Feb 1956, 77°27′S, 166°30′E, 320 m.

Colossendeis megalonyx megalonyx
Pycnogonum gaini
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*
Ammothea (*Theammoa*) *minor*
Austroraptus juvenilis

Sta. 20 (=TR–5), 28 Jan 1959, 77°40′S, 35°30′W, 608 m, Blake trawl, coll. J. Tyler.

Pycnogonum gaini

Sta. 28 (=TR–14), 22 Mar 1959, 68°05′S, 66°04′W, 201 m, Blake trawl, coll. J. Tyler.

Austroraptus praecox

Sta. 31 (=TD–5), 24 Mar 1959, 66°20′S, 67°47′W, 503 m, triangular dredge, coll. J. Tyler.

Ammothea (*Ammothea*) *glacialis*

(9) USS *Glacier* Stations 1958

See below under **Stanford University Stations,** Stations GLD-5 to GLD-16.

Deep Freeze IV Sta. GL-5. Equals Stanford Sta. GLD-4
Deep Freeze IV Sta. GL-6. Equals Stanford Sta. GLD-5
Deep Freeze IV Sta. GL-8. Equals Stanford Sta. GLD-7
Deep Freeze IV Sta. GL-9. Equals Stanford Sta. GLD-8
Deep Freeze IV Sta. GL-13. Equals Stanford Sta. GLD-13
Deep Freeze IV Sta. GL-17. Equals Stanford Sta. GLD-17

(10) Benthic Invertebrate Program – Stanford University Stations 1958-61

Most of these collections were made by J. H. Dearborn; other collectors include J. L. Littlepage, J. S. Pearse, and H. H. DeWitt.

Abbreviations: A.T. Alaska fish trap; B.T.2, two-foot Blake trawl; B.T.4, four-foot Blake trawl; D.N., long-handled dip net; D.R.N., small draw-net; D.T., drum trap; E.P.D., Emery pattern dredge (modified Petersen); F.G., Forest grab, max. vol. 5 l; G.N., gill net, variable mesh; H.L., hook and line; L.P.G., large Petersen grab, 0.2 sq. m; M.P.G., modified Petersen grab, 0.1 sq. m; N.T., net trap; O.P., orange-peel grab; P.C., Phleger core; P.N.5, plankton net, 0.5 m diam., coarse mesh; P.N.1, plankton net, 1 m diam., coarse mesh; R.N., ring net, 28 in. diam., 1 in. stretch mesh; R.T., ring trap; S.D.D., sand dollar dredge; S.T., small tangle of net or rope; T.D., small triangular dredge; U.L., underwater light; W.T., wire mesh traps, various sizes.

Sta. GLD–4, 27 Nov 1958, 76°31.8′S, 164°55′E, SWRoss Sea, 587 m, BT 4. Equals USS *Glacier* D.F. IV Ocean. Sta. GL–5.

Colossendeis megalonyx megalonyx

Sta. GLD–5, 27 Nov 1958, 76°11.6′S, 164°46′E, SWRoss Sea, 695 m, T.D., sponge-gorgonacean complex. Equals USS *Glacier* D.F. IV. Sta. GL–6.

Colossendeis megalonyx megalonyx

Sta. GLD–7, 29 Nov 1958, 75°46.4′S, 165°15′E, SWRoss Sea, 860 m, B.T.4, sponge-coelenterate complex. Equals USS *Glacier* D.F. IV Ocean. Sta. GL-8.

Colossendeis megalonyx megalonyx

Sta. GLD-8, 29 Nov 1958, 75°30′S, 165°44′E, off S Terra Nova Bay, Ross Sea, 631 m, B.T. 4, sponge-gorgonacean complex. Equals USS *Glacier* D.F. IV Ocean. Sta. GL-9.

Colossendeis lilliei
Decolopoda australis

Sta. GLD-10, 30 Nov 1959, 74°58′S, 164°04′E, Terra Nova Bay, Ross Sea, 832 m, B.T. 4, rocky with sponges.

Colossendeis megalonyx megalonyx
Colossendeis lilliei

Sta. GLD-11, 30 Nov 1959, 74°58′S, 164°04′E, Terra Nova Bay, Ross Sea, 860 m, R.T., no bottom data.

Ammothea (*Theammoa*) *clausi*

Sta. GLD-13, 30 Nov 1958, 74°39′S, 165°52′E, off Cape Washington, Ross Sea, 165 m, B.T. 4, sponge-coelenterate complex. Equals USS *Glacier* D.F. IV Ocean. Sta. GL-13.

Colossendeis megalonyx megalonyx
Endeis australis
Ammothea (*Ammothea*) *glacialis*
Ammothea (*Theammoa*) *clausi*
Ammothea (*Theammoa*) *minor*

Sta. GLD-16, 2 Dec 1958, 73°46.7′S, 169°09′E, off Coulman Island, Ross Sea, 836 m, T.D., gravel and pebbles. Equals USS *Glacier* D.F. IV Ocean. Sta. GL-17.

Colossendeis megalonyx megalonyx

Sta. A, 19 Nov 1958, 5 Jan 1959, 77°51′03″S, 166°37′19″E, off Hut Point, McMurdo Sound, 51 m, M.G.P., N.T., P.N. 5, W.T., sponge-coelenterate complex. Equals DeWitt and Tyler (1960) Sta. MM-20.

Colossendeis megalonyx megalonyx

Sta. B, 19 Nov 1958, 5 Jan 1959, 77°50′14.8″S, 166°35′05″E, off Hut Point, McMurdo Sound, 115 m, M.P.G., W.T., sponge-coelenterate complex. Equals DeWitt and Tyler (1960) Sta. MM-18.

Colossendeis megalonyx megalonyx
Ammothea (*Theammoa*) *clausi*
Ammothea (*Theammoa*) *minor*

Sta. F, 9 Jan 1959, 22 Feb 1959, 77°51′16.3″S, 166°39′16″E, NW shore of Cape Armitage, 7–15 m, H.L., M.P.G., W.T., volcanic gravel and sandy mud. Equals DeWitt and Tyler (1960) Sta. MM-25.

Colossendeis megalonyx megalonyx

Sta. G, 11 Jan, 22 Feb 1959, 77°51′42.7″S, 166°40′21″E, near tip of Cape Armitage, McMurdo Sound 5.5 m, H.L. M.P.G., W.T., volcanic gravel and sandy mud. Equals DeWitt and Tyler Sta. MM-26.

Ammothea (*Ammothea*) *glacialis*

Sta. K, 6–16 Apr 1959, 77°50′48″S, 166°37′38″E, off N. shore Hut Point, McMurdo Sound, 3.3 m, D.N., U.L., W.T., volcanic gravel and sand.

Colossendeis robusta

Sta. N, 22 Apr, 21 Nov 1959, 77°51′11.2″S, 166°38′46″E, S. of Hut Point, McMurdo Sound, 43 m, D.T., F.G., G.N., H.L., O.P., P.N. 5, S.T., W.T., greyish brown gravelly mud with sponge debris and *Limatula* valves.

Colossendeis robusta

Sta. S, 25 Nov, 24 Dec 1959, 77°50′05.1″S, 166°36′26″E, off Arrival Heights, McMurdo Sound, 64.5 m, F.G., O.P., P.N. 5, P.N. 1, W.T., sponge-coelenterate complex.

Colossendeis megalonyx megalonyx

Sta. W, 24 Dec 1959, 13 Jan 1960, 77°51′25″S, 166°38′44″E, off NW shore of Cape Armitage, McMurdo Sound, 53 m, F.G., P.N. 5, P.N. 1, W.T., sponge complex.

Colossendeis megalonyx megalonyx

Sta. X, 24 Dec 1959, 21 Feb 1960, 77°51′43.1″S, 166°37′24″E, W of Cape Armitage, McMurdo Sound, 135 m, F.G., P.N.5, P.N.1, W.T., sponge-shell complex.

Colossendeis megalonyx megalonyx
Ammothea (Ammothea) glacialis

Sta. 60A, 5 Dec 1960, 26 Feb 1961, 77°51′56.8″S, 166°43′05″E, SE of Cape Armitage, McMurdo Sound, 239 m, P.N.1, W.T., sponge-coelenterate complex.

Colossendeis megalonyx megalonyx

Sta. 61B, 9 Apr 1961, 3 Jan 1962, 77°51′59.6″S, 166°43′14″E, SE of Cape Armitage, McMurdo Sound, 278–290 m, F.G., H.L., L.P.G., O.P., P.N.5, P.N.1, S.D.D., W.T., sponge-coelenterate complex.

Colossendeis megalonyx megalonyx
Ammothea (Ammothea) glacialis

Sta. 61D, 10 May, 3 Nov 1961, 77°51′57.3″S, 166°41′17″E, S. of Cape Armitage, McMurdo Sound 128–136 m, B.T.2, F.G., H.L., O.P., P.N.5, P.N.1, T.D., U.L., W.T., sponge-coelenterate complex, station moved with the ice several hundred feet during the year.

Colossendeis robusta
Thavmastopycnon striata

Sta. EAD-3, aboard USCGC *Eastwind*, 19 Feb 1960, 77°42.1′S, 166°19.5′E to 77°43.1′S, 166°19.1′E, off Inaccessible Island, McMurdo Sound, 351–432 m, B.T.2, sponge complex with some rocks.

Colossendeis robusta

(11) **Tressler Oceanographic Stations 1960**

Sta. 2, 15 May 1960, 77°53′S, 166°44′E, McMurdo Sound, 570 m, temp. −1.8°c.

Colossendeis australis

Sta. 19, 29 Nov 1960, 77°53′S, 166°44′E, McMurdo Sound, 585 m, temp. −1.6°c.

Colossendeis australis

(12) **USNS *Eltanin* Stations 1962–64**

Sta. 138, 8 Aug 1962, 62°02′S, 61°09′30″W to 62°04′S, 61°07′30″W, Crary Sta. 11, 1,435–1,289 m, 10 ft beam trawl, echinoderms particularly varied with many large ones, pycnogonids, hydroids.

Ammothea (Homathea) longispina

Sta. 222, 27 Sept 1962, 53°14.7′S, 66°51.3′W to 53°23.7′S, 66°29.9′W, South Atlantic Ocean; off east coast of Tierra del Fuego (WAC 1669) 78–79 m, 40 ft otter trawl.

Pycnogonum platylophum

Sta. 268, 20 Aug 1962, 64°01.2′S, 67°44′07″W to 64°07.8′S, 67°44′03″W, 2,785–2,731 m, 10 ft Blake trawl, pycnogonids, brittle stars, isopods, sponges, and fish.

Cilunculus acanthus

Sta. 353, 5 Dec 1962, 55°14′05″S, 58°54′05″W to 55°17′05″S, 58°57′07″W, 3,511–3,639 m, Blake trawl, 1 large rat-tail, sea-urchin tests, 1 octopus, holothurians, pycnogonids, 1 myctophid (probably caught on the way up).

Colossendeis megalonyx megalonyx

Sta. 362, 7–8 Dec 1962, 57°08.5′S, 58°57.8′W to 57°59.7′S, 58°50′W; 3,588–3,475 m.

Ascorhynchus cuculus

Sta. 376, 20–21 Dec 1962, 54°03.6′S, 56°04.8′W to 54°02.8′S, 56°02.8′W, 1,719–1,737 m, rock dredge, sponges, 1 gastropod, 1 pycnogonid, 1 crayfish, remains of barnacles, many rocks.

Colossendeis megalonyx megalonyx

Sta. 393, 28 Dec 1962, 57°57.4′S, 55°57.8′W to 58°43.1′S, 55°47.9′W, 4,005–3,987 m, 10 ft Blake trawl.

Colossendeis megalonyx orcadense

Sta. 407, 31 Dec 1962, 61°14.2′S, 56°13.6′W to 61°15.5′S, 56°11.5′W, 247–232 m, rock dredge, grey mud, sand, pebbles, and cobble.

Colossendeis scotti

Sta. 410, 31 Dec 1962, 61°18′S, 56°08′05″W to 61°19′05″S, 56°10′02″W, 219–*c.* 239 m, 5 ft Blake trawl, sponges, fish, echinoderms, many pycnogonids, octopods.

Colossendeis megalonyx megalonyx
Colossendeis lilliei
Colossendeis scotti
Pentapycnon charcoti
Ammothea (Ammothea) carolinensis

Sta. 413, 1 Jan 1963, 62°07′S, 55°37′09″W to 62°07′09″S, 56°05′01″W, 1,112–1,152 m, 5 ft Blake trawl, holothurians, worms, crinoid, asteroids, ophiuroids.

Colossendeis megalonyx megalonyx
Pentapycnon charcoti

Sta. 418, 2 Jan 1963, 62°38′09″S, 56°10′02″W to 62°39′09″S, 56°07′08″W, 421–307 m, Blake trawl.

Colossendeis megalonyx megalonyx
Colossendeis robusta
Colossendeis lilliei

Sta. 423, 4 Jan 1963, 62°27′06″S, 58°07′03″W to 62°32′05″S, 58°12′06″W, 1,810–1,687 m, 5 ft Blake trawl, bottom relatively smooth, some rocks, sea anemones, fish, holothurians, ophiuroids, pycnognonids, sponges, hydroids.

Colossendeis megalonyx megalonyx

Sta. 426, 5 Jan 1963, 62°26′05″S, 57°57′06″W to 62°34′S, 57°49′02″W, 1,115–808 m, 5 ft Blake trawl, ophiuroids, sponges, molluscs, asteroidea, worms, fish.

Decolopoda australis
Pycnogonum rhinoceros
Magnammothea gigantea

Sta. 428, 5 Jan 1963, 62°41′S, 57°51′W, to 62°39′S, 57°46′W, 662–1,119 m, 5 ft Blake trawl.

Decolopoda australis
Pentapycnon charcoti
Ecleipsothremma spinosa

Sta. 432, 7 Jan 1963, 62°52′03″S, 59°27′02″W, to 62°54′07″S, 59°14′08″W, 924–873 m, 5 ft Blake trawl.

Colossendeis robusta
Decolopoda australis

Sta. 436, 8 Jan 1963, 63°14′S, 58°45′W to 63°13′03″S, 58°49′W, 72 m, 40 ft otter trawl.

Cilunculus cactoides

Sta. 437, 9 Jan 1963, 62°49′06″S, 60°40′W to 62°50′S, 60°34′07″W, 264–307 m, 5 ft Blake trawl.

Colossendeis megalonyx megalonyx
Colossendeis australis
Decolopoda australis

Sta. 439, 9 Jan 1963, 63°51′02″S, 62°37′06″W to 63°49′05″S, 62°35′01″W, 163–126 m, 5 ft Blake trawl.

Colossendeis lilliei
Colossendeis scotti
Decolopoda australis

Sta. 441, 10 Jan 1963, 63°26′06″S, 67°37′02″W to 63°24′08″S, 62°38′06″W, 154–249 m, 5 ft Blake trawl.

Colossendeis megalonyx megalonyx
Colossendeis lilliei
Colossendeis scotti
Pycnogonum rhinoceros

Sta. 444, 11 Jan 1963, 62°55′09″S, 62°01′08″W to 62°50′01″S, 62°04′04″W, 749–731 m, 5 ft Blake trawl, sea anemone, molluscs, one tunicate.

Colossendeis lilliei
Decolopoda australis
Pycnogonum rhinoceros

Sta. 445, 12–13 Jan 1963, 62°01′07″S, 59°04′07″W to 62°00′S, 59°07′05″W, 100 m, 40 ft otter trawl.

Colossendeis megalonyx megalonyx
Colossendeis scotti
Ammothea (*Ammothea*) *carolinensis*

Sta. 489, 18 Feb 1963, 60°05′S, 45°27′W, to 60°01.7′S, 45°22.3′W, north of South Orkney Islands, 5,227 m, 5 ft Blake trawl, ophiuroids, asteroids, holothurians, worm tubes, fish, pycnogonids, anemones, and rocks.

Colossendeis megalonyx scoresbii

Sta. 514, 24 Feb 1963, 66°17.8′S, 44°53.5′W to 63°24′S 44°55.3′W, 3,075–3,610 m, 5 ft Blake trawl, holothurians, 3 rat-tailed fish, worm tubes, isopods, 2 gastropods, sea anemones, ophiuroids, sponges (grey in life).

Colossendeis robusta

Sta. 534, 5 Mar 1963, 61°08′S, 48°44′W to 61°06.5′S, 48°40.5′W, 2,510–2,532 m, 5 ft Blake trawl, ophiuroids, 1 fish, hydrozoa, holothurians, pycnogonids, asteroids, echinoids, salps, and sponge.

Colossendeis megalonyx megalonyx

Sta. 538, 6 Mar 1963, 60°31.5′S, 47°41.5′W to 60°30′S, 47°41′W, 700–566 m, 5 ft Blake trawl, fish, 2 octopus, echinoids, asteroids, gastropods, anemones, hydroids, 2 sponges.

Colossendeis megalonyx megalonyx

Sta. 545, 7 Mar 1963, 60°01.5′S, 49°08′W to 60°02′S, 49°14′W, 2,649–3,970 m, 5 ft Blake trawl, sea anemones, holothurians, asteroids, several rat-tailed fish, 2 sponges, 1 caprellid-type arthropod, gastropods.

Colossendeis megalonyx megalonyx

Sta. 558, 14 Mar 1963, 51°55′02″S, 56°38.7′W to 51°58′S, 56°38′W, 845–645 m, 5 ft Blake trawl, ophiuroids, asteroids, rat-tail fishes, holothurians, soft corals, salytre coral, gastropods, pelecypods, isopods, echinoids, worms, polychaete worms, bryozoa, sponges.

Colossendeis stramenti

Sta. 608, 6–7 May 1963, 60°06.4′S, 22°16.4′W to 60°11′S, 23°13.5′W, 3,623–3,569 m, 5 ft Blake trawl, bottom fauna including sponges.

Colossendeis megalonyx megalonyx

Sta. 686, 25–26 Aug 1963, 54°59′S, 38°13′W to 55°04.2′S, 38°0.74′W, Scotia Sea, south of South Georgia, 2,196–2,379 m, 5 ft Blake trawl, holothurians, polychaetes, macrurid, gorgonia.

Colossendeis megalonyx megalonyx

Sta. 691, 27 Aug 1963, 56°25.2′S, 36°56.8′W to 56°29′S, 37°05′W, Scotia Sea, south of South Georgia, 3,118 m, 5 ft Blake trawl, jelly fish, holothurians.

Colossendeis megalonyx megalonyx

Sta. 709, 2 Sept 1963, 58°47.8′S, 36°24.1′W to 58°46.4′S, 36°23′W, Scotia Sea, south of South Georgia, 1,733–1,784 m.

Colossendeis megalonyx megalonyx

Sta. 723, 9 Sept 1963, 54°00′S, 33°40′W to 54°05′S, 33°43′W, Scotia Sea, east of South Georgia, 2,663–2,718 m, 5 ft Blake trawl, holothurians, asteroids, ophiuroids, crinoids, polychaetes.

Colossendeis megalonyx megalonyx

Sta. 993, 13 Mar 1964. 61°24.9′S, 56°30.1′W to 61°24.9′S, 56°32.0′W, NNW of Gibbs Island, 300 m, 10 ft Blake trawl.

Pycnogonum eltanin

Sta. 1082, 14 Apr 1964, 60°50.0′S, 42°55.1′W to 60°51.7′S, 42°56.3′W, South Scotia Ridge, slope of South Orkney Islands, 298–302 m, 5 ft Blake trawl, 7 octopods in haul, porifera, molluscs, holothurians, asteroids, polychaetes, gorgonians, rocks, and gravel.

Pycnogonum gaini

(13) RV *Vema* Stations, 1968

Sta. 17–99, 13 Jun 1961, 44°23′S, 59°53′W, 150 m—SBT gear.

Colossendeis megalonyx megalonyx

Sta. 17–100, 13 Jun 1961, 44°23′S, 59°53′W, 166–177 m—SBT gear.

Colossendeis megalonyx megalonyx

Sta. 17–101, 19 Jun 1961, 38°13′S, 55°19′W, 450–454 m—SBT gear.

Colossendeis megalonyx megalonyx

TERMINOLOGY AND MEASUREMENTS

A variety of terms has been used in the past to denote the structures and organs of pycnogonids. We have preferred the set of terms used in Fig. 3. These have no particular advantage over any other set of terms and their choice is purely arbitrary, but they are used consistently throughout the text.

It is possible to create considerable confusion by indiscriminate use of the words "joint", "article", "segment", and "somite". Throughout this work segment refers to a portion of an appendage bounded at one or two ends by a "joint". We consider that joints are of two kinds: when articular membranes and special articular structures are present we have called the joint an articulation; when these are absent, and there can be little or no movement about the joint, we have referred to the joint as a suture. The term somite has been used only when referring to regions of the trunk separated from one another by either type of joint—regardless of the embryological and phylogenetic connotations of the term. The word "article" has been avoided altogether.

In discussions of the spination of the propodal sole we have used the terms "homogeneous" and "heterogeneous". A group of sole spines is considered to be homogeneous if the length of the smallest spines is not less than 70% of the length of the longest; and if the length of the shortest spine is clearly less than 70% of the length of the longest the spine group is considered to be heterogeneous.

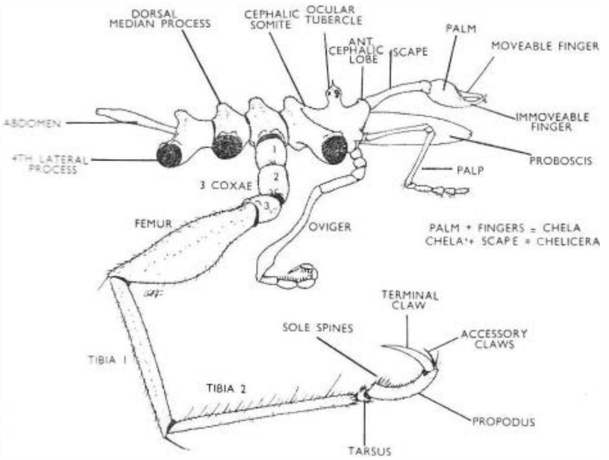

FIG. 3—Lateral view of an "ideal" pycnogonid, illustrating the terms used throughout this report.

The terms "synaxial" and "anaxial" have been used to describe the angle formed by the longitudinal axes of two segments at their region of articulation. If the angle between the axes can be 0° or very small then the articulation is considered to be synaxial. If this angle can never be reduced to 0° then the articulation is said to be anaxial. (See Fig. 40, *Colossendeis tortipalpis*.)

Particular care has been paid to the dimensions chosen to represent the lengths and breadths of structures. It is extremely rare for any structure to be bilaterally symmetrical in all planes passing through its longitudinal axis, and in some species differences in length of as much as 30% can be obtained by measuring a coxal segment from different aspects. The insertion of the proboscis into the cephalic somite is oblique in most, if not all, pycnogonids, so that measurements of both trunk and proboscis can vary considerably, depending on whether they are made from the dorsal or ventral aspects.

In this account the following purely arbitrary procedures have been used. Firstly, each structure has been measured from the same aspect in all specimens of all species. Secondly, the length of any segment or other structure has been taken as the distance between the centres of the joints at its two ends. Where the structure is curved, measurement has been made of the chord of the arc. In the case of a distal structure, the length has been considered as the distance between the centre of its proximal joint and its distal extremity—distal spines excluded. Figure 4 shows the planes of measurements of structures of the proboscis, chelicerae, trunk, and abdomen.

The proboscis and trunk have been measured from the dorsal aspect, the palp from the ectal aspect, the oviger from the endal aspect, and the leg segments from the postero-lateral aspect. In the measurement of the palp the most proximal segment is not included in the total length, as this segment is always very small and usually cannot be detached without considerable damage to the cephalic somite. There is no difficulty in determining the endal aspect of the palp.

On the other hand, it is sometimes difficult to determine the ectal and endal aspects of the ovigers. For the sake of consistency only, we have considered the ovigers as projecting forward under the trunk, with the distal hook of four segments pointing downwards.

The 3rd left leg has been selected for the "leg length" in all specimens, except where this appendage has been lost accidentally, or when 10- or 12-legged forms have been discussed. In the polymerous forms the penultimate left leg has been chosen to represent "leg length".

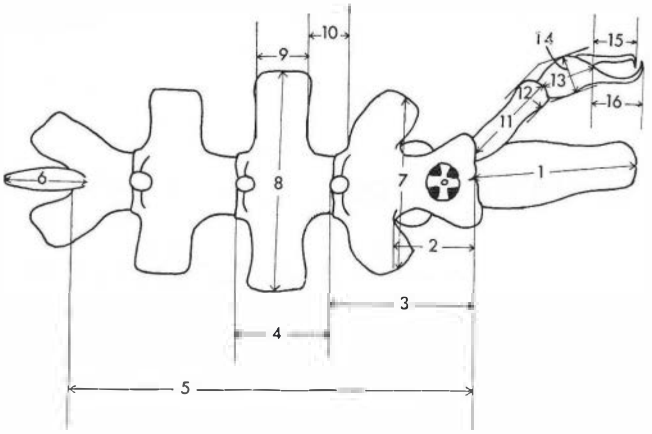

FIG. 4—Dorsal view of a generalised pycnogonid, showing lines of the measurements discussed in text. 1, length of proboscis; 2, length of "neck"; 3, length of cephalic somite; 4, length of 2nd somite; 5, total length of trunk; 6, length of abdomen; 7, width of cephalic somite; 8, width of 2nd somite; 10÷9, separation of 1st and 2nd lateral processes; 11, length of scape; 12, greatest width of scape; 13, length of palm; 14, greatest width of palm; 15, length of moveable finger; 16, length of immoveable finger.

These particular legs have been selected because in every specimen so far seen the penultimate (3rd, 4th, or 5th) legs are always the longest. Except where stated, "palp length", "oviger length", and dimensions of the chelicerae refer to the appendages of the left side.

THE SHAPE OF THE PROBOSCIS IN PYCNOGONIDA (Figs 5, 6)

The shapes of proboscides in pycnogonids have frequently been described by a single adjective, e.g., "clavate", "oval", "spindle-shaped", etc. Such descriptions can include wide variations, and conceal a number of character states of proboscis shape which are of use in diagnosing affinities or differences between individuals or taxa.

In order to make such character states available for use in keys, descriptions, and comparisons, a scheme of classification of proboscis shape is proposed here and used throughout the work. The number of co-ordinates used in this scheme has been kept to a minimum. It is extremely difficult to represent any biological form geometrically, but the present scheme appears to have worked well for the collections studied, and has proved to be an adequate method for describing intraspecific variation in proboscis shape.

The co-ordinates used in the scheme are the distal and proximal diameters of the proboscis; the presence or absence of a dilation at some point along the proboscis; the position of such a dilation with relation to the mid-length of the proboscis; the presence or absence, and the size relative to the proximal diameter, of a second and more distal dilation; and the type of curvature of the proboscis. Assessment of curvature is made from the lateral aspect, and the other criteria are assessed from the dorsal aspect.

Descriptions of proboscis shape using this scheme of classification may be written out in simple formulae, e.g., *Colossendeis robusta*, B‴: 1; *Ammothea australis*, D or D′ or A: 1 or 2: E. The second example indicates the range of variation of proboscis shape encountered in this species. The types of expression of the various criteria which have been observed in pycnogonids are shown in Figs. 5 and 6.

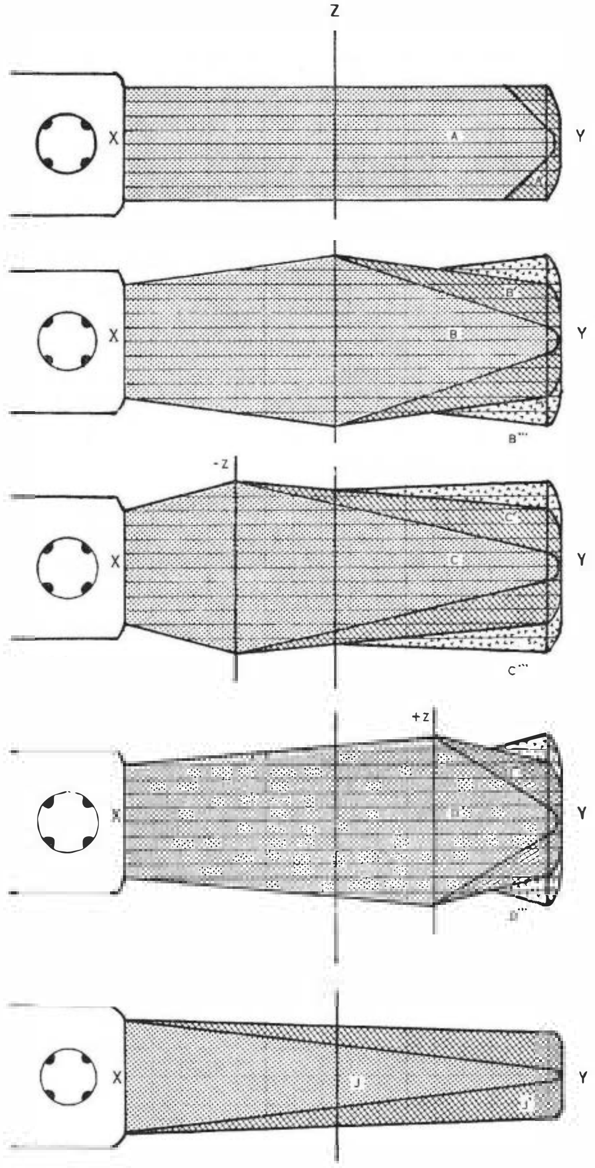

FIG. 5—The five main types of proboscis shape in the Pycnogonida. The criteria involved are: The presence or absence, and position, of one or two dilations; the relative diameters of the proboscis at its insertion into the cephalic somite and at its distal extremity. X and Y indicate proximal and distal diameters; Z indicates the midpoint of the longitudinal axis. (See text for further details.)

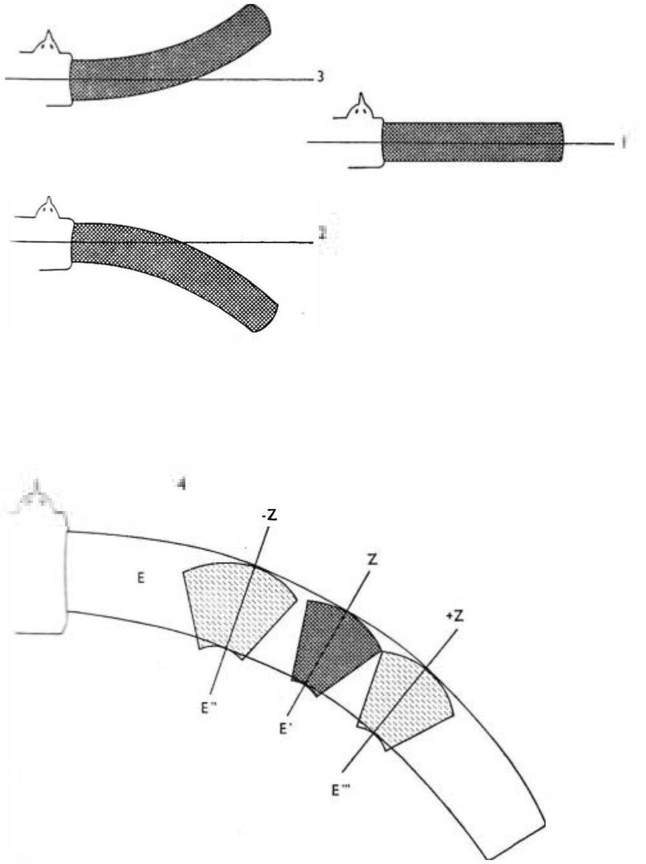

FIG. 6—Types of proboscis curvature in Pycnogonida: 1, straight; 2, downcurved; 3, upcurved; 4, types of variation in the distribution of curvature, E = uniform throughout, E′ = greatest curvature about midpoint of length of axis, E″ = greatest curvature proximal to the midpoint of the axis length, E‴ = greatest curvature distal to the midpoint of the axis length. Z indicates the midpoint of the axis length. (See text for further discussion.)

PARTIAL CHECKLIST OF ROSS SEA PYCNOGONIDS

Bold type indicates a new record for the Ross Sea

Colossendeis megalonyx megalonyx n. comb.
Colossendeis megalonyx arundorostris n. subsp.
Colossendeis robusta Hoek, 1881
Colossendeis drakei Calman, 1915
Colossendeis tortipalpis Gordon, 1932
Colossendeis lilliei Calman, 1915
Colossendeis scotti Calman, 1915
Colossendeis wilsoni Calman, 1915
Colossendeis australis Hodgson, 1907

Decolopoda australis Eights, 1834

Dodecolopoda mawsoni Calman and Gordon, 1933

Pycnogonum gaini Bouvier, 1910
Pentapycnon charcoti Bouvier, 1910
Endeis australis Hodgson, 1907

Ammothea (*Ammothea*) *carolinensis* Leach, 18
Ammothea (*Ammothea*) *glacialis* (Hodgson, 1
Ammothea (*Theammoa*) *clausi* Pfeffer, 1889
Ammothea (*Theammoa*) *minor* (Hodgson, 190
Ammothea (*Mathoma*) *calmani* Gordon, 1932
Ammothea (Homathea) longispina Gordon, 19

Thavmastopycnon striata (Möbius, 1902)

Athernopycnon meridionalis (Hodgson, 1915)
Ecleipsothremma spinosa (Hodgson, 1907)

Achelia (*Pigrolavatus*) *spicata* (Hodgson, 1907)
Achelia (*Pigrolavatus*) *communis* (Bouvier, 1906)

Austroraptus polaris Hodgson, 1907
Austroraptus juvenilis Calman, 1915
Austroraptus praecox Calman, 1915

Cilunculus cactoides n. sp.

SYSTEMATICS

The limited scope of this section of the report, and the unsatisfactory state of the taxonomy of the higher taxa of the Pycnogonida, has prevented us from attempting to devise keys to genera or families, which, in their layout, reproduce the classification of the Pycnogonida, and throughout this work the keys are entirely artificial in their design. All the forms known to occur in the Ross Sea are extensively illustrated, as are most of the Antarctic forms occurring outside that area.

KEY TO THE GENERA DISCUSSED IN THIS BULLETIN

1	Tarsus straight, cylindrical, at least half as long as propodus	2
	Tarsus arcuate, as wide as or wider than long, less than half as long as propodus	5
2	Four pairs of walking legs	3
	More than four pairs of walking legs	4
3	Chelicerae absent in adults, scape 2-segmented in juveniles	**Colossendeis**
	Chelicerae present in all stages, scape 1-segmented	**Ascorhynchus**
4	Five pairs of walking legs	**Decolopoda**
	Six pairs of walking legs	**Dodecolopoda**
5	Palps absent	6
	Palps present	8
6	Accessory claws absent	7
	Accessory claws present	**Endeis**
7	Four pairs of walking legs	**Pycnogonum**
	Five pairs of walking legs	**Pentapycnon**
8	Trunk somites distinct, articulated, bearing a dorsal transverse ridge	9
	Trunk somites fused or articulated, without a dorsal transverse ridge	14
9	Chelae fingers well-developed and functional	10
	Chelae fingers atrophied	11
10	Proboscis bulbous, straight	**Magnammothea**
	Proboscis cylindrical, strongly downcurved	**Thavmastopycnon**
11	Terminal segments of oviger bearing compound ventral spines	12
	Terminal segments of oviger bearing simple ventral spines	**Ammothea, Anammothea, Athernopycnon, Ecleipsothremma**
12	Scape of chelicerae 1-segmented	13
	Scape of chelicerae 2-segmented	**Cilunculus**
13	Palp 7-segmented, ovigers without terminal claw	**Sericosura**
	Palp 9-segmented, ovigers with strong terminal claw	**Ascorhynchus**
14	Accessory claws present on some or all legs	15
	Accessory claws absent from all legs	16
15	Terminal segments of ovigers bearing simple ventral spines, all segments of the palp articulated synaxially*	**Austroraptus**
	Terminal segments of ovigers bearing compound ventral spines, or, if simple spines, then 5th and 6th palp segments articulated markedly anaxially*	**Achelia**
16	Palp 8-segmented, trunk somites fused	**Aduncorostris**
	Palp 9-segmented, trunk somites articulated	**Ascorhynchus**

Family COLOSSENDEIDAE Hoek, 1881

Palps: 8- or 9-segmented, in adults always at least as long as the proboscis. **Ovigers** 10-segmented, present in both sexes, the four terminal segments bearing a variably differentiated field of special spines, which is at least three rows wide; the terminal segment with a larger distal spine. Four to 6 pairs of **legs**, between 5 and 16 times as long as the trunk in adults, and without **accessory claws. Tarsus** cylindrical and subequal in length to propodus. **Proboscis** always more than three-quarters, and as much as twice as long as the trunk, massive; **trunk** never with prominent dorsal ridges or projections; no large projections on the lateral processes or the coxal segments of the leg; **ocular tubercle** always present; **chelicerae** variably present in adults, strongly chelate with a 2-segmented scape in juveniles, never found in a reduced or non-chelate form. **Genital pores** on all 2nd coxae in both sexes.

Juveniles of only a few species within the family are known, and no eggs or larvae have ever been identified*.

Of the five genera recognised in this family, *Pentacolossendeis* and *Rhopalorhynchus* are not represented in Antarctic or subantarctic waters. (*Pentacolossendeis* has been taken only in the Straits of Florida.) *Dodecolopoda* has been taken at two localities on the Antarctic shelf, while *Decolopoda* occurs in both Antarctic and subantarctic waters. *Colossendeis* is represented in every major ocean basin of the world, although in all but Antarctic and Arctic waters the species have been collected from great depths only. Around Antarctic coasts, several species are found in depths of a very few metres, while two species have been recorded from the Arctic upper sub-littoral.

The standing of the genus *Rhopalorhynchus* Wood-Mason 1873 has been somewhat uncertain. Haswell (1885) considered it synonymous with *Colossendeis*, while Loman (1908) and Calman (1923) considered it distinct. Losina-Losinsky and Turpaeva (1958) suggested a "group articulata" for the species of *Colossendeis* with segmented trunk and small, ventrally directed abdomen. Stock (1958a) considered *Rhopalorhynchus* as a distinct genus on the basis of these characters and the structure of the proboscis (spindle-shaped with a constricted basal petiole). As defined by Stock, *Rhopalorhynchus* has at least 12 species in two sections, the *kröyeri* section with a dorsal tooth on the proboscis, and the *articulatum* section without such a tooth. The *kröyeri* section is Indo-Pacific, the *articulatum*

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*See page 19.

*Unless the larvae described by Moseley (1879) from some deep-sea Stylasteridae should prove to be of *Colossendeis* species.

section predominantly north Pacific in distribution. Losina-Losinsky and Turpaeva described two more species from the north Pacific; the genus as defined by Stock therefore has at least 14 species. His idea that they may be separated from those of *Colossendeis* s. str. on the basis of bathymetric range does not agree with the known distribution of many species of *Colossendeis* in shallower water than some *Rhopalorhynchus*.

KEY TO THE GENERA OF COLOSSENDEIDAE

1. More than four pairs of walking legs 2
   Four pairs of walking legs 4
2. Five pairs of walking legs 3
   Six pairs of walking legs .... **Dodecolopoda**
3. Lateral processes widely separated at their bases; intersegmental sutures present on the trunk; no chelicerae in adults .... **Pentacolossendeis**
   Lateral processes contiguous over at least the basal half of their lengths; no intersegmental sutures on the trunk; chelicerae well developed and chelate in adults ..... **Decolopoda**
4. Trunk segments distinct; lateral processes widely separated at base; proximal part of proboscis filiform or constricted; abdomen minute .... **Rhopalorhynchus**
   Trunk segments fused; lateral processes separated by less than 3.00; proximal part of proboscis never filiform .... **Colossendeis**

Genus **Colossendeis** Jarzynsky, 1870

Four pairs of legs; chelicerae absent in sexually mature forms; ovigeral spines of four basic types (Figs. 9, 10). Variation in other characters as wide within this genus as between the other genera of the family.

In previous taxonomic treatments of the genus, the degrees of spination of the body and legs have been used as diagnostic characters. Variation in degree of spination, and of spine size, observed in the collections does not confirm the consistent value of this character. Variation is sometimes enormously wide within what otherwise appear to be discrete species. For this reason, degree of spination, arrangement of spines, and relative spine sizes have not been given special weight in specific descriptions.

RELATIVE GROWTH IN *Colossendeis* SPECIES

A number of authors have placed considerable reliance on the relative proportions of a variety of structures, both in their descriptions and in their keys to the species of *Colossendeis*. During the examination of the present material we observed that while non-mensural characters tended to be useful for determining the specific identities of specimens, mensural characters expressed as absolute measurements or as ratios frequently proved very misleading.

One of the tacit assumptions of taxonomic writings concerning the Pycnogonida is that growth, in all species, is continuous throughout life—allowing for the fact that growth occurs by ecdysis. To test this assumption, and at the same time to discover the reasons for the apparent uselessness of relative proportions as diagnostic characters, we carried out a simple analysis of growth in the species of *Colossendeis*.

As there are no data available on relative growth in the Pycnogonida, we decided to begin analysis with only the largest structures and appendages. This procedure makes it possible to use many of the older descriptions of specimens, in which only the total lengths of such structures as trunk, leg, palp, and proboscis have been recorded. Accordingly, we chose the lengths of the following structures for study: 3rd leg, left palp, trunk, proboscis, and three functional units of leg segments. The three leg segment units are the three coxal segments, the three long middle segments (femur, 1st tibia, and 2nd tibia), and the three distal segments (tarsus, propodus, and terminal claw).

Measurements of all but the largest structures were obtained with a calibrated microscope eyepiece micrometer. The largest structures were measured with dividers.

Throughout the study the data were analysed in their original state, and regression equations were calculated in the form $y' = bx+a$. Although we could have used the more highly refined techniques which have been developed for the analysis of allometry, we considered that the nature of the study did not warrant this.

The specimens did not belong to successive stages in a particular ontogeny, which precluded a study of allometry of growth as defined by Teissier (1960), and there was no great advantage in treating them as individuals of varying sizes at some particular stage of development, when allometry of size could be studied. Rather, one of the purposes of the study was to determine whether or not there are specific stages of development whose boundaries could be detected by changes in relative growth.

Above all we thought it advisable to leave the conclusions in such a state that they could be tested by subsequent applications of additional data with an absolute minimum of mathematical effort. The ideal kept in mind throughout was that any hypotheses proposed after analysis of the data should be as easily manageable and comparable as are the characters whose states are used in keys and descriptions.

The choice of the 3rd leg as a reference dimension is purely arbitrary, as indeed the choice of any one dimension must be, since no structure is totally independent of any other. The use of a single reference dimension rather than some general factor such as Teisser's "general growth factor" helps also to keep the results of the analyses very simple.

The plotting of regression lines to find regression equations and the subsequent testing of null hypotheses were performed by the simplified method suggested by Tate and Cleland (1957, pp. 78–80).

Although existing knowledge of pycnogonid morphology indicates that no radical morphological changes occur once the full complement of legs is realised, a preliminary hypothesis tested throughout the study was that there are differences in relative growth parameters between sexually mature and immature forms. Where the quantity of data permitted, this hypothesis was tested by comparing the two regression equations of the slopes for juveniles and adults. Rejection or acceptance of the null hypotheses was based on the 95% probability of X^2_{rh} with two degrees of freedom.

Where no significant differences between the heterogonic growth parameters of adults and juveniles were detectable, or where the data from either juveniles or adults were insufficient for the detection of differences, the regression lines and equations for the total data were determined.

Although the samples differ greatly in size amongst the several species, certain generalisations can be made from the analyses.

Firstly, growth of all the structures considered in all the species is continuous throughout life. Secondly, all the structures considered grow heterogonically in relation to the growth of the total leg, but no two heterogonic relations in any one species are found to be the same.

Only in the relative growth of the palp, middle segments, and distal segments of the leg of *Colossendeis megalonyx megalonyx* could a change of heterogonic growth be detected at the onset of sexual maturity. Even in these the change was only just detectable at 95% probability of X^2_{rh}.

The differences in relative growth of the various structures are very marked; the leg especially grows very much faster than any of the other structures considered. This is perhaps surprising in juveniles and adults, although the metamorphosis from the protonymphon to a small juvenile with the full complement of legs obviously involves very marked heterogony.

Except for the heterogonic growth relationships between leg and proboscis and leg and palp in *C. robusta*, all the data appear to fit closely around a straight regression line.

The persistence of marked heterogonic growth relationships between the leg and the other structures considered may be due to the fact that the animals possess no respiratory or excretory organs or tissues and must therefore maintain a high surface to volume ratio. A simple method of maintaining such a high ratio would be by rapid elongation of narrow tubular leg segments, and this would have the added advantage of maintaining a high ratio of gut surface to total volume and at the same time providing space for enlarging gonads, since both gut diverticula and gonads are carried in the legs. In species found on soft mud, the relative length of the legs must also be very important in allowing easy locomotion.

The relatively very rapid growth of the legs and the heterogonic growth relationships between all structures studied reveals why the use of ratios or other measures of relative proportions can be extremely misleading; the heterogonic growth ensures that relative proportions vary continuously throughout the size ranges of the species. Relative proportions, in terms of ratios, can be taxonomically useful to a limited extent, if the point in the size range where a particular ratio occurs is recorded. Figures 7 and 8 indicate the limitations of usefulness of the ratios leg length ÷ trunk length and leg length ÷ proboscis length in distinguishing between the species of *Colossendeis*. The values for the ratios are calculated from the regression equations derived from the appropriate scatter diagrams; they thus ignore all variation. Similarly, the ranges of the mean of the ratios have been determined only for the known size ranges. If the values of ratios for the lowest size ranges of all the species were known there would doubtless be still more overlaps in Figs. 7 and 8.

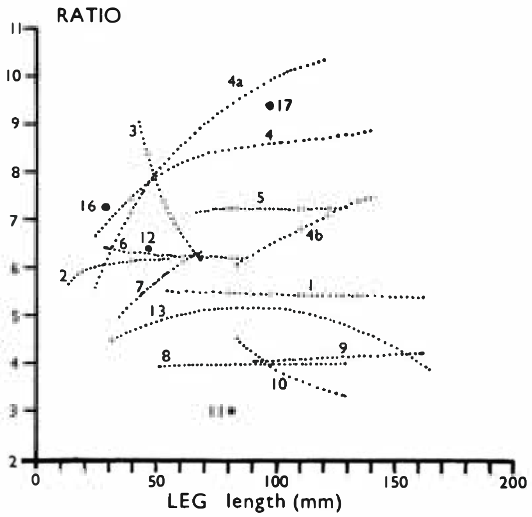

FIG. 7—Variation of the mean ratio leg length proboscis length with variation in leg length in 14 species of *Colossendeis*: 1, *C. "megalonyx"* (=*C. m. megalonyx*, *C. m. orcadense*, and *C. m. arundorostris*); 2, *C. m. scoresbii*; 3, *C. drakei*; 4, *C. robusta* (total data); 4a, *C. robusta* specimens with proboscis length of less than 12 mm; 4b, *C. robusta*, specimens with proboscis length of more than 12 mm; 5, *Decolopoda australis*; 6, *C. lilliei*; 7, *C. wilsoni*; 8, *C. tortipalpis*; 9, *C. scotti*; 10, *C. australis*; 11, *C. longirostris*; 12, *C. angusta*; 13, *C. macerrima*; 16, *C. minuta*; 17, *C. hoekii.*

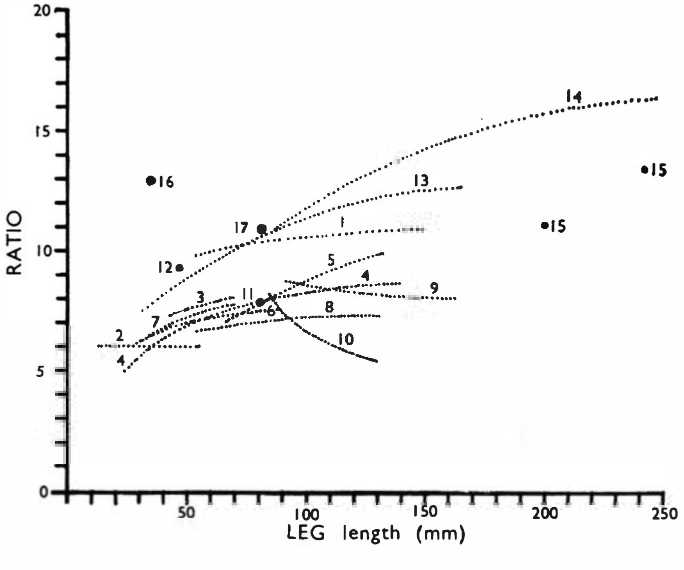

FIG. 8—Variation of the mean ratio leg length trunk length with changes in leg length in 16 species of *Colossendeis*: 14, *C. colossea*; 15, *Dodecolopoda mawsoni*; other numbers as in fig. 7.

Nonetheless, Figs. 7 and 8 are of some diagnostic significance, as witness the differences between the ranges of the two ratios for *C. m. scoresbii* and the other subspecies of *C. megalonyx*, and the differences between *C. minuta* and *C. colossea*.

DISTRIBUTION

Sixteen species of *Colossendeis*, out of about 30 known species, have been taken in waters south of 40°S. These 16 species fall into 2 discrete groups of 12 and 4. The species in the first group are endemic to waters south of 40°S and most are confined essentially to waters shallower than 1,000 m; the species in the second group are cosmopolitan and most of the known specimens have been taken deeper than 1,000 m—some as deep as 5,000 m.

The endemic species apparently form a morphologically discrete group, and are apparently more closely related amongst themselves than to any of the cosmopolitan species. On the other hand, the abyssal and bathyal cosmopolitan species are apparently derived from shallow water forms—the possession by the deep water cosmopolitan forms of an eye tubercle with atrophied eyes is almost indisputable evidence for this—and the Antarctic coastal and shelf regions are the only shallow waters in the world which support an endemic *Colossendeis* fauna. So, unless we are to postulate the existence of a vanished shallow water fauna in other parts of the world, we might expect that the cosmopolitan species are derived from the endemic Antarctic forms.

However, the Antarctic *Colossendeis* fauna does appear to be discrete, and although the present state of taxonomic knowledge of the cosmopolitan species does not allow us to trace fainter resemblances, and hence relationships, between the cosmopolitan fauna and the endemic Antarctic fauna, it is worth trying to discover possible reasons for this discreteness. The situation is complicated by the fact that *C. longirostris* (very closely related to, and possibly even a subspecies of *C. tortipalpis*), and *C. hoeki* occur in deep water. Furthermore, whereas some cosmopolitan species of *Colossendeis* are apparently stenothermous and eurybathic, and have been taken in very shallow Arctic water, they are apparently confined below 1,000 m in Antarctic and subantarctic waters. This suggests that there are conditions peculiar to shallow and shelf regions of the southern oceans which preclude the exploitation of shallower waters in the area by any but specialised forms. On the other hand, endemic shallow water species are apparently capable of contributing to the bathyal and abyssal fauna.

The zoogeography of *Colossendeis* has been discussed in more detail by Fry (1946b), and presented in the Antarctic map folio by Hedgpeth (1969).

OVIGERAL SPINES
(Figs. 9, 10)

All species of *Colossendeis*, and also those of *Decolopoda* and *Dodecolopoda*, bear roughly elliptical fields of spines on the ventral surfaces of the four terminal segments of the ovigers.

Observations on living specimens of Antarctic species of *Nymphon* and *Colossendeis* have shown that in these genera the terminal segments of the ovigers are used to keep the surfaces of the body and appendages clean.

Examination of specimens in the present collections has indicated that certain patterns discernible within the spine fields are of specific value. Accordingly, a formula and a system of pictorial conventions have been devised which are capable of showing differences between any two spine fields of adult Colossendeidae.

Four basic types of special spines are recognisable. Extensive wear to a spine is indicated when the spine lumen is connected with, or is close to, the exterior, and by the heavily pitted or jagged nature of the spine surface.

The two types of spine found in every field are the peg and the needle types (Fig. 9) and these completely intergrade in form. Both may be varyingly curved, and the relative abundance of the two types may vary from individual to individual and even from one segment to another of the same oviger. However, their morphological and spatial distinctness in *C. australis* warrants their separation in the formula proposed for this species. In these formulae, the types are designated by P (peg) and N (needle); where they occur together in either fixed or varying proportions, the symbol P/N is used.

A third type of spine is the spatulate (Sp). These are distinguished from the needle type by their flatness. Their distal edges are produced into two flanges which may be varyingly curved in towards the mid-line of the spine, and their edges may bear minute setae or teeth.

The fourth type is the molariform (MF), which occurs only in a distinct row medial to an endal row of spatulate spines. This type is always smaller than the spatulate spine and less flattened.

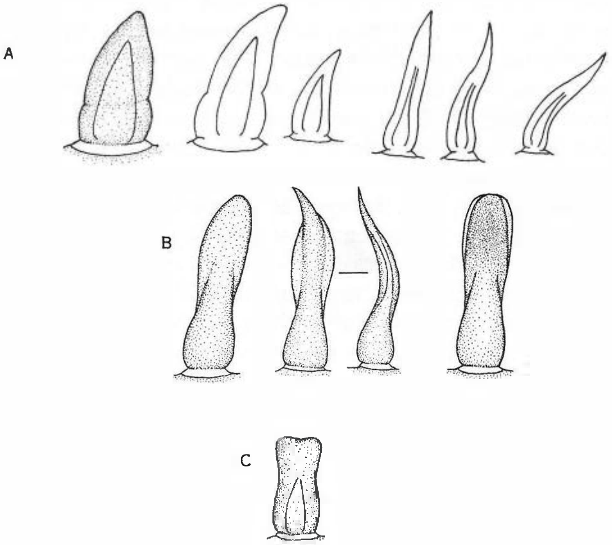

FIG. 9—The four types of ovigeral spines found in the genera *Colossendeis*, *Decolopoda*, and *Dodecolopoda*: A, peg and needle types; B, spatulate type; C, molariform type.

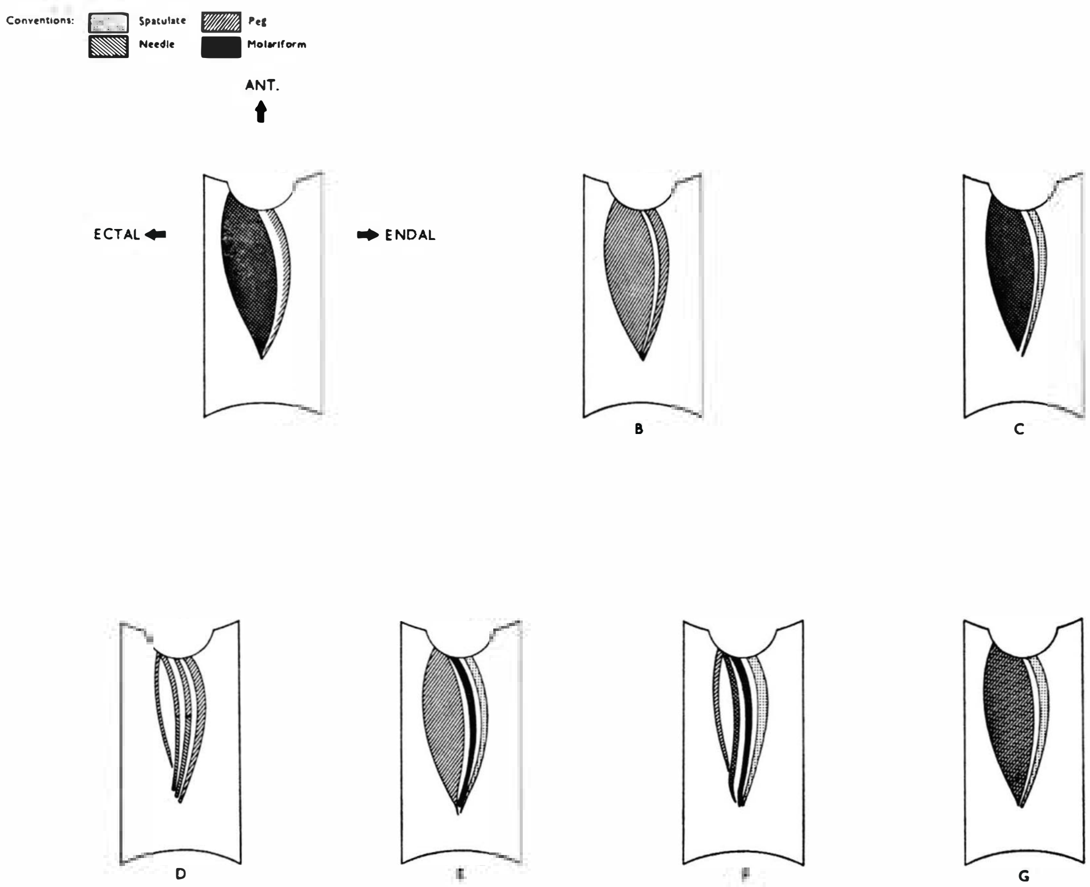

FIG. 10—Diagrammatic representation of the ovigeral spine fields in some Colossendeidae. A, *C robusta*, *C. lilliei*; B, *C. scotti*, *Decolopoda australis*; C, *Dodecolopoda mawsoni*; D, *C. australis*; E, *C. megalonyx*, *C. drakei*; F, *C. tortipalpis*; G, *C. wilsoni.* Conventions: Spatulate = dots; peg = diagonal lines from lower left to upper right; needle = diagonal lines from lower right to upper left; molariform = solid black.

In its least differentiated form, the field consists of a patch of spines in which no clear pattern of rows is discernible. Then there is a state where only an endal row is distinct from the rest of the field, and then only by virtue of physical separation of a discrete row of spines larger than the rest. The field may be further subdivided into as many as four rows on the basis of the disjunctness of such rows, and superimposed on these spatial subdivisions are variations in the type of spine found in each row.

The ectal row of spines is always irregular, which suggests that differentiation of the field has proceeded from the endal to the ectal side.* In the formulae the spine rows are designated (endal to ectal) as A, B, C, . . ., while irregular rows or fields are designated as **n.**

If the distal spine of row A on the terminal segment is enlarged to form a subchela with the terminal spine this is indicated by the symbol S: at the left hand side of the formula; NS: indicates the absence of such a condition.

For example,

$$S : \frac{Sp}{A} : \frac{MF}{B} : \frac{P/N}{n=3 \text{ or } 4}$$

indicates that a terminal subchela is present, and that two endal rows containing spatulate and molariform spines respectively can be clearly distinguished from an ectal field of three or four indistinct rows of needle and peg spines.

It is tempting to speculate on the phylogenetic significance of the variations in spine fields, and to assume that the undifferentiated field of peg- and needle-shaped spines is primitive. However, in the absence of paleontological data, most phylogenies can be read as easily one way as another.

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*But see, following, the mode of development of the spine field in *Colossendeis megalonyx.*

KEY TO THE SPECIES OF *Colossendeis* TAKEN SOUTH OF 40°S

1 Palps 9-segmented 2
Palps 8-segmented (2nd and 3rd lateral processes contiguous over at least part of their length, or separated by not more than 0.2; ocular tubercle bluntly rounded) .... **wilsoni**

2 Palp segments 7 to 9 together less than 10% of the total palp length 3
Palp segments 7 to 9 together longer than 10% of the total palp length 5

3 8th palp segment articulated anaxially with 7th segment proboscis straight or down-curved 4
8th palp segment articulated synaxially with 7th segment (proboscis up-turned in distal half) .... **macerrima**

4 Proboscis of shape* B or B′ : 2 : E, less than twice the length of the trunk; palp segment 4 ÷ segment 2 from 0.65 to 0.76; (eyes well developed and pigmented) ...... **tortipalpis**
Proboscis of shape C : 1 or 2 : E, more than twice the length of the trunk; palp segment 4 ÷ segment 2 approximately 0.91; (eyes small and unpigmented) .... **longirostris**

5 5th palp segment less than 10% of the total length of the palp; 7th and 8th palp segments always articulated synaxially 6
5th palp segment more than 10% of the total length of the palp; in some adults, palp segments 7 and 8 articulated anaxially .... **angusta(=gracilis)**

6 2nd and 3rd lateral processes contiguous over at least half their lengths .... **scotti**
2nd and 3rd lateral processes separated over their entire lengths 7

7 6th palp segment more than three times as long as wide .. 8
6th palp segment less than three times as long as wide 14

8 Oviger tip not subchelate; row A† of ovigeral fields consisting entirely or mainly of spatulate spines 9
Terminal spine of row A on the distal segment of the oviger enlarged greatly, so that the oviger tip appears subchelate; no spatulate spines in the ovigeral fields .... **australis**

9 No discrete row (B) of molariform ovigeral spines 10
Ovigeral spine fields with a discrete row (B) of small molariform spines; (ocular tubercle conical, with four variably developed eyes) .... **megalonyx** 12

10 Ocular tubercle very low and rounded; eyes inconspicuous or absent 11
Ocular tubercle steeply conical; anterior pair of eyes very strongly developed .... **hoekii** (see Gordon, 1944:11;2)

11 Sexual maturity attained at leg lengths of less than 35 mm; two sharp pronounced anterior cephalic spurs (see also fig. 8) .... **minuta** (see Gordon, 1944:11;2)
Sexual maturity attained at leg lengths of 80 mm or more; no pronounced cephalic spurs. (See fig. 8) .... **colossea**

12 5th palp segment less than 10% of the total palp length; eyes present, pigmented or unpigmented 13
5th palp segment more than 10% of the total palp length; eyes present or absent .... **megalonyx orcadense**

13 Proboscis subequal to trunk in length ..... **megalonyx scoresbii**
Proboscis more than 1½ times as long as trunk ....
megalonyx megalonyx and **megalonyx arundorostris**

14 Lateral processes separated by 0.5 or more; terminal segment of palp at least half as long as penultimate 15
Lateral processes separated by about 0.25; terminal segment of palp about or less than half as long as penultimate .... **lillei**

15 6th palp segment longer than 7th, 8th, and 9th (separately) 16
6th palp segment longer than 7th, but shorter than either 8th or 9th . ... **drakei**

16 Basal width of ocular tubercle ¾ or more of the width of the cephalon (excluding the lateral processes); ocular tubercle bluntly rounded and completely devoid of eyes ..... **stramenti**
Basal width of ocular tubercle not more than half the width of the cephalon (excluding the lateral processes); ocular tubercle a rounded cone bearing four eyes .... **robusta**

THE "*megalonyx*" COMPLEX

Gordon (1932), Loman (1923), Fage (1956), and Stock (1963) have expressed doubts as to the separateness of *Colossendeis megalonyx*, *C. frigida*, *C. rugosa*, and *C. scoresbii*. From descriptions, it is apparent that all four species are morphologically very similar; Gordon's 1938 key does not distinguish between *frigida* and *megalonyx*, while *rugosa* is separated from the previous two species because of its spiny legs. *C. scoresbii* is separated from the other species by the states of five characters.

While there were few adult specimens in the collections which might be attributed to *scoresbii*, the 50 or so specimens of this complex available showed ranges of variation for several characters which embrace, or immediately adjoin, previous descriptions of data from *rugosa*, *frigida*, and *megalonyx*. In addition, body and appendages show a wide range of variation in spine density, spine size, and in the degree to which the spines of the leg segments are arranged in discrete rows. Variation appears continuous from completely glabrous forms to those which might be attributed to *Colossendeis rugosa*. In view of these facts, *frigida*, *rugosa*, and *megalonyx* are here united under the prior name.

According to Gordon (1932), *C. scoresbii* differs from *frigida* in the following characters: (1) size of adults, (2) relative lengths of proboscis and trunk, (3) relative lengths of femur and tibia 2, (4) relative lengths of trunk and leg, (5) shape of ovigeral spines in row A, and (6) the relative lengths of tarsus, propodus, and terminal claw. Except for characters (3), (4), and (6), the ranges of variation recorded for *scoresbii* either adjoin or are included in the variation shown by the *megalonyx* (sens. str.) sample. Two specimens in the sample which are otherwise attributable to *megalonyx* have values for (2) included in or adjoining the range shown by *scoresbii*, and both specimens are juveniles. In view of what is known of relative growth in *megalonyx* (see p. 24, Table 2, and Fig. 7 and 8), characters (1), (2), (4), and possibly (6) indicate that *scoresbii* may be a neotonous form of *megalonyx*. The configuration of the ovigeral spine fields supports such an idea.

On the basis of these data, and the fact that *scoresbii* has been taken from only one part of the northern extreme of the range of *megalonyx*, *C. scoresbii* is here reduced to subspecific rank within *C. megalonyx*.

Two of the specimens of *megalonyx* differ markedly from all other specimens in the extremely attenuated nature of the body and all appendages. This state is so striking that we have been led to propose a new subspecies within *C. megalonyx*—*C. m. arundorostris*—to accommodate them.

Hodgson (1908) reported a single blind specimen from the South Orkneys, which he placed in a separate species, *C. orcadense*. In most of its characters this specimen is very similar to *C. megalonyx*. On the other hand, the type of *C. orcadense* differs from the subspecies of *megalonyx* in the complete absence of eyes and the greater relative length of the 5th palp segment.

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*See page 20.

†See page 27.

TABLE 2. Relative Growth Parameters ($y'=bx+a$) in Antarctic Colossendeidae

Leg. L. against:	L. 3 Coxae	L. 3 Middle Segments	L. 3 Distal Segments	L. Trunk	L. Palp	L. Proboscis
Decolopoda	0.042x+5.0	0.69x+5.0	0.36x+10.0	0.06x+5.4	0.18x+2.5	0.136x+0.2
C. "megalonyx" (Adult)*	0.064x±0	0.622x+4.7	0.297x−3.7	0.085x+0.9	0.271x±0	0.187x−0.3
C.m. megalonyx (Juvenile)	0.064x±0	0.688x−1.0	0.255x+0.6	0.085x+0.9	0.381x−4.9	0.187x−0.3
C.m. scoresbii	0.102x±0	0.671x−1.6	0.133x+4.5	0.166x±0	0.242x−0.45	0.155x+0.25
C. scotti	0.126x−3.5	0.90x−22.5	0.235x−30.0	0.137x−2.1	0.451x−11.5	0.222x+2.5
C. robusta (total)	0.63x+1.4	0.82x−6.0	0.183x+1.4	0.096x+2.45	0.118x+4.5	0.103x+1.2
C. robusta (Prob. > 12 mm)	"	"	"	"	"	0.087x+6.5
C. robusta (Prob. < 12 mm)	"	"	"	"	"	0.075x+2.5
C. lilliei	0.08x+1.0	0.72x−2.5	0.23x±0	0.117x+1.3	0.180x+3.25	0.18x−1.2
C. tortipalpis	0.087x±0	0.98x−23.0	0.406x−13.0	0.128x+1.2	0.170x+11.0	0.242x+0.6
C. wilsoni	0.094x+0.75	0.622x+3.5	0.219x+3.5	0.102x+1.8	0.171x+3.0	0.111x+3.1
C. drakei	0.076x±0	0.70x−1.5	0.243x−1.0	0.102x+1.5	0.24x−1.0	0.246x−5.9
C. australis	0.147x+6.0	0.528x+24.0	0.182x+1.0	0.305x−15.7	0.52x−15.2	0.118x−17.0

*Includes data from *C. m. megalonyx*, *C. m. arundorostris*, and *C. m. orcadense.*

It seems very probable that Hodgson's specimen belongs to *Colossendeis megalonyx*. Despite a re-examination of the holotype we could not discuss further its place within the species (except to regard it, somewhat dubiously, as a subspecies of *C. megalonyx*) were it not for the recent collection of an apparently very similar specimen from a depth of 3,410 m off Madagascar (Fage, 1956, *C. megalonyx*). This specimen, while undoubtedly belonging to *C. megalonyx*, agrees with the holotype of *orcadense* in the absence of eyes and the great relative length of the 5th palp segment. We have referred it to the subspecies *C. m. orcadense* in which we also include the specimen from *Eltanin* Sta. 393. Further light has been shed on this form by the description by Stock (1963) of several specimens from deep water off the South African coast, which undoubtedly belong to *C. m. orcadense*. In its depth and temperature tolerances *C. m. orcadense* thus appears to be a Southern Hemisphere counterpart of *C. angusta* (Table 3).

TABLE 3. Spatial Distribution of Sixteen Species of *Colossendeis* Occurring South of 40° S

Stenobathic:	
A. Below 1,000 m	†*hoekii*
	†*longirostris*
	angusta
	colossea
Stenobathic:	
B. Above 1,000 m	†*megalonyx scoresbii*
	†*m. arundorostris*
	†*australis*
	†*lilliei*
	†*scotti*
	†*drakei*
	†*tortipalpis*
	†*wilsoni*
	†*stramenti*
Eurybathic:	
	*angusta**
	macerrima
	†*m. orcadense*‡
	†*m. megalonyx*
	†*longirostris*
	†*robusta*

*Eurybathic in high Arctic waters only.
†Confined to the Southern Hemisphere.
‡Eurybathic in high Antarctic waters only.

Colossendeis megalonyx Hoek, 1881. (Figs. 7, 8, 10–23)

Colossendeis megalonyx Hoek 1881: 67; IX 1–3. Calman 1915b: 15–16. Helfer and Schlottke 1935: 293. Fage 1956: 177–8.
Colossendeis frigida Hodgson 1907: 63; IX 3, X 5–6. Calman 1915b: 17–18. Loman 1923: 7. Gordon 1932: 16–17; 5a, 6a, d, d′, 7d. Helfer and Schlottke, 1935: 293. Gordon 1944: 10. Fage 1956.
Colossendeis rugosa Hodgson 1907: 64; IX 4, X 7. Calman 1915b: 16–17. Gordon 1932: 12, 17. Helfer and Schlottke, 1935: 293.
Colossendeis orcadense Hodgson 1908: 184. Helfer and Schlottke 1935: 294.
Colossendeis scoresbii Gordon 1932: 18–21; 5c, 6b, b′, c, c′, 7a, b.
Colossendeis orcadensis Stock 1963: 334, 7.

DESCRIPTION

PROBOSCIS SHAPE: B′′′: 1 or 2: E′′′

OVIGERAL SPINE FIELD CONFIGURATION

$$NS : \frac{Sp}{A} : \frac{MF}{B} : \frac{N/P}{\mathbf{n}=2 \text{ to } 6 \text{ in adults}}$$

During growth, the area **n** in juveniles passes through stages when **n** = 1, and **n** = 2. In *C. m. arundorostris*, the juvenile state **n** = 2 is apparently retained in maturity, as in *C. m. scoresbii.*

GENITAL PORES: There appear to be two distinct types of pore on the ventral surface of the 2nd coxae of all legs, and these two types never occur together on the same specimen. The first type is smaller, borne on a small, low protuberance. In specimens where the integument is fairly transparent, a duct may be seen passing from this pore, through the protuberance, parallel for a short distance with the segment's circumference, before bending sharply inwards.

The second type of pore is large in relation to the width of the coxa, and is not borne on a protuberance. No such configuration of the duct, as in the first type is visible. The duct appears shorter, and runs from the pore diametrically into the lumen of the coxa.

The first type is the male orifice; the second, the female.

Recorded Distribution

Throughout Antarctic and subantarctic waters, between 7 and 5,000 m; also as far north as Madagascar, taken only below 3,000 m.

Colossendeis megalonyx megalonyx n. comb. (Figs. 7, 8, 11–16, 23)

Material Examined

NZOI Sta. A 459, 3 ♂♂, 3 ♀♀, 1 juvenile; Sta. A 461, 21 ♂♂; Sta. A 464, 1 ♀; Sta. A 468, 2 ♀♀; Sta. A 469, 1 juvenile; Sta. A 471, 1 ♀.

Trans-Antarctic (N.Z.) Sta. 4, 1 ♂; Sta. 6, 1 ♀, 1 juvenile; Sta. 75, 1 ♂; Sta. 79, 1 ♂, 1 ♀; Sta. 100, 1 juvenile.

Dominion Museum (N.Z.) Sta. McMurdo Sound (Fishtrap) 1♂. *Edisto* Sta. 8 (ED-8), 1 juvenile; *Northwind* Sta. 5, 1 ♂, 2 ♀♀; *Burton Island* Sta. 16, 1 ?♂.

Stanford Sta. GLD-4, 1 ♂; Sta. GLD-5, 1 juvenile; Sta. GLD-7, 1 juvenile; Sta. GLD-10, 2 ♂♂; Sta. GLD-13, 2 juveniles; Sta. GLD-16, 1 ♀; Sta. A, 1 ♀; Sta. B, 2 ♀♀; Sta. F, 2 ♀♀, 1 juvenile; Sta. S, 1 ♂; Sta. W, 1 ♂, 1 ♀; Sta. X, 1 ♂, 1 ♀; Sta. 60A, 1 ♂; Sta. 61B, 1 ?♂.

Kainan Bay, 1 juvenile.

Eltanin Sta. 268, 2? soft; Sta. 353, 1?; Sta. 376, 1 ♂; Sta. 393, 1?; Sta. 410, 10♂♂, 9 ♀♀, 2 indeterminate, 1 juvenile; Sta. 413, 3 ♂♂; Sta. 418, 1 ♂; Sta. 423, 1 ?; Sta. 437, 5 ♂♂, 8 ♀♀, 5 indeterminate; Sta. 411, 1 ♂; Sta. 445, 4 ♂♂, 1 ♀; Sta. 534, 1 ♀, 1 juvenile; Sta. 538, 2 ♂♂, 6 ♀♀, 1 indeterminate; Sta. 545, 1 ♂, 3 ♀♀; Sta. 558, 1 ♂, 1♀; Sta. 608, 1 ♂; Sta. 686, 2 ♀♀; Sta. 691, 1 juvenile; Sta. 709, 1 indeterminate; Sta. 723, 1 ♂?, 1 ♀.

Vema Sta. 17–99, 1 ♂, 2 indeterminate, 1 fragmentary; Sta. 17–100, 1 ♀?; Sta. 17–101, 2 ♂♂, 1 ♀.

B.M. (N.H.) Regn. No. 1933.3.23.30–6; 1933.3.23.21–6; 1907.6.24.108–17 (Types of *C. frigida*); 1956.10.10.421; 1915.7.2.24.8–27; 1933.3.23.27–9; 1933.3.23.37–9; 1942.12.30.3; 1915.7.24.6; 81.38 (Types of *C. megalonyx*); 1907.6.24.118 (Holotype of *C. rugosa*); 1915.7.24.7; Unregistered: *Discovery* Sta. 1948; *Discovery* Sta. 1952.

Description

Based on 187 adult and 23 juvenile specimens, augmented by data from earlier works.

SIZE RANGES EXAMINED:

	Juveniles	Adults
L. trunk	3.72– 6.40 mm	5.73– 12.90 mm
L. proboscis	5.60–14.60	10.25– 27.50
L. palp	5.41–21.88	15.73– 41.10
L. leg	22.80–55.20	54.10–149.00

PROPORTIONS palp segments (as percentage of terminal 8 segments):

	Range
9th	5.55–10.23
8th	4.92– 9.75
7th	1.94–11.51
6th	9.09–12.61
5th	6.53– 9.73
4th	19.69–28.12
3rd	2.46– 5.13
2nd	21.97–41.43

Leg segments (as percentage of total leg length)

	Range
3 coxae	3.87– 9.56
Femur	19.46–28.50
Tibia 1	20.54–25.43
Tibia 2	18.64–23.92
Tarsus	8.08–13.73
Propodus	6.17–10.61
Claw	2.94– 7.73

RELATIVE PROPORTIONS:

L. palp÷L. proboscis	0.96– 1.91
L. palp÷L. trunk	0.85– 3.34
L. leg÷L. proboscis	3.99– 6.68
L. leg÷L. palp	3.21– 4.56
L. leg÷L. trunk	3.49–13.02
L. proboscis÷L. trunk	0.87– 2.48
L. femur÷L. tibia 1	0.80– 1.24
L. femur÷L. tibia 2	0.80– 1.47
L. tarsus÷L. propodus	1.13– 1.86
L. claw÷L. propodus	0.40– 0.87
L. 4th palp segt.÷L. 2nd palp segt.	0.55– 0.90

RELATIVE GROWTH: Data on relative growth of certain structures are depicted in Figs. 11–14, 17–20; the parameters there illustrated are given in algebraic form in Table 2.

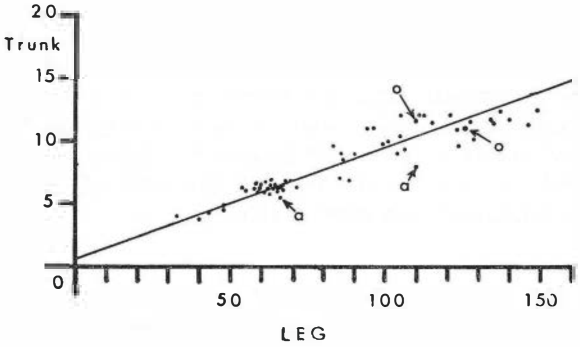

FIG. 11—*C. megalonyx megalonyx*, *C. m. orcadense*, and *C. m. arundorostris*: Relative growth of leg length and trunk length; **o** indicates specimens of *C. m. orcadense;* **a** indicates specimens of *C. m. arundorostris*; other points *C. m. megalonyx*. (Dimensions in mm.) Adults and juveniles not distinguished.

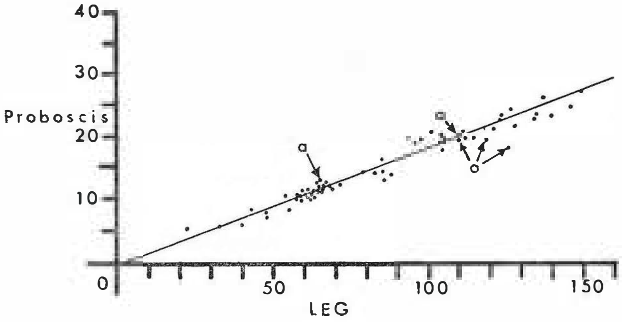

FIG. 12—*C. m. megalonyx*, *C. m. orcadense*, and *C. m. arundorostris*. Relative growth of proboscis and leg. Conventions as in fig. 11. (Dimensions in mm.)

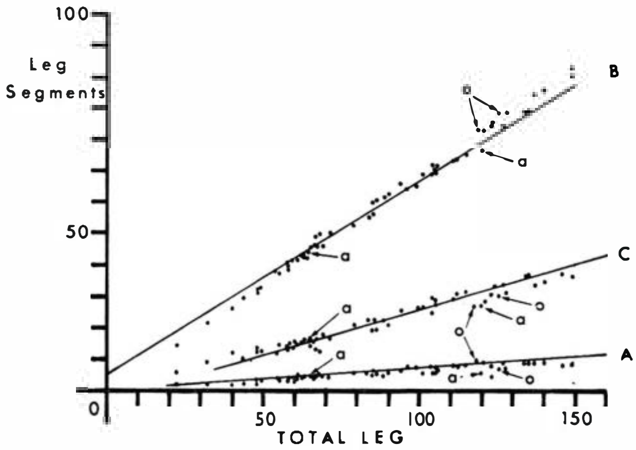

FIG. 13—*C. m. megalonyx*, *C. m. orcadense*, and *C. m. arundorostris*: Relative growth of groups of leg segments. Regression curve B indicates total length of femur + two tibiae: Curve A indicates total length of three coxae; curve C indicates total length of tarsus + propodus + terminal claw. Other conventions as in fig. 11. (Dimensions in mm.)

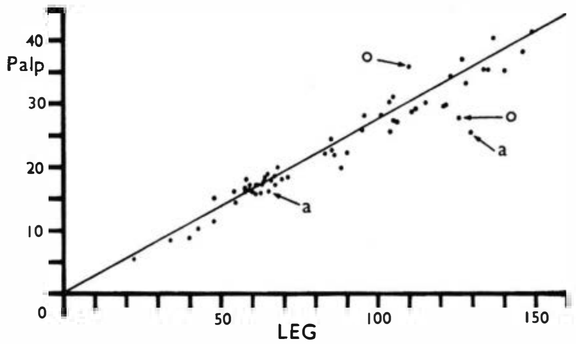

FIG. 14—*C. m. megalonyx*, *C. m. orcadense*, and *C. m. arundorostris*: Relative growth of leg length and palp length. Conventions as in fig. 11. (Dimensions in mm.)

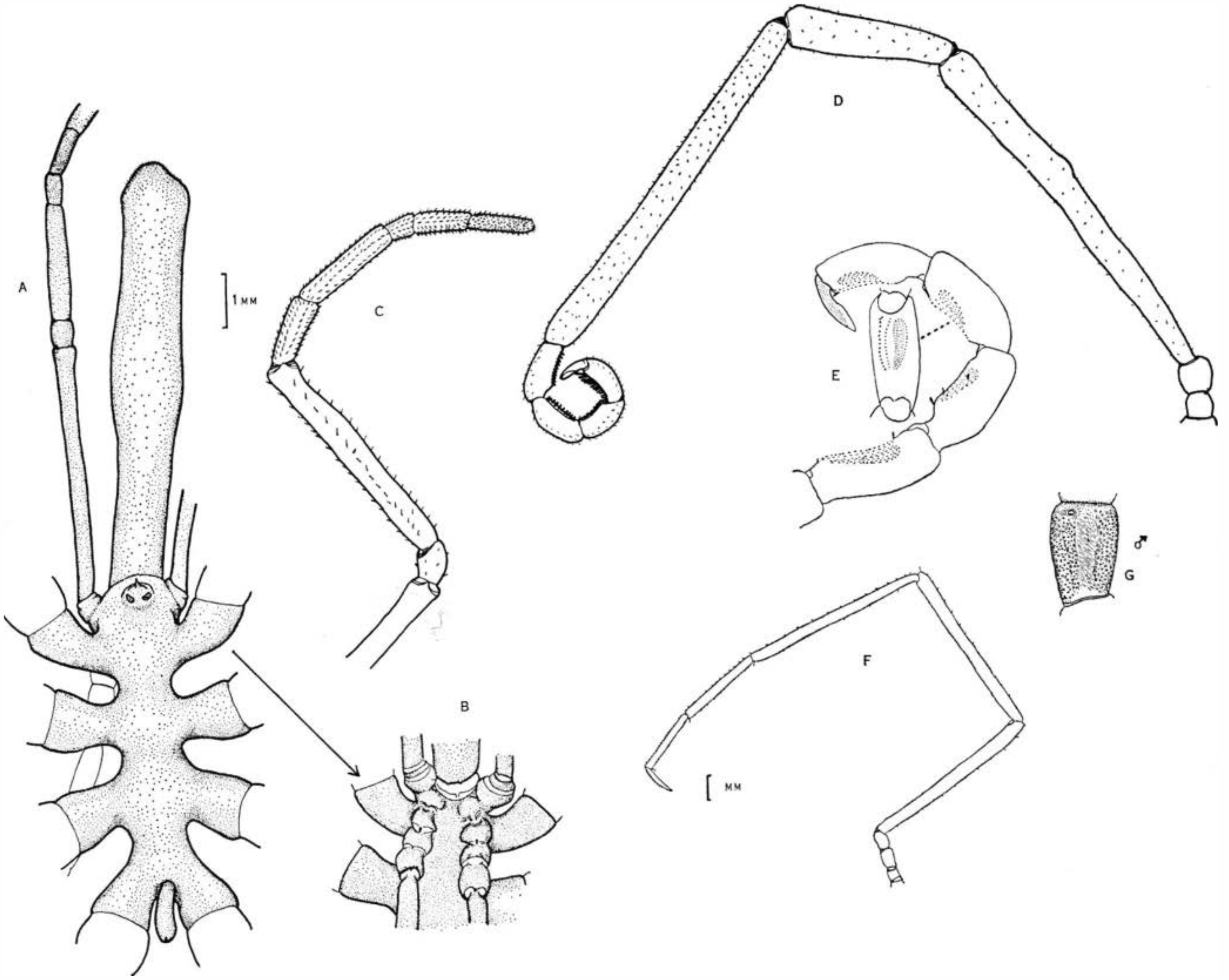

FIG. 15—*C. megalonyx megalonyx*: A, Dorsal view of trunk and proboscis; B, insertion of proboscis, palps, and ovigers into trunk; C, terminal segments of left palp; D, left oviger; E, terminal segments of right oviger; F, 3rd left leg; G, 2nd coxa, showing cuticle patterning and male genital orifice. Scales indicate 1 mm.

ABNORMALITIES OF THE PALP: In five specimens of *C. m. megalonyx*, one or other palp is aberrant, having eight instead of nine segments (Table 4). A similar condition has been noted (Calman, 1915, footnote to p. 26) in *Colossendeis lilliei*, and it also appears in *Decolopoda*. This might appear to be a very trivial feature, except that it enables us to recognise that some of the terminal palp segments form a unit and apparently react together to certain morphogenetic factors.

Superficially, a palp with one segment less than the normal could be the result of partially completed regeneration processes or their disturbance, or of a disturbance of the normal initial growth pattern of the palps.

The two immature specimens of *Colossendeis* discussed (p. 51) and figured (Figs. 72–74) indicate that the growth pattern of the palps in this genus is more complicated than that described by Sanchez (1959, pp. 39–45) for *Nymphon gracile* and *Achelia echinata*. In the specimen from Trans-Antarctic (NZ) Sta. 1, the articulation between the 3rd and 4th definitive segments is not fully formed, even though the palp is composed of eight clearly articulated segments.

In the five specimens which have a "wrong" number of segments in one palp, the relative lengths of the four terminal segments are unaffected, except in (1), where the 9th segment simply appears to be missing. In the other four, the totals of the four terminal segments are approximately equal for both right and left palp.

Whatever the initial cause of there being one articulation less in the palps of these specimens, the evidence suggests that the four terminal segments react together as a unit in longitudinal growth. Segmentation of this unit is apparently controlled by another factor or factors.

TABLE 4—Aberrant Palps in *Colossendeis megalonyx megalonyx**

(1) GLD 10 ♂

Segments	Right		Left	
9th	..	23.78	7.28	28.21
8th	8.11		7.06	
7th	3.78		3.65	
6th	11.89		10.22	
5th	8.38		9.73	
4th	27.57		25.79	
3rd	4.05		3.65	
2nd	36.22		32.60	
Total L.	37.0 mm		41.10 mm	

(2) A 456 No. 21♀

Segments	Right		Left	
9th	..	29.05	5.77	29.05
8th	10.00		6.58	
7th	7.19		5.11	
6th	14.39		11.59	
5th	7.19		7.23	
4th	23.80		24.59	
3rd	2.87		3.64	
2nd	34.46		35.52	
Total L.	18.47 mm		18.39 mm	

(3) A 459 No. 25 ♂

Segments	Right		Left	
9th	..	27.60	8.15	27.47
8th	9.00		6.34	
7th	6.60		3.32	
6th	12.00		9.66	
5th	7.50		7.25	
4th	25.20		24.16	
3rd	3.00		3.32	
2nd	36.60		37.75	
Total L.	33.03 mm		33.10 mm	

(4) A 459 No. 25 ♀

Segments	Right		Left	
9th	8.22	29.59	..	28.77
8th	6.30		8.46	
7th	4.11		6.77	
6th	10.96		13.54	
5th	7.95		7.33	
4th	24.39		23.97	
3rd	2.74		3.10	
2nd	35.53		36.66	
Total L.	36.50 mm		35.40 mm	

(5) A 461 ♂

Segments	Right		Left	
9th	..	27.43	8.20	29.00
8th	6.41		6.45	
7th	7.59		3.22	
6th	13.43		11.13	
5th	8.74		8.79	
4th	27.44		23.44	
3rd	4.08		2.93	
2nd	32.13		35.75	
Total L.	32.74 mm		34.10 mm	

*Lengths of palp segments expressed as percentage of total length of eight distal segments.

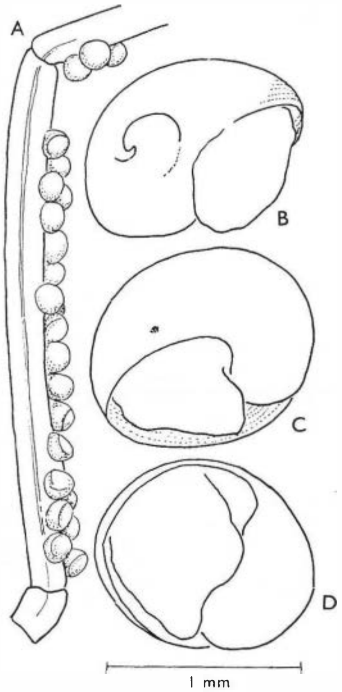

FIG. 16—A, coxa, femur, and part of tibia I of specimen of *C. m. megalonyx* showing adhering prosobranch egg capsules; B, C, D, embryos removed from capsule. (See Hedgpeth, 1964.)

Colossendeis megalonyx scoresbii n. comb. (Figs. 7, 8, 17–20, 23)

MATERIAL EXAMINED

Eltanin Sta. 489, 1♂.
B.M. (N.H.) Regn. No. 1933.3.23.40 (Holotype); 1933.3.23.41–48 (Paratypes); 81.38, *Challenger* Sta. 313.

DESCRIPTION

Based on data from all previously identified specimens of the species.

SIZE RANGES EXAMINED. (see also Figs. 7, 8, 17):

	Juveniles	Adults
L. trunk	2.74– 5.64 mm	7.30– 8.30 mm
L. proboscis	2.41– 6.93	7.50– 8.10
L. palp	2.93– 8.36	9.94–12.40
L. leg	13.89–34.99	43.50–55.00

This species falls within the ranges of the character states of *C. m. megalonyx* except in the following:

(1) Sexual maturity is attained at leg lengths between 35 and 40 mm.

(2) The heterogonic growth relationships of leg and trunk, 3 coxae, and 3 distal leg segments (see p. 24, Figs. 7, 8, 17–20, and Table 2).

(3) The ratio of the length of the tarsus to the length of the propodus varies between 0.94 and 1.09.

(4) The length of the claw to the length of the propodus varies between 1.00 and 1.35.

(5) The length of the femur to the length of the 2nd tibia varies between 1.42 and 1.69.

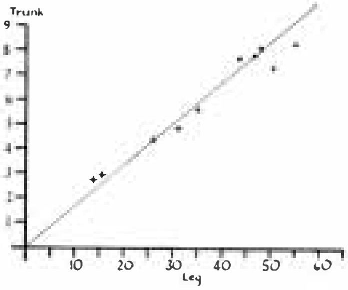

FIG. 17—*C. m. scoresbii:* Relative growth of leg length and trunk length. Juveniles denoted by crosses. (Dimensions in mm.)

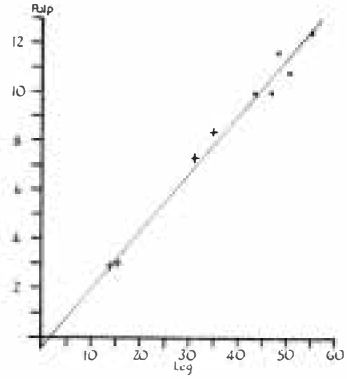

FIG. 19—*C. m. scoresbii:* Relative growth of leg length and palp length. Juveniles indicated by crosses. (Dimensions in mm.)

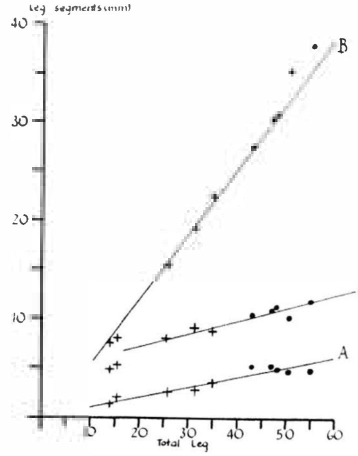

FIG. 20—*C. m. scoresbii:* Relative growth of three groups of leg segments. A, three coxae; B, femur + two tibiae; C, three terminal segments. Juveniles indicated by crosses. (Dimensions in mm.)

(6) The configuration of the ovigeral spine fields in large juveniles and adults is

$$\text{NS}: \frac{\text{Sp}}{\text{A}} : \frac{\text{MF}}{\text{B}} : \frac{\text{N/P}}{\text{n} = 2}$$

RECORDED DISTRIBUTION AND DEPTH RANGE:

Subantarctic, confined to the Magellanic region only. Depth range—143–5,227 m.

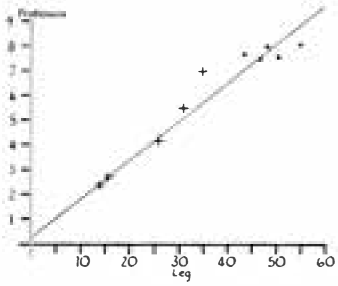

FIG. 18—*C. m. scoresbii:* Relative growth of leg length and proboscis length. Juveniles indicated by crosses. (Dimensions in mm.)

Colossendeis megalonyx arundorostris n. subsp. (Fig. 7, 8 11–14, 21, 23)

MATERIAL EXAMINED

Atka Sta. 4 (= AT–4), 78° 10′S, 162° 22′W to 78° 09′S, 162° 30′W; 610 m, 1 ♀ (holotype) U.S.N.M. Holotype No. 113000, 1 juvenile.

DESCRIPTION

Trunk, proboscis, and appendages extremely slim and attenuated. Type specimen and juvenile completely glabrous. Ovigeral spine field of configuration

$$\text{NS}: \frac{\text{Sp}}{\text{A}} : \frac{\text{MF}}{\text{B}} : \frac{\text{N/P}}{\text{n}=2}$$

in both specimens.

DIMENSIONS

	Type ♀	Juvenile
Left palp	24.87 mm	16.56 mm
L. 9th segt.	2.13	1.19
L. 8th	1.99	0.93
L. 7th	0.40	0.26
L. 6th	2.8×0.33	1.69×0.26
L. 5th	1.99	1.19
L. 4th	7.05	4.39
L. 3rd	0.61	0.40
L. 2nd	7.90	6.51
L. proboscis	20.5	12.50
L. trunk	8.0	5.05
L. abdomen	2.4	1.33
Sep. lat. procs.	1.00	0.66
W. trunk across 2nd lat. procs.	5.2	2.2
3rd right leg	110.10	65.67
L. coxa 1	1.50	0.93
L. coxa 2	2.2	0.93
L. coxa 3	2.1	1.06
L. femur	30.2	16.76
L. tibia 1	24.5	14.60
L. tibia 2	22.3	13.30
L. tarsus	13.2	8.25
L. propodus	8.9	6.12
L. claw	5.2 (3rd left)	3.72

RELATIVE PROPORTIONS

	Type ♀	Juvenile
L. palp ÷ L. proboscis ..	1.21	1.32
L. palp ÷ L. trunk ..	3.11	3.28
L. leg ÷ L. proboscis ..	5.37	5.25
L. leg ÷ L. palp	4.43	3.96
L. leg ÷ L. trunk	13.76	13.00
L. proboscis ÷ L. trunk ..	2.56	2.47
L. femur ÷ L. tibia 1 ..	1.23	1.15
L. femur ÷ L. tibia 2 ..	1.32	1.26
L. tarsus ÷ L. propodus ..	1.48	1.35
L. claw ÷ L. propodus ..	0.59	0.65

Colossendeis megalonyx orcadense n. comb. (Figs. 7, 8, 11–14, 22, 23)

MATERIAL EXAMINED

Through the kindness of Mr Rodger Waterston and the authorities of the Royal Scottish Museum, we have been able to re-examine Hodgson's type specimen.

Eltanin Sta. 393, 1 ♂.

DESCRIPTION

Based on the type specimen and one additional male specimen, augmented by information in Hodgson's description and in Fage (1956) and Stock (1963). The holotype has been fixed with glue to an opaque glass plate, and therefore it was not possible to examine all of its structures.

EYES. Completely lacking, or if present, entirely unpigmented.

OVIGERAL SPINE FIELDS: Ovigeral spine fields with the configuration

$$\mathrm{NS} : \frac{\mathrm{Sp}}{\mathrm{A}} : \frac{\mathrm{MF}}{\mathrm{B}} : \frac{\mathrm{N/P}}{\mathrm{n}=2.}$$

RECORDED SIZE RANGES:

L. leg	110–126 mm
L. trunk	12–13 (?+)
L. proboscis	18–20
L. palp	27.3–35.85

PERCENTAGE LENGTHS OF SEGMENTS:

Palp segments

	Holotype	Madagascar
9th	6.95	8.05 (—)
8th	6.95	7.32 (—)
7th	5.00	3.66 (—)
6th	15.98	14.64 (—)
5th	11.12	11.34 (—)
4th	19.46	21.96 (—)
3rd	3.61	?
2nd	30.58	32.94 (—)

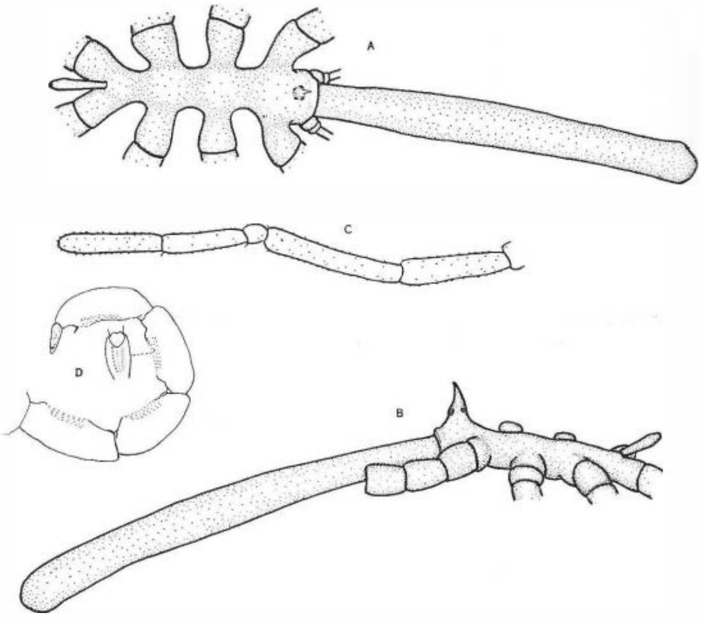

FIG. 21—*C. megalonyx arundorostris*: A, dorsal, B, lateral views of trunk and proboscis: C, terminal segments of left palp; D, terminal segments of right oviger, showing one of the two juvenile conditions observed in the spine field of this species.

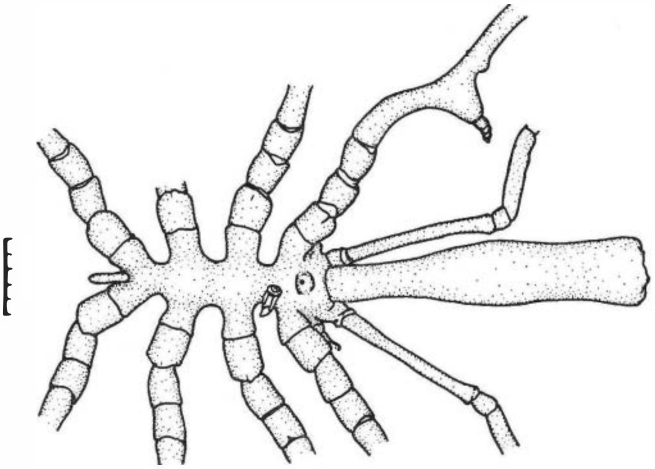

FIG. 22—*C. megalonyx orcadense*: dorsal view of trunk and proboscis of Hodgson's type specimen of *C. orcadense*. (The scale represents mm.)

Leg

3 coxae ..	5.46	5.53
Femur ..	29.12	27.65
Tibia 1 ..	33.67	23.70
Tibia 2 ..	20.02	18.96
Tarsus ..	10.01	10.27
Propodus ..	6.37	6.71
Claw ..	4.55	6.71

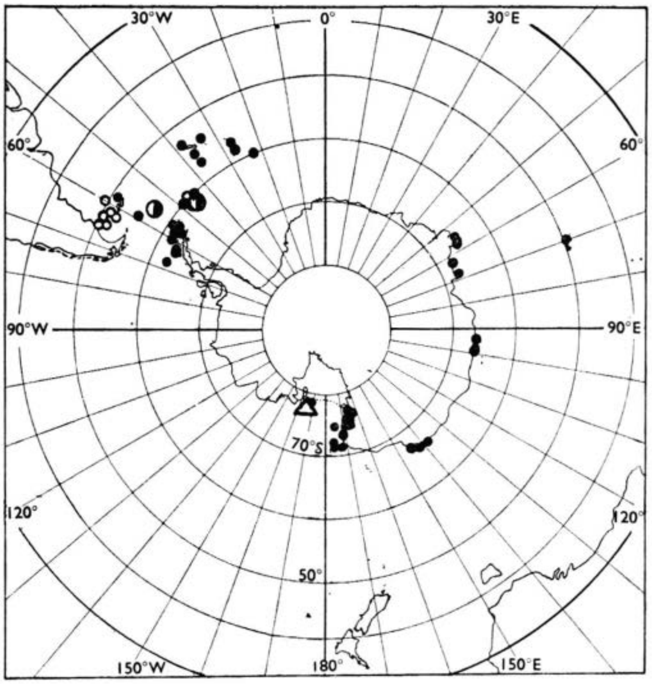

FIG. 23—Distribution of sub-species of *C. megalonyx*: solid circle = *C. m. megalonyx*; hollow circle = *C. m. scoresbii*; hollow triangle = type locality of *C. m. arundorostris*; circle with right half solid = *C. m. orcadense*.

RELATIVE PROPORTIONS (See also Figs. 7, 8, 11–14, and Table 2):

	Holotype	Madagascar
L. leg ÷ L. trunk	8.46	10.50
L. leg ÷ L. proboscis	5.50	7.00
L. leg ÷ L. palp	3.06	4.61 (−)
L. palp 4th ÷ L. palp 2nd	0.63	0.67
L. femur ÷ L. tibia 1	1.14	1.16
L. femur ÷ L. tibia 2	1.45	1.45
L. proboscis ÷ L. trunk	1.53	1.50

DEPTH RANGE AND DISTRIBUTION

The Madagascar and South African records extend by more than two thousand metres the greatest depth recorded for *Colossendeis megalonyx*. In view of the variable development of its eyes, it seems reasonable to suggest that this sub-species is primarily an abyssal form. Hodgson gave no depth for his specimen, although he refers to it as a "shallow water" form. Such an apparently wide bathymetric range is not as surprising as appears at first. *C. angusta*, which occupies an abyssal habitat in all major temperate and tropical ocean basins is found in the sub-littoral region of the Arctic (Stephensen, 1933).

Colossendeis robusta Hoek, 1881 (Fig. 7, 8, 10, 24–31)

Colossendeis robusta Hoek, 1881: 66; IX 4–5. Möbius, 1902: 190; XXIX 1–5. Bouvier, 1913: 54; 8–11. Calman, 1915b: 24. Gordon, 1932b: 12 (in key). Helfer and Schlottke, 1935: 293. Gordon, 1938: 8 (in key).

Colossendeis glacialis Hodgson, 1907b:61; IX 2, X 3–4. Calman, 1915b: 20–22. Gordon, 1932b:21–2; 4d, 7g, 8a. Helfer and Schlottke, 1935:293. Gordon, 1938:8 (in key), 11. Gordon, 1944:10.

Colossendeis gracilipes Bouvier, 1911b:1137. Bouvier, 1913: 58–63; 12–19. Helfer and Schlottke, 1935: 2193.

MATERIAL EXAMINED

NZOI Sta. A 449, 1 juvenile; Sta. A 456, 2 ♂♂, 4 ♀♀, 1 juvenile; Sta. A 459, 1 ♂; Sta. A 464, 1 ♀; Sta. A 467, 1 ♂; Sta. A 471, 1 ♀.

Trans-Antarctic (N.Z.) Sta. 1, 1 juvenile; Sta. 79, 4 ♀♀, 1 juvenile. *Northwind* Sta. 5, 4 ♀♀, 1 ♂; *Atka* Sta. 22a, 1 ♂; *Staten Island* Sta. 1, 1 ♂; *Burton Island* Sta. 8, 1 ♀; Sta. 13, 1 ♂.

Stanford Sta. K, 1 ♂; Sta. N, 1 ♂; Sta. X, 1 juvenile; Sta. 61D, 1 ♂; Sta. EAD-3,1 ♂; Bay of Whales, 14:3:1961, 1 chelate juvenile.

Eltanin Sta. 418, 1 ? ♂; Sta. 432, 1 ♂; Sta. 514, 1 adult (recent ecdysis).

B.M. (N.H.) Regn. Nos. 1907. 6. 24. 103–7 (Types of *glacialis*); 1915.7.24.29–32; 1915.7.24.37–8; 1933.3.23.50–6; 1942.12.30.6–7; 81. 38 (Holotype of *robusta*); 1915.7.24.41–2; 1920.7.21.46.

There is considerable confusion in the literature over the supposed differences between *C. robusta* and *C. glacialis*, here united under the prior name. Gordon (1932 and 1944) considered they might be separated by the relative lengths of the femur and 2nd tibia, while the "bottle-shape" of the terminal palp segments of *C. glacialis*, and the relative degrees of development of body spines have also been used as diagnostic criteria.

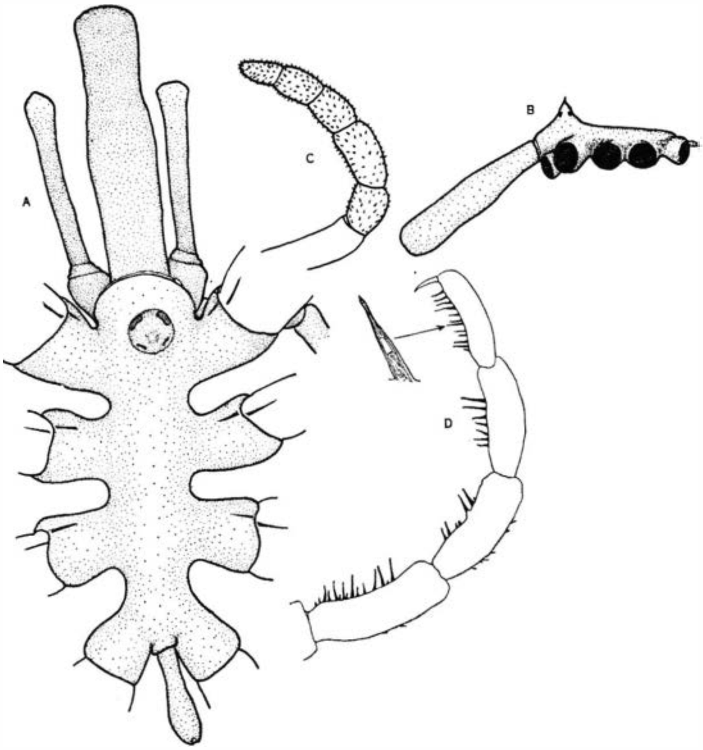

FIG. 24—*C. robusta*: A, dorsal and B, lateral, views of trunk and proboscis; C, terminal segments of left palp; D, terminal segments of left oviger showing the form of the needle spines in row A observed in some specimens.

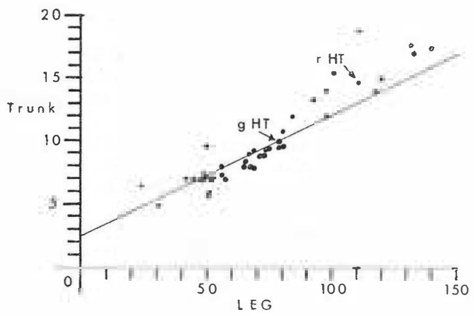

FIG. 25—*C. robusta:* Relative growth of leg length and trunk length. gHT = holotype of *glacialis;* rHT = holotype of *robusta.* The regression curve has been calculated for the total data. (Dimensions in mm.)

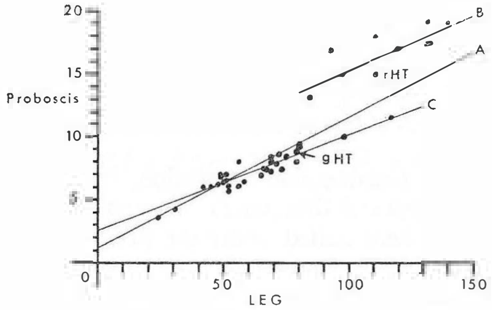

FIG. 26—*C. robusta:* Relative growth of leg length and proboscis length. gHT = holotype of *glacialis;* rHT = holotype of *robusta.* Regression curve A fits the total data; curve B fits the data when proboscis length is more than 12 mm; curve C fits the data when the proboscis length is less than 12 mm. (Dimensions in mm.)

We have not been able to distinguish between the two described species, although it is still possible that the sample described here as *C. robusta* does not represent a single homogeneous population.

Gordon (1932) claimed that in *C. glacialis* the femur is longer than the 2nd tibia, while in *C. robusta* the reverse holds. Figure 29 shows the distribution of the states of this character about unity, in the total sample here described as *robusta.* The histogram is apparently bimodal, but this could be due entirely to the nature of the sample. The ratio length of femur : length of 2nd tibia plotted against leg length gives no clear indication that the sample is heterogeneous (Fig. 30).

The plots of "leg against proboscis" and "leg against palp" show a scatter quite unlike anything encountered in the rest of the genus. In these plots there is some suggestion of two entities with different heterogonic growth.

The data of the plot of leg length against palp length (Fig. 27) we considered to be inadequate for further statistical analysis, but for the other plot we selected a null hypothesis that there are two groups, one with proboscis length less than 12 mm, and the other with proboscis length of more than 12 mm. The regression lines of heterogonic growth (against leg length) of these two groups were found to be quite distinct (Fig. 26, B, C). This in itself is inconclusive, since the null hypothesis precluded the incorporation of any data from small individuals with data from the group with proboscis length more than 12 mm. On the other hand, the removal of several data from the total of data used to calculate the regression line of the group with proboscis length of less than 12 mm would not have greatly altered the position or slope of the regression line of that group, so slight is the scatter about the lower regression line. The fact remains that the equations for both regression lines B and C are quite unlike the heterogonic growth equations of leg : proboscis encountered in any of the other species (see Table 2).

For these reasons we have been forced to reject the idea that the sample is taxonomically heterogeneous, especially as no comparable phenomenon could be detected for any other character. If this is so, then the heterogonic growth relationship of leg and proboscis in this species must be quite unlike that found in the other species of *Colossendeis*, for only an S-shaped curve with greatly increased variance at the higher leg lengths would appear to fit the data in Figs. 26 and 27.

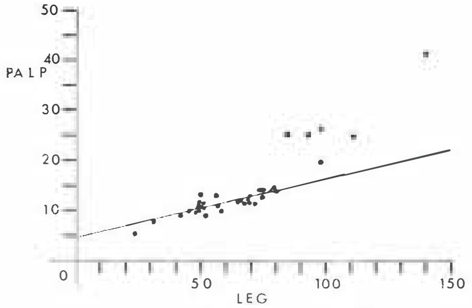

FIG. 27—*C. robusta:* Relative growth of leg length and palp length. The regression curve fits the total data. (Dimensions in mm.)

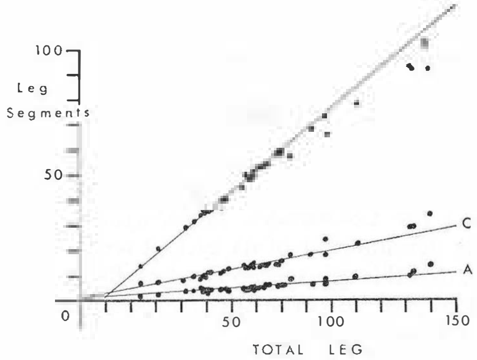

FIG. 28—*C. robusta:* Relative growth of three units of leg segments. A, three coxal segments; B, femur + two tibiae; C, three terminal segments. The regression curves fit the total data in each case. (Dimensions in mm.)

Such a heterogonic growth pattern indicates a sudden increase in growth rate of the proboscis, relative to all other structures measured, at leg lengths between 80 mm and 120 mm.

We found that we could not rely on the shape of the terminal segments of the palp to separate *robusta* and *glacialis*, for variation in the shape of these is very wide and apparently continuous.

Similarly, the degree of spination of the trunk and proboscis, even among specimens which might be designated as *robusta* or *glacialis* because of the relative lengths of their femora and 2nd tibiae, is extremely variable, and extends from a completely glabrous condition to that depicted by Bouvier for *robusta* (*gracilipes*, Bouvier, 1911a).

Bouvier apparently associated a rough, knobbed appearance of the lateral processes and coxae with *robusta*. This condition appears to be correlated with size—and, presumably, age.

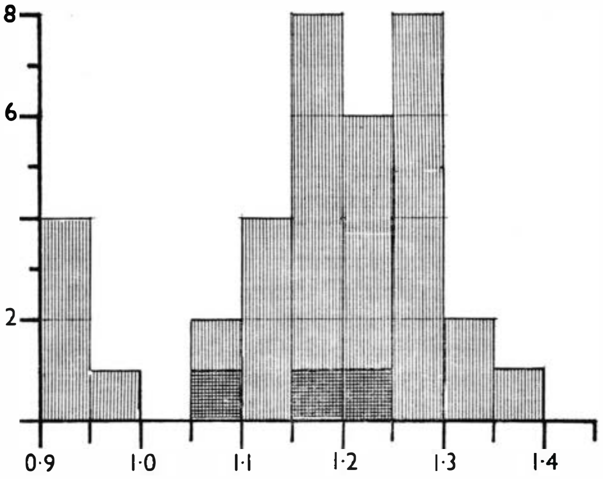

FIG. 29—*C. robusta*: distribution of values of the ratio length of femur : length of 2nd tibia amongst specimens attributable to either *C. robusta* or *C. glacialis*. Ordinate indicates frequency; abscissa indicates values of the ratio. (NOTE: The variation in hatching on this diagram has no significance.)

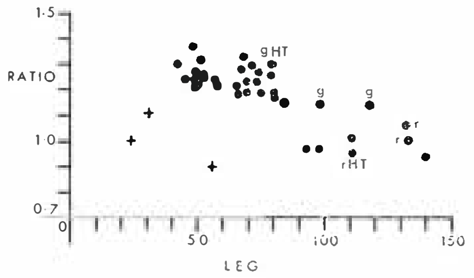

FIG. 30—*C. robusta:* variation in the ratio length of femur length of 2nd tibia with changes in the total leg length. gHT = holotype of *glacialis;* rHT = holotype of *robusta;* g = paratypes of *glacialis;* r = paratypes of *robusta;* juveniles indicated by crosses. (Leg length in mm.)

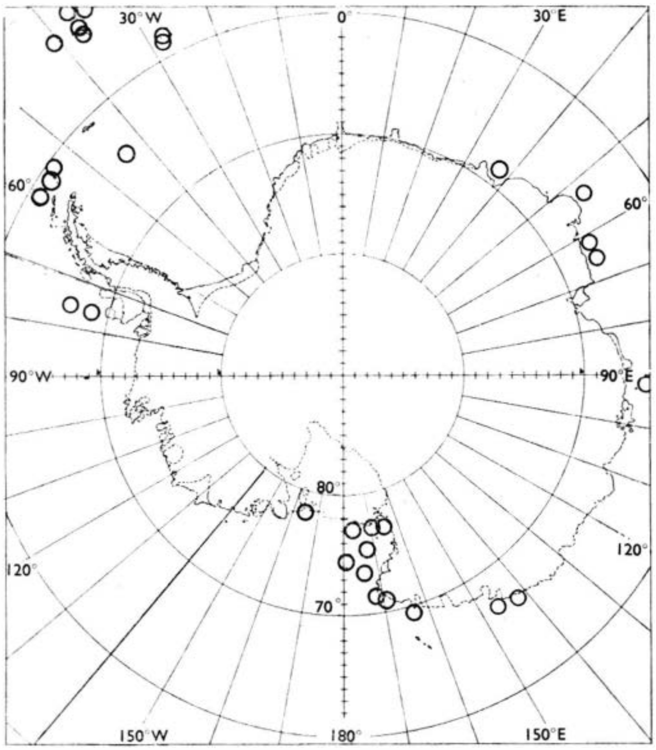

FIG. 31—Distribution records of *C. robusta.*

DESCRIPTION

Based on 47 adult and nine juvenile specimens, supplemented by information from previously published descriptions.

PROBOSCIS SHAPE: B''': 1.

OVIGERAL SPINE FIELD CONFIGURATION:

$$\text{NS} : \frac{\text{P/N}}{\text{A}} : \frac{\text{P/N}}{\text{n}=3}$$

RELATIVE LENGTHS: Relative lengths of nine structures, and their variations, are shown in Figs. 25–28.

SIZE RANGES:

	Adults	Juveniles
L. proboscis	5.70– 19.10 mm	4.20– 6.40 mm
L. trunk	5.90– 17.40	4.90– 7.30
L. palp	9.07– 41.67	7.69–12.90
L. leg	45.40–140.20	23.83–56.70

PERCENTAGE LENGTHS OF SEGMENTS:

Left Palp	Adults	Juveniles
9th	6.61– 10.32	7.44– 9.69
8th	6.73– 9.39	7.43– 9.69
7th	6.58– 9.32	7.26– 8.58
6th	9.42– 13.62	10.85–12.26
5th	6.83– 10.37	6.85–10.53
4th	14.09– 23.85	17.29–23.85
3rd	3.76– 6.85	4.15– 8.58
2nd	26.34– 33.85	27.12–30.51

Third Leg	Adults	Juveniles
3 coxae	6.64–11.28	7.82– 8.94
Femur	21.51–27.05	20.07–24.99
Tibia 1	20.87–27.30	19.41–27.07
Tibia 2	19.11–23.46	20.07–22.70
Tarsus	6.66–10.92	9.50–16.72
Propodus..	5.86–8.94	6.46– 9.57
Claw	2.62–6.93	3.83– 7.72

RELATIVE PROPORTIONS (see also Figs. 7, 8, 25–30):

	Range
L. proboscis÷L. trunk	0.83–1.26

RECORDED DISTRIBUTION

See Fig. 31.

RECORDED DEPTH RANGE

c. 0.3 m—3,610 m.

Colossendeis stramenti* n.sp. (Figs. 32–33)

MATERIAL EXAMINED

Eltanin Sta. 558, 51° 55′ 02″ S, 56° 38.7′ W to 51° 58′ S, 56° 38′ W, 845–645 m, 1 ♂ Holotype, 1 ♀ paratype, U.S.N.M. Holotype No. 113385.

Unfortunately, both specimens are much broken, although all parts are present. Because the two specimens are almost exactly equal in size it was not possible to identify the owner of each loose appendage. It may be necessary, therefore, to select a new holotype when more specimens are found.

DESCRIPTION

Based on the damaged ♂ holotype and damaged ♀ paratype.

TRUNK: Trunk without traces of segmentation, almost completely glabrous (only a few scattered small spinules); 1st and 2nd lateral processes separated by 1.0; ocular tubercle very low and rounded, wider than long, occupying almost the whole width of the cephalon, with indication of separation into two lateral lobes; eyes completely absent; lateral processes smooth, without any processes.

PALP: 9-segmented, with only a few small scattered spinules; all segments articulated synaxially; segments in order of decreasing length 2nd : 4th : 6th : 7th≃5th≃8th : 9th : 3rd; length of 4th segment ÷ length of 2nd segment = 0.67; 5th segment less than three times as long as wide, and less than 10% of the total palp length; 6th segment more than 10% of the total palp length, and less than three times as long as wide.

PROBOSCIS SHAPE: B''' : 1, slightly longer than trunk (1.07 times as long in holotype).

OVIGERAL SPINES:

$$NS : \frac{Sp}{A} : \frac{Sp/N}{B} : \frac{MF/P}{C}$$

LEGS: All damaged, no estimate of their length possible; spination very meagre, few scattered spinules only; tarsus longer than propodus; genital pores on the ventral surface of 2nd coxae of all four pairs of legs in both sexes.

DIMENSIONS:

	Holotype ♂	Paratype ♀
L. trunk	8.39mm	9.19mm
Gtst. w. trunk (across 2nd latl. procs.)	4.84	4.84
L. proboscis	9.03	?
L. abdomen	2.09	2.26
Total L. palp	14.82	?
Palp 9th segment	1.13	..
L. 8th segment	1.29	..
L. 7th segment	1.29	..
L. 6th segment	1.61	..
L. 5th segment	..1.29 (×0.80)	..
L. 4th segment	2.90	..
L. 3rd segment	0.80	..
L. 2nd segment	4.51	..

DISCUSSION

The ocular tubercle indicates that this species is essentially a deep water form, and further deep hauls in the Magellanic region will doubtless show that its range extends below the recorded depth. In terms of the ovigeral spine formula *C. stramenti* is closest to *wilsoni*, *colossea*, and *minuta* amongst those species in which the spines have been described. On other counts, however, *stramenti* appears to be morphologically very similar to *hoekii*, *robusta*, and *bruuni* Fage, 1956.

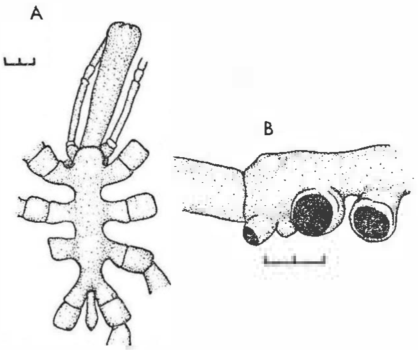

FIG. 32—*C. stramenti*: A, dorsal view of holotype ♂; B, lateral view of cephalic region of holotype. (The scales represent 2 mm.)

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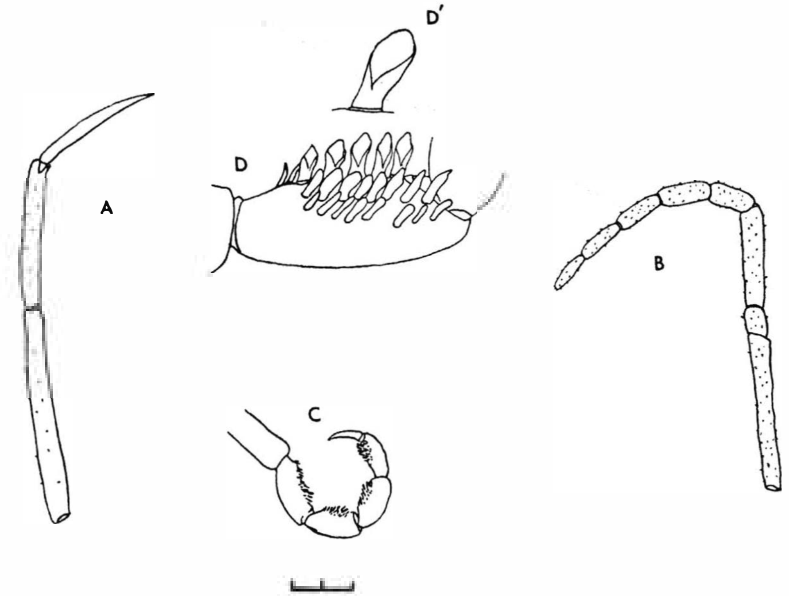
*Stramentum, L.=straw.

FIG. 33—*C. stramenti*: A, terminal segments of walking leg; B, terminal segments of palp; C, terminal segments of oviger; D and D′, eighth oviger segment showing distribution and form of ovigeral spines. A, B, and C all to the same scale (indicated as mm.)



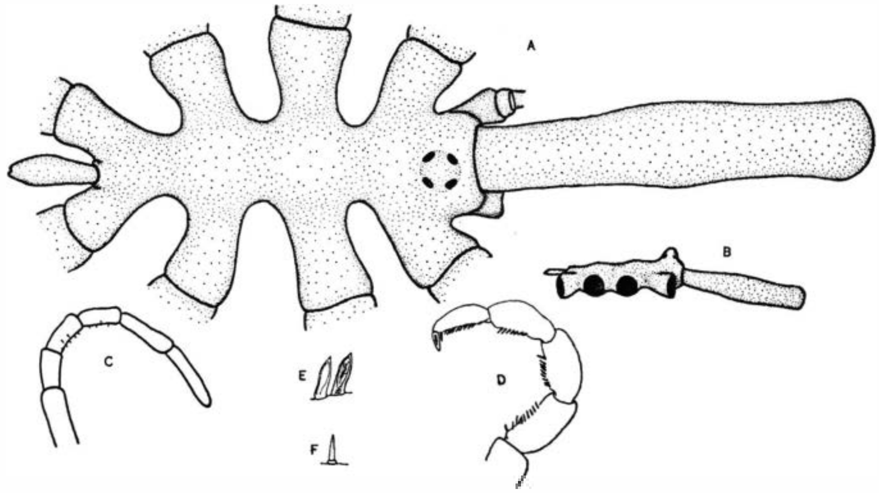


FIG. 34—*C. drakei*: A, dorsal, and B, lateral views of trunk and proboscis; C, terminal segments of left palp; D, terminal segments of right oviger; E, spines of row A; F, spines of area n of the ovigeral spine fields.

Colossendeis drakei Calman, 1915. (Figs. 7, 8, 10, 34–39)

Colossendeis drakei Calman, 1915b: 11, 22–3; 3. Gordon, 1932: 22–4; 4c, 7e, f, 8b. Helfer and Schlottke, 1935: 294. Gordon, 1938: 8 (in key), 10. Gordon, 1944: 10–11.

MATERIAL EXAMINED

NZOI Sta. A 459, 1 ♂.
Northwind Sta. 8, 1 ♂.

B.M. (N.H.) Regn. Nos. 1915.7.24.39–40 (Types); 1933.3.23.57–59; 1942.13.30.9.

DESCRIPTION

Based on eight adults, and on Calman's and Gordon's discussions.

PROBOSCIS SHAPE: B‴:1.

OVIGERAL SPINE FIELD CONFIGURATION:

$$\mathrm{NS} : \frac{\mathrm{Sp}}{\mathrm{A}} : \frac{\mathrm{MF}}{\mathrm{B}} : \frac{\mathrm{N/P}}{\mathbf{n}=2}$$

PALP: Palp with terminal segments appearing even more slender than indicated in Gordon's (1932) figures; a few scattered spines on the ventral side of segments six and seven.

RECORDED SIZE RANGES (no data from juveniles):

L. leg	43.0–68.3mm
L. trunk	6.5–8.9
L. proboscis	5.5–8.5
L. palp	12.14–14.20

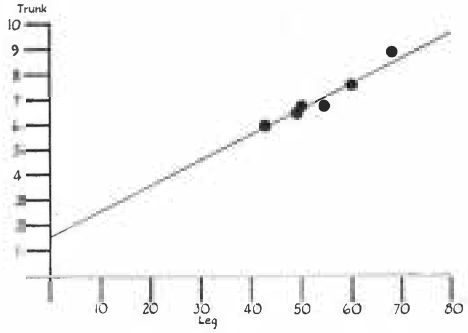


FIG. 35—*C. drakei:* Relative growth of leg length and trunk length. (Dimensions in mm.)

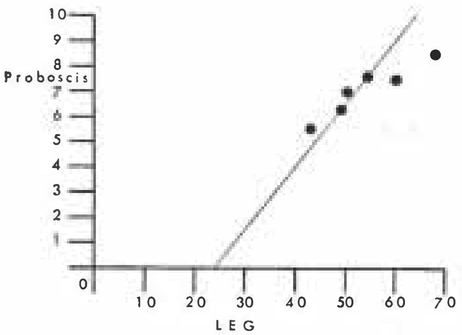


FIG. 36—*C. drakei:* Relative growth of leg length and proboscis length. (Dimensions in mm.)

PERCENTAGE LENGTHS OF SEGMENTS:

Left Palp	Range
9th	11.19–12.01
8th	9.79–10.77
7th	6.50–8.38
6th	7.46–7.78
5th	6.50–7.18
4th	22.46–24.03
3rd	4.19–5.43
2nd	26.93–29.92

Third Leg	Range
3 coxae	7.30–8.35
Femur	24.82–27.24
Tibia 1	21.67–22.53
Tibia 2	18.56–20.19
Tarsus	8.17–8.82
Propodus	7.30–8.51
Claw	6.77–8.12

RELATIVE PROPORTIONS (see Table 2; Figs. 7, 8, 36–38):

	Range
L. leg÷L. trunk	7.54–7.93
L. leg÷L. proboscis	7.19–8.04
L. leg÷L. palp	4.51–4.81
L. proboscis÷L. trunk	0.91–1.11
L. palpal 4÷L. palpal 2	0.75–0.86
L. femur÷L. tibia 1..	1.14–1.25
L. femur÷L. tibia 2	1.23–1.42

DISTRIBUTION

See Fig. 39. Specimens have been taken at depths between 3 and 549 m.

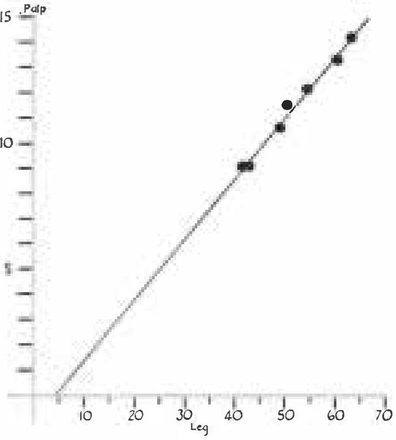


FIG. 37—*C. drakei:* Relative growth of leg length and palp length. (Dimensions in mm.)

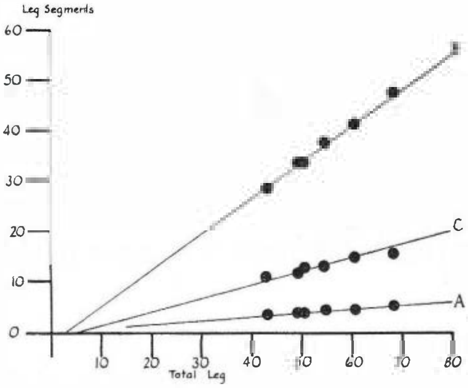


FIG. 38—*C. drakei:* Relative growth of three units of leg segments. A, three coxal segments; B, femur + two tibiae; C, three distal segments. (Dimensions in mm.)

Colossendeis tortipalpis Gordon, 1932. (Figs. 7, 8, 10, 40–45)

> *Colossendeis tortipalpis*, Gordon, 1932: 12–15; 2b–e, 4a. Helfer and Schlottke, 1935: 294. Gordon, 1944: 9–10.

MATERIAL EXAMINED

NZOI Sta. A 464, 1 ♀.
B.M. (N.H.) Regn. No. 1933.3.23.15 (Holotype); 1933.3.23.13–14 (Paratypes); 1942.12.30.5.

This is only the third record for this species. The other specimens were taken by the *Discovery* and B.A.N.Z.A.R. expeditions.

The single specimen in this collection agrees fairly closely with the other specimens and with Gordon's initial description of the species, although one or two differences are apparent. The proboscis is considerably more attenuated in its distal half than previously indicated, and the trunk bears a distinct post-ocular hump. In relative proportions of leg segments, this specimen falls between the *Discovery* and B.A.N.Z.A.R. expeditions' specimens. The palp segments agree with Gordon's description of the relative lengths of the 5th, 6th, 8th, and 9th segments, but the 2nd is about 1.3 times the length of the 4th instead of 1.5 as quoted by Gordon (1932).

DESCRIPTION

Based on five adults, as well as previous descriptions.

PROBOSCIS SHAPE: B or B′: 2: E.

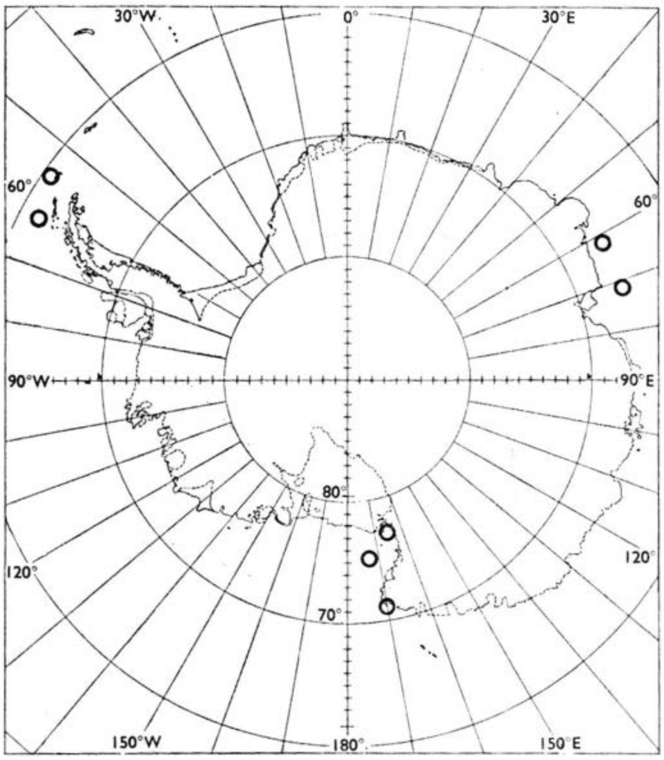


FIG. 39—Distribution records of *C. drakei*.

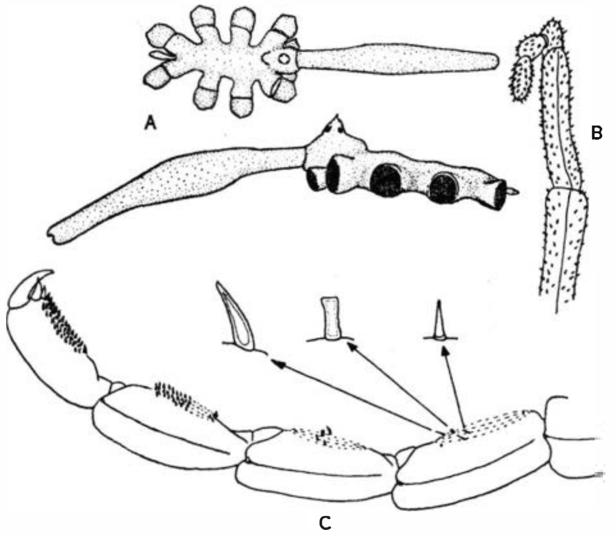


FIG. 40—*C. tortipalpis*: A, dorsal and lateral views of trunk and proboscis; B, terminal segments of left palp; C, terminal segments of left oviger, showing the three types of special spines.

OVIGERAL SPINE FIELD CONFIGURATION:

$$S : \frac{P}{A} : \frac{P}{B} : \frac{N}{n} = 2/3.$$

Pronounced post-ocular hump. Greatest trunk width across the first pair of lateral processes. In most, if not all other, species of *Colossendeis*, the greatest width is across the second pair.

SPINATION OF THE LEGS: Gordon (1932) has noted that both this species and *Colossendeis australis* have ventral semi-circles of stout spines at the distal ends of the 2nd tibia and the tarsus. However, this character occurs with various frequencies, and is variously developed, in all species of the genus studied.

SIZE RANGES:

	Adults	Juveniles
L. palp ..	21.12mm*	—
L. trunk ..	9.0–17.2	7.7
L. proboscis	15.5–31.8	12.5
L. leg ..	60.9–129.00	61.8

*Data from one specimen only.

PERCENTAGE LENGTHS OF SEGMENTS:

Left Palp	Range
9th	3.73– 3.86
8th	2.44– 2.51
7th	1.42– 3.07
6th	9.20– 9.41
5th	9.34– 9.41
4th	27.51–29.56
3rd	3.13– 3.17
2nd	42.41–39.02

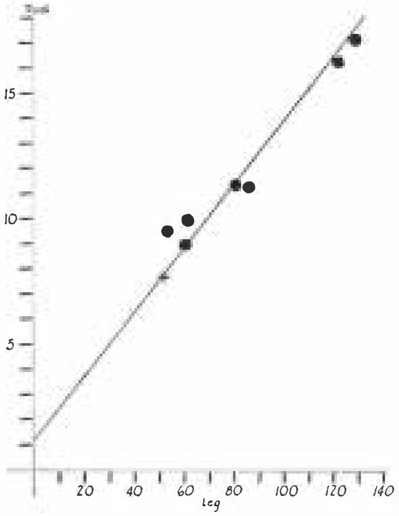


FIG. 41—*C. tortipalpis:* Relative growth of leg length and trunk length. The cross indicates a juvenile specimen. (Dimensions in mm.)

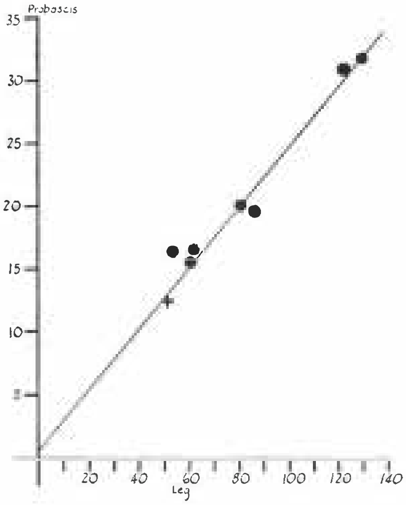


FIG. 42—*C. tortipalpis:* Relative growth of leg length and proboscis length. The cross indicates a juvenile. (Dimensions in mm.)

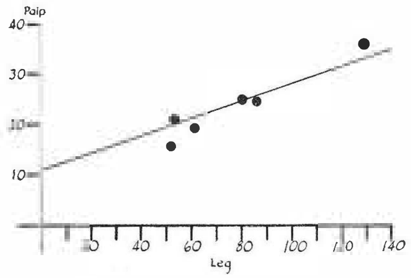


FIG. 43—*C. tortipalpis:* Relative growth of leg length and palp length. (Dimensions in mm.)

Third Left Leg	Range
3 coxae	7.02– 9.72
Femur	21.23–26.22
Tibia 1	21.61–24.51
Tibia 2	18.14–22.63
Tarsus	7.21– 8.58
Propodus	6.36– 7.44
Claw	4.08– 6.82

RELATIVE PROPORTIONS (see Table 2; Figs. 7, 8, 41–44):

	Range
L. palp÷L. proboscis*	1.30
L. proboscis÷L. trunk	1.62–1.76
L. leg÷L. proboscis	3.29–4.41
L. leg÷L. trunk	5.62–7.59
L. leg÷L. palp.	2.52
L. palp÷L. trunk	2.23
L. femur÷L. tibia 1	0.91–1.07
L. femur÷L. tibia 2	1.14–1.21
L. palp 4÷L. palp 2	0.65–0.76

*Data from one specimen only.

DISTRIBUTION

The localities for three samples are shown in Fig. 45. Specimens have been taken at depths between 219 and 1,400 m.

Colossendeis longirostris Gordon, 1938. (Figs. 7, 8, 45, 46)

Colossendeis longirostris Gordon, 1938: 8 (in key), 9–10; 1. Utinomi, 1959: 10–12; 6.

MATERIAL EXAMINED

No specimens seen.

DESCRIPTION

Based on Gordon (1938)

EYES: Small and inconspicuous and without pigment.

PROBOSCIS SHAPE: C: 1 or 2: E.

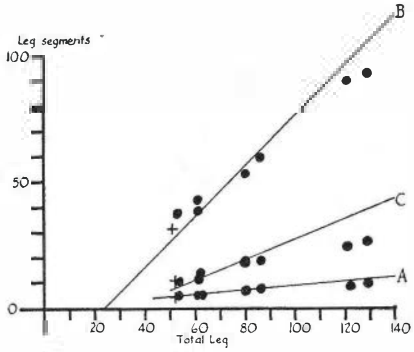


FIG. 44—*C. tortipalpis:* Relative growth of three units of leg. Crosses indicate juvenile specimens. A, three coxal segments; B, femur + two tibiae; C, three terminal segments. (Dimensions in mm.)

OVIGERAL SPINE FIELD CONFIGURATION:

$$\text{NS to S} : \frac{P/N}{A} : \frac{?}{B} : \frac{?}{C} : \frac{?}{\mathbf{n} = 1}$$

SIZE:

L. leg	81.1 mm
L. proboscis	26.8
L. trunk	10.4
L. palp	29.1 (++)

PERCENTAGE LENGTHS OF SEGMENTS:

Third Leg

3 coxae	6.76*
Femur	28.04*
Tibia 1	25.21*
Tibia 2	19.68
Tarsus	7.38*
Propodus	6.15
Claw	6.52

RELATIVE PROPORTIONS (see also Figs. 7, 8):

L. proboscis÷L. trunk	2.57*
L. leg÷L. trunk	7.79*
L. leg÷L. proboscis	3.03
L. palp segt. 4÷L. palp segt. 2	0.91*
L. femur÷L. tibia 1	1.11*
L. femur÷L. tibia 2	1.42*

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*Characters in which *longirostris* differs markedly from specimens of *tortipalpis*.

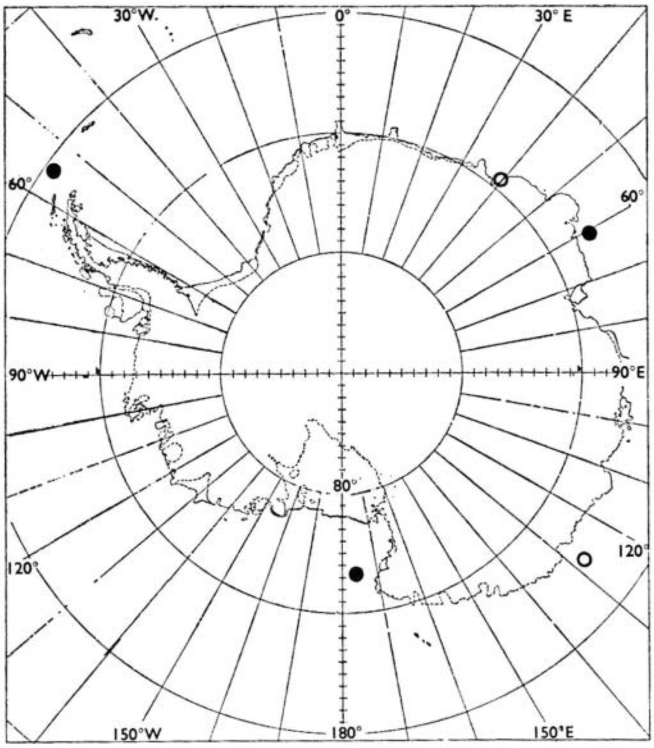

FIG. 45—Distribution records of *C. tortipalpis* (solid circles) and *C. longirostris* (hollow circles).

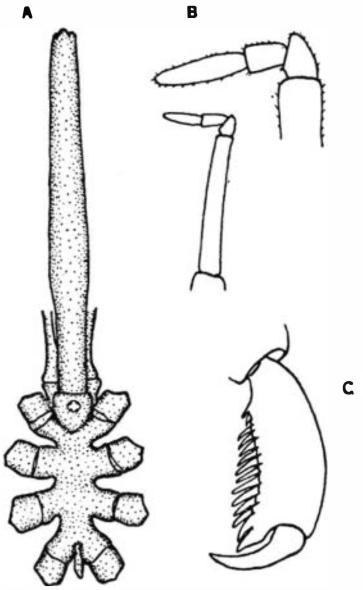

FIG. 46—*C. longirostris*: A, dorsal view of trunk and proboscis; B, terminal segments of palp; C, distal segments of oviger. (After Gordon, 1938, fig. 1.)

DISTRIBUTION

The type locality is shown in Fig. 45. The type specimen was taken at approximately 2,400 m. The locality of the specimen described by Utinomi, taken at 2.5 m is shown in the same figure.

DISCUSSION

It seems very doubtful that the specimen assigned by Utinomi to *longirostris* does in fact belong to the species. Very few data are given, but such as he gives suggest strongly that his specimen belongs to *C. australis.*

Colossendeis longirostris appears closest to *C. tortipalpis*, although it differs from the specimens of the latter species collected to date. It may well be an essentially abyssal subspecies of *tortipalpis.*

Colossendeis lilliei Calman, 1915. (Figs. 7, 8, 10, 47–52)

Colossendeis lilliei Calman, 1915b: 25–7; 4. Helfer and Schlottke, 1935: 294. Gordon, 1938 (in key): 11. Gordon, 1944: 11.

MATERIAL EXAMINED

NZOI Sta. A 450, 1 juvenile, 1 adult (recently ecdysed); Sta. A 454, 1 adult (recently ecdysed); Sta. A 456, 1 ♂, 1 ♀; Sta. A 459, 1 ♂, 1 ♀; Sta. A 460, 1 ♀; Sta. A 461, 1 ♂; Sta. A 464, 1 ♂, 1 adult (recently ecdysed); Sta. A 468, 2 ♀♀; Sta. A 529, 1 ♂.

Stanford Sta. GLD-8, 1 ?♀; Sta. GLD-10, 1 ?♀.

Eltanin Sta. 410, 1 ♀; Sta. 418, 1 ♀; Sta. 428, 1 ♀; Sta. 439, 2 ♀♀; Sta. 441, 1 ♀; Sta. 444, 1 ♀.

B.M. (N.H.) Regn. No. 1915.7.24.43–45 (Types); 1942.12.30.4; 1942.12.30.8.

A number of Ross Sea specimens are badly damaged, or have recently ecdysed, so that their sex cannot be determined, nor can accurate measurements be taken.

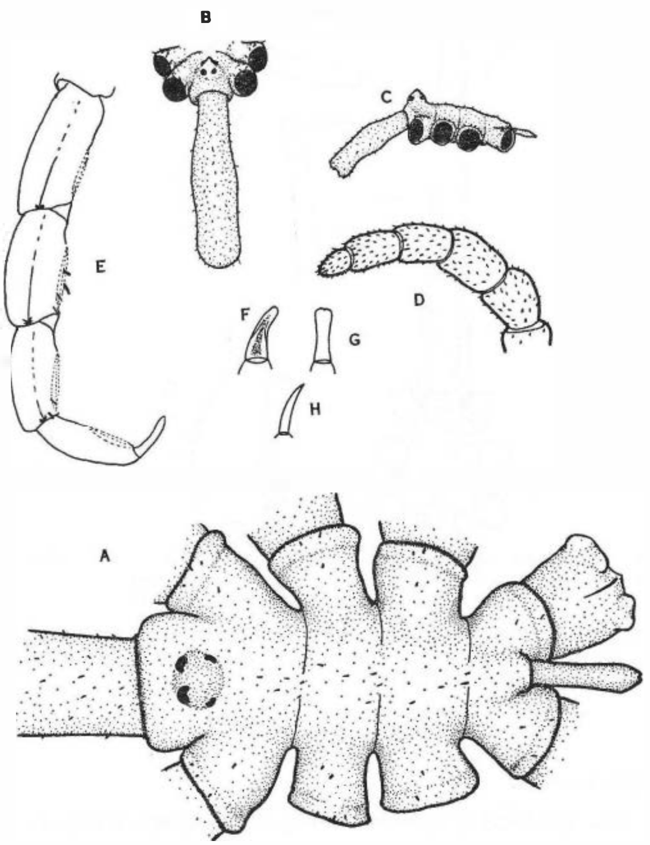

FIG. 47—*C. lilliei*: A, dorsal, view of trunk; B, dorsal view of proboscis and cephalic somite; C, lateral view of trunk and proboscis; D, terminal segments of left palp; E, terminal segments of right oviger; F, G, and H, spines of rows A and B, and area **n**.

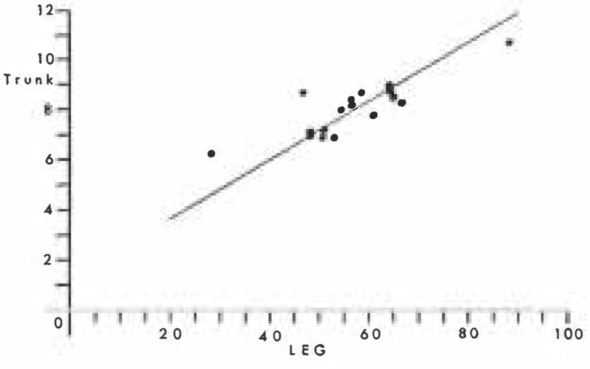

FIG. 48—*C. lilliei:* Relative growth of leg length and trunk length. (Dimensions in mm.)

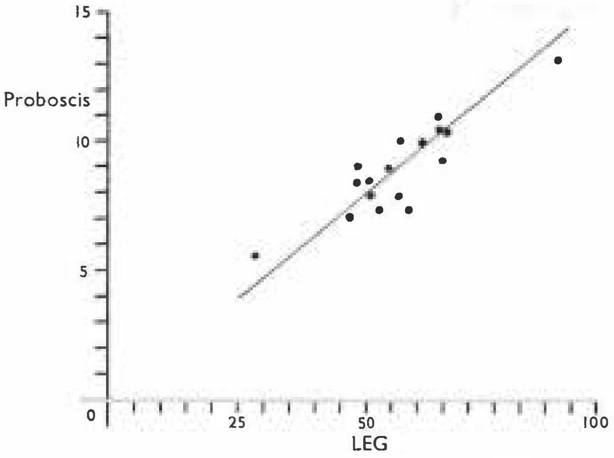

FIG. 49—*C. lilliei:* Relative growth of leg length and proboscis length. (Dimensions in mm.)

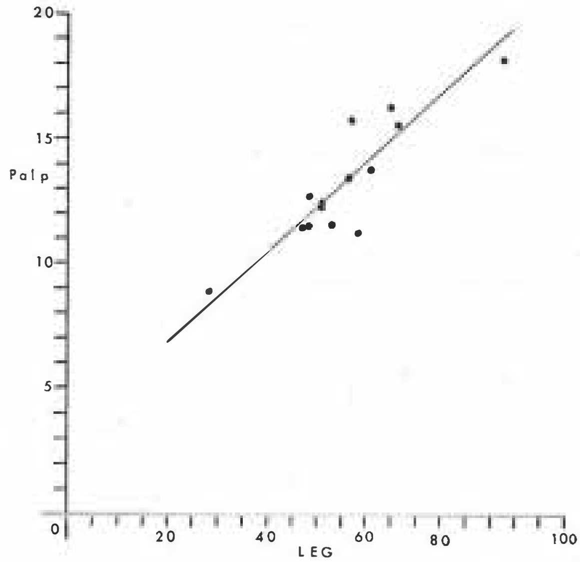

FIG. 50—*C. lilliei:* Relative growth of leg length and palp length. (Dimensions in mm.)

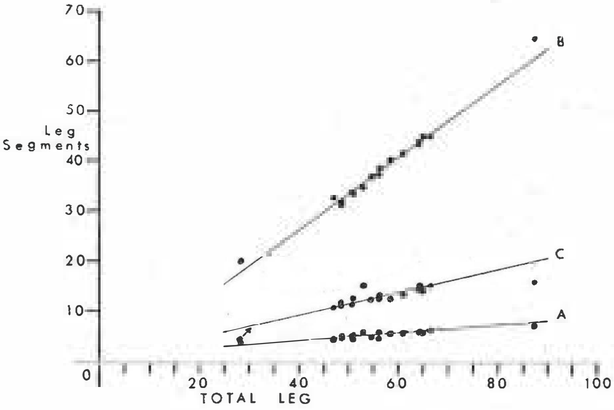

FIG. 51—*C. lilliei:* Relative growth of three units of leg segments A, three coxal segments; B, femur + two tibiae; C, three terminal segments. (Dimensions in mm.)

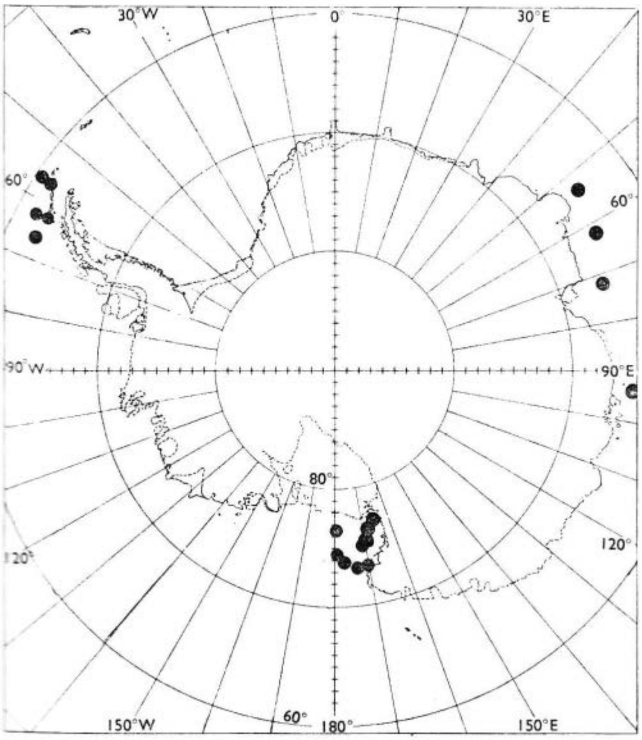

FIG. 52—Distribution records of *C. lilliei.*

DESCRIPTION

Based on 24 adults and one juvenile, and on Calman (1915b) and Gordon (1938).

PROBOSCIS SHAPE: B‴: 2: E.

OVIGERAL SPINE FIELD CONFIGURATION:

$$\text{NS} : \frac{P/N}{n=4 \text{ or } 5} \text{ or } \frac{N}{A} : \frac{P/N}{n=4 \text{ or } 5}$$

PALP: The spination of the terminal segments of this appendage appears to be more uniform than Calman's figure suggests.

SIZE RANGES:

	Adults
L. trunk	6.9 – 9.0 mm
L. proboscis	7.9 –11.0
L. palp	11.55–16.30
L. leg	48.50–66.40

PERCENTAGE LENGTHS OF SEGMENTS:

Left Palp	Adults
9th	3.93– 6.33
8th	6.76– 8.47
7th	6.74– 8.47
6th	8.02–11.52
5th	6.41– 9.49
4th	18.14–21.49
3rd	4.04– 6.76
2nd	34.65–41.62

Third Left Leg	Range
3rd coxae	9.08– 11.34
Femur	19.38– 23.61
Tibia 1	19.71– 21.34
Tibia 2	23.78– 25.73
Tarsus	7.95– 9.68
Propodus	7.80– 8.65
Claw	5.23– 7.82

RELATIVE PROPORTIONS (see Table 2; Figs. 7, 8, 48–51):

	Adults
L. leg ÷ L. trunk	6.80–8.00
L. leg ÷ L. proboscis	4.59–7.15
L. leg ÷ L. palp	3.59–4.58
L. palp segt. 4 ÷ L. palp segt. 2	0.42–0.59
L. femur ÷ L. tibia 1	0.93–1.12
L. femur ÷ L. tibia 2	0.75–0.99

DISTRIBUTION

See Fig. 52. Specimens have been taken at depths between 110 and 1,119 m.

Colossendeis scotti Calman, 1915. (Figs. 7, 8, 10, 53–58)

Colossendeis scotti Calman, 1915b: 10 (in key), 11–13; 1. Gordon, 1932: 11 (in key) and 12. Helfer and Schlottke, 1935: 294. Gordon, 1938: 8 (in key), 12.

MATERIAL EXAMINED

Specimens IH-23, and IH-24 from Icefoot, Edisto Beach, Hallett Inlet, 2 ♀♀; 2.2 m, 30 Dec 1958; Specimens IH-19, -20, -21, and -22, from Edisto Beach and Willett Cove, Hallett Inlet, 2 m to 20 ft, 26 to 28 Dec 1958, 2 ♀♀, 1 very large specimen without genital pores. Collection data are somewhat uncertain.

Eltanin Sta. 407, 1 ♀; Sta. 410, 1 ♂, 1 ♀, 1 ?♀; Sta. 439, 1 ♀; Sta. 441, 1 ♀; Sta. 445, 2 ♂♂, 1 ♀, 1 ?♀.

B.M. (N.H.) Regn. No. 1915.7.24.1–2 (Types); 1933.3.23.11–12.

In two details these specimens differ slightly from Calman's description of the species. Calman stated that the proboscis is more than twice as long as the trunk, but in these the proboscis length varies between 1·86 and 2·10 times the length of the trunk. In addition, the 7th segment of the palp is not necessarily less than half the length of the 8th segment.

It is interesting that specimen IH-19 shows no trace of genital pores, although it has a leg span of 230 mm. Specimen IH-20 is of almost identical size, but has well developed pores.

DESCRIPTION

Based on 20 adult specimens, supplemented by information from Calman (1915b).

PROBOSCIS SHAPE: B‴: 2: E″.

OCULAR TUBERCLE: Ocular tubercle shape and the pronounced postocular hump are diagnostic of this species (see Fig. 53).

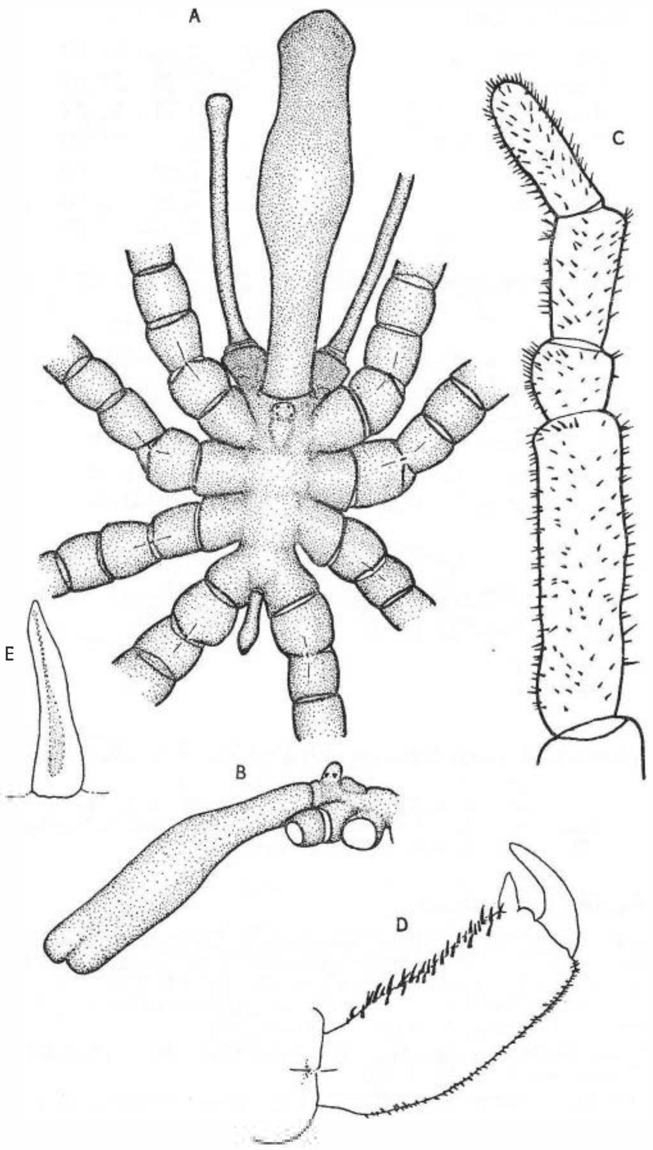

FIG. 53—*C. scotti*: A, dorsal view of trunk and proboscis; B, lateral view of proboscis and cephalic somite; C, terminal segments of left palp; D, terminal segments of right oviger; E, ovigeral spine of row A.

OVIGERAL SPINE FIELD CONFIGURATION:

$$S : \frac{P}{A} : \frac{P}{n=2}$$

SIZE RANGES: (No juveniles have been collected)

L. leg	114.80–162.00 mm
L. trunk	13.50– 16.25
L. proboscis	26.00– 35.25
L. palp	38.81– 48.22

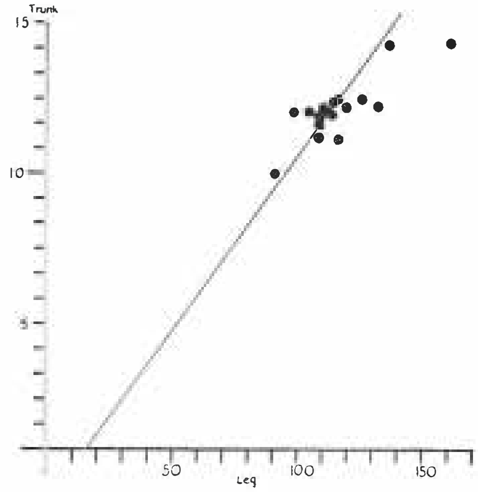

FIG. 54—*C. scotti:* Relative growth of leg length and trunk length. (Dimensions in mm.)

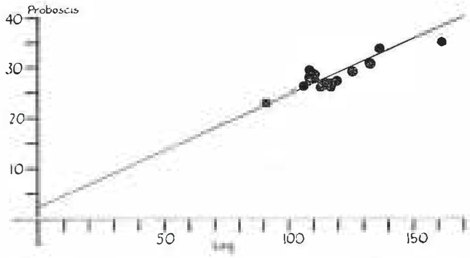

FIG. 55—*C. scotti:* Relative growth of leg length and proboscis length. (Dimensions in mm.)

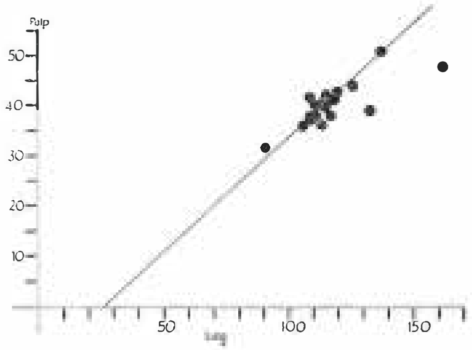

FIG. 56—*C. scotti:* Relative growth of leg length and palp length. (Dimensions in mm.)

PERCENTAGE LENGTHS OF SEGMENTS:

Left Palp	Range
9th	5.69– 6.86
8th	4.77– 5.29
7th	2.06– 3.33
6th	10.58–11.88
5th	7.64.10.37
4th	21.56–23.23
3rd	3.31– 4.70
2nd	39.14–41.02

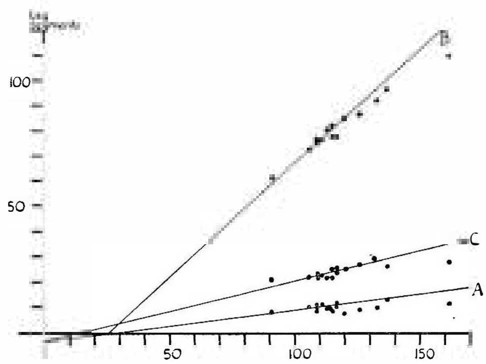

FIG. 57—*C. scotti:* Relative growth of three groups of leg segments. A, three coxal segments; B, femur + two tibiae; C, three terminal segments. (Dimensions in mm.)

Third Leg	Range
3 coxae	7.41–10.46
Femur	23.86–27.32
Tibia 1	22.09–23.92
Tibia 2	20.06–21.49
Tarsus	7.39– 8.86
Propodus	5.55– 7.24
Claw	3.68– 6.79

RELATIVE PROPORTIONS (see Table 2; Figs. 7, 8, 54–57):

	Range
L. leg ÷ L. proboscis	4.06–4.59
L. leg ÷ L. trunk	8.28–9.97
L. leg ÷ L. palp	2.69–3.42
L. palpal 4 ÷ L. palpal 2	0.53–0.57
L. femur ÷ L. tibia 1	1.06–1.31
L. femur ÷ L. tibia 2	1.12–1.30

DISTRIBUTION

See Fig. 58. Specimens have been taken at depths between 36 and 250 m.

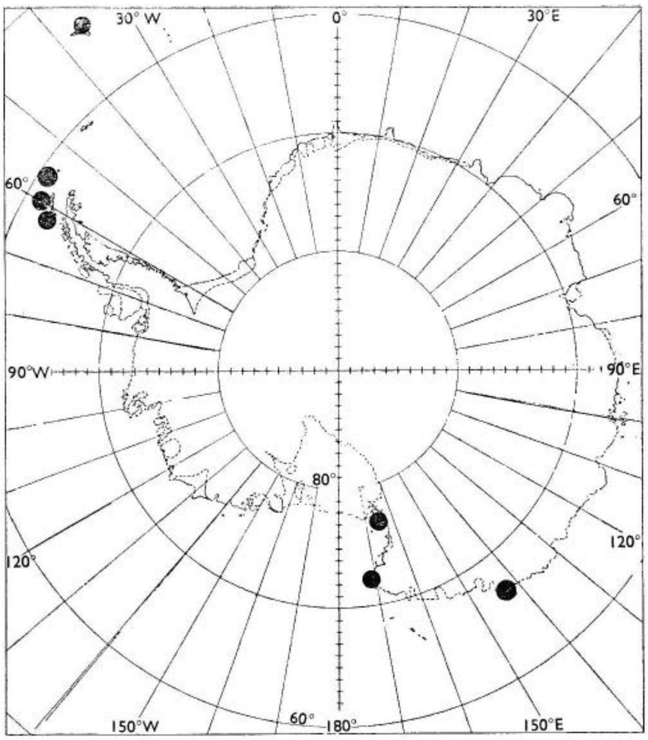

FIG. 58—Distribution records of *C. scotti.*

Colossendeis wilsoni Calman, 1915. (Figs. 7, 8, 10, 59–64)

Colossendeis wilsoni Calman, 1915b: 11 (in key), 18–20; 2. Gordon, 1932: 12 (in key). Helfer and Schlottke, 1935: 294. Gordon, 1938: 8 (in key), 12.

MATERIAL EXAMINED

NZOI Sta. A 468, 1 ♀, 1 ?♂; Sta. A 456, 1 ♂, 1 ♀.

[illegible] Sta. 22a, 1 ♀.

B.M. (N.H.) Regn. No. 1915.7.24.28 (Holotype); 1933.3.23.49.

DESCRIPTION

Based on seven adults, supplemented by information from Calman (1915b).

PROBOSCIS SHAPE: B′ or B‴: 2: E″ or E‴.

OVIGERAL SPINE FIELD CONFIGURATION:

$$\mathrm{NS} : \frac{\mathrm{Sp}}{\mathrm{A}} : \frac{\mathrm{Sp}\ \&\ \mathrm{P}}{\mathbf{n}=3 \text{ or } 4}$$

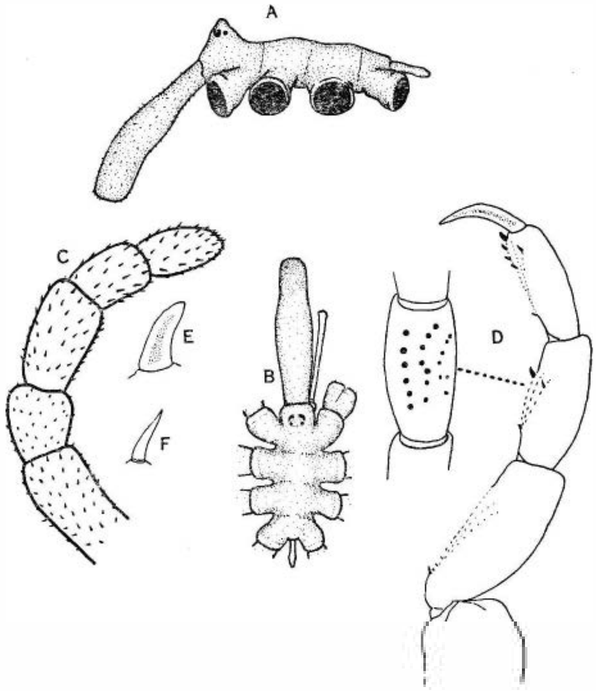

FIG. 59—*C. wilsoni*: A, lateral, and B, dorsal, views of trunk and proboscis; C, terminal segments of left palp; D, terminal segments of right oviger, showing the incomplete nature of the field in a juvenile specimen; E, F, needle and peg spines from the area **n** and row A in the juvenile specimen depicted in D.

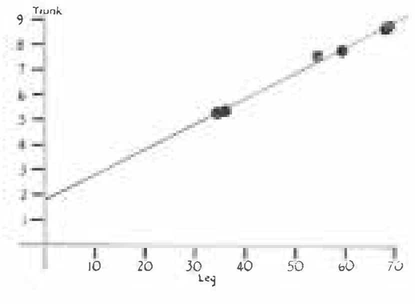

FIG. 60—*C. wilsoni:* Relative growth of leg length and trunk length. (Dimensions in mm.)

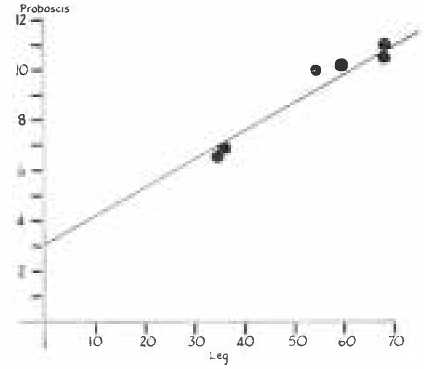

FIG. 61—*C. wilsoni:* Relative growth of leg length and proboscis length. (Dimensions in mm.)

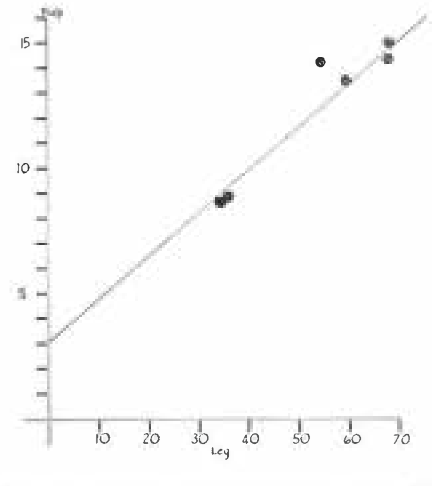

FIG. 62—*C. wilsoni:* Relative growth of leg length and palp length. (Dimensions in mm.)

SIZE RANGES (No juveniles have been collected):

L. leg	36.06–38.30 mm
L. trunk	5.28– 8.80
L. proboscis	6.56–11.00
L. palp	8.64–15.00

PERCENTAGE LENGTHS OF SEGMENTS:

Left Palp	Range
8th	5.51– 9.81
7th	6.66– 8.33
6th	9.99–11.57
5th	6.47– 9.25
4th	20.39–24.06
3rd	4.38– 7.04
2nd	34.25–41.69

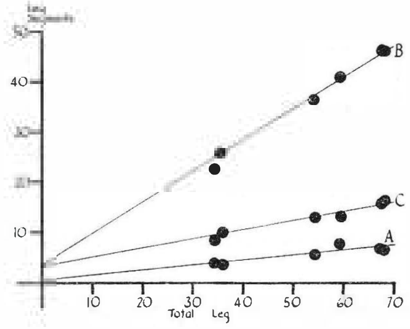

FIG. 63—*C. wilsoni:* Relative growth of three groups of leg segments. A, three coxal segments; B, femur + two tibiae; C, three distal segments. (Dimensions in mm.)

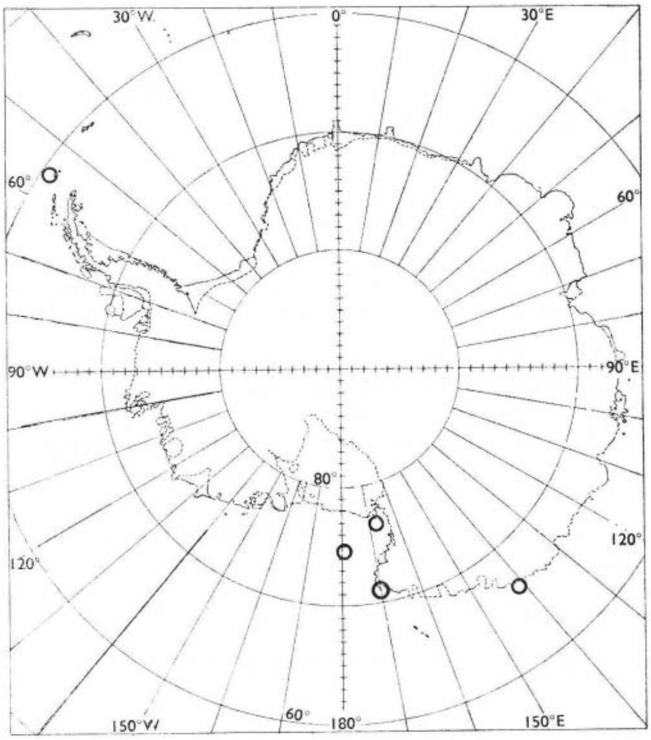

FIG. 64—Distribution records of *C. wilsoni.*

Third Leg	
3 coxae	9.41–10.91
Femur	19.76–21.84
Tibia 1	20.68–23.37
Tibia 2	23.37–27.42
Tarsus	8.15– 9.94
Propodus	7.05– 9.94
Claw	5.67– 8.09

RELATIVE PROPORTIONS (see Table 2; Figs. 7, 8, 60–63):

	Range
L. leg ÷ L. trunk	6.51–7.83
L. leg ÷ L. proboscis	5.22–6.48
L. leg ÷ L. palp	3.84–4.74
L. proboscis ÷ L. trunk	1.20–1.33
L. palp segt. 4 ÷ L. palp segt. 2	0.48–0.70
L. femur ÷ L. tibia 1	0.89–1.03
L. femur ÷ L. tibia 2	0.75–0.89

Distribution

See Fig. 64. Specimens have been taken at depths between 110 and 314 m.

Colossendeis australis Hodgson, 1907. (Figs. 7, 8, 10, 65–71)

Colossendeis australis Hodgson, 1907: 59; IX, 1, X, 1–2. Bouvier, 1913: 63; 20–1. Calman, 1915b: 10 (in key), 14–15. Gordon, 1932: 12 (in key), 15–16; 2a, 3a, c, 4b. Helfer and Schlottke, 1935: 293. Gordon, 1938: 8 (in key), 10. Gordon 1944: 10.

Material Examined

NZOI Sta. A 464, 1 ♂.

Tressler Oceanographic Sta. 2 (McMurdo Sound), 1 ?♀; Sta. 19, (McMurdo Sound), 1 ?♂.

Eltanin Sta. 437, 1 ♀.

B.M. (N.H.) Regn. No. 1907.6.24.101–102 (Types); 1915.7.24.3; 1915.7.24.4–5; 1933.3.23.16–18; 1933.3.23.19; 1933.3.23.20; 1942.12.30.1–2.

Description

Based on 16 adult specimens, supplemented by information in Hodgson (1907b), Bouvier (1913), Calman (1915b), and Gordon (1932). No juveniles have been identified yet.

PROBOSCIS SHAPE: C''': 2: E'''.

OVIGERAL SPINE FIELD CONFIGURATION:

$$S : \frac{P}{A} : \frac{P/N}{B} : \frac{P/N}{C} : \frac{P}{\mathbf{n} = 1}$$

SIZE RANGES:

L. leg	84.00–135.20 mm
L. trunk	19.00– 23.20
L. proboscis	27.50– 39.90
L. palp	48.30– 55.40

PERCENTAGE LENGTH OF SEGMENTS:

Left Palp	Range
9th	5.94– 6.43
8th	4.95– 5.22
7th	4.95– 5.22
6th	8.28– 9.00
5th	4.95– 5.79
4th	20.70– 22.50
3rd	3.42– 3.96
2nd	43.20– 45.32

Third Leg	Range
3 coxae	6.65– 11.66
Femur	23.08– 25.28
Tibia 1	23.84– 25.20
Tibia 2	23.36– 26.89
Tarsus	5.95– 11.08
Propodus	4.64– 6.19
Claw	1.31– 3.20

RELATIVE PROPORTIONS (see Table 2; Figs. 7, 8, 67–70):

L. leg ÷ L. trunk	4.42– 6.76
L. leg ÷ L. proboscis	3.11– 3.81
L. leg ÷ L. palp	2.25– 2.27
L. proboscis ÷ L. trunk	1.45– 1.77
L. palp segt. 4 ÷ L. palp segt. 2	0.45– 0.54
L. femur ÷ L. tibia 1	0.95– 1.00
L. femur ÷ L. tibia 2	0.90– 1.04

Distribution

See Fig. 71. Specimens have been taken at depths between 91 and 640 m.

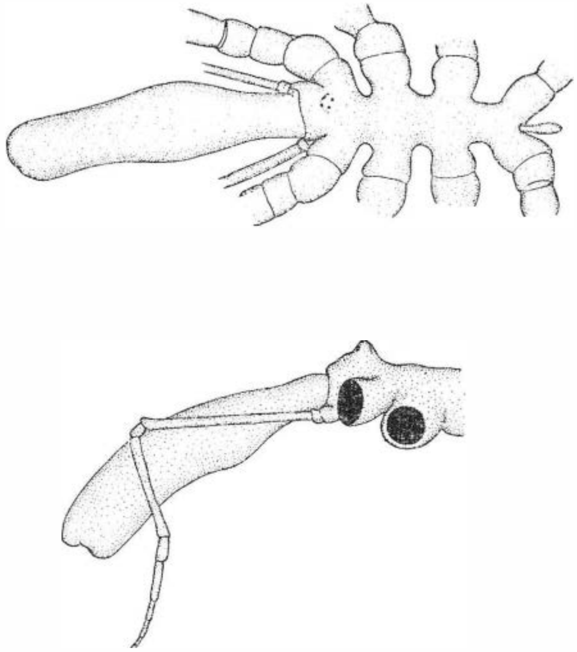

FIG. 65—(Left) *C. australis*: Dorsal view of trunk and proboscis, and lateral view of proboscis, palp, and cephalic somite.

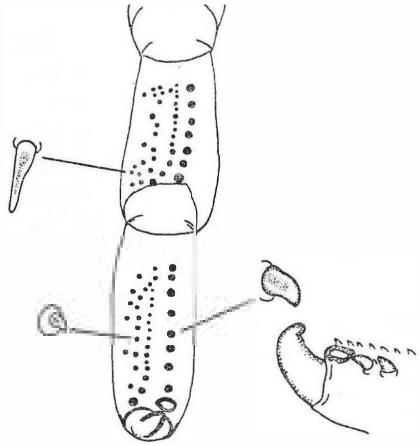

FIG. 66— *C. australis:* Terminal segments of right oviger, showing types of ovigeral spines.

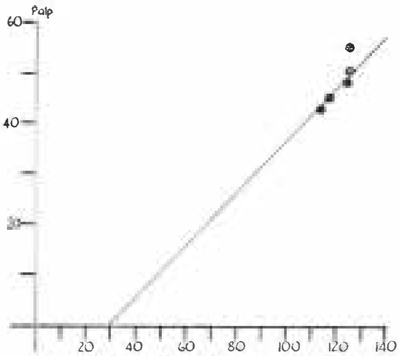

FIG. 69—*C. australis:* Relative growth of leg length and palp length. (Dimensions in mm.)

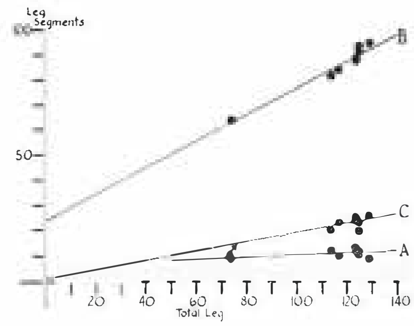

FIG. 70—*C. australis:* Relative growth of three groups of leg segments. A, three coxal segments; B, femur + two tibiae; C, three terminal segments.

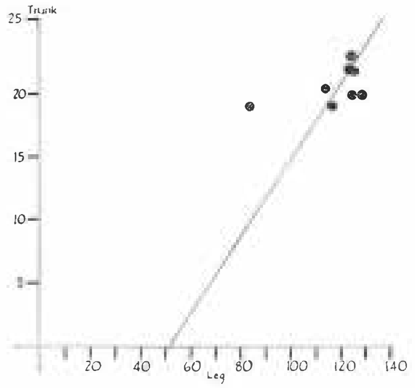

FIG. 67—*C. australis:* Relative growth of leg length and trunk length. (Dimensions in mm.)

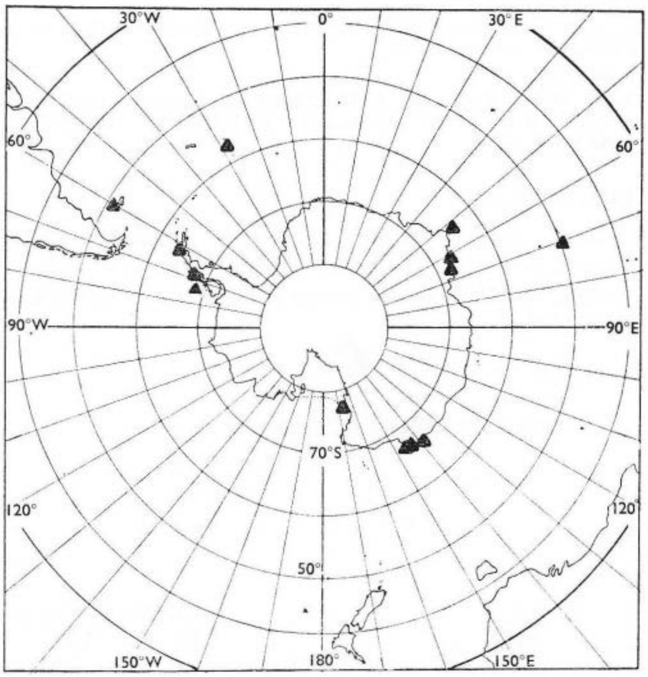

FIG. 71—Distribution records of *C. australis.*

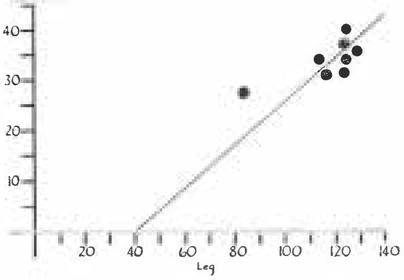

FIG. 68—*C. australis:* Relative growth of leg length and proboscis length. (Dimensions in mm.)

Colossendeis hoeki Gordon, 1944. (Figs. 7, 8).

Colossendeis hoeki Gordon, 1944: 8 (in key), 11–13; 1a, b.

MATERIAL EXAMINED

No specimens seen.

DESCRIPTION

The species is diagnosed and described from a single specimen from B.A.N.Z.A.R. Expedition Sta. 66, 47°5′S, 79°16′E, 3,112 m.

PROBOSCIS SHAPE: B′′′: ?1.

OVIGERAL SPINE FIELD CONFIGURATION: Undescribed.

SIZE:

L. proboscis	90 mm
L. trunk	7.90
L. palp	12.85
L. 4th leg	65.20

PERCENTAGE LENGTHS OF SEGMENTS:

Palp	
9th	6.88
8th	5.67
7th	5.59
6th	12.81
5th	8.25
4th	20.64
3rd	4.21
2nd	25.43
Fourth leg	
3 coxae	6.12
Femur	29.37
Tibia 1	25.24
Tibia 2	19.43
Tarsus	7.65
Propodus	6.58
Claw	5.20

RELATIVE PROPORTIONS:

L. leg ÷ L. trunk	8.25
L. leg ÷ L. proboscis	7.24
L. leg ÷ L. palp	5.07
L. proboscis − L. trunk	1.14
L. palp segt. 4 ÷ L. palp segt. 2	0.58
L. femur ÷ L. tibia 1	1.16
L. femur ÷ L. tibia 2	1.51

OCULAR TUBERCLE: Very wide at the base (five sevenths the width of the cephalon); eyes unpigmented, anterior pair more than twice the size of the posterior pair.

DISCUSSION

Gordon (1944) has discussed the similarity of this species to Hoek's species *C. angusta*, *media*, and *brevipes*, which all have abyssal records. In some respects this species resembles *C. stramenti* (see p. 38).

Colossendeis sp. (Figs. 72, 73)

MATERIAL EXAMINED

Trans-Antarctic (N.Z.) Sta. 1, 1 juvenile.

DESCRIPTION

This specimen appears closest to *C. robusta* in proportions, except that the 7th segment of the palp is longer than the terminal and penultimate segments. The proboscis is also distinctly shorter in relation to the trunk than in *C. robusta*.

PALP: Palp incompletely segmented, but with a constriction where the articulation between the 3rd and 4th segments occurs in other species of the genus (see also p. 32).

LEG: The terminal claw is relatively very short. The propodus has two large ventral spines unlike anything reported previously for the genus. Both tarsus and propodus are very long in relation to the three "long segments" of the leg. Femur, tibia 1, and tibia 2 bear prominent spines.

OVIGERAL SPINES: Two rows only are present, the spines of both being similar; short but stout, and quite regular. Formula

$$NS : \frac{P}{A} : \frac{P}{B}$$

PROBOSCIS SHAPE: A′′′: 1.

Colossendeis sp. (Fig. 74)

MATERIAL EXAMINED

Edisto Sta. 6 (ED-6), 1 juvenile.

DESCRIPTION

This is quite distinct from the above specimen, and has little affinity with any known species of the genus. Unfortunately, the proboscis has been broken off short.

PALP: Palp remarkable for its segmental pattern. There is no indication whether or not this appendage is in its final form, or whether it will be further subdivided at a later moult.

LEG: Claw, propodus, and terminal claw are subequal; propodus without the special spines seen in the previous specimen.

OVIGERAL SPINES: Two rows visible; spines of row A are similar to spines of the same row in *Colossendeis megalonyx*; those of row 2 are shorter and stoutly conical.

OVIGERAL SPINE FIELD CONFIGURATION:

$$?\ S : \frac{Sp}{A} : \frac{P}{B}$$

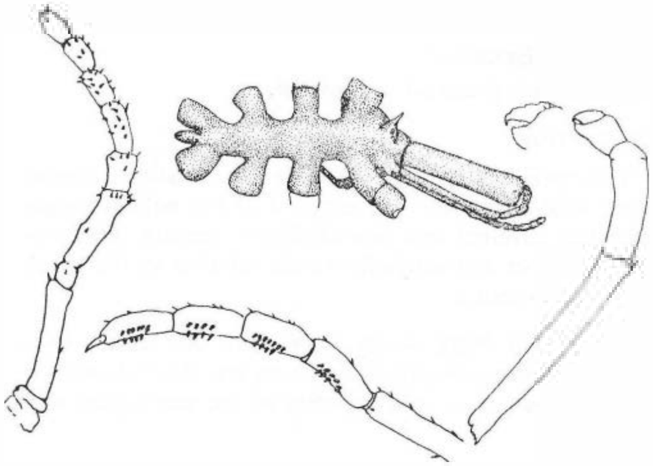

FIG. 72—Juvenile of *Colossendeis sp.*, from Hut Point, Ross Island (N.Z. Sta 1), showing trunk, proboscis, left palp, left chelicera, and terminal segments of right oviger.

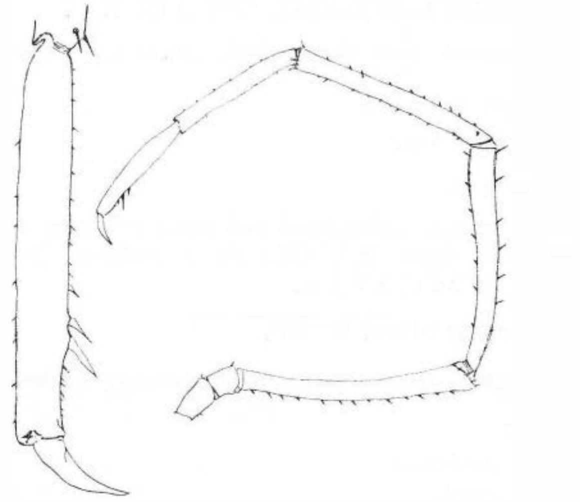

FIG. 73—Juvenile of *Colossendeis sp.*, from Hut Point, Ross Island, showing 3rd left leg and terminal segments of leg.

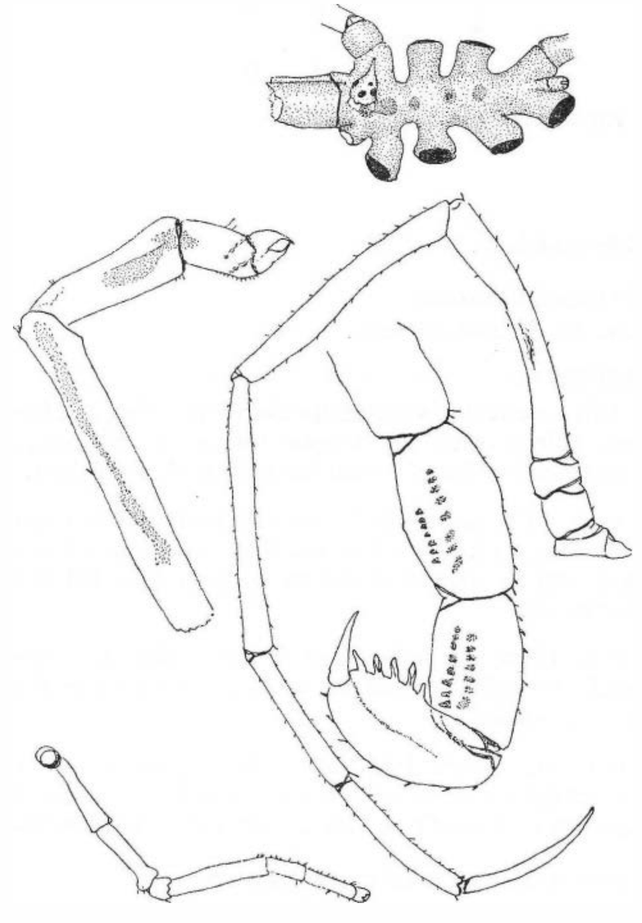

FIG. 74—Juvenile of *Colossendeis sp.*, from *Edisto* Sta 6, showing trunk, left palp, left chelicera, terminal segments of right oviger, and 3rd left leg.

Colossendeis angusta Sars, 1877. (Figs. **7,** 8)

Colossendeis angusta Sars, 1877: 268–9. Wilson 1881: 243–4; III 8, 13. Smith (*in* Verrill), 1885: 560. Sars, 1891: 140. Topsent, 1891: 178. Meinert, 1899: 59. Möbius, 1902: 191. Norman, 1908: 228. Stephensen, 1913. Olsen, 1914: 3. Bouvier, 1917: 8–9. Schimkevitch, 1930: 39. Gordon, 1932: 12 (in key). Stephensen, 1933: 28–30; 6, 7. Helfer and Schlottke, 1935: 293. Stephensen, 1935: 33. Bouvier, 1937: 25–6. Calman, 1938: 148–9. Gordon, 1938: 8 (in key). Stephensen, 1943: 1. Needler, 1943; 5; 2a–d. Hedgpeth, 1948: 269–71; 50a. Fage, 1956: 175.

Colossendeis gracilis Hoek, 1881: 69–70; IX, 6–8, X 6 & 7. Schimkevitch, 1893: 32. Marcus, 1940: 110. Stock 1963: 330; 6a.

SYNONYMY

It seems reasonable at the moment to consider *C. angusta* Sars, 1877, and *C. gracilis* Hoek, 1881 as synonymous. Stock's (1963) suggestion to the contrary may be correct, but his discussion of relative proportions does not make convincing argument for the reinstatement of *gracilis*.

Marcus's attempt (1940b) to replace *angusta* with *gracilis* would, if it were accepted (see Fage, 1956, Hedgpeth, 1948), makes the synonymy of the species unnecessarily confused. Marcus's reason for declaring *angusta* a *nomen nudum* appears to derive from an error in page numbering in Sars (1877).

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 81.38; 90.12.1.80; 1937.12.14.1; 1956.10.10.441–2; *Porcupine* Collections (unregistered).

DESCRIPTION

Based on the few specimens in the collections of the British Museum (Natural History), and on previously published descriptions.

PROBOSCIS SHAPE: B''': 1.

OCULAR TUBERCLE: Sharply conical, no eyes present.

DIMENSIONS: (Data from specimen described by Fage, 1956)

L. trunk	5.0 mm
L. proboscis	6.90
L. palp	9.77
L. leg	46.50 (+)

PERCENTAGE LENGTHS OF PALP SEGMENTS:

9th	6.14
8th	3.07
7th	3.07
6th	16.37
5th	12.27
4th	20.46
3rd	5.83
2nd	32.73

RELATIVE PROPORTIONS (see also Figs. 7, 8):

L. leg÷L. proboscis	6.74 (+)
L. leg÷L. trunk	9.30 (+)
L. leg÷L. palp	4.75 (+)
L. proboscis÷L. trunk	1.38
L. palp segt. 4÷L. palp segt. 2	0.62
L. femur÷L. tibia 1	1.07
L. femur÷L. tibia 2	1.52

DISTRIBUTION

This is essentially an abyssal form, occurring in all the major temperate and tropical ocean basins, although it has been taken once in the North Atlantic in 172 m and on several occasions in 400 m (Hedgpeth, 1948). However, in the high Arctic, the species has been recorded in 12–18 m (Stephenson, 1913). It has not been taken in the southern oceans at depths of less than 2,000 m.

DEPTH RANGE

Mostly between 1,800 and 5,480 m.

Colossendeis macerrima Wilson, 1881. (Figs. 7, 8)

Colossendeis macerrima Wilson, 1881: 246–7; I 9–12, V 32. Verrill, 1885: 560; 170. Schimkevitch, 1893: 30. Norman, 1908: 229. Bouvier, 1917: 10; I 1, III 1, 2. Bouvier, 1923: 25. Calman, 1923: 267–8. Calman, 1915b: 11. Helfer and Schlottke, 1935: 293. Bouvier, 1937: 30–1. Gordon, 1938: 12. Hedgpeth, 1948: 273. Hedgpeth, 1949: 299. Stock, 1953: 308–11; 17e–h. Barnard, 1954: 85. Fage, 1956: 180. Stock, 1963: 326.
Colossendeis gigas-leptorhynchus Bouvier, 1937: 32.

MATERIAL EXAMINED

Scripps I.O. Sta. P. 285–61, 2 ♀♀; Scripps I.O. Sta. 137–60, 1 ♂. B.M. (N.H.) Regn. No. 1908.1.6.10; 1923.10.6.1; 1948.5.19.1.

DESCRIPTION

Based on six specimens and on the literature.

PROBOSCIS SHAPE: C or C′: 3: E‴.

OVIGERAL SPINE FIELD CONFIGURATION:

$$\mathrm{NS} : \frac{\mathrm{N}}{\mathrm{A}} : \frac{\mathrm{N}}{n=5 \text{ or } 6}$$

SIZE RANGES (adults and juveniles):

L. trunk	4.12–13.00 mm
L. proboscis	6.91–41.90
L. palp	7.48–45.99
L. leg	31.11–165.10

PERCENTAGE LENGTHS OF SEGMENTS:

Palp	Range
9th	1.15– 2.54
8th	0.84– 1.73
7th	1.15– 1.72
6th	4.90–11.17
5th	6.05– 8.82
4th	47.89–49.69
3rd	3.57– 6.64
2nd	23.21–35.50

Third Leg	Range
3 coxae	3.94– 5.19
Femur	7.55–12.70
Tibia 1	3.59– 5.24
Tibia 2	1.67– 3.22
Tarsus	1.35– 2.14
Propodus	0.93– 0.97
Claw	1.33– 1.61

RELATIVE PROPORTIONS (see also Figs. 7, 8):

	Range
L. leg ÷ L. proboscis	3.94– 5.19
L. leg ÷ L. trunk	7.55–12.70
L. leg ÷ L. palp	3.59– 5.24
L. proboscis ÷ L. trunk	1.67– 3.22
L. palp segt. 4 ÷ L. palp segt. 2	1.35– 2.14
L. femur ÷ L. tibia 1	0.93– 0.97
L. femur ÷ L. tibia 2	1.33– 1.61

DISTRIBUTION

This species has been taken from the Atlantic, Pacific, and Indian Ocean basins at depths between 400 and 3,670 m. There is one doubtful record from 79 m from South Africa, and another from 139 m off Iceland. There are no station data for the Australasian Antarctic Expedition specimens.

Colossendeis colossea Wilson, 1881. (Fig. 8)

Colossendeis colossea Wilson, 1881: 244–6; I 1, III 5–7. Hoek, 1881: 147. Verrill, 1885: 560; 196. Topsent, 1891: 177. Schimkevitch, 1893: 29. Meinert, 1899: 58. Loman, 1908: 21. Norman, 1908: 229. Cole, 1909: 187. Loman, 1911: 4. Stephensen, 1913: 409. Olsen, 1914: 4. Bouvier, 1917: 13–16; I 2, II 1. Bouvier, 1923: 25. Calman, 1923: 266. Flynn, 1928: 7. Helfer and Schlottke, 1935: 293. Ohshima, 1936: 866. Bouvier, 1937: 31–2. Gordon, 1938: 12. Marcus, 1940: 109, 112 (in key). Needler, 1943: 4; 1a–e. Hedgpeth, 1943: 55–6. Gordon, 1944: 11. Hedgpeth, 1948: 271. Hedgpeth, 1949: 12. Fage, 1956: 178.
Colossendeis gigas Hoek, 1881: 61–4, 147; VIII 1–2, X 1–5. Ohshima and Kishida, 1947: 1009.

MATERIAL EXAMINED

Oregon Sta. 2050 (Gulf of Mexico), 2 ♀♀; Scripps I.O. Sta. P.137–60 (N.E. Pacific), 1 ♂, 1 ♀.

DESCRIPTION

Based on four adults and supplemented by information from previous descriptions.

PROBOSCIS SHAPE: B′ or B‴: 1 or 2: E.

OVIGERAL SPINE FIELD CONFIGURATION:

$$\mathrm{NS} : \frac{\mathrm{Sp}}{\mathrm{A}} : \frac{\mathrm{Sp/N}}{\mathbf{n}=5 \text{ or } 6}$$

SIZE RANGES (adults only):

L. trunk	7.80– 21.10 mm
L. proboscis	15.70– 35.50
L. palp	21.53– 60.90
L. leg	85.40–247.20

PERCENTAGE LENGTH OF SEGMENTS:

Left Palp	Range
9th	5.52– 6.96
8th	4.92– 6.70
7th	6.17– 8.56
6th	12.94–17.20
5th	6.17– 7.87
4th	21.50–30.85
3rd	2.19– 4.03
2nd	26.49–30.85
Third Leg	
3 coxae	3.99– 7.49
Femur	30.77–33.68
Tibia 1	28.78–32.24
Tibia 2	24.48–26.32
Tarsus	3.20– 4.56
Propodus	1.72– 3.72
Claw	0.0 – 0.84

RELATIVE PROPORTIONS (see also Fig. 8):

L. leg ÷ L. proboscis	5.44–12.95
L. leg ÷ L. trunk	10.94–16.48
L. leg ÷ L. palp	3.91– 4.92
L. proboscis ÷ L. trunk	1.33– 2.01
L. palp segt. 4 ÷ L. palp segt. 2	0.81– 1.00
L. femur ÷ L. tibia 1	0.96– 1.11
L. femur ÷ L. tibia 2	1.16– 1.37

DISTRIBUTION

This species is essentially an abyssal and bathyal form which has been taken from all the major ocean basins. Its bathymetric range appears to be from approximately 1,000 to more than 2,000 m. No data on depths and localities are available for the Australasian Antarctic Expedition specimens (Gordon, 1938, p. 12). The single B.A.N.Z.A.R. Expedition specimen was taken in 2,267 m at 64°31′S, 116°02′E.

Genus **Decolopoda** Eights

Five pairs of legs: chelicerae well developed in adults, with a 2-segmented scape; fingers of the chelae large and strongly arched, although apparently not necessarily functional; trunk very compact and massive, all lateral processes contiguous over at least part of their lengths; palp of 8 to 10 segments, the most distal being very variably developed.

Decolopoda australis Eights, 1835. (Figs. 7, 8, 10, 75, 76, 78–82)

Decolopoda australis Eights, 1835: 203–6; VII. Stebbing, 1902: 185–9. Bouvier, 1905: 36. Carpenter, 1905. Cole, 1905: 405. Hodgson, 1905a: 36–42; III. Hodgson, 1905b: 254–6. Hodgson, 1905c. Loman, 1905: 722–3. Bouvier, 1906a: 16–18. Bouvier, 1906b: 21–29; II 6–9. Hodgson, 1908: 181–4; III 2–2c. Calman, 1909, 687–93. Thompson, 1909: 531. Bouvier, 1910a: 27. Bouvier, 1911b: 1136. Bouvier, 1911c: 491, Bouvier, 1913: 48–52; 1–7. Gordon, 1932: 8–9. Helfer and Schlottke, 1935: 280.

Decolopoda antarctica Bouvier, 1905: 27. Bouvier, 1913: 48. Calman, 1920: 244. Gordon, 1932: 8–9; 1a–e. Helfer and Schlottke, 1935: 280.

Decolopoda sp.? Gordon, 1944: 8–9.

Gordon (1944) expressed dissatisfaction with her key (1932) for the separation of *D. australis* and *D. antarctica*, because a specimen from Heard Island could not be placed comfortably in either species according to the 1932 definitions. None of the present specimens can be placed in either of Gordon's two species with any degree of satisfaction. Furthermore, the single remaining specimen of Eights's types of *australis** does not fall into either of the species (see Table 5).

TABLE 5: Number of characters* indicating affinity of four specimens with either *Decolopoda australis* or *D. antarctica*

	australis	*antarctica*	intermediate	outside extremes
Eights' Type	4	1	..	2
Sta. S1–1	2	1	2	2
Sta. A 451	2	1	1	3
Sta. GLD-8	3	4	..	..

*From seven diagnostic characters in Gordon, 1932, p. 9.

It is apparent from a study of these four specimens alone that Gordon's criteria for separating *D. australis* and *D. antarctica* are not very useful, and careful study of specimens and literature on the genus does not indicate any clear dichotomy of variation. Perhaps a statistically more useful sample might indicate variations in the distribution of some character states, but we have not found any clear discontinuities in the ranges of variation, and the only marked associations between extreme states of different characters which could be detected can be explained by heterogonic growth. For these reasons *D. australis* Eights and *D. antarctica* Bouvier are here reunited under the prior name.

It can be seen from Gordon's (1944) data that, if this is done, the Heard Island specimen lies in the middle of the range of variation of some characters, and is included well within others.

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*Lent to us by courtesy of the authorities of the Museum of Comparative Zoology at Harvard University.

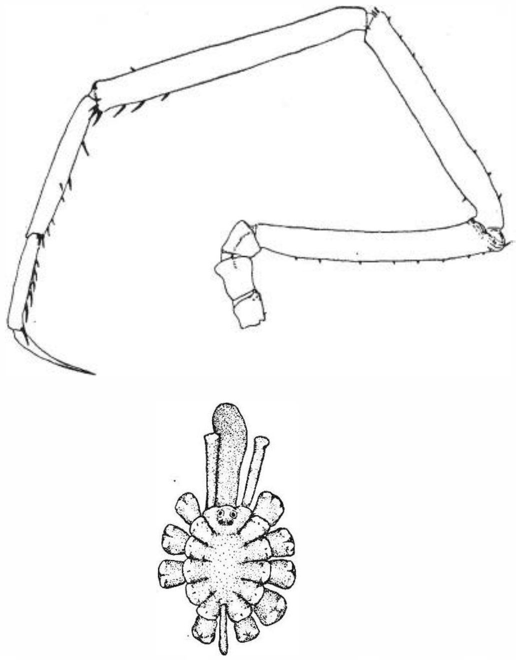


FIG. 75—*Decolopoda australis*: dorsal view of trunk and proboscis, and 4th left leg.

MATERIAL EXAMINED

Sta. A 451, 1 ?♂.
Staten Island Sta. 1, 1 ?♂.
Stanford Sta. GLD-8, 1 ?♂.
Eltanin Sta. 426, 1 ♀; Sta. 428, 1 ♂; Sta. 432, 1 ♀; Sta. 437, 1 ♀; Sta. 439, 2 ♀♀; Sta. 444, 1 ♀.
M.C.Z. (Harvard) No. 12271 (One of Eights's original type series).
B.M. (N.H.) Regn. No. 1912.10.5.29; 1920.7.21.51; 1933.3.23.1–2; 1933.3.23.3; 1933.3.23.4–6; 1933.3.23.7; 1933.3.23.8–9; 1933.3.23.10; 1956.6.1.1–2; *Discovery* Sta. 140 OTL, Falkland Islands, coll. 28.2.61.

DESCRIPTION

Based on 27 adults, supplemented by information from previous descriptions of both *D. australis* and *D. antarctica*.

PROBOSCIS SHAPE: D‴: 2: E‴.

OVIGERAL SPINE FIELD CONFIGURATION:

$$S : \frac{P}{A} : \frac{P}{n = 2}$$

SIZE RANGES (adults only):

L. leg	66.00–132.00 mm
L. proboscis	6.60– 17.00
L. palp	15.28– 23.20
L. trunk	8.10– 18.60
Width across 2nd latl. procs.	8.30– 15.00

PERCENTAGE LENGTHS OF SEGMENTS:

Palp

Terminal segments	8.20–21.10
7th	6.93– 9.15
6th	7.76–10.25
5th	7.76–11.33
4th	18.53–24.40
3rd	3.92– 8.19
2nd	31.32–36.63

Fourth Leg

3 coxae	7.72–12.09
Femur	19.00–20.86
Tibia 1	19.35–22.57
Tibia 2	22.95–24.98
Tarsus	8.59–12.12
Propodus	8.45– 9.07
Claw	6.04– 7.32

RELATIVE PROPORTIONS (see Table 2; Figs. 7, 8, 78–81):

L. leg ÷ L. trunk	5.40–10.82
L. leg ÷ L. proboscis	5.62–11.00
L. leg ÷ L. palp	3.56– 5.81
L. proboscis ÷ L. trunk	0.69– 1.45
L. palp segt.4 ÷ L. palp segt. 2	0.50– 0.72
L. femur ÷ L. tibia 1	0.89– 1.00
L. femur ÷ L. tibia 2	0.75– 0.96
W. trunk ÷ L. trunk	0.93– 1.20
L. scape 1 ÷ L. trunk	0.30– 0.81
Total L. scape ÷ chela	1.33– 2.45
L. palm ÷ L. fingers	0.58– 0.69

OCULAR TUBERCLE: Low and bluntly rounded, its basal diameter ranging from less than two-fifths to more than three-fifths of the width of the cephalon.

CHELAE FINGERS: Variably arched, and apparently non-functional, since the joints sometimes appear cemented, and are frequently immobilised by heavy growths of polyzoa.

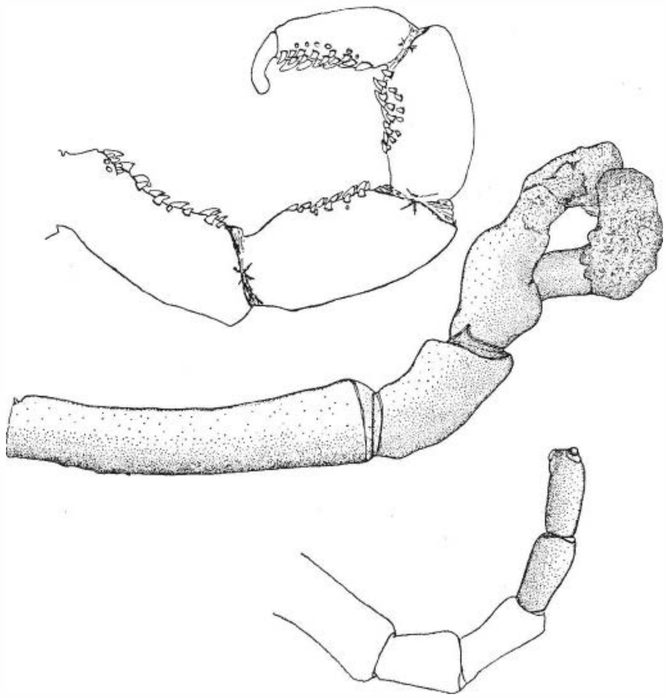


FIG. 76—*Decolopoda australis*: Terminal segments of right oviger, left chela, and terminal segments of left palp.

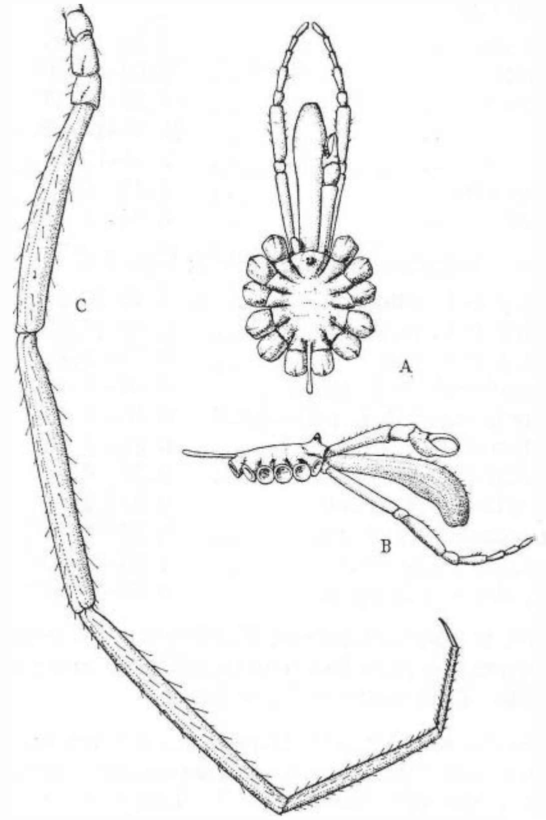


FIG. 77—*Dodecolopoda mawsoni*: A and B, dorsal and lateral views of proboscis, trunk, palps, and chelicerae of the holotype; C, 4th leg of the holotype. (This figure is reproduced by permission of Dr Isabella Gordon and the Mawson Institute.)

DISTRIBUTION

See Fig. 82.

KNOWN DEPTH RANGE

Littoral to 1,119 m.

Genus **Dodecolopoda** Calman and Gordon, 1933

Six pairs of legs; chelicerae persistent in adults, with a 2-segmented scape, and with apparently perfectly functional chelae fingers; trunk compact, with all lateral processes contiguous over part of their lengths; no intersegmental sutures or articulations on the trunk.

Dodecolopoda mawsoni Calman and Gordon, 1933. (Frontispiece, Fig. 7–10, 77–82)

Dodecolopoda mawsoni Calman and Gordon, 1933: 107–15; 1. Helfer and Schlottke, 1935: 280. Gordon, 1944: 7–8; 1. Hedgpeth, 1947: 17 ff.: 8–10.

MATERIAL EXAMINED

NZOI Sta. A 459, 75° 17′ S, 172° 20′ E, 534–549 m, 1 ♂.
B.M. (N.H.) Regn. No. 1934.12.31.67, 1 ♂ Holotype.

This is the second specimen of this remarkable 12-legged form to be taken. The holotype (also a male) was taken at B.A.N.Z.A.R. Expedition Station 107, 62° 03′ E, at a depth of 219 m. Unlike the holotype, this specimen is entire, although two legs were crumpled by the trawl. It is singularly free of epifauna or flora, and had presumably recently ecdysed. As can be seen from the data, the NZOI specimen differs slightly from the holotype in one or two relative dimensions, while the 4th leg is relatively much shorter than that of the holotype.

DESCRIPTION

Based on the two adults.

Six pairs of legs, covered with a sparse coating of long, simple spines; chelicerae persistent in adults, and apparently perfectly functional, shorter in total length than the proboscis; trunk compact, with all lateral processes contiguous over part of their length at least, no trace of inter-segmental articulations; ocular tubercle low and bluntly rounded, with two pairs of well developed eyes, the anterior appearing slightly larger than the posterior pair; 4th palp segment swollen in relation to other segments.

PROBOSCIS SHAPE: D‴: 2: E‴.

OVIGERAL SPINE FIELD CONFIGURATION:

$$S : \frac{Sp}{A} : \frac{P/N}{\mathbf{n} = 4 \text{ or } 5}$$

DIMENSIONS:

	Holotype ♂	Sta. A459 ♂
L. leg	242.30 mm	200.00 mm
L. trunk	18.00	18.00
L. proboscis	31.50	31.00
L. palp	48.20	45.30
L. scape segment 1 ..	13.50	11.70
L. scape segment 2 ..	4.60	4.00
L. total chelicera ..	28.10	25.50

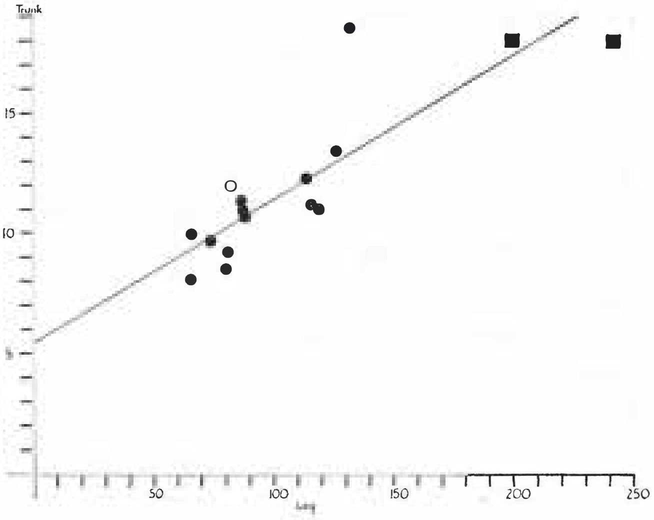


FIG. 78—*Decolopoda and Dodecolopoda*: Relative growth of leg length and trunk length. Hollow circle = one of Eight's type series of *Dec. australis*; solid circle = *Dec. australis*; solid square = *Dodec. mawsoni.* (Dimensions in mm.)

PERCENTAGE LENGTHS OF SEGMENTS:

Palp	Holotype ♂	Sta. A459 ♂
9th	7.28	8.62
8th	6.86	8.39
7th	6.86	8.62
6th	12.06	11.93
5th	7.28	8.18
4th	23.92	22.54
3rd	4.78	4.42
2nd	31.20	27.40
Fourth Leg		
3 coxae	7.38	8.00
Femur	19.88	18.00
Tibia 1	23.57	22.50
Tibia 2	23.86	22.50
Tarsus	14.80	15.00
Propodus	7.79	9.00
Claw	2.87	4.00

RELATIVE PROPORTIONS (see also Figs. 7, 8, 78–81):

	Holotype	Sta. A459
L. leg ÷ L. proboscis	7.69	6.45
L. leg ÷ L. palp	5.02	4.41
L. leg ÷ L. trunk	13.46	11.11
L. proboscis ÷ L. trunk	1.75	1.72
L. palp segt. 4 ÷ L. palp segt. 2	0.76	0.82
L. femur ÷ L. tibia 1	0.84	0.80
L. femur ÷ L. tibia 2	0.83	0.80
W. trunk ÷ L. trunk	1.00	0.75
L. scape 1 ÷ L. trunk	0.25	0.65
L. total scape ÷ L. chela	1.81	1.60

DISTRIBUTION

See above, and Fig. 82.

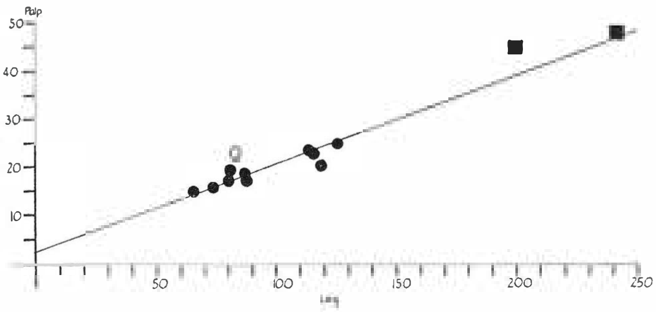


FIG. 80—*Decolopoda* and *Dodecolopoda*: Relative growth of leg length and palp length. Symbols as in Fig. 78. (Dimensions in mm.)

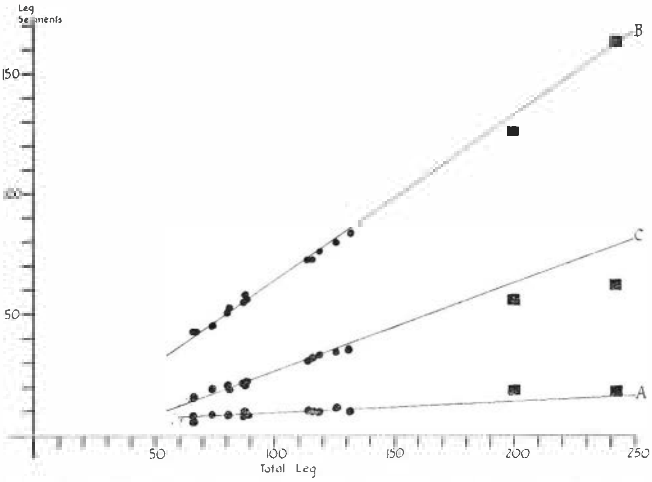


FIG. 81—*Decolopoda* and *Dodecolopoda*: Relative growth of three groups of leg segments. A, three coxal segments; B, femur + two tibiae; C, three distal segments. Other conventions as in Fig. 78. (Dimensions in mm.)

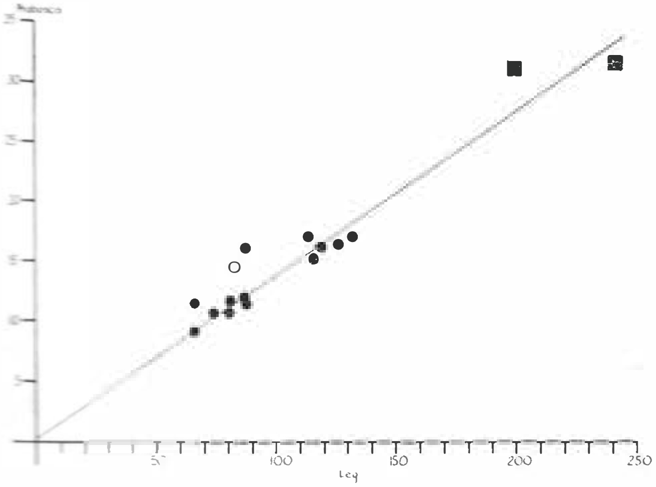


FIG. 79—*Decolopoda* and *Dodecolopoda*: Relative growth of leg length and proboscis length. Symbols as in Fig. 78. (Dimensions in mm.)

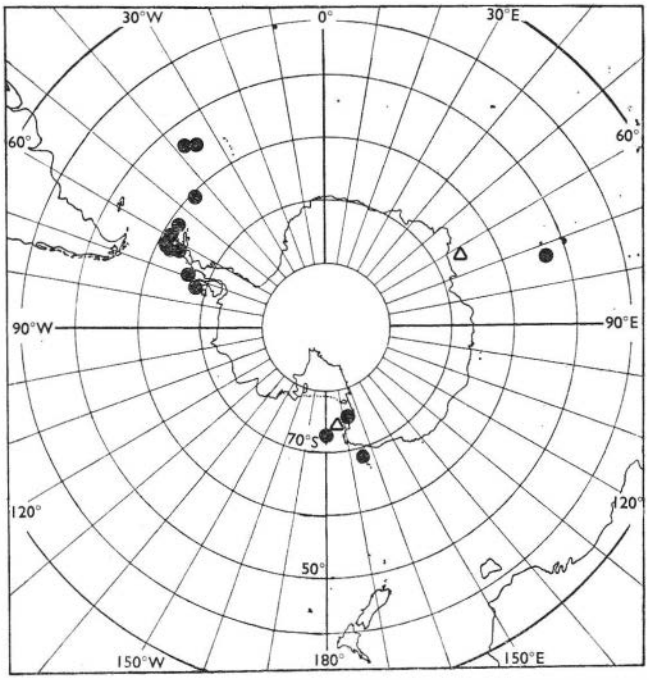


FIG. 82—Distribution records of *Dec. australis* (solid circles) and *Dodec. mawsoni* (hollow triangles).

Family PYCNOGONIDAE Wilson, 1878

Chelicerae and **palps** absent in adults; **ovigers** borne by males only, 4- to 9-segmented, with large terminal claw (considered by some authors as another segment); **propodus** well developed, but without heel or heavy basal spines; **tarsus** arcuate, much shorter than propodus. Members of the family are characterised by their thick-set appearance; the diameters of the leg segments are large in relation to the leg length, the legs are short in relation to the trunk, and the trunk is very broad in relation to its length. The proboscis is never longer than the trunk, and is stout. Family of world-wide distribution.

Key to the Two Genera of Pycnogonidae

1. Four pairs of legs.............................**Pycnogonum**
   Five pairs of legs.............................**Pentapycnon**

Genus **Pycnogonum** Brunnich, 1764

Some 22 or 23 species have been described for this genus, which is represented by at least 1 species in every major ocean basin. The following species have been described from the southern oceans and the Antarctic shelf regions: *P. rhinoceros* Loman, 1923; *P. magnirostris* Möbius, 1902; *P. platylophum* Loman, 1923; *P. magellanicum* Hoek, 1898; *P. sivertensi* Stock, 1955; *P. gaini* Bouvier, 1910; and *P.* sp. Gordon, 1932. The descriptions of some of these species leave much to be desired, and since we have not had access to extensive material other than of *P. gaini*, we consider it better not to attempt to review the Antarctic species. The inadequacies of some of the specific descriptions do not permit the construction of a key of any great value.

Four species of *Pycnogonum* are represented in the present collections; all are well characterised and can be distinguished easily from one another. *Pycnogonum gaini* has an angular, ungainly appearance at all sizes because of the conformation of the abdomen and posterior trunk segments, and the relatively long legs. *Pycnogonum rhinoceros* is a lumpy species with prominent tubercles on the proboscis and a well defined patch of sharp spines on the base of the tarsus. *Pycnogonum platylophum* is a small, clean-limbed species with rather narrow trunk somites, which give it a more elongate appearance. The fourth species, represented by a single large female, has a styliform proboscis, prominent conical dorsal tubercles and a small tubercle on the abdomen. We are unable to decide whether *Pycnogonum platylophum* is the same as *P. magellanicum* on the basis of this material.

Pycnogonum gaini Bouvier, 1910. (Figs. 83–85)

Pycnogonum gaini Bouvier, 1910: 30. Bouvier, 1913: 156; 101–4. Calman, 1915b: 68; 22. Hodgson, 1927: 354. Helfer and Schlottke, 1935: 298. Gordon, 1938: 28. Gordon, 1944: 68; 26a–d.

Material Examined

NZOI Sta. A 449, 1 ♀; Sta. A 450, 1 ♂, 1 ♀ (? juv.); Sta. A 521, 1 ♂; Sta. A 526, 1 ovigerous ♂.

Edisto Sta. 5, 1 larva; Sta. 8, 1 ♂, 1 ♀, 4 juveniles; *Burton Island* Sta. 5, 1 ♀; *Northwind* Sta. 8, 2 ♀♀; *Staten Island* Sta. SI-3, Ocean Sta. 11, 1 ♀.

Eltanin Sta. 1082, 1 ♂.

B.M. (N.H.) Regn. No. 1915.7.24.290–293, 5 ♂♂, 3 ♀♀, 1 juvenile; *Terra Nova* Sta. 220; B.M. (N.H.) Regn. No. 1935.11.7.21, 1 ♀, A.A.E. Sta. 66° 52′ S., 145° 30′ E.

Description

Based on 21 adults, 5 juveniles, and many larvae, supplemented by information from previous discussions.

PROBOSCIS SHAPE: B: 1. Gordon (1944) has described a distal dorsal "hump" on the proboscis of some of the B.A.N.Z.A.R.E. material. This condition may be formalised as D‴: 1. (See also under Larvae, below.)

TRUNK: Somites distinctly articulated, with a median dorsal projection at the posterior border of the somites. As in *Pentapycnon charcoti*, there is sometimes a second small projection anterior to the posterior dorsal border of the cephalic somite.

LEGS: First coxae of all legs with three or four prominent dorsal tubercles on the dorsal distal margin of the segment. In large specimens, these are very much worn down or reduced in relative size. All specimens in the collections studied bear, at the apex of the ventral protuberance on the femur of all the legs, a hollow, open-tipped spine having the appearance of a spigot, or the external portion of a duct.

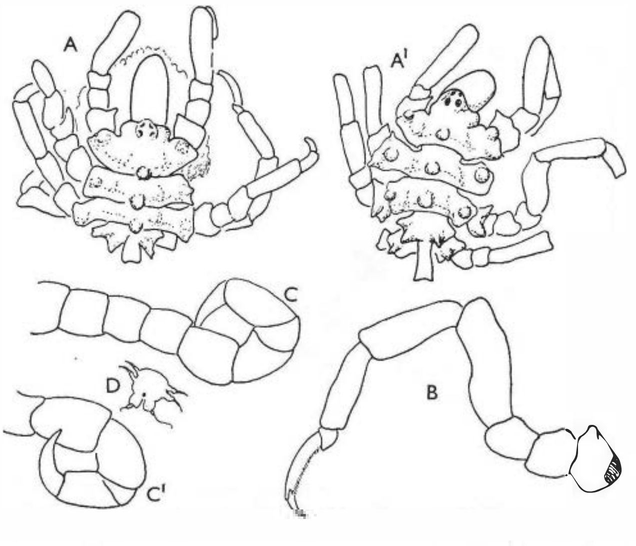


FIG. 83—*Pycnogonum gaini*, A and A′, dorsal views of trunk and proboscis of ovigerous and larvigerous male from *Eltania* Sta. 526; B, 3rd left leg; C and C′, views of oviger; D, larva from egg mass. (To same scale as C and C′).

OVIGERS: 8-segmented, 7th segment very much shorter than the 5th, 6th, or 8th; terminal claw equal to, or very slightly shorter than the 8th segment; no special spines, although a few small and simple spines are scattered over all the segments; on the 3rd segment, these spines form a tuft, and half a dozen spines are arranged in an irregular line on the ventral surface of the 8th segment.

SIZE RANGES (juveniles and adults):

L. leg	6.07–27.99 mm
L. trunk	1.99–12.20
L. proboscis	1.33– 7.90
L. abdomen	1.19– 3.50
Width across 2nd latl. procs.	2.39– 8.50
L. cephalic somite	1.59– 4.20

PERCENTAGE LENGTHS OF LEG SEGMENTS:

Third Leg

3 coxae	20.53–25.17
Femur	19.63–26.53
Tibia 1	17.49–20.88
Tibia 2	13.03–16.65
Tarsus	1.79– 3.65
Propodus	8.42–15.34
Claw	2.82–10.89

RELATIVE PROPORTIONS:

L. proboscis ÷ L. trunk	0.41– 0.74
Width of trunk ÷ L. trunk	0.68– 1.20
L. leg ÷ L. proboscis	3.54– 4.56
L. leg ÷ L. trunk	2.17– 3.05
L. femur ÷ L. tibia 1	1.11– 1.38
L. femur ÷ L. tibia 2	1.26– 1.79
L. cephalic segment ÷ L. trunk	0.32– 0.55

LARVAE: A single specimen from Sta. ED–8 is almost certainly larval. It bears certain close resemblances to Gordon's (1944) description of larval specimens placed in this species. The most striking points of resemblance are the lateral flanges on the distal portion of the abdomen, and the configuration of the dorsal projections, as well as the reduction of the chelae, ovigers, and palpi. We consider it a larval *P. gaini*. The very remarkable feature is a bifid proboscis (Fig. 84), each branch of which apparently has a very small aperture at its tip. If this specimen represents a normal stage of development it would apparently substantiate the views of Sanchez (1959) on the homology of the pycnogonid proboscis with two somites.

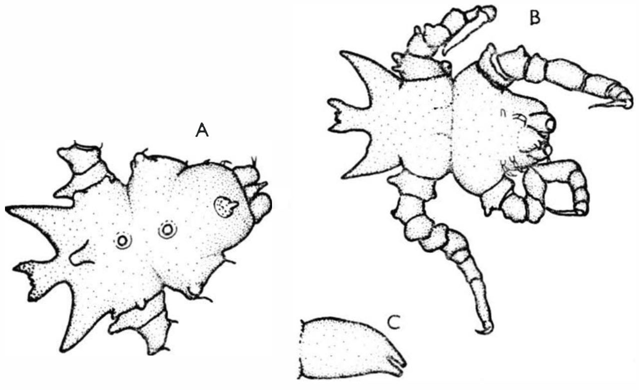


FIG. 84—*Pycnogonum gaini* (?), larva from Sta. ED-8; A, dorsal, and B, ventral, views; C, lateral view of proboscis.

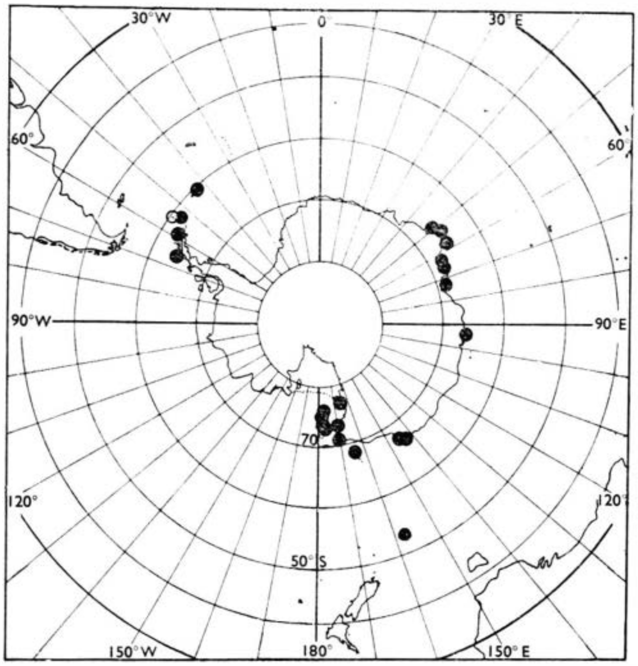


FIG. 85—Recorded distribution of *Pycnogonum gaini* (solid circle) and *P. eltanin* (hollow circle.)

Distribution Records

See Fig. 85. Record from the *Pourquoi Pas?* is given by Bouvier as 64°49′W (of Paris).

Known Depth Range

Upper sublittoral to 2,495 m.

Pyconogonum rhinoceros Loman, 1923. (Figs. 86–88)

Pyonogonum rhinoceros Loman 1923a: 7–9; A. Gordon 1932: 125; 71. Helfer and Schlottke, 1935: 298.

Material Examined

Staten Island Sta. 3 (SI-3), 1 ♀ (overgrown with hydroids).

Eltanin Sta. 426, 1 ovigerous ♂, 2 ♀♀; Sta. 441, 1 ♀ (fragments); Sta. 444, 1 ♀.

This is a large robust species, well characterised by the prominent dorsal median, and distal tubercles on the proboscis. As Gordon (1932) has indicated, the oviger is 9-segmented with a terminal claw, and the eyes are well developed in the adult. Since Loman's illustrations are barely recognisable, illustrations of several specimens are provided. A consistent feature in all specimens examined (including Gordon's *Discovery* specimen), is the presence of a kind of gland field or wart-like process on the anterior face of the 3rd coxa. This has not been observed in other Antarctic species of *Pycnogonum* or *Pentapycnon*; it occurs on all legs, but most conspicuously on the anterior ones. There is also a swelling near the base of the femur on the anterior surface, conspicuous as a light-coloured spot, but the femur lacks the ventral spigot of *P. gaini*. The spines on the sole of the propodus are small and evenly distributed; those on the base of the tarsus are sharply pointed and occur in a dense, discrete patch, as in *Pentapycnon charcoti*.

Morphologically, this species seems to be the octopodous form closest to *Pentapycnon charcoti*, and not *P. gaini*, as previously supposed (Hedgpeth, 1947).

MEASUREMENTS

(Specimens from *Eltanin* Sta. 426):

	♂	♀	♀
L. proboscis ..	7.0 mm	9.0 mm	9.0 mm
Gtst. diameter proboscis	3.5	4.5	5.0
L. cephalic somite ..	4.0	5.0	4.5
W. cephalic somite ..	4.0	5.0	4.5
Width, 2nd lat. proc.	6.0	9.5	9.0
Trunk	9.0	15.0	12.0
L. abdomen ..	2.5	3.5	3.0
L. 3rd leg	22.5	28.2	27.5
Coxae	5.0	6.0	6.5
Femur	4.5	6.2	6.0
Tibia 1	5.0	6.5	6.0
Tibia 2	4.0	5.0	5.0
Tarsus and propodus	3.0	3.5	3.0
Main claw ..	1.0	1.0	1.0

DISTRIBUTION

(See Fig. 88.) Previously reported from South Georgia. These records extend the range to the South Shetlands and the Weddell Sea.

DEPTH RANGE

Specimens have been taken at depths between 154 and 1,115 m.

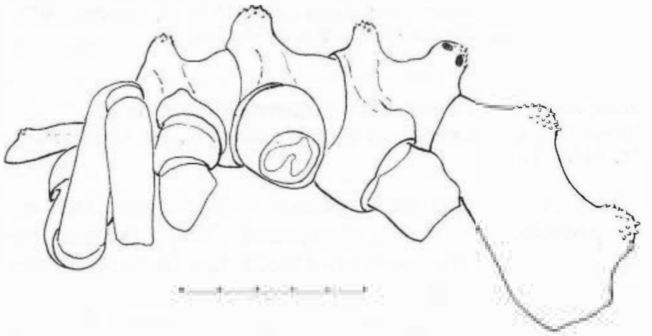


FIG. 86—*Pycnogonum rhinoceros*; lateral view of ovigerous ♂ from *Eltanin* Sta. 426. (The scale represents 5 mm.)

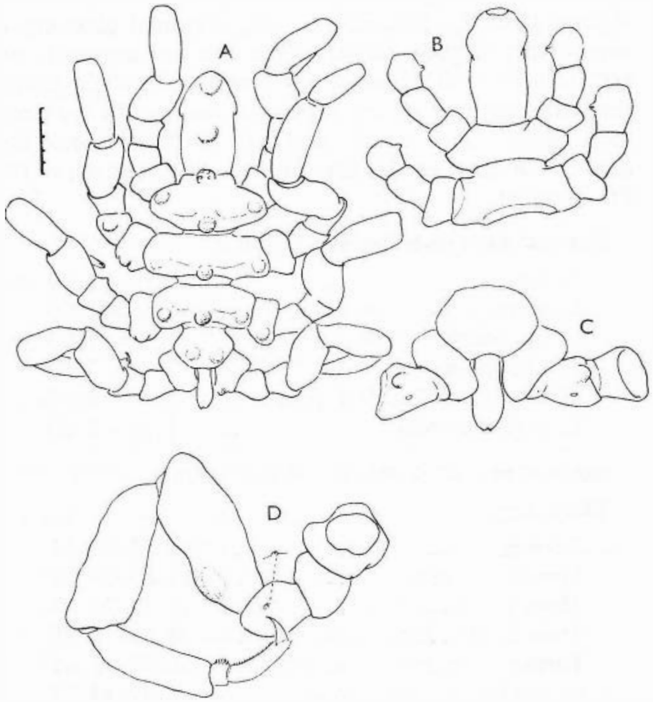


FIG. 87—*Pycnogonum rhinoceros*, ♀ from *Eltanin* Sta. 426; A, dorsal view; B, ventral view of proboscis and anterior somites; C, ventral view of abdomen and posterior somite, showing genital pores; D, 3rd left leg. (A and B to the scale representing 5 mm.)

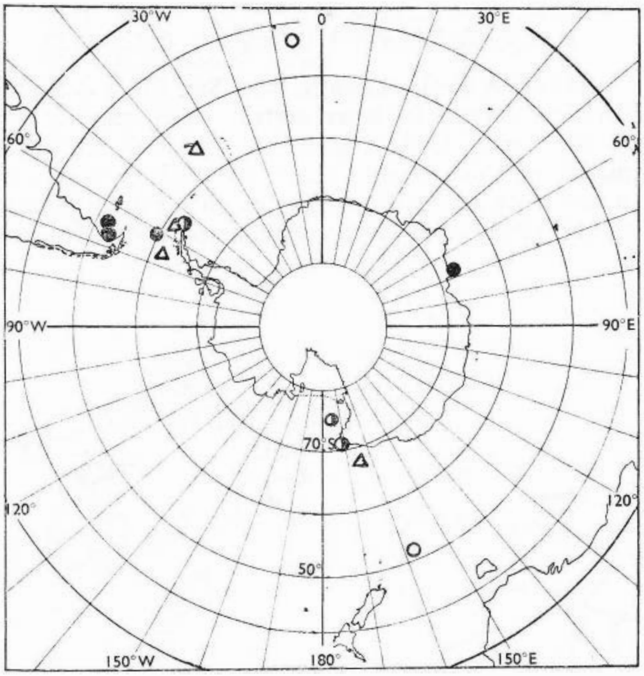


FIG. 88—Distribution records of *Pycnogonum rhinoceros* (hollow triangle), *P. platylophum* (solid circle), *P. sivertensi* (hollow circle), and *Pentapycnon charcoti* (circle with right half shaded). NOTE: The hollow circle in the lower right quadrant should be solid.

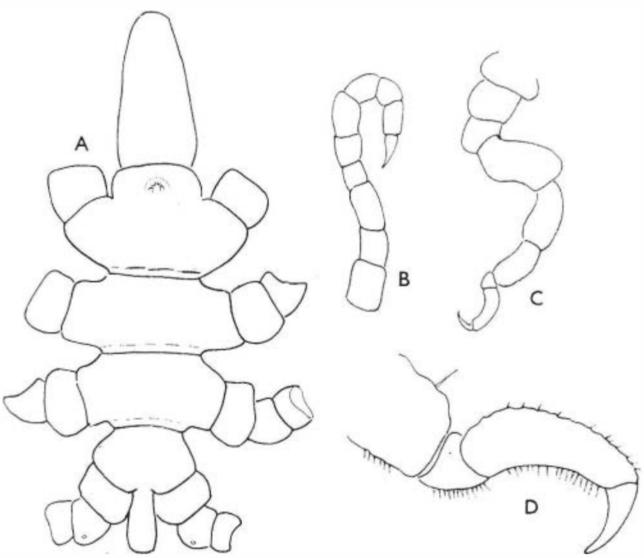


FIG. 89—*Pycnogonum platylophum*, ♀ from *Vema* Sta. V-15 110; A, dorsal view; B, oviger; C, 3rd right leg; D, terminal segments of leg.

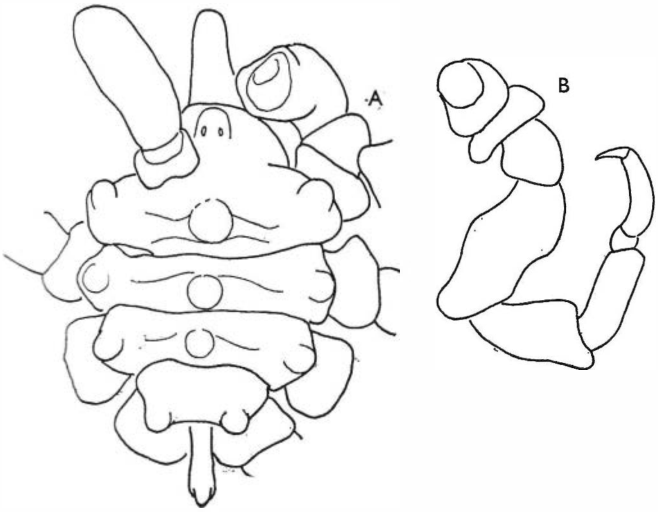


FIG. 90—*Pycnogonum eltanin*; A, dorsal view of holotype ♀; B, 3rd left leg.

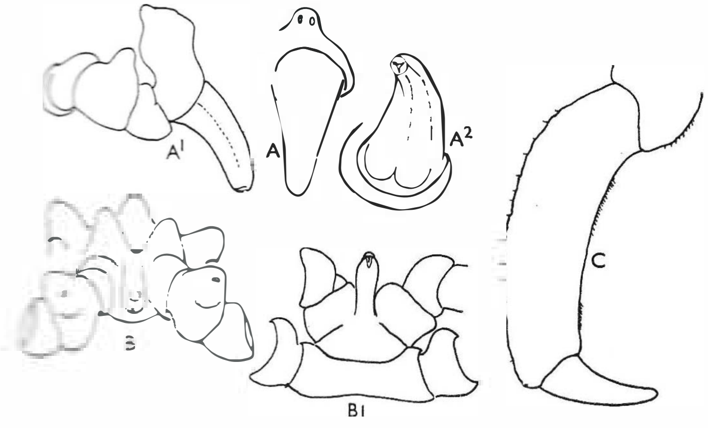


FIG. 91—*Pycnogonum eltanin*; A, anterior, A^1 lateral, and A^2 ventral, view of proboscis; B, posterior and B^1 ventral views of posterior end of trunk and abdomen; C, terminal segments of leg.

Pycnogonum platylophum Loman, 1923. (Figs. 88, 89)

Pycnogonum platylophum Loman, 1923b: 10–12. Gordon, 1932: 126; 71a, b. Gordon, 1944: 69–70; 27c, d. Helfer and Schlottke, 1935: 298.

MATERIAL EXAMINED

Eltanin Sta. 222, 3 ♂♂.
Vema Sta. V-15-106, 1 ♂; Sta. V-15-110, 1 ♂, 1 ♀.

This material varies little from what can be construed from Loman's description, except that one of the males from the *Eltanin* station has low dorsal tubercles on the median part of the posterior trunk ridges. Additional material may show that this species is synonymous with *P. magellanicum* Hoek, although, as Stock (1955) has indicated, the "*magellanicum* complex" may contain several distinct species associated with particular oceanic islands.

MEASUREMENTS

	Eltanin 222 ♂	*Vema* V-15-110 ♀
L. proboscis	2.3 mm	2.6 mm
Greatest dia. proboscis	1.2	1.2
L. cephalic somite	1.7	1.8
Width, 2nd lat. proc.	2.6	2.8
L. trunk	4.6	5.6
L. abdomen	1.1	1.1
Third leg:	5.9	..
Coxae	1.5	..
Femur	1.4	..
Tibia 1	1.1	..
Tibia 2	0.5	..
Tarsus	0.3	..
Propodus	0.75	..
Claw	0.4	..

RECORDED DISTRIBUTION

Subantarctic, circumpolar, except for the record from BANZARE Sta. 30 at 66°48′S, 71°42′E (Gordon, 1944). Most of the records are from east of Tierra del Fuego and the Falkland Islands; also from Macquarie Island (Gordon, 1932). It is recorded from depths of 18 to 540 m.

Pycnogonum eltanin n.sp. (Figs. 85, 90, 91)

MATERIAL EXAMINED

Eltanin Sta. 993, 1 ♀, Holotype, U.S.N.M. Holotype No. 113005.

This large specimen differs from all the other Antarctic representatives of the genus in having a strongly downcurved, evenly tapered, styliform proboscis which lacks tubercles or processes except for two ventral basal swellings. The trunk is also very stout and thick-set, with contiguous lateral processes. There are prominent dorsal and lateral tubercles on the trunk, and a small one at the dorsal tip of the abdomen; accordingly the anus appears slightly ventral in orientation. The spines on the propodus are very small, restricted to the proximal third of the segment and to a small region distally. There is no conspicuous patch of spines on the tarsus, and no gland field on the 3rd coxa.

The proboscis is distinctly different from that of *Pycnogonum gaini*, and the legs much shorter in proportion to the trunk segments than in *P. gaini*.

MEASUREMENTS OF HOLOTYPE ♀

Proboscis: L. basal chord	6.5 mm
L. cephalic somite	3.0
Width, 2nd lat. proc.	8.0
L. trunk	11.0
L. abdomen	3.0
L. 2nd right leg	22.0
Coxae	5.0
Femur	5.0
Tibia 1	4.5
Tibia 2	3.5
Tarsus and propodus	3.0
Claw	1.0

RECORDED DISTRIBUTION

The holotype was taken at approximately 61°25′S, 56°31′W, NNW of Gibbs Island, at a depth of 300 m.

Genus **Pentapycnon** Bouvier, 1910

Definition as for the genus *Pycnogonum*, except that the species has five pairs of walking legs.

Pentapycnon charcoti Bouvier, 1910. (Figs. 88, 92–95)

Pentapycnon charcoti Bouvier, 1910: 29. Bouvier, 1911a: 40. Bouvier, 1911b: 1140. Bouvier, 1913: 151–156; 98–100. Helfer and Schlottke, 1935: 298.

MATERIAL EXAMINED

NZOI Sta. A 459, 1 ♀. Cape Adare, Dec 1958, from fish stomach, depth?, 1 ♀.

Eltanin Sta. 410, 1 ovigerous ♂; Sta. 413, 1 ♀; Sta. 428, 1 ♀ (recently ecdysed).

These are the first records since Bouvier's description of the type, which is male.

The female is very similar to the male, except for the absence of ovigers. The specimens from *Eltanin* Sta. 410 and 413 are larger than Bouvier's male. There are well developed sexual openings on the 2nd coxae of the 5th pair of legs. The specimen from Sta. A 459 has the pore of the right side much larger than that of the left side. The Cape Adare specimen was, apparently, recovered from the stomach of a fish, and has suffered accordingly.

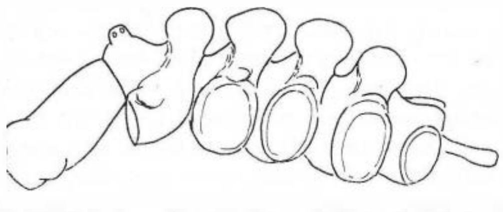


FIG. 92—*Pentapycnon charcoti*. Lateral view of ♀ from *Eltanin* Sta. 413.

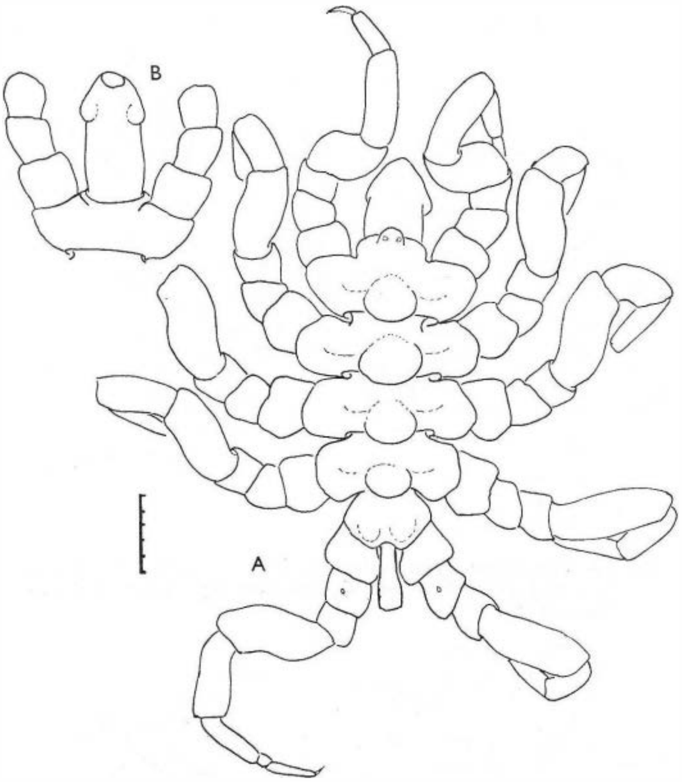


FIG. 93—*Pentapycnon charcoti*. ♀ from *Eltanin* Sta. 413; A, dorsal view; B, ventral view of proboscis and cephalic somite. (The scale represents 5 mm.)

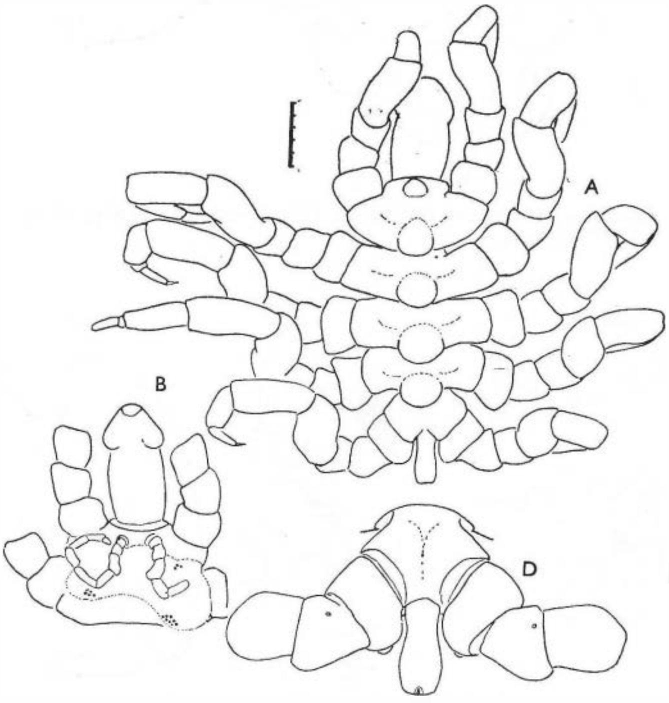


FIG. 94—*Pentapycnon charcoti*. Ovigerous ♂ from *Eltanin* Sta. 410; A, dorsal view; B, ventral view of proboscis and anterior trunk; C, ventral view of abdomen and posterior trunk. (The scale represents 5 mm.)

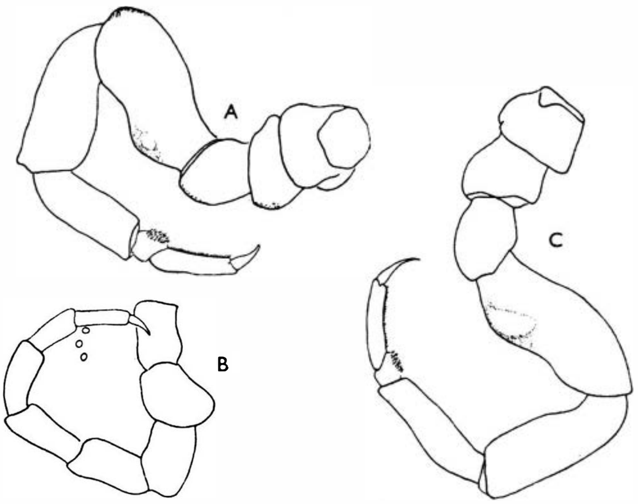


FIG. 95—*Pentapycnon charcoti.* A, 4th left leg of ovigerous ♂; B, left oviger of same specimen; C, 4th right leg of ♀.

DESCRIPTION

Based on five specimens and Bouvier (1913).

PROBOSCIS: Half to three-quarters the length of the trunk, roughly ovoid in shape, slightly recurved ventrally; bearing subterminally two larger ventral, and one smaller, dorsal, blunt projection; greatest diameter lies approximately one-third of the distance along its length from the basal attachment; the opening lies slightly ventral to the tip. Formula: C''': 2: E.

TRUNK: compact, but not disciform; lateral processes almost contiguous; individual somites clearly defined, with distinct intersegmental membranes; first four with a steep posterior ridge projected dorsally into a large knob (these knobs look like puffballs when viewed laterally); 5th somite markedly different from the others, both in dimensions and configuration; in females this somite is distinctly saddle-shaped—far more so than indicated in Bouvier's figures of the male. The length and width of the first four somites diminish gradually antero-posteriorly, and the 5th somite is markedly smaller. The striking sculpturing and ridging on both dorsal and ventral surfaces of the first four somites is absent on the 5th. Cephalic somite bearing a moderate-sized blunt ocular tubercle with four small eyes, and another small conical tubercle midway between the median posterior and the ocular tubercles. The 2nd tubercle is produced laterally into a low and indistinct ridge; lateral processes have distally and posteriorly a swelling, which increases in size antero-posteriorly in the first four segments; abdomen club-shaped, projecting slightly beyond the 1st coxae of the 5th pair of legs.

OVIGERS: 9-segmented, present only in the male, with a short, bluntly curved terminal claw; 2nd segment swollen, segments 3 to 9 successively reduced in diameter; proximal 9 segments more or less subequal in length.

LEGS: short and stout, approximately twice the trunk length; 3 coxae subequal in length, diminishing in width distally; 1st coxa of each leg bearing dorsally and distally a pair of low, blunt tubercles; in males, femur and 1st tibia subequal, the femur appearing insignificantly longer; in females the 1st tibia noticeably shorter than the femur; 2nd tibia decidedly shorter than the 1st in both sexes; in both sexes, femur bearing a prominent swelling approximately half way along its ventral midline, apparently lower and more rounded in females than in males; tarsus very short and arcuate, with a dense field of short sharp spines on the ventral surface; propodus without pronounced heel or basal spines, a row of minute spines on its ventral surface; terminal claw short, sharply tapered, and slightly curved; genital pores on the dorsal posterior surface of the 2nd coxae of the 5th pair of legs; pores larger in females than in males, situated on a swelling of the coxae.

DIMENSIONS

	Pourquoi Pas? ♂ mm	A 459 ♀ mm	Cape Adare ♀ mm	*Eltanin* 410 ♂ mm	*Eltanin* 413 ♀ mm
L. proboscis	7.7	6.9	5.5	9.2	8.5
Greatest diameter	3.6	3.6	3.2	4.0	4.0
L. cephalic somite	2.8	2.8	1.6	3.0	4.0
W. cephalic somite	4.0	3.8	2.8	5.0	4.8
W. trunk	4.6	3.9	3.4	5.0	4.5
L. abdomen	4.0	3.9	2.9	5.0	4.5
L. trunk	17.0	12.3	8.0	19.0	19.8
W. across 2nd lat. procs.	10.0	7.3	5.1	11.5	15.0
L. 2nd right leg	29.5	25.0	18.8	31.5	34.0
3 coxae	6.2	6.4	4.2	8.0	8.0
Femur	6.0	5.9	3.9	7.0	7.0
Tibia 1	6.0	4.2	3.7	6.0	7.5
Tibia 2	4.8	4.0	3.2	5.0	5.5
Tarsus and prop.	4.0	3.0	2.8	4.5	4.0
Claw	2.5	1.5	1.0	1.0	2.0

DISTRIBUTION RECORDS

See Fig. 88.

KNOWN DEPTH RANGE

240–1,420 m.

Family ENDEIDAE Norman, 1908

Chelicerae and **palps** absent in adults; four pairs of walking legs; **ovigers** borne by males only, 7- to 8-segmented; **tarsus** short, arcuate; **propodus** well developed, arched, with pronounced proximal heel and heterogeneous sole spines; strongly developed **accessory claws**; **legs** long, animals slender in appearance. Monogeneric family of world-wide occurrence.

Genus **Endeis** Philippi, 1843

Palps and chelicerae absent in adults and juveniles, lost at metamorphosis, although the chelicerae may be represented by minute projections on a ridge anterior to the eye tubercle; ovigers present in males only, 7- to 8-segmented, with no special spines; all 4 trunk somites articulated; legs 2 to 10 times the length of the trunk, bearing propodus with accessory claws, tarsus very short; proboscis of shape B or D: 1; ocular tubercle steeply conical, with 4 well developed eyes.

Rarely has the standing of a generic name been subject to so much controversy, both personal and objective, as has the name *Endeis*. Despite the arguments on nomenclatural procedure that enshrouded the name of the genus for more than half a century (see Hedgpeth, 1948), there has been little or no attempt to review the genus from a biological standpoint.

While the various species occur widely, the genus is morphologically remarkably compact and homogeneous, and separation of species is based upon characters which show relatively small ranges of variation and tend to play only a secondary role in specific diagnosis in most other genera of pycnogonids. Carpenter (1908) went so far as to doubt whether any of the species of *Endeis* then recognised were "good" species.

Although the range of morphological variation in the genus is so small and the potential of variation is further reduced by the complete absence of palps and chelifores, the discontinuities in the ranges are sufficiently clear-cut to dispel any doubts as to the validity of nearly all the species. Admittedly, the small number of known specimens of some species necessitates caution in defining their absolute ranges of variation. We have had access to material of *Endeis spinosa* and *E. australis* only, and to some unpublished data on *E. meridionalis*. For the other species, we have had to rely solely upon published data, so the key to the species proposed, and the analyses of data are tentative. A more conclusive review of the genus will have to await the collection of more specimens and restudy of collections in the Indian and South African Museums.

The possibility that *E. charabdaea* may be, after all, a valid species (Hedgpeth, 1948) is particularly interesting. The characters upon which it was originally separated from *E. spinosa* (Bouvier, 1923) are no longer considered critical, and a reassessment of its standing must await very detailed analyses of large populations from both sides of the Atlantic, and especially from the Sargasso Sea.

We do not regard the number of femoral cement glands, previously considered as diagnostic of the various species, as being of any great significance, because of wide variation between individuals which otherwise obviously are of the same species. Calman (1923) was correct in suggesting that there is more than one species in which the ducts are arranged irregularly; in *E. australis*, the pattern of ducts may be very variable. Unfortunately, there are no data on the ducts of *E. procera*.

Attempts have also been made to use the relative lengths of the three long leg segments as specific criteria. Except for *Endeis procera*, variations in these lengths are too uniformly distributed throughout the genus, and show insufficient discontinuities, to be used with any confidence in diagnosis. Throughout the genus, in adult specimens at least, the 1st tibia is always the shortest of the three. In general, the femur and 2nd tibia are subequal. In *E. procera* alone, the 2nd tibia is decidedly and consistently longer than the femur.

Calman's species, *E. flaccida*, seems to us to be highly suspect. His expression, "body rather contracted", might be expressed more clearly with reference to the separation of the lateral processes, for the trunk is not, in fact, short in relation to the proboscis or legs. The use of the softness of the integument as a specific criterion is unacceptable. Specimens with a soft integument are known for practically every species of pycnogonid and no one has suggested that such forms represent anything other than recently ecdysed animals. Since his specimens had been preserved for some time, the significance of the transparency of the cuticle is very doubtful. Transparency seems also to be associated with cuticular softness immediately following ecdysis.

Although knowledge of variation in the internal anatomy of the Pycnogonida is very slight, it is possible that the formation of the intestinal diverticula is of significance in speciation, and this and the relative lengths of the three basal segments of the oviger are the only characters left by which we may separate *E. mollis* and *E. flaccida*. The very close similarity between the distal segments of the oviger in these two species makes us doubt the validity of the latter difference, but we prefer to retain the name *E. flaccida* until further material of *E. mollis* and *E. flaccida* (if any) has been studied.

Endeis australis (Hodgson, 1907). (Figs. 96–98)

Phoxichilus australis Hodgson, 1907: 5–7; I, 1. Bouvier, 1911b: 1139. Bouvier, 1913: 118–20; 74. Helfer and Schlottke, 1935: 279.

Endeis australis Calman, 1915b: 49; 11. Gordon, 1932: 93–94. Helfer and Schlottke, 1935: 297. Gordon, 1938: 20. Gordon, 1944: 48. Fage, 1952b: 184.

MATERIAL EXAMINED

NZOI Sta. A 449, 1 ♀; Sta. A 459, 2 ♀♀; Sta. A 471, 1 ♀.

Trans-Antarctic (N.Z.) Sta. 79, 1 ovigerous ♂; Sta. 100, 1 ♀.

Stanford Sta. GLD-13, 1 ♀, partly decomposed; Sta. B, 1 ♀; Sta. X, 1 ♀.

DESCRIPTION

Based on 11 adults, supplemented by information from all previous descriptions.

PROBOSCIS SHAPE: B: 1.

CEMENT DUCTS: present on the femora of all, or of the last three pairs of legs in the male; number varies from 12 to 25.

OVIGER: 7- or 8-segmented, the distal suture variably developed.

SIZE RANGES (adults only):

L. leg	24.70–32.57 mm
L. trunk	2.93– 5.00
L. proboscis	2.00– 4.00
L. abdomen	0.66– 0.93
W. across 2nd latl. pros.	2.26– 3.00

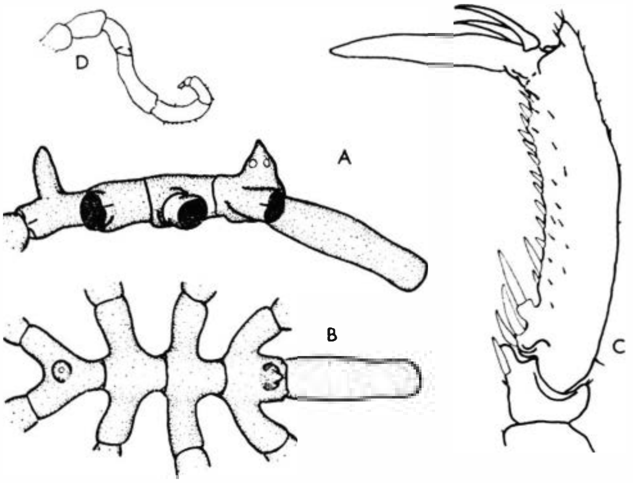


FIG. 96—*Endeis australis*; A, B, lateral and dorsal views of trunk and proboscis; C, tarsus, propodus, and claws of 3rd left leg; D, oviger.

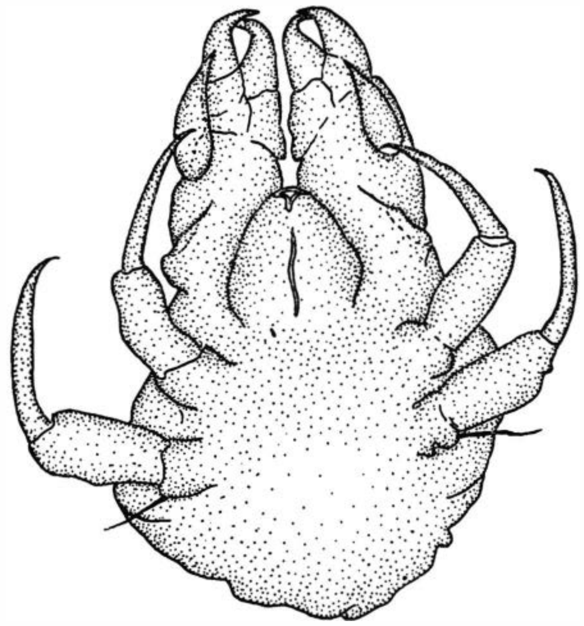


Fig. 97—*E. australis*, ventral view of larva, showing "spinnerets" on the scape of the chelicerae.

PERCENTAGE LENGTHS OF LEG SEGMENTS:

Third Leg	
3 coxae	14.87–18.73
Femur	23.12–26.95
Tibia 1	19.65–24.58
Tibia 2	26.07–28.86
Tarsus	0.43– 0.95
Propodus	4.56– 6.15
Claw	2.22– 3.87

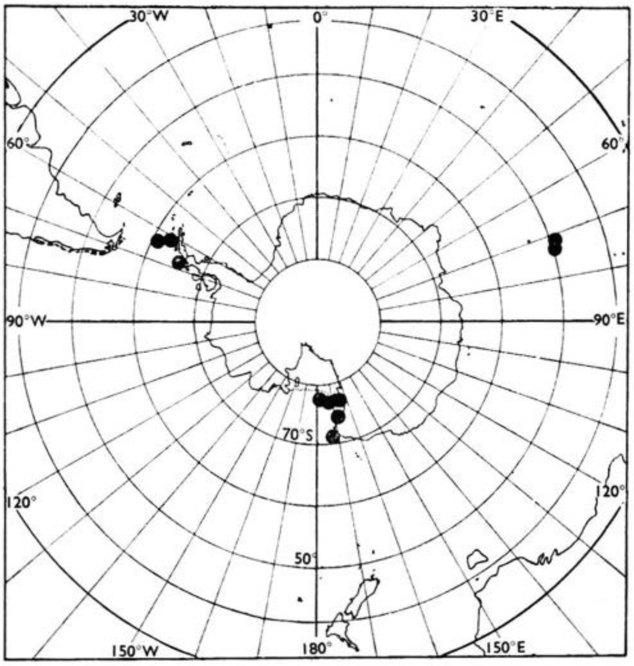


FIG. 98—*E. australis*, Antarctic distribution records.

RELATIVE PROPORTIONS:

L. proboscis ÷ L. trunk	0.68– 1.00
W. trunk ÷ L. trunk	0.64– 0.82
L. leg ÷ L. proboscis	7.50–10.94
L. leg ÷ L. trunk	6.00– 9.86
L. femur ÷ L. tibia 1	1.04– 1.20
L. femur ÷ L. tibia 2	0.86– 1.12
L. claw ÷ L. propodus	0.49– 0.59
L. accessory claw ÷ L. claw	0.33– 0.59

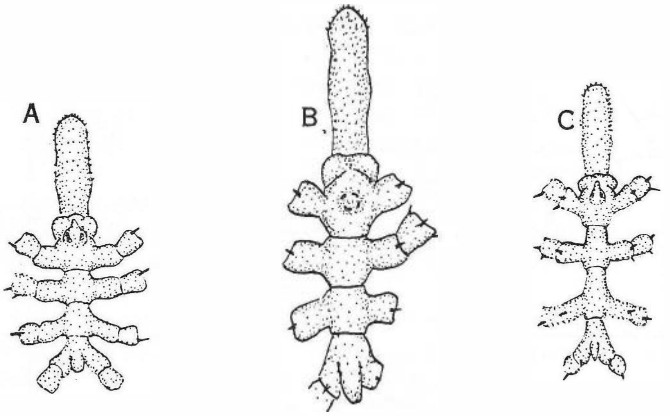
DISTRIBUTION (Fig. 98)

Specimens have been taken between 5 and 1,000 m.

KEY TO ADULTS OF THE KNOWN SPECIES OF *Endeis* (Figs. 99–102)

1 3rd leg 3–5 times as long as trunk; (pronounced collar above insertion of proboscis).......................... 2
3rd leg *ca.* 8 times as long as trunk; (no pronounced collar).. **australis**
2 1st and 2nd lateral processes separated by 1.00, or less.... 3
1st and 2nd lateral processes separated by more than 1.00 8
3 Ovigerous male specimens only........................ 4
Both male and female specimens....................... 6
4 Propodus extended beyond insertion of terminal claw as a sharp narrow process; (relative lengths of 6 basal oviger segments, in order of increasing size: 1:6:3:2:5:4)....**clipeata**
No distal prolongation of propodus.................... 5
5 Relative lengths of 6 basal oviger segments, in order of increasing size: 6:3:1:4:5:2........................**flaccida**
Relative lengths of 6 basal oviger segments, in order of increasing size: 1:6:3:4:5:2........................**spinosa**
6 Femur bearing 2 marked lateral projections, each surmounted by a large spine; (width across 2nd lateral processes subequal to half the length of the trunk) 7
Femur with no specially pronounced lateral projections or spines; (width across 2nd lateral processes greater than half the length of the trunk)..........................**clipeata**
7 *North Atlantic and Mediterranean distribution.......**spinosa**
Indian Ocean (? Bay of Bengal only)...............**flaccida**

*See discussion of the genus, p. 64.



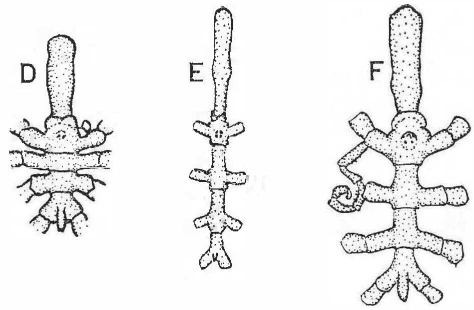


FIG. 99—Dorsal view of the body of *Endeis* species. A. *E. flaccida*; B, *E. spinosa*; C, *E. meridionalis*; D, *E. clipeata*; E, *E. procera*; F, *E. mollis.*

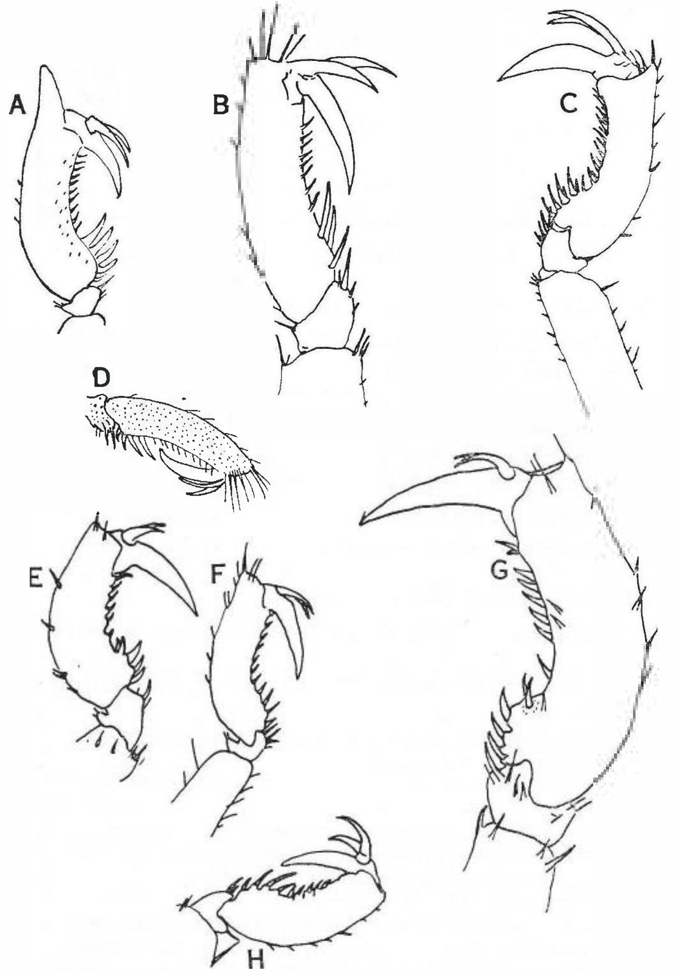


Fig. 100—Terminal segments of the leg of *Endeis* species. A, *E. clipeata*; B, *E. procera*; C, *E. flaccida*; D, *E. mollis*; E, F, G, *E. spinosa*; H, *E. meridionalis.*

8 Lateral processes separated by more than 2.00........... 9
Lateral processes separated by more than 1.00 but less than 2.00.. 10
9 2nd tibia markedly longer than either 1st tibia or femur; leg segments very narrow.........................**procera**
Femur, tibia 1 and tibia 2 all subequal, 1st tibia being slightly shorter..............................**meridionalis**
10 *Integument transparent and flaccid; intestinal diverticula with accessory caeca.............................**flaccida**
Integument not especially transparent; intestinal diverticula simple...**mollis**

*See discussion of the genus, p. 64.

Family AMMOTHEIDAE Dohrn, 1881

At least 40 genera (Table 6) have been placed within this family at one time or another, and of these some 30 are probably generally accepted as valid taxa.

Some attempts have been made to subdivide the family —notably by setting up the families Tanystylidae (Schimkevitch, 1913) and Austrodecidae (Stock, 1957)* —but in each case the discovery of new species and genera has discredited the usefulness of the diagnoses of these smaller units. At present it appears unlikely that the 30 valid genera which might be considered as "ammotheid" form a homogeneous group, and we have made no attempt to define a family Ammotheidae in this work.

A major revision of the relationships of these many genera is long overdue. This will involve the simultaneous correct assessment of nearly 200 species—a feat which is almost certainly beyond the mental capa-

TABLE 6. The Genera Which Have at One Time or Another Been Included in the Family *Ammotheidae* Dohrn, 1881

Achelia Hodge, 1864
Aduncorostris n. gen.
**Ainigma* Helfer, 1938
Ammothea Leach, 1814
Ammothella Verrill, 1900
Anammothea n. gen.
Ascorhynchus Sars, 1877
Athernopycnon n. gen.
Austrodecus Hodgson, 1907
Austroraptus Hodgson, 1907
**Austrothea* Hodgson, 1915
**Barana* Dohrn, 1881
**Bathyzetes* Loman, 1908
Böhmia Hoek, 1881
Calypsopycnon Hedgpeth, 1948
Cilunculus Loman, 1908
**Clotenia* Dohrn, 1881
**Corniger* Böhm, 1879
Discoarachne Hoek, 1881
Dorhynchus Hoek, 1881
Ecleipsothremma n. gen.
Ephyrogymna Hedgpeth, 1943
Eurycyde Schiödte, 1857
Fragilia Loman, 1908
Hannonia Hoek, 1881
Hemichela Stock, 1954
Heterofragilia Hedgpeth, 1943
**Kyphomia* Helfer, 1938
Lecythorhynchus Böhm, 1879
**Leionymphon* Möbius, 1902
Magnammothea n. gen.
Nymphonella Oshima, 1927
Nymphopsis Haswell, 1884
**Oiceobates* Hesse, 1867
**Parazetes* Ortmann, 1891
Paranymphon Caullery, 1896
**Pasithoe* Goodsir, 1842
Rhynchothorax Costa, 1861
Sericosura n. gen.
Scipiolus Loman, 1908
Tanystylum Miers, 1879
Thavmastopycnon n. gen.
Trageus Dohrn, 1881

*Generally accepted, at present, as junior synonyms of other genera on this list.

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*The genus *Austrodecus* is treated in Section 2 (in preparation).

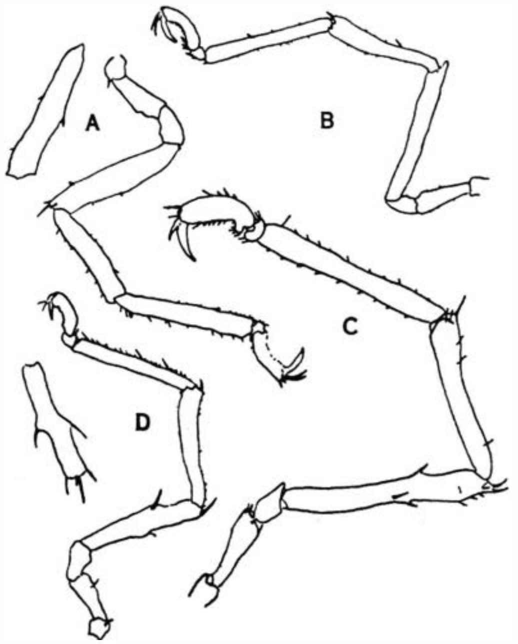

Fig. 101—Legs of *Endeis* species. A, *E. flaccida*, with dorsal view of femur; B, *E. mollis*; C, *E. spinosa*; D, *E. meridionalis*; with dorsal view of femur.

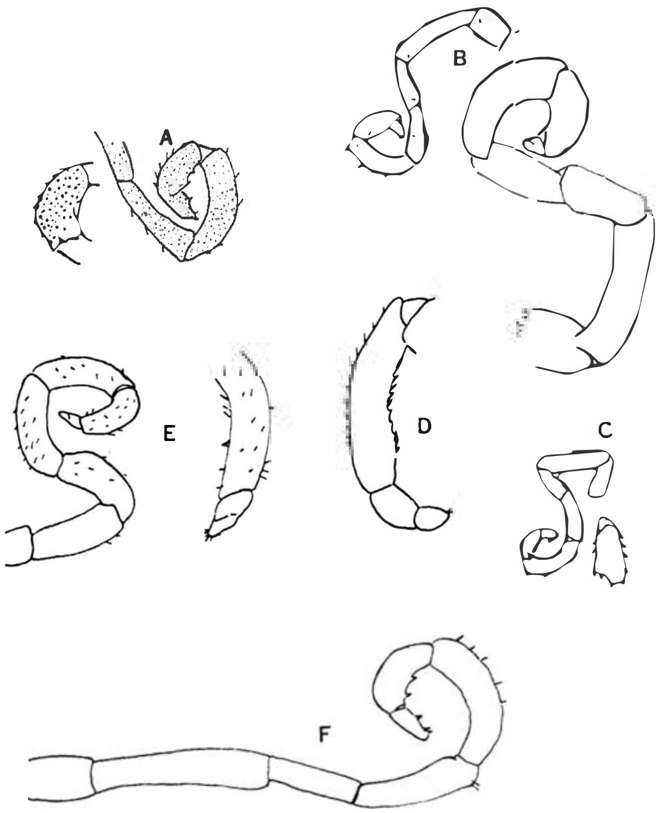

Fig. 102—Ovigers of *Endeis* species. A, *E. mollis*; B, *E. spinosa*; C, E. *flaccida*; D, *E. clipeata*; E, *E. clipeata*; F, *E. meridionalis*.

bilities of any one person, although it is within the competence of modern computers. But meaningful computation of similarities relies on accurate and consistent detailed descriptions of all species. Many of the descriptions in the literature are far from accurate and by no means consistently detailed, and the taxonomist who undertakes the revision of this family will have to assess anew the identity of most of the species. Such a revision of the family is far outside the scope of this work, and we have not attempted it. We have, however, used three different numerical techniques in revising the genera *Ammothea* Leach, 1814, and *Achelia* Hodge, 1864. The results confirm our view that not only is the family Ammotheidae highly heterogeneous but also that the genera are less discrete than hitherto suggested. Furthermore, these numerical techniques have demonstrated that it is essential to consider heterogony—whether of meristic or mensural characters—when describing taxa and when using characters in preparing classifications.

Genus **Ammothea** Leach, 1814

RELATIONSHIPS OF JUVENILES

The descriptions of the 15 species of the genus *Ammothea* (as envisaged by Gordon (1932, 1938, 1944) and other authors) incorporate data from 127 specimens. With this wealth of data, using numerical taxonomic methods, we have attempted to find a technique to separate juveniles of the various species with some degree of confidence, and simultaneously relate them to their respective adults—an accomplishment which has so far eluded workers on the genus. This attempt failed, for reasons which are of interest both in relation to our knowledge of pycnogonid biology and to the methods of numerical taxonomy. These procedures, and their significances, which are outlined below have been discussed in greater detail elsewhere (Fry, 1964a).

NUMERICAL METHODS

Adult and juvenile specimens were first grouped into species intuitively by a grouping based largely on characters emphasised in Gordon's 1932 key, to provide groups which could be compared with those derived by numerical methods. The 127 specimens were then treated as Michener and Sokal (1957, 1958) compared species of megachilid bees. Forty-three characters were considered, whose states varied in number between two and nine. The computation of the Q-type product-moment correlation coefficients was carried out on the Burroughs 220 digital computer at Stanford University. The specimen groupings which resulted from analysis of the correlation coefficient matrices by the weighted group variable method were totally unlike the groupings derived intuitively.

To find explanations for the striking differences between the two dendrograms, the distribution of the characters states within the intuitively defined species was investigated. It was found that the great majority of both meristic and mensural characters varied more or less continuously from metamorphosis from the protonymphon stage to the attainment of maximum size.

TABLE 7. Matrix of "Percentage Matching Coefficients"* between Species of *Ammothea*

	1 *minor*	2 *meridionalis*	3 *carolinensis*	4 *spinosa*	5 *allopodes*	6 *tetrapora*	7 *glacialis*	8 *clausi*	9 *stylirostris*	10 *calmani*	11 *longispina*	12 *striata*	13 *gigantea*	14 *magniceps*
1 *minor*	—													
2 *meridionalis*	5134	—												
3 *carolinensis*	7025	5674	—											
4 *spinosa*	4053	4593	5124	—										
5 *allopodes*	4593	4053	5404	5134	—									
6 *tetrapora*	3783	4593	4863	3242	5404	—								
7 *glacialis*	6606	4848	8181	3512	4242	4242	—							
8 *clausi*	8736	6485	4863	4593	4593	4343	5757	—						
9 *stylirostris*	7272	4545	7025	4053	5757	5151	4848	6060	—					
10 *calmani*	5404	4053	6755	6214	7836	5134	5757	4593	6363	—				
11 *longispina*	6060	3636	7272	3512	4593	5454	5757	5151	6363	6666	—			
12 *striata*	4593	4323	6214	3783	4593	4593	4863	4863	3939	4593	3939	—		
13 *gigantea*	5404	4593	5853	5366	4863	4323	5454	5944	5404	6755	4863	5134	—	
14 *magniceps*	8294	6116	4750	4250	4117	3432	6864	8340	3614	4726	5304	5000	5250	—
15 *profunda*	3892	3510	5282	4050	4448	4170	4680	5560	4056	5838	4368	7228	4862	3432

*Decimal points have been omitted from the percentages, which are expressed to two decimal places.

Many of the mensural characters employed were relative proportions of appendages, segments, and other structures, expressed as simple ratios. The plots of these ratios demonstrated that every structure considered grows heterogonically in relation to every other, while no two heterogonic relationships in a single species lie within the same confidence limits. Furthermore, some of the heterogonic relationships undergo a slight, but detectable, change at the onset of sexual maturity.

The effect of these growth patterns, combined with arbitrary division of the character states for the purpose of coding, is to overemphasise similarities between the smallest individuals of different species, and at the same time to overemphasise dissimilarities between the largest and smallest individuals of the same species (Figs. 103 and Table 8). The dendrogram derived from the matrix revealed that the specimens were grouped essentially according to size.

As stated above, some of the meristic characters also varied from metamorphosis to the attainment of maximum size. Much, if not all of this variation, e.g., the numbers of propodal sole spines, projections on the lateral processes, etc., could no doubt be correlated in some measure with particular stadia. If the developmental life histories of the species had been known sufficiently for different stadia to be recongised and then compared, all the problems of heterogony could doubtless be overcome. Two possibilities for overcoming the biasing of the coding procedures were examined.

The relative proportions used as characters can be described as heterogonic growth, in algebraic terms, including confidence limits. Arbitrary coding states can be defined within the range of heterogonic relationships thus described, and the relative proportions of individuals can be coded in terms of these states. Unfortunately, the description of the heterogonic growth must be derived from specimens grouped intuitively into species. Resulting correlations between species would consequently be biased heavily towards the formation of the original intuitive groups.

Another possibility is to relate each item of information on relative proportions to every other such item. This can be done by including, in the data from which the correlation coefficients are computed, absolute measurements of the structures whose relative proportions are already being considered. Unfortunately, this amounts to a twofold weighting of each measurement involved,

TABLE 8. Distribution in Four Species, of Seven Arbitrary States of the Character Depicted in Fig. 103

	Code States	
Species	Juveniles	Adults
1	A B C D	D E F G
2	A B C	C D E F
3	A B C	D E
4	A	B C

——————————————→
Increasing size of specimens.

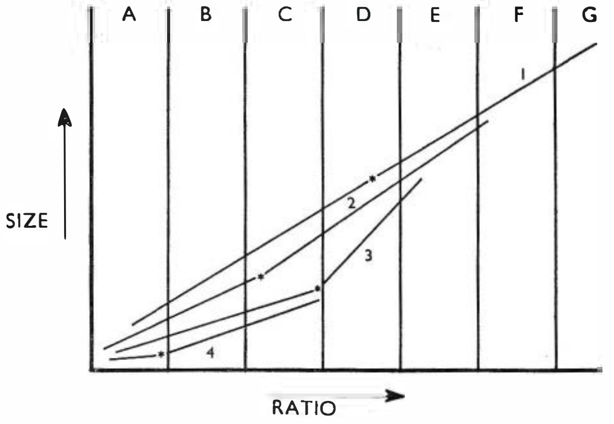

FIG. 103—Hypothetical heterogonic relationships of two structures in four species (1—4), demonstrating the difficulty of defining codeable states for numerical taxonomic purposes (see text). A to G represent arbitrary coded states. The asterisks mark the attainment of sexual maturity; in species 2, 3, and 4, this is accompanied by a change in heterogony.

and such weighting is not only contrary to an essential premise of Adansonian taxonomy, but is also difficult to justify within any logical system of taxonomy.

It is apparent that there are considerable difficulties when relative proportions are used as characters to assess pycnogonid relationships by numerical taxonomic methods. Until the distortions of correlation coefficients by persistent heterogony can be compensated mathematically it would appear wiser to use non-numerical information, or meristic characters not affected by heterogony. This is most unfortunate, since the coding of non-numerical data is a far more subjective process than the coding of meristic or mensural data. Two of the intellectually most attractive features of numerical taxonomic methods are repeatability and the reduction in subjective bias of data descriptions.

INTERRELATIONSHIPS OF THE SPECIES

Since the method described above was not statistically satisfactory, the specimens were grouped intuitively into species, and a search was made for a repeatable and biologically satisfactory method of comparing the species with one other. The method finally employed was chosen because it appeared to resemble very closely the methods of reasoning which would be employed in an intuitive assessment of a group of species if no characters were especially weighted. This method is described more fully in Fry (1964a).

It was found that the patterns of heterogony described above precluded the use of a satisfactory state-coding procedure for some characters, and therefore of a product-moment correlation coefficient. This was due to striking differences in the widths of the ranges of variation of some characters, which produced a very complicated pattern of overlaps of variation. The distribution of the range overlaps of 15 characters* was such that no code system could be devised which would not result in one or more species having at least two code numbers for one character or more (see Fig. 104).

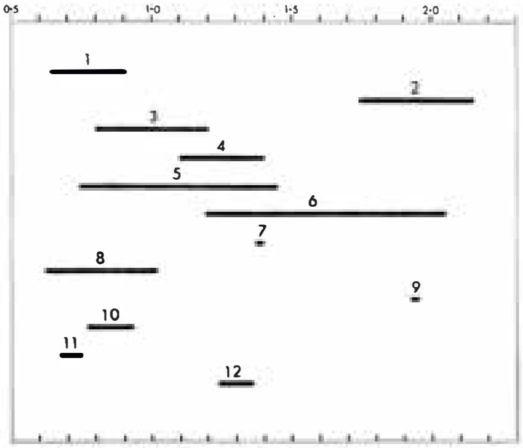

FIG. 104—The ranges of variation of the ratio length of 4th segment of palp : length of 2nd segment of palp in the adults of 12 species of *Ammothea*; 1 = *clausi*; 2 = *carolinensis*; 3 = *minor*; 4 = *glacialis*; 5 = *striata*; 6 = *longispina*; 7 = *tetrapora*; 8 = *calmani*; 9 = *stylirostris*; 10 = *spinosa*; 11 = *meridionalis*; 12 = *gigantea.*

An attempt to reduce the range of variation of the relative proportions by interpreting them as heterogonic growth failed. The numbers of specimens varied so widely from species to species that the confidence intervals which could be attached to the parameters of their heterogonic growth varied greatly in width. Since this variation in the width of confidence intervals follows

TABLE 9. Characters Employed in the Analysis of Morphological Relationships between Specimens and Species of *Ammothea*

Meristic Characters

1. Number of palp segments (excluding regenerating forms)
2. Number of legs bearing genital pores
3. Female oviger: number of special ventral spines on segment 10
4. Female oviger: number of special ventral spines on segment 9
5. Female oviger: number of special ventral spines on segment 8
6. Female oviger: number of special ventral spines on segment 7
7. Male oviger: number of special ventral spines on segment 10
8. Male oviger: number of special ventral spines on segment 9
9. Male oviger: number of special ventral spines on segment 8
10. Male oviger: number of special ventral spines on segment 7
11. Number of major proximal sole spines on the four anterior propodi*

Mensural Characters

12. Length of the longest leg spines relative to their segment's diameter
13. Leg length at the attainment of sexual maturity
14. Length of trunk ÷ l. proboscis*
15. L. palp ÷ l. proboscis*
16. L. chela ÷ l. scape*
17. L. scape ÷ l. proboscis*
18. L. cephalic somite ÷ l. trunk*
19. L. 4th palp segment ÷ l. 2nd palp segment*
20. L. claw ÷ l. propodus*
21. L. accessory claw ÷ l. claw*
22. L. largest propodal sole spine ÷ l. claw*
23. L. longest scape setae ÷ greatest diameter of scape

Qualitative Characters

24. Distribution of proboscis mass about the longitudinal axis
25. Curvature of proboscis
26. Shape of ocular tubercle*
27. Disparity in size between eyes of anterior and posterior pairs*
28. Configuration of dorsal ridges on the trunk somites
29. Pattern of spination on dorsal ridges of trunk somites
30. Perfection of chelae fingers after the onset of sexual maturity
31. Shape of the scape
32. Articulation of chela with scape
33. Shape of anterior cephalic lobes
34. Arrangement of spines on the three long segments of the legs*
35. Longest leg segment*
36. Projection on dorsal surface at the base of the abdomen
37. Curvature of 4th palp segment
38. Presence or absence of an ectal mound and pore on the 4th palp segment
39. Shape of the projections on the dorsal distal surfaces of the lateral processes
40. Heterogeneity of size of major proximal sole spines of four anterior propodi*
41. Distribution of major proximal spines of four anterior propodi
42. Configuration of distal spines field of four anterior propodi
43. Differences of spination between anterior and posterior propodi
44. Nature of male ovigeral spines (simple or compound)
45. Nature of female ovigeral spines (simple or compound)
46. Shape of 10th segment of female oviger

from the statistical procedure for demarcating such intervals, it does not seem sound to treat the confidence intervals as if they were all an expression of biological variation alone.

As some of the species compared are known from only two or three specimens, any attempt to describe their interrelationships must be partly typological in approach (cf. Simpson, 1961, p. 48). The method of comparison finally used is an analogue of that employed by Sturtevant (1942) in his study of species of *Drosophila*. The method produced a matrix of "percentage matching coefficients", derived from comparing each species with every other, and counting every overlap of the ranges of 46 characters as a "match". The derived values were then converted into percentages of 46—the maximum possible number of matches. No attempt was made to measure the degree of overlap or the ranges of variation of the characters. Such measures would be meaningless without a knowledge of the frequency distribution of the states of each character in the whole population of each species. Thus contiguity of ranges was counted an equal of a 100% overlap; both would be recorded as matches.

The magnitudes of the percentage matching coefficients vary between 32·42 and 87·36. As for the matching coefficient described by Sokal and Michener (1958, pp. 1417–8), the sampling distribution of the percentage matching coefficient is unknown, and it is therefore uncertain what confidence can be attached to the lower values of the coefficients.

The matrix was searched for groups by use of the weighted group-variable method described by Sokal and Michener (loc. cit.). The distribution within the matrix of lowerings of L_n was such that a drop of 4·00% or over was rejected, while any decrease of L_n of less than this value was accepted (see Fig. 105).

Grouping of the Species

The dendrogram shown in Fig. 105 differs in three major points from the picture of relationships derived intuitively. It shows *A. magniceps*, *A. clausi*, and *A. minor* as the closest species, *A. minor* being far more closely related to the others in its group than to *A. glacialis*, previously assumed to be its nearest relative.

Separation of *A. allopodes* from *A. spinosa* is justified by the dendrogram, which shows the former to be closest to *A. calmani*, while *A. spinosa* is morphologically very distinct overall from these two species. It may be assumed from this that the propodal dimorphism shown by *spinosa* and *allopodes* represents either long standing parallelism or convergence, and that the two species cannot be regarded as siblings.

The specimen of *A. profunda*, described and figured by Losina-Losinsky (1961), appears to be much distorted and, accordingly, some of its character states could be defined only with some hesitation. The occurrence of this species of *Ammothea*, so far north of the habitats of the other species of the genus, is puzzling. If the small size of the propodal spines of *striata* is an adaptation favouring locomotion over smooth surfaces, as proposed below (see pages 71 to 73), it could be that *striata* and *profunda* had, as a common precursor, a stenothermal but eurybathic form adapted to locomotion on soft mud. Losina-Losinsky gives no indication of the type of bottom over which the specimen of *profunda* was taken, (at 1,500 m), but the straightness of the propodus, brevity of the terminal claw, and arrangement of the sole spines suggest adaptation to walking on smooth surfaces, rather than to climbing.

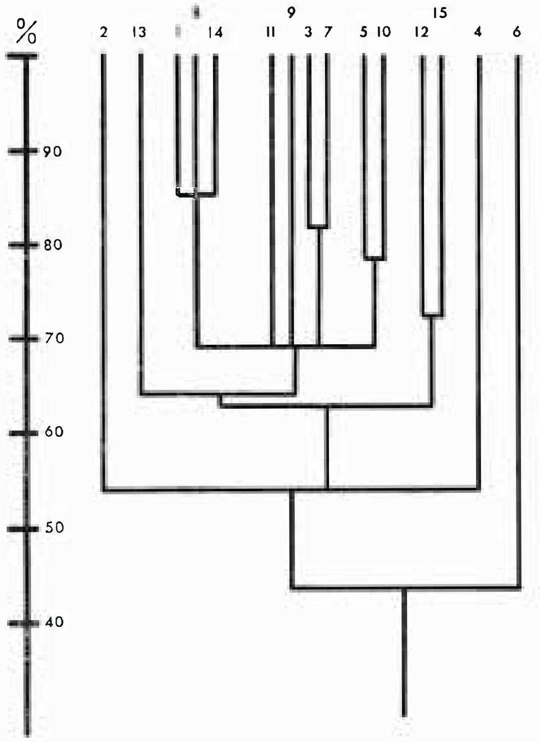

FIG. 105—The morphological similarities of 15 species of *Ammothea* as indicated by percentage matching similarities. Dendrogram derived from analyses of the matrix of %S in Table 7.

Reclassification of the Genus *Ammothea* Leach

The success of the percentage matching coefficient in delimiting at least two groups of species which were previously intuitively assessed as systematically discrete, e.g., 1, 8, 14, and 3, 7 (Fig. 105), gives us the confidence to extrapolate to a reclassification of all the species previously included in the genus *Ammothea*.

Since the assessment of similarities does not include all genera and species presently included in the Ammotheidae, little taxonomic significance could be attached to a reclassification of the species which involved any but the lowest taxa. Inclusion of species of *Achelia* or *Lecythorhynchus*, for example, would probably not influence the composition of the smallest subgroups, but might well alter considerably the arrangement of such subgroups. Accordingly, the reclassification proposed here involves only genera and subgenera.

The 66% matching level has been arbitrarily selected for delimiting genera. Subdivisions occurring at a higher percentage level than this have been interpreted as depicting subgenera. Consistent use of these criteria provides the following taxonomic arrangement.

- Genus *Ammothea* Leach
  - Subgenus *Ammothea* new rank
    - 3.**A. carolinensis* Leach
    - 7. *A. glacialis* (Hodgson)
  - Subgenus *Theammoa* n. subgen.
    - 1. *Th. minor* (Hodgson)
    - 8. *Th. clausi* Pfeffer (inc. *Ammothea australis* (Hodgson))
    - 14. *Th. magniceps* Thomson (inc. *Ammothea australiensis* (Flynn))
  - Subgenus *Mathoma* n. subgen.
    - 10. *M. calmani* Gordon
    - 5. *M. allopodes* n. sp.
  - Subgenus *Thammota* n. subgen.
    - 9. *Th. stylirostris* Gordon
  - Subgenus *Homathea* n. subgen.
    - 11. *H. longispina* Gordon
- Genus *Magnammothea* n. gen.
  - 13. *Mag. gigantea* (Gordon)
- Genus *Thavmastopycnon* n. gen.
  - 12. *Thav. striata* (Möbius)
  - 15. *Thav. profunda* (Losina-Losinsky)
- Genus *Athernopycnon* n. gen.
  - 2. *Ath. meridionalis* (Hodgson)
- Genus *Ecleipsothremma* n. gen.
  - 4. *E. spinosa* (Hodgson)
- Genus *Anammothea* n. gen.
  - 6. *An. tetrapora* (Gordon)

*See Table 7 and Fig. 105.

KEY TO ADULTS OF *Ammothea* SENS. AUCT.

This key is designed for identifying adult specimens only. Six species are known from adults only, so a key to juveniles could not be used with any confidence for the identification of further collections. As in all discussion of the Ammotheidae, "adult" is applied to a form in which the oviger has attained its final number of segments, shape, and spination, and in which the genital pores are perforate. The state of perfection of the chelae fingers should not be relied on as a criterion of maturity, although it can be in some other genera of pycnogonids.

1 Palp longer than, or subequal in length to, the proboscis.. 3
Palp 0.6 times the length of the proboscis, or shorter..... 2

2 Palp 9-segmented; two groups of propodal sole spines not distinguishable.................**Thavmastopycnon profunda**
Palp 8- or 9-segmented; two groups of propodal sole spines distinguishable......................**Ammothea longispina**

3 The propodi of the anterior and posterior four legs very similar in relative proportions and in sole spination...... 5
The propodi of the four posterior legs appearing more slender, and bearing fewer sole spines, than the propodi of the four anterior legs................................ 4

4\. The three dorsal trunk processes surmounted by slender, forward inclined, conical processes; strong curved spurs on the anterior cephalic lobes; (articulation of scape and palm synaxial)..........................**Ecleipsothremma spinosa**
The three dorsal trunk processes not surmounted by slender conical processes, but flat topped and swollen below the tip; anterior cephalic lobes low (palm articulated anaxially with scape)..........................**Ammothea allopodes**

5 Genital pores on the 2nd coxae of the last two pairs of legs only.. 7
Genital pores on the 2nd coxae of all eight legs.......... 6

6 Palp 9-segmented....................**Ammothea magniceps**
Palp 8-segmented...................**Anammothea tetrapora**

7 4th palp segment without a pronounced ectal mound and pore...8
4th palp segment bearing, on its ectal surface, a prominent mound surmounted by a pore..........**Ammothea glacialis**

8 Proboscis massive or cylindrical and strongly down-curved 9
Proboscis tapering abruptly but evenly from base to tip... **Ammothea stylirostris**

9 Fingers of the chelae atrophied and non-functional....... 11
Fingers of the chelae well developed and functional...... 10

10 Proboscis straight, bulbous, and massive................ **Magnammothea gigantea**
Proboscis essentially cylindrical, but strongly and uniformly down-curved....................**Thavmastopycnon striata**

11 Setae of the dorsal surfaces of the long segments of the leg never as long as the diameter of the segment on which they are sited... 12
Setae of the dorsal surfaces of the three long leg segments as much as, or more than 1½ times, the diameter of the segment on which they are sited; (ocular tubercle taller than wide and waisted basally)........**Athernopycnon meridionalis**

12 Leg length less than 40 mm........................... 13
Leg length more than 40 mm.........**Ammothea carolinensis**

13 The posterior dorsal ridges of the three anterior trunk somites bearing strong dorsal projections....**Ammothea minor**
The posterior dorsal ridges of the three anterior trunk somites lacking dorsal projections..........**Ammothea clausi**

THE PROPODUS

Among and within the 16 species of this genus there is considerable variation in the propodus, affecting its curvature, its armature of sole spines, and the size and form of its main claw.

Except for *A. profunda* and *A. striata* which are morphologically very similar, all species have two groups of sole spines. Although there is rarely a diastema between the two groups, they are readily distinguishable by the relative sizes of their component spines, and by the patterns of arrangement, relative to size, of these spines.

The curvature of the entire propodus varies from an almost straight condition, as in *A. profunda*, to the strongly arched state found in the larvae and smallest juveniles of all the species.

It is highly likely that the structure of the propodus and its armature reflects closely the type of substrate upon which the animals move and feed. If the potential habitats of the genus were known, one could compare the patterns of the propodal structures shown by different species with reference to their functional efficiencies. Although the photographic work of Bullivant (1959; 1961) in the Ross Sea has greatly increased our knowledge of the range of benthic habitats in that area, we are still far from recognising all potential microhabitats of Antarctic Pycnogonida. A classification of propodal structures in terms of functional morphology would therefore be little more than surmise, since the functions of the individual propodal structures can only be guessed at.

On the other hand, the propodal structures of all the larvae examined are very similar (Fig. 107). They are characterised by a strongly arched propodus and a small number (1—3) of proximal sole spines, which are long in relation to the basal diameter of the propodus. These basal spines, in combination with a markedly curved main claw, form a subchela, which can hold, with little expenditure of energy, a strand of material large in diameter in relation to the length of the propodal sole. In some specimens, there are also one or two widely separated distal sole spines, which are apparently shed at or near the completion of metamorphosis and replaced by a larger number of minute spinules. This particular pattern is probably related to the habit these small animals have of remaining firmly attached to the substrate for long periods. The "substrate" would be either other individuals in the egg-mass, or structures at large on the sea bottom.

Comparison of adult and larval propodal structures can be more readily understood if expressed in terms of the heterogonic growth of the propodal components. It was found that four characters, each with two states, could be used to express all the variation encountered. The characters and their states are:

Character 1. *Growth of the basal sole spines relative to increase in the basal diameter of the propodus*
State a: Negative heterogony of the spines
State b: Positive heterogony of the spines, or no heterogony

Character 2. *Straightening of the propodus*
State a: Straightening
State b: No straightening, or increased curvature

Character 3. *Increase in the number of basal sole spines*
State a: Increase
State b: No increase, or decrease

Character 4. *Growth of the distal sole spinules* relative to the distal diameter of the propodus*
State a: Positive heterogony of spinules
State b: Negative heterogony of spinules, or no heterogony

The use of these 4 characters showed the species to have 11 categories of variation. These categories, arranged in order of increasing heterogony of the propodal structures during growth, are shown in Table 10.

Variation within the genus. Of the 16 possible combinations of the states of the 4 characters, 11 have been observed in the genus. The range of variations is from the condition where no heterogony is involved in the formation of the adult propodal structures, to that found in *minor* and the four anterior propodi of *spinosa*, where marked heterogony involves three of the four characters.

Variation within species. Ten species are monomorphic with regard to the four characters, in so far as the very variable numbers of specimens give a good picture of variation. *A. striata* also seems to be monomorphic, while *profunda* is known from one specimen only.

TABLE 10. States of Four Characters of the Propodus in Fifteen *Ammothea* (sens. auct.) Species

Groups	Characters 1	2	3	4
1. *carolinensis*, *calmani*, *longispina*, *gigantea*, *glacialis*	b	b	b	b
2. *carolinensis*, *glacialis*	b	b	b	a
3. *tetrapora*	a	b	b	b
4. *magniceps*	b	b	a	b
5. *allopodes* (post. 4 propodi)	b	a	b	b
6. *clausi*	a	b	a	b
7. *stylirostris*, *spinosa* (post. 4 propodi)	a	a	b	b
8. *allopodes* (ant. 4 propodi)	b	a	b	a
9. *meridionalis*	b	a	a	b
10. *minor*, *striata*, *profunda*	a	a	a	b
11. *spinosa* (ant. 4 propodi)	b	a	a	a

Two types of dimorphism occur in the genus. The first, exhibited by *carolinensis* and *glacialis*, is a dimorphism, shown by the propodi of different specimens, accompanied by only very small variations of the propodi of any one individual. The second type is that shown by *allopodes* and *spinosa*, in which the major differences are between the anterior and posterior four propodi of an individual.

Functional significances of variation of propodal form. Analysis of distribution of the character states (Table 10) reveals no clear positive or negative associations of state amongst the four characters (Table 11). This suggests that the 11 combinations of the 8 character states actually match 11 substrate microhabitats. This number is in fact probably equivalent to 15 (the number of species involved in the analysis) since there is variation in the propodal sizes of the adults in groups, 1, 2, 3, 7, and 10, the various heterogonies differ from each other in degree. On the other hand the dimorphisms shown by *allopodes* and *spinosa* involve only two characters.

The condition shown by the members of Group 1 (*carolinensis*, *calmani*, *longispina*, *gigantea*, *glacialis*) is essentially that found in the larvae and earliest juveniles of all species, since no heterogony occurs in growth. It seems reasonable to assume, therefore, that the propodus in these forms is adapted to clinging for long periods to fibrous substrates with large diameters relative to the length of the propodal sole. It does not seem possible to interpret the functional significance of the propodal variations of the other groups, except by the generalisation that, the more heterogony is involved in the growth of the propodus, the less likely it is that the adult propodus performs the same functions as the larval propodus. Thus, groups 10 and 11 (*spinosa*, ant. 4 propodi) are probably highly unsuited to clinging for long periods to fibrous substrates with large diameters relative to the length of the propodal sole.

This generalisation makes all the more difficult any interpretation of the dimorphisms in *spinosa* and *allo-*

TABLE 11. Association of Character States of Four Propodal Characters within Eleven Propodal Variations in the Genus *Ammothea*

Characters	Frequency of Similarity of State Codes	Frequency of Disparity between State Codes	Total
1, 2	5	6	11
1, 3	6	5	11
1, 4	5	6	11
2, 3	6	5	11
2, 4	6	5	11
3, 4	5	6	11

---

*The reference is to the field of spinules of the smallest juveniles, rather than to the variably present, larger, distal spines of the larvae.

podes. In *spinosa* it is the four posterior propodi which show less difference from the larval form (and therefore presumably function more like the larval form) than the anterior four propodi. Both anterior and posterior propodi in *allopodes* differ from the larval form by two character states, but differ from each other by the distribution of these states, i.e., the sites of heterogony. Again, the four propodal forms found in the two species differ from each other by the distribution of their character states. *A. striata* and *profunda* differ from all other species in the genus in the very poor development of all their propodal spines. In both species the propodus is straightened, and in *profunda* the main claw is straight and very short relative to the propodal length. *A. profunda* has been taken at a depth of 1,500 m, and in general, substrates at this depth are smooth. In species of *Colossendeis* found at such depths the main claw is straight and relatively short, and the propodal sole is either smooth or has a spine arrangement like that of *A. profunda*. If we assume that *profunda* is adapted to walking on smooth substrates, then *striata* is probably similarly adapted. The depth range of *striata* is no greater than that of several other Antarctic species of *Ammothea*, but there are patches of superficially rather barren mud and volcanic materials in some Antarctic coastal waters (Bullivant, 1959, 1961). *Ammothea striata* is one of the common pycnogonids inhabiting the shallow regions of McMurdo Sound, where the bottom is rather coarse basalt sand (see Hedgpeth, 1968).

Genus **Ammothea** Leach, 1814

Palp: 8- or 9-segmented; fingers of the chelae atrophying at or near the onset of sexual maturity; ovigers borne by both sexes 10-segmented, segments 7 and 8 articulated anaxially in males; 4 trunk somites clearly demarcated by articulations; each of the 3 anterior trunk somites bearing a dorsal and a ventral posterior ridge, which may or may not be prolonged into a strong dorsal process; genital pores on the coxae of either 4 or 8 legs; 2 groups of propodal sole spines always recognisable—distal and proximal, the spines of the 2 groups usually differing greatly in size.

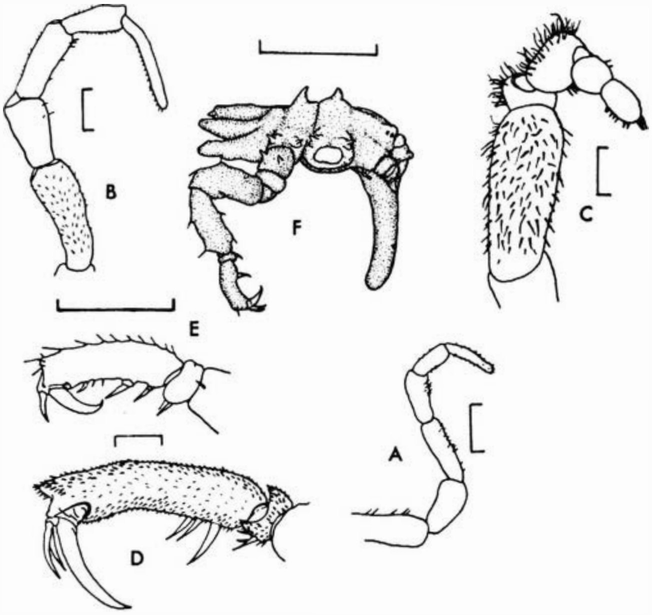

FIG. 107—*Ammothea* (*Amm.*) *carolinensis:* A, terminal segments of left palp of adult; B, terminal segments of female oviger; C, terminal segments of male oviger; D, terminal segments of 3rd left leg of adult; E, terminal segments of 3rd left leg of larva just before completion of metamorphosis; F, dorsolateral view of larva undergoing metamorphosis. (The scales represent 1 mm.)

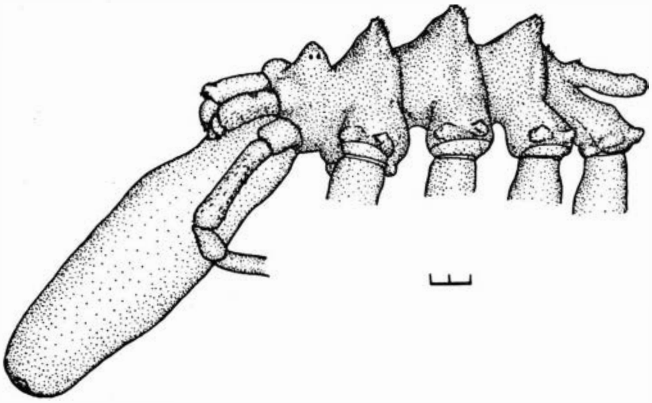

FIG. 106—*Ammothea* (*Amm.*) *carolinensis*: lateral view of adult male. (The scale represents 2 mm.)

Subgenus **Ammothea** new rank

Palp: 9-segmented; dorsal trunk processes massively conical; eye tubercle bluntly conical, basally wider than high; proboscis massive, straight and bulbous; all eight propodi similar in relative proportions and sole spination; sexual maturity reached at leg lengths of about 40 mm; genital pores on 2nd coxae of last four legs.

Ammothea (Ammothea) carolinensis Leach, 1814. (Figs. 104–108)

Ammothea carolinensis Leach, 1814: 34, XIII. Loman, 1908: 10. Bouvier, 1913: 127–31, 78–82. Hodgson, 1915: 146. Calman, 1915a: 310–15, 1–3. Calman, 1915b: 51–2. Hodgson, 1927: 341, 342 (in key). Gordon, 1932: 95, 109. Hedgpeth, 1950: 152. Stock, 1957: 100.
Nymphum carolinensis Milne-Edwards, 1840: 126.
Ammothea grandis Pfeffer, 1889: 43. Bouvier, 1913: 126. Hodgson, 1927: 341.
Colossendeis gibbosa Möbius, 1902: 192 XXX 1–5.
Colossendeis (?) *charcoti* Bouvier, 1905: 296.
Ammothea curculio Bouvier, 1906a: 19. Bouvier, 1906b: 40. Hodgson, 1927: 341.
Leionymphon grande Bouvier, 1906b: 60–5, 40–8, III 6. Hodgson, 1907: 41–3; VI 1. Hodgson, 1908: 169–70. Bouvier, 1911b: 1140.
Leionymphon gibbosum Hodgson, 1907: 40.
Ammothea gibbosa Hodgson, 1927: 341. Gordon, 1938: 20–21. Gordon, 1944: 452. Hedgpeth, 1950: 152.
Leionymphon carolinensis Helfer and Schlottke, 1935: 284.

MATERIAL EXAMINED

NZOI Sta. A 530, 1 juvenile.
Atka Sta. 22A, 8 juveniles, 1 larva; *Westwind* Sta. 9, 1 juvenile. *Eltanin* Sta. 410, 3 ovigerous ♂♂, 3 ♀♀, 12 juveniles. Sta. 445, 6 juveniles.
Holotype, No B.M. (N.H.) Regn. No., "*carolinensis*", 1 juvenile; B.M. (N.H.) Regn. No. 1907.6.24.81–2, 1 ♀, 1 juvenile, "*gibbosa*"; B.M. (N.H.) Regn. No. 1911.10.16.22–4, 2 ♀♀, 1 juvenile, "*grandis*"; B.M. (N.H.) Regn. No. Commonwealth Bay, 3rd and 4th:9:1912, 1 juvenile, "*ammothea*" n. sp.?"; B.M. (N.H.) Regn. No. 1915.7.24.208, 1 juvenile ♂, "*gibbosa*"; B.M. (N.H.) Regn. No. 1920.7.21.49–50, 1 ♂, 1 ♀, "*carolinensis* (=*grandis*)"; No B.M. (N.H.) Regn. No. *Discovery* Sta. 39. 25/3/1926, 179–235 m., 1 juvenile, "*gibbosa*"; B.M. (N.H.) Regn. No. 1933.3.23.667, 1 ovigerous ♂, "*carolinensis*"; B.M. (N.H.) Regn. No. 1933.3.23.668, 1♀, "*carolinensis*"; No B.M. (N.H.) Regn. No., B.A.N.Z.A.R. E. Sta. 30, 1 juvenile ♂, "*gibbosa*"; No B.M. (N.H.) Regn. No., B.A.N.Z.A.R.E. Sta. 34, larvae from oviger of ♂ "*gibbosa*"; B.M. (N.H.) Regn. No. 1942.12.30.67, 1 ♀, "*gibbosa*".

DESCRIPTION

Based on data derived from 14 adults and 32 juveniles —including the holotype—supplemented by published data.

PALP: 9-segmented, segments 5–8 essentially tubular in shape and only sparsely spinose (Fig. 107A); 4th segment at least one and a half times the length of the 2nd segment, not markedly curved, without a sharp ectal projection surmounted by a pore.

PROBOSCIS: In adults the shape varies between C′:1 and D′:1; in juveniles, from A, J, or J′:2:E in the larvae and smallest juveniles to C′:1 in the largest juveniles.

TRUNK: The posterior ridges of the three anterior trunk somites are surmounted by massive dorsal projections. In adults these projections overtop the ocular tubercle. In the smallest juveniles they are slender. Ocular tubercle bluntly conical, bearing two pairs of darkly pigmented eyes; eyes of the anterior pair very slightly larger than those of the posterior pair; spination very sparse, consisting of a few small spinules, confined to the apical portions of the dorsal processes; low bluntly conical projection anterior to dorsal insertion of the abdomen.

CHELICERAE: Fingers atrophying, in most individuals, at or near the onset of sexual maturity, at leg length of 47 mm–54 mm. Spination restricted to a very sparse scattering of spinules on the dorsal surfaces of scape and chela.

LEG: 2nd tibia the longest segment. Spination a very variable density of small, stout, curved spinules, either uniformly scattered over the surface of the segments, or arranged in six variably discrete bands or rows. Where the spinules are segregated in this way, the two dorsal and two ventral bands are from three to four rows of spines wide, while the two lateral bands are one or two rows wide.

REPRODUCTION: Sexual maturity attained at leg lengths between 47 and 50 mm; leg length of smallest adult female 51·80 mm; of smallest adult male 51·52 mm; ovigerous males taken between December and March; eggs approximately 0·77 mm in diameter; genital pores on the 2nd coxae of the last two pairs of legs only.

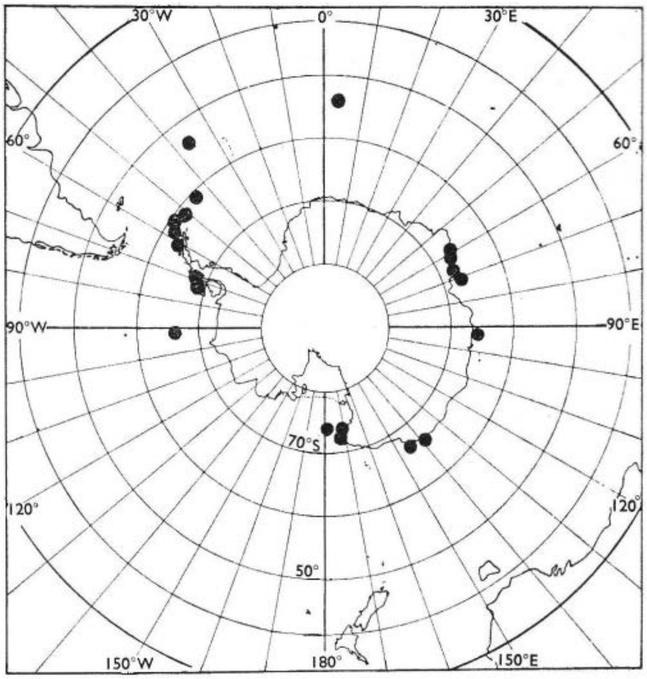

FIG. 108—Distribution records of *Ammothea* (*Amm.*) *carolinensis*.

DISTRIBUTION

All documented records are shown in Fig. 108. Specimens have been taken at depths of 10–640 m.

MENSURAL CHARACTERS

	Adults	Juveniles
Range of leg lengths examined (mm)	51.52–87.20	3.07–47.62
Palp L. ÷ proboscis L.	1.25– 1.63	0.75– 1.35
L. 4th palp segt. ÷ L. 2nd palp segt.	1.74– 2.15	1.62– 3.41
L. chela ÷ L. scape	0.46– 1.00	0.73– 1.24
L. scape ÷ L. proboscis	0.09– 0.22	0.12– 0.22
L. cephalic somite ÷ L. trunk	0.39– 0.52	0.40– 0.74
L. leg ÷ L. trunk	4.47– 5.81	1.93– 5.94
L. trunk ÷ L. proboscis	0.70– 0.99	0.60– 1.50
L. claw ÷ L. propodus	0.52– 0.67	0.42– 0.73
L. accy. claw ÷ L. claw	0.44– 0.98	0.29– 0.91
L. largest propodal sole spine ÷ L. claw	0.19– 0.65	0.30– 0.75

PROPODAL SOLE SPINATION

The number of enlarged proximal spines varies between two and four in juveniles, and between three and four in adults. These spines are either of equal size, or vary only slightly. In most specimens, the distal sole has spinules alone, but in a few specimens there is a single large spine near the base of the main claw (see section on the propodus, p. 71).

DISCUSSION

Calman (1915a, pp. 313–14) considered the *A. grandis* of Pfeffer (1889) and *Colossendeis* (?) *charcoti* of Bouvier (1905) to be conspecific with Leach's *Ammothea carolinensis* (1814). Hodgson (1927, p. 341) suggested these were further conspecific with the *Ammothea* (*Colossendeis*) *gibbosa* of Möbius (1902) and the *A. curculio* of Bouvier (1906a). Apparently, both Gordon (1932, 1938, 1944) and Hedgpeth (1950) overlooked Hodgson's paper. There have been several attempts to delimit new species from *Ammothea carolinensis*, but the literature suggests that in only one of the characters used can the states be objectively compared. This is the pattern of leg spination and even in this the range of states is apparently continuous. In the limited number of specimens examined in this study the arrangement of the leg spinules varies almost continuously from a random scattering to a state of six discrete bands. It does not appear possible to correlate such variation with geographical distribution; a juvenile and an adult female (B.M.(N.H.) Regn. No. 1907.6.24.81-2) from the same station show both extremes of variation, although on all other counts they are so similar as to suggest identical origins. Equally, it does not appear that variation in the distribution of leg spinules can be correlated with size. This suggests that leg spination may be influenced by very local environmental conditions, or that the species is polymorphic in this respect.

Ammothea (Ammothea) glacialis (Hodgson, 1907). (Figs. 104, 105, 109–111)

Leionymphon glaciale Hodgson, 1907: 50–2; VII 3. Helfer and Schlottke, 1935: 234.
Ammotheaglacialis Bouvier, 1913: 123 (in key). Calman, 1915b: 50–1. Hodgson, 1915: 146. Hodgson, 1927: 342–3. Gordon, 1932: 96 (in key). Gordon, 1938: 21. Gordon, 1944: 51–2. Hedgpeth, 1950: 152. Fage, 1952b: 271.
Ammothea gibbosa Calman, 1915b: 51–2 (partim).

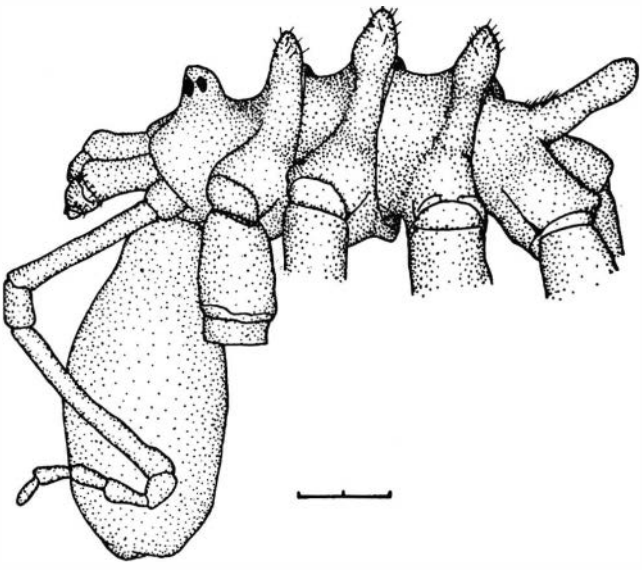

FIG. 109—*Ammothea* (*Amm.*) *glacialis*: lateral view of adult female. (The scale represents 2 mm.)

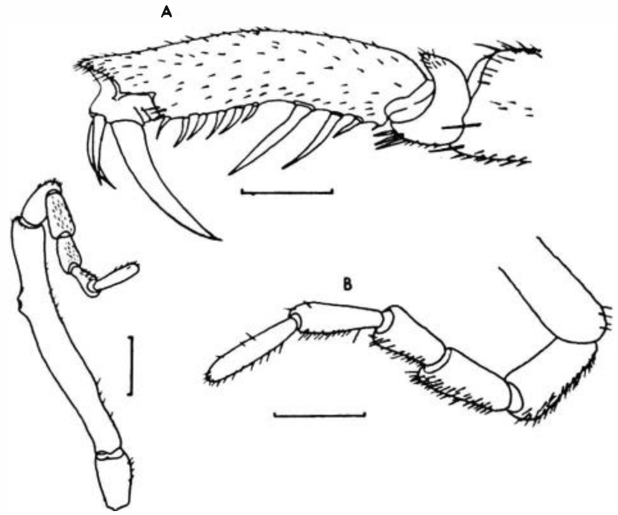

FIG. 110—*Ammothea* (*Amm.*) *glacialis*: A, terminal segments of 3rd left leg of adult; B, C, lateral and dorsal view of left palp. (The scales represent 1 mm.)

MATERIAL EXAMINED

NZOI Sta. A 449, 1 juvenile; Sta. A 450, 1 juvenile; Sta. A 464, 1 juvenile; Sta. A 467, 1 ovigerous ♂, 2 ♀♀, 1 juvenile; Sta. A 468, 2 juveniles; Sta. A 471, 1 juvenile.
Trans-Antarctic (N.Z.) Sta. 6, 1 larvigerous ♂; Sta. 75, 3 ♀♀; Sta. 98, 1 ovigerous ♂, 1 juvenile; Sta. 100, 4 juveniles.
Edisto Sta. 6 (ED-6), 1 ovigerous ♂; Sta. 8 (ED-8), 1 ♀, 3 juveniles; Sta. 31 (TD-5), 1 juvenile.
Stanford Sta. GLD-13, 1 ♀, 1 juvenile; Sta. G. trap, 1 ovigerous ♂; Sta. X, 1 ♀; Sta. 61B, 1 juvenile.
Holotype, B.M. (N.H.) Regn. No. 1907.7.24.96, 1 juvenile, "*Leionymphon glaciale*"; B.M. (N.H.) Regn. No. 1915.7.24.209, 1 juvenile, "*gibbosa*"; B.M. (N.H.) Regn. No. 1915.7.24.188–207, 1 ♂, 1 ♀, "*glacialis*"; B.M. (N.H.) Regn. No. 1942.12.30.65–6, 1 ♂, 1 ♀, 1 juvenile, "*glacialis*"; No B.M. (N.H.) Regn. No., *Discovery* Sta. 39, 1 juvenile, "*gibbosa*".

DESCRIPTION

Based on 17 adults and 26 juveniles.

PALP: Nine-segmented, segments 5–8 varying from almost perfectly cylindrical to a markedly asymmetrical conical shape (the "serrated ventrally" of Gordon, 1932). The species is characterised by the combination of a slender, markedly curved, 4th segment, and the strong swelling, surmounted by a pore, which this segment bears ectally (Fig. 110, C.). The terminal four segments are markedly spinulose, with an obvious ventral fringe (Fig. 110 B.).

PROBOSCIS: Highly variable shape amongst juveniles, the following shapes having been observed; A: 1, C''': 1, J: 2: E, and D: 1. The four large juveniles from Stations *Edisto* 31, and NZOI A 449, A 468, A 471 have a proboscis of shape J:2:E, and in these the curvature is very marked. There can be little doubt, however, that they belong in this species, for all their other characters fit well within the range of character states of other specimens of *glacialis*. The adult proboscis varies very little compared with the juvenile proboscis, only shapes D:1 and D':1 having been recorded. Unlike *carolinensis*, the proboscis of the smaller juveniles and larvae is not markedly down-curved.

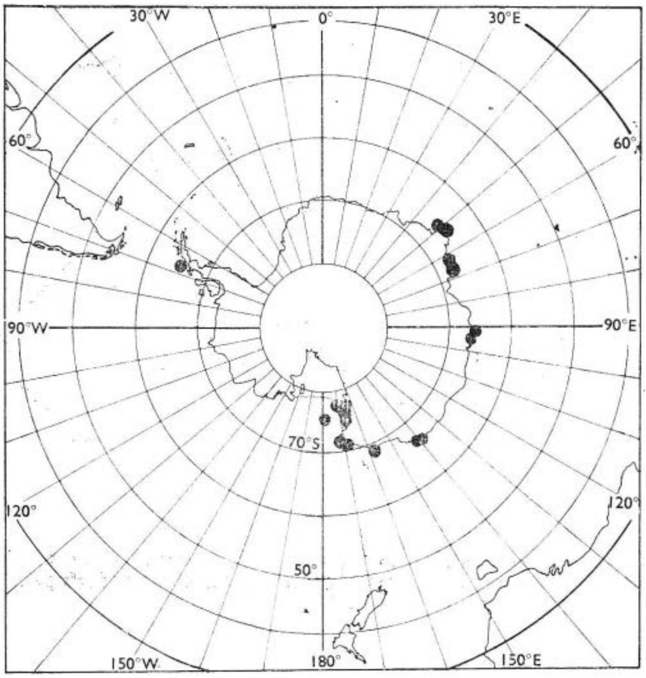

Fig. 111—Distribution records of *Ammothea* (*Amm.*) *glacialis*.

TRUNK: Three anterior trunk somites bearing massive pointed projections on the dorsal surfaces of their posterior ridges (in the smaller juveniles these projections are steeply conical); eye tubercle a rounded cone, rarely rising to the height of the dorsal processes, with two pairs of darkly pigmented eyes; eyes of the anterior pair slightly larger than those of the posterior pair; spines restricted to a very sparse scattering of small spinules on the dorsal ridges and at the base of the abdomen.

CHELICERAE: The fingers of the chelae atrophy at or near the onset of sexual maturity, at leg lengths of between 48 mm and 50 mm; scape with a distal fringe of short setae; very few short setae only on the dorsal surface of the palm.

LEG: Second tibia the longest segment; long segments with a dense covering of minute, stout, spinules, arranged in bands of varying discreteness. In the most highly segregated arrangement there are six bands of spinules. The two dorsal and two ventral bands are between two and four spinules wide, while the two lateral bands are one spine wide. The two dorsal and two ventral bands may be fused, and the spines of the dorsal bands may be on small rounded projections.

REPRODUCTION: Sexual maturity attained at leg lengths of between 40 and 56 mm; smallest recorded ovigerous male with a leg length of 46·25 mm; smallest adult female with a leg length of 44·53 mm; ovigerous and larvigerous males taken in January and February; egg diameters between 0·62 and 0·77 mm; genital pores on the 2nd coxae of the two posterior pairs of legs.

DISTRIBUTION

Stations at which specimens have been taken are shown in Fig. 111. Specimens have been taken from the intertidal zone down to 500 m.

MENSURAL CHARACTERS

	Adults	Juveniles
Range of leg length examined	40–80 mm	10–52 mm
Palp L. ÷ proboscis L.	1.10–1.50	1.30–1.90
L. 4th palp segt. ÷ L. 2nd palp segt.	1.10–1.40	1.10–1.80
L. chela ÷ L. scape	0.20–0.60	0.50–1.20
L. scape ÷ L. proboscis	0.10–0.22	0.10–0.30
L. cephalic somite ÷ L. trunk	0.31–0.40	0.33–0.43
L. leg ÷ L. trunk	4.50–7.00	3.40–7.00
L. trunk ÷ L. proboscis	0.86–1.10	0.95–1.40
L. claw ÷ L. propodus	0.44–0.51	0.27–0.55
L. accy. claw ÷ L. claw	0.42–0.60	0.39–0.47
L. largest propodal sole spine ÷ L. claw	0.30–0.70	0.30–0.90

PROPODAL SOLE SPINES

Among juveniles the proximal sole spines vary between 4 and 8, among adults, between 8 and 11. These spines are variably heterogeneous in size.

Amongst the adults and larger juveniles, the sole spines of the distal group are either very strongly developed (Fig. 110A), or present as spinules; no intermediates have been noted. *A. glacialis* and *carolinensis* may be regarded as dimorphic in respect of the distal sole spines.

DISCUSSION

Whereas previous descriptions of *glacialis* and of *minor* have tended to stress the similarity between them, the above method of judging morphological similarities puts them in quite distinct subgenera.

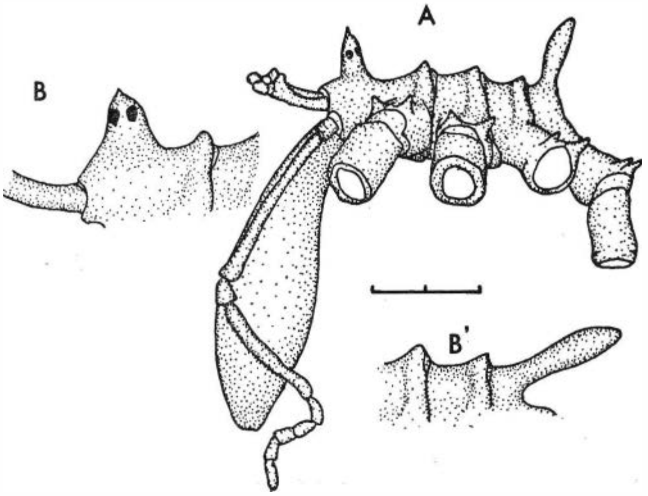

Fig. 112—*Ammothea* (*Th.*) *clausi*: A, lateral view of adult male of "Magellanic" form; B, B′, ocular tubercle and insertion of abdomen in the "Victoria Land form". (The scale represents 2 mm.)

A. glacialis appears to be the only species of Antarctic "*Ammothea*" which has a sharp ectal mound and pore on the 4th palp segment. It is of interest that all Antarctic species of *Colossendeis* have a similar structure. Unfortunately, its detailed structure and functional significance are quite unknown.

Subgenus **Theammoa** n. subgen.

Palp 9-segmented; dorsal trunk processes present or absent, never massive; eye tubercle rounded, surmounted by a small conical projection; proboscis bulbous, but rarely massive; straight or very slightly down-curved; genital pores on the last four, or all eight, legs; sexual maturity reached at leg lengths of less than 20 mm.

Ammothea (Theammoa) clausi Pfeffer, 1889. (Figs. 104, 105, 112–115)

Ammothea clausi Pfeffer, 1889: 45. Bouvier, 1913: 135–8, 88–9. Hodgson, 1927: 342, 343 (in key). Gordon, 1932: 109–10. Hedgpeth, 1950: 152.
Ammothea antarctica Bouvier, 1905: 296. Bouvier, 1906a: 19.
Leionymphon antarcticum Bouvier, 1906b: 56–60; 37–39, III 4–5.
Leionymphon clausi Hodgson, 1907: 40. Hodgson, 1908: 160–71; II. Bouvier 1911b: 1140. Helfer and Schlottke, 1935: 284.
Leionymphon australe Hodgson, 1907: 46–9; VII 1.
Ammothea australis Bouvier, 1913: 123 (in key). Calman, 1915b: 53. Hodgson, 1927: 341, 342 (in key). Gordon, 1938: 20.
Ammothea australe Loman, 1923d: 23.

MATERIAL EXAMINED

NZOI Sta. A 450, 3 ♀♀; Sta. A 456, 2 ovigerous ♂♂, 1 larvigerous ♂, 3 ♀♀; Sta. A 467, 10 ovigerous ♂♂, 2 ♀♀; Sta. A 471, 2 ovigerous ♂♂, 2 ♀♀.

Trans-Antarctic (N.Z.) Sta. 5, 1 ovigerous ♂; Sta. 78, 1 juvenile; Sta. 79, 4 ovigerous ♂♂, 1 ♂, 1 ♀, 2 juveniles; Sta. 98, 2 ovigerous ♂♂; Sta. 99, 1 ♀; Sta 100., 2 ♀♀.

Stanford Sta. GLD-11, 1 juvenile; Sta. GLD-13, 4 ovigerous ♂♂, 8 ♀♀, 1 juvenile; Sta. B, 1 ovigerous ♂♂.

Burton Island Sta. 3, 2 juveniles; Sta. 5, 1 ♂; Sta. 13, 1 juvenile.

Edisto Sta. 8 (ED-8), 1 ovigerous ♂, 1 ♀, 12 juveniles.

B.M. (N.H.) Regn. No. 1907.6.24.90–94, 1 ovigerous ♂, 1 ♀, 2 juveniles, *australe*, types; B.M. (N.H.) Regn. No. 1920.7.5.83, 1 ♀, *clausi*; B.M. (N.H.) Regn. No. 1931.7.8.1, 1 ovigerous ♂, cotype *clausi*, ex Hamburg Museum; B.M. (N.H.) Regn. No. 1933.3.23. 669–73, 1 ♂, 5 ♀♀, 2 juveniles, *clausi*; B.M. (N.H.) Regn. No. 1956.10.10.433, 1 juvenile, co-type *australe*.

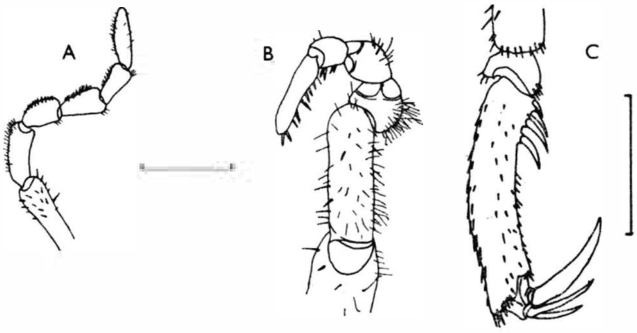

FIG. 113—*Ammothea* (*Th.*) *clausi*: A, terminal segments of left palp; B, terminal segments of male oviger; C, terminal segments of 3rd left leg of adult. (The scales represent 1 mm; A and B to the same scale.)

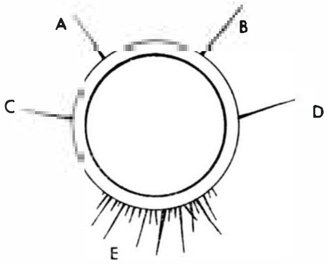

FIG. 114—*Ammothea* (*Th.*) *clausi*: diagrammatic cross section of one of the long segments of the leg, showing the distribution of the tracts of setae. (See text.)

DESCRIPTION

Based on 84 adult and 24 juvenile and larval specimens.

PALP: 9-segmented, segments 5 to 8 varying from almost perfectly cylindrical to markedly asymmetrically conical (="serrated ventrally" of Gordon, 1932), 4th segment neither strongly curved nor bearing an ectal mound surmounted by a pore; dense elliptical fields of fine spines on the ventral surfaces of segments 5–9, while dorsal and lateral spination of these segments is very sparse.

PROBOSCIS: In both adults and juveniles the shape varies only slightly, between D:1 and D′:1. In some specimens there is a slight curvature immediately distal to the proboscis insertion on the cephalic somite.

TRUNK: Within *Ammothea*, only this species and *Theammoa magniceps* have no dorsal processes on the dorsal ridges of the three anterior trunk somites. Within the subgenus *Theammoa* there is a tendency for these dorsal processes to be very low and insignificant, compared with their development in the other subgenera of *Ammothea*, and in *Magnammothea*, *Thavmastopycnon*, *Athernopycnon*, *Ecleipsothremma*, and *Anammothea*. The ocular tubercle is bluntly conical in the Victoria Land form and more steeply conical and relatively slightly taller in the "magellanic" form. In both forms the eyes of the anterior pair are very slightly larger than those of the posterior pair; both pairs are only lightly pigmented. In some specimens the pigment is almost completely absent, or is very readily soluble in alcohol. Spines are virtually absent from the trunk and abdomen—there is only a very sparse scattering of the most minute spinules on the trunk, and in some specimens a small patch of similar spinules on the dorsal distal surfaces of the lateral processes. Each of the eight lateral processes bears a pair of steeply conical projections on its dorsal distal surface; there are three in juveniles.

CHELICERAE: Fingers of the chelae atrophying at or near the onset of sexual maturity, at leg lengths of between 21 and 34 mm. In juveniles and larvae the dorsal distal surface of the scape bears a large seta, mounted on a low projection. During growth after metamorphosis, the seta does not increase in size, but the projection enlarges until the seta disappears at or just before the attainment of sexual maturity (Fig. 112A).

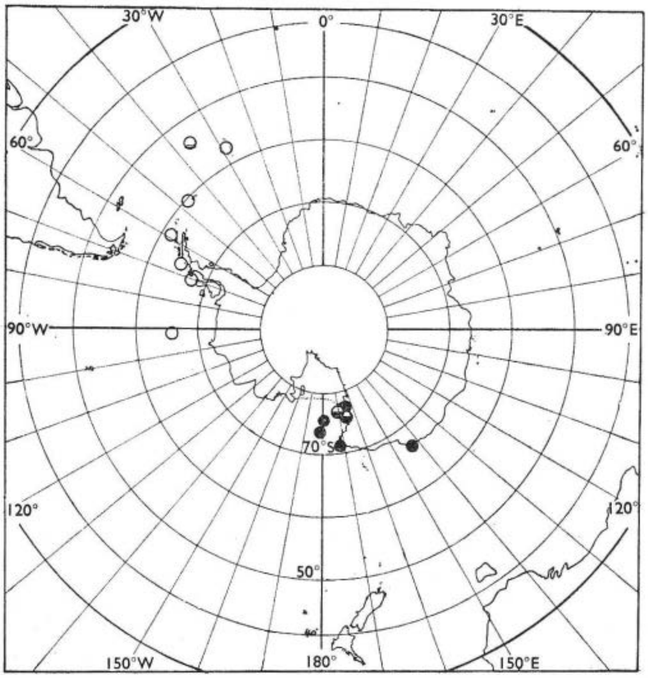

FIG. 115—Distribution records of *Ammothea* (*Th.*) *clausi*. Hollow circle = "Magellanic form", solid circle = "Victoria land form".

LEG: Second tibia the longest leg segment in the great majority of specimens (in one adult and five juvenile specimens the femur is the longest segment); legs very spiny, with four rows and a vental band of setae (Fig. 114). Rows A, B, C, and D in Fig. 114 are rough lines of alternating long and short setae; these setae are never longer than half the diameter of the segments on which they are sited. The ventral band, E, consists of setae of a great range of sizes, randomly arranged in siting and size; the longest of these setae are approximately the same length as the longer setae in rows A, B, C, and D.

REPRODUCTION: Sexual maturity attained at leg lengths of betweeen 17 mm and 22 mm; leg length in smallest adult female is 17.65 mm, in smallest ovigerous male it is 21.63 mm. Ovigerous males of the Magellanic form taken in December and January, and of the Victoria Land form taken from September to December; genital pores on the 2nd coxae of the two posterior pairs of legs.

ABDOMEN: In the Magellanic form the abdomen is directed almost vertically, giving the appearance of a considerable shortening of the dorsal surface of the 4th somite. In the Victoria Land form the abdomen is horizontal, or at only a small angle from the horizontal.

DISTRIBUTION

Recorded sites of the collection of both Magellanic and Victoria Land forms are shown in Fig. 115.

DEPTH RANGE

Specimens of the Magellanic form have been taken from depths between 15 m and 391 m, while Victoria Land forms have been taken between 3 m and 860 m.

MENSURAL CHARACTERS

	Adults	Juveniles
Range of leg length examined	17–36mm	3–24mm
Palp L. ÷ proboscis L.	1.10–1.88	1.18–1.80
L. 4th palp segt. ÷ L. 2nd palp segt...	0.64–0.91	0.67–1.03
L. chela ÷ L. scape ..	0.10–0.80	0.30–0.90
L. scape ÷ L. proboscis	0.15–0.35	0.15–0.45
L. cephalic somite ÷ L. trunk..	0.28–0.56	0.32–0.60
L. leg ÷ L. trunk	6.67–10.00	3.26–9.09
L. trunk ÷ L. proboscis	0.65–1.40	0.65–1.40
L. claw ÷ L. propodus	0.30–0.68	0.30–0.68
L. accy. claw ÷ L. claw	0.30–0.74	0.34–0.70
L. largest propodal sole spine ÷ L. claw	0.10–0.42	0.10–0.54

PROPODAL SOLE SPINES

The number of special proximal sole spines varies between 3 and 4 in juveniles and larvae, and between 2 and 8 in adults. Spines of the proximal group are homogeneous in size, except for the markedly smaller most proximal spine. The proximal group is confined entirely within the proximal half of the propodal sole; the distal group is represented by very small spinules.

DISCUSSION

The vertical posture of the abdomen and the steep, sharp, ocular tubercle are the character states by which *A. clausi* Pfeffer has been distinguished from *A. australis* (Hodgson). The ranges of variation observed in the two forms coincide almost exactly in the 46 characters used in the analysis described above.

Until the recent collections were made, records of *A. clausi* had been confined between 20°W and 100°W; records of *A. australis* had been, and remain, confined between 170°W and 140°E. The present collections contained four adult specimens, immediately attributable to *A. clausi*, from three stations in the western part of the Ross Sea.

There can be no question of these specimens being intermediate between *clausi* and *australis* in their critical characters. Detailed biometric analysis strongly suggests that they are more closely related to specimens attributable to *australis* from the same stations* than to any other specimens of either *australis* or *clausi*. If this is so, the four "*clausi*" specimens have presumably the same immediate genetic origins as the "*australis*" forms from the same stations, i.e., they have been derived from the same local breeding populations. It is significant

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*Sta. A 467, 1 ovigerous ♂, and 1 ♀ *clausi* form; 23 *australis* forms. NZOI Sta. A 471, 1 ovigerous ♂ *clausi* form; 3 *australis* forms. *Edisto* Sta. 8, 1 ♀ *clausi* form; 13 *australis* forms.

in this respect, that all four "*clausi*" specimens are apparently perfectly normal adult specimens, and two are ovigerous males, which suggests that in the Ross Sea the "*clausi*" form is capable of breeding as it is in the Magellanic region of the Antarctic. In contrast, there is no evidence to suggest that the "*australis*" form can survive to breed in the Magellanic region.

The data do not support the possibility that the two forms are the extremes of a cline, for the biometric data of "*australis*" and "*clausi*" specimens combined are homogeneous for specimens of similar size. Unfortunately, the absence of specimens from between 100°W and 170°W prevents a high degree of confidence being attached to this, or any similar genetic explanation.

On the other hand, the presence in two breeding populations of the character states whose absence in one population had previously been considered sufficient grounds for delimiting that population as a distinct species, is not compatible with either a morphological or a genetic definition of those species. Consequently, *australis* is considered to be a synonym of *clausi*, while the apparent spatial isolation of two breeding populations, which differ in the frequency of occurrence of two character states, is emphasised by the use of the terms "Magellanic form" (=*clausi* Pfeffer) and "Victoria Land form" (=*australe* Hodgson).

Ammothea (Theammoa) minor (Hodgson, 1907). (Figs. 104, 105, 116–119).

Leionymphon minus Hodgson, 1907: 44; VI 2. Helfer and Schlottke, 1935: 284.
Ammothea gracilipes Bouvier, 1913: 132–5; 85–7.
Ammothea minor Bouvier, 1913: 131–2; 83–4. Calman, 1915b: 52–3. Loman, 1923d: 23. Hodgson, 1927: 342 (in key). Gordon, 1932: 102–4. Gordon, 1938: 21–22. Gordon, 1944: 51. Fage, 1952b: 271–2.

MATERIAL EXAMINED

NZOI Sta. A 468, 1 ovigerous ♂, 3 juveniles; Sta. A 530, 1 juvenile.
Trans-Antarctic (N.Z.) Sta. 100, 1♂.
Atka Sta. 22a, 1 ♀; Sta. 23, 2 juveniles. *Edisto* Sta. 8, 1 juvenile.
Stanford Sta. GLD-13, 1 ovigerous ♂; Sta. B, 2 ♂♂.
B.M. (N.H.) Regn No. 1907.6.24.87, 1 ♂, *minor*; B.M. (N.H.) Regn. No. 1907.6.24.86, 1 ovigerous ♂, *minor*; B.M. (N.H.) Regn. No. 1915.7.24.224, 1 juvenile, *minor*; B.M. (N.H.) Regn. No. 1915.7.24.223, 1 ♂, *minor*; B.M. (N.H.) Regn. No. 1933.3.23.661, 1 ♀, *minor*.

DESCRIPTION

Based on 12 adults and 8 juveniles, supplemented by previous descriptions.

PALP: Nine-segmented; in most specimens segments 5–8 strongly asymmetrically conical (in a few specimens these segments approach a perfectly cylindrical shape); terminal four segments with densely spinose ventral surfaces (Fig. 117A); 4th segment stout and almost straight, without an ectal mound surmounted by a pore.

PROBOSCIS: Very variable in shape, varying in both adults and juveniles between D:1 and B:2:E″. In the latter case the curvature is always very slight. The majority of adults have a proboscis of shape D:1.

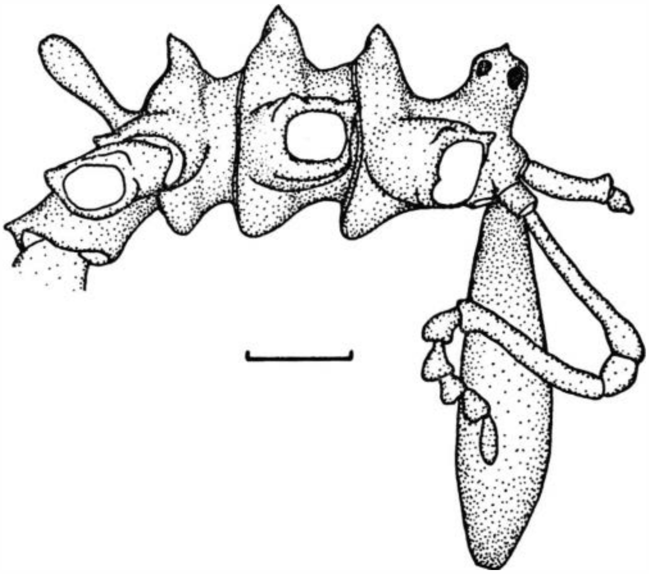

FIG. 116—*Ammothea* (*Th.*) *minor*: lateral view of adult female. (The scale represents 1 mm.)

TRUNK: Three dorsal processes on the anterior trunk somites bluntly conical, little if any taller than the ocular tubercle. In juveniles, the dorsal processes are slenderly conical. Ocular tubercle squat and bluntly rounded, surmounted by a minute, sharp, conical process; two pairs of eyes usually lightly pigmented (in some specimens there does not appear to be any pigment); eyes of the anterior pair slightly larger than those of the posterior pair; spines restricted to a very sparse scattering of minute spinules over the whole trunk (even these may be entirely absent); lateral processes with a pair of low, bluntly conical projections on their dorsal distal surfaces.

CHELICERAE: Fingers atrophying at or near the attainment of sexual maturity at leg lengths of 21–24 mm. As in *A. clausi*, the scape of small juveniles bears a large seta on a low projection on the dorsal distal surface. During growth, the size of the seta decreases relatively, while the projection increases, until the condition shown in Fig. 116 is reached at sexual maturity. The projection on the adult scape is not as high as in *clausi*.

LEG: Second tibia the longest segment; spines either completely absent or restricted to a sparse scattering of minute, stout, spinules on the dorsal surfaces of the femora; propodus in all specimens with a dense covering of such spinules.

REPRODUCTION: Sexual maturity reached at leg lengths of 16–24 mm; leg length of smallest recorded female, 21·38 mm; of smallest adult male, 22·00 mm; ovigerous males taken from November to March; eggs between 0·15 mm and 0·23 mm in diameter; genital pores on the 2nd coxae of the two posterior pairs of legs.

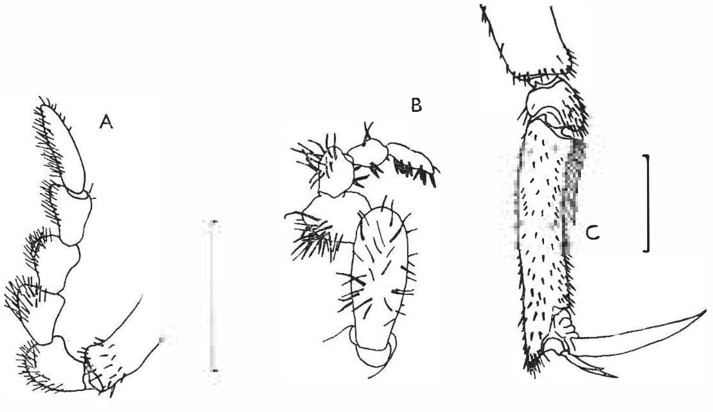

FIG. 117—*Ammothea* (*Th.*) *minor*: A, terminal segments of left palp; B, terminal segments of male oviger; C, terminal segments of 3rd left leg of adults. (The scales represent 1 mm; A and B to the same scale.)

DISTRIBUTION

The stations at which specimens have been taken are shown in Fig. 119; depths were from 15 m to 392 m.

MENSURAL CHARACTERS

	Adults	Juveniles
Range of leg length examined	21–32mm	4–24mm
Palp L. ÷ Proboscis L. ..	1.10–1.60	1.20–1.90
L. 4th palp segt. ÷ L. 2nd palp segt.	0.80–1.20	0.80–1.30
L. chela ÷ L. scape ..	0.20–0.50	0.70–0.90
L. scape ÷ L. proboscis ..	0.22–0.34	0.18–0.32
L. cephalic somite ÷ L. trunk	0.39–0.52	0.32–0.54
L. leg ÷ L. trunk ..	6.00–10.81	4.00–7.50
L. trunk ÷ L. proboscis ..	0.95–1.18	0.82–1.56
L. claw ÷ L. propodus ..	0.45–0.57	0.42–0.62
L. accy. claw ÷ L. claw ..	0.42–0.57	0.18–0.67
L. largest propodal sole spine ÷ L. claw	0.02–0.30	0.10–0.30

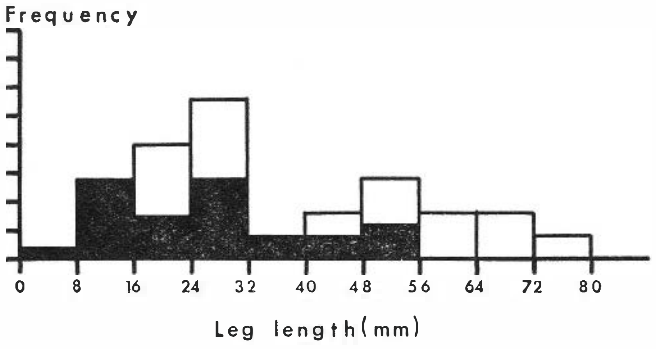

FIG. 118—Size frequency distribution of adult and juvenile specimens attributable to either *Ammothea* (*Th.*) *minor* or *Ammothea* (*Amm.*) *glacialis*. Shaded areas represent juvenile frequencies. The frequency is indicated on the ordinate in tens.

PROPODAL SOLE SPINES

In adults the number of proximal sole spines is four to seven, in juveniles, two to five. The proximal spines are homogeneous in size, and confined within slightly less than half the length of the propodal sole. The distal group consists of a fairly dense scattering of small stout spinules, none of which ever develops into large spines.

DISCUSSION

Examination of the type material of both *A. minor* and *A. glacialis* suggests that Gordon's 1932 key leads to an overemphasis of the similarities between the two species. The specimens from the present collections show such wide ranges of variation in the "key character" that it is impossible to separate them by means of Gordon's key.

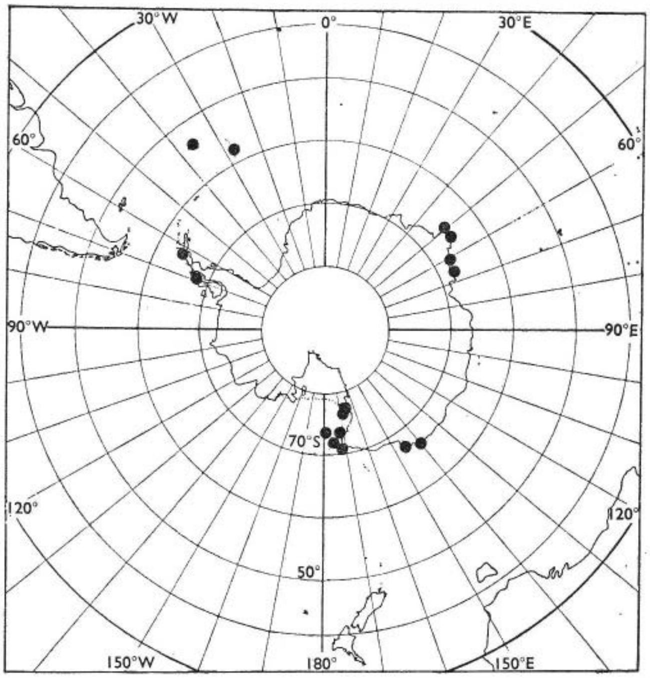

FIG. 119—Distribution records of *Ammothea* (*Th.*) *minor*.

When the ranges of the character states of the specimens attributable to either *minor* or *glacialis* were analysed, it became apparent that the material included two size groups of mature individuals, and that there were juveniles equal in size to, or even larger than, the adults in the smaller size group (Fig. 118). The overlap of juvenile and adult sizes covers approximately 50% of the total range of the leg lengths. In other species of Ammotheidae such overlaps usually comprise between 10% and 20% of the size range.

Re-examination of Hodgson's description of the type of *glacialis* suggested that the ectal mound and pore on the 4th palp segment was a character which would separate the two species. This was confirmed by a complete correlation between the presence or absence of this character and the sizes of the adult specimens. The ectal pore and mound were then used to separate juvenile specimens.

The percentage matching coefficient analysis places *minor* and *glacialis* in different subgenera on the basis of 46 characters.

Ammothea (Theammoa) magniceps Thomson, 1884. (Figs. 105, 120–122)

Ammothea magniceps Thomson, 1884: 244–5; XV 1–5 and XVI 3. Hutton, 1904: 247. Stock, 1956: 43–5: 6.
Ammothea australiensis Flynn, 1919: 95–9; XIV 4, 5 and 6. Stock, 1954b: 105. Stock, 1956: 43. Clark, 1963: 58–9.
Achelia flynni Marcus, 1940: 128.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 86.32, 1 ovigerous and larvigerous ♂, 1 ovigerous ♂, 2 ♀♀, "*australiensis*?, Port Phillip".

DESCRIPTION

Based on four adult specimens in the British Museum (Natural History) collections and from the writings of Thomson, Flynn, Stock, and Clark.

PALP: Nine-segmented, segments 5–8 asymmetrically conical; 4th segment relatively stout, curved markedly but evenly over its whole length, and without sharp ectal mound surmounted by a pore; spination restricted to sparse fields of fine setae on the ventral surfaces of the five terminal segments and the distal third of the dorsal surface of segment 9.

PROBOSCIS: Massive and bulbous in appearance and of shape D or D′: 1 although Stock's figure shows a very slight down curvature of the longitudinal axis.

TRUNK: Dorsal processes on the posterior ridges of the three anterior somites very variably developed, although never strikingly large. Thomson's type description, and the discussion by Stock (1956), indicate that in specimens formerly attributed to *magniceps* the ridges are quite unadorned. Dorsal processes always very much lower and slimmer than the ocular tubercle, which is steeply conical, and surmounted by a small, sharp, conical projection. In the material included in *A. magniceps* by Thomson and Stock, the ocular tubercle has a deep notch behind the terminal conical projection, which renders the tubercle strikingly asymmetrical in side view. Although Flynn's description of the type of *A. australiensis* gives no indication of a similar notch, the four British Museum specimens from Port Phillip Bay show this character state. Spination of the trunk appears to consist—at most—of a very few fine setae on the distal dorsal surfaces of the lateral processes.

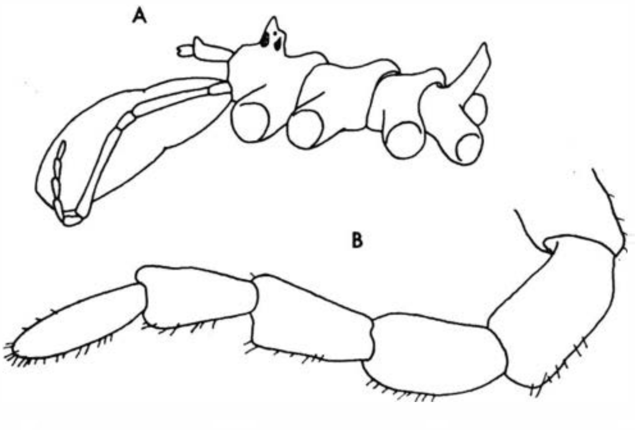

FIG. 120—*Ammothea* (*Th.*) *magniceps*: A, lateral view of trunk and proboscis; B, terminal segments of left palp. After Thomson (1884) and Stock (1956), specimens from Akaroa and Lyttelton, New Zealand.

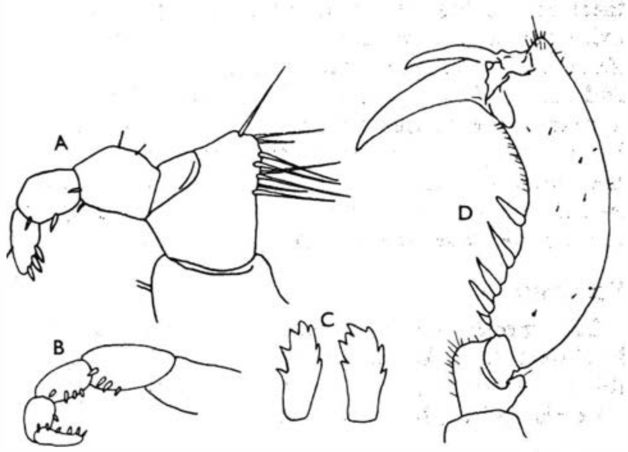

FIG. 121—*Ammothea* (*Th.*) *magniceps*: A, terminal segments of male oviger; B, terminal segments of female oviger; C, special oviger spines of female oviger; D, terminal segments of leg. After Stock (1956), specimens from Akaroa and Lyttelton, New Zealand.

CHELICERAE: The fingers of the chelae atrophy at or near the onset of sexual maturity. Although no juveniles have been recorded, one of the males from Port Phillip Bay is apparently perfectly chelate. The articulation of scape and palm is synaxial, but the scape itself may or may not bear a strong, rounded, dorsal distal projection such as occurs in *clausi* and *minor*. No large setae have been detected or described on the scape or the chela.

LEG: The longest segment is either the 1st or 2nd tibia, or the femur, or else femur and 2nd tibia are of equal length and longer than the 1st tibia. There does not appear to be any consistent arrangement of the few fine spines borne on the dorsal and lateral surfaces of the long segments. The coxal segments have a sparse distal fringe of similar spines. The longest spines recorded are not more than one-third the diameter of the segment on which they are sited.

REPRODUCTION: Sexual maturity attained at leg lengths of 6 mm or less; smallest ovigerous males with leg lengths of 6.34 mm and 6.48 mm, and bearing eggs with diameters of approximately 0.15 mm; smallest female with a leg length of 7.50 mm. Unfortunately, there are no indications of the time of year when the ovigerous and larvigerous males were taken. As in *Anammothea tetrapora*, there are genital pores on the 2nd coxae of all eight legs. The females of this species appear to be unique within the genus *Ammothea* in having compound spines on the terminal segments of the ovigers—a character state placing them close to *Achelia* species.* The dorsal spination of the 7th segment of the male oviger is also strikingly unusual.

DISTRIBUTION

The species has been recorded so far from three localities; (a) Akaroa and Lyttelton, New Zealand, (b) Shark Island, Port Jackson, Australia, and (c) Port Phillip Bay, Melbourne, Australia.

DEPTH RANGE

Locality details are sparse. The New Zealand specimens were taken between 4fm and 8fm; Flynn's specimen was collected amongst mussels at "low tide".

MENSURAL CHARACTERS

	Adults
Range of leg length	6.34–*c*.15 mm
L. palp ÷ L. proboscis	1.01–1.51
L. 4th palp segt. ÷ L. 2nd palp segt.	1.00–1.32
L. chela ÷ L. scape	0.39–0.74
L. scape ÷ L. proboscis	0.13–0.18
L. cephalic somite ÷ L. trunk	0.36–0.49
L. leg ÷ L. trunk	3.26–5.10
L. trunk ÷ L. proboscis	0.83–1.09
L. claw ÷ L. propodus	0.34–0.56
L. accy. claw ÷ L. claw	0.59–0.76
L. largest propodal sole spine ÷ L. claw	0.26–0.68

PROPODAL SOLE SPINES

Two groups of sole spines are clearly visible. The proximal group has 3–5 spines either subequal in length, or with the most proximal markedly smaller than the others. This group is confined well within the proximal half of the sole. The distal group forms an elliptical field of short fine setae, confined within the distal half of the propodal sole. The propodus itself is very strongly curved.

DISCUSSION

Stock (1956) considered that *australiensis* and *magniceps* were quite clearly morphologically distinct; sufficiently for each form to be accorded specific rank. However, the four specimens from Port Phillip Bay appear to have some character states intermediate between the two forms. To clarify this, Flynn's "type" of *australiensis*, the New Zealand specimens, and the four adults from Port Phillip Bay were compared by the percentage matching coefficient method (see p. 70).

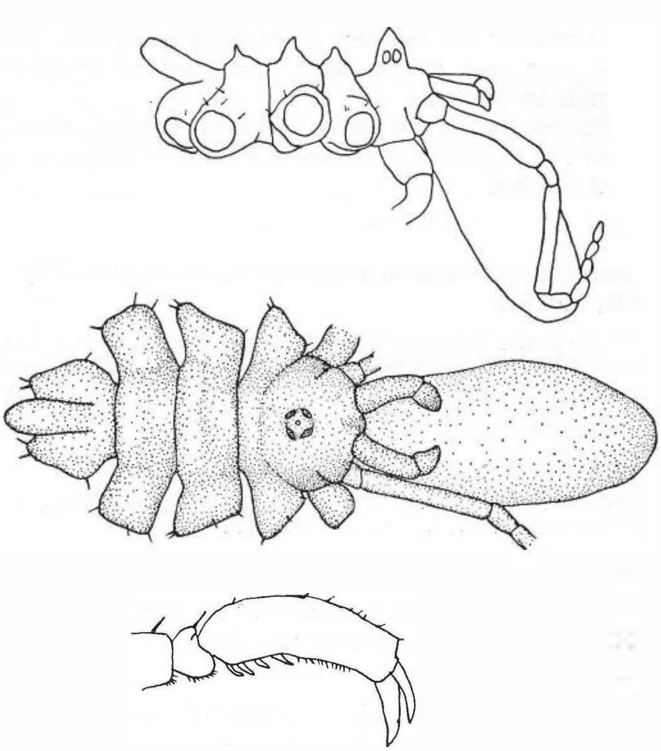

FIG. 122—*Ammothea* (*Th.*) *magniceps*: dorsal and lateral views of trunk and proboscis, and lateral view of the distal segments of the leg. After Flynn's (1919) figures of "*Ammothea australiensis*" from Port Jackson, Australia.

The 46 characters given in Table 9 were used, and it was found that the 3 forms matched in 63.27% of character states. This was the percentage matching coefficient between the New Zealand specimens and Flynn's *australiensis*. However, the percentage matching coefficient between Flynn's *australiensis* and the Port Phillip Bay specimens was 96.57%, while that between the New Zealand and the Port Phillip Bay specimens was 99.93%. On these figures *australiensis* Flynn and *magniceps* Thomson are regarded as synonymous, and Thomson's name takes precedence.

Clark's distinction between *australiensis* and *magniceps* is not convincing on the evidence displayed. Separation of the species by size may reduce the other characters to no more than expression of heterogonic growth.

The two latter percentage matching coefficients appear to be high because of the wide range of variation of many of the character states of the Port Phillip Bay specimens. Admittedly, Flynn's type description of *australiensis* was based on a single specimen, but data are available from four or five specimens of *magniceps* from southern New Zealand.

In several characters, the Port Phillip Bay specimens appear to be intermediate between the New Zealand and the Port Jackson specimens:

(a) The New Zealand and Port Phillip Bay Specimens have a strongly notched ocular tubercle, while the Port Jackson specimen has a symmetrical tubercle.

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*The variability of *Ammothea tetrapora* is also reminiscent of *Achelia* species.

(b) The New Zealand specimens have no dorsal processes on the trunk ridges, while the Australian specimens have low ridges.

(c) In the New Zealand specimens either the 1st tibia is the longest leg segment, or else the femur and 2nd tibia are equal longest. In the Port Phillip Bay specimens the femur and 2nd tibia are equal longest, or else the 2nd tibia is longest. In the Port Jackson specimen the 2nd tibia is the longest segment.

Just as these characters might suggest that the Port Phillip Bay specimens are intermediate in form and therefore represent a genetically intermediate population between the Banks Peninsula and the Port Jackson population, so other characters suggest that the Port Phillip Bay specimens might be members of a parent population from which the other two populations have diverged. Unfortunately, there are no published descriptions of specimens collected at intermediate points.

The patterns of distribution of the other species of *Ammothea* suggest that the Antarctic coastal waters have provided the sites for the greatest radiation of the genus, and that the northern records for the genus do not represent the relatively unmodified descendants of an early stock. The set of deep and surface currents around New Zealand (Burling, 1961; Garner, 1961, 1962; Starr, 1961) suggests that direct transportation northwards from the Antarctic mainland to New Zealand is impossible. It seems more likely that *A. magniceps* has reached the South Island of New Zealand from the south-east coast of Australia and Tasmania. Assuming that the species had an Antarctic coastal progenitor, *A. magniceps* could only have reached Australia with the aid of the Westwind Drift. Unfortunately, the fauna of the southern Atlantic and Indian Ocean islands is too imperfectly known to substantiate or refute such a hypothesis, although the occurrence around both New Zealand and southern South America of *Achelia* (*Ignavogriphus*) *assimilis* (see p. 102) is evidence of widespread disjunct distributions in the southern oceans.

It is of interest that the local populations of the Melbourne region would be capable of providing colonists adapted to withstand the conditions of the Banks Peninsula area. The mean monthly surface temperature of the Melbourne region is 17.5°c (+) (Burling, 1961) and the surface temperatures around Banks Peninsula range from 7°–18°c between August and February (Garner, 1961). In view of the set of known currents in the Tasman Sea and around New Zealand (Burling, 1961; Garner, 1961, 1962; Starr, 1961) it is possible that the Australian and New Zealand components of the species maintain a persistent exchange of genetic material. Also, it must not be forgotten that such small, sluggish animals can be carried many miles in weed or hydroids attached to ships.

Stock (1956) considered that *magniceps* is a morphological link between *Lecythorhynchus* and *Ammothea*, and that these two genera should be united. This conclusion appears to be based on six characters, five of which are shared by *magniceps* and species of *Lecythorhynchus*. Stock considers this mismatch of the sixth character insignificant in the face of the five matches. It may be that a thoroughly detailed comparison of *Lecythorhynchus* species and *magniceps* would support Stock's contention, but for the present we hesitate to merge two genera on the basis of an opinion supported by so few data.

Subgenus **Mathoma** n. subgen.

Palp more than 1½ times as long as the proboscis, which is squat and bulbous, or cylindrical; ocular tubercle higher than wide basally; articulation of scape and palm anaxial; dorsal trunk projections massive; genital pores on the 2nd coxae of the last four legs; sexual maturity attained at leg lengths of more than 45 mm; anterior four and posterior four propodi either similar or dissimilar in relative proportions and sole spination.

Ammothea (Mathoma) calmani Gordon, 1932. (Figs. 104, 105, 123–125)

Ammothea striata? Calman, 1915b: 55.
Ammothea calmani Gordon, 1932: 104–6; 54–5. Helfer and Schlottke, 1935: 285.

MATERIAL EXAMINED

NZOI Sta. A 459, 1 ovigerous ♂; Sta. A 460, 1 ♀.
B.M. (N.H.) Regn. No. 1915.7.24.231, 1 ♂, holotype, *calmani*;
B.M. (N.H.) Regn. No. 1933.3.23.663, 1 juvenile, *calmani*, paratype;
No B.M. (N.H.) Regn. No. *Discovery* (1925–31) Sta. 371, 1 juvenile, *Ammothea* sp.?

DESCRIPTION:

Based on two adult males, one adult female, and two juveniles.

PALP: nine-segmented, segments 5–9 essentially cylindrical; 4th segment scarcely curved, without an ectal mound; spines confined to the ventral surfaces of the five terminal segments and a distal collar of short, stout spines on the 4th segment, a very few scattered spinules on segments 2, 3, and 4.

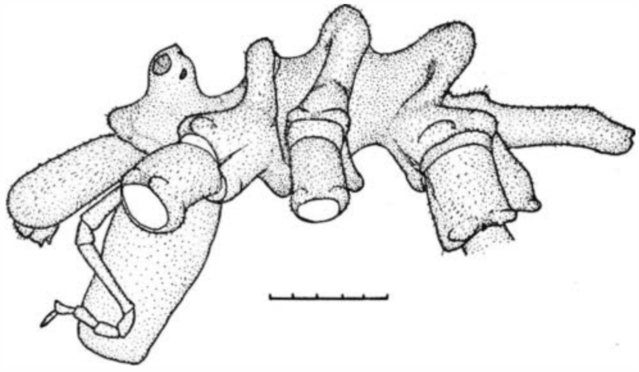

FIG. 123—*Ammothea* (*M.*) *calmani*: lateral view of holotype (♂). (The scale represents 5 mm.)

TRUNK: The three anterior trunk somites each bear a bluntly conical dorsal process on their posterior dorsal ridges. In both adults and juveniles the dorsal process of the cephalic somite is lower than the ocular tubercle. In adults the dorsal processes on somites 2 and 3 are higher than the ocular tubercle; in juveniles these 2 dorsal processes are lower than the ocular tubercle. Ocular tubercle steep-sided, surmounted by a small rounded cone; anterior pair of eyes strikingly larger than the posterior pair (both pairs darkly pigmented); short, stout, spinules in dense fields on the dorsal processes, dorsal trunk ridges, dorsal surfaces of the lateral processes, cephalic lobes, and dorsal and distal ventral surfaces of the abdomen.

PROBOSCIS: Proboscis in adults of shape A′: 1; in juveniles varying between C′ : 1 and A′ : 1.

CHELICERAE: Fingers of the chelae imperfect in adults, appearing to atrophy at leg lengths 47–49 mm; minute stout spinules in dense fields on the dorsal surface of the scape.

LEG: The 2nd tibia or femur the longest segment in adults, but in juveniles, the 2nd tibia is longest. Long segments with two dorsal, two ventral, and two lateral bands of very short stout spinules; the entire surface of each coxal segment covered with a dense field of short stout spinules.

REPRODUCTION: Sexual maturity attained at leg lengths of 47–49 mm; leg length of smallest male recorded 47.46 mm; of smallest known female 82.50 mm; the only recorded ovigerous male was taken in the Ross Sea in January; male 7th oviger segment bears ventrally a small irregular projection; genital pores on the 2nd coxae of the two posterior pairs of legs.

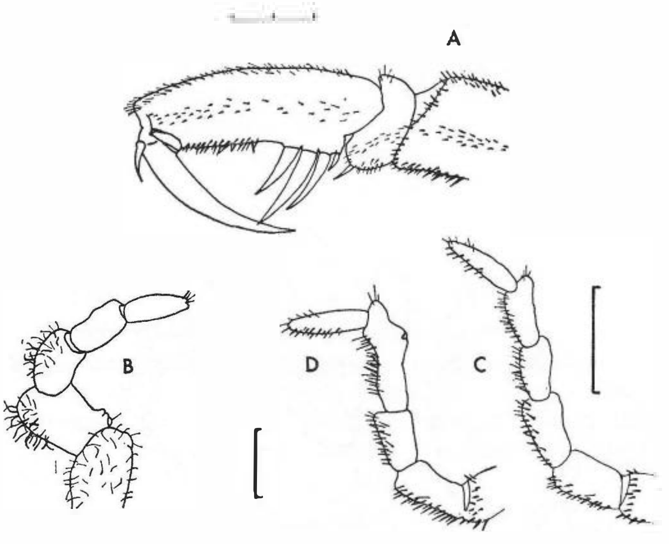

FIG. 124—*Ammothea* (*M.*) *calmani*: A, distal segments of 3rd left leg; B, distal segments of right oviger of holotype (♂); C, distal segments of right palp of paratype; D, distal segments of right palp of holotype. (The scales represent millimetres; B and D to the same scale.)

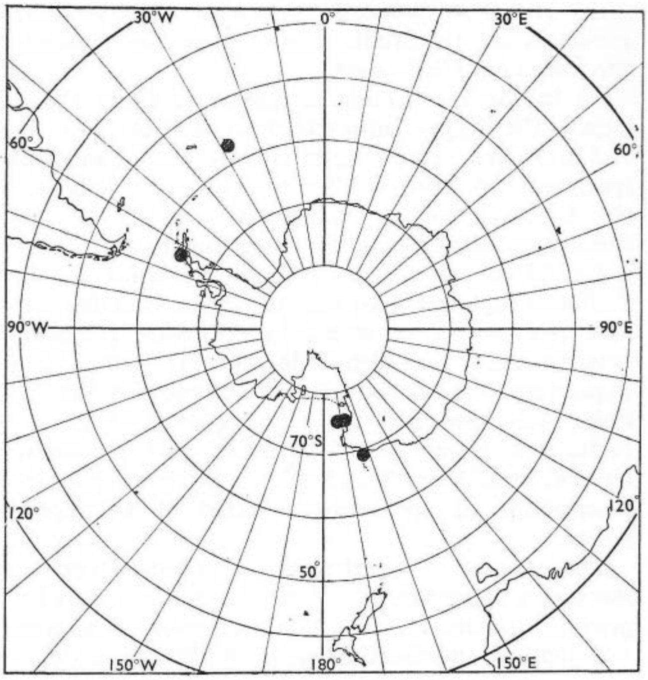

FIG. 125—Distribution records of *Ammothea* (*M.*) *calmani.*

DISTRIBUTION

The localities of all documented specimens are shown in Fig. 125; specimens taken at depths of 99–549 m.

MENSURAL CHARACTERS:

	Adults	Juveniles
Range of leg length ..	47.46–82.50 mm	21.63–48.70 mm
L. palp ÷ L. proboscis	1.31– 1.65	0.82– 1.10
L. 4th palp segt. ÷ L. 2nd palp segt. ..	0.62– 1.02	1.29– 1.84
L. chela ÷ L. scape ..	0.29– 0.38	0.38– 1.00
L. scape ÷ L. proboscis	0.59– 0.62	0.66– 0.69
L. cephalic somite ÷ L. trunk ..	0.43– 0.48	0.40– 0.44
L. leg ÷ L. trunk ..	0.70– 5.54	4.29– 5.73
L. trunk ÷ L. proboscis	1.58– 2.44	1.80– 1.81
L. claw ÷ L. propodus	0.44– 0.74	0.63
L. accy. claw ÷ L. claw	0.33– 0.45	0.33– 0.41
L. largest propodal sole spine ÷ L. claw	0.42– 0.55	0.40– 0.52

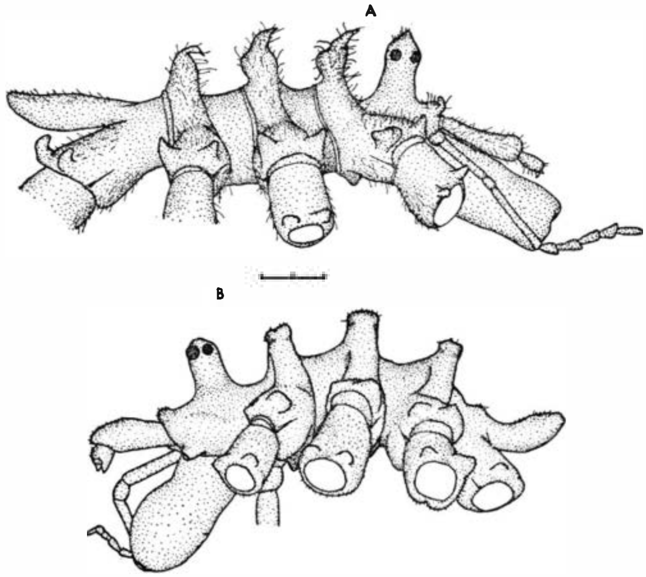

FIG. 126—A, lateral view of holotype of *Ecleipsothremma spinosa;* B, lateral view of holotype of *Ammothea* (*M.*) *allopodes.* (The scale represents 2 mm.)

PROPODAL SOLE SPINES

Large spines of the proximal group number two or five in adults, two or three in juveniles. The proximal spines are highly heterogeneous in size, and cover less than the proximal half of the propodal sole; the distal group is a dense elliptical field of minute, fine setae.

DISCUSSION

The very close morphological similarity between this species and *A.* (*M.*) *allopodes* (see Fig. 105) is perhaps the most striking discovery resulting from the use of the percentage matching coefficient.

Ammothea (Mathoma) allopodes* n.sp. (Figs. 104, 105, 126–129)

Ammothea spinosa var. Gordon, 1944: 50–1; 16a–e, 17.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1942.12.30.70, 1 ovigerous ♂, *spinosa* var. The female from B.A.N.Z.A.R.E. Sta. 30 is untraceable.

DESCRIPTION

An expansion of pp. 50–1 in Gordon (1944), including new data from the holotype.

PALP: 9-segmented, segments 5–8 asymmetrically conical; 4th segment stout and straight, without strong ectal mound surmounted by a pore; five terminal segments with ventral fields of fine setae; 9th segment bearing similar dorsal and lateral fields; segments 6, 7, and 8 with a small clump of about six fine setae on their dorsal distal surfaces. The total length of the palp greatly exceeds that of the proboscis—as in *Ecleipsothremma spinosa* (see p. 96).

PROBOSCIS SHAPE of the holotype is D: 1 (Fig. 126).

TRUNK: Each of the dorsal ridges on the three anterior trunk somites bears a stout, steep-sided, and essentially flat-topped, dorsal process. The most distal portion of each process is very slightly swollen. Ocular tubercle steep-sided and rounded terminally, taller than the dorsal processes; two pairs of darkly pigmented eyes protruding noticeably from the surface of the ocular tubercle; anterior pair larger than posterior pair; spination restricted to small patches of spinules on the tops of the dorsal processes and anterior cephalic lobes, and to the base, and dorsal surface of the abdomen; distal dorsal surfaces of the lateral processes bearing low, rounded, projections.

CHELICERAE: The two known adult specimens are achelate, with greatly reduced fingers. Scape stouter than in *E. spinosa*, more expanded distally; articulation of scape with palm is antero-ventral, anaxial (in *E. spinosa* the articulation is synaxial).

The scape has a scattering of short stout spinules on its dorsal and dorso-lateral surfaces. It does not appear to be relatively shorter in this species than in *E. spinosa*, as suggested by Gordon (1944), but, rather, the atrophied chela is relatively longer (cf. Mensural Characters, below).

LEG: The femora are the longest segments in the holotype. The spines on the coxae are much shorter than in *E. spinosa* and the whole surface of each coxal segment is covered with short spines. Spines on the long segments are longer, although still little more than a quarter of the diameter of the segments on which they are sited, and in four discrete bands; one dorsal, one ventral, and two lateral.

REPRODUCTION: The holotype has a leg length of 51.52 mm, and bears eggs with diameters of approximately 0.5 mm. It was taken off the Knox Coast in January. The four terminal segments of the holotype's oviger are much shorter than in *E. spinosa.* The terminal and

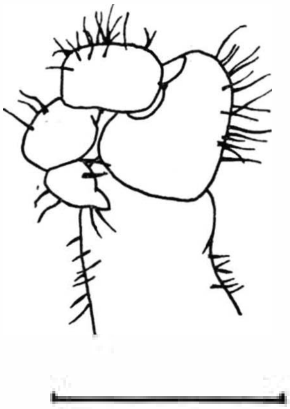

FIG. 127—*Ammothea* (*M.*) *allopodes*: terminal segments of oviger of holotype (♂). (The scale represents 1 mm.)

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*αλλοσ, different; πους, foot.

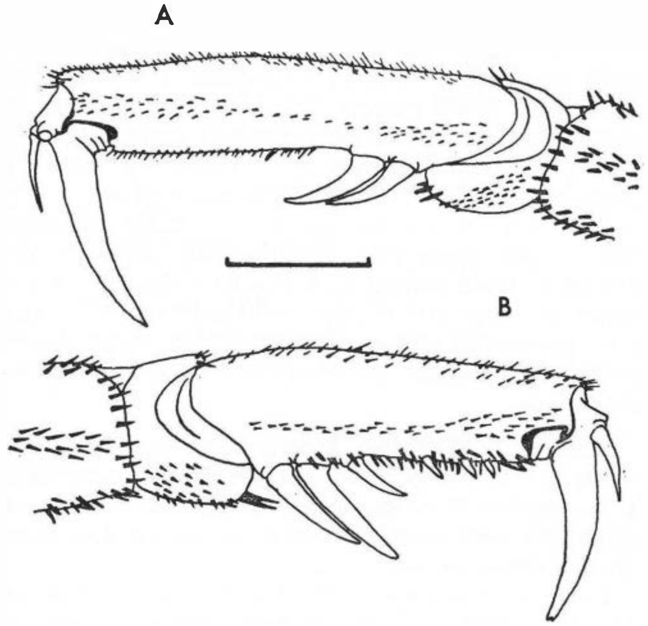

FIG. 128—*Ammothea* (*M.*) *allopodes*: **A,** distal segments of 3rd leg of holotype; **B,** distal segments of 1st leg of holotype. (The scale represents 1 mm.) (cf. fig. 148).

penultimate segments in *E. spinosa* bear no spines at all, but in *allopodes* they have six, three, and six spines respectively. The two small ventro-lateral projections on the terminal segment in *E. spinosa* may well be the vestigial counterparts of the two similarly placed, stout spines in *allopodes.* Since the only known female specimen of *allopodes* is not available for examination, no comparisons can be made between the female ovigers of the two species. Genital pores occur on the 2nd coxae of the two posterior pairs of legs.

DISTRIBUTION

The localities of the two known specimens are shown in Fig. 129; specimens taken at depths of 474 m and 540 m.

MENSURAL CHARACTERS:

	Holotype ♂
Leg length	51.52 mm
L. palp ÷ L. proboscis	3.35
L. 4th palp segt. ÷ L. 2nd palp segt.	0.84
L. chela ÷ L. scape	0.43
L. scape ÷ L. proboscis	0.59
L. cephalic somite ÷ L. trunk	0.44
L. leg ÷ L. trunk	4.15
L. trunk ÷ L. proboscis	2.56
L. claw ÷ L. propodus	0.40, 0.41
L. accy. claw ÷ L. claw	0.44, 0.51
L. largest propodal sole spine ÷ L. claw	0.55

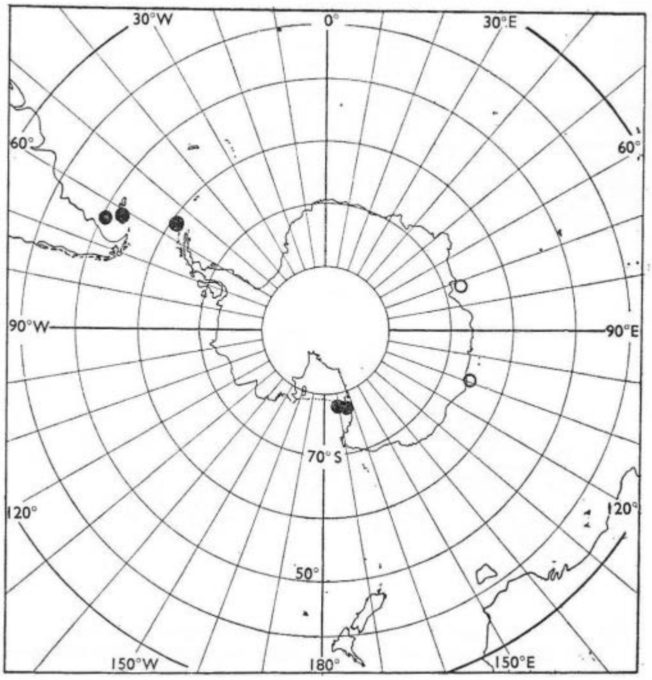

FIG. 129—Distribution records of *Ammothea* (*M.*) *allopodes* (hollow circle) and *Ecleipsothremma spinosa* (solid circle).

PROPODAL SOLE SPINES

As in *E. spinosa*, *allopodes* shows clear dimorphism between the anterior four and the posterior four propodi, but the dimorphism is clearly dissimilar in the two species.

ANTERIOR PROPODI: The propodus is very stout, although no shorter in relation to other leg segments than the posterior propodi. The proximal group of propodal spines contains three large spines of strikingly different size, and covers less than the proximal half of the propodal spine. The distal group of sole spines is a dense elliptical field of short, stout, setae, with three or four much larger spines in their midst. The field of stout setae extends back to surround the bases of the two more distal spines of the proximal group.

POSTERIOR PROPODI: These are much more slender than the four anterior propodi, although they do not form a larger percentage of the total leg length. The proximal group of sole spines contains two large subequal spines, set close together on the proximal quarter of the propodal sole. The distal sole spine group is a narrow field of very fine, short setae.

DISCUSSION

E. spinosa and *A. allopodes* appear to be the only two species within the Ammotheidae (sens. auct.) which show dimorphism between anterior and posterior propodi. Without knowing the habits of *A. allopodes* and of *E. spinosa* and their preferred substrates, it is difficult to envisage the functional importance of the two propodal types. In both species the soles of the anterior propodi are rougher overall, which suggests that the anterior and posterior propodi perform different functions during clinging and climbing.

See also the Discussion of *Amm. calmani* (p. 85).

Subgenus **Thammota** n. subgen.

Palp 9-segmented; three dorsal trunk projections massively conical; articulation of scape with palm anaxial; ocular tubercle taller than wide, waisted basally, rounded and surmounted by small conical process; proboscis straight, tapering abruptly but evenly over whole length; propodi of all eight legs similar in relative proportions and sole spination; genital pores on 2nd coxae of last two pairs of legs; sexual maturity attained at leg length of about 45 mm.

Ammothea (Thammota) stylirostris Gordon 1932 (Fig. 104, 105, 130–132)

Ammothea stylirostris Gordon, 1932: 106–8; 56–8. Helfer and Schlottke, 1935: 285.

Material Examined

B.M. (N.H.) Regn. No. 1933.3.23.664, 1 ♀, *stylirostris*, holotype; B.M. (N.H.) Regn. No. 1933.3.23.665, 1 juvenile, *stylirostris*, paratype.

Description

Based on the only two known specimens, supplemented by data from Gordon (1932).

PALP: 9-segmented, the 5 terminal segments essentially cylindrical; 4th segment stout and straight, without an ectal mound surmounted by a pore; spination restricted to dense fields of fine setae on the ventral surfaces of the 5 terminal segments, and distal fringes of similar setae on segments 2 and 4.

PROBOSCIS: Both specimens have a proboscis of shape J:1, uniformly tapered over the whole of its length.

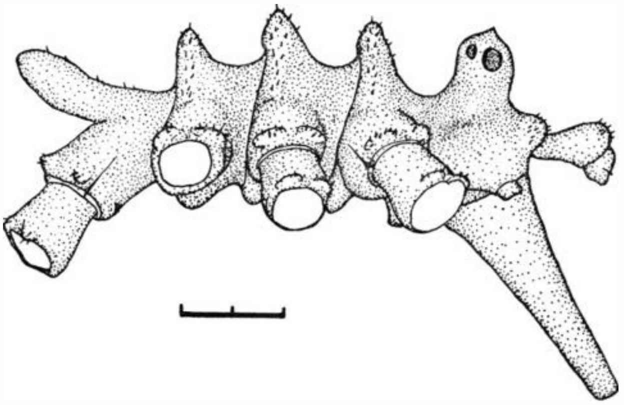

FIG. 130—*Ammothea* (*Th.*) *stylirostris*: lateral view of holotype (♀). (The scale represents 2 mm.)

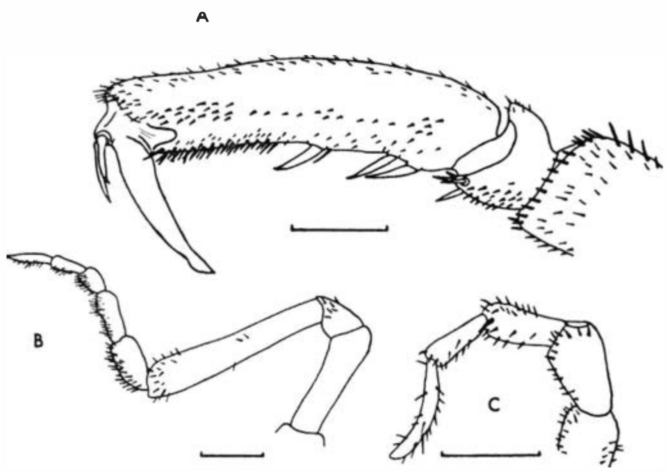

FIG. 131—*Ammothea* (*Th.*) *stylirostris*: A, terminal segments of 3rd left leg; B, left palp of holotype; C, terminal segments of left oviger of holotype (♀). (Scales represent 1 mm.)

TRUNK: Stout, rounded dorsal processes on the posterior dorsal ridges of the three anterior trunk somites scarcely as high as the ocular tubercle in the adult; in the juvenile obviously shorter, although as stout as in the adult. Ocular tubercle steep-sided, approximately as high as it is wide, its rounded distal surface surmounted by a small conical projection.

EYES: Moderately darkly pigmented (brown in alcohol), the anterior two considerably larger than the posterior two.

Cephalic somite much expanded and flattened on either side of the ocular tubercle. Trunk, chelae, scapes, and anterior cephalic lobes bearing sparse random scattering of minute spinules.

CHELICERAE: Fingers of the chelae atrophying at or near the onset of sexual maturity, at leg lengths of 33–49 mm.

LEG: In both adult and juvenile specimens the 2nd tibia is the longest leg segment. The three long segments of each leg bear six discrete rows of minute, sharp spinules; ventral and dorsal surfaces each bearing two rows, each side of the segment with one row.

REPRODUCTION: No ovigerous males known; the single adult female with a leg length of 49.00 mm; genital pores in female on the 2nd coxae of the last two pairs of legs only. The distal segment of the female oviger is curved upwards over all its length; in this it resembles the same segment of the female oviger of *Magnammothea gigantea* (Fig. 138).

Distribution

The only two specimens so far recorded were taken off South Georgia at a depth between 179 m and 235 m (Fig. 132).

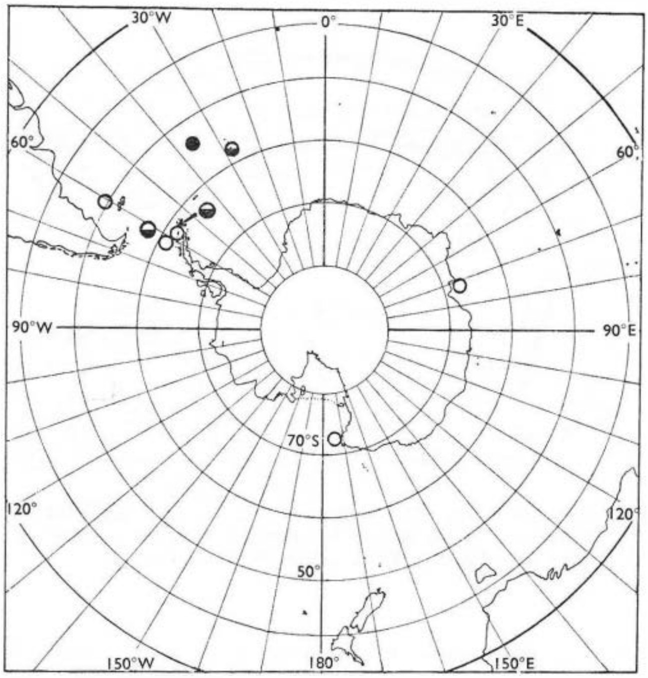

FIG. 132—Distribution records of *Ammothea* (*Th.*) *stylirostris* (solid circle), *Ammothea* (*Ho.*) *longispina* (hollow circle), and *Magnammothea gigantea* (circle with lower half solid).

Mensural Characters

	Adult	Juvenile
Range of leg lengths ..	49.00 mm	33.89 mm
L. palp ÷ L. proboscis ..	1.15	1.10
L. 4th palp segt. ÷ L. 2nd palp segt.	1.94	1.38
L. chela ÷ L. scape ..	0.50	1.26
L. scape ÷ L. proboscis ..	0.28	0.19
L. cephalic somite ÷ L. trunk	0.48	0.41
L. leg ÷ L. trunk ..	4.37	3.77
L. trunk ÷ L. proboscis ..	1.43	1.45
L. claw ÷ L. propodus ..	0.40	0.54
L. accy. claw ÷ L. claw ..	0.41	0.85
L. largest propodal sole spine ÷ L. claw	0.20	0.29

Propodal Sole Spines

Proximal group containing two to five spines, homogeneous in size, and confined within the basal half or two-thirds of the propodal sole; distal group a dense, elliptical field of stout setae, which, while markedly heterogeneous in size, may attain half the length of the proximal spines.

Discussion

The shape of the proboscis—unique in the genus—suggests that this species has exploited for food a substance or tissue not usually eaten by other species.

Subgenus **Homathea** n. subgen.

Palp 8-segmented, approximately half the proboscis length; articulation of palm with scape anaxial; ocular tubercle taller than wide, waisted basally, terminated by sharp conical process; dorsal trunk processes steeply conical; propodi of all eight legs similar in relative proportions and sole spination; genital pores on 2nd coxae of last two pairs of legs; sexual maturity attained at leg lengths of about 35 mm.

Ammothea (Homathea) longispina Gordon, 1932. (Figs. 104, 105, 132–136)

Ammothea longispina Gordon, 1932: 101–3; 50–2. Helfer and Schlottke, 1935: 285. Gordon, 1944: 49–50; 16f.
Ammothea sp. ? Gordon, 1932: 108, 58.

Material Examined

NZOI Sta. A 464a, 1 ♀.
Eltanin Sta. 138, 1 juvenile ♂.
B.M. (N.H.) Regn. No. 1933.3.23.659, 1 ♀ holotype, *longispina*;
B.M. (N.H.) Regn. No. 1933.3.23.666, 1 ♀ *Ammothea* sp. ?

Description

Based on three adult females and the first recorded juvenile specimen.

PALPS: Palps very much reduced, with 7, 8, or 9 segments, strikingly shorter than proboscis; 4th segment stout and straight, without a strong ectal mound surmounted by a pore; spines restricted to patches of small, fine, setae on ventral surfaces of segments 5 to 7 (or 8, or 9), and a small patch of similar setae on the distal end of segment 4 (see Discussion).

PROBOSCIS: In adult and juveniles the form varies between B and C: 1, (although there is a slight suggestion that the median longitudinal axis is curved upwards terminally) and the whole proboscis is slim. In the juvenile (*Eltanin* Sta. 138) the proboscis is relatively longer, and more attenuated than in the adults, and is of the form C: 3: E''' (see Fig. 135).

TRUNK: Conical dorsal processes on the dorsal posterior ridges of the three anterior trunk somites; those of the juvenile much more slender and steep-sided than those of the adults (processes variable in height relative to the height of the ocular tubercle); ocular tubercle taller than wide basally, steep-sided, surmounted by a small conical process. The adults have two pairs of darkly pigmented eyes, the anterior pair being larger than the posterior pair. In the juvenile specimen, only the lenses of the anterior pair are discernible although these two eyes are well developed; only the outlines of the two posterior eyes are visible. Spination restricted to sparse patches of short fine setae on the tops of the dorsal processes, a very few such setae at the base of the abdomen.

CHELICERAE: Fingers of the chelae atrophying at or near the onset of sexual maturity, at leg lengths of about 31 mm; chelae fingers of the juvenile equal in length, as long as the palm, and strongly bowed.

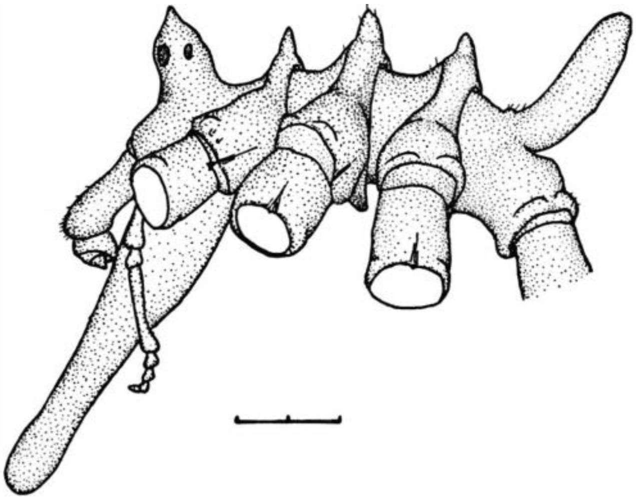

FIG. 133—*Ammothea* (*Ho.*) *longispina*: lateral view of adult female. (The scale represents 2 mm.)

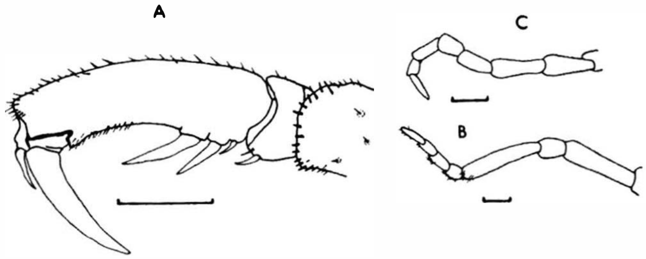

FIG. 134—*Ammothea* (*Ho.*) *longispina*: A, terminal segments of 3rd left leg of adult; B, left palp; C, terminal segments of ♀ oviger. (The scales represent 1 mm (after Gordon 1932, fig. 52.))

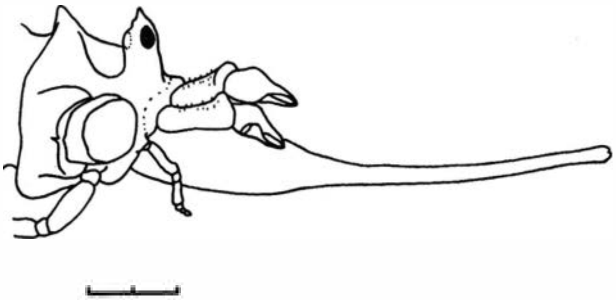

FIG. 135—*Ammothea* (*Ho.*) *longispina*: lateral view of anterior end of juvenile ♂ from *Eltanin* Sta. 138. (The scale represents 2 mm.)

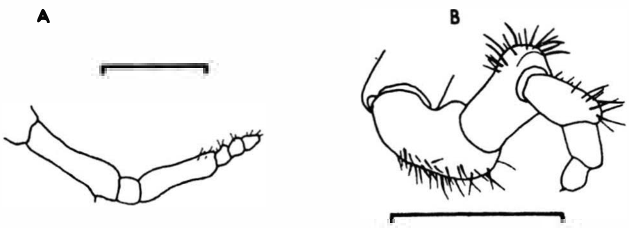

FIG. 136—*Ammothea* (*Ho.*) *longispina*: juvenile ♂ from *Eltanin* Sta. 138 A, endal view of right palp; B, ectal view of terminal segments of right oviger. (The scales represent 1 mm.)

LEG: The longest leg segment either the 2nd tibia or the femur; short, fine setae, with a maximum length of half the diameter of the segment on which they are sited, scattered on low tubercles on the dorsal surfaces of the femora and two tibiae; a field of similar setae, not mounted on tubercles, and all shorter, on the ventral surfaces of the three long segments; a single row of short, fine, setae on both lateral surfaces of long segments; coxal segments glabrous or bearing a small dorsal patch of short fine setae.

REPRODUCTION: Sexual maturity apparently attained at a minimum leg length of 31 mm. The single chelate juvenile male appears to have perfectly developed ovigers, although no sexual pores are discernible; leg length is 34.21 mm. Leg length of smallest adult female is 31.16 mm; only known ovigerous male taken off MacRobertson Land in December. Genital pores on the 2nd coxae of the last two pairs of legs only.

DISTRIBUTION:

All localities for this species are shown in Fig. 132. The adult female from NZOI Sta. A 464 is the first record of this species from the Ross Sea.

DEPTH RANGE

The adult specimens have been taken at depths of 219—540 m, the single juvenile at 1,454 m. The latter depth is at least 500 m greater than that at which any other species of *Ammothea* has been taken in Antarctic waters. No doubt this reflects the frequency of hauls in Antarctic waters deeper than 1,000 m. (See Discussion.)

MENSURAL CHARACTERS

	Adults	Juvenile
Range of leg length (mm)	31.16–58.20	34.21
L. palp ÷ L. proboscis	0.37–0.51 (+)	0.22
L. 4th palp segt. ÷ L. 2nd palp segt.	1.19–2.06	0.71
L. chela ÷ L. scape	0.15–0.36	0.89
L. scape ÷ L. proboscis	0.21–0.30	0.14
L. cephalic somite ÷ L. trunk	0.38–0.42	0.39
L. leg ÷ L. trunk	3.84–5.10	5.81
L. trunk ÷ L. proboscis	0.87–1.34	0.54
L. claw ÷ L. propodus	0.54–0.57	0.53
L. accy. claw ÷ L. claw	0.26–0.28	0.43
L. largest propodal sole spine ÷ L. claw	0.51–0.73	0.87

PROPODAL SOLE SPINES

In all specimens the proximal group of sole spines consists of two or three spines of very different sizes within the proximal third of the propodal sole. The distal group is a sparse elliptical field of short, fine setae, within the distal third of the propodal sole.

DISCUSSION

Both Gordon's *Ammothea* sp. ? and the juvenile from *Eltanin* Sta. 138 are far closer, morphologically, to the type specimens of *longispina* than to any other species of ammotheid. Gordon, confused by the 9-segmented palp, was doubtful of the exact position of her specimen (1932, p. 108). The juvenile shows that the number of palp segments in this species is variable.

The enormous elongation of the proboscis of the juvenile of *longispina* suggests that the palp is not used for tactile exploration of food materials before feeding. Possibly, the food of the species is such that the palps would be constantly damaged if employed in feeding, while the stouter proboscis would be unharmed. Whatever the significance of this proboscis elongation, the palps appear to be atrophying in this species, and instability of palp segment numbers is thus not at all surprising*.

Ammothea longispina greatly resembles *Thavmastopycnon profunda* in having a relatively short palp. Since both species have been taken from depths of about 1,500 m it seems reasonable to suppose that their morphological similarities are an example of convergence, arising from exploitation of similar food substances.

It is difficult, without further material, to comprehend the taxonomic significance of the poorly developed posterior pair of eyes in the juvenile from *Eltanin* Sta. 138. It might be a developmental defect, and therefore of no taxonomic importance, or it might be a characteristic of a deep-water form of *A. longispina*. Before this specimen was collected, *A. longispina* had been taken from an area extending over 240° of longitude, and 20° of latitude. This specimen now adds approximately 1,000 m to the depth range. It would hardly be surprising, therefore, to encounter a wide range of morphological variation in a species with so large a spatial range. Until many more specimens have been collected the only allowable course, on the existing data, is to include all the known specimens under one specific name, as if they were members of different components of a freely intrabreeding population.

Genus **Magnammothea** n. gen.

Adults of very large size, sexual maturity attained at leg lengths of about 120 mm; palp 9-segmented; fingers of chelae perfectly developed and functional in adults; scape very long in relation to proboscis; articulation with palm anaxial; ocular tubercle wider basally than tall, rounded, and surmounted by small conical process; trunk processes massive, steep-sided, and rounded terminally; propodi of all eight legs similar in relative proportions and sole spination; two groups of sole spines of very different sizes; genital pores on 2nd coxae of last two pairs of legs; ovigers 10-segmented, borne by both sexes; proboscis massive and bulbous, straight.

Magnammothea gigantea (Gordon, 1932). (Figs. 104, 105, 132, 137, 138.)

Ammothea gigantea Gordon, 1932: 97.9; 46–7. Helfer and Schlottke, 1935: 285.

MATERIAL EXAMINED

Eltanin Sta. 426, 1 larvigerous ♂.
B.M. (N.H.) Regn. No. 1933.3.23.655–6, 1 ovigerous and larvigerous ♂, holotype, 1 ♀, paratype, *Ammothea gigantea*.

DESCRIPTION

Based on three specimens, supplemented by information from Gordon (1932).

PALP: 9-segmented, segments 5–8 essentially cylindrical; 4th segment slightly curved distally, with a very low ectal swelling surmounted by a pore. All nine segments bear a uniformly sparse cover of short fine setae. Only on the 5th and 9th segments is there any formation of a denser dorsal or ventral field of these setae.

PROBOSCIS: Massive, with the shape D′ or D:1.

TRUNK: The three dorsal processes on the ridges of the anterior trunk somites rounded and massive, as tall as, or taller than, the ocular tubercle, which is approximately as wide as tall and is surmounted by a small conical process; darkly pigmented eyes of the anterior and posterior pairs subequal in size; small, stout spines scattered randomly over all the surface of the trunk.

CHELICERAE: In the four known adult specimens the fingers of the chelae appear perfectly formed and normally functional. Scape constricted just distal to the mid-point of its length, bearing on its dorsal and lateral surfaces a thin scattering of small spinules; fringe

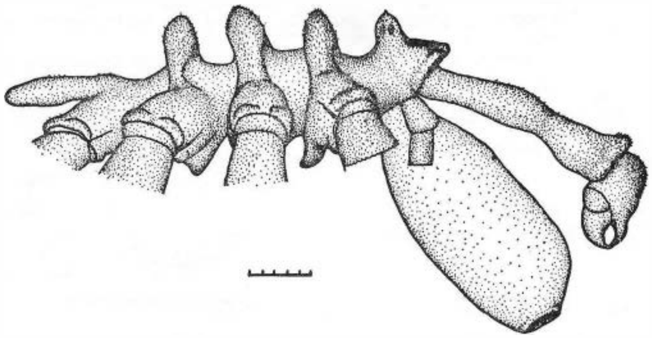

FIG. 137—*Magnammothea gigantea*: lateral view of ♂ (holotype). (The scale represents 5 mm.)

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*Instability of palp segment numbers appears to be common throughout the Pycnogonida. See under *Colossendeis*.

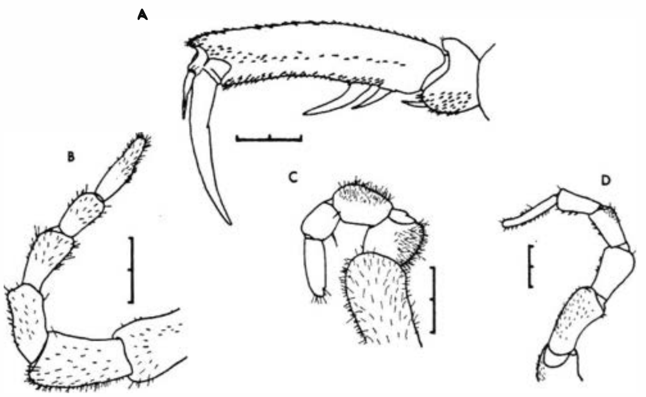

FIG. 138—*Magnammothea gigantea*: A, terminal segments of 3rd left leg of holotype; B, terminal segments of left palp of paratype; C, terminal segments of oviger of holotype (♂); D, terminal segments of oviger of paratype (♀). (The scales represent 2 mm.)

of similar spinules around the distal end of the scape; proximal dorsal surface of the palm with a dense circular field of small spinules.

LEG: Femur the longest leg segment; spines of the long leg segments small and stout, in six discrete tracts; two dorsal and two ventral tracts are bands three to four setae wide; lateral tract of each side of one or two irregular rows; coxal segments with very sparse random scattering of small spinules.

REPRODUCTION: Sexual maturity is apparently attained at leg lengths of 116 mm or less. The larger ovigerous male (leg length 116.30 mm) was taken at the South Sandwich Islands in March, and the smaller ovigerous male in January. The paratype has a leg length of 145.90 mm. As in *A.* (*Th.*) *stylirostris*, the terminal segment of the female oviger is curved upwards along all its length. The genital pores occur on the 2nd coxae of the two posterior pairs of legs.

Distribution

The recorded localities are shown in Fig. 132. The specimens were taken at depths between 99 and 1,115 m.

Mensural Characters

	Adults
Range of leg length	116–146 mm
L. palp ÷ L. proboscis	1.42– 1.63
L. 4th palp segt. ÷ L. 2nd palp segt.	0.93– 1.36
L. chela ÷ L. scape	0.34– 0.54
L. scape ÷ L. proboscis	0.77– 0.79
L. cephalic somite ÷ L. trunk	0.42– 0.45
L. leg ÷ L. trunk	5.01– 6.34
L. trunk ÷ L. proboscis	1.13– 1.38
L. claw ÷ L. propodus	0.62– 0.64
L. accy. claw ÷ L. claw	0.28– 0.48
L. largest propodal sole spine ÷ L. claw	0.40– 0.52

Propodal Sole Spines

The proximal group consists of two or three large spines of heterogeneous size, within the proximal third of the propodal sole; the distal group a sparse elliptical field of small spinules.

Discussion

The overall morphological dissimilarity of this species to the members of the subgenus *Ammothea* was one of the surprising results of the analysis of the percentage matching coefficients. In the initial intuitive assessment of morphological similarities, *A. gigantea* had been placed very close to *A.* (*Ammothea*) *carolinensis.*

Genus **Thavmastopycnon*** n. gen.

Palp 9-segmented, either longer than or about half as long as proboscis, which is essentially cylindrical and down-curved along its length; fingers of chelae perfectly developed and functional in adults; propodi of all eight legs similar in relative proportions and sole spination; propodal sole spines all small and not clearly divided into two functional groups, but scattered over whole surface of the sole; genital pores on 2nd coxae of last two pairs of legs; dorsal trunk processes strongly developed, rounded; ovigers 10-segmented, borne by both sexes; sexual maturity attained at leg lengths of more than 40 mm.

Thavmastopycnon striata (Möbius, 1902). (Figs. 104, 105, 139–142)

Leionymphon striatum Möbius, 1902: 183–4; XXVI 7–12. Bouvier, 1906b: 55. Hodgson, 1907: 40. Bouvier, 1911b: 1140.
Ammothea striata Bouvier, 1913: 124–6; 7–12. Calman, 1915b: 55. Hodgson, 1927: 341, 342 (in key). Gordon, 1932: 96–7. Gordon, 1938: 22.

Material Examined

Trans-Antarctic (N.Z.) Sta. Cape Evans, 14 Mar, 1961, 1 ovigerous ♂; Stanford Sta. 61D, 1 ♀.
B.M. (N.H.) Regn. No. 1933.3.23.653, 1 ♂, *striata.*

Description

Based on four males and five females, from the above specimens and previous descriptions. No juveniles have as yet been identified.

PALP: Palp 9-segmented in normal specimens (the single British Museum specimen has the two terminal segments of the left palp incompletely separated); 4th segment stout and straight, without an ectal mound surmounted by a pore; all segments of the palp with a very sparse scattering of stout spinules and short setae, covering their entire surfaces.

PROBOSCIS: The following proboscis shapes have been recorded; B, B′, or J: 2: E, E′, or E″; proboscis curvature very highly pronounced in all specimens.

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* θαυμαστος, surprising.

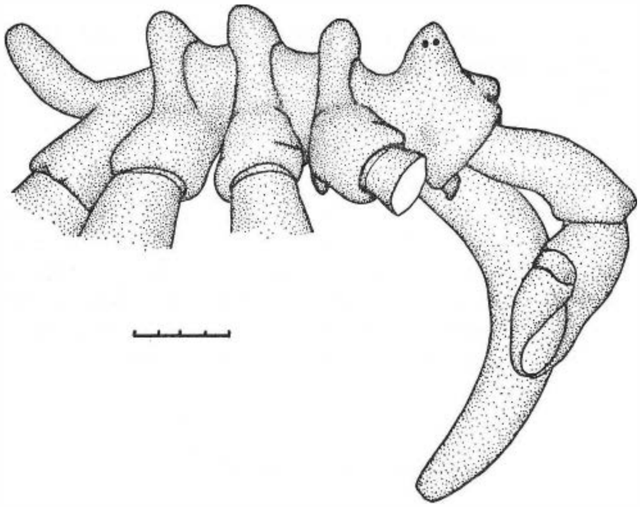

FIG. 139—*Thavmastopycnon striata*: lateral view of adult ♂, B.M. (N.H.) Regn. No. 1933. 3. 23.653. (The scale represents 4 mm.)

TRUNK: Each of the posterior dorsal ridges on the three anterior trunk somites with a rounded dorsal process, as tall as, or taller than, the ocular tubercle, which is massively conical; basal diameter of the tubercle greater than its height; the four small, darkly pigmented eyes subequal in size; spination restricted to a sparse random scattering of very small fine spines.

CHELICERAE: In all the adult specimens, the fingers of the chelae are very strongly developed, and are apparently functionally normal.

LEG: The 2nd tibia appears to be the longest segment, although the figure* in Bouvier's (1913) description indicates that the femur may be the longest segment in some instances. Spination consists of stout, blunt-tipped spines on the long segments, never longer than one-fifth the diameter of the segment on which they are sited, either scattered randomly over the surface of the segments or concentrated in tracts. In the latter condition, there are four tracts, each of two or six spines wide, occurring on the dorsal, lateral, and ventral surfaces. Coxal segments with sparse random scattering of minute spinules. This species is unusual in the Ammotheidae in the straightness of the accessory claws of all the legs.

REPRODUCTION: Sexual maturity appears to be attained at leg lengths of 78 mm or less. The only recorded ovigerous male was taken in the Ross Sea in March. The genital pores occur on the 2nd coxae of the two posterior pairs of legs.

DISTRIBUTION

Collection localities are indicated in Fig. 142. Specimens have been taken at depths of 75–567 m.

MENSURAL CHARACTERS

	Adults
Range of leg length ..	78 –104 mm
L. palp÷L. proboscis ..	0.69– 1.23
L. 4th palp segt.÷L. 2nd palp segt.	0.74– 1.45
L. chela÷L. scape	0.94– 1.31
L. scape÷L. proboscis ..	0.43– 0.57
L. cephalic somite÷L. trunk..	0.44– 0.54
L. leg÷L. trunk	5.67– 7.21
L. trunk÷L. proboscis ..	1.09– 1.63
L. claw÷L. propodus ..	0.45– 0.66
L. accy. claw÷L. claw ..	0.50– 0.58
L. largest propodal sole spine÷ L. claw	0.10

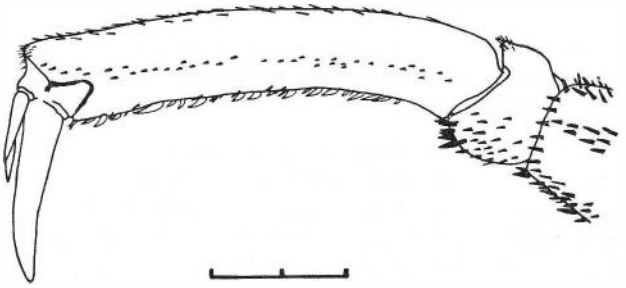

FIG. 140—*Thavmastopycnon striata*: terminal segments of 3rd left leg of adult. (The scale represents 2 mm.)

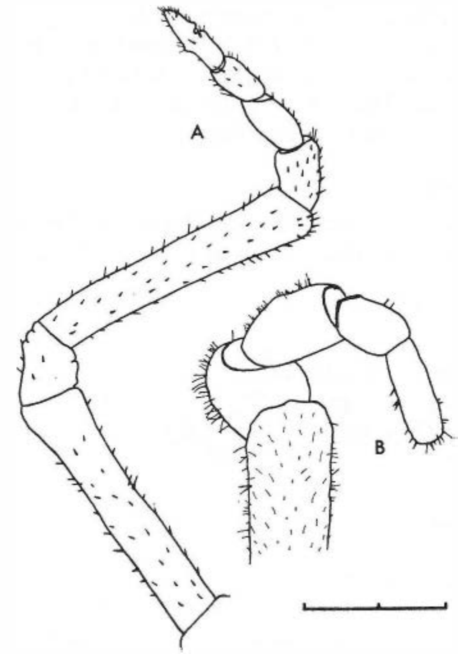

FIG. 141—*Thavmastopycnon striata*: adult ♂, B.M. (N.H.) Regn. No. 1933.3.23.653. A, left palp; B, terminal segments of oviger. (The scale represents 2 mm.)

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*This is rather inadequate, and its scale appears to be incorrectly given, unless the ratio of leg length to trunk length in the figured specimen was 3.10 (cf. Mensural Characters for this species).

Propodal Sole Spines

The spines are not arranged in a distal and a proximal group, but are scattered over the whole surface of the sole, and, in general, are very broad based and strongly curved; small spinules occur with them.

Discussion

The relationship of *Thavm. striata* and *Thavm. profunda* has been discussed on pp. 71–3.

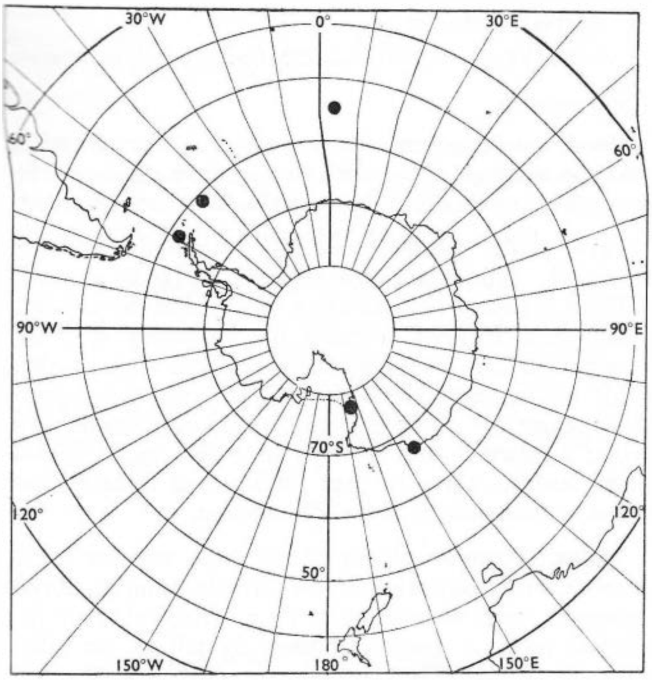

Fig. 142—Distribution records of *Thavmastopycnon striata.*

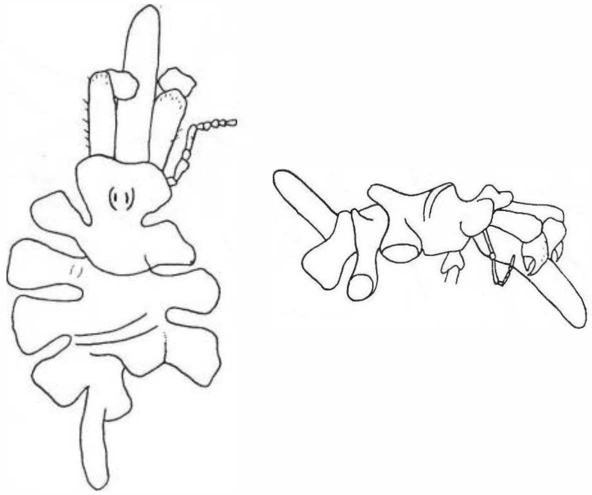

Fig. 143—*Thavmastopycnon profunda*: dorsal and lateral views of holotype (♂). (After Losina-Losinsky, 1961, Fig. 24.)

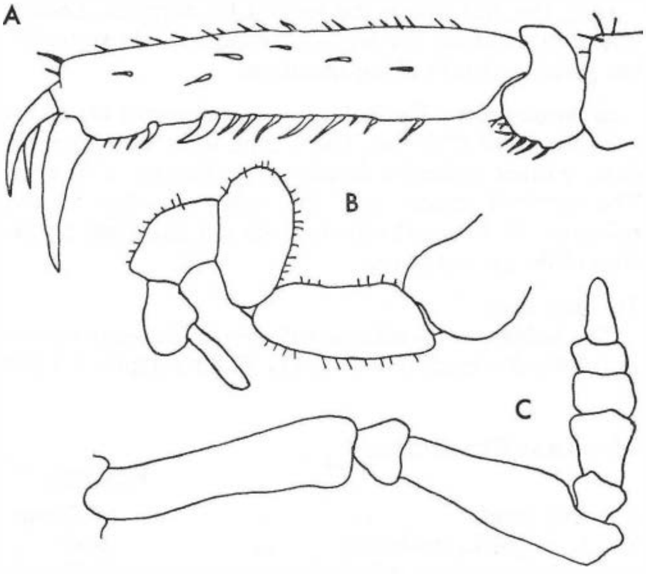

Fig. 144—*Thavmastopycnon profunda*: A, terminal segments of leg; B, terminal segments of male oviger; C, palp. (After Losina-Losinsky, 1961, Fig. 24.)

Thavmastopycnon profunda (Losina-Losinsky, 1961). (Figs. 105, 143, 144)

Ammothea profunda Losina-Losinsky, 1961: 105–7; 24.

Material Examined

No material was seen.

Description

The following is a translation and re-emphasis of Losina-Losinsky's description of the holotype.

PALP: Palp 9-segmented, the terminal five segments of shapes not encountered in other species of *Ammothea* (sens. auct.) (Fig. 144, C). 4th segment stout and straight, apparently with a strong ectal mound surmounted by a pore; five terminal segments articulating anaxially with the 4th segment. The apparently completely glabrous nature of the palp, as well as its striking shortness in relation to proboscis length, suggests that the palp is not normally employed as a tactile sense organ.

PROBOSCIS: Proboscis of shape C : 2 : E. The down-curvature is only slight compared with *Thavm. striata.*

TRUNK: The whole appearance of the trunk is very striking, and it seems likely that the specimen has been deformed during growth and strobilisation. Only two trunk articulations are clearly discernible, and the three rounded dorsal processes appear to be highly distorted. The ocular tubercle is very low and obscure, with "rudimentary eyes". The entire trunk and abdomen appear to be quite glabrous.

CHELICERAE: The fingers of the chelae of the holotype—an ovigerous male—are perfectly developed, and appear quite functional. The scape has a few fine setae on its dorsal and distal surfaces.

LEG: The 2nd tibia is the longest leg segment. Losina-Losinsky describes the legs as "comparatively smooth", but gives no details of leg spination.

REPRODUCTION: The holotype, an ovigerous male, has a leg length of 67.2 mm. There is no information on the date or other collection details, or on the size of its eggs. The terminal segments of the oviger bear no ventral spines at all. Losina-Losinsky does not comment on the sites of the genital pores.

DISTRIBUTION

The holotype was taken south-east of Shikotan Island, in the Kuril Islands (*c.* 49°N, 174°E), at a depth of 1,500 m.

MENSURAL CHARACTERS

	Holotype ♂
Leg length	67.2 mm
L. palp÷L. proboscis	0.61
L. 4th palp segt.÷L. 2nd palp segt.	0.74
L. chelae÷L. scape	0.76
L. scape÷L. proboscis	0.53
L. cephalic somite÷L. trunk	0.50
L. leg÷L. trunk	6.11
L. trunk÷L. proboscis	1.46
L. claw÷L. propodus	0.38
L. accy. claw÷L. claw	0.53
L. largest propodal sole spine÷L. claw	0.11

PROPODAL SOLE SPINES

As in *striata*, the propodal sole spines are not divided into two groups, but are scattered over the length of the sole. They are relatively longer than in *striata*, and two of the more distal ones are very much stouter than the rest.

DISCUSSION

This is the first record north of the equator for this group of species. Before this the most northerly record was *Ammothea* (*Thammota*) *magniceps*, at 33°S. As suggested in the section on the propodus (p. 71), it seems likely that the holotype of *profunda* is a species closely related to *striata*, and has spread into the Northern Hemisphere by way of the cold abyssal or hadal regions. If this is so, it should not be long before other representatives of this genus—or even of other "strictly Antarctic" genera of Ammotheidae—are brought up from great depths in other parts of the world. The scorn with which the locality data of Leach's *Ammothea carolinensis* were at one time greeted now seems excessive.

Genus **Athernopycnon*** n.gen.

Palp 9-segmented; longer than the proboscis, which is straight; dorsal trunk processes well developed, steeply conical; propodi of all eight legs similar; two groups of sole spines of distinctly differing sizes; fingers of chelae atrophied in adults; genital pores on the 2nd coxae of the last two pairs of legs; ovigers 10-segmented, borne by both sexes; sexual maturity attained at leg lengths of more than 40 mm.

Athernopycnon meridionalis (Hodgson, 1915). (Figs. 104, 105, 145–147)

Ammothea meridionalis Hodgson, 1915: 146. Calman, 1915b: 53–5; 12. Hodgson, 1927: 342 (in key), 343–4. Gordon, 1944: 51.
Leionymphon meridionalis Helfer and Schlottke, 1935: 284.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1915.7.24.230, 1 ovigerous ♂, *meridionalis.*

DESCRIPTION

Based on the one specimen available for examination, and the writings of the authors who have discussed the four other known adults. No juveniles have been recorded.

PALP: Palp 9-segmented, five terminal segments essentially cylindrical; 4th segment markedly curved, without a strong ectal swelling surmounted by a pore; small setae scattered densely but randomly over all segments of the palp (they occur in more concentrated fields on the dorsal and ventral surfaces of segments 4–8); segment 9 with a uniformly dense covering of such setae; segment 8 with a single long seta on its dorsal distal surface; three or four similar long setae on the distal ventral surface of the 4th segment.

TRUNK: Posterior ridges of the three anterior trunk somites with relatively narrow, steeply conical, dorsal processes surmounted by a finer, anteriorly curved, conical process; dorsal processes as tall as, or taller than, the ocular tubercle, which is waisted basally and swollen and rounded terminally; four darkly pigmented

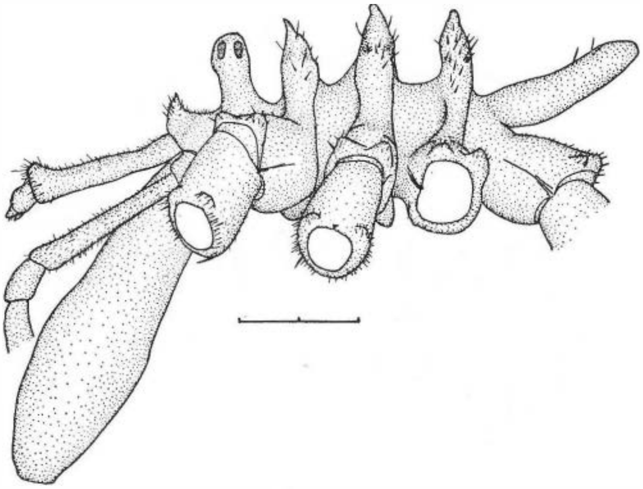

FIG. 145—*Athernopycnon meridionalis*: lateral view of adult male. (The scale represents 2 mm.)

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*Αθερηις, armed with spikes.

eyes of subequal size; a hooked cephalic spur, bearing a tuft of spines, over the insertion of each scape; fine spinules scattered over all the trunk surfaces; larger spines on the dorsal processes, the dorsal surface of the abdomen, and at the distal ends of the lateral processes; lateral processes each with a pair of low rounded projections on their dorsal distal surfaces.

PROBOSCIS: In all the specimens described, the proboscis appears to be of shape D: 1, and has a sparse covering of minute spinules.

CHELICERAE: In each of the five recorded adults, the fingers of the chelae are atrophied, suggesting that atrophy occurs at or near the onset of sexual maturity. Scape clothed in minute spinules; at its distal end a fringe of longer spines and a low, rounded, dorsal projection.

LEG: Second tibia the longest segment; femur and 1st tibia subequal; long segments and coxae with six irregular but distinct rows of spines; spines of the two dorsal rows on the two tibiae as much as one and one-quarter times as long as the diameters of their respective segments; single lateral rows of all three long segments, two dorsal rows of the femora, and all six rows on the coxae with spines approximately half as long as the diameter of their segments; spines of the two ventral rows of the long segments are shorter still; all coxal segments and the three long segments have distal frills of long spines.

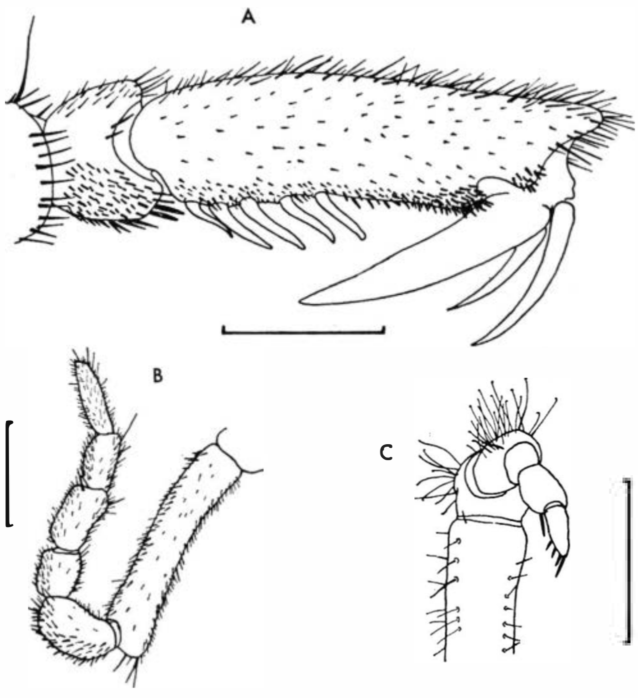

FIG. 146—*Athernopycnon meridionalis*: A, terminal segments of 3rd left leg of adult; B, terminal segments of palp; C, terminal segments of male oviger. (The scales represent 1 mm.)

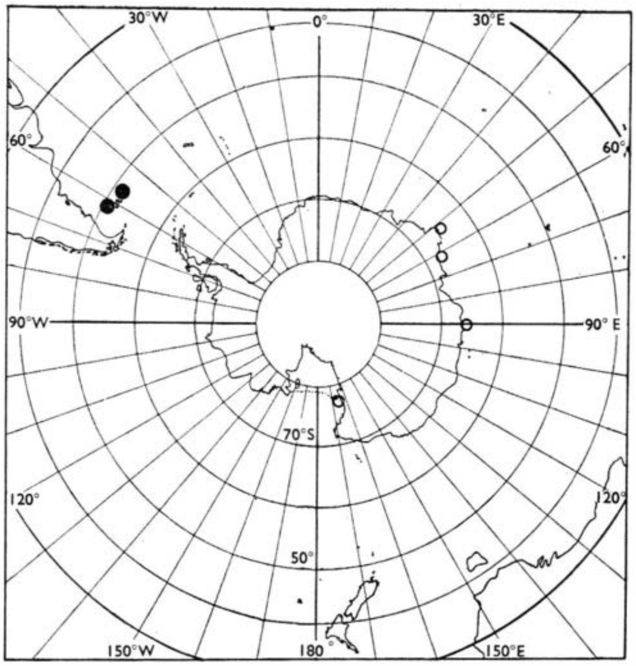

FIG. 147—Distribution records of *Athernopycnon meridionalis* (hollow circle), and *Anammothea tetrapora* (solid circle).

REPRODUCTION: Sexual maturity is apparently attained at leg lengths of 40 mm or less; the single recorded ovigerous male with a leg length of 44·90 mm; adult female holotype with a leg length of more than 40 mm; ovigerous male taken at McMurdo Sound in January, carrying eggs with diameters of about 0·15 mm; ventral spination of the 6th segment of the male oviger unusual in having the spines in regular rows on low projections; genital pores on the 2nd coxae of the last two pairs of legs only.

DISTRIBUTION

The four collection sites of this species are shown in Fig. 147. Specimens have been taken at depths of 91–385 m.

MENSURAL CHARACTERS

	Adults
Range of leg length	*c.* 40–45 mm
L. palp ÷ L. proboscis	1.54
L. 4th palp segt. ÷ L. 2nd palp segt.	0.67–0.76
L. chela ÷ L. scape	0.22
L. scape ÷ L. proboscis	0.46
L. cephalic somite ÷ L. trunk ..	0.43
L. leg ÷ L. trunk	8.31
L. trunk ÷ L. proboscis	0.89–1.04
L. claw ÷ L. propodus	0.53
L. accy. claw ÷ L. claw	0.66
L. largest propodal sole spine ÷ L. claw	0.30

Propodal Sole Spines

The proximal group of sole spines contains five or six spines, of heterogeneous size. These spines are highly characteristic of the species, since they are slender and slightly, but quite definitely, sigmoid. The proximal group is confined within the proximal half of the propodal sole; the distal group is a very dense, elliptical field of short stout spinules, within the distal half.

Genus **Ecleipsothremma*** n. gen.

Palp 9-segmented, longer than the straight, stout proboscis; dorsal trunk processes strongly developed, steeply conical; propodi of anterior four legs differing markedly in relative proportions and sole spination from propodi of posterior four legs; fingers of chelae atrophied in adults; genital pores on the 2nd coxae of the last two pairs of legs; ovigers 10-segmented, borne by both sexes; sexual maturity attained at leg lengths of less than 29 mm.

Ecleipsothremma spinosa (Hodgson, 1907). (Figs. 104, 105, 126, 129, 148, 149)

Leionymphon spinosum Hodgson, 1907: 49–50; VII 2. Bouvier, 1906b: 55. Helfer and Schlottke, 1935: 284.
Ammothea spinosa Bouvier, 1913: 123 (in key). Calman, 1915b: 52. Hodgson, 1927: 341, 342 (in key). Gordon, 1932: 95 (in key), 103; 53.

Material Examined

Eltanin Sta. 428, 1 ovigerous ♂, 1 ♀.
B.M. (N.H.) Regn. No. 1907.6.24.95, 1 ♀, holotype, *spinosum*;
B.M. (N.H.) Regn. No. 1915.7.24.211–12, 1 ♂, 1 ♀, *spinosa*;
B.M. (N.H.) Regn. No. 1933.3.23.660, 1 ♂, *spinosa*.

Description

Based on six of the seven known specimens, all of which are mature.

PALP: Palp 9-segmented; five terminal segments essentially cylindrical; 4th segment stout and straight, without an ectal mound surmounted by a pore; five distal segments with a moderately dense fringe of fine spines on their ventral surfaces; 9th segment similarly clothed over its whole surface, segments 8, 7, and 6 with a few dorsal spines; 5th segment without dorsal spines.

PROBOSCIS: In all specimens the proboscis has the shape C''':1.

TRUNK: Each of the three anterior trunk somites has, on its posterior dorsal ridge, a strong dorsal process surmounted by an anteriorly curved conical spur (in the holotype these spurs are very much longer and more attenuated than in the other specimens); dorsal processes and their supporting ridges clothed in long fine curved setae; dorsal and ventral surfaces of the lateral processes and the anterior cephalic lobes with similar spines; dorsal distal surfaces of the lateral processes with very pronounced, medially recurved spurs, a pair of similar spurs on the anterior cephalic lobes; ocular tubercle steep-sided basally, topped by a rounded cone; four darkly pigmented eyes of subequal size.

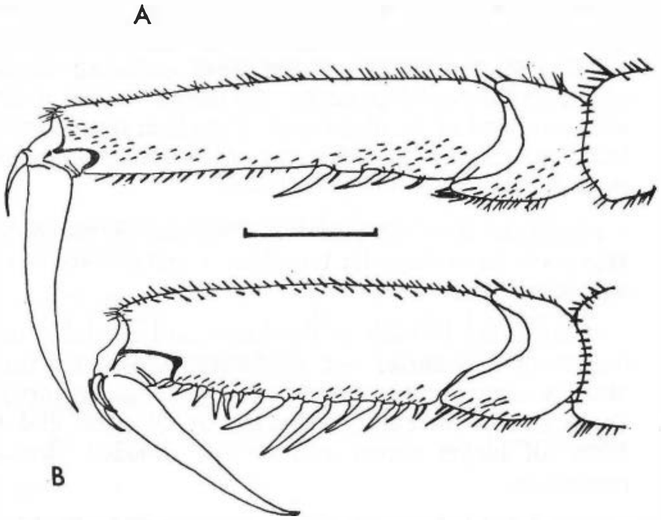

FIG. 148—*Ecleipsothremma spinosa:* A, distal segments of 3rd left leg; B, distal segments of 2nd left leg. (The scale represents 1 mm.)

CHELICERAE: Fingers of the chelae apparently atrophying at or near the onset of sexual maturity; scape club-shaped and relatively slender, with long, fine, spines, like those on the trunk; palm of the reduced chela slender, with a small ventral field of fine spines.

LEG: Either the femur or 1st tibia the longest segment (in three specimens the femur and 1st tibia are equal in length). Spines fine and hair-like, those of the dorsal surfaces of the three long segments the longest, as much as one-third the diameter of the segment on which they are sited; lateral and ventral fields of shorter, fine spines on the long segments; three coxae with fine spines on their lateral surfaces only.

REPRODUCTION: Sexual maturity apparently attained at leg lengths of 29 mm or less; leg length of the single ovigerous male 28·99 mm; of smallest mature female recorded 46·83 mm; eggs 0·39–0·50 mm in diameter; ovigerous male taken in January; genital pores on the 2nd coxae of the two posterior pairs of legs only.

Distribution

The collection sites of this species are shown in Fig. 129. The specimens were collected at depths of 146–1,119 m.

Mensural Characters

	Adults
Range of leg length	29–63 mm
L. palp ÷ L. proboscis	1.74–3.21
L. 4th palp segt. ÷ L. 2nd palp segt.	0.77–1.22
L. chela ÷ L. scape	0.22–0.37
L. scape ÷ L. proboscis	0.44–0.72
L. cephalic somite ÷ L. trunk	0.34–0.45
L. leg ÷ L. trunk	3.73–6.30
L. trunk ÷ L. proboscis	1.96–2.57
L. claw ÷ L. propodus	0.45–0.70
L. accy. claw ÷ L. claw	0.13–0.49
L. largest propodal sole spine ÷ L. claw	0.22–0.45

εκλειπω, left out; *θρεμμα*, a nursling.

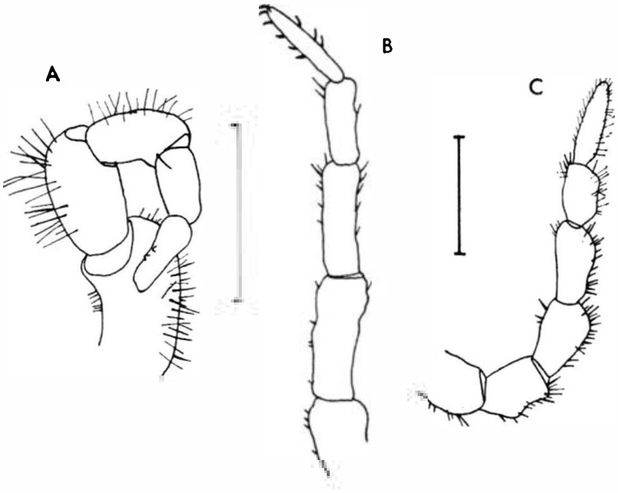

FIG. 149—*Ecleipsothremma spinosa*: A, terminal segments of male oviger; B, terminal segments of female oviger; C, terminal segments of left palp. (The scales represent 1 mm; B and C drawn to the same scale.)

PROPODAL SOLE SPINES

The propodi are dimorphic as in *Ammothea* (*Mathoma*) *allopodes*, in that the four anterior propodi differ from the four posterior propodi in their form and spine armature, but the dimorphism in the two species is different.

ANTERIOR FOUR PROPODI: The propodus is stouter than the four posterior propodi, although no shorter as a percentage of total leg length. Two groups of sole spines are discernible. The proximal group consists of five or six spines of very heterogeneous size, and evenly spaced over the proximal two-thirds of the sole; all point distally. The distal group is contiguous to the proximal group, with five or six spines of heterogeneous size, and the largest no longer than the shortest spine of the proximal group. The spines of the distal group slope like the rays of an opened fan.

POSTERIOR FOUR PROPODI: These are more slender than the anterior four propodi, and only the proximal group of spines is well developed, with three or four spines of heterogeneous size confined to the proximal third of the sole. In relation to the maximum diameter of the propodus, the longest of these proximal spines is no shorter than the longest proximal spine on the anterior propodi, but considerably shorter relative to the propodal length (see p. 71). The distal group of sole spines consists of a row of fine, short, setae.

DISCUSSION

The morphological relationships of this species are discussed under *A.* (*M.*) *allopodes*. There is no information available which might indicate the functional significance of the differences between the anterior and posterior sets of propodi. If the animals cling for long periods to fibrous structures such as hydroids or gorgonians it is possible that the poor development of the distal spinules of the posterior propodi is associated, not with a need for the posterior propodi to lock on to a substrate, but rather to be readily disentangled during climbing or walking. In the anterior propodi, the need to be easily disentangled during locomotion is overruled by the need to grip securely during such processes as feeding. The roughness of the sole—increased by development of the distal sole spines—would reduce the strain on the muscles locking the propodal claw around the strands of the substrate.

The ovigerous male from *Eltanin* Sta. 428 is remarkably malformed. The right chela retains its chelate, juvenile form, and the right oviger is still in an imperfect state, although egg masses are borne by both ovigers. There is no articulation or suture between the 3rd and 4th somites, and the 3rd somite is devoid of dorsal ridges and a medial dorsal process. The small size of this specimen suggests that it may recently have undergone an imperfectly completed pubertal moult.

Genus **Anammothea** n. gen.

Palp 8-segmented, longer than proboscis; longitudinal axis of proboscis slightly upturned in distal third; dorsal trunk processes steeply conical; propodi of all eight legs similar in relative proportions and sole spination; two size groups of sole spines readily recognisable; ovigers 10-segmented, borne by both sexes; genital pores on 2nd coxae of all eight legs; sexual maturity attained at leg lengths of about 25 mm.

Anammothea tetrapora (Gordon, 1932). (Figs. 104, 105, 147, 150, 151)

Ammothea tetrapora Gordon, 1932: 99–101; 48–50. Helfer and Schlottke, 1935: 285.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1933.3.23.656, 1 larvigerous ♂, holotype, *tetrapora*; B.M. (N.H.) Regn. No. 1933.3.23.657–8, 1 ♂, 1 ♀, paratypes, *tetrapora.*

DESCRIPTION

Based on data from the only three specimens of this genus so far recorded, and essentially a rephrasing and re-emphasis of the description in Gordon's 1932 *Discovery* Report.

PALP: Palp 8-segmented, segments 6–8 essentially cylindrical; 4th segment stout and straight without an ectal mound surmounted by a pore; 6th to 8th segments with a ventral fringe of setae, some as long as the diameters of the segments on which they are sited.

PROBOSCIS: This is the only species of ammotheid other than *A.* (*H*) *longispina* with the longitudinal axis of the proboscis upturned distally. The proboscis is of shape B: 3: E‴.

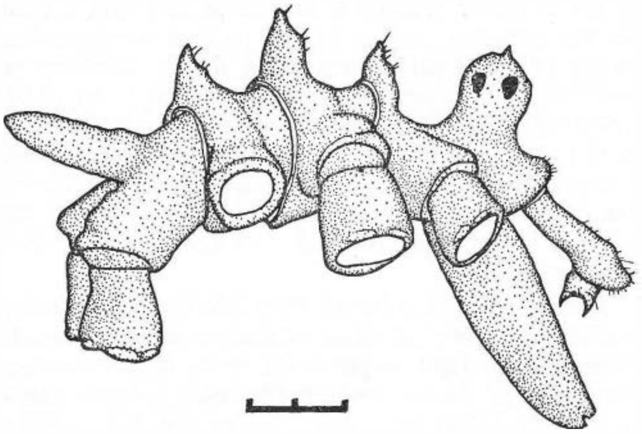

FIG. 150—*Anammothea tetrapora*: lateral view of holotype (♂). (The scale represents 2 mm.)

TRUNK: Three anterior trunk somites with dorsal projections on their posterior dorsal ridges, as high as, or slightly shorter than, the ocular tubercle, which is squat (though slightly waisted basally) and rounded; little if any difference in the sizes of the anterior and posterior pairs of eyes, both pairs very variably pigmented; spination confined to a sparse scattering of setae on the distal surfaces of the dorsal processes and the anterior cephalic lobes.

CHELICERAE: Fingers of the chelae atrophying almost completely, apparently at or before the onset of sexual maturity; in dorsal view, scape markedly club-shaped, in side view, strongly downcurved distally; distal dorsal surface with a small fringe of setae.

LEG: Either the 2nd tibia or the femur the longest segment; spines nowhere arranged in discrete rows; the longest in a strip on the dorsal surface of the femur; a similar strip, or loosely organised band, of shorter spines, on the ventral surfaces of all long segments and coxae; shortest spines those which are variably present on the lateral surfaces of the long segments.

REPRODUCTION: Sexual maturity apparently attained at leg lengths of about 38 mm or less; leg length of smallest recorded ovigerous male 39.40 mm; of smallest adult female 38.33 mm; the only known ovigerous male taken near the Falkland Islands in July.

This species is not unique in *Ammothea* (sens. auct.) as Gordon (1932) supposed, in having genital pores on the 2nd coxae of all eight legs. This condition is found also in *A.* (*Theammoa*) *magniceps*.

DISTRIBUTION

The collection sites of all recorded specimens are shown in Fig. 147. Specimens have been taken at depths of 105–253 m. The species has not been recorded from the Ross Sea.

MENSURAL CHARACTERS

	Adults
Range of leg length	28.52–39.40 mm
L. palp ÷ L. proboscis ..	1.03– 1.46
L. 4th palp segt. ÷ L. 2nd palp segt.	1.10– 1.40
L. chela ÷ L. scape ..	0.45– 0.50
L. scape ÷ L. proboscis ..	0.44– 0.50
L. cephalic somite ÷ L. trunk..	0.45– 0.50
L. leg ÷ L. trunk	4.19– 4.92
L. trunk ÷ L. proboscis ..	1.66– 1.89
L. claw ÷ L. propodus ..	0.37– 0.42
L. accy. claw ÷ L. claw ..	0.37– 0.44
L. largest propodal sole spine ÷ L. claw	0.40– 0.54

PROPODAL SOLE SPINES

Proximal group of two subequal spines, within the proximal quarter of the propodal sole. Distal group of a small number of spinules and small setae scattered irregularly over the distal three quarters of the propodal sole.

DISCUSSION

While the intuitive assessment of ammotheid interrelationships suggests that *tetrapora* is distinct from most other species in a number of character states, the degree of morphological distinctness suggested by the dendrogram (Fig. 105) was not expected. Just as *Magnammothea gigantea* requires separate generic status, so does *Anammothea tetrapora*. The distribution of the species of the five genera removed from the old genus *Ammothea* suggests that, for the Ammotheidae at least, the Falkland Islands, the Antarctic Peninsula, and Magellanic Islands Arc form a region which has encouraged diversification and speciation on a greater scale than other Antarctic regions. The fact that the Antarctic Convergence migrates across this region is doubtless of great importance in this respect.

However, before placing too much emphasis on the Magellanic region as an area of high rate of diversification, it must be remembered that collection of material has probably been far more intensive there than in any other Antarctic region of comparable area.

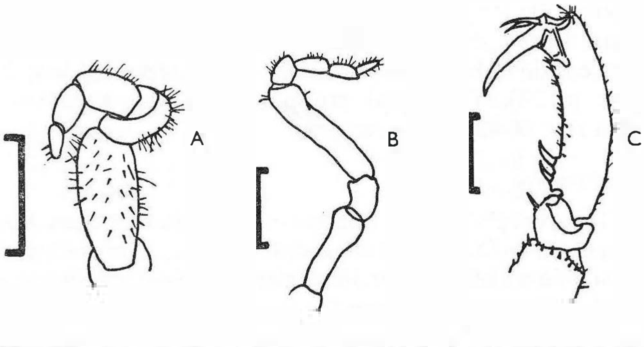

FIG. 151—*Anammothea tetrapora*: A, terminal segments of male oviger; B, left palp; C, terminal segments of 3rd left leg. (The scales represent 1 mm.)

Genus **Achelia** Hodge, 1864

The collections of *Achelia* consist of 69 specimens from 16 stations, confined to two species only, *A. spicata* and *A. communis.* Nevertheless, we have thought it necessary to consider 19 species of *Achelia* in all, although only 5 of these might be considered truly Antarctic.

When we attempted to use the keys devised by Calman (1915b) and Gordon (1938), we found that neither worked adequately for the new material, and very few of the 69 specimens could be named with any degree of certainty. We found overlaps in the ranges of the relative lengths of the accessory claw, and of the chelophore, and the patterns of trunk somite fusion are clearly not as specific as was previously thought. Calman himself (1915b) was clearly dissatisfied with his key to the genus, as it forced him to describe some "abnormal" specimens.

In a preliminary attempt to reduce the genus to some order, we have analysed numerically the morphological similarities of 19 species of *Achelia* from the coasts of South America, Antarctica, and Australasia. We were guided by the degrees of morphological distinctness which we discovered amongst the non-Antarctic species in interpreting the distinctness of the described Antarctic species.

Material of only a few of the non-Antarctic species was available, so we relied largely on previously published descriptions and figures when assessing these species. This is an obvious disadvantage, particularly where some of the species are closely similar. We employed the percentage matching coefficient used to analyse morphological similarities between species of *Ammothea* (sens. auct.) (see p. 70, and Fry 1964b), a method which does not allow distinctions to be made between populations which display the same character states, but display them in different frequencies, or in different stadia. To date there are no studies of *Achelia* species which provide such detailed information.

The percentage matching coefficients of morphological similarity were derived in the same way as those between *Ammothea* species, the data from previously published descriptions and illustrations being checked by examination of actual specimens when these were available. For *Achelia*, 49 characters were used (Table 12) and in all pairs of comparisons it proved possible to use data from at least 40 characters, despite the varying qualities of illustrations and descriptions.

In calculating these coefficients, some very high values were obtained. The %S between *assimilis* and *variabilis* is 96·20, that between *communis* and *brucei* is 94·50, and that between *intermedia* and *spicata* is 96·35. Such high degrees of similarity do not give much confidence in any key which might attempt to distinguish between the species of any of these pairs, and we accepted these high %S values as confirmation of opinions expressed in previous publications. Hedgpeth (1961) considered *assimilis* and *variabilis* conspecific, and Calman (1915b) suggested that *communis* and *brucei* might well be a single species, and that *spicata* and

TABLE 12. Characters Employed in Calculating Similarities between 19 Species of *Achelia*

PALP

1. Number of palp segments
2. Shape of penultimate segment of palp
3. Shape of antepenultimate segment of palp
4. Position of maximum width of 4th palp segment
5. Articulation of 5th and 6th palp segments

TRUNK

6. Nature of joint between somites 1 and 2
7. Nature of joint between somites 2 and 3
8. Nature of joint between somites 3 and 4
9. Form of dorsal ridges or projections on somite 1
10. Form of dorsal ridges or projections on somite 2
11. Form of dorsal ridges or projections on somite 3
12. Form of anterior cephalic spurs
13. Spire of ocular tubercle
14. Waist of ocular tubercle
15. Relative proportions of ocular tubercle
16. Separation of 1st and 2nd lateral processes
17. Development of anterior distal dorsal projections on 3rd lateral processes
18. Development of median distal dorsal projections on 3rd lateral processes
19. Development of posterior distal dorsal projections on 3rd lateral processes
20. Number of anterior distal dorsal projections on 3rd lateral processes
21. Length of abdomen relative to midpoint of length of 2nd coxae of 4th legs

PROBOSCIS

22. Proboscis shape
23. Proboscis curvature

CHELICERAE

24. Form of chelae fingers in adults
25. Projections on dorsal surface of scape

THIRD LEG

26. Leg length of smallest mature adult
27. Length of accessory claw relative to length of main claw
28. Development of anterior distal dorsal spurs of 1st coxa
29. Development of median distal dorsal spurs of 1st coxa
30. Development of posterior distal dorsal spurs of 1st coxa
31. Number of anterior distal dorsal spurs of 1st coxa
32. Longest leg segment
33. Length of longest setae relative to diameter of segments on which sited
34. Distribution of setae on femur, tibia 1 and tibia 2
35. Size heterogeneity of propodal sole spines
36. Number of spatially distinct groups of propodal sole spines
37. Number of larger proximal propodal sole spines
38. Arrangement of proximal propodal sole spines
39. Total number of propodal sole spines
40. Total number of dorsal propodal spines
41. Size heterogeneity of dorsal propodal spines
42. Development of distal dorsal spigot of femora

OVIGER

43. Number of special compound ventral spines on 10th oviger segment
44. Number of special compound ventral spines on 9th oviger segment
45. Number of special compound ventral spines on 8th oviger segment
46. Number of special compound ventral spines on 7th oviger segment
47. Number of special compound ventral spines on 6th oviger segment

REPRODUCTION

48. ♂, number of pairs of legs with genital pores
49. ♀, number of pairs of legs with genital pores

TABLE 13. Matrix of Percentage Matching Coefficients* of Similarity between 16 Species† of *Achelia*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	—															
2.	3953	—														
3.	5581	9347	—													
4.	5116	5744	7916	—												
5.	3023	4468	7291	4583	—											
6.	4418	6808	8125	5918	4583	—										
7.	4418	6170	7916	6734	4583	5714	—									
8.	4186	6383	7659	4583	5000	5833	5208	—								
9.	4651	5217	8085	7021	4680	5532	7659	5744	—							
10.	5516	6170	8125	7551	5416	6939	6734	6666	6808	—						
11.	4884	8723	8750	6734	7083	7347	7755	7916	7659	7959	—					
12.	4210	4750	8571	5581	3414	5952	5714	4634	5750	5238	7857	—				
13.	4418	6808	8750	6530	5416	7347	7143	5833	7021	6939	8367	7381	—			
14.	4186	7021	7917	5102	5625	7755	6939	7500	5744	5714	9388	7143	7551	—		
15.	4186	6596	8125	4081	4583	5918	5510	7916	5319	5306	8367	5476	5918	9384	—	
16.	4286	5227	8261	5744	4444	6170	7826	5106	6522	6522	8478	6341	8478	6739	5652	16

*The coefficients are given to 2 decimal places, but the decimal points have been omitted to save space.
†The numbers of the species correspond to the numbers of the species in Figs. 152–156, and Table 14.

intermedia would prove to be synonymous. We consider *brucei*, *intermedia*, and *variabilis* to be junior synonyms, especially since, with one exception, the %S values between the other, non-Antarctic species are all below 85. On the other hand, Loman (1923a, b) considered *communis* and *hoekii* to be synonymous. However, Gordon (1932) pointed out that part of the material, which Loman considered to be *hoekii*, was almost certainly *communis*. A %S of 61·44 between *communis* and *hoekii* appears to confirm Gordon's supposition.

The matrix of similarities was recomputed after pooling data from *communis* with *brucei*, from *variabilis* with *assimilis*, and from *intermedia* with *spicata* (Table 13). Three new high %S were observed, that between *spicata* (sens. nov.) and *serratipalpis* being 93·84; between *spicata* and *communis*, 93·88; and between *assimilis* (sens. nov.) and *australiensis*, 93·47. The character states which enable one to separate *assimilis* and *australiensis* are not likely to be confused by personal interpretation (see key below) and we have therefore decided to distinguish between these two forms. The character states which distinguish *serratipalpis* from *spicata* (sens. nov.) might be due entirely to the very large size of specimens ascribed to *serratipalpis*, but we cannot be sure of this, and since we have distinguished between *assimilis* and *australiensis* at an almost identical level of %S, we have treated *serratipalpis* and *spicata* as separate species. Because of the close similarity of %S values, *serratipalpis* and *communis* should not be synonymised without also synonymising *serratipalpis* and *spicata*. As the key indicates (p. 103), it is as easy to distinguish between *serratipalpis* and *communis* as between *communis* and *spicata*. The existence of these high levels of morphological similarity amongst *Achelia* species suggests that their differentiation and speciation mechanisms are different from those within the genus *Ammothea*, where the highest interspecific %S is approximately 85 (Figs. 105 and Table 7).

The matrix of values of %S was analysed by two different methods. The first method involved recalculation of similarities between groups of species by a determination of average similarities (Rao, 1952). This gave a dendrogram of similarities (Fig. 152). If the difference in similarity (L_n) was less than 4.00% then a species was admitted to a group without recalculating the average %S of the group. The second method, which was carried out on the Rothamsted Experimental Station computer, involved calculation of the latent roots and vectors of the matrix values. These results are shown in terms of the 2nd, 3rd, and 4th vectors (Fig. 153).

The two analyses agree completely in placing *transfuga*, *mitrata*, and *aspera* far apart from each other and from the other species considered. They differ markedly in two features only. The first is the greater distinctness of *australiensis* and *assimilis* shown by vector analysis, and the second is the clear separation of three groups at the 60%S level by Rao's method. The three major groups in the dendrogram reflect very closely the geographical distribution of the species within each group, so that within one of the groups a distinct "Antarctic" subgroup can be recognised at the 70%S level. Because of

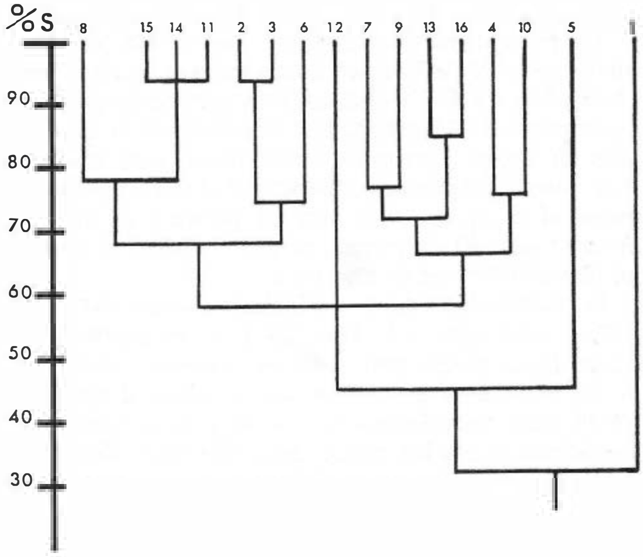

FIG. 152—The morphological similarities of 16 species of *Achelia* indicated by analysis by the method of Rao (1952) of the matrix of %S in Table 13.

this reflection of morphological similarity in geographical distributions we have been guided by the dendrogram in arranging the species taxonomically, fully aware that it is doubtless a gross oversimplification, and that the picture given by vector analysis (Fig. 153) is more likely to be accurate.

We have transferred *A. transfuga* and *A. mitrata* to new genera, as they are both dissimilar to all other known species and to each other. The remaining 14 species have been arranged in 3 new subgenera which are distinct at approximately 65 %S level.

We have redescribed only Antarctic species, except where examination of specimens indicated that existing descriptions were inadequate or incorrect, but we have devised a key to all of those species involved in the analyses and considered to be definable entities.

Variation Within the Genus

The adults of the known species of *Achelia* are small and appear to spend their lives clinging to the substrates upon which they depend for food. All of those observed in life behave very sluggishly, and it appears highly likely that the protonymphon stages of most, if not all, species are passed in the tissues of the organism on which the free juveniles and adults feed. However, many species occur along considerable lengths of coastline and continental shelf. Because of their clinging habit and parasitic development within a sessile organism, they have few opportunities for rapid dispersal over a great distance, although doubtless some adults are carried over open water clinging to drifting material, while some larvae may be transported in hydrozoan medusae (cf. Lebour, 1945). If this is so—and there does not seem to be any evidence to the contrary—then genetic changes must take a very long time to be diffused throughout a species. Thus, one would expect to find on any particular length of coast morphological or other clines. They might be continuous or stepclines, or both, depending upon the detailed distributions of the species populations.

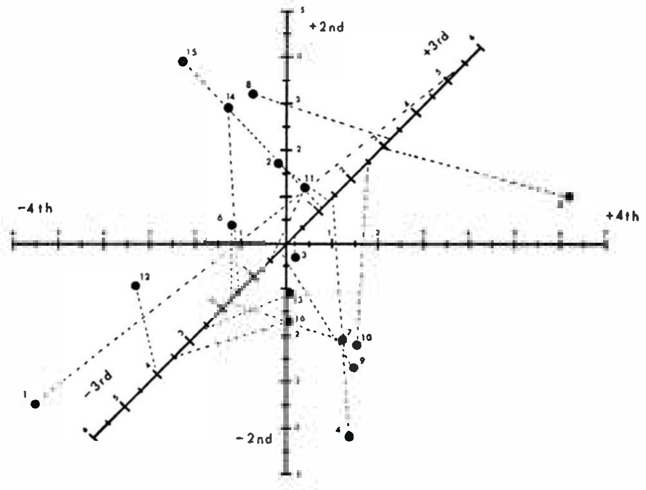

FIG. 153—The morphological similarities of 16 species of *Achelia* as indicated by the 2nd, 3rd, and 4th latent roots of the vectors of the components of the matrix of %S in Table 13.

TABLE 14. Classification of the Species* of *Achelia* (sens. auct.) Discussed in this Report

Genus **Sericosura** n. gen.
  1.* *Sericosura mitrata* (Gordon, 1944)
Genus **Aduncorostris** n. gen.
  5. *Aduncorostris transfuga* (Stock, 1954)
Genus *Achelia* Hodge, 1864
  Subgenus *Pigropycnon* n. subgen.
    12. *A.* (*Pigropycnon*) *aspera* (Loman, 1923)
  Subgenus **Ignavogriphus** n. subgen.
    8. *A.* (*Ignavogriphus*) *hoekii* (Pfeffer, 1889)
    15. *A.* (*Ignavogriphus*) *serratipalpis* (Bouvier, 1911)
    11. *A.* (*Ignavogriphus*) *communis* (Bouvier, 1906)
      (=*communis*+*brucei* Calman, 1915)
    14. *A.* (*Ignavogriphus*) *spicata* (Hodgson, 1915)
      (=*spicata*+*intermedia* Calman, 1915)
    2. *A.* (*Ignavogriphus*) *australiensis* (Miers, 1884)
    3. *A.* (*Ignavogriphus*) *assimilis* (Haswell, 1875)
      (=*assimilis wilsoni* Schchimkevitch, 1887+*variabilis* Stock, 1954)
    6. *A.* (*Ignavogriphus*) *dohrni* (Thomson, 1884)
  Subgenus **Pigrolavatus** n. subgen.
    7. *A.* (*Pigrolavatus*) *sufflata* Gordon, 1944
    9. *A.* (*Pigrolavatus*) *besnardi* Sawaya, 1951
    13. *A.* (*Pigrolavatus*) *parvula* (Loman, 1923)
    16. *A.* (*Pigrolavatus*) *fernandeziana* (Loman, 1920)
    4. *A.* (*Pigrolavatus*) *gracilis* Verrill, 1900
    10. *A.* (*Pigrolavatus*) *sawayai* Marcus, 1940

*The numbers of the species refer to the numbers in Figs. 153–156 and Table 13.

We consider that such a situation would account for the bewildering array of "forms", "abnormal specimens", and subspecies of *Achelia* species which have been described. However, this supposition could only be tested by a very detailed study of the *Achelia* fauna of a particular length of coastline. As far as we know, the material for such a study is nowhere available.

Distribution of Southern Species of Achelia
(Figs. 154–155)

Only five species of *Achelia*—*spicata*, *communis*, *serratipalpis*, *hoekii*, and *sufflata*—may be considered to be truly Antarctic, in that they occur on the Antarctic continental shelf. Of these five, only *sufflata* is confined to the continent itself, but it is morphologically far more similar to some South American species than to any of the other high Antarctic species. It is thus not possible to recognise a truly Antarctic group, in which morphological similarities are exactly paralleled by the distribution of its members.

We have therefore defined an Antarctic morphogroup*, consisting only of *spicata*, *serratipalpis*, *communis*, and *hoekii*. *A. communis* and *spicata* are apparently circumpolar in distribution, extending from the Antarctic continental shores in the south to the eastern end of the Magellanic arc of islands in the north and this similarity of distribution is mirrored in their close morphological similarity. The other two species of the Antarctic group, *serratipalpis* and *hoekii*, have part of their ranges in com-

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*In this context a morphogroup is a number of species which form a morphologically homogeneous group, isolated by the morphology of its components from other groups or single species.

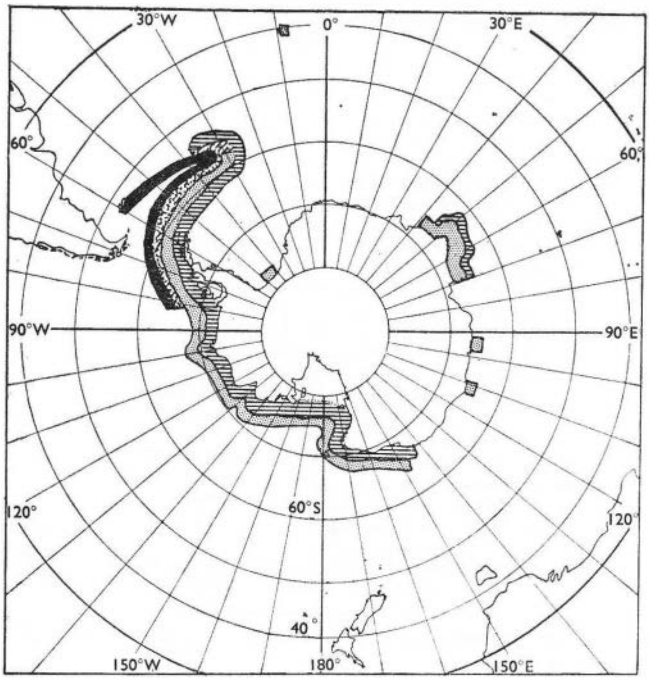

FIG. 154—Coastal distributions of the four species of *Achelia* belonging to the "Antarctic morphogroup". Horizontal lines = *A.* (*I.*) *communis* (11); dots = *A.* (*I.*) *spicata* (14); random dashes = *A.* (*I.*) *serratipalpis* (15); solid areas = *A.* (*P.*) *hoekii* (8).

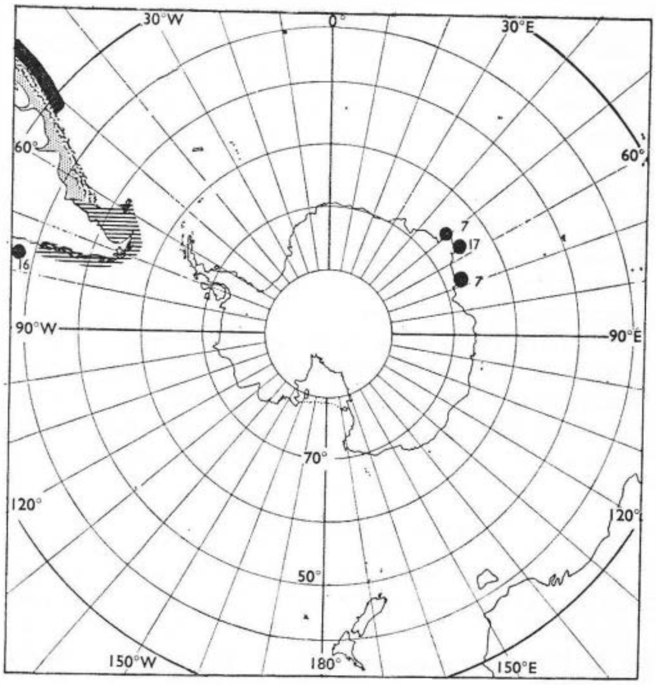

FIG. 155—Coastal distribution of species of *Achelia* of the "southern South American morphogroup", 7 = *A.* (*P.*) *sufflata;* 16 = *A.* (*P.*) *fernandeziana*; dots = *A.* (*P*). *besnardi* (9); horizontal lines=*A.* (*P.*) *parvula* (13), and the "Central American morphogroup", solid areas = *A.* (*P.*) *gracilis* (4); random dashes = *A.* (*P.*) *sawayai* (10). (NOTE: For 17 read 7.)

mon. Both occur as far south as the base of the Antarctic Peninsula, but *serratipalpis* occurs no farther north than South Georgia, while *hoekii* occurs around the Falkland Islands.

A second group of species is the southern South American morphogroup, *parvula*, *fernandeziana*, *sufflata*, and *besnardi*. *A. besnardi* has been recorded from the coast of the Belgian Congo as well as from the eastern coast of South America. Surface currents in the northern South Atlantic would account for this disjunct distribution, but the occurrence of *sufflata* in the eastern Antarctic sector is not readily explained. Until possible—rather than speculative—migration routes along the Magellanic arc of islands have been demonstrated clearly, the geographical isolation of *sufflata* cannot be accounted for.

What we have termed the Central American morphogroup overlaps the northern range of the southern South American morphogroup. The Central American group is represented in this study by *sawayai* and *gracilis* only, both of which also occur north of the equator.

Undoubtedly the most interesting group of species, which we term the South Temperate morphogroup, consists of *australiensis*, *assimilis*, and *dohrni*. *A. dohrni* appears to be restricted to the coasts of New Zealand, while *australiensis* is found on the southern coasts of Australia as well as around New Zealand. *A. assimilis*, like *besnardi*, has remarkable disjunct distribution, being found around New Zealand and southern South America, where its range overlaps with the Central American and southern South American morphogroups.

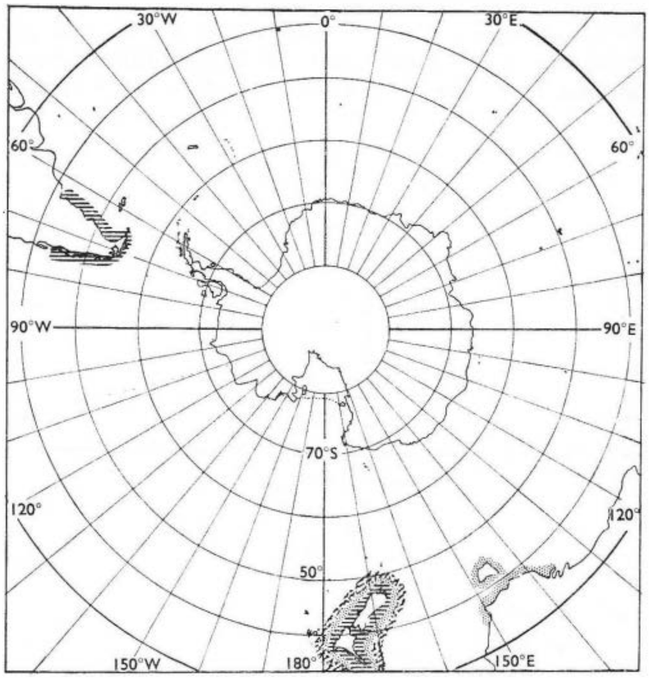

FIG. 156—Coastal distribution of the species of *Achelia* of the "South Temperate morphogroup". Horizontal lines = *A.* (*I.*) *assimilis* (3); dots = *A.* (*I.*) *australiensis* (2); random dashes=*A.* (*I.*) *dohrni* (6).

The remaining species, *A. aspera*, has been recorded from the north-west coast of Australia only, and its geographic separation from other species of *Achelia* is paralleled by its morphological distinctness, although it is closer to *Achelia* species than to either *Sericosura mitrata* or *Aduncorostris transfuga*. When a proper analysis can be made, *A. aspera* will doubtless be found to belong to an East Indies or Indo–West Pacific group.

KEY TO ADULTS OF THE SPECIES OF *Achelia* (SENS. AUCT.) DISCUSSED IN THIS REPORT

1 More than seven palp segments........................ 2
Seven palp segments.......................... **Ach. gracilis**
(p. 104)

2 Eight palp segments.................................. 3
Nine palp segments..................... **Ach. fernandeziana**
(p. 104)

3 Larger basal propodal sole spines stout and strongly curved, arranged on a well developed heel.............. 4
Larger basal propodal sole spines slender and at most only slightly curved, heel low............................ 5

4 All propodal sole spines arranged in a row (2–5 basal)....
Ach. spicata, Ach. serratipalpis
(p. 109) (p. 107)
Large basal propodal sole spines arranged in a field (7–12)
Ach. hoekii
(p. 106)

5 Palp segments 5 and 6 articulated synaxially............. 6
Palp segments 5 and 6 articulated anaxially...... **Ach. dohrni**
(p. 106)

6 Longest setae of femur, tibia 1 or tibia 2 not exceeding 1⅓ times the diameter of the segments on which they are sited.. 7
Longest setae of femur, tibia 1 or tibia 2 exceeding 1½ times the diameter of the segments on which they are sited.....
Ach. sufflata
(p. 105)

7 Setae of legs on rounded tubercles..................... 8
Setae of legs not on rounded tubercles.................. 9

8 Seta-bearing tubercles on trunk somites and/or scape, and/or palp................................ **Ach. assimilis**
(p. 106)
No setae-bearing tubercles on trunk somites, scape, or palp
Ach. communis
(p. 110)

9 Legs with various patterns of longer setae but without dense covering of minute spinules........................... 10
Legs bearing dense uniform covering of minute spinules, as well as some longer setae................. **Ach. australiensis**
(p. 106)

10 Total leg length less than 3 mm........................
Ach. besnardi, Ach. sawayai
(p. 105) (p. 104)
Total leg length more than 3 mm..................... 11

11 Longest leg setae longer than the diameter of the segments on which they are sited....................... **Ach. parvula**
(p. 103)
Longest leg setae shorter than the diameter of the segments on which they are sited... **Ach. communis** (? and **Ach. aspera**)
(p. 110) (p. 103)

Genus **Achelia** Hodge, 1864

Palp 6- to 9-segmented; ovigers 10-segmented, well developed in both sexes, terminal segments with a few ventral compound spines, without terminal claw, segments 7 and 8 articulated synaxially in both sexes; accessory claws present, very variably developed; chelicerae present, scape 1-segmented, fingers reduced in adults; trunk somites without dorsal transverse ridges, variably fused or articulated.

Subgenus **Pigropycnon*** n. subgen.

There are no character states common to all members of any one of the three subgenera of *Achelia* recognised in this report which do not appear in at least one species of the other two subgenera. Even geographical distribution can be used to distinguish only between *A.* (*Pigropycnon*) *aspera* and all other species of the two other subgenera, for any attempt to separate *Ignavogriphus* spp. and *Pigrolavatus* spp. on distribution is upset by the locality at which *A.* (*P.*) *sufflata* was collected. Because of the absence of isolated "key characters" it is not possible to give useful diagnoses of the three new subgenera proposed here.

Achelia (**Pigropycnon**) **aspera** (Loman, 1923). (Figs. 152, 153, Tables 13, 14)

Ammothea (*Achelia*) *aspera* Loman, 1923b: 1–4; 1. Helfer and Schlottke, 1935: 285.

Subgenus **Pigrolavatus**† n. subgen.

Achelia (**Pigrolavatus**) **parvula** (Loman, 1923). (Figs. 152, 153, 155, 157–159, Tables 13, 14)

Ammothea (*Achelia*) *parvula* Loman, 1923a: 2–4; A. Helfer and Schlottke, 1935: 285.

Achelia parvula Gordon, 1932: 113–14; 62. Gordon, 1938: 22 (in key). Marcus, 1940: 80, 81 (in key). Hedgpeth, 1950: 153. Sawaya, 1951: 274 (in key). Hedgpeth, 1961: 12.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1933.3.23.685–714, 6 ♂♂, 5 ♀♀, 4 juveniles.

DESCRIPTION

Loman's original description and figures of this species are far from clear, and although Gordon (1932) has refigured the palp and legs we feel that a complete redescription is necessary, especially as this species appears to be so abundant in the Magellanic region. The redescription is based on all previous descriptions, augmented by data from 15 specimens in the collections of the British Museum (Natural History).

PALP: Palp 8-segmented; segment 7 asymmetrically conical; segment 6 either asymmetrically conical or essentially cylindrical; segment 4 with its maximum width in proximal third; segments 5 and 6 articulated synaxially.

TRUNK: Trunk somites all fused, without trace of dorsal sutures; no dorsal transverse ridges or dorsal median projections; small conical anterior cephalic spurs with a seta; ocular tubercle approximately as high as the length of the basal diameter, waisted, without spire; eyes present; 1st and 2nd lateral processes contiguous (=0); lateral processes with 0–3 distal dorsal spurs of highly variable size; abdomen reaching midpoint of 2nd coxae of 4th legs.

**Piger*, sluggish.
†*Lavatus*, a bather.

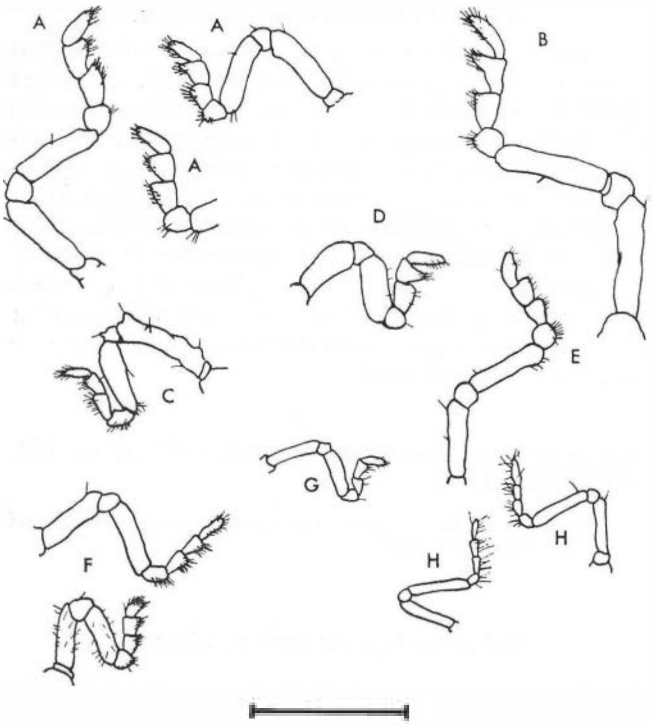

FIG. 157—Palps of *Achelia* species; A, *intermedia*; B, *serratipalpis*; C, *assimilis*; D, *hoekii*; E, *spicata*; F, *communis*; G, *parvula*; H, *sufflata*. (Scale indicates 1 mm.)

PROBOSCIS: Proboscis shape C′: 1.

CHELICERAE: Fingers greatly reduced in adults; scape devoid of dorsal protuberances.

THIRD LEG: Lengths between 3 mm and 5 mm (adults); accessory claw variably developed, 0.4–0.8 times the length of the main claw; 1st coxae bearing one to four variably developed distal dorsal spurs surmounted by a seta; 2nd tibia the longest segment; distal dorsal femoral spigot strongly developed in both sexes, bifid or trifid in some adult males; longest setae on dorsal surfaces of femora, 1st tibiae, and 2nd tibiae, where they tend to occur in pairs, 1.0–1.5 times the diameters of the segments on which they are sited; propodal sole spines of heterogeneous size, in two spatially distinct rows, 15–30 in all; proximal group of three larger spines; 6–20 dorsal propodal setae of variable size.

OVIGER: Oviger 10-segmented, with special ventral compound spines on terminal segments as

$$\frac{1/2}{\text{10th}} : \frac{1/2}{\text{9th}} : \frac{1/2}{\text{8th}} : \frac{1/2}{\text{7th}} : \frac{0/1}{\text{6th}} ;$$

segments 7 and 8 articulated synaxially; no dorsal field of special setae on segment 7.

REPRODUCTION: Leg length of smallest adult male 3.35 mm; of smallest adult female 3.34 mm; genital protuberances on 2nd coxae of male very strongly developed, more than half the diameter of the coxa; ovigerous males collected in February; egg sizes not recorded.

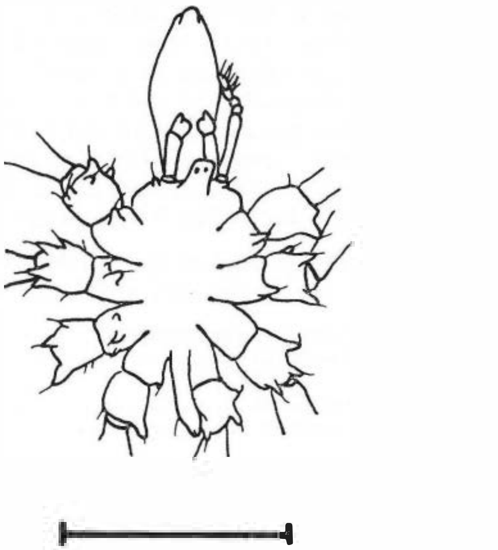

FIG. 158—*Achelia* (*P.*) *parvula*: dorsal view of trunk and proboscis. (The scale represents 1 mm.)

DISTRIBUTION

See Fig. 155 and p. 102; specimens have been collected at depths of 0–20 m.

DIMENSIONS

	Juveniles	Adults
L. leg	1.91–2.89 mm	3.34–4.39 mm
L. trunk ..	0.44–0.56	0.60–0.72
L. proboscis ..	0.42–0.67	0.55–0.81
L. palp ..	0.57–0.70	0.82–1.02
L. accy. claw ÷ L. main claw ..	0.52–0.68	0.55–0.74

Achelia (Pigrolavatus) fernandeziana (Loman, 1920). (Figs. 152, 153, 155, 160, Tables 13, 14)

Ammothea fernandeziana Loman, 1920: 142–4; 2. Helfer and Schlottke, 1935: 285.
Achelia fernandeziana Giltay, 1934: 5. Marcus, 1940: 79, 81 (in key). Sawaya, 1951: 274 (in key).

Achelia (Pigrolavatus) gracilis Verrill, 1900. (Figs. 152, 153, 155, Tables 13, 14)

Achelia (?) *gracilis* Verrill, 1900: 582; LXX, 10.
Ammothea gracilis Cole, 1904: 317–23; XXI 4–14. Helfer and Schlottke, 1935: 285.
Ammothea (*Achelia*) *gracilis* Giltay, 1934: 5.
Achelia gracilis Marcus, 1940: 79, 80 (in key). Hedgpeth, 1948: 244, 38f, g. Sawaya, 1951: 274 (in key). Stock, 1954a: 117.

Achelia (Pigrolavatus) sawayai Marcus, 1940. (Figs. 152, 153, 155, Tables 13, 14)

Achelia sawayai Marcus, 1940: 81–6; 10a–f, 17a–k. Hedgpeth. 1948: 244–5; 38e. Fage, 1949: 28; 4. Sawaya, 1951: 274 (ir key). Hedgpeth, 1954: 427. Stock, 1954a: 47. Stock, 1954b 117.
Achelia sawayai f. *typica* Stock, 1955a: 245–6; 16.

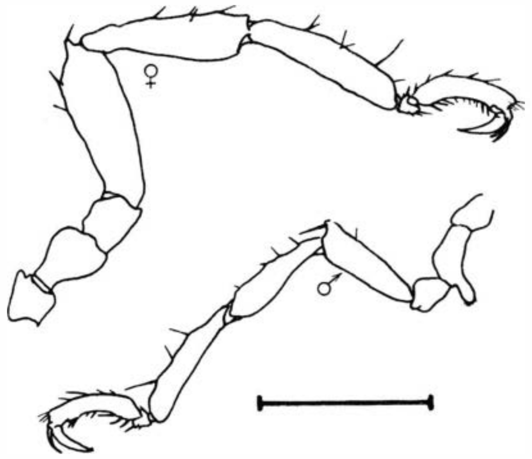

FIG. 159—*Achelia* (*P.*) *parvula*: 3rd legs of male and female. (The scale represents 1 mm.)

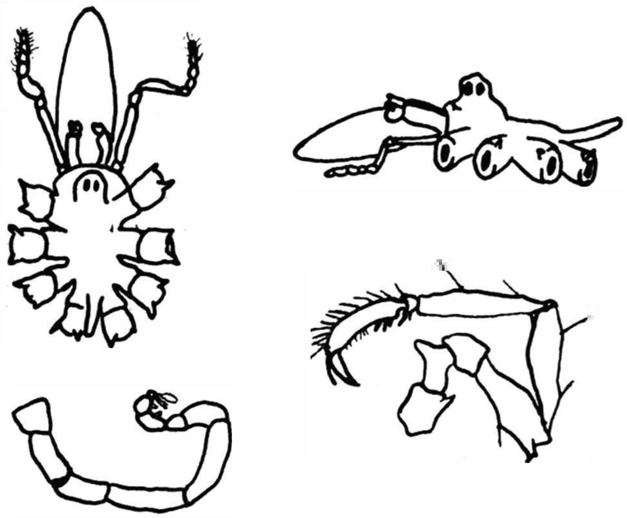

FIG. 160—*Achelia* (*P.*) *fernandeziana*: dorsal and lateral view of trunk and proboscis, and oviger and leg. (After Loman (1921)).

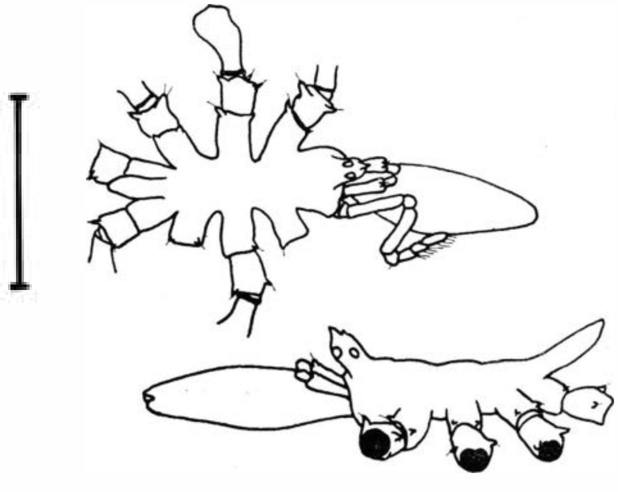

FIG. 161—*Achelia* (*P.*) *sufflata*: dorsal and lateral views of trunk and proboscis. (The scale represents 1 mm.)

Achelia (Pigrolavatus) besnardi Sawaya, 1951. (Figs. 152, 153, 155, Tables 13, 14)

Achelia besnardi Sawaya, 1951: 271–9; 1, 2.
Achelia sawayai f. *besnardi* Stock, 1955a: 246–7.

The results of the numerical analysis place this species as morphologically quite distinct from *A. (P.) sawayai*, and indicate greater differences between the species than suggested by Stock (1955).

Achelia (Pigrolavatus) sufflata Gordon, 1944. (Figs. 152, 153, 155, 156, 161, 162, Tables 13, 14)

Achelia sufflata Gordon, 1944: 53–4; 18a–e.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1942.12.30.71, B.A.N.Z.A.R.E. Sta. 41 and 42, Holotype (♀), 2 ovigerous ♂♂, 5 ♂♂, 3 ♀♀, 1 juvenile.

DESCRIPTION

Based on Gordon (1944), augmented by reference to the type material.

PALP: Palp 8-segmented; segments 6 and 7 essentially cylindrical; segment 4 with its maximum width in distal third; segments 5 and 6 articulated synaxially.

TRUNK: Trunk somites 1, 2, and 3 either fused or separated by dorsal suture lines; somites 3 and 4 fused; all somites devoid of dorsal transverse ridges and central dorsal projections; anterior cephalic spurs absent; ocular tubercle taller than wide, waisted, with low spire; 1st and 2nd lateral processes separated by 0.5–1.0; distal dorsal projections of 3rd lateral processes low to strong (anterior), absent (median), and low to strong (posterior); 1st lateral processes with a single anterior distal dorsal projection; abdomen not extending beyond middle of 2nd coxae of 4th legs.

PROBOSCIS: Proboscis shape C or C′: 1.

CHELICERAE: Chelae fingers reduced in adults; scape devoid of strong dorsal projections; total length of chelicerae never more than half proboscis length.

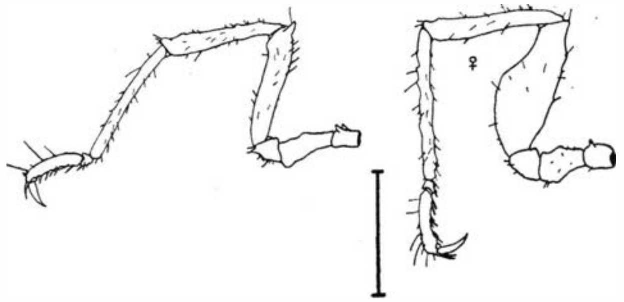

FIG. 162—*Achelia* (*P.*) *sufflata*: 3rd left legs of male and female. (The scale represents 1 mm.)

THIRD LEG: 3.93 mm long in smallest recorded adult; distal dorsal projections of first coxae single, strong (anterior), absent (median), and strong (posterior); femora or 2nd tibiae the longest segments; longest leg setae more than one-and-a-half times the diameter of the segments on which they are sited, borne on the dorsal surfaces of femora, tibiae, and propodus, and ventral surfaces of 2nd tibiae; propodal sole spines similarly arranged on all eight propodi, of homogeneous size, forming a continuous row of six to eleven spines; dorsal propodal spines of heterogeneous size, two to eight in number; distal dorsal femoral spigot single, stronger in males than in females; genital pores of males not on a strong projection.

OVIGER: 10-segmented; distal segments with ventral compound spines as

$$\frac{2}{10\text{th}} : \frac{2}{9\text{th}} : \frac{1}{8\text{th}} : \frac{0}{7\text{th}} : \frac{0}{6\text{th}};$$

segments 8 and 7 articulated synaxially; segment 7 devoid of special dorsal setae.

REPRODUCTION: Males and females with genital pores on three posterior pairs of legs; leg length of smallest recorded ovigerous male 3.93 mm; of smallest recorded adult female 3.98 mm; eggs 0.40–0.50 mm in diameter; ovigerous males collected in January.

DISTRIBUTION

The recorded distribution of this species is shown in Fig. 155, and discussed on pp. 101-2. Specimens have been taken at depths of 180–300 m.

DIMENSIONS

	Juveniles	Adults
L. leg	3.20 mm	3.93–4.76 mm
L. trunk	0.97	0.86–1.01
L. proboscis	0.97	0.85–1.05
L. palp		1.05–1.42
L. accy. claw ÷ L. main claw	0.73	0.36–0.61

DISCUSSION

The differences between the apparent taxonomic position of this species and its geographical grouping are discussed on pp. 101–2.

Subgenus **Ignavogriphus*** n. subgen.

Achelia (Ignavogriphus) australiensis Stock, 1954. (Figs. 152, 153, 156, Tables 13, 14)

Achelia laevis var. *australiensis* Miers, 1884: 323–4; 35 A. Loman, 1908: 62. Shchimkevitch, 1929: 139.
Ammothea australiensis Helfer and Schlottke, 1935: 285.
Achelia flynni Marcus, 1940: 84; 128.
Achelia australiensis Stock, 1954: 105–7, 49. Stock, 1956: 43. Clark, 1963: 57–9; 29a–g.
? *Achelia* sp. affin. *australiensis* Stock, 1958; 552.

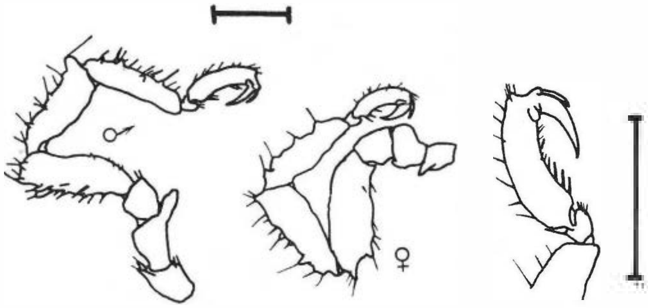

FIG. 163—*Achelia (I.) assimilis*: 3rd right legs of male and female, and terminal segments of leg. (The scales represent 1 mm.)

Achelia (Ignavogriphus) dohrni (Thomson, 1884). (Figs. 152, 153, 156, Tables 13, 14)

Ammothea dohrni Thomson, 1884: 243–5; XIV 5–9. Hutton, 1904: 247. Helfer and Schlottke, 1935: 285.
Achelia dohrni Stock, 1954b: 107–9; 50, 51. Stock, 1956: 42.

Achelia (Ignavogriphus) assimilis (Haswell, 1885). (Figs. 152, 153, 156–157, 163, Tables 13, 14)

Ammothea assimilis Haswell, 1885: 1026–7; LV 5–9. Whitelegge, 1889: 233. Loman 1908: 59–60. Helfer and Schlottke, 1935: 285.
Ammothea wilsoni Schchimkevitch, 1887: 271. Hodgson, 1907: 10–13; 3. Marcus 1940: 80–1.
Achelia assimilis Bouvier, 1913: 140 (listed). Flynn, 1920: 87–90; XXII 22–6. Stock, 1954b: 97. Stock, 1956: 42–3. Hedgpeth, 1961: 7–11; 3–7.
Achelia assimilis small form Stock, 1954b: 98–9; 45.
Achelia assimilis large form Stock, 1954b: 99–100; 46.
Achelia variabilis Stock, 1954b: 100–5; 47, 48.

DISCUSSION

The close similarity between *A. variabilis* and this species, shown by numerical methods (pp. 99–101), has led us to synonymise the two, when the name *assimilis* has priority. Very little material of this species was available, and we have not attempted to redescribe the species, especially since Hedgpeth (1961) has reviewed it only recently.

Achelia (Ignavogriphus) hoekii (Pfeffer, 1889). Figs. 152–154, 157, 164–165, Tables 13, 14)

Ammothea hoekii Pfeffer, 1889: 46. Helfer and Schlottke, 1935: 285.
Ammothea (Achelia) hoekii Loman, 1923a: 4. Loman, 1923d: 24.
Achelia hoekii Gordon, 1932: 110–12; 59a, b, 60a, c. Gordon, 1938: 22 (in key). Marcus, 1940: 80 (text and key). Sawaya, 1951 (in key).

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1933.3.23.674–5, 1 ♂, 2 ♀♀.

DESCRIPTION

Based on previous descriptions and illustrations, augmented, where necessary, from the few specimens in the British Museum collections.

**Ignavus*, slothful; *griphus*, a net.

PALP: Palp 8-segmented; segment 7 markedly asymmetrically conical, segment 6 essentially cylindrical; maximum width of segment 4 in middle third; segments 5 and 6 articulated synaxially.

TRUNK: Somites 1 and 2, and 2 and 3 articulated, somites 3 and 4 articulated or separated only by a faint suture; no dorsal transverse ridges or central dorsal projections; anterior cephalic spurs absent; ocular tubercle low, basal diameter greater than height, without waist or spire; 1st and 2nd lateral processes contiguous (=0); all lateral processes without distal dorsal spurs; abdomen reaching only just beyond distal ends of 1st coxae of 4th legs.

PROBOSCIS: Proboscis shape B: 1.

CHELICERAE: Fingers greatly reduced in adults; scape without any dorsal projections.

THIRD LEG: Recorded lengths (adults) 8.04–8.63 mm; accessory claw very variably developed, 0.25–0.50 times the length of the main claw; distal dorsal projections of 1st coxae absent or very obscure, single (anterior and posterior); femur or tibia 2 the longest leg segments; distal dorsal femoral spigot very low in both sexes; longest setae less than half the diameters of the segments on which they are sited, borne on distal dorsal surfaces of 1st and 2nd tibiae; propodal sole spines of heterogeneous size, in two spatially distinct groups, 30–40 in all; 7 to 12 larger proximal spines in a broad field on a very well developed heel; dorsal propodal setae absent or very few.

OVIGER: Oviger 10-segmented, distal segments with special compound ventral spines as

$$\frac{2}{10\text{th}} : \frac{1/2}{9\text{th}} : \frac{2}{8\text{th}} : \frac{2}{7\text{th}} : \frac{0}{6\text{th}};$$

segments 7 and 8 articulated synaxially; segment 7 without a dorsal field of special setae.

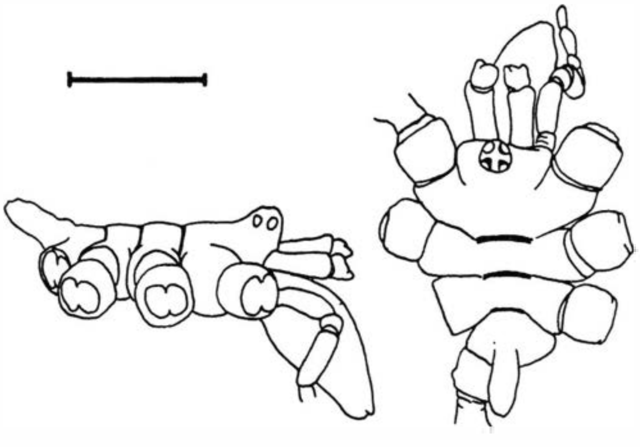

FIG. 164—*Achelia* (*I.*) *hoekii*: lateral and dorsal views of trunk and proboscis. (The scale represents 1 mm.)

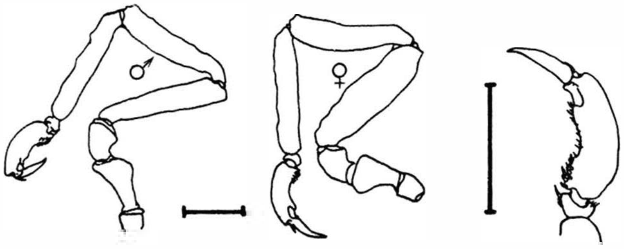

FIG. 165—*Achelia* (*I.*) *hoekii*: 3rd left legs of male and female, and terminal segments of leg. (The scales represent 1 mm.)

REPRODUCTION: Males with genital pores on two posterior pairs of legs only, genital processes of 2nd coxae very variably developed; females with genital pores on all four pairs of legs; leg length of smallest recorded adult male 8.63 mm; of smallest recorded adult female 8.04 mm; ovigerous males have been taken in May; diameter of eggs unrecorded.

DISTRIBUTION

See Fig. 154 ; recorded from depths of 5–60 m.

DIMENSIONS

	Adults
L. leg	8.04–8.63 mm
L. trunk	1.36–1.39
L. proboscis	1.32–1.47
L. palp	1.33–1.45
L. accy. claw ÷ L. main claw ..	0.25–0.50

Achelia (Ignavogriphus) serratipalpis (Bouvier, 1911). (Figs. 152–154, 156, 166–67, Tables 13, 14)

Ammothea serratipalpis Bouvier, 1911b: 1140. Helfer and Schlottke, 1935: 285.
Achelia serratipalpis Bouvier, 1913: 140–4; 90–5. Gordon, 1932: 113. Gordon, 1938: 24. Marcus, 1940: 80 (text and key). Sawaya, 1951: 274 (key).
Ammothea (*Achelia*) *serratipalpis* Loman, 1920: 141. Loman, 1923d: 25.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1933.3.23.682–4, 1 ovigerous ♂, 1 ♂, 2 ♀♀.

DESCRIPTION

Based on the material in the British Museum Collections and all previous descriptions and illustrations.

PALP: Palp 8-segmented, segments 7 and 6 markedly asymmetrically conical (giving the "serratiform" appearance to the palps); segments 5 and 6 articulated synaxially; maximum width of segment 4 in its distal third.

TRUNK: All four somites separated by regions of articulation; no dorsal transverse ridges or dorsal median projections; anterior cephalic spurs absent; ocular tubercle taller than length of basal diameter, with low spire, without waist, with well developed eyes; 1st and 2nd lateral processes separated by 0–0.25; 3rd lateral processes with distal dorsal projections on posterior margins only, low to strong; abdomen not reaching beyond midpoint of 2nd coxae of 4th legs.

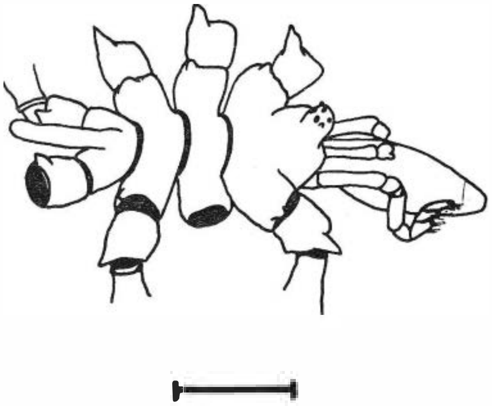

FIG. 166—*Achelia (I.) serratipalpis*: dorsal view of trunk and proboscis. (The scale represents 1 mm.)

PROBOSCIS: Proboscis shape B: 1.

CHELICERAE: Fingers greatly reduced in adults; scape without dorsal projections.

THIRD LEG: Lengths 13–15 mm (adults); accessory claws variably developed, 0.4 to 0.8 times the length of the main claw; 1st coxae with distal dorsal spurs as absent (anterior), absent (median), and strong or very strong (posterior); 2nd tibiae longest leg segments; distal dorsal femoral spigot single, strong in both sexes; longest setae 0.5–1.0 times the diameters of the segments on which they are sited, scattered on the dorsal surfaces of femora and both tibiae and on ventral surfaces of 2nd tibiae; propodal sole spines 20–40 in number, of heterogeneous size, in two spatially distinct groups; proximal group of three to four larger spines arranged in a row; 10–20 short dorsal propodal setae of roughly uniform size.

OVIGER: Oviger 10-segmented, distal segments with special ventral compound spines as

$$\frac{2/3}{10\text{th}} : \frac{1}{9\text{th}} : \frac{2/3}{8\text{th}} : \frac{3/4/5}{7\text{th}} : \frac{0}{6\text{th}};$$

segments 7 and 8 articulated synaxially; segment 7 without dorsal field of special setae.

REPRODUCTION: Males have genital pores on three posterior pairs of legs; females, on all four pairs of legs; male protuberance on 2nd coxae variably developed, but never more than half the diameter of the coxal segment; leg length of smallest recorded ovigerous male 14.34 mm; of smallest recorded adult female 13.18 mm; ovigerous males taken in March and May; eggs of diameter 0.19–0.20 mm.

DISTRIBUTION

See Fig. 154; specimens have been taken at depths of 64–391 m.

DIMENSIONS

	Adults
L. leg	13.18–15.18 mm
L. trunk	1.78– 2.10
L. proboscis	1.55– 1.90
L. palp	2.14– 2.40
L. accy. claw÷L. main claw	0.41– 0.72

DISCUSSION

Neither the serratiform appearance of the palp, nor the relative size of the accessory claws is useful in diagnosing this species. The 6th and 7th palp segments vary considerably in form, while remaining always asymmetrically conical, and have been used in keys in the past largely, we suspect, because the large size of the specimens makes such detail more immediately visible. The same extremes of "serration" occur in specimens of *spicata* and *hoekii.*

While the posterior or distal dorsal projections on the 1st coxae are relatively very much larger in some specimens than in any of the other species, this is not always so.

In general, this projection tends to be larger in males than in females of the same size, and the projections increase in size from the first to the fourth legs.

The distinctness of this species from *spicata* must be in some doubt, despite the fact that the numerical analysis shows *serratipalpis* to resemble equally *communis* and *spicata. A. serratipalpis* has been described on the basis of a few very large specimens only. The character states by which these specimens differ from *spicata* may be due either to size alone or to size and geographical isolation from other races of *spicata.*

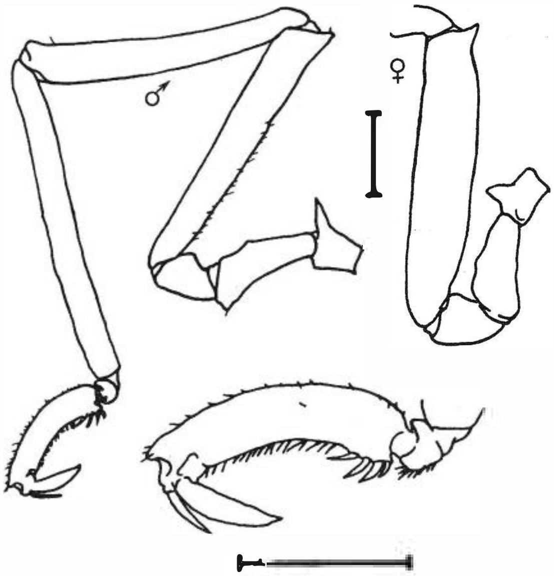

FIG. 167—*Achelia (I.) serratipalpis*: 3rd left leg of male, coxae and femur of female, and terminal segments of leg. (The scales represent 1 mm.)

That the problem is unlikely to be solved without examining many more specimens can be judged from the fact that although the ranges of the relative length of the accessory claws of the two species overlap, the accessory claws are relatively shorter in adult *spicata* than in juveniles, while in adult *serratipalpis* the accessory claws are relatively very large.

Achelia (Ignavogriphus) spicata (Hodgson, 1915). (Figs. 152–154, 157, 168–170, Tables 13, 14)

Austrothea spicata Hodgson, 1915: 147.
Achelia spicata Calman, 1915b: 57–60; 13, 14. Gordon, 1938: 22, (in key), 23. Gordon, 1944: 52. Hedgpeth, 1950: 153, 159. Fage, 1952b: 263.
Achelia intermedia Calman, 1915b: 57 (in key), 60; 15. Hodgson, 1927: 345 (in key). Gordon, 1932: 112; 61. Marcus, 1940: 80, 81 (in key). Gordon, 1944: 52 (in key). Stephensen, 1947: 85. Hedgpeth, 1950: 153, 159. Sawaya, 1951: 274 (in key). Fage, 1952a: 181. Fage, 1952b: 263.
Ammothea spicata Helfer and Schlottke, 1935: 285.

MATERIAL EXAMINED

NZOI Sta. A 449, 1 juvenile; Sta. A 450, 1 ovigerous ♂, 1 ♂, 7 ♀♀; Sta. 456, 1 ♀; Sta. A 468, 1 ovigerous ♂, 3 ♀♀; Sta. A 471, 1 ovigerous ♂, 2 ♀♀; Sta. A 520, 3 ♀♀; Sta. A 528, 1 ♂, 2 ♀♀; Sta. A 529, 1 ♂, 5 ♀♀; Sta. A 533, 1 ovigerous ♂, 1 juvenile.

Staten Island Sta. 1, 1 ovigerous ♂, U.S.N.M. Acq. No. 226350; Sta. 24, 1 ♀; *Burton Island* Sta. 5, 2 ovigerous ♂♂, 1 ♂, 3 ♀♀, 1 juvenile; *North Wind* Sta. 8, 2 ♀♀, U.S.N.M. Acq. No. 226350; *Edisto* Sta. 6, 1 ovigerous ♂, 1 ♀, 2 juveniles; *Atka* Sta. 22a, 1 ovigerous ♂, 3 ♂♂, 6 ♀♀, 6 juveniles; *Atka* Sta. 23, 1 ovigerous ♂, 2 ♂♂, 3 ♀♀; *Atka* Sta. 29, 1 juvenile, U.S.N.M. Acq. No. 224443.

B.M. (N.H.) Regn. No. 1909.8.31.87, Visokoi Island, S. Sandwich Group, 1 ♀, labelled *intermedia*; B.M. (N.H.) Regn. No. 1915.7.24. 232–51, *Terra Nova* Sta. 220 & 355, 2 ovigerous and larvigerous ♂♂, 5 ♂♂, 7 ♀♀, 1 juvenile, labelled *spicata*; B.M. (N.H.) Regn. No. 1915.7.24.252-9, *Terra Nova* Sta. 220, 3 ovigerous and larvigerous ♂♂, 2 ♂♂ (includes holotype), 4 ♀♀, labelled *intermedia*; B.M. (N.H.) Regn. No. 1933.3.23.676-8, *Discovery* Sta. 371, 3 ♀♀, labelled *intermedia*.

DESCRIPTION

Based on previous descriptions and illustrations, augmented and amended by data from 89 adults and 14 juveniles.

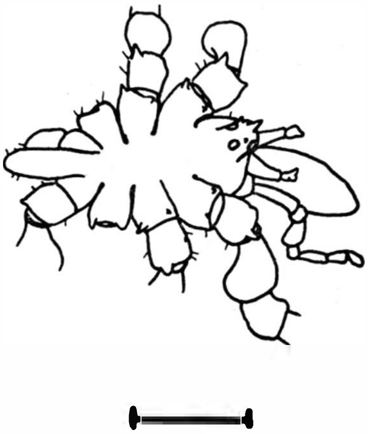

FIG. 168—*Achelia* (*P.*) *spicata*: dorsal view of trunk and proboscis, showing the "compact form" of Calman (1915b). (The scale represents 1 mm.)

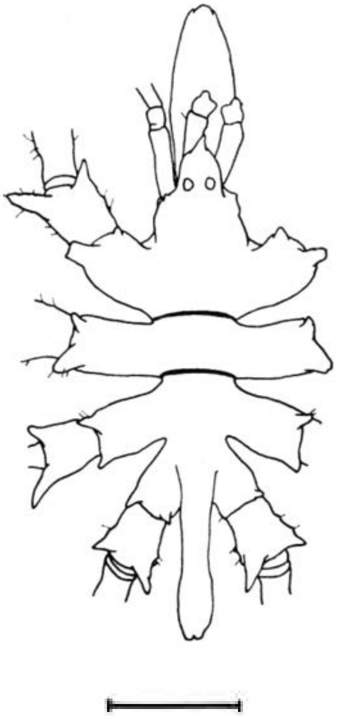

FIG. 169—*Achelia* (*P.*) *spicata*: dorsal view of trunk and proboscis, showing the "elongate form" of Calman (1915b). (The scale represents 1 mm.)

PALP: Palp 8-segmented, segments 7 and 6 varying from markedly asymmetrically conical to essentially cylindrical; maximum width of segment 4 in distal third; segments 5 and 6 articulated synaxially.

TRUNK: Somites either fused, articulated, or distinguished by dorsal suture lines; no dorsal transverse ridges or dorsal median projections; anterior cephalic spurs absent; ocular tubercle taller than length of basal diameter, waisted, with a low rounded to tall narrow spire; eyes present, well developed, subequal; 1st and 2nd lateral processes separated by 0 to 0.4; 3rd lateral processes with distal dorsal spurs as single, low to strong (anterior), absent (median), and low, single (posterior); abdomen of variable length, but not reaching beyond midpoint of 2nd coxae of 4th legs.

PROBOSCIS: Proboscis shape B, B′, C, or C′: 1.

CHELICERAE: Fingers atrophied in adults; scape devoid of dorsal projections.

THIRD LEG: Lengths 7–15 mm in adults; accessory claws poorly developed in adults, much more strongly developed in juveniles; 1st coxae with distal dorsal projections as single, low to strong (anterior), absent (median), and single, low to strong (posterior); 2nd tibia the longest leg segment; distal dorsal femoral spigot well developed in both sexes, single; longest setae 0.2–0.6 times the diameter of the segment on which they are sited, scattered irregularly over all aspects of femora and two tibiae; propodal sole spines 20–30 in all, of heterogeneous size, forming two spatially distinct rows;

proximal row of two to four stout, curved, thorn-like spines; distal row of shorter, fine spines; 10–20 short dorsal propodal setae, of homogeneous size.

OVIGER: Oviger 10-segmented; distal segments bearing special compound ventral spines as

$$\frac{1/2/3}{\text{10th}} : \frac{1/2}{\text{9th}} : \frac{1/2}{\text{8th}} : \frac{1/2}{\text{7th}} : \frac{0/1}{\text{6th}} :$$

segments 7 and 8 articulated synaxially in both sexes; segment 7 without dorsal field of special setae.

REPRODUCTION: Males with genital pores on low, rounded protuberances on the 2nd coxae of the posterior three pairs of legs; females with genital pores on 2nd coxae of all four pairs of legs; leg length of smallest recorded ovigerous male 7.38 mm; of smallest recorded adult female 8.04 mm; ovigerous and larvigerous males taken in January and February; egg diameters 0.12–0.19 mm.

DISTRIBUTION

See Fig. 154; specimens have been taken at depths of 30 m and 470 m.

DIMENSIONS

	Juveniles	Adults
L. leg ..	5.24–9.49 mm	7.38–14.53 mm
L. trunk ..	1.32–1.63	1.16– 2.09
L. proboscis ..	1.08–1.20	1.06– 1.71
L. palp ..	1.11–1.49	1.44– 2.23
L. accy. claw ÷		
L. main claw ..	0.24–0.52	0.11– 0.42

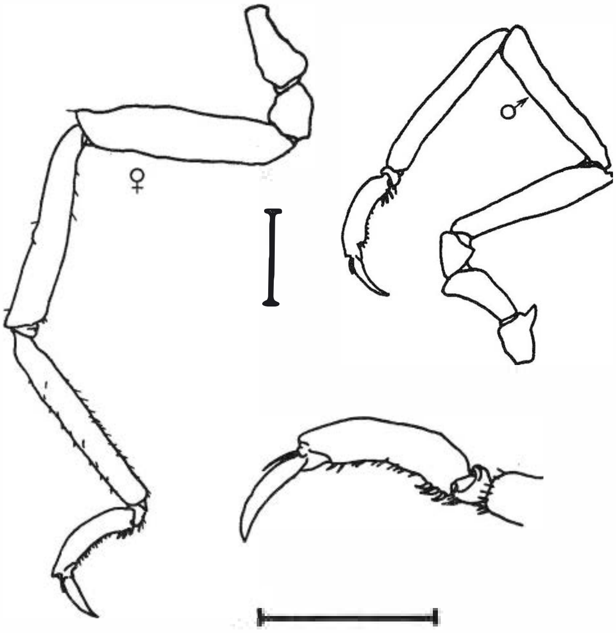

FIG. 170—*Achelia* (*P.*) *spicata*: 3rd left legs of male and female, and terminal segments of leg. (The scales represent 1 mm.)

DISCUSSION:

The reasons for synonymising *spicata* and *intermedia* are given on pp. 99–100. These species, as envisaged by Hodgson, Calman, and other authors, cannot in fact be separated by the relative lengths of the accessory claws and scape of the chelicerae, nor by the degrees of distinctness of the trunk somites. In the samples examined, the states of these characters do not appear to be associated consistently.

Only the relative length of the abdomen and the degree of development of the ocular spire—2 characters of the 49 employed in the numerical comparison—might be used to distinguish between *intermedia* and the "elongate" form of *spicata.* In the elongate form the ocular spire is relatively much taller than in the compact forms, and the abdomen is much longer. In all other characters, however, there is no clear division of elongate and compact forms.

On the other hand, *spicata* (sens. nov.) does show a very wide range of morphological variation, which is not surprising as the species occurs along several thousand miles of Antarctic continental shelf. In this species and probably in *assimilis* also, highly detailed studies of populations from the entire geographical range of the species will doubtless permit recognition of a number of geographical races.

Achelia (Ignavogriphus) communis (Bouvier, 1906). (Figs. 152–154, 157, 171–172, Tables 13, 14)

Ammothea communis Bouvier, 1906a: 20, 44–50; 23–32, III 3. Hodgson, 1907: 177–179; II 1, 1a. Bouvier, 1911a: 1140. Loman, 1920: 141.
Ammothea affinis Bouvier, 1906b: 50–3, 33–6; III.
Achelia communis Calman, 1915b: 57 (in key). Hodgson, 1927: 344. Gordon, 1932: 110–12; 59c, 60b. Gordon, 1938: 22 (in key). Gordon, 1944: 53. Hedgpeth, 1950: 153. Stock, 1955b: 3–4.
Achelia brucei Calman, 1915b: 61; 16. Gordon, 1932: 113. Giltay, 1934: 5. Gordon, 1938: 22 (in key). Marcus, 1940: 79, 81 (in key). Gordon, 1944: 52. Sawaya, 1951: 274 (in key). Fage, 1952a: 185. Fage, 1952b: 263.
Ammothea (*Achelia*) *hoekii* Loman, 1923a: 4 (partim). Loman, 1923d: 24–5 (partim).
Ammothea communis Helfer and Schlottke, 1935: 285
Achelia sp. (? *brucei*) Hedgpeth, 1950: 154.

MATERIAL EXAMINED

NZOI Sta. A 450, 2 ovigerous ♂♂, 2 ovigerous and larvigerous ♂; Sta. A 456, 1 ♀, 1 juvenile; Sta. A 520, 1 ♀.

Edisto Sta. 6, 2 ♀♀; *Burton Island* Sta. 3, 1 juvenile; *Atka* Sta. 22a, 2 ♀♀; Sta. 23, 2 ovigerous ♂♂, 3 ♀♀, 6 juveniles.

B.M. (N.H.) Regn. No. 1914.7.27.1–4, Petermann Island, labelled *communis*; B.M. (N.H.) Regn. No. 1914.7.24.260–79, *Terra Nova* Sta. labelled *brucei* (including holotype), 11 ovigerous ♂♂, 1 larvigerous ♂, 4 ♂♂, 45 ♀♀.

DESCRIPTION

Based on previous descriptions and on data from 79 adults and eight juveniles. This includes all material in the British Museum (Natural History) labelled as either *communis* or *brucei.*

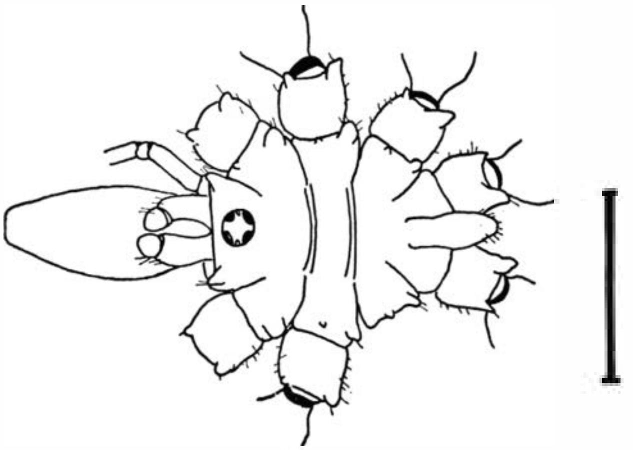

FIG. 171—*Achelia* (*P.*) *communis*: dorsal view of trunk and proboscis. (The scale represents 1 mm.)

PALP: Palp 8-segmented, segments 6 and 7 essentially cylindrical, or only slightly asymmetrically conical; maximum width of 4th segment in proximal or median third; segments 5 and 6 articulated synaxially.

TRUNK: Somites 3 and 4 always fused, without trace of suture; somites 1, 2, and 3 either fused or articulated or separated by sutures; no dorsal transverse ridges or median dorsal projections; anterior cephalic spurs conical, each with one to three fine setae; ocular tubercle waisted, taller than length of basal diameter, without spire, or very low spire; four well developed, subequal eyes; 1st and 2nd lateral processes contiguous (= 0); distal dorsal spurs of 3rd lateral processes as absent or single, low to strong (anterior), absent (median), and absent or single, low to strong (posterior); abdomen not reaching midpoint of 2nd coxae of 4th legs.

PROBOSCIS: Proboscis shapes B, B′, C, or C′: 1.

CHELICERAE: Fingers greatly reduced in adults; scape without dorsal projections.

THIRD LEG: Lengths of 5 mm and 9 mm; accessory claw very variably developed, 0.3–0.8 times the length of the main claw; 1st coxae with single low to strong distal dorsal spurs; femur, 1st tibia, or 2nd tibia the longest leg segment; longest setae scattered over 1st and 2nd tibiae, 0.25–0.75 times the diameter of the segments on which they are sited; distal dorsal femoral spigot single and well developed in both sexes; propodal sole spines heterogeneous, 10–20 in all, in two spatially distinct rows; proximal row of three or four longer spines; 5–10 dorsal propodal setae.

OVIGER: Oviger 10-segmented, terminal segments with special compound ventral spines as

$$\frac{1/2}{\text{10th}} : \frac{1/2}{\text{9th}} : \frac{0/1/2}{\text{8th}} : \frac{0/1/2}{\text{7th}} : \frac{0/2}{\text{6th}};$$

segments 7 and 8 articulated synaxially in both sexes; segment 7 without dorsal field of special spines in either sex.

REPRODUCTION: Leg length of smallest recorded ovigerous male 5.71 mm; of smallest recorded adult female 5.29 mm; males with genital pores on last two pairs of legs; females with genital pores on all four pairs of legs; genital protuberance on 2nd coxae of males very variably developed; ovigerous and larvigerous males collected in September to January; egg diameters 0.10–0.16 mm.

DISTRIBUTION

See Fig. 154; specimens have been taken at depths of 0–470 m.

DIMENSIONS

	Adult
L. leg	5.22–8.35 mm
L. trunk	1.01–1.61
L. proboscis	0.97–1.57
L. palp	1.09–1.65
L. accy claw ÷ L. main claw	0.28–0.77

DISCUSSION

While this species shows a very wide range of variation in several character states, it does not seem possible to subdivide the present material into two or more distinct forms. The %S between *Achelia communis* (Bouvier) and *A. brucei* Calman is 94.50 (p. 99). In support of this evidence of their extremely high similarity, we find that neither Calman's (1915b) nor Gordon's (1938) keys are

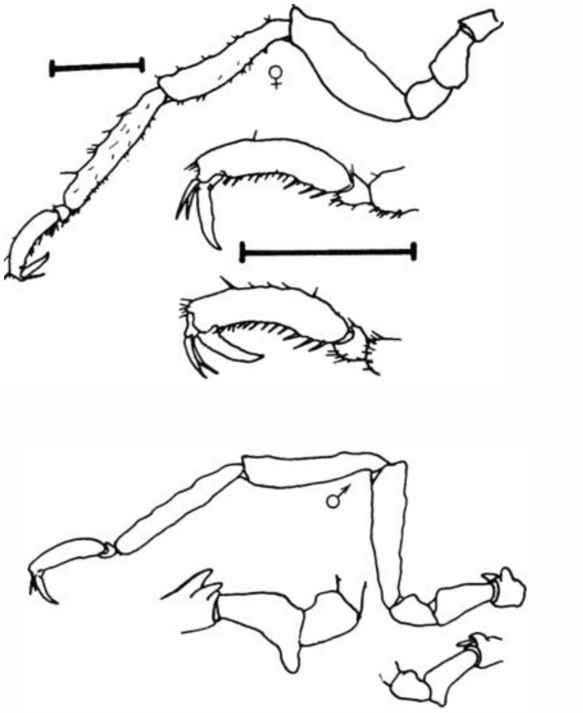

FIG. 172—*Achelia* (*P.*) *communis*: 3rd left legs of males and female, showing the variation in spination of the propodus, and in the height of the genital mound on the second coxae of males. (The scales represent 1 mm.)

consistent in separating either new material, or previously described material, into groups coinciding with the descriptions of *communis* and *brucei*.

Although *communis* (sens nov.) has a high %S with both *intermedia* and *spicata* it can be distinguished from them by the shape and distribution of the proximal propodal sole spines. In *intermedia* and *spicata* these spines are closely set and are stout and thorn-like, but in *communis* they are straighter, more slender, and further apart.

Genus **Sericosura*** n. gen.

? *Achelia*, Gordon, 1944: 54–57

Palp 7-segmented; ovigers 10-segmented, well developed, four terminal segments with one to three compound ventral spines, without terminal claw; accessory claws well developed; chelicerae present, scape stout, one-segmented, inserted under strong cephalic hood, chelae greatly reduced in adults; all trunk somites articulated with posterior dorsal transverse ridges.

Sericosura mitrata (Gordon, 1944). (Figs. 152–153, 173, Tables 13, 14)

(?) *Achelia mitrata* Gordon, 1944: 54–7; 19a–e, 22 b.

MATERIAL EXAMINED

Holotype ♀ from B.A.N.Z.A.R.E. Sta. 107, B.M. (N.H.) Regn. No. 1964.10.26.1

DESCRIPTION

Based on Gordon's description of the single type specimen, and a re-examination of this specimen.

PALP: Palp 7-segmented; segments 5 and 6 essentially cylindrical; maximum width of segment 4 in proximal third; segments 5 and 6 articulated synaxially.

TRUNK: All four somites articulated; somites 1–3 with low transverse dorsal ridges, but no central dorsal projections; cephalic spurs minute, conical, on a very strongly developed cephalic hood; ocular tubercle taller than wide, inclined forward, without spire; eyes absent; 1st and 2nd lateral processes separated by 0.25–0.50; distal dorsal projections of lateral processes small, two to five in number; abdomen horizontal, reaching to beyond the mid-point of the 2nd coxae of the 4th legs.

PROBOSCIS: Shape D′: 1.

CHELICERAE: Chelae fingers absent in adults; palm very much reduced; scape with one or two small spurs on distal dorsal surface.

LEG: Leg 10·93 mm long; 1st coxae with two to four short, stout, setae on anterodorsal and posterodorsal aspects; femora and 1st tibiae equal longest segments; longest setae more than twice as long as the diameter of the segment on which they are sited; longest hair-like setae on the ventral surfaces of 1st and 2nd tibiae, tarsus and propodus; row of shorter, stout, setae on ventral and lateral surfaces of femora, and 1st and 2nd tibiae; very few slightly longer setae on dorsal surfaces of all segments; accessory claws well developed, 0·4–0·6 times the length of the main claw; femora without distal dorsal spigot; propodal sole spines similar on all eight propodi, homogeneous in size, forming a single row of six to ten spines; six to ten dorsal propodal setae.

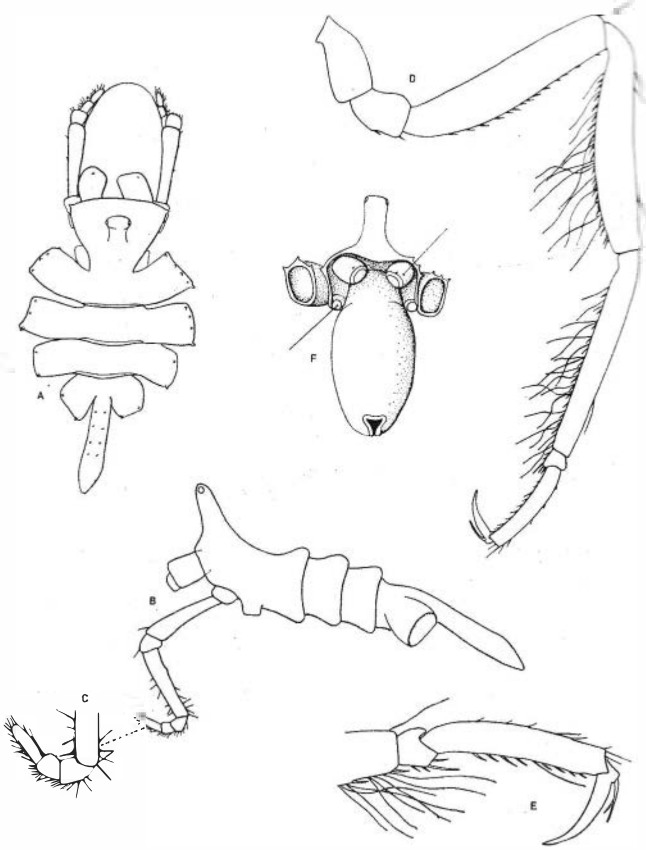

FIG. 173—*Sericosura mitrata*: dorsal and lateral views of trunk and proboscis, left palp, 3rd right leg, propodus, and anterior view of proboscis and cephalic somite. (This figure is reproduced by permission of Dr Isabella Gordon and the Mawson Institute.)

OVIGER: Oviger 10-segmented; distal segments have ventral compound spines as

$$\frac{2}{10\text{th}} : \frac{1}{9\text{th}} : \frac{2}{8\text{th}} : \frac{3}{7\text{th}} : \frac{0}{6\text{th}};$$

segments 8 and 7 articulated synaxially; segment 7 devoid of special dorsal setae.

REPRODUCTION: Female with genital pores on the 2nd coxae of the three posterior pairs of legs.

DISTRIBUTION

The collection site of the holotype is 66°45′S, 62°03′E, at 219 m. The occurrence in shallow Antarctic waters of other blind specimens of various species which have been

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*Sericatus, "clothed in silken attire"; sura, calf of the leg.

discussed in other parts of this report, make us less sceptical than was Gordon (1944, p. 57) about the reliability of the station data for this specimen.

Dimensions of Holotype ♀

L. left leg	10.93 mm
L. trunk	2.39
L. proboscis	2.04
L. palp	2.42
L. chelicera	0.31
L. accy. claw ÷ L. main claw	0.4–0.6

Discussion

Numerical analysis of the species of *Achelia* occurring in the southern oceans confirms Gordon's misgivings at placing this species in *Achelia*. We have placed it in a separate genus to indicate its distinctness from all other species of Ammotheidae.

Its assignation to an exact taxonomic position must wait until all species belonging to the much-abused "family" Ammotheidae can be compared.

Genus **Aduncorostris*** n. gen.

Achelia, Stock, 1954: 109–12.

Palp 8-segmented; ovigers 10-segmented, well developed, five terminal segments with one or two compound ventral spines; chelicerae present but so reduced in adults that palm and fingers are indistinguishable, scape 1-segmented; no strong cephalic hood; all trunk somites fused, without dorsal transverse ridges; propodus stout and strongly arched; accessory claws absent.

Aduncorostris transfuga (Stock, 1954)

Achelia transfuga Stock, 1954b: 109–12; 52–3.

Material Examined

None.

Description

Stock (loc. cit.) has given a very clear description of this species, redescribed here to draw attention to character states which we have employed in the numerical analysis, but which Stock did not stress.

PALP: Palp 8-segmented, segments 7 and 6 essentially cylindrical; greatest width of segment 4 in proximal half; segments 5 and 6 articulated synaxially.

TRUNK: Somites all fused, without trace of sutures, without dorsal transverse ridges or dorsal projections; anterior cephalic spurs absent; ocular tubercle with strong spire, without waist, as tall as length of basal diameter; 1st and 2nd lateral processes contiguous (= 0); distal dorsal spurs of 3rd lateral processes absent (anterior), spine (median), and absent (posterior); abdomen reaching distal end of 1st coxae of 4th legs.

PROBOSCIS: Shape C: 2: E″.

CHELICERAE: Palm and fingers indistinguishable, in adults, from scape, but not replaced by setae as in *Tanystylum*; scape devoid of dorsal projections.

THIRD LEG: Length 6.60 mm (adult female); accessory claws absent; 1st coxae with one anterior and one posterior distal dorsal spine; femur the longest leg segment; distal dorsal femoral spigot single, low; longest leg setae 0.25 to 0.5 times the diameter of the segments on which they are sited, distributed over all aspects of femur and two tibiae; propodus stout and strongly arched; propodal sole spines of heterogeneous size, in two spatially distinct rows, three larger basal spines, and 10–20 smaller distal spines; 20–30 dorsal propodal setae.

OVIGER: Oviger 10-segmented, distal segments with special compound ventral spines as

$$\frac{2}{\text{10th}} : \frac{1}{\text{9th}} : \frac{1}{\text{8th}} : \frac{1}{\text{7th}} : \frac{1}{\text{6th}};$$

segments 7 and 8 articulated synaxially in females; segment 7 without dorsal field of special setae.

REPRODUCTION: No ovigerous or other males recorded; leg length of smallest adult female 6.60 mm; adult females with genital pores on 2nd coxae of all four pairs of legs.

Distribution

The holotype and paratype were taken in Lyttelton Harbour at depths between 2 and 10 m.

Discussion

This species is morphologically far further removed from other southern species of *Achelia* than Stock considered it to be; so that we have had no hesitation in ascribing it to a new and separate genus.

Genus **Austroraptus** Hodgson, 1907

Palps 5–8 segmented, longer than proboscis; trunk of four fused somites, without strong transverse dorsal ridges; ocular tubercle with well developed eyes; proboscis with small terminal diameter, shorter than trunk; chelicerae present, fingers reduced or persistent in adults, scape 1-segmented; tarsus short, arcuate; accessory claws short, frequently shed; ovigers of both sexes well developed, 10-segmented, with simple spines on the four terminal segments, 6th segment with one or more stout conical spines in male, segments 7 and 8 articulated synaxially in both sexes; genital pores in females on all eight legs, in males on posterior four legs only.

The species of *Austroraptus* are morphologically very similar to those of *Achelia*, and the number of palp segments certainly cannot be used to distinguish them from *Achelia* species, as has been done in the past. Even the nature of the ovigeral spines cannot be used as a clear generic criterion, for *Achelia dohrni*, unlike

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*Aduncus, hooked like an eagle's beak.

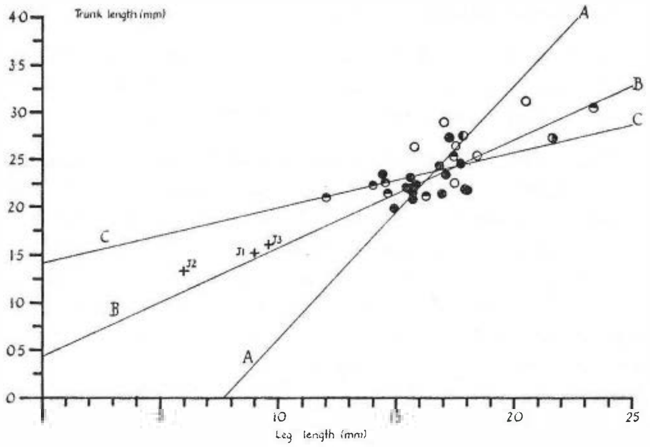

FIG. 174—Relative growth of leg length and trunk length in *Austroraptus* species: solid circle = *A. juvenilis*; hollow circle = *A. polaris*; circle with top half solid = *A. praecox*; circle with right half shaded = *A. sicarius*; circle with left half solid = *A. calcaratus*; + = juvenile specimens; A, regression curve for *A. polaris*; B, regression curve for *A. juvenilis*; C, regression curve for *A. praecox*.

other species of *Achelia*, has simple spines. The taxonomic standing of *Austroraptus* in the amorphous family Ammotheidae still awaits clarification.

While Calman (1915b) perhaps overstressed the significance of paedogenesis in the relationships between *A. juvenilis*, *A. praecox*, and *A. polaris*, these three species are undoubtedly morphologically closer to one another than any one of them is to *A. calcaratus* or *A. sicarius*, or than these two are to each other.

The palp segmentation in this genus is perplexing. Even when, as in *A. juvenilis* or the three known juvenile specimens of *Austroraptus*, the terminal portion of the palp is clearly subdivided into three segments separated by articular membranes, there are no muscles capable of moving these segments relative to one another. Furthermore, even where there is a short 3rd segment separating the two long segments of the palp—as in *juvenilis*, *praecox*, *polaris*, and *sicarius*—there are no muscles which act directly on that segment; the muscles inserted into the proximal end of the 4th segment originate in the distal wall of the 2nd segment. It is not altogether surprising to find that in *calcaratus* the short 3rd segment is completely missing, and that this segment is undefined in the left palp of one of the juvenile specimen (J_1). The functional necessity of these palp subdivisions is questionable, and, should there be none, the taxonomic significance of this character must also be in doubt.

It seems more probable that the retention of the functional chelae in *praecox* does represent paedogenesis, but it is interesting to note that in *praecox* the scape undergoes persistent reduction in length like that in the achelate adults of *juvenilis* and *polaris*.

The paucity of ovigeral spines in both males and females of *polaris* may be regarded as yet another example of paedogensis, in the sense that the normal developmental sequence in pycnogonids is towards increasing ovigeral complexity.

Relationships between *juvenilis*, *praecox*, and *polaris* cannot be determined solely by postulating paedogenetic divergences. As Fig. 175 shows, reliance on possible paedogenetic trends to explain the origins of the three species is not very fruitful.

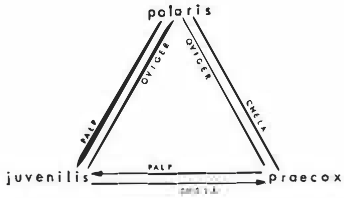

FIG. 175—Phylogenetic relationships between *Austroraptus polaris*, *A. juvenilis*, and *A. praecox* indicated when reliance is placed on the supposed paedogenetic conditions of palp, chelae, and ovigeral spination.

JUVENILES OF *Austroraptus* SPECIES (FIGS. 174, 176–181)

Only three juveniles of this genus are known, and their relationships to adults of the known species cannot be determined with any certainty. Calman (1915b) described a juvenile (= J_3 in Fig. 174 and 176–181), from *Terra Nova* Sta. 220 which he referred to *polaris*. The other juvenile (= J_1), in the collections of the British Museum (Natural History) came from *Discovery* Sta. 123, and is similar in size to that described by Calman; it has not been referred to any species. The third juvenile (= J_2), from *Burton Island* Sta. 5, is much smaller than the other two.

Calman referred the specimen he studied (J_3) to *polaris* mainly because of the separation of the lateral processes and the nature of the distal dorsal spurs of the lateral processes and 1st coxae. Referring to the 7-and 8-segmented palps of the juvenile, he stated that "this makes it very probable that the young of *A. polaris*, like the adults of *Achelia*, have the palp composed of eight segments". At the same time he enumerates several striking differences between the juvenile specimen and adults of *polaris*. Examination of adults of *polaris*, *juvenilis*, and *praecox* reveals that, on the basis of the separation of the lateral processes and the adornment of the lateral processes and 1st coxae, the juvenile (J_3) could be referred to any of those three species.

There does not appear to be any evidence to justify Calman's statement on palp segmentation; in fact the repeated evidence of unstable palp segmentation throughout the Pycnogonida* suggests that it is unwise to extrapolate from a single example.

Studies on the ontogeny of various pycnogonids (e.g., Ohshima, 1937; Marcus, 1940; Sanchez, 1959) have shown that subdivision of the palp is progressive, and, although the possibility cannot be excluded, there is no evidence to show that secondary fusion of palp segments occurs. This makes it doubtful that Calman's choice of *juvenilis* as a specific epithet was wise.

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*See amongst the Colossendeidae especially.

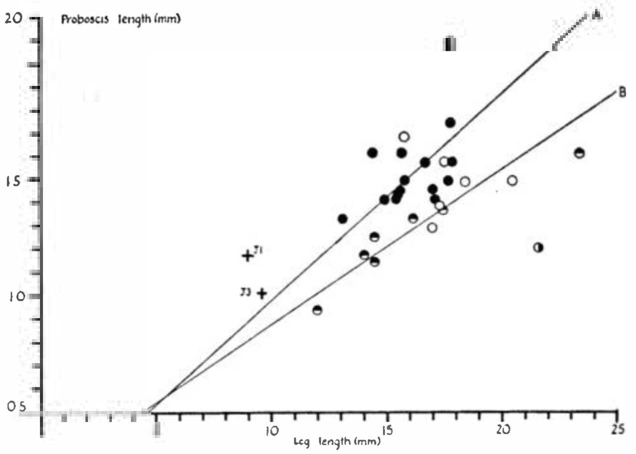

FIG. 176—Relative growth of proboscis length and leg length in *Austroraptus* species; A, regression curve for *A. juvenilis*; B, regression curve for *A. praecox*. Other conventions as in Fig. 174.

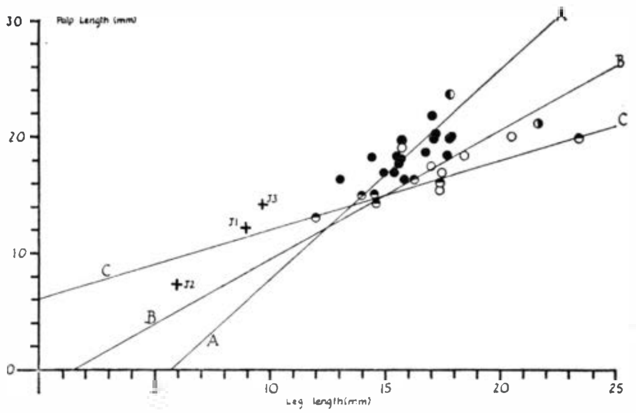

FIG. 177—Relative growth of palp length and leg length in *Austroraptus* species: A, regression curve for *A. juvenilis*; B, regression curve for *A. polaris*; C, regression curve for *A. praecox*. Other conventions as in Fig. 174.

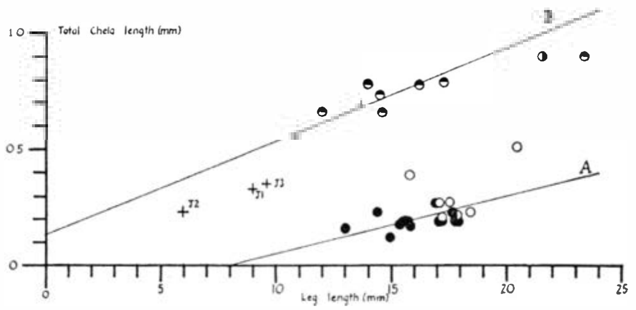

FIG. 178—Relative growth of total chela length (palm + fingers) and leg length in *Austroraptus* species: A, regression curve for *A. juvenilis*; B, regression curve for *A. praecox*. Other conventions as in Fig. 174.

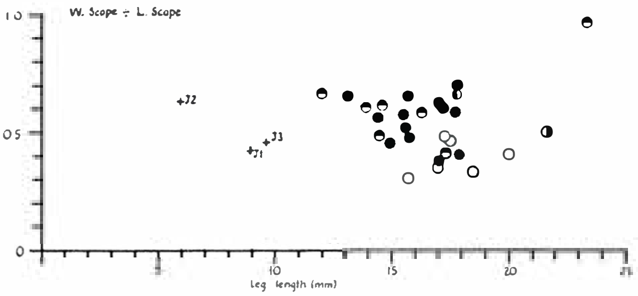

FIG. 179—Variations in the relative proportions of the scape with differences in leg length in *Austroraptus* species. Conventions as in Fig. 174.

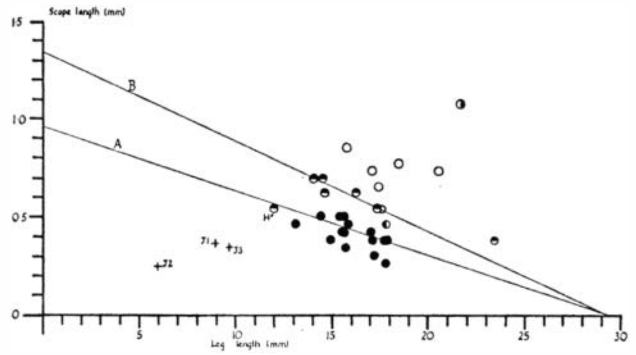

FIG. 180—Relative growth of the scape length and leg length in *Austroraptus* species: A, regression curve for *A. juvenilis*; B, regression curve for *A. praecox*; H. holotype of *A. praecox*. Other conventions as in Fig. 174.

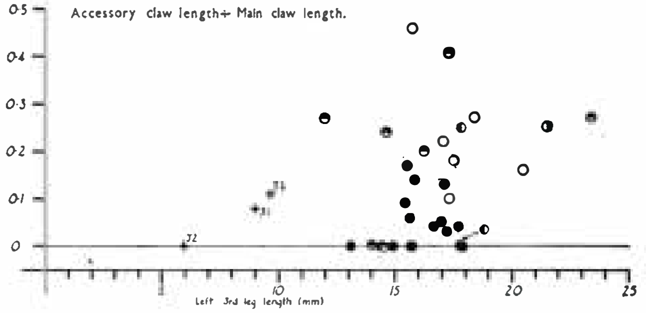

FIG. 181—Variations in the ratio length of accessory claw : length of main claw with differences in leg length in *Austroraptus* species. Conventions as in Fig. 174.

When referring the juvenile specimen to *polaris*, Calman pointed out some features in which the juvenile differed from adults of *polaris*. All three juveniles that we have examined differ in many respects from the adults of all the species of *Austroraptus*. Thus, while some of the relative proportions and other characters, such as the ventral spination of the tarsus (Figs. 176–181), indicate that all the juveniles might belong to *juvenilis*, it is likely that juveniles of all species are subject to marked heterogony in both mensural and meristic characters during development. This happens in *Ammothea* (see above) and almost certainly throughout the Pycnogonida. No known technique for assessing similarities between adults and juveniles can allow accurately for such heterogony. It is likely that the seemingly lengthy and tedious process of rearing pycnogonids in the laboratory will provide the easiest way of determining the ontogenies of species of *Austroraptus* and other genera.

Key to Adults of the Species of *Austroraptus*

1 Palp 8-segmented.................................... 2
Palp 5- or 6-segmented................................ 3
2 2nd Tibia with two strong lateral distal projections........ **A. sicarius** (p. 121)
2nd Tibia without strong lateral distal projections......... **A. juvenilis** (p. 117)
3 Palp 5-segmented; trunk bearing strong dorsal processes... **A. calcaratus** (p. 120)
Palp 6-segmented; trunk without dorsal processes......... 4
4 Fingers of chelae fully developed and functional.... **A. praecox** (p. 119)
Fingers of chelae atrophied....................... **A. polaris** (p. 116)

Austroraptus polaris Hodgson, 1907. (Figs. 174–186)

Austroraptus polaris Hodgson, 1907: 54–6; VIII 2. Calman, 1915b: 62–3; 17. Hodgson, 1915: 147. Loman, 1923: 30. Hodgson, 1927: 350; 15. Gordon, 1932: 114. Helfer and Schlottke, 1935: 291; 207. Gordon, 1938: 24. Hedgpeth, 1950: 154.

Material Examined

NZOI Sta. A 449, 1 ovigerous ♂; Sta. A 456, 1 ♀; Sta. A 531, 1 ♀. *Staten Island* Sta. 1, 1 ovigerous ♂, U.S.N.M. Acq. No. 226350. B.M. (N.H.) Regn. No. 1907.6.24.98–9, 1 ♀ (holotype), 1 ♂ (paratype), "off Barrier"; B.M. (N.H.) Regn. No. 1915.7.24.280–1 (partim), 1 ♀, *Terra Nova* Sta. 220.

Description

Based on seven adults.

PALP: Palp 6-segmented, the terminal segment without traces of subdivision; 4th segment with 12 short, stout spines on the surface, 10 on the ectal; dense fields of similar spines on the ventrolateral aspects of segments 5 and 6.

TRUNK: Somites all firmly fused (in three specimens there are faint dorsal sutures); no dorsal transverse ridges or median dorsal processes; ocular tubercle taller than length of basal diameter, with low to strong spire (absent in one specimen) and four pigmented eyes, the anterior pair slightly larger than the posterior pair; anterior cephalic spurs small, steeply conical; 1st and 2nd lateral processes separated by 0.25–0.33; all lateral processes with two dorsal distal spurs, the posterior spur on each process the larger.

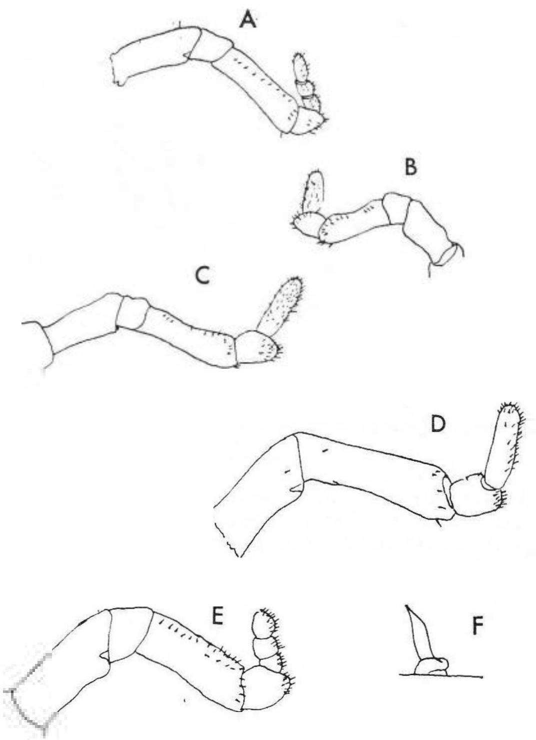

FIG. 182—Palps of *Austroraptus* species: A, *A. juvenilis*, left palp of holotype; B, *A. praecox*, right palp of holotype; C, *A. polaris*, left palp of paratype; D, *A. calcaratus*, left palp of holotype; E, *A. sicarius*, left palp of holotype; F, special spine from the lateral surfaces of the 4th segment (3rd in *A. calcaratus*).

ABDOMEN: Abdomen at an angle of between 20° and 30° to the long axis of the trunk, reaching just beyond 2nd coxae of the 4th legs.

PROBOSCIS: Proboscis shape D:1, narrowing abruptly in distal third.

CHELICERAE: Chelicerae fingers atrophied in adults; scape without strong setae or spurs, greatest width in distal quarter, 0.30–0.50 times the length.

LEG: Leg lengths of adults 15–21 mm; 1st coxae with two dorsal distal spurs, the posterior much the larger; femur or 2nd tibia the longest segment; 2nd tibia without distal lateral spurs; long segments bearing on all aspects a sparse scattering of setae, the longest of which are never more than one third the diameter of the segments on which they are sited; tarsus with two large ventral setae; propodus with a row of three to five large proximal sole spines, 20–35 smaller distal spines in four irregular rows; accessory claws small, apparently not lost haphazardly as in *praecox* and *juvenilis*, 0.1–0.5 times the length of the main claw. This claw proportion decreases as total leg length increases.

OVIGER: Oviger of males with greatly reduced number of spines on the four terminal segments, compared with the males of *juvenilis*, *praecox*, and *sicarius*; female oviger spination relatively less reduced than in males; 10th segment with three setae in males, one seta in females; 9th segment devoid of setae in both sexes; 6th segment in males with a simple stout spine.

REPRODUCTION: Sexual maturity attained at leg lengths of 15 mm or less; leg length of smallest adult female 15.75 mm; leg length of smallest recorded ovigerous male 20.49 mm; eggs approximately 0.23 mm in diameter; ovigerous and larvigerous males have been taken in January and September (Staten Island, Sta. 1, 1959).

DISTRIBUTION

Recorded localities are shown in Fig. 186. Specimens have been taken at depths of 50–439 m.

GROWTH PARAMETERS (relative to increase in total leg length)

Length of palp $y' = 0.110\,x - 0.17$ (Fig. 177)

The wide variations in relative proportions, and the small range and size of the sample, limit the reliability of any parameters other than those describing the relative growth of the palp.

Austroraptus juvenilis Calman, 1915. (Figs. 174–183, 187–189, 196)

Austroraptus juvenilis Calman, 1915b: 63–5; 18. Gordon, 1932: 114–15. Helfer and Schlottke, 1925: 291. Gordon, 1938: 24. Fage, 1952b: 263, 272.

MATERIAL EXAMINED

NZOI Sta. A 450, 2 ♀♀; Sta. A 467, 1 ♂, 1 ♀; Sta. A 528, 1 ♀. *Edisto* Sta. 8, 1 ovigerous ♂, 2 ♀♀; *Atka* Sta. 28, 1 ♀, U.S.N.M. Acq. No. 224443.

B.M. (N.H.) Regn. No. 1915 7.24.282–3, 1 ovigerous ♂ (holotype), 1 ♀ (paratype), *Terra Nova* Sta. 220; B.M. (N.H.) Regn. No. 1933.3.23.717–720, 1 ♀ *Discovery* Sta. 195, 1 ♀. Sta. 363; No Regn. No., *Discovery* Sta. 1873, 13:XI:1936, 1 ♂.

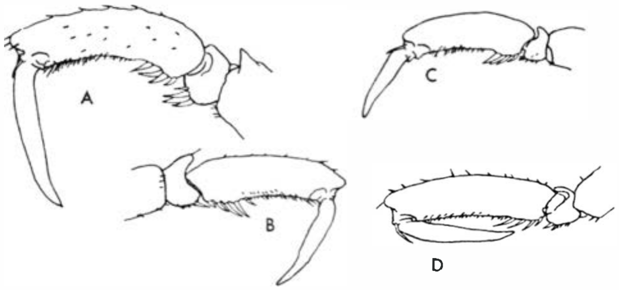

FIG. 183—Terminal segments of 3rd leg in *Austroraptus* species: A, *A. calcaratus*; B. holotype of *A. juvenilis*; C, holotype of *A. praecox*; D, holotype of *A. polaris*.

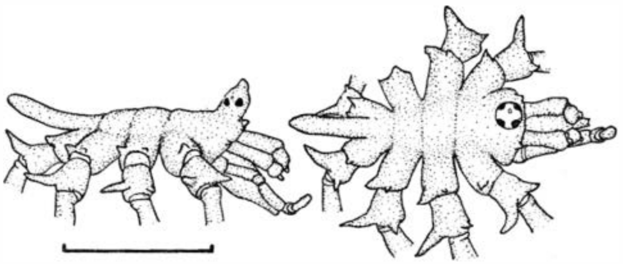

FIG. 184—*Austroraptus polaris*: lateral and dorsal views of holotype. (The scale represents 1 mm.)

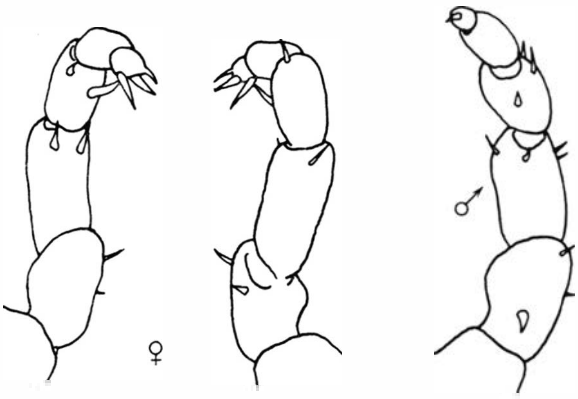

FIG. 185—*Austroraptus polaris*: left, two aspects of terminal segments of female oviger; right, terminal segments of male oviger.

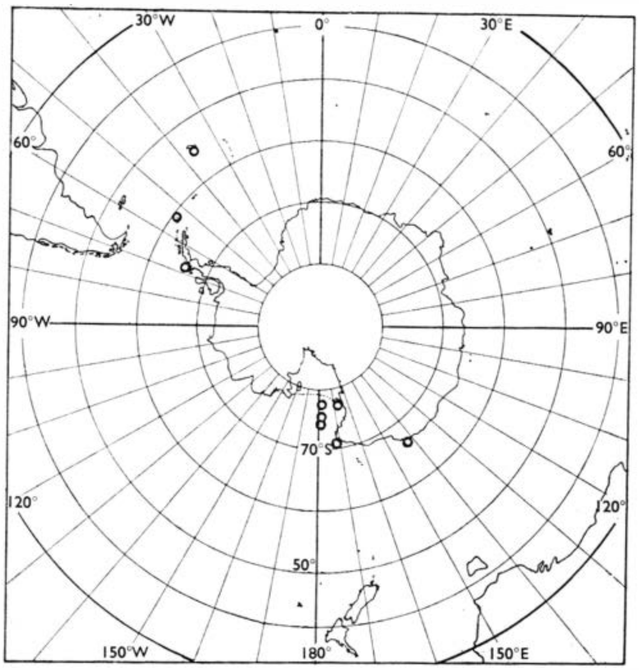

FIG. 186—Distribution records of *Austroraptus polaris*.

DESCRIPTION (Based on 16 adults)

PALP: Palp 8-segmented, segments 6–8 articulated but without musculature (in one female from NZOI Sta. A450 the 3rd segment is undefined, cf. *A. calcaratus*): 4th segment with 12 short, stout spines on the endal surface, 8 on the ectal; dense fields of similar spines on the ventro-lateral aspect of segments 5–8.

TRUNK: Somites all firmly fused (in three specimens faint dorsal sutures are visible); no dorsal transverse ridges or median dorsal processes; ocular tubercle waisted, with a low rounded to tall slender spire (spire totally absent in one specimen), four pigmented eyes of subequal size; anterior cephalic spurs absent or present as minute cones; 1st and 2nd lateral processes separated by 0–0.25; all lateral processes have one or two dorsal distal spurs.

ABDOMEN: Abdomen at an angle of between 30° and 40° to the longitudinal axis of the trunk, without strong setae or spurs.

PROBOSCIS: Proboscis shape D: 1 or D: 2: E (curvature very slight), narrowing abruptly in distal third.

CHELICERAE: Fingers atrophied in adults; scape without strong setae or distal spurs, greatest width in distal quarter, 0.35–0.75 times the length; scape length decreasing with increasing leg length, while the reduced chela continues to increase in length.

LEG: Lengths of adults 13–18 mm; 1st coxae with two dorsal distal spurs, the posterior much the larger; femur or 2nd tibia the longest segment; sparse scattering of setae on all aspects of the long segments, the longest setae not longer than half the diameter of the segment on which they are sited; no lateral distal spurs on 2nd tibiae; tarsus with one large ventral spine; propodus with proximal row of four to eight large sole spines, 20–30 small distal sole spines in four irregular tracts; accessory claws 0.15–0.05 times the length of the main claw, frequently lost after the onset of sexual maturity; where not lost, accessory claws decreasing in size relative to the length of the main claw.

OVIGER: Oviger of males and females with many simple spines on the four terminal segments; 10th segment has four setae in males and three setae in females; 9th segment has one seta in females; 6th segment of males has, as well as finer setae, four stout spines.

REPRODUCTION: Sexual maturity attained at leg lengths of approximately 13 mm; leg length of smallest recorded adult female 13.08 mm; leg length of smallest ovigerous male 14.40 mm; eggs approximately 0.16 mm in diameter; ovigerous and larvigerous males taken in January.

DISTRIBUTION

The known localities are shown in Fig. 196. Specimens have been taken at depths of 40–472 m.

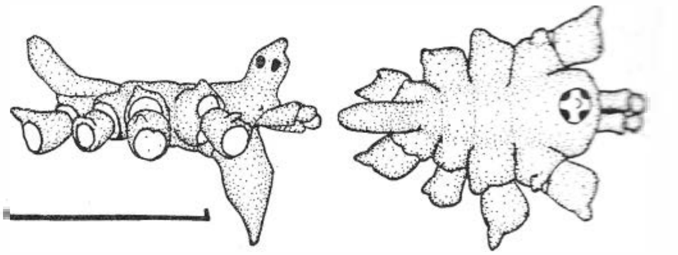

FIG. 187—*Austroraptus juvenilis*: lateral and dorsal views of paratype. (The scale represents 1 mm.)

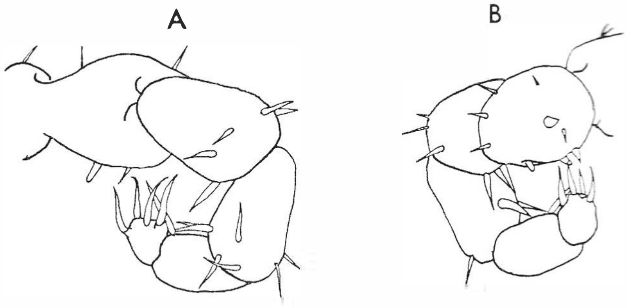

FIG. 188—*Austroraptus juvenilis*: terminal segments of male oviger. A, *Discovery* Sta. 1873; B, holotype (ovigerous.)

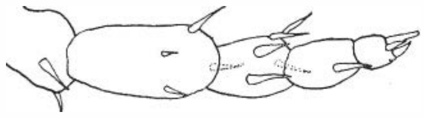

FIG. 189—*Austroraptus juvenilis*: terminal segments of female oviger. Female from N.Z.O.I. Sta. A 467.

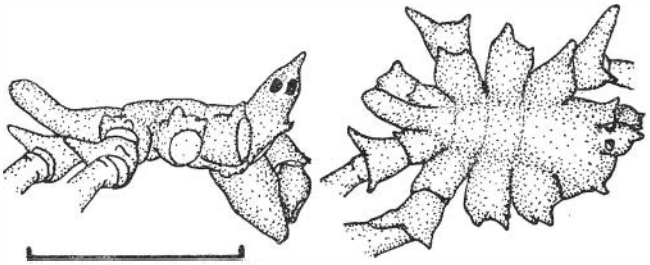

FIG. 190—*Austroraptus praecox*: lateral and dorsal views of holotype. (The scale represents 1 mm.)

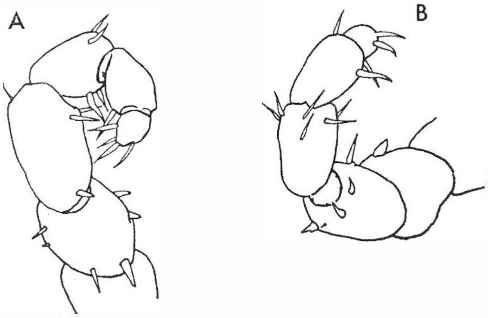

Fig. 191—*Austroraptus praecox*: terminal segments of left ovigers of males. A. holotype; B, B.M. (N.H.) Regn. No. 1933.3.23. 715-6.

GROWTH PARAMETERS (relative to increase in total leg length):

L. trunk . . $y' = 0.113x + 0.44$ (Fig. 174)
L. proboscis . . $y' = 0.089x + 0.09$ (Fig. 176)
L. palp . . $y' = 0.160x - 0.74$ (Fig. 177)
L. chela . . $y' = 0.025x - 0.19$ (Fig. 178)
L. scape . . $y' = -0.033x + 0.96$ (Fig. 180)

Austroraptus praecox Calman, 1915. (Figs. 174–183, 190–193)

Austroraptus praecox Calman, 1915b: 65–6; 19. Gordon, 1932: 114. Helfer and Schlottke, 1935: 291. Gordon, 1938: 24. Gordon, 1944: 57–8; 20a, b.

MATERIAL EXAMINED

Edisto Sta. 28, 1 ♀.
B.A.N.Z.A.R.E. Sta. 41, 1 ♀; B.A.N.Z.A.R.E. Sta. 105, 1 ♂.
B.M. (N.H.) Regn. No. 1915.7.24.284, 1 ♂ (holotype), *Terra Nova* Sta. 220; B.M. (N.H.) Regn. No. 1933.3.23.715–6, 2 ♂♂, *Discovery* Sta. 44; B.M. (N.H.) Regn. No. 1935.11.7.10–11, 1 ovigerous ♂, 1 ♀, A.A.E. Sta. 67° S, 142° 36′ E.

DESCRIPTION

Based on eight adults.

PALP: Palp 6-segmented, the terminal segment without trace of subdivision; 4th segment with 12 short, stout spines on the endal surface, 8 or 9 on the ectal; segment 5 has similar spines on the ventral distal surface; segment 6 with a dense field of spines on the ventrolateral surfaces.

TRUNK: Somites all firmly fused; faint dorsal sutures visible in some specimens; no median dorsal processes or transverse dorsal ridges; ocular tubercle taller than basal diameter is long, with steeply conical spire; four pigmented eyes, the anterior pair slightly larger than the posterior pair; anterior cephalic spurs conical and well developed; 1st and 2nd lateral processes separated by 0–0.2; all lateral processes with two dorsal distal spurs, the posterior the larger in each pair.

ABDOMEN: Borne at an angle of 20°–30° to the longitudinal axis of the trunk; devoid of strong setae or spurs.

PROBOSCIS: Shape D: 1 or D: 2: E (curvature very slight); diameter decreasing abruptly in the distal third.

CHELICERAE: Fingers functional in adults, well developed; scape with a distal dorsal groove, the sides of which are variably extended to form two conical spurs; greatest width of scape, in distal quarter, 0.4–0.95 times the length; scape and chela articulated anaxially; length of scape decreases as leg length increases; palm globular, as wide as long; fingers stout, only slightly curved distally, as long as palm; moveable finger slightly longer than immoveable finger; total length of chela increases as leg length increases. (Note size of chela of holotype in Fig. 190.)

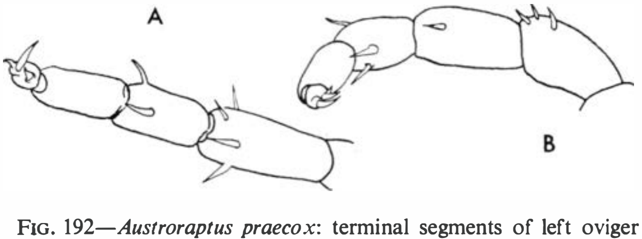

FIG. 192—*Austroraptus praecox*: terminal segments of left oviger of females.

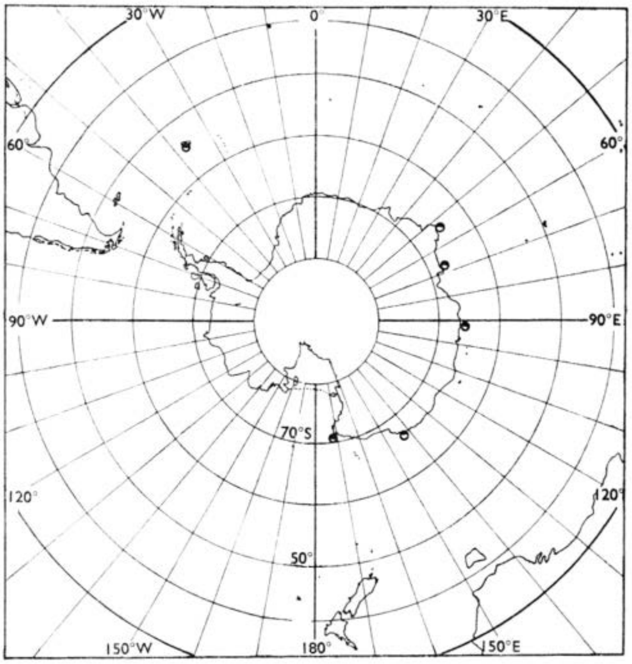

FIG. 193—Sites of collection of *Austroraptus praecox.*

LEG: Lengths of adults 12–24 mm; 1st coxae with two dorsal spurs, the posterior the larger; femur or 2nd tibia the longest segment; no lateral distal spurs on 2nd tibiae; long segment has on all aspects a sparse irregular covering of setae, of which the longest are 0.25–0.5 times the length of the diameter of the segments on which they are sited; tarsus with two large ventral spines; propodus with a row of four large proximal sole spines, 20–40 smaller distal sole spines in four irregular rows; accessory claws relatively larger than in *A. juvenilis*, 0.2–0.45 times the length of the main claw, frequently lost.

OVIGER: Oviger of males and females with many simple spines on the four terminal segments; 10th segment has four setae in males, three in females; 9th segment in females without any setae; 6th segment in males has three widely separated stout spines.

REPRODUCTION: Sexual maturity attained at leg lengths of approximately 12 mm; smallest recorded adult female with leg length of 14.04 mm; smallest ovigerous male with leg length of 11.94 mm; egg diameter approximately 0.16 mm; ovigerous males have been taken in September and January.

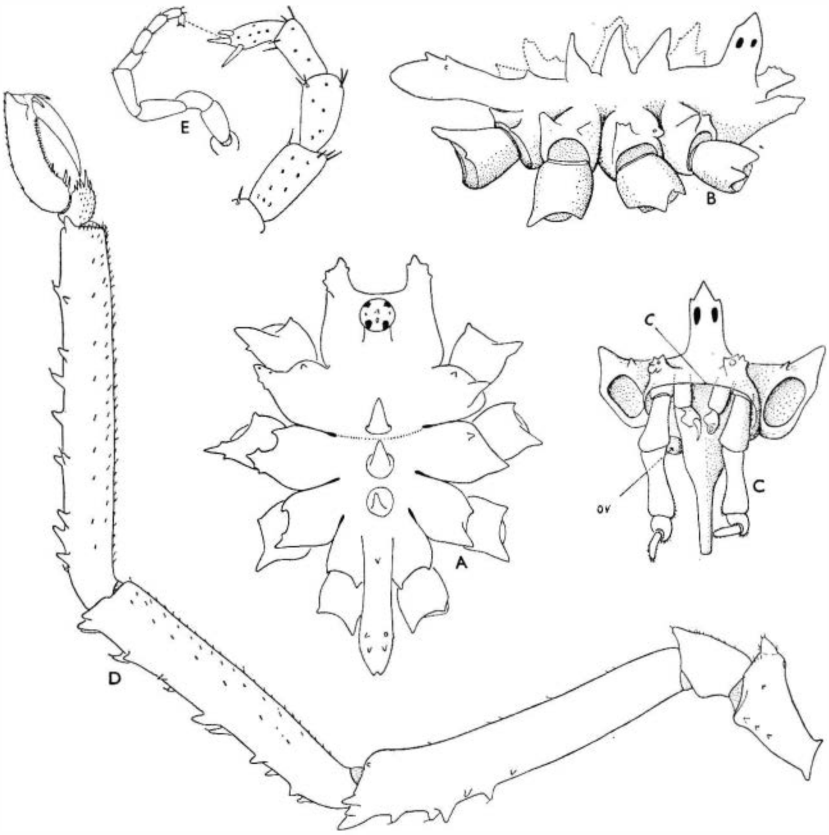

FIG. 194—*Austroraptus calcaratus*: A, trunk and abdomen from dorsal aspect; B, lateral aspect of trunk and abdomen; C, anterior view of proboscis, chelicerae, and cephalic somite, showing the cephalic collar *(c.)*; D, 4th leg; E, oviger. *OV.* = basal protuberance of oviger. (This figure is reproduced by permission of Dr Isabella Gordon and the Mawson Institute.)

DISTRIBUTION

Recorded localities are shown in Fig. 193. Specimens have been taken at depths of 50–209 m.

GROWTH PARAMETERS (relative to increase in total leg length):

L. trunk .. $y' = 0.057x + 1.42$ (Fig. 174)
L. proboscis .. $y' = 0.067x + 0.2$ (Fig. 176)
L. palp .. $y' = 0.06x + 0.6$ (Fig. 177)
L. total chela.. $y' = 0.04x + 0.13$ (Fig. 178)
L. scape .. $y' = -0.046x + 1.35$ (Fig. 180)

Austroraptus calcaratus Gordon, 1944. (Figs. 174, 176–183, 194–196)

Austroraptus calcaratus Gordon, 1944: 58–62; 21a–e.

MATERIAL EXAMINED

B.M. (N.H.) Regn. No. 1964.10.26.2, 1 ♀, (holotype), B.A.N.Z.A.R.E. Sta. 107.

DESCRIPTION

Based on holotype alone.

PALP: Palp 5-segmented, the two long segments not separated by a short segment as in other species; 5th segment without traces of subdivision; 3rd segment with 5 stout spines on the endal surface, 11 on the ectal; sparse irregular scattering of similar spines on ventral distal surface of segment 4, and distal and ventrolateral surfaces of segment 5.

TRUNK: Somites all firmly fused, with dorsal sutures visible between 1st and 2nd; no dorsal transverse ridges, but single, tall, steeply conical median dorsal processes on somites 1–3; anterior cephalic spurs extended forward to form two anterior flanges with sharply irregular surfaces; ocular tubercle taller than wide, waisted basally, with low spire, and four pigmented eyes of subequal size; 1st and 2nd lateral processes contiguous; all lateral processes with two strong dorsal distal spurs with sharply irregular surfaces.

ABDOMEN: Abdomen at an angle of less than 20° to the longitudinal axis of the trunk; with one dorsal proximal, and four dorsal distal, sharp conical spurs.

PROBOSCIS: Proboscis shape C: 2: E''', the curvature more pronounced than in other species of the genus.

CHELICERAE: Fingers atrophied in adults; scape devoid of strong setae or spurs, its greatest width—0.66 times the length—in the basal quarter; palm as wide as long, the right chela only with a strongly curved moveable finger.

LEG: Length 17.82 mm; 1st coxae bearing two dorsal distal spurs, with sharply irregular surfaces, the posterior of each pair the larger; 2nd tibia the longest segment; dorsal surfaces of all three long segments with curved conical papillae, some with short setae; 2nd tibiae with two small distal lateral spurs (papillae) which do not obscure the tarsus in side view; three long segments with sparse scattering of short setae on the ventral and ventrolateral aspects; tarsus with four large ventral spines; propodus slightly curved, without strong heel, but a row of four large proximal sole spines; four irregular distal rows of small spines; accessory claws approximately 0.25 times the length of the main claw, apparently lost on occasion.

OVIGER: Oviger of female with many setae on the terminal segments; 10th segment with three setae, 9th segment with four or five setae.

REPRODUCTION: Sexual maturity attained at leg lengths of 17 mm or less; no ovigerous or larvigerous males known.

DISTRIBUTION

Figure 196 shows the locality of the holotype, which was taken from 219 m.

RELATIVE GROWTH PARAMETERS

The relative proportions of the holotype, compared with the relative growth trends of the other species of the genus, are shown in Figs. 174, 176–181.

DIMENSIONS OF THE HOLOTYPE

LEFT PALP:

Segment 5	0.43 mm
Segment 4	0.26
Segment 3	0.98
Segment 2	0.70
Total palp length	2.37
Proboscis length	2.78
Scape length	0.47
Greatest scape width	0.47
Total chela length	0.34 (right) 0.25 (left)

THIRD LEFT LEG:

Coxa 1	0.55
Coxa 2	1.41
Coxa 3	0.51
Femur	3.92
Tibia 1	3.68
Tibia 2	4.74
Tarsus	0.27
Propodus	1.53
Main claw	1.21
Total leg length	17.82
Accessory claw length	0.31

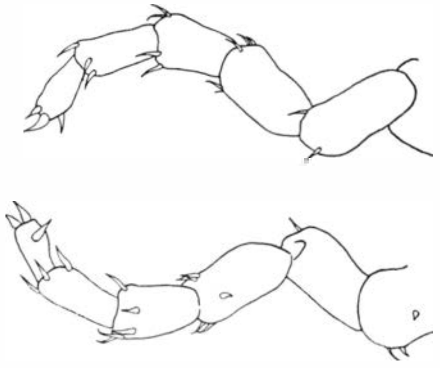

FIG. 195—*Austroraptus calcaratus*: two aspects of the terminal segments of the left oviger of the holotype (♀).

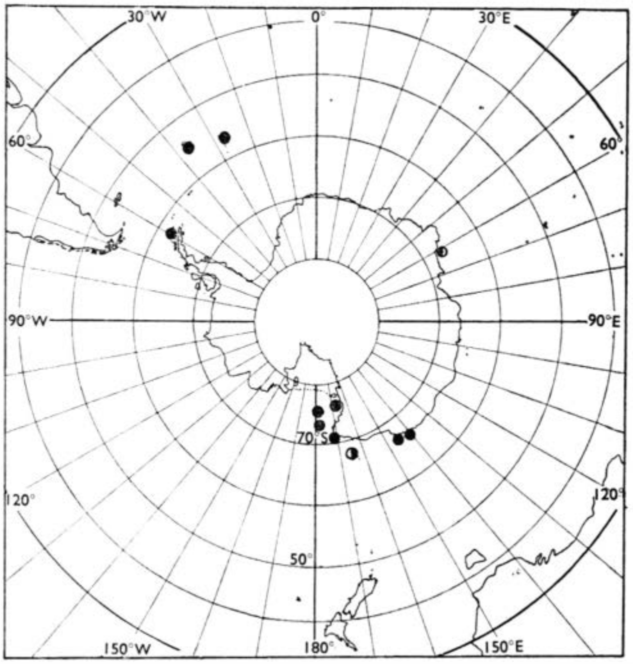

FIG. 196—Distribution records of *Austroraptus juvenilis* (solid circle), *A. calcaratus* (circle with right half shaded), and *A. sicarius* (circle with left half shaded.)

Austroraptus sicarius* n. sp. (Figs. 174, 176–182, 196–200)

MATERIAL EXAMINED

North Wind Sta. 9, 1 ♂ (holotype).

DESCRIPTION

Based on the holotype alone.

PALP: Palp 8-segmented, segments 6–8 freely articulated but without musculature; 4th segment with 22 short, stout spines on the endal surface, 15 on the ectal;

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*Sicarius, an assassin.

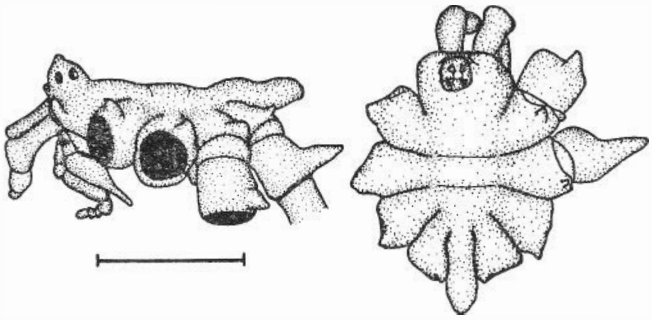

FIG. 197—*Austroraptus sicarius* n. sp.: lateral and dorsal aspects of holotype (♂). (The scale represents 1 mm.)

dense fields of similar spines on ventral distal surface of segment 5, ventral surfaces of segments 6–8.

TRUNK: Somites all firmly fused, dorsal sutures visible between somites 1, 2, and 3; no dorsal transverse ridges or dorsal median projections; ocular tubercle a rounded cone, wider than tall, with low, rounded spire, four eyes subequal in size; anterior cephalic spurs low, rounded flanges; 1st and 2nd lateral processes separated by 0; all lateral processes with a single low, posterior distal dorsal spur.

ABDOMEN: Abdomen at an angle of less than 20° to the longitudinal axis of the trunk, without strong setae or spurs, but with a pronounced basal swelling.

PROBOSCIS: Shape C: 1, tapering to a very small distal diameter.

CHELICERAE: Fingers persistent and functional in adults; scape devoid of strong setae or spurs, its greatest width in the distal quarter 0.51 times the length; scape and chela articulated anaxially; palm width 0.59 times the length; fingers strongly curved, of subequal length.

LEG: Length 21.62 mm; 1st coxae with a single strong posterior distal dorsal spur; 2nd tibia the longest segment, bearing two strong distal lateral spurs which partially mask the tarsus in lateral aspect; all three long segments have a very sparse covering of setae, the longest not more than 0.25 times the diameter of the segments on which they are sited; tarsus with two large ventral spines; propodus strongly arched, with well pronounced heel, with eight or nine large proximal sole spines arranged in an irregular row, 30–40 smaller distal sole spines in a narrow tract; accessory claws on all legs, 0.25 times the length of the main claw.

OVIGER: Oviger of male with many setae on the terminal segments; 10th segment has four setae, 9th segment one seta; 6th segment has four stout spines, two of which are very close together.

REPRODUCTION: Sexual maturity attained at leg lengths of 21 mm or less; no ovigerous or larvigerous males, or adult females known; male genital pores on strong ventral protuberances on the 2nd coxae.

DISTRIBUTION

Fig. 196 shows the locality of the holotype, which was taken at a depth of 380 m.

RELATIVE GROWTH PARAMETERS

The relative proportions of the holotype, compared with the relative growth trends of other species of the genus, are shown in Figs. 174, 176–181.

DIMENSIONS OF THE HOLOTYPE

LEFT PALP:

Segment 8	0.17 mm
Segment 7	0.09
Segment 6	0.07
Segment 5	0.23
Segment 4	0.71
Segment 3	0.16
Segment 2	0.69
Total palp length	2.12
Trunk length	2.74
Proboscis length	1.21
Scape length	1.08
Greatest scape width	0.55
Palm length	0.59
Finger length	0.31
Total chela length	0.90
Greatest palm width	0.35

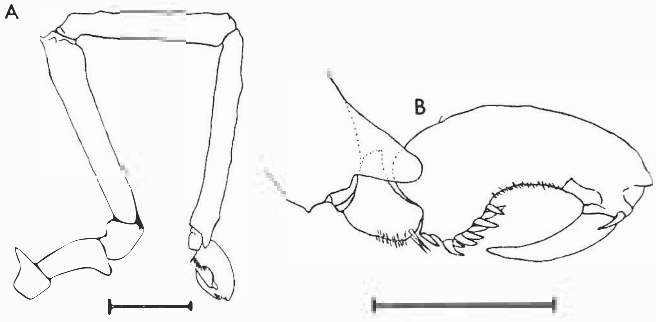

FIG. 198—*Austroraptus sicarius* n. sp.: A, 3rd right leg (scale represents 1 mm.) B, terminal segments of 3rd leg. (The scale represents 0.5 mm.)

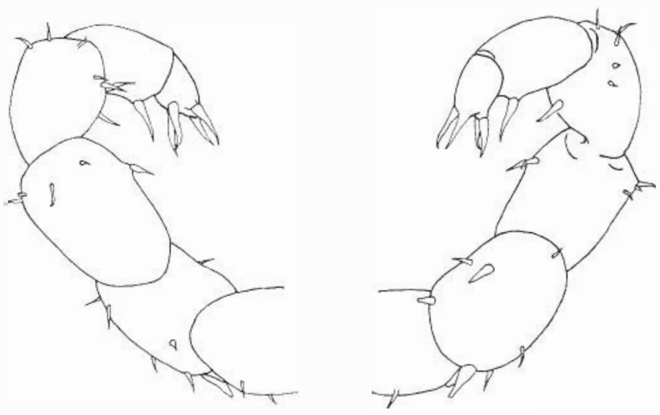

FIG. 199—*Austroraptus sicarius* n. sp.: two aspects of the terminal segments of the left oviger of the holotype (♂).

THIRD LEFT LEG:

Coxa 1	0.80
Coxa 2	1.77
Coxa 3	0.97
Femur	5.24
Tibia 1	4.51
Tibia 2	5.32
Tarsus	0.39
Propodus	1.72
Main claw..	0.90
Total leg length	21.62
Accessory claw length	0.23

Genus **Ascorhynchus** Sars, 1877

Palp 9-segmented; trunk of four distinct articulated somites, with or without strong dorsal transverse ridges or projections; ocular tubercle with well developed eyes; proboscis of distinctive shape, B or C: 1, capable of a wide range of movement in vertical plane; chelicerae present, but fingers atrophied in adults; scape 1-segmented; tarsus short and arcuate to long, cylindrical, more than half as long as propodus; propodal sole spines homogeneous in size and shape; accessory claws absent; ovigers 10-segmented, plus an additional terminal claw, segments 8 and 7 articulated anaxially, similar in both sexes, with numerous denticulate spines on the four terminal segments.

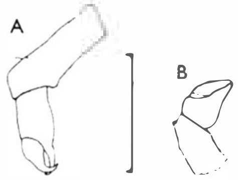

FIG. 200—A, left chelicera of holotype of *Austroraptus sicarius*; B, right chelicera of holotype of *A. praecox*. (The scale represents 0.5 mm.)

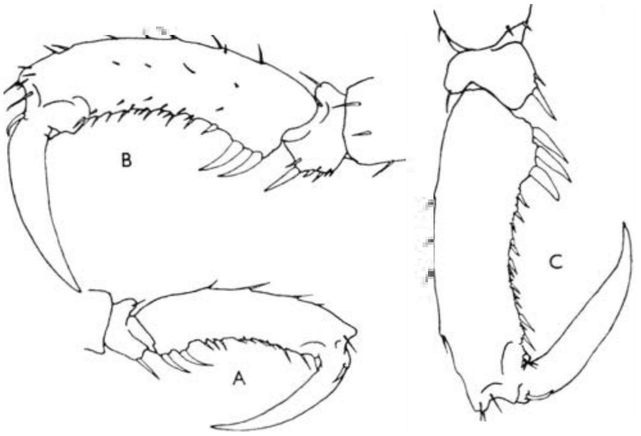

FIG. 201—Terminal segments of 3rd legs of juvenile *Austroraptus*: A, 3rd right leg of specimen from *Burton Island* Sta. 5 (total leg length 5.99 mm); B, 3rd left leg of specimen from *Discovery* Sta. 123 (total leg length 8.93 mm); C, 3rd left leg of specimen from *Terra Nova* Sta. 220 (total leg length 9.66 mm). (All to the same scale.)

FIG. 202—Chelicerae of juvenile *Austroraptus* specimens: A, right chelicera of specimen from *Terra Nova* Sta. 220 (total leg length 9.66 mm); B, specimen from *Burton Island* Sta. 5 (total leg length 5.99 mm). (Both to the same scale.)

Ascorhynchus cuculus n. sp. (Figs. 203, 204)

Material Examined

Eltanin Sta. 362, 7–8, Dec 1962; 57° 08.5′ S, 58° 57.8′ W to 57° 59.7′ S, 58° 50′ W; 3,475–3,588 m, 1 larvigerous ♂, holotype, U.S.N.M. Acq. No. 113001.

Description

A graceful, clean-limbed species without conspicuous spination.

LATERAL PROCESSES: Long and well separated, giving the body a broadly elliptical outline; cephalic somite produced forward as a heavy neck supporting the various anterior appendages, including ovigers; cephalic somite broadest just anterior to the eye tubercle, with a pointed conical anterior cephalic lobe, a smaller, median conical process dorsally over the insertion of the palps; eye tubercle massive, irregular, with several smaller processes above the small eyes; at the posterior margin of the cephalic segment and trunk somites 2 and 3 is an erect conical tubercle—this is produced as the median part of the ring-like process marking the posterior margin of the somites; ovigers seated in the cephalic somite anterior to the first pair of legs.

LATERAL PROCESSES: Separated by slightly more than 1.0, diverging distally with a dorsal conical tubercle at the end of each; lateral processes of the last segment short; abdomen situated ventrally so that it projects downward.

PROBOSCIS: Directed ventrally, triangular in cross section, shape B:1.

CHELICERAE: Short; scape cylindrical, chela reduced to a knob.

PALP: Slender second segment the longest, 4th the next longest; 5th the shortest; the four terminal segments long, slender, and progressively shorter distally.

LEG: Slender, femur and 1st tibia subequal; 2nd tibia slightly shorter; tarsus shorter than propodus or terminal claw; terminal claw long, slender and pointed; no accessory claws.

OVIGER: Oviger simple, without heavy spines, but a series of reversed spines on the 6th segment; terminal claw short, without denticulations. On the holotype the ovigers carry two large molluscan eggs, each with a diameter of about 1.44 mm; hidden between the two eggs is a small larval mass with unhatched protonymphon larvae about 0.05 mm wide. The presence of the mollusc eggs has possibly prevented the animal from building up a large egg mass, or the foreign eggs may have crowded some of the original eggs off (Hedgpeth, 1964).

DIMENSIONS OF ♂ HOLOTYPE

Palp length	2.8 mm
Trunk length	3.0
Proboscis length	1.5
Cephalic somite	
length	1.4
width	0.5
2nd lateral process width	2.0
Chelicerae	
scape length	0.9
chela length	0.1
Oviger length	5.5
Third leg	
Coxae	1.75
Femur	1.7
Tibia 1	1.65
Tibia 2	1.3
Tarsus	0.8
Propodus	0.6
Main claw	0.9
Total leg length	8.7

DISCUSSION

This species appears to be closely related to *Ascorhynchus cryptopygium* Ortmann (see Utinomi, 1955) from Sagami Bay in general aspect, proportions, and the ventral position of the abdomen. The proboscis, however, is much broader at the tip than in *cryptopygium*, and lacks a definite constriction in the basal third. The eye tubercle is broader, situated near the centre of the cephalic projection instead of near the base over the insertion of the ovigers (as in *cryptopygium*), and has conspicuous bosses or processes that give it an irregular lumpy appearance.

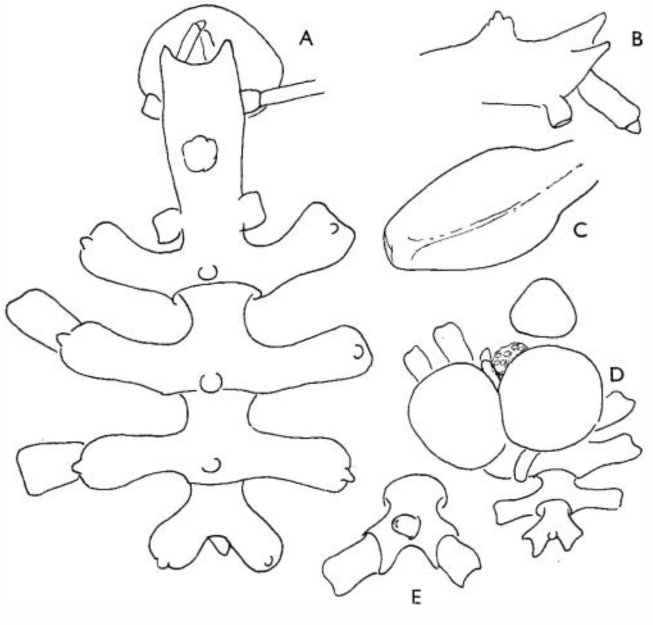

FIG. 203—*Ascorhynchus cuculus* n. sp. A, dorsal view of holotype; B. lateral view of anterior part of cephalic somite; C, lateral view of proboscis; D, ventral view, showing two large molluscan eggs on ovigers; E, ventral view of posterior trunk somite and abdomen.

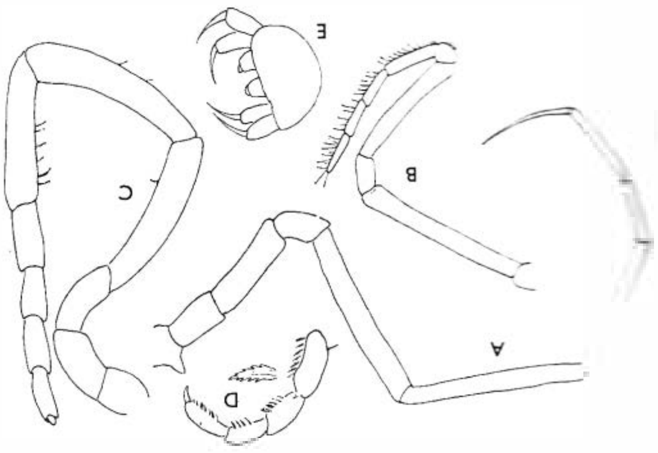

FIG. 204—*Ascorhynchus cuculus* n. sp. A, 3rd right leg; B, palp; C, oviger; D, terminal segments of oviger; E, protonymphon from egg and larval mass.

Genus **Cilunculus** Loman, 1908

Cilunculus, Stock, 1955a: 255–7; Clark, 1963: 71–5.

Species ascribed to this genus can be separated from most species of *Ammothella* by the anterior part of the cephalic somite, which projects as an overhanging rim or hood in which the chelicerae and palpi are seated. The males also have strongly developed femoral cement gland tubes (as some species of *Ammothella*). The oviger is like that of *Ammothella*, especially in the structure and spination of the terminal claws. Usually there are auxiliary claws. All described species have long, slender spines often curved, on the lateral processes and legs.

At best, *Cilunculus* is an uneasy genus, mostly of deep-water forms. Its close relationship to *Ammothella* is indicated by Fage (1956), who confused the two in identifying Calman's *Cilunculus sewelli* as *Ammothella gigas* n. sp. It is also similar to *Ascorhynchus*, especially in the proboscis. Hence it seems best to avoid specific names in all three genera which might possibly become homonyms on revision of the genera or reassignment of the various species.

The two species described below bring the total number of species described in this genus to nine; they are the first to be recognised from Antarctic waters.

Cilunculus cactoides n. sp. (Figs. 205, 206)

MATERIAL EXAMINED

Atka Sta. 23, 1 ♂, holotype, U.S.N.M. Acq. No. 113006; *Burton Island* Sta. 3, 1 ♂, allotype, U.S.N.M. Acq. No. 113002.
Eltanin Sta. 436, 1 ♀.

DESCRIPTION

A small, exceedingly spinose species.

PALP: Comparatively large for the size of the animal, slender and spiny.

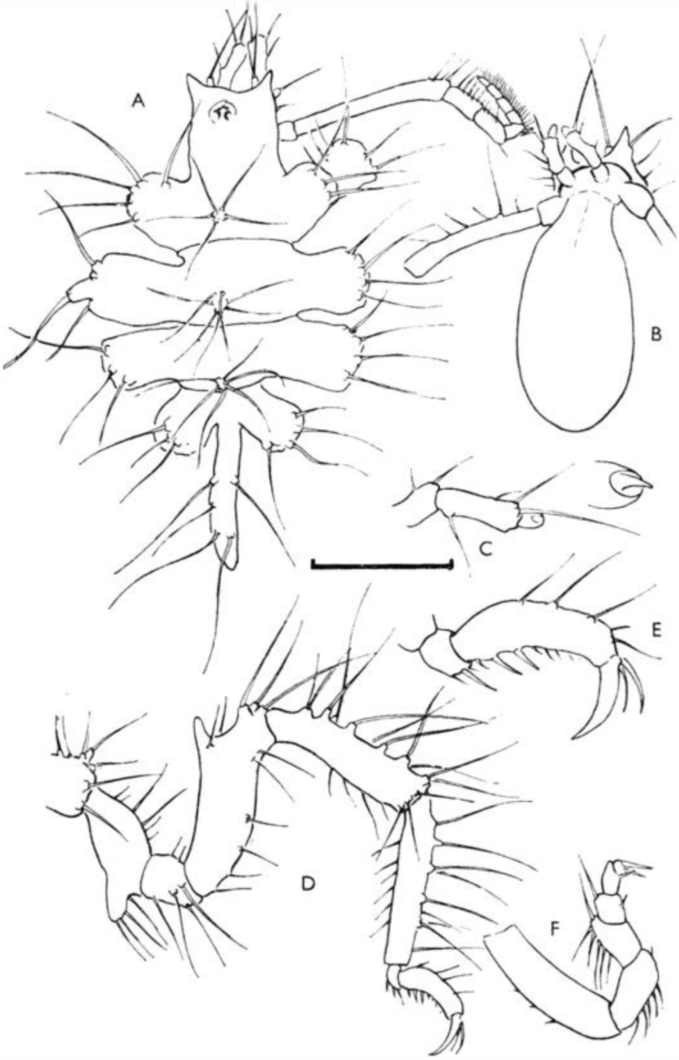

FIG. 205—*Cilunculus cactoides* n. sp. A, dorsal view of holotype; B, anterior view of holotype; C, chelicera of holotype (with detail of tip); D, leg of holotype; E, tarsus and propodus; F, terminal segments of oviger. (The scale represents 1 mm.)

TRUNK: Oval in outline, lateral processes narrowly separated, trunk somites distinct; cephalic somite produced forward with spiny anterior cephalic spurs; eye tubercle tall, rounded; eyes conspicuous and well developed; on the three anterior trunk somites there are median tubercles flanked by smaller tubercles with large spines; similar complexes of spiny tubercles at the ends of the lateral processes; abdomen long, with spinose tubercles. There are so many spiny tubercles that it is impossible to decide how many there are, or to measure the specimen accurately.

CHELICERAE: Chelicerae 3-segmented, the terminal segment with a spur-like dactyl set in a hollow; large spines on the two scape segments.

OVIGER: Terminal segments with rather large spines, which do not appear to be strongly denticulate.

LEGS: Short, heavily spinose; many of the spines arising from elevated tubercles; large genital prominence on the 2nd coxa of the male, a short, heavy cement gland spigot on the femur at about a third the distance from the distal end; tarsus short, with a few basal spines; propodus with three large basal spines and several smaller ones on the sole; terminal claw approximately two-thirds as long as propodus, curved; accessory claws well developed, about half as long as the terminal claw.

DIMENSIONS OF HOLOTYPE ♂

Trunk length	2.3 mm
Proboscis length	1.6
Abdomen length	0.97
Cephalic somite length	1.1
2nd lateral process width	1.45
Leg length	
Coxa 1	0.3
Coxa 2	0.6
Coxa 3	0.24
Femur	1.2
Tibia 1	1.1
Tibia 2	1.2
Tarsus	0.12
Propodus	0.6
Main claw	0.3
Accessory claw	0.12
Total leg length	5.78

DISCUSSION

This species resembles *Cilunculus australiensis* Clark, but is more spinose. The dorsal tubercles are lower than the eye tubercle, however, and the cement gland spigot is differently located (in *C. australiensis* it is at the end of the femur). The ovigeral spines are not strongly denticulate as in Clark's species.

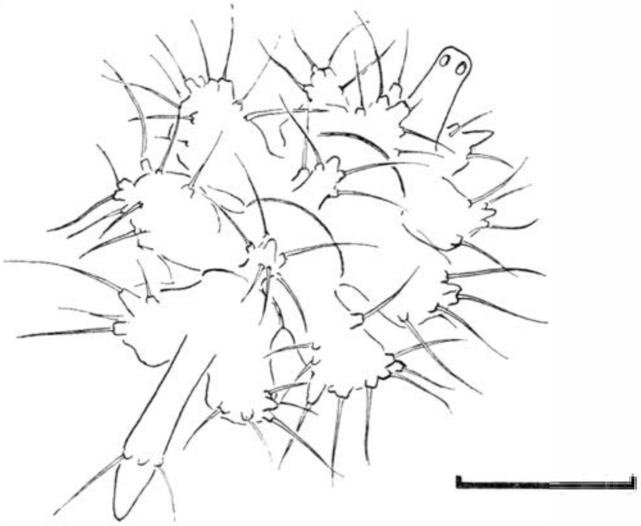

FIG. 206—*Cilunculus cactoides* n. sp. Habit sketch from dorsal rear, showing appearance of spination and eye tubercle. (The scale represents 1 mm.)

DISTRIBUTION

Specimens have been taken in the Ross Sea and off the South Shetlands, at depths of 72–433 m.

Cilunculus acanthus n. sp. (Fig. 207–209)

MATERIAL EXAMINED

Eltanin Sta. 268, 10 ♂, 6 ♀♀, 1 juv.
Holotype, 1 ovigerous ♂, U.S.N.M. No. 112003; allotype, ♀ U.S.N.M. No. 113004; Paratype ♂ B.M. (N.H.) Regn. No. 1966.3.11.4; ♀ paratype, B.M. (N.H.) Regn. No. 1966 3.11.5.

DESCRIPTION

Based on 16 adults and 1 juvenile.

PALP: Palp 9-segmented, terminal segments with a dense armature of long spines ventrally.

PROBOSCIS: Proboscis shape B:1, not much longer than wide, mouth large, triangular.

TRUNK: Trunk rather stout but graceful; lateral processes widely separated and diverging so that their ends describe an ellipse; trunk somites articulated, raised posteriorly in ring-like expansions. Each trunk somite except the last has a tall pointed median dorsal tubercle on the posterior swelling, that of the cephalic somite being the lowest; ocular tubercle two or three times taller than the trunk tubercles, slender and pointed; eyes indistinct, near the tubercle apex; abdomen about three-quarters the trunk length, swelling to its largest diameter near the tip; a very long, erect, slender spine at the median dorsal distal margin of each lateral process, lateral and dorsal spines at the middle of the abdomen.

CHELICERAE: Chelicerae 3-segmented, long spines at the end of the 2nd segment; chelae subchelate, small.

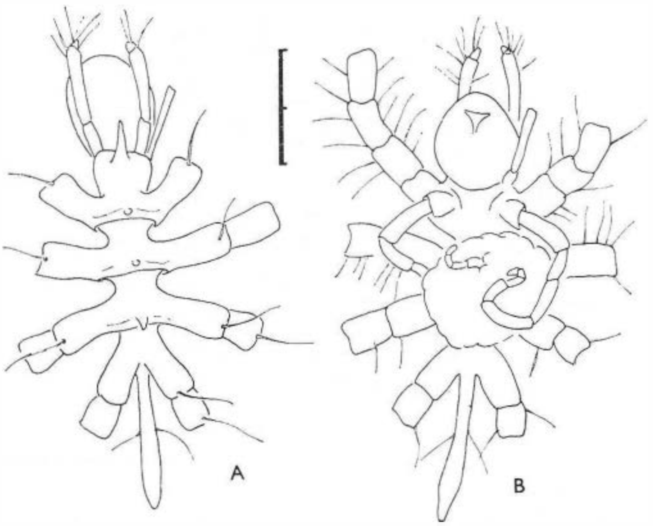

FIG. 207—*Cilunculus acanthus* n. sp. A, dorsal view of allotype ♀; B, ventral view of holotype ♂. (The scale represents 2 mm.)

OVIGER: Oviger of male large, stout, 10-segmented, 7th segment with recurved spines, terminal segment with two heavy denticulate spines with four large denticulations on each side; single large denticulate spines on segments 8 and 9, and probably also on segment 7.

LEGS: Female slightly slenderer in general aspect, with slightly swollen femur, without the conspicuous cement gland tube; somewhat less spinose than male. Very long, straight spine at end of femur in both sexes; this is often broken off. Many, slender, curved spines on coxae and long segment of legs. These spines are several times as long as the diameter of the leg segments; long straight cement gland tubercle just beyond the middle of the femur in the male. The cement gland lies just beneath the dorsal part of the broad base of the tubercle; propodus without basal spine or heel; terminal claw about half as long as propodus; accessory claws absent.

DIMENSIONS	Holotype ♂	Allotype ♀
Trunk length	3.5 mm	3.75 mm
Proboscis length	1.8	2.0
Proboscis width (max.)	1.5	1.5
Abdomen length	2.8	3.0
Cephalic somite length	1.5	1.25
2nd lateral process width	3.3	3.3
THIRD LEG:		
Coxa 1	0.8	0.8
Coxa 2	1.2	1.0
Coxa 3	0.8	0.8
Femur	2.5	2.4
Tibia 1	3.2	3.2
Tibia 2	2.9	3.0
Tarsus	0.1	0.1
Propodus	0.9	1.0
Main claw	0.6	0.6
Total leg length	13.0	12.9

DISTRIBUTION

The type locality is 64°1.2′S, 07°44′7″ to 64°07′S, 67°44′W, depth approximately 2,700 m.

DISCUSSION

This species differs from others of its genus in lacking accessory claws. As Hedgpeth (1949) has suggested, the presence or absence of auxiliary claws is probably not a good generic character in the Ammotheidae (cf. *Austroraptus*). *Cilunculus acanthus* appears to be closest to *C. hirsutus* Clark, from New South Wales, but is distinct in the structure of the male oviger, size and position of the large femoral cement gland tube, and shape and size of the proboscis, which is shorter and more globose than in *hirsutus*. *C. acanthus* also has fewer denticulations on the ovigeral spines. The chela lacks the peg-like dactyl described for *C. hirsutus*; in *C. acanthus* it is a blunt lobe.

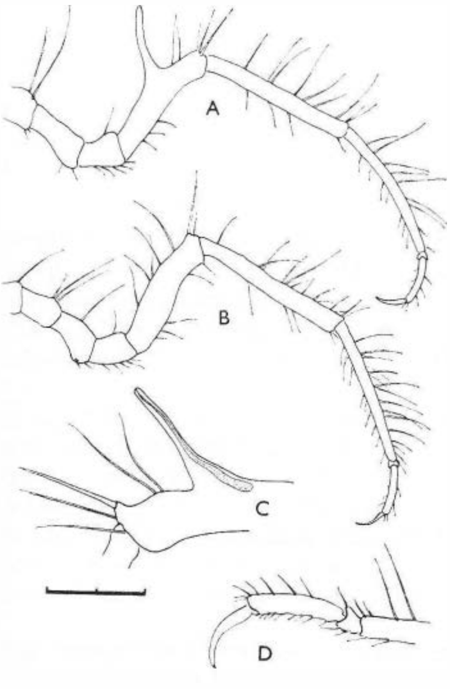

FIG. 208—*Cilunculus acanthus* n. sp. A, 3rd right leg of holotype ♂; B, 3rd right leg of allotype ♀; C, detail of cement gland tube from A; D, detail of terminal segments of A. (The scale (for A and B) represents 2 mm.)

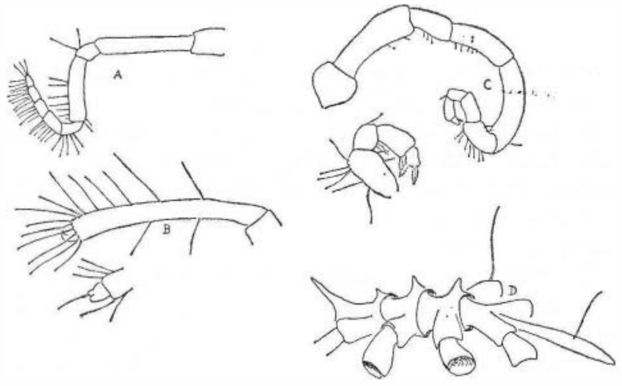

FIG. 209—*Cilunculus acanthus* n.sp. A, palp of holotype; B, chelicera of holotype; C, oviger of holotype; D, dorsolateral view of allotype.

ZOOGEOGRAPHY

Although this first section of the report concerns only 17 of a total of 26 Antarctic genera, these 17 genera illustrate clearly a number of important features of the distribution and zoogeography of the Antarctic pycnogonids. This material has also provided the basis for discussion of distribution patterns of pycnogonids by Hedgpeth (1969b).

The most obvious feature is that the Ross Sea is not a distinct faunal province—at least as far as pycnogonids are concerned. Of 17 genera occurring on the Antarctic continental shelf, 12 are represented in the Ross Sea by one or more species (Tables 15 and 16). None of these 12 is endemic to the Ross Sea, 2 are confined to the Ross Sea and Magellanic Region (Antarctic Peninsula, and islands of the Scotia Arc and their surrounding shelves), and 2 are confined to the Ross Sea and the coasts of eastern Antarctica. On the other hand, four genera are represented in the Ross and Weddell Seas, Magellanic Region, and East Antarctica—that is, are circumpolar—while another five genera are presumably also circumpolar, although the absence of records from the relatively little-sampled Weddell Sea does not allow this to be stated with any certainty*. Of the other Antarctic shelf regions only the Magellanic, with 14 genera, has a more cosmopolitan fauna than the Ross Sea.

This picture is repeated at the specific level. Of the 28 species occurring in the Ross Sea, 1 subspecies only is endemic. Four species and 1 subspecies are confined to the Ross Sea and Magellanic Region, 1 species to the Ross Sea and the coasts of eastern Antarctica, and the remaining 22 species and 1 subspecies are circumpolar, or apparently circumpolar.

In general, local endemicity on the Antarctic continental shelf is low. Two monospecific genera are confined to the Magellanic Region, none to the Weddell Sea, and one only to the coasts of eastern Antarctica. In all Antarctic shelf regions so far sampled, the circumpolar element is the largest faunal component.

In contrast to the Ross Sea, the Magellanic Region appears to be faunistically more discrete in some respects, but it is not yet possible to decide whether or not more than one faunistic province can be recognised within the region. Thirteen species and two subspecies of another species are endemic (cf. five species endemic to the coasts of eastern Antarctica, none to the Weddell Sea). The 2°c isotherm between South Georgia and the Falkland Islands, which Fell (1961) and Clark (1963) considered important in limiting migration of asteroids and ophiuroids across Drake Passage, does not appear to be so firmly limiting to the movement of pycnogonids although it, or a similar temperature or salinity barrier (Hedgpeth, 1947, fig. 11 and text), is undoubtedly important.

However difficult northward or southward migrations across Drake Passage may be, there can be no doubt that the Magellanic Region provides the Antarctic pycnogonid fauna with one of its only two present-day links with more northern shelf regions. (The other link is by direct migration along the sea bottom, a route apparently extensively exploited only by *Colossendeis* species.)

Five genera (excluding *Colossendeis*) with species in the Magellanic Region have Australasian representatives, although there are no species common to the two areas. Five genera (excluding *Colossendeis*) occurring in the Magellanic region have species in South American waters. *Ecleipsothremma spinosa* appears to be the only species common to the two areas.

The relationships between the Magellanic, South American, and Australasian faunas are obscured on the one hand by the fact that all four Magellanic—South American genera and all but one of the Magellanic—Australasian genera are represented on other continental shelf regions, and on the other hand by our ignorance of oceanic island forms which might link Magellanic and Australasian species.

Fossil data on the history of southern pycnogonid faunas is totally lacking at present, but there are nonetheless items of evidence of fairly recent migrations from the Magellanic Region to South America and to Australasia. The morphological similarity between *Ammothea* (*Theammoa*) *magniceps* of Australasia and *A.* (*Th.*) *minor* and *A.* (*Th.*) *clausi* of Antarctica (see pp. 70–71, 82–83) suggests migration by Westwind Drift, while the similarity of *Achelia* (*Pigrolavatus*) *sufflata* to other species of the southern South American morphogroup indicates movement across Drake Passage. At present there is no way of estimating accurately the antiquity of these migrations, but their very small number suggests that they probably occurred when the Antarctic Continent and South America and Australasia were widely separated. These general patterns agree on the whole with those of other invertebrate groups that have undergone active speciation in the Antarctic (Hedgpeth, 1969a).

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*All the records in the Weddell Sea to date are of circumpolar species.

TABLE 15. Recorded Distribution of the 17 Genera Discussed in this Bulletin

Genus	Ross Sea	Magellanic Region	Weddell Sea	E. Antarctica	Australasia	S. America	N. Hemisphere
Colossendeis	+	+	+	+	+	+	+
Decolopoda	+	+	−	+	−	−	−
Dodecolopoda	+	−	−	+	−	−	−
Endeis	+	+	−	+	−	+	+
Pycnogonum	+	+	+	+	+	+	+
Pentapycnon	+	+	−	−	−	−	+
Ammothea	+	+	+	+	+	−	−
Athernopycnon	−	−	−	+	−	−	−
Ecleipsothremma	+	+	−	−	−	+	−
Magnammothea	−	+	−	−	−	−	−
Thavmastopycnon	+	+	−	+	−	−	+
Anammothea	−	+	−	−	−	−	−
Achelia	+	+	+	+	+	+	+
Sericosura	−	−	−	+	−	−	−
Aduncorostris	−	−	−	−	+	−	−
Austroraptus	+	+	−	+	−	−	−
Ascorhynchus	−	+	−	−	+	+	+
Cilunculus	+	+	−	−	+	−	+

TABLE 16. Distribution of 49 Species of Antarctic Pycnogonida Discussed in this Bulletin

Species	Ross Sea	Magellanic Region	Weddell Sea	E. Antarctica
Colossendeis megalonyx megalonyx	+	+	−	+
Colossendeis megalonyx scoresbii	−	+	−	−
Colossendeis megalonyx arundorostris	+	−	−	−
Colossendeis megalonyx orcadense	−	+	−	−
Colossendeis robusta	+	+	+	+
Colossendeis stramenti	−	+	−	−
Colossendeis drakei	+	+	−	+
Colossendeis tortipalpis	+	+	−	+
Colossendeis longirostris	−	−	−	+
Colossendeis lilliei	+	+	−	+
Colossendeis scotti	+	+	−	+
Colossendeis wilsoni	+	+	−	+
Colossendeis australis	+	+	−	+
Colossendeis colossea	−	−	−	+
Decolopoda australis	+	+	−	+
Dodecolopoda mawsoni	+	−	−	+
Pycnogonum gaini	+	+	+	+
Pycnogonum rhinoceros	−	+	−	+
Pycnogonum platylophum	−	+	−	+
Pycnogonum eltanin	−	+	−	−
Pentapycnon charcoti	+	+	−	−
Endeis australis	+	+	−	+
Ammothea (Ammothea) carolinensis	+	+	+	+
Ammothea (Ammothea) glacialis	+	+	−	+
Ammothea (Theammoa) clausi	+	+	+	+
Ammothea (Theammoa) minor	+	+	−	+
Ammothea (Mathoma) calmani	+	+	−	−
Ammothea (Mathoma) allopodes	−	−	−	+
Ammothea (Thammota) stylirostris	−	+	−	−
Ammothea (Homathea) longispina	+	+	−	−
Magnammothea gigantea	−	+	−	−
Thavmastopycnon striata	+	+	−	+
Athernopycnon meridionalis	+	+	−	+
Ecleipsothremma spinosa	+	+	−	−
Anammothea tetrapora	−	+	−	−
Achelia (Pigrolavatus) parvula	−	+	−	−
Achelia (Pigrolavatus) fernandeziana	−	+	−	−
Achelia (Pigrolavatus) sufflata	−	−	−	+
Achelia (Ignavogriphus) assimilis	−	+	−	−
Achelia (Ignavogriphus) hoekii	−	+	−	−
Achelia (Ignavogriphus) serratipalpis	−	+	−	−
Achelia (Ignavogriphus) spicata	+	+	+	+
Achelia (Ignavogriphus) communis	+	+	−	+
Sericosura mitrata	−	−	−	+
Austroraptus polaris	+	+	−	+
Austroraptus juvenilis	+	+	−	+
Austroraptus praecox	+	+	−	+
Austroraptus calcaratus	−	−	−	+
Austroraptus sicarius	−	−	−	+
Ascorhynchus cuculus	−	+	−	−
Cilunculus cactoides	+	+	−	−
Cilunculus acanthus	−	+	−	−

REFERENCES

Barnard, K. H. 1954: South African Pycnogonida. *Ann. S. Afr. Mus. 41* (*3*): 81–158; figs. 1–34.

Böhm, R. 1879: Uber die Pycnogoniden des Kgl. zool. Museums zu Berlin, insbesondere uber die von S.M.S. *Gazelle* mitgebrachten Arten. *Mber. dt. Akad. Wiss. Berl. 1879*: 53–60.

Bouvier, E. L. 1905: Observations préliminaires sur les Pycnogonides recueillis dans la région antarctique par la mission du *Français*. *Bull. Mus. Hist. nat., Paris, 11*: 294–8.
———1906a: Nouvelles observations sur les Pycnogonides recueillis dans les régions antarctiques au cours de la compagne dirigée par M. Jean Charcot. *C. r. hebd. Séanc. Acad. Sci., Paris. 142*: 15–22.
———1906b: Pycnogonides du *Français*. *Exped. antarct. fr.*: 1–69; I–III, 48 figs.
———1910: Les Pycnogonides à cinq paires de pattes recueillis par la Mission antarctique Jean Charcot à bord du *Pourquoi Pas?* *C. r. hebd. Séanc. Acad. Sci., Paris, 151*: 26–32.
———1911a: Les Pycnogonides du *Pourquoi Pas?*. *Ibid., 125:* 1136–41.
———1911b: Observations sur les Pycnogonomorphes et principalement sur le *Pentapycnon geayi*, espéce tropicale à dix pattes. *Ibid., 152*: 491–4.
———1911c: Les Pycnogonides décapodes et la classification des Pycnogonides. *Int. Congr. Ent., Bruxelles, 1910*: 45–355.
———1913: Pycnogonides du *Pourquoi Pas?*. *Deuxième Exped. Antarct. fr.*: 1–169; 109 figs.
———1917: Pycnogonides provenant des campagnes scientifiques de S.A. *le Prince de Monaco* (1885–1913). *Résult. Camp. scient. Prince Albert I 51*: 1–56; I–IV.
———1923: Pycnogonides. *Faune Fr. 7*: 1–69; 61 figs.
———1937: Étude sur les Pycnogonides du *Travailleur* et du *Talisman* précédé d'observations systématiques sur les Articulées de ce group. *Annls. Sci. nat., Zool. ser. 10, 20* (*1*): 1–42; 13 figs.
———1920: On a collection of Pycnogonida from the South Orkney Islands. *Ann. Mag. nat. Hist., ser. 9, 6*: 244–7; 2 figs.

Brunnich, M. T. 1764: "Entomologia sistens Insectorum Tabulas Systematicas, cum Introductione et Iconibus, etc." 87 pp. I pl., 4 figs. Hafniae.

Bullivant, J. S. 1959: Photographs of the bottom fauna in the Ross Sea. *N.Z. Jl Sci. 2* (*4*): 485–97; 10 figs.
———1961: Photographs of the Antarctic bottom fauna. *Polar Rec. 10* (*68*): 505–8; 5 pl. 1 fig.

Burling, R. W. 1961: Hydrology of circumpolar waters south of New Zealand. *Bull. N.Z. Dep. sci. industr. Res. 143*: 1–66; figs. 1–19, 1 map.

Calman, W. T. 1909: The problem of the Pycnogonids. *Sci. Prog., Lond. 1909:* 687–93.
———1915a: The holotype of *Ammothea carolinensis* Leach (Pycnogonida). *Ann. Mag. nat. Hist., ser 9, 15*: 310–4; 3 figs.
———1915b: Pycnogonida. *Br. Antarct. Terra Nova Exped. 1910, Zool. 3* (*1*): 1–74; 22 figs.
———1923: Pycnogonida of the Indian Museum. *Rec. Indian Mus. 25* (*3*): 265–99; 17 figs.
———1937a: James Eights, a pioneer Antarctic naturalist. *Proc. Linn. Soc. Lond., 1936–37, 149* (*4*): 171–84; IV, 3 figs.
———1933: A dodecapodous Pycnogonid. *Nature, Lond. 131* (*3309*): 242.
———1938: Pycnogonida. *Scient. Rep. John Murray Exped. 5* (*6*): 147–66; figs. 1–10.

Calman, W. T.; Gordon, I. 1933: A dodecapodous Pycnogonid. *Proc. R. Soc. 113*: 107–15; 3 figs.

Carpenter, G. H. 1905: The marine fauna of the coast of Ireland. Part VI, Pycnogonida. *Scient. Invest. Fish. Brch Ireland 4*: 171–8; I–III.
———1908: The Percy Sladen Trust Expedition to the Indian Ocean; Pycnogonida. *Trans. Linn. Soc. Lond., ser. 2, 12*: 95–101; XII, XIII.

Caullery, M. 1896: Résultats scientifiques de la campagne du *Caudan* dans la golfe de Gascogne, août-sept. 1895; Pycnogonides. *Annls. Univ. Lyon, 1896*: 361–4.

Clark, H. E. S. 1963: Asteroidea. The Fauna of the Ross Sea. Part 3. *Bull. N.Z. Dep. sci. industr. Res. 151*: 1–84; colour pls. 1–2, pls. 1–15; figs. 1–20.

Clark, W. C. 1963: Australian Pycnogonida. *Rec. Aust. Mus. 26* (*1*): 1–81; 38 figs.

Cole, L. J. 1904: Pycnogonida collected at Bermuda in the summer of 1903. *Proc. Boston Soc. nat. Hist., 31*: 315–18; 20–22.
———1905: Ten-legged pycnogonids, with remarks on the classification of the Pycnogonida. *Ann. Mag. nat. Hist. ser. 7, 15*: 415–41; 1 fig.
———1909: Reports on the scientific results of the expedition to the Eastern Tropical Pacific in charge of Alexander Agassiz, by the U.S. Fish Commission Steamer *Albatross* from October 1905 to March 1906. XIX. Pycnogonida. *Bull. Mus. comp. Zool. Harv. 52* (*11*): 185–92; 3 pl.

Costa, O. G. 1861: "Microdoride mediterranei, o descrizione de' poco ben conosciuti od affatto ignoti viventi minuti e microscopici del Mediterraneo, etc." Vol. 1: 1–15; pls. I–III, Naples.

Eights, J. 1835: Description of a new animal belonging to the Arachnides of Latreille discovered in the sea along the shores of the New South Shetland Islands. *Boston J. nat. Hist. 1*: 203–6; VII.

Fage, L. 1949: Pycnogonides du Congo Belge. *Archs. Zool. exp. gén. 86*: 20–31; 1–6.
———1952a: Pycnogonides. Missions du bâtiment polaire *Commandant Charcot*, recoltes faites en Terre Adelie (1950). *Bull. Mus. natn. Hist. nat., Paris, ser. 2, 24* (*2*): 180–6; 1, 2.
———1956: Les Pycnogonides (excl. la genre *Nymphon*). *Galathea Rep. 2*: 167–82.
———1952b: Pycnogonides de la Terre Adélie. *Bull. Mus. natn. Hist. nat. Paris, ser 2, 24* (*3*): 263–73; 1, 2.

Fell, H. B. 1961: Ophiuroidea. The Fauna of the Ross Sea, Part I. *Bull. N.Z. Dep. sci. industr. Res. 142*: 1–79; pls. 1–19.

Flynn, T. T. 1919: Two new Australian Pycnogonida. *Pap. Proc. R. Soc. Tasm. 1919*: 91–100, pls. XIII, XIV.
———1920: A re-examination of Professor Haswell's types of Australian Pycnogonida. *Pap. Proc. R. Soc. Tasm. 1920*: 70–92; pls. XVIII–XXII.
———1928: The Pycnogonida of the Marine Survey of South Africa. *Rep. Fish. mar. biol. Surv. Un.S.Afr. 6*: 3–36.
———1929: Pycnogonida from the Queensland coast. *Mem. Qd Mus., 9* (*3*): 252–60; 9 figs.

Fry, W. G. 1964a: The Pycnogonida and the coding of biological information for numerical taxonomy. *Syst. Zool. 13* (*1*): 32–41; 4 figs.
———1964b: The Pycnogonid fauna of the Antarctic continental shelf, *in* "Biologie Antarctique", *Act. Sci. Industr. 1312*: 263–69.

Garner, D. M. 1961: Hydrology of New Zealand coastal waters, 1955. *Bull. N.Z. Dep. sci. industr. Res. 138*: 1–85; figs. 1–40.
———1962: Analysis of hydrological observations in the New Zealand Region, 1874–1955. *Ibid. 144*: 1–45, figs. 1–24.

Giltay, L. 1934: Remarques sur le genre *Ammothea* Leach et déscription d'une espèce nouvelle de la mer d'Irlande. *Bull. Mus. r. Hist. nat. Belg. 10* (*18*): 1–6, 3 figs.

Goodsir, H. 1842: Descriptions of some new species of Pycnogonidae. *Edinburgh new philos. J. 33*: 363–8; 1 pl.

Gordon, I. 1932: Pycnogonida. *Discovery Rep.* 6: 1–138; 75 figs.
———1938: Pycnogonida. *Scient. Rep. Australas. Antarct. Exped. ser. C.*, (*Zool. and Bot.*) *2* (*8*): 1–40; 8 figs.
———1944: Pycnogonida. *Rep. B.A.N.Z. Antarct. Res. Exped., ser. B*, *5* (*1*): 1–72; 27 figs.

Haswell, W. A. 1885: Pycnogonida of the Australian coast. *Proc. Linn. Soc. N.S.W. 9*: 1021–33.

Hedgpeth, J. W. 1943: Pycnogonida from the West Indies and South America collected by the *Atlantis* and earlier expeditions. *Proc. New Engl. zool. Club 22*: 41–58; pls. VIII–X.
———1947: On the evolutionary significance of the Pycnogonida. *Smithsonian misc. Collns 106* (*18*): 1–53; pl. I, 16 figs.
———1948: The Pycnogonida of the western North Atlantic and the Caribbean. *Proc. U.S. natn. Mus. 97* (*3216*) *:* 157–342; figs. 4–53, 3 charts.
———1949: Report on the Pycnogonida collected by the *Albatross* in Japanese waters in 1900 and 1906. *Ibid. 98* (*3231*) *:* 233–321; figs. 18–51.
———1950: Pycnogonida of the United States Navy Expedition 1947–48. *Ibid. 100* (*3260*)*:* 147–60; figs. 17–19.
———1954: Pycnogonida. The Gulf of Mexico, its origin, waters and marine life. *Fishery Bull. Fish Wildl. Serv. U.S. 89* (*55*): 425–7; fig. 69.
———1961: Pycnogonida. Rep. Lund Univ. Chile Expedition 1948–49. *Acta Univ. lund, N.F. Avd. 2, 57* (*3*): 3–18; figs. 1–11.
———1963: Pycnogonida of the North American Arctic. *J. Fish Res. Bd. Can. 20* (*5*): 1315–48; figs. 1–12.
———1964: Notes on the peculiar egg laying habit of an antarctic prosobranch (Mollusca: Gastropoda). *Veliger 7* (*1*): 45–6; 1 fig.
———1969a: Introduction to Antarctic Zoogeography. *Antarct. Map Folio Ser. Am. geogr. Soc. Folio 11*: 1–9; 15 figs.
———1969b: Pycnogonida. *Ibid. Folio 11:* 26–28; pls. 13, 14.

Hedgpeth, J. W.; Fry, W. G. 1964: Another dodecopodous pycnogonid. *Ann. Mag. nat. Hist., ser. 13, 7*: 161–9; 3 figs.

Helfer, H. 1938: Einige neue Pantopoden aus der Sammlung des Zoologischens Museums in Berlin. *Sber. Ges. naturf. Freunde Berl. 1937* (*2*): 162–85; 11 figs.

Helfer, H.; Schlottke, E. 1935: Pantopoda. *Bronn's kl. Ordn. Tierreichs*, *5*, *Abt. IV*, *2*, (*1*): 1–314; 223 figs.

Hesse, M. 1867: Observations sur des crustaces rares ou nouveaux des côtes de France. *Annls Sci. nat., ser. 5*, *7*: 199–216; pl. IV, 1, 9.

Hodge, G. 1864: List of the British Pycnogonidea, with descriptions of several new species. *Ann. Mag. nat. Hist., ser. 3, 13*: 113–17; pls. XII, XIII.

Hodgson, T. V. 1902: Crustacea (Pycnogonida). "Report on the collections of Natural History made in the Antarctic Regions during the Voyage of the *Southern Cross*." pp. 256–8; pl. 40.
———1904: On a new pycnogonid from the South Polar regions. *Ann. Mag. nat. Hist., ser. 7, 14*: 458–62; 1 fig.
———1905a: Preliminary report of the biological collections of the *Discovery*. *Geogr. J. 25*: 396–400.
———1905b: *Decolopoda* and *Colossendeis. Zool. Anz., 29*: 254–6.
———1905c: The *Scotia* collections, VII. On *Decolopoda australis* Eights. *Proc. R. phys. Soc. Edinb., 16* (*1*): 35–42; 2 pl.
———1907: Pycnogonida. *National Antarctic Expedition 1901–1904, Nat. Hist., 3*: 1–72; 10 pl.
———1908: The Pycnogonida of the Scottish National Antarctic Expedition. *Trans. R. Soc. Edinb. 46* (*1*), *pt. 6*: 159–88; pls. I–III.
———1914: Preliminary report on the Pycnogonida of the German Southpolar Expedition, 1901–1903. *Zool. Anz. 45*: 158–65.
———1915: The Pycnogonida collected by the *Gauss* in the antarctic regions, 1901–3; preliminary report. *Ann. Mag. nat. Hist. ser. 8, 15*: 141–9.
———1927: Die Pycnogoniden der Deutschen Süd-polar-Expedition 1901–03. *Dt. Südpol.-Exped., 19*: 303–58; 17 figs.

Hoek, P. P. C. 1881: Report on the Pycnogonida dredged by HMS *Challenger* 1873–1876. *Rep. scient. Results explor. Voyage Challenger, Zool., 3*: 1–167; 21 pl.
———1898: On four Pycnogonides dredged during the cruise of the *Challenger. Tijdschr. ned. dierk. Vereen., 5*: 290–301.

Hutton, F. W. 1904: "Index Faunae Novae Zealandiae." pp. 246–7 Dulau, London.

Jarzynsky, 1870: "Praemissus catalogus Pycnogonidarum inventarum in mari glaciali, ad oras Lapponiae rossicae et in mari albe 1869 et 70. Petersburg." (reprod. *in* Wagner, N. 1885. "Die Wirbellosen des Weissen Meeres", Leipzig: 168–71.)

Kenny, R.; Haysom, N. 1962: Ecology of rocky shore organisms at Macquarie Island. *Pacif. Sci. 16* (*3*): 245–63; 1–12.

Leach, W. E. 1814: "The Zoology Miscellany, 1." 33–4, 43–5; pls. XIII, XIX. London.

Lebour, M. V. 1945: Notes on the Pycnogonida of Plymouth. *J. mar. biol. Ass. U.K. 26*: 139–65; 7 figs.

Loman, J. C. C. 1905: *Decolopoda* Eights oder *Colossendeis* Jarz. *Zool. Anz. 28*: 722–3.
———1907: Pycnogoniden. Hamburg. Matathaensische Sammelreise: 1–20; figs. 1–6.
———1908: Die Pantopoden der Siboga-Expedition. *Siboga Exped. Monogr. 40*: 1–88; 15 pl.
———1911: Japanische Podosomata; Beiträge zur Naturgeschichte Ostasiens, herausg. v. F. Doflein. *Abh. bayer. Akad. Wiss. Suppl.* 4: 1–17; 2 pl.
———1920: Pycnogoniden von Juan Fernandez. *In* Skottsberg, Carl (Ed.), "The Natural History of Juan Fernandez and Easter Island." 3: 137–44.
———1923a: Subantarctic Pantopoda from the Stockholm Museum. *Ark. Zool. 15* (*9*): 1–13.
———1923b: A new pycnogonid from Australia. *Ark. Zool. 15* (*10*): 1–4; 1 fig.
———1923c: The Pycnogonida of the Swedish Antarctic Expedition 1901–1903. *Zool. Results Swed. Antarct. Exped. 1* (*2*): 1–41; 7 figs.

Losina-Losinsky, L. K. 1961: Mnogokolanchatiye (Pantopoda) dalnyevostochnich morei S.S.S.R. [Pycnogonida of the far eastern seas of the U.S.S.R.] *Issled. dalnevost Morei SSSR. 7*: 47–117; figs. 1–27.

Losina-Losinsky, L. K.; Turpaeva, E. P. 1958: The genus *Colossendeis* (Pantopoda) in the northern part of the Pacific Ocean. *Byull. m. o-va. isp. Prirody, otd. Biol., 58* (*1*)*:* 23–33; 4 figs.

Marcus, E. 1940. Os Pantapoda brasilieros e os demais sul-americanos. *Bolm. Fac. Filos. Ciênc. Univ. S. Paulo 19*, *Zool. 4*: 3–179; pls. I–XVII.

Meinert, F. 1899: Pycnogonida. *Dan. Ingolf-Exped. 3* (*1*): 1–71; 5 pl. 1 map.

Michener, C. D.; Sokal, R. R. 1957: A quantitative approach to a problem in classification. *Evolution, Lancaster, Pa. 11*: 130–62.

Miers, E. J. 1875a: Descriptions of new species of Crustacea collected at Kerguelen's Island by the Rev. A. E. Eaton. *Ann. Mag. nat. Hist. ser. 4*, *16*: 73–6.
———1875b: Descriptions of three additional species of Crustacea from Kerguelens Land and Crozet Island, with remarks upon the genus *Paramaera. Ann. Mag. nat. Hist., ser. 4*, *16*: 115–8.
———1877: Zoology of Kerguelen's Island; Crustacea, Pycnogonida. *Phil. Trans. R. Soc. 168*: 211–4; pl. XI.
———1879: Crustacea (and Pycnogonida) of the Transit of Venus Expedition, Kerguelen Island. *Phil. Trans. R. Soc. Lond. 168*: 200–14.
———1884: Pycnogonida. Pp. 323–26 *in* "Report on the Zoologica Collections Made in the Indo Pacific during the Voyage of HMS *Alert* 1881–82".

Milne-Edwards, M. 1840: "Histoire naturelle des Crustacés." Paris. pp. 530–7; pl. XLI.

Möbius, K. 1902: Die Pantopoden der Deutschen Tiefsee-Expedition, 1898–99. *Wiss. Ergebn. dt. Tiefsee-Exped. Valdivia 3*: 175–96; 7 pl.

Moseley, H. N. 1879: On the structure of the Stylasteridae, a family of hydroid stony corals. *Phil. Trans. R. Soc. 169*: 425–504.

Needler, A. B. 1943: Pantopoda. *Can. Atlant. Fauna 10*: 1–16; 21 figs.

Norman, C. A. 1908: The Podosomata (=Pycnogonida) of the temperate Atlantic and Arctic Ocean. *J. Linn. Soc. Zool. 30*: 198–238; pls. XXIX, XXX.

Ohshima, H. 1927a: *Nymphonella tapetis* n.g., n.sp., a pycnogon parasitic in a bivalve. *Annotnes zool. jap. 11* (*3*): 257–63; 4 figs.

——— 1936: A list of Pycnogonida recorded from Japanese and adjac ent waters. *Zool. Mag. 48* (*8–10*): 861–9.

——— 1937: The life-history of *Nymphonella tapetis* Ohshima. *Int. Congr. Zool. 12*: 1616–25; LXXX, 5 figs.

Ohshima, H.; Kishida, K. 1947: Pantopoda. "Illustrated Encyclopaedia of the Fauna of Japan." Tokyo. pp. 1005–10; 16 figs.

Olsen, O. 1914: Pycnogonida. *Rep. scient. Results Michael Sars N. Atlant. deep Sea Exped. 3* (*1*): Zool. 3–8; pl. 1, 9 figs.

Ortmann, A. E. 1891: Bericht über die von Herrn Dr. Döderlein in Japan gesammelten Pycnogoniden. *Zool. Jb.* (*Syst.*) 5: 157–68; pl. XXIV.

Pfeffer, G. 1889: Zur Fauna von Süd-Georgien; Pycnogoniden; *Jb. hamb. wiss. Anst. 6*: 1–13.

Philippi, A. 1843: Uber die neapolitanischen Pycnogoniden. *Arch. Naturgesch. 9* (*2*): 175.

Rao, C. R. 1952: "Advanced Statistical Methods in Biometric Research." John Wiley, New York.

Sanchez, S. 1959: Le développement des Pycnogonides et leurs affinités avec les Arachnides. *Archs Zool. exp. gen. 98* (*1*): 1–101; 1–29.

Sars, G. O. 1887: Prodromus descriptionis crustaceorum et pycnogonidarum, quae in expeditione norvegica anno 1876 observavit. *Arch. Math. Naturv. 2*: 237–71.

———1891a: Pycnogonidea. *Norwegian N-Atlant. Exped. 1876–8, Zool. 20*: 163 pp; 15 pl., 1 map.

———1891b: Pycnogonidea of the Norwegian North Sea Expedition. *Jl. R. microsc. Soc. 1891*: 185–6.

Sawaya, M. P. 1951: *Achelia besnardi*, n.sp. (Pantopoda-Ammotheidae). *Boln Fac. Filos Ciênc. Univ. S. Paulo Zool. 16*: 271–80; I, II.

Schimkevitch, V. 1887: Sur les Pantopodes de l'expédition *Vettor Pisani. Zool. Anz., 10*: 271–2.

———1893: Report on the dredging operations off the West Coast of Central America to the Galapagos . . . carried out by the steamer *Albatross* during 1891; compte rendu sur les Pantopodes. *Bull. Mus. comp. Zool. Harv. 25* (*2*): 27–43; 1 pl.

———1930: Pantopodes (Pantopoden). *Fauna SSSR. 1* (*2*): 1–532; 166 figs. 10 pl.

Schiödte, J. C. 1857: Udsigt over Grønlands Land Ferskvands- og Strandbreds-Arthropoder. *In* Rink, H., "Grønland geografisk og tatistisk beskrevet" 2 (3): 50–74 (Pycnogonida p. 71). Kobenhavn.

Schmitt, W. L. 1945: Miscellaneous zoological material collected by the United States Antarctic Service Expedition, 1939, 1941. *Proc. Am. phil. Soc. 89* (*1*): 297.

Simpson, G. G. 1961: "Principles of Animal Taxonomy." 247 pp. 30 figs. O.U.P.

Smith, S. J. 1885: *In* Verrill, A. E., Results of the explorations made by the steamer *Albatross* off the northern coast of the United States in 1883. *Rep. U.S. Commnr Fish. 1883*: 503–601; 38 pl.

Sokal, R. R.; Michener, C. D. 1958: A statistical method for evaluating systematic relationships. *Bull. Univ. Kansas 38*: 1409–38.

Sokal, R. R.; Sneath, P. H. A. 1963: "Principles of Numerical Taxonomy." Freeman, London. 359 pp.

Starr, R. B. 1961: A thermal profile and sea surface observations across the southern Tasman Sea. *N.Z. Jl. Geol. Geophys. 4 (2)*: 125–31; 1–4.

Stebbing, T. R. R. 1902: The Nobodies, a sea-faring family. *Knowledge 25*: p. 37.

Stephensen, K. 1913: Pycnogonida. *In* Grønlands Krebsdyr og Pycnogonider (Conspectas Crustaceorum et Pycnogonidorum Groenlandiae). *Meddr Grønland 22*: 382–409.

———1933: Crustacea and Pycnogonida; the Scoresby Sound Committee's 2nd East Greenland Expedition in 1932 to King Christian IX Land. *Ibid., 104* (*15*): 10–12, 1 map.

———1935: Pycnogonida from Norway and adjacent waters. *Bergens Mus. Arb. 1935 Nat. rekke 7*: 3–39; 1 fig.

———1943: Pycnogonida. The zoology of east Greenland. *Meddr Grønland 121* (*8*): 1–41; 7 figs.

———1947: Tanaidacea, Isopoda, Amphipoda and Pycnogonida. *Results Norw. scient. Exped. Antarct. 27*: 1–90; figs. 1–24 [Pycnogonida: 80–6]

Stock, J. H. 1953: Re-description of some of Helfer's Pycnogonid type-specimens. *Beaufortia 4* (*35*): 33–5; 1–6.

———1954a: Four new *Tanystylum* species, and other Pycnogonida from the West Indies. *Stud. Fauna Curaçao 5* (*24*): 115–29; 24–9.

———1954b: Pycnogonida from Indo-West-Pacific, Australian and New Zealand waters. Papers from Dr Th. Mortensen's Pacific Expedition 1914–1916, LXXVII. *Vidensk. Meddr. dansk naturh. Foren. 116*: 1–168, figs. 1–81.

———1955a: Pycnogonida from the West Indies, Central America and the Pacific Coast of North America. Papers from Dr Th. Mortensen's Pacific Expedition 1914–1916, LXXVIII. *Ibid., 117*: 209–66; figs. 1–26.

———1955b: Pycnogonida from Tristan da Cunha. *Results Norw. scient. Exped. Tristan da Cunha 33*: 1–13, 1–5.

———1956: Pantopoden aus dem Zoologischen Museum Hamburg. *Mitt. hamb. zool. Mus. Inst. 54*: 33–48. 1–7.

———1957: Pantopoden aus dem Zoologischen Museum Hamburg (2. Tiel). *Ibid., 55*: 81–106, 1–20.

———1958: On some South African Pycnogonida of the University of Cape Town Ecological Survey. *Trans. R. Soc. S. Afr. 35* (*5*): 549–67.

———1958a: The Pycnogonid genus *Rhopalorhynchus* Wood-Mason, 1873. *Tijdschr. Entomol. 101 (2)* : 113–137; 63 figs.

———1958b: On some South African Pycnogonida of the University of Cape Town Ecological Survey. *Trans. R. Soc. S. Afr. 35 (5)* : 549–567.

———1963: South African deep-sea Pycnogonida, with descriptions of five new species. *Ann. S. Afr. Mus. 46* (*12*): 321–40, 1–10.

Sturtevant, A. H. 1942: The classification of the genus *Drosophila* with descriptions of nine new species. *Univ. Tex. Publ. 4212*: 1–51.

Sverdrup, H. U.; Johnson, M. W.; Fleming, R. H. 1942: "The Oceans, their Physics, Chemistry and General Biology." Prentice-Hall, New York. 1087 pp. 265 figs, 7 charts.

Tate, M. W.; Cleland, R. C. 1957: "Nonparametric and Shortcut Statistics." Interstate Printers and Publishers, Danville, Illinois. 171 pp.

Teissier, G. 1960: Relative growth, *in* "The Physiology of Crustacea." Waterman, T. H., (Ed.), *1*: 537–60.

Thompson, W. d'Arcy. 1909: Pycnogonida. "The Cambridge Natural History," *4*: pp. 501–42; figs. 262–87.

Thomson, G. M. 1884: On the New Zealand Pycnogonida, with descriptions of new species. *Trans. Proc. N.Z. Inst. 16*: 242–8, pl. XIV–XVI.

Topsent, E. 1891: Les Pycnogonides provenant des campagnes du yacht *l'Hirondelle. Bull. Soc. zool. Fr. 16*: 176–80.

Tressler, W. L.; Ommundsen, A. M. 1962: Seasonal oceanographic studies in McMurdo Sound, Antarctica. *Tech. Rep. hydrogr. Off., Wash., 125*: 141 pp. 25 figs. pl. XXX, 13 tables.

Utinomi, H. 1955: Report on the Pycnogonida collected by the Soyo-Maru Expedition made on the continental shelf bordering Japan during the years 1926–30. *Publs. Seto mar. biol. Lab. 5* (*1*): 1–42, 1–23.

———1959: Pycnogonida of the Japanese Antarctic Research Expedition 1956–58. Biological Results of the Japanese Antarctic Research Expedition. *Spec. Publs. Seto mar. biol. Lab. 8*: 1–12, 1–6. (*Contr. Seto mar. biol. Lab. 341.*)

Verrill, A. E. 1885: See Smith, S. S. 1885.

———1900: Additions to the Crustacea and Pycnogonida of the Bermudas. *Trans. Conn. Acad. Arts Sci. 10 (2)*: 580–2.

Whitelegge, T. 1889: List of the marine and fresh-water invertebrate fauna of Port Jackson and the neighbourhood. *J. Proc. R. Soc. N.S.W. 23* (*2*): 163–325.

Williams, G. 1940: Pycnogonida of Western Australia. *J. Proc. R. Soc. West. Aust. 25*: 197–205; 9 figs.

Wilson, E. B. 1878: Descriptions of two new genera of Pycnogonida. *Am. J. Sci. Arts. ser. 3, 15*: 200–3, 3 figs.

———1881: Report on the Pycnogonida ("Blake"). *Bull. Mus. comp. Zool. Harv. 8* (*12*): 239–56; pl. V.

Wood-Mason, J. 1873: On *Rhopalorhynchus Kröyeri*, a new genus and species of Pycnogonida. *J. Asiatic Soc. Bengal 42 (2)*: 171–5; pl. XIII.

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