NEW ZEALAND
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

BULLETIN 139 (1)

# Biological Results of The Chatham Islands 1954 Expedition

PART 1



**New Zealand Oceanographic Institute**

**Memoir No. 4**

1960

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# THE CHATHAM ISLANDS 1954 EXPEDITION

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*Photo: D. Marshall*

Sorting a trawl haul on the after deck

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# FOREWORD

The Chatham Islands 1954 Expedition was organised and led by Prof. G. A. Knox of the Zoology Department of Canterbury University. The expedition was planned to explore the distribution of benthic and pelagic animals between the New Zealand coast and the Chatham Islands over the Chatham Rise, and to investigate the faunal affinities of the Chathams group, which lies in the Subtropical Convergence zone.

A substantial grant towards the cost of the expedition was made by the Council for Scientific and Industrial Research on the recommendation of the N.Z. Oceanographic Committee: further financial support was given by Canterbury University, Canterbury Museum, Dominion Museum and Canterbury and Southland Branches of the Royal Society of New Zealand. The expedition was carried out from the M.V. *Alert* under the command of her owner and master, Mr A. J. Black.

The scientific staff was drawn from the following organisations: Canterbury Museum (R. R. Forster); Canterbury University (G. A. Knox, E. W. Dawson, J. R. MacIntyre); Dominion Museum (R. K. Dell, J. M. Moreland); N.Z. Oceanographic Institute (D. M. Garner); Otago University (D. Marshall); Portobello Marine Biological Station (E. J. Batham); Victoria University of Wellington (J. C. Yaldwyn).

Prof. G. A. Knox has been responsible for organisation of the sorting and allocation of material. Type material from the expedition is deposited at Canterbury Museum. Preliminary technical editing of the resulting manuscripts has been carried out by Prof. Knox and Dr D. E. Hurley. Mr M. O'Connor (Information Bureau, D.S.I.R.) has been responsible for final editing.

Further results of the expedition will be published in this series as the examinations of other animal groups are completed.

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

# CONTENTS

# Crustacea Decapoda Natantia from the Chatham Rise: A Deep Water Bottom Fauna from New Zealand

By J. C. YALDWYN,
Dominion Museum, Wellington*

**Abstract**

Six species, four being described as new, are recorded from 10 stations between 125 and 330 fm. A further species, *Sclerocrangon richardsoni* n.sp. is described from c. 550 fm in Cook Strait. The definition of the family Rhynchocinetidae is amended to include the Eugonatonotidae and *Lipkius holthuisi* n.gen., n.sp. The Australian *Campylonotus rathbunae* is recorded from New Zealand waters and shown to be a protandrous hermaphrodite. A key to the genus *Campylonotus* is given, based on a re-examination of types in the British Museum (N.H.). *Notopandalus* n.gen. is described for *Pandalus magnoculus* Bate, a widespread New Zealand shelf and archibenthal species recorded here for the first time since its description in 1888. *P. magnoculus* is not a protandrous hermaphrodite. *Sclerocrangon knoxi* n.sp., *Pontophilus acutirostratus* n.sp. and *Prionocrangon curvicaulis* n.sp. form an interesting and unique southern hemisphere assemblage of Crangonids. Details of rostral variation, colour pattern and distribution have been given where possible.

## INTRODUCTION

Little has been published on the deep water natant decapods of the New Zealand region. The only records of benthic species from below 100 fm (archibenthal and abyssal-benthic zones) are those of Bate (1888) and Yaldwyn (1957c). In describing the material taken by the *Challenger* Expedition in 1874, Bate records the following four species: *Pandalus magnoculus* Bate from 150 and 275 fm, *Nematocarcinus hiatus* Bate and *N. serratus* Bate from 700 fm, and *Pontophilus gracilis* Bate (now known as *P. challengeri* Ortmann) from 1,100 fm. These remained the only deep water benthic natants recorded from the New Zealand area until 1957 when the author (Yaldwyn, 1957c) recorded the partially benthic

* This study is part of a series undertaken at the Department of Zoology, Victoria University of Wellington, while the author held a Research Fellowship of the University of New Zealand.

*Sergestes potens* Burkenroad from 380 and 550 fm in Cook Strait.

Since the *Challenger* Expedition the only overseas expeditions to make archibenthal and abyssal-benthic collections in New Zealand waters were those of the R.R.S. *Discovery II* in 1932 and again in 1950, as well as the Danish Deep Sea Expedition in H.D.M.S. *Galathea* during 1951–52 (see Yaldwyn, 1957b). The *Discovery II* in 1932 did not take any benthic natants from below 100 fm (unpublished information) and those taken by the same ship in 1950, and by the *Galathea,* have not as yet been described.

The first locally organised investigation to collect archibenthal natants was the Chatham Islands 1954 Expedition, sponsored by the New Zealand Oceanographic Committee, and led by Mr G. A. Knox of the Canterbury University Zoology Department (Knox, 1957). In addition to making numerous littoral and shallow water collections around the shelf of the Chatham Islands themselves, the Expedition worked, from the M.V. *Alert,* a number of bottom stations on the Chatham Rise, to the east of the South Island of New Zealand. Ten of these stations, between 125 and 330 fm, produced archibenthal natant decapods belonging to a deep water faunal assemblage unlike anything else described from the southern hemisphere. The author was privileged to be present on this Expedition and, in addition to seeing much of the material brought to the surface alive, was fortunate enough to be allowed to describe the interesting and relatively large collection of natant decapods which was accumulated. The description of this collection will be divided into two parts. The first part will deal with bottom fauna of the Chatham Rise, while the second will cover the littoral and shelf fauna of the Chatham Islands. The specimens collected from the Mernoo Bank, between 41 and 100 fm, are typical species of the New Zealand shelf fauna and will be discussed in the second part. Two species of bathypelagic natants were taken incidentally in the trawl while working the Chatham Rise stations. These were *Sergestes arcticus* Kröyer from Sta. 7 and 52, which was discussed by Yaldwyn (1957c: 10), and an apparently undescribed species of *Pasiphaea* from Sta. 6 very similar to, but distinct from, the Atlantic *P. sivado* (Risso). The latter species occurs abundantly in the 50- to 150-fathom zone of Cook Strait and will be described later in a paper on the bathypelagic natant fauna of that area.

Since the Chatham Islands Expedition other locally organised expeditions have made representative collections of archibenthal natants from the areas in which they have been working. All specimens, of species described from the Chatham Rise, taken by these other investigations, have been listed in this paper, and in addition *Sclerocrangon richardsoni* n.sp. has been described from Cook Strait as it is convenient to deal with it in conjunction with *S. knoxi* n.sp. from the Chatham Expedition collections. Thus this report deals with some of the material taken by the Zoology Department, Victoria University of Wellington, from Cook Strait; the Portobello Marine Biological Station, from the so-called "Otago Canyons"; the Dominion Museum, from the "Otago Canyons" and the Bay of Plenty, as well as the *Discovery* Expedition from off the North Auckland Peninsula. Full reports on the Natantia collected by these deep water expeditions will appear in other publications.

## ENVIRONMENTAL SETTING

The Chatham Rise is described by Reed (1952) as "a broad submarine shelf outlined by the 500-fathom contour [which] extends southwards from the coast of Canterbury on the South Island of New Zealand as far as the Chatham Islands, a distance of over 500 miles. To the north and south, the sea bed rapidly falls to depths of more than 1,000 or 1,500 fathoms. On the Rise, shoalings to less than 100 fathoms occur at several places, the best known being Mernoo Bank, 90 miles east of the South Island." The Rise is separated from the continental shelf of New Zealand by depths of a little more than 300 fm (Fleming & Reed, 1951, p. 22). The bottom sediments at the ten stations discussed in this paper varied from a fine green mud at Sta. 41, through green and grey muds and sands, to fine sand and gravel at Sta. 34. The physical conditions in the Chatham Rise archibenthal zone have been summarised by Dell (1956) from the data discussed by Garner (in Knox, 1957). The water temperature varied from 10·5° to 11·5°c between 100 and 200 fm, which was 3·9° to 2·9°c below that at the surface, and from 6·8° to 8·6°c between 200 and 300 fm,

which was 7·4° to 5·8°c below that at the surface. The salinities were similar to those at the surface, between about 34·6‰ and 35·1‰, and the whole area was below the photic zone.

## MATERIAL AND METHODS

The majority of the specimens examined were collected by the Chatham Islands 1954 Expedition, but material was also made available by the Dominion Museum, the Victoria University Zoology Department, the Portobello Marine Biological Station and the *Discovery* Collections, National Institute of Oceanography, England. Through the kindness of Dr Isabella Gordon, of the British Museum (Natural History) I was able to examine, during 1955, the type material of many species taken by the *Challenger* Expedition and now in the collections under her charge.

The following abbreviations are used in presenting the collection and station data for this material: BT, beam trawl; DC, conical dredge (*Discovery* Exped.); DL, large dredge; DS, Salpa-pattern dredge; N4-T, net with 4-mm mesh (*Discovery* Exped.); OT, otter trawl; fm, fathoms; h., hours (time given in international 24-h system); m, metre; mm, millimetre; B.S., Dominion Museum Bottom Station; CIE, Chatham Islands Expedition Station; VUZ, Victoria University Zoology Dept. Cook St. Collection; f., fine; g., gravel; gn., green; gy., grey; m., mud; s., sand. All drawings have been made with an Abbé camera lucida. The carapace length, measured directly with fine dividers and accurate within 0·5 mm, is used as the standard measurement of the shrimp throughout, and this is the measurement given in the "material available" lists.

A list of the Chatham Islands 1954 Expedition stations on the Chatham Rise, from which natant Decapoda were taken, is now given (Knox, 1957) with an indication of the species found at each.

Sta. 6. Chatham Rise, 43°40·S., 179°28′E., 24/1/54, 1115–1231 h, BT and DL on bottom of f. gy. s.m. at 220 fm. – *Campylonotus rathbunae, Notopandalus magnoculus, Sclerocrangon knoxi, Prionocrangon curvicaulis, Pasiphaea* aff. *P. sivado.*

Sta. 7. Chatham Rise, 43°42′S., 179°55′E., 24/1/54, 1755–1815 h, BT on bottom of f. gy. s.m. at 280 fm. – *C. rathbunae, S. knoxi, Pontophilus acutirostratus, Pr. curvicaulis, Sergestes arcticus* (Yaldwyn, 1957c).

Sta. 34. E. of Forty Fours, 44°04′S., 175°23·5′ W., 1/2/54, 1300–1428 h, OT, DL and DS on bottom of f. s. g. at 130 fm, bottom temperature 51·9°F. – *N. magnoculus.*

Sta. 40. S.E. of Pitt Is., 44°32′S., 176°05′W., 3/2/54, 1316–1455 h, OT and DL on bottom of f. gn. s. at 155 fm, bottom temperature 50·4°F. – *C. rathbunae, N. magnoculus, P. acutirostratus.*

Sta. 41. S.E. of Pitt Is., 44°35·5′S., 176°04′W., 3/2/54, 1605–1630 h, OT on bottom of f. gn. m. s. at 330 fm (temperature at 275 fm 47·5°F.) – *C. rathbunae, N. magnoculus, P. acutirostratus, Pr. curvicaulis.*

Sta. 44. N. 30°E. of Kaingaroa, 43°35′S., 176° 03·5′W., 7/2/54, 1122–1230 h, OT and DL on bottom of f. gn. s. m. at 120–125 fm, bottom temperature 52·5°F. – *N. magnoculus.*

Sta. 52. Chatham Rise, 44°04′S., 178°04′W., 10/2/54, 0632–0736 h, BT and DL on bottom of f. gn. s. m. at 260 fm, bottom temperature 43·5°F. – *Lipkius holthuisi, C. rathbunae, N. magnoculus, S. knoxi, P. acutirostratus, Pr. curvicaulis, Sergestes arcticus* (Yaldwyn, 1957c).

Sta. 58. Chatham Rise, 43°40′S., 177°59′E., 11/2/54, 1245–1300 h, BT on bottom of f. gn. m. at 320 fm, bottom temperature 43·2°F. – *C. rathbunae, N. magnoculus.*

Sta. 59. Chatham Rise, 43°38′S., 177°19′E., 11/2/54, 1730–1807 h, BT and DL on bottom of f. gn. s. m. at 290 fm, bottom temperature 45·5°F. – *C. rathbunae, N. magnoculus, S. knoxi, P. acutirostratus.*

Sta. 60. Chatham Rise, 43°36′S., 175°31′E., 12/2/54, 0630–0650 h, BT on bottom of f. gn. s. at 205 fm, bottom temperature 47·3°F. – *N. magnoculus.*

The holotypes of *Pontophilus acutirostratus, Sclerocrangon knoxi,* and *Prionocrangon curvicaulis* are deposited in the Canterbury Museum, while those of *Lipkius holthuisi* and *Sclerocrangon richardsoni* are deposited in the Dominion Museum (Catalogue No. Cr. 781 and Cr. 782 respectively).

# SYSTEMATICS

## Order **DECAPODA**

## Suborder **NATANTIA**

## Section **CARIDEA**

### Superfamily BRESILIOIDA Holthuis, 1955

Mandible cleft into molar and incisor processes, though the latter may be much reduced. Mandibular palp present, 2- or 3-segmented. Distal segment of 2nd maxilliped articulated at end of penultimate segment or applied as a strip along the side of this segment. Exopod present on 3rd maxilliped. 1st and 2nd pereiopods chelate; 1st stouter and heavier, but often shorter than 2nd. Fingers of all four chelae not extremely long and not all pectinate, each chela with only one movable finger. Carpus of 2nd pereiopods entire. 3rd to 5th pereiopods of normal length.

KEY TO FAMILIES OF THE BRESILIOIDA

1 (2) 1st pereiopod with movable finger compressed, semicircular, deeply recessed in a slit in the propodus when chela is closed. Rostrum depressed ..... DISCIADIDAE

2 (1) 1st pereiopod with normal chela. Rostrum compressed.

3 (4) Distal segment of 2nd maxilliped articulated at end of penultimate segment. Exopods present on at least 1st and 2nd pereiopods. No epipods on pereiopods ..... BRESILIIDAE

4 (3) Distal segment of 2nd maxilliped articulated as strip alongside of penultimate segment. Exopods absent or rudimentary on pereiopods. Epipods present on 1st and 4th pereiopods ..... RHYNCHOCINETIDAE

### Family RHYNCHOCINETIDAE Amended

Redefined to include Rhynchocinetidae Ortmann, 1890 and Eugonatonotidae Chace, 1937 (see Holthuis, 1955).

Rostrum compressed, movable or immovable. Mandible cleft though incisor process may be much reduced. Mandibular palp 3-segmented. Exopod of 1st maxilliped with flagellum. Distal segment of 2nd maxilliped applied as strip to side of penultimate segment. 1st pereiopod stouter and heavier than 2nd, chela normal. Exopods on pereiopods absent, or, if present, rudimentary. Epipods on 1st to 4th pereiopods.

KEY TO GENERA OF RHYNCHOCINETIDAE

1 (2) Rostrum movable. No exopods on pereiopods. Tips of fingers of 1st and 2nd pereiopods dark-coloured ..... **Rhynchocinetes** H.M.-Edw., 1837

2 (1) Rostrum immovable. Rudimentary exopods on at least 1st to 3rd pereiopods.

3 (4) Rostrum relatively deep. Carapace with lateral carinae. Incisor process of mandible much reduced. Tips of fingers of 1st and 2nd pereiopods dark-coloured ..... **Eugonatonotus** Schmitt, 1926

4 (3) Rostrum long and slender. No lateral carinae on carapace. Incisor process of mandible well developed. Tips of fingers not dark-coloured ..... **Lipkius** nov. gen.

### **Lipkius** nov. gen.

*Definition*

Rhynchocinetidae with long, slender, immovable rostrum armed on dorsal margin with movable teeth proximally and small, fixed teeth distally, on ventral margin with fixed teeth. Eyes large, wider than ocular peduncles. Carapace without lateral carinae. Incisor process of mandible well developed. 2nd maxilla with long "lash" of setae projecting posteriorly from distal lobe of scaphognathite. Tips of fingers of 1st and 2nd pereiopods not dark-coloured. Rudimentary exopods present on 1st to 3rd pereiopods in adult. Anteriorly projecting, bifid plate on ventral surface of cephalothorax between bases of 2nd to 5th pereiopods.

*Type species:* **Lipkius holthuisi** *n.sp.*

*Material Examined*

*Chatham Islands 1954 Expedition:* Sta. 52 – 1 ♀ 9 mm.

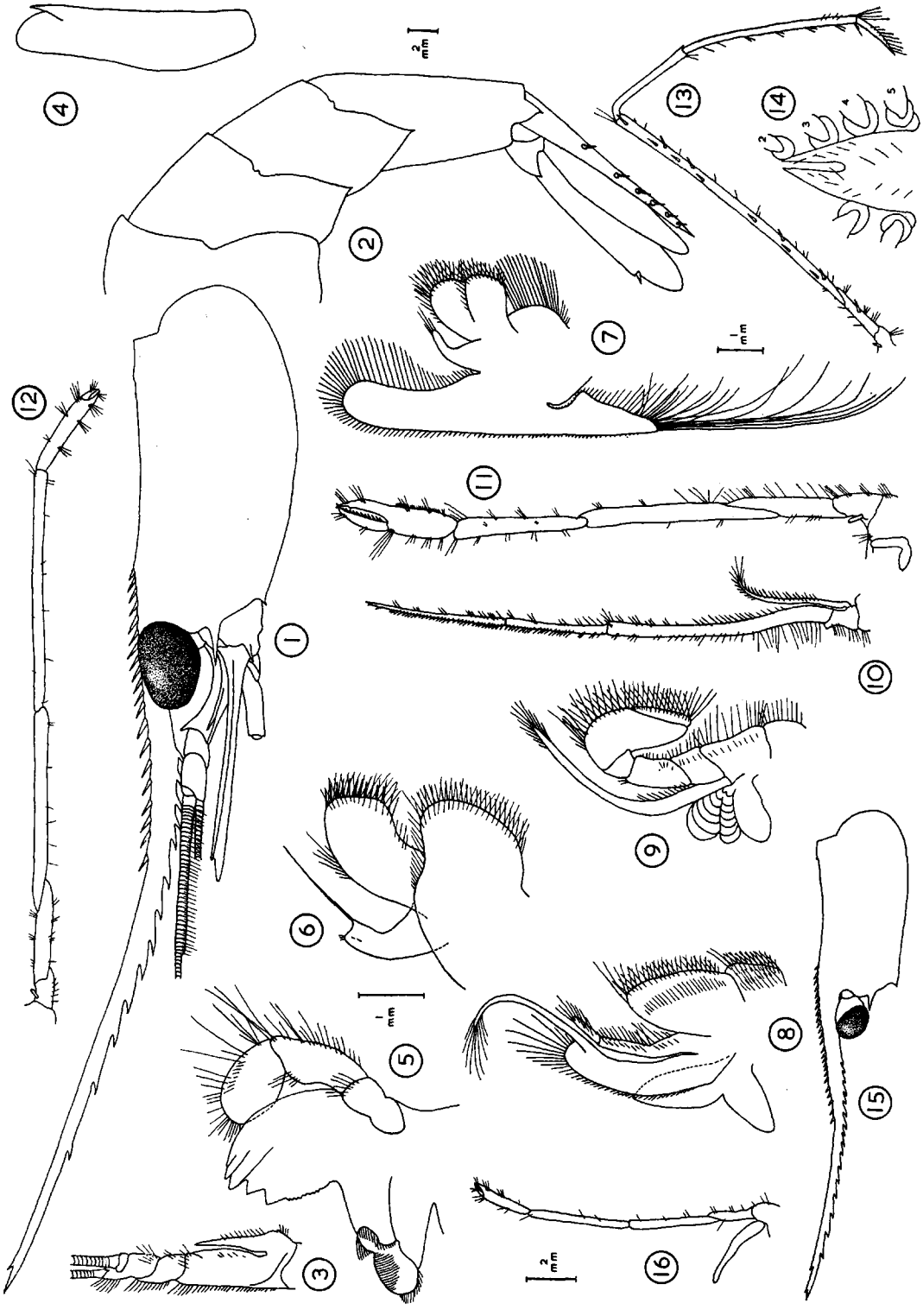
*Victoria University Zoology Department Cook Strait Collections:*

Coll. VUZ 54 (Stat. GUL) 41°39′30″S., 175°17′E., 23/2/56, 0300–0450 h, BT on bottom of mud and gravel between 50 and 200 fm (probably c. 200 fm) – 1 ♀ 16·5 mm.

*Description*

This description is based entirely on the holotype, a female specimen, with carapace length 16·5 mm, from VUZ 54.

A relatively large, slender-bodied shrimp with an extremely elongate, narrow rostrum and large prominent eyes.



TEXT-FIG. 1 – *Lipkius holthuisi* n.gen., n.sp. Fig. 1 – Lateral view carapace. Fig. 2 – Lateral view 3rd to 6th segments abdomen. Fig. 3 – Dorsal view antennular peduncle. Fig. 4 – Dorsal view scaphocerite. Fig. 5 – Right mandible. Fig. 6 – Right 1st maxilla. Fig. 7 – Right 2nd maxilla. Fig. 8 – Right 1st maxilliped. Fig. 9 – Right 2nd maxilliped. Fig. 10 – Left 3rd maxilliped. Fig. 11 – Right 1st pereiopod. Fig. 12 – Right 2nd pereiopod. Fig. 13 – Right 3rd pereiopod. Fig. 14 – Ventral view plate on cephalothorax (origins of 2nd to 5th pereiopods shown). Fig. 15 – Lateral view carapace. Fig. 16 – Right 2nd pereiopod. Figs. 1–4, 10, 13, 15 to same scale; 5 and 6 to same scale; 7–9 to same scale; 11, 12, 14, 16 to same scale. Figs. 15 and 16 from female, carapace length 9 mm, remainder from holotype.

Rostrum long and slender just under 2½ times length of the carapace, initially slightly downcurved, but distal 2/3 trends dorsally so that distal acute tip is well above dorsal line of carapace. Armed dorsally with a small subapical fixed tooth and a proximal series of 20 movable teeth, of which posterior 5 are situated on carapace behind orbit. Dorsal margin, between subapical tooth and 1st of movable series, nearly 2/3 of rostrum, is unarmed. Ventral margin bears 13 fixed teeth, the 1st being at a distance from tip twice that between 1st and 2nd, the others becoming closer together posteriorly. Carapace, except for short postrostral carina and a small, blunt, dorsal tubercle about 1/8 length of carapace from posterior margin, smooth and armed with strong antennal and small pterygostomial spines.

First and 2nd abdominal segments normal, 3rd with dorsal midline produced slightly posteriorly to overlap 4th segment. No posterodorsal spines or projections on 4th, 5th and 6th segments. Pleura of 1st to 3rd segments broadly rounded, those of 4th and 5th terminating in a short spine. 6th segment twice length of 5th, with pleuron produced into spine and with rounded posterolateral angle. Telson subequal to 6th segment and armed with 6 pairs of dorsal spines, the 1st pair being a little more than 1/3 length of telson from proximal margin, while 6th pair overlaps distal margin. Telson terminates distally in acute median point bearing a pair of small spines; on each side of this acute point is a long stout spine which extends well beyond median spines.

Eyes large, normally shaped, with ocellus barely distinguishable from cornea.

Antennular peduncle with relatively stout first segment bearing a long, tapering stylocerite with an acute tip. Second and third segments subequal and together shorter than first. Outer flagellum with about 40 basal segments thickened. Antennal scaphocerite long, about 4 times as long as broad, with straight lateral margin terminating in an acute, slender tooth which does not project beyond the rounded apex of the lamella.

Mandible with broad incisor process terminating in 5 strong teeth and with median margin serrate; stout molar process with finely ridged distal end, and with large 3-segmented palp a little shorter than incisor process. 1st maxilla with broad, rounded proximal endite, prominent distal endite and truncate endopod armed distally with a long stout bristle. 2nd maxilla with rounded proximal endite, distal endite well developed and strongly bilobed, endopod simple and tapering, and scaphognathite large with distal lobe long, tapering and bearing a long posterior "lash" of setae. This lash, when 2nd maxilla is *in situ,* extends over lateral surface of gills to just beyond pleurobranch of 5th pereiopod. 1st maxilliped with endites clearly separated, endopod long and apparently 2-segmented, exopod with long flagellum and epipod large and bilobed. 2nd maxilliped with distal segment articulated distomedially with penultimate and with well developed podobranch and epipod. 3rd maxilliped overreaches distal end of scaphocerite by 1/3 distal segment and is longer that 1st or 2nd pereiopods. Penultimate segment is 3/4 length of distal segment and these two together are slightly longer than antepenultimate. Long exopod, epipod and 2 arthrobranchs present.

First pereiopod chelate, stouter, but little shorter, than 2nd, and reaching 2/3 distance along scaphocerite. 2nd pereiopod overreaches 1st by half length of propodus, 3rd overreaches scaphocerite by 2/3 propodus as does 5th, which, owing to the differing lengths of the propodi, overreaches 3rd by 1/3 propodus. Both 4th periopods missing. 1st chela with fingers 3/4 palm, free finger with row of small, movable, spine-like teeth on cutting edge, fixed finger with single broad tooth on cutting edge near tip. Hand subequal with carpus, which is 2/3 merus and a little longer than ischium. There is a very small rudimentary exopod on 1st, 2nd and 3rd pereiopods. 2nd pereiopod slender, chelate, with fingers 1/5 palm, hand about 2/5 carpus and subequal with ischium, carpus a little longer than merus. 3rd pereiopod slender, with dactyl simple, acute, unarmed and a little more than 1/4 length of unarmed propodus. Carpus, a little more than 1/2 propodus with short, acute projection of distal margin. Merus 5/3 propodus, bears two irregularly spaced rows of spines, a lateral of 7 and a posterior of 4. Ischium 1/3 propodus and armed with 1 spine on posterior margin. 5th pereiopod substantially as 3rd, ischium, merus and dactyl subequal in both, but carpus and propodus each 1/2 as long again as equivalent segments in 3rd. Merus armed with lateral row of 8 spines and ischium unarmed.

First pleopod with endopod short and tapering to point, 2nd to 5th pleopods with well developed appendix interna. Uropods elongate, endopod subequal with telson and exopod a little longer; lateral margin of exopod terminates in a microscopic tooth with a strong spine immediately median to it.

On ventral surface of the cephalothorax there is a prominent, anteriorly projecting plate, which arises immediately posterior to bases of 5th pereiopods and extends to between bases of 2nd pereiopods. This plate tapers to a deeply bifid, acute apex, and appears to be unattached to the thoracic sternites over at least its anterior half.

*Branchial Formula*

| | Maxillipeds | | | Pereiopods | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 4th | 5th |
| Pleurobranchiae | – | – | – | 1 | 1 | 1 | 1 | 1 |
| Arthrobranchiae | – | – | 2 | 1 | 1 | 1 | 1 | – |
| Podobranchiae | – | 1 | – | – | – | – | – | – |
| Epipodites | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Exopodites | 1 | 1 | 1 | r | r | r | – | – |

r = rudimentary exopodite

*Notes on Post-Larval Specimen*

The only other specimen of this species available is the female from CIE 52 with carapace length 9 mm. While similar in almost all respects to the female just described, two points of difference should be mentioned. The rostrum (text-fig. 1, fig. 15), armed dorsally with 2 fixed distal and 25 movable proximal teeth, and ventrally with 16 fixed teeth, is not as long in relation to the carapace, and has the proximal dorsal teeth raised on a distinct crest which extends on to the anterior portion of the carapace. This crest is virtually absent in the larger specimen. The 1st to 4th pereiopods in the 9 mm specimen bear prominent, well-developed exopods, that of the 2nd pereiopod being subequal with the merus in length (text-fig. 1, fig. 16). None of these pereiopodal exopods, however, bears setae at its distal tip as do the exopods of the maxillipeds. In all other respects, including the development and relative size of the ventral plate on the cephalothorax, I can detect no noticeable difference between the two specimens.

The apparent differences in the eyes, as shown in the two figures, are merely due to the slightly different positions in which they have become fixed on preservation.

There is no doubt in my mind that these two specimens are conspecific. The smaller one is thus probably in a post-larval stage, the presence of well developed exopods appearing to confirm this, though the large size is unusual.

*Colour in Life*

The CIE 52 specimen was transparent and virtually colourless when alive, except for a band of red on the distal portion of the rostrum, a patch of red distally on the tail-fan, and bright red viscera.

The VUZ 54 specimen was examined in the laboratory while fresh and the following colour notes made. In general the shrimp was mainly red with some paler patches on the abdomen. More intense patches of red pigment were present on the anterior half of the rostrum, the branchial region of the carapace, the edges of the abdominal segments, the thoracic appendages and the tail fan. The setae of the mouth parts were very distinctly red. Only one type of chromatophore, the simple, red type, was seen.

*Systematic Position*

Although this new species is superficially pandalid in general appearance, the chelate 1st pereiopod and the entire carpus of the 2nd pereiopod immediately exclude it from that group. These two characters, coupled with the fact that the 1st pereiopods are stouter, heavier and shorter than the 2nd, place it clearly in the Bresilioida. This superfamily was recently put forward by Holthuis (1955), to include four families, containing between them only five genera. Holthuis (p. 36) states that two of these families, the "Rhynchocinetidae and the Eugonatonotidae certainly are closely related. They differ from the two other families [Bresiliidae and Disciadidae] in having the mandible more Palaemonid, with a distinct incisor and molar process, by the articulate palp of the first maxilliped, by the second maxilliped having the last joint applied sidewise to the penultimate joint, by the shape of the finger tips of the first pair of legs, by the exopods of the pereiopods which are rudimentary or absent." All these characters are shown by *Lipkius holthuisi,* which thus belongs to this section of the Bresilioida. The problem now is the placing of the genus *Lipkius.* The immovable rostrum excludes it from the Rhynchocinetidae, as formerly understood by all carcinologists, while the presence of a strong incisor process on the mandible appears to exclude it from the Eugonatonotidae. Thus either a third, and new, monogeneric family must be placed in this section of the Bresilioida, or some rearrangement of the characters of an existing family must be made to include *Lipkius.*

The solution I have put forward above is to enlarge the family Rhynchocinetidae Ortmann, 1890, to include the genera *Rhynchocinetes, Eugonatonotus* and *Lipkius,* thus abandoning the family Eugonatonotidae Chace, 1937. I have great pleasure in naming this new species *Lipkius holthuisi* in honour of Dr Lipke Bijdeley Holthuis

of the Rijksmuseum van Natuurlijke Historie, Leiden, who has spared no trouble in discussing this and other problems of caridean nomenclature with me both in Leiden during 1955 and by letter since.

*Distribution and Ecology*

Taken between c. 200 and 260 fm, from Cook Strait (41°39'S.) in the north to the Chatham Rise (44°4'S.) in the south. Both VUZ 54 and CIE 52 were from mud bottoms with a characteristic fauna of the polychaete *Hyalinoecia tubicola* and the isopod *Serolis bromleyana.*

## Superfamily PALAEMONOIDA

## Family CAMPYLONOTIDAE

### Genus **Campylonotus** Bate, 1888

1888 *Campylonotus* Bate, Challenger Exped. Rep. 24: 767.

1891 *Anchistiella* A. M.-Edwards, Miss. Sci. Cap Horn 6: 37.

1910 *Campylonotus* Sollaud, Bull. Mus. Nat. Hist. Nat. 1910: 377.

1913 *Campylonotus* Sollaud, Bull. Mus. Nat. Hist. Nat. 1913: 184.

*Definition*

Campylonotidae with 2 lateral carinae on carapace. Mandible not cleft. 2nd pereiopods subequal. Epipods present on 1st to 4th pereiopods.

*Type species:* **C. semistriatus** Bate, 1888, from the Patagonian region.

Three other species are now recognised, all from the southern hemisphere: *C. vagans* Bate, also from the Patagonian region; *C. capensis* Bate, from off Marion Island and Pernambuco, Brazil, and *C. rathbunae* Schmitt, originally from Australian waters but here recorded also from the New Zealand area.

Since 1926, when Schmitt published his key to this genus, Holthuis (1952) has shown *C. seneuili* (A. M.-Edwards) to be a synonym of *C. vagans,* and a re-examination of the types of *C. capensis* (see below) has enabled this hitherto misunderstood species to be placed with more certainty. Thus it is now possible to give a new idea of the relationships within the genus.

KEY TO THE GENUS CAMPYLONOTUS

1 (6) Distal margin of scaphocerite broad and rounded. Rostrum normally with not more than 4 ventral teeth.

2 (3) Abdomen armed dorsally with spines and a blunt tubercle ..... **C. rathbunae** Schmitt

3 (2) Abdomen dorsally unarmed.

4 (5) Rostrum normally with 4 to 5 dorsal and 3 (rarely 4) ventral teeth ..... **C. semistriatus** Bate

5 (4) Rostrum normally with 6 (rarely 5) dorsal and 4 ventral teeth ..... **C. capensis** Bate

6 (1) Scaphocerite narrows gradually towards distal tip and terminates in an acute tooth. Rostrum normally with 7 or more ventral teeth. Abdomen dorsally unarmed ..... **C. vagans** Bate

### **Campylonotus rathbunae** Schmitt, 1926

1926 *Campylonotus rathbunae* Schmitt, Biol. Rec. Endeavour V (6): 373, pl. 67.

1955 *Campylonotus rathbunae* Holthuis, Zool. Verhand. 26: fig. 20a (after Schmitt).

*Material Examined*

*Chatham Islands 1954 Expedition:* Sta. 6 – 103 ♂♂ 9–14 mm, 22 ♀♀ 15–20 mm (3 ovigerous 15–20 mm); Sta. 7 – 113 ♂♂ 5–15 mm, 35 ♀♀ 14–24 mm (1 ovigerous 16 mm); Sta. 40 – 1 ♂ 9mm; Sta. 41 – 16 specimens 5–19 mm; Sta. 52 – 69 specimens 8–20 mm (3 ovigerous ♀♀ 14– 20 mm); Sta. 58 – 3 ♂♂ 9 mm; Sta. 59 – 15 specimens 9–15 mm.

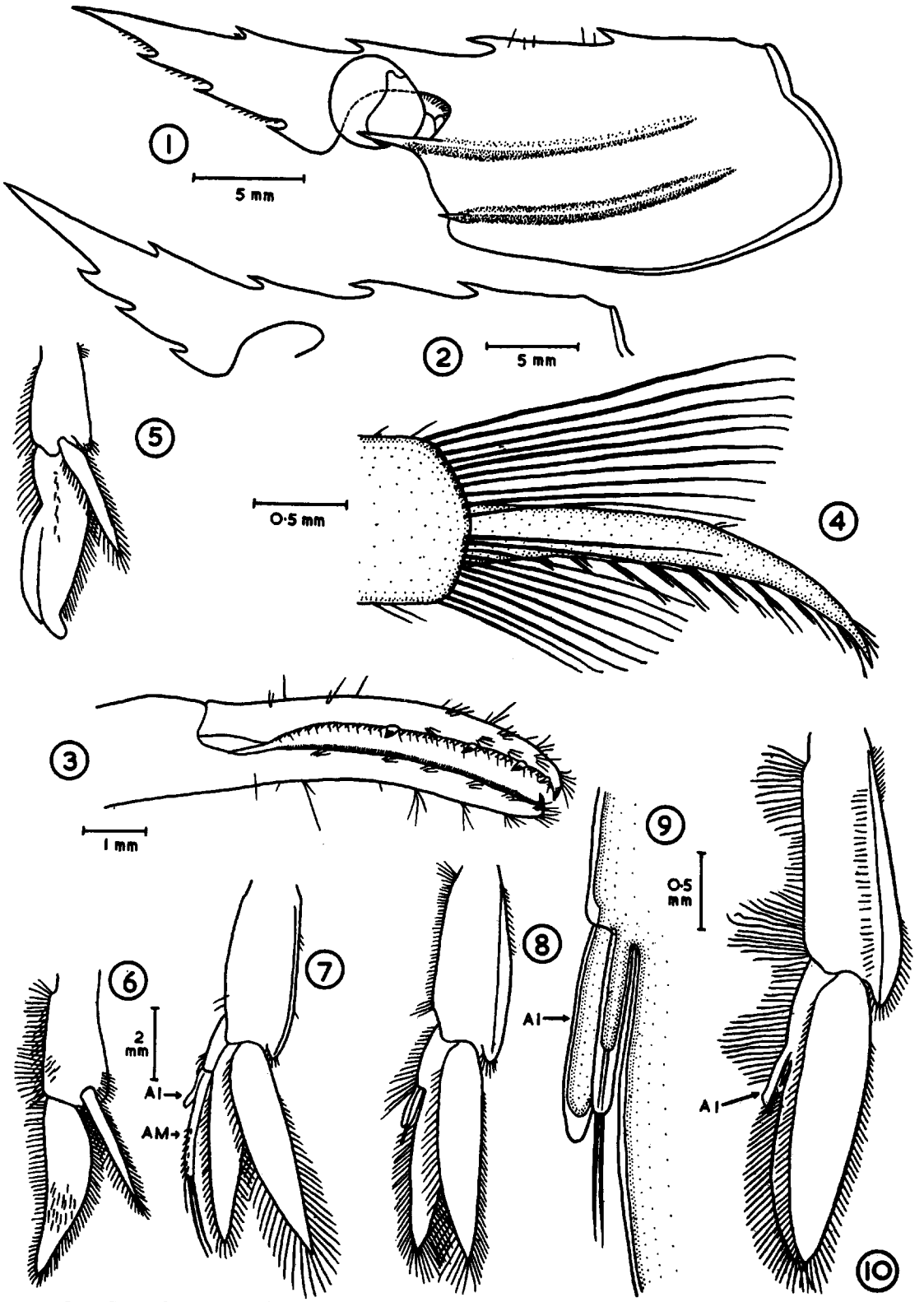
*Victoria University Zoology Department Cook Strait Collections:* Coll. VUZ 53 (Sta. HUL) 41°41'S., 175°17'E., 23/2/56, 0100–0215 h, BT on bottom of mud and gravel at 250–350 fm – 2 ♂♂ 5–10·5 mm, 1 ♀ 21 mm; VUZ 54 (Station GUL) as before – 1 ♀ 23·5 mm.

*Portobello Marine Biological Station Collection:* Sta. *Alert* 54–13, N.E. of Otago Heads, Canyon A, 2/3/54, BT on bottom at 275 fm – 2♂♂ 11·5–12 mm.

This species was described by Schmitt (1926) from specimens taken in the Great Australian Bight, between 190 and 450 fm, during fisheries investigations by the F.I.S. *Endeavour* 1909–14, and has not been recorded in the literature since.

*Specific Diagnosis*

A relatively large, robust prawn with prominent, blade-like rostrum and rostral formula of 4/3 (rarely 3 or 5/3 or 4/4) of which 2 dorsal teeth are situated on carapace, posterior to orbit. Carapace dorsally carinated; 2 lateral carinae, one




TEXT-FIG. 2 – *Campylonotus rathbunae* Schmitt. Fig. 1 – Lateral view male carapace. Fig. 2 – Lateral view of intersex carapace. Fig. 3 – Chela of right 2nd pereiopod. Fig. 4 – Dactyl of right 3rd pereiopod. Fig. 5 – Left 1st male pleopod. Fig. 6 – Left 1st female pleopod. Fig. 7 – Left 2nd male pleopod. Fig. 8 – Left 2nd intersex pleopod. Fig. 9 – Appendices of Fig. 8 enlarged. Fig. 10 – Left 2nd pleopod of ovigerous female. Figs. 5–8 and 10 to same scale; 2, 6, 8 and 9 from transitional specimen, carapace length 15 mm; 4 and 10 from female, carapace length 20 mm, remainder from study male. AI appendix interna, AM appendix masculina.

from each of the antennal and branchiostegal spines. 3rd abdominal segment with prominent, dorsally flattened tubercle on middorsal line; 3rd, 4th and 5th abdominal segments producted posteriorly into prominent spines; pleura of 5th segment posteroventrally acute and armed with posterolateral spine. 1st pair of pereiopods alike, similarly 2nd pair.

*Additional Morphological Description*

The new Zealand specimens agree in every way with Schmitt's (1926) description except for three minor points.

1. Both males and females are of a much smaller size. Carapace length of New Zealand males 5 to 16 mm, of females 14–24 mm; against Schmitt's figures of 17 to 24 mm for male and 27 to 28 mm for female carapace lengths.
2. The posterodorsal spines of the 3rd, 4th and 5th abdominal segments are not as prominent in my specimens as those shown in Schmitt's plate 67. This may, however, be due to the smaller size of the New Zealand specimens.
3. Schmitt describes a "series of six paired spines on the dorsum of the telson". Six pairs are rare in the New Zealand material. The majority have only 5 pairs and seldom are all these pairs complete.

The differences are so slight and the agreement otherwise so complete that I do not hesitate in identifying the New Zealand specimens with the Australian *C. rathbunae*.

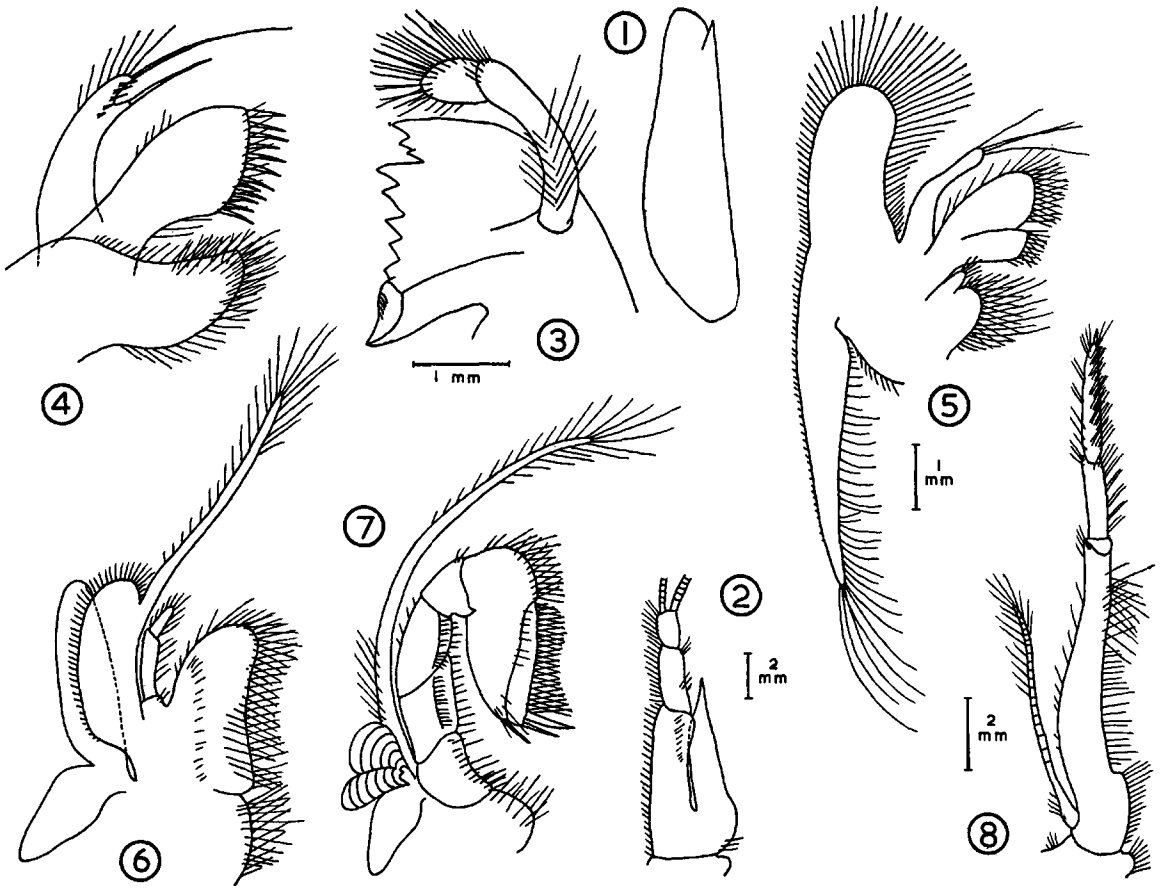
The sexes can be easily distinguished by the shape of the rostrum (the question of the appendix masculina will be dealt with below). In the male the rostrum is an almost straight continuation from the dorsal midline of the carapace, only slightly upturned towards the tip (text-fig. 2, fig. 1) while in the female it is strongly dorsally curved, the dorsal margin being evenly concave (see Schmitt, 1926, pl. 67).

An account of the antennular peduncle, the scaphocerite, the mouthparts, the chela of the 2nd pereiopod, the dactyl of the 3rd pereiopod and the branchial formula are given below for the first time. These descriptions are based mainly on a male specimen, with carapace length 14 mm, from CIE 6.

Antennular peduncle with relatively slender first segment bearing a long, tapering, stylocerite from its expanded base. Stylocerite reaches about midway along second peduncular segment. Third segment about 2/3 second and together with second about 2/3 first. Outer flagellum with about 25 basal segments thickened. Antennal scaphocerite 3½ times as long as broad, with straight lateral margin terminating in a strong tooth which does not project beyond the rounded apex of the lamella.

Mandible not cleft, with incisor and molar processes fused into one denticulate plate, 2-segmented palp present. 1st maxilla with bluntly-tapering proximal endite, prominent distal endite armed with stout bristles, and bifid endopod armed distally with a long bristle on each apex. 2nd maxilla, 1st and 2nd maxillipeds substantially as illustrated for *C. vagans* (as *C. seneuili*) by Sollaud (1910). 2nd maxilla with proximal endite unequally bilobed, distal endite well developed and strongly bilobed, endopod simple and scaphognathite large with distal lobe long, narrow and tapering to point bearing long curved setae. 1st maxilliped with endites clearly separated, endopod 3-segmented, exopod with long flagellum and epipod large and bilobed. 2nd maxilliped with distal segment articulated distomedially with penultimate and with well developed podobranch and epipod (podobranch not shown by Sollaud in 1910 but mistake corrected in 1913). 3rd maxilliped with basal segment broad, curved and bearing a relatively long, slender exopod which is indistinctly multiarticulated.

2nd pereiopods relatively longer in the smaller specimens, which, as will be shown below, are male. Thus male 2nd pereiopod reaches beyond distal end of scaphocerite by almost entire hand, while in larger, female specimens it reaches beyong scaphocerite by little more than fingers. Fingers of study male (text-fig. 2, fig. 3) are about 2/3 length of palm and curved, outer margin of free finger is convex and that of fixed, concave. Inner margin of free finger is armed with 3 prominent teeth, one midway along edge and the other 2 evenly spaced between it and the inwardly curved acute tip of finger. There is a 4th smaller tooth between the tip and distal tooth of above series. Along entire inner margin of this finger, between and beyond, the larger teeth described above, is a series of small, slightly curved, evenly spaced teeth which close against another set of small teeth along inner margin of fixed finger. This latter series consist of short, thin, straight teeth placed close together like teeth of a comb




TEXT-FIG. 3 – *Campylonotus rathbunae* Schmitt. Fig. 1 – Right scaphocerite. Fig. 2 – Right antennule. Fig. 3 – Right mandible. Fig. 4 – Right 1st maxilla. Fig. 5 – Right 2nd maxilla. Fig. 6 – Right 1st maxilliped. Fig. 7 – Right 2nd maxilliped. Fig. 8 – Right 3rd maxilliped. Figs. 1 and 2 to same scale; 3 and 4 to same scale; 5–7 to same scale. All figs. of study male.

and extend from the articulation of free finger to the acute, inwardly recurved tip of fixed finger. The large teeth of free finger overlap this series when chela is closed. Numerous tufts of setae occur over both fingers.

Dactyl of 3rd pereiopod (text-fig. 2, fig. 4), as in 4th and 5th, is about 1/4 length of propodus and curves to terminate in a single, acute tip. The concave ventral surface bears about 9 evenly spaced, movable acute bristles, each accompanied by about 2 long feathered setae. Entire proximal half of dactyl is obscured by an outwardly expanding cone of long feathered setae arising from distal end of propodus.

*Branchial Formula*

| | Maxillipeds | | | Pereiopods | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 4th | 5th |
| Pleurobranchiae | – | – | 1 | 1 | 1 | 1 | 1 | 1 |
| Arthrobranchiae | – | – | 1 | 1 | 1 | 1 | 1 | – |
| Podobranchiae | – | 1 | – | – | – | – | – | – |
| Epipodites | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – |
| Exopodites | 1 | 1 | 1 | – | – | – | – | – |

This agrees with the formulae, as given for the genus *Campylonotus* by Bate (1888) and Sollaud (1910).

*Colour in Life*

Specimens of *C. rathbunae* were examined during the Chatham Islands Expedition both alive

and in the laboratory after a short period in preservative. The VUZ 54 specimen was also examined in detail in the laboratory. Live specimens are transparent with many small red chromatophores scattered over the body, ocular peduncles, appendages and tail fan. These red chromatophores are concentrated in places into a number of irregular pinkish-red blotches. The number, shape and position of these blotches vary from specimen to specimen but three more or less characteristic positions are: the tip of the rostrum distal to the 1st dorsal tooth; the posterior portion of the pleuron of the 2nd, the pleurae of the 3rd and 4th and the anterior portion of the pleuron of the 5th abdominal segments, and finally the most characteristic patch of all, a "saddle" on the 3rd abdominal segment across the area of the middorsal tubercle and extending distolaterally on the tergite.

A number of the specimens when brought up alive in the trawl were stained a dark grey or black on appendages and ventral surfaces of the body. These specimens came from bottoms of fine mud and both their colour and appearance were reminiscent of sulphide staining.

*Distribution*

*C. rathbunae* has been found in the Great Australian Bight, between 190 and 450 fm, and off the east coast of the South Island of New Zealand, where it has been taken, between 155 and 330 fm from Cook Strait (about 41°30′S.) in the north to off Otago Heads (about 45°50′S.) in the south.

*Variation in Rostral Formula*

The rostral formulae of the 123 apparently undamaged specimens from CIE 6 were examined and the variation found to be as follows:

| | | | | | |
|---|---|---|---|---|---|
| Ventral | 4 | | 5 | | |
| Rostral | 3 | 5 | 110 | 3 | |
| Teeth | | | | | |
| | | 3 | 4 | 5 | |

Dorsal Rostral Teeth

Thus about 88·5% had the single formula 4/3, the remaining 11·5% being divided fairly evenly between 4/4, 3/3 and 5/3. As in all specimens examined the posterior 2 teeth of the dorsal series were situated on the carapace, the predominant formula should be expressed as $\frac{2+2}{3}$.

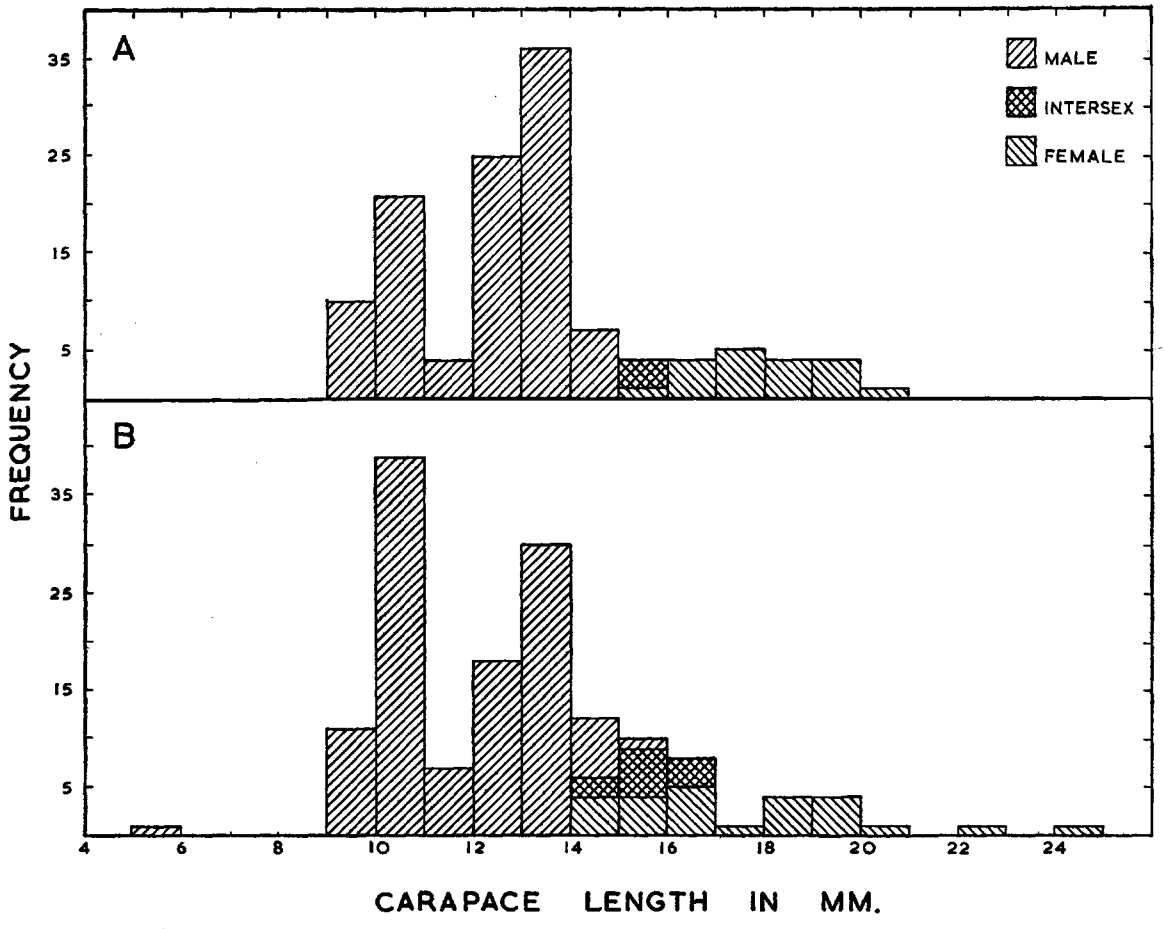
A single specimen from CIE 6 had the formula of 5/9, and though the 9 ventral teeth were uniform and evenly spaced, it would appear to be a case of damage and multiple regeneration. No other specimen with more than 4 ventral teeth was seen in the material available to me.

*Notes on Life History*

The size frequency graphs of the specimens from CIE 6 and CIE 7 (text-fig. 4) indicated that *Campylonotus rathbunae* could be a protandrous hermaphrodite. This hypothesis was confirmed by an examination of the form of the appendix masculina on the 2nd pleopod of the male and its subsequent degeneration into the diminutive "stylamblys" of the female.

Thus the Campylonotidae becomes the third natant family in which protandrous hermaphroditism has been shown to occur. Berkeley (1930) reviews the literature on sex reversal in Crustacea. Spitschakoff (1912) was the first to describe this phenomenon in a natant, as he was able to establish the hermaphrodite character of *Lysmata seticaudata* (Family Hippolytidae), though a change in external features does not appear to take place in this species. Dohrn and Holthuis (1950) deal with further work on sex reversal in this species and in the closely allied *L. nilita*. Berkeley herself in 1929, demonstrated protandrous hermaphroditism in *Pandalus danae* (Family Pandalidae) and in 1930, for a further three species of *Pandalus, P. borealis, P. hypsinotus, P. platyceros* and one species of *Pandalopsis, P. dispar*. Rasmussen (1953), in his important work on geographical variation in growth and sexual development of *Pandalus borealis,* reviews the work up to that date and thoroughly analyses the life history of this prawn at a number of different localities.

Text-fig. 4 (Graph A) shows that in CIE 6 there are 103 males with carapace lengths between 9 and 15 mm and 22 females with carapace lengths between 15 and 21 mm. Three specimens, with carapace lengths between 15 and 15·5 mm, are in a transitional stage of appendix masculina reduction, but have achieved female form in other external features. Three females are ovigerous (15, 16 and 20 mm carapace lengths), all with eggs in an early stage of development measuring, after preservation, 1·3 to 1·4 × 1·0 to 1·1 mm. Similarly text-fig. 4 (Graph B) shows that in CIE 7 there are 113 males between 5 and 16 mm and 25 females between 14 and 25 mm. In this case 10 specimens between 14 and 17 mm are in a transitional stage of appendix masculina reduction but have achieved female external form. One female is ovigerous at 16 mm.




TEXT-FIG. 4 – *Campylonotus rathbunae* Schmitt. Size frequency graphs for CIE Sta. 6 (graph A) and CIE Sta. 7 (graph B) specimens.

The male 1st pleopod (text-fig. 2, fig. 5) has a modified endopod, longer and much wider than the straight-edged, tapering exopod. The distal 2/3 of the medial margin of the endopod expands convexly and is devoid of setae. Between it and the distal lateroventrally directed lobe is a small notch where a groove running down the anterior face of the expanded portion of the endopod meets the medial margin. There are a number of very small hooks along this margin proximal to the notch. The lateral margin of the endopod is convex and setose as far as the distal lobe.

The 1st pleopod from one of the above mentioned transitional, or intersex, specimens is illustrated in text-fig. 2, fig. 6, this being identical in shape and form with the 1st pleopod of a fully developed female. Here the endopod, though longer and wider than the straight-edged, tapering exopod, is of a general elongate triangular form. The margins are setose, the medial being weakly concave, the lateral convex and the distal tip bluntly pointed. A number of setae are present on the anterior face of the endopod.

The male 2nd pleopod (text-fig. 2, fig. 7) has both endopod and exopod with weakly convex, setose, lateral and medial margins tapering to acute distal tips. On the proximal portion of the medial margin of the endopod there is a slightly expanded lobe bearing an appendix interna and an appendix masculina. The appendix interna is simple and just over 1/5 the length of the endopod. The appendix masculina is over 1/2 the length of the endopod and 2½ times the length of the appendix interna. It is slightly curved, its medial margin being weakly convex, and is of about uniform width to its abrupt distal extremity. This

extremity bears 2 very long stout bristles about 3/4 the length of the appendix itself and one shorter seta. The distal half of the appendix bears a number of short curved setae along its medial margin and anterior face. *In situ* the appendix masculina with its distal bristles just overreaches the endopod.

The 2nd pleopod of a transitional specimen (text-fig. 2, figs. 8 and 9) has exopod, endopod and appendix masculina similar to the male described above. However, the appendix masculina is very much shorter, being nearly subequal or a little shorter than the appendix interna. The appendix masculina bears distally 2 long setae, about 1/2 the length of the appendix itself and a number of small setae along the distal half of its medial margin. Text-fig. 2, fig. 9, is a greatly enlarged view of the two appendices. The specimen was about to moult and the underlying structures have pulled away from the cuticle enabling one to see the form they would have taken after the moult. The reduced size of the underlying appendix masculina, still bearing two distal setae, when compared with the underlying appendix interna, can be clearly seen. After the next moult the appendix masculina would be only about 2/3 the length of the appendix interna instead of being subequal with it, and this specimen, already bearing a female 1st pleopod, would then be a true female, though possibly not sexually mature until after another moult.

The 2nd pleopod of an ovigerous female (carapace length 20 mm) is shown in text-fig. 2, fig. 10. This pleopod, though in a "breeding-dress" of longer and more numerous setae than those of other mature but non-ovigerous females, shows clearly the condition of the 2 appendices on a mature female pleopod. Here the "appendix masculina" is less than 1/2 the length of the appendix interna and of a much smaller diameter, though it still bears 2 distal setae. The appendix interna is still just over 1/5 the length of the endopod. Holthuis (1952), realising that the smaller appendix was homologous with the appendix masculina, a term "not very appropriate here", referred to it, in *Campylonotus semistriatus,* as the stylamblys. Thus, in *Campylonotus rathbunae* we are able to follow the degeneration of the appendix masculina of the male into the greatly reduced stylamblys of the female as the specimen changes from a mature male into a mature female. As will be shown below, a re-examination of the type material of *Campylonotus semistriatus* in the British Museum confirmed the belief that that species also is a protandrous hermaphrodite. It now appears likely that this condition may prove to be a character of the genus *Campylonotus.*

The rostrum of a transitional specimen, as shown in text-fig. 2, fig. 2, has a more concave dorsal margin and is consequently more upturned than in the almost straight male rostrum, though not to such a great extent as in a mature female.

The almost complete reduction of the pair of forwardly inclined plates on the ventral surface between the 4th pair of pereiopods in the male to the low ridges of the female (Schmitt, 1926, pl. 67, figs. 2 and 5) can be followed in the CIE material. The above transitional specimen has a pair of plates only about 1/2 the normal size in the male and within these it can be seen that after the next moult only the low ridges of the mature female will be present.

In this CIE material, the transitional length for sex reversal appears to be a carapace length of about 14 to 17 mm. Schmitt's (1926) *C. rathbunae* males, from Australia, with carapace lengths of 17 to 24 mm, can be explained from the well documented fact that in *Pandalus borealis* "the great differences found in the life histories of these widely separated prawn populations were largely due to environmental factors . . . it is necessary to revise any previous conceptions that the life history of the deep sea prawn should be largely uniform in its whole area of distribution. The growth and maturing change, not only from one locality to another, but also brood to brood born in different years in one and the same locality" (Rasmussen, 1953). Thus the Australian males change sex at some size between their largest carapace length, 24 mm, and the smallest female length of about 27 mm.

It should be pointed out that neither the specimen from CIE 7 with the carapace length of 5 mm, nor the specimen from CIE 41 of similar length, have a trace of an appendix masculina. However, the rostra are of the male type and the specimens are clearly sexually immature. Any speculation as to the growth rate of this species from the information available would be premature. The two graphs distinctly reflect the same tendencies, especially in the two maxima for the male specimens, but the relative ages of these are unknown.

*Ecology*

From the list of stations given above it can be seen that *C. rathbunae* has been taken off bottoms of fine mud and sand. From the evidence of the dark staining and from the fact that specimens were often covered in mud on being brought up in the trawl it would appear that it dwelt in or on the surface of the mud at these depths.

*Parasitism*

One male (9·5 mm) from CIE 6 and another specimen (13·5 mm) from CIE 7 had bopyrid isopods attached to the ventral surface of the abdomen between the pleopods. In the case of the latter the isopod was relatively large and greatly distended and the prawn bore clear signs of parasitic castration. Although from its carapace length the latter would have been expected to be male, only a diminutive stylamblys was present and the rostrum was already in the female form.

## Notes on the type material of Campylonotus semistriatus, C. vagans and C. capensis

During 1955 I was able to examine the type material of the 3 species originally included by Bate (1888) in the genus *Campylonotus*. As this examination cleared up certain obscure points in our knowledge of these species, the following notes are given as a contribution to the biological understanding of this southern genus.

**Campylonotus semistriatus** Bate, 1888

Restricted synonymy

1888 *Campylonotus semistriatus* Bate, Challenger Exped. Rep. 24: 768, pl. 128, figs. 1, 2.

1891 *Anchistiella hahni* A. M.-Edwards, Miss. Sci. Cap Horn 6: 41, pl. IV, fig. 2.

1952 *Campylonotus semistriatus* Holthuis, Lunds Univ. Arssk. 2, 47 (10): 68, fig. 15.

*Material Examined*

All the specimens listed below must be regarded as syntypes, though it is clear from the labels present that a male with carapace length 14 mm, separated out from Sta. 307, was Bate's "study male" and that 3 females from Sta. 309 were his "study females". As the localities are all in the channels among the islands off the west coast of Patagonia, and are given in detail with depths by Bate, they will be omitted here.

*Challenger* Sta. 305A, 3 ♂♂ 11–13 mm, 1 intersex 16·5 mm, 2 ♀♀ 17–18 mm; Sta. 306A, 3 ♂♂ 13·5–19 mm (container labelled Sta. 306 but trawl haul at this station should be 306A); Sta. 307, 3 ♂♂ 12–14 mm, 5 intersexes 15–19 mm, 8 ♀♀ 18–23 mm. Bate records 40 specimens from this station; some, at least, of the balance are in the University Museum, Dundee (Thompson, 1901). Sta. 308, 1 ♂ 11 mm, 3 intersexes 14–18 mm, 5 ♀♀ 16·5–20 mm; Sta. 309, 3 ♀♀ 19–22 mm; Sta. 310, 3 ♂♂ 16·5–20 mm, 1 intersex 22 mm, 2 ♀♀ 22–24 mm; Sta. 311, 3 ♂♂ 10·5–15 mm, 1 ♀ 21·5 mm.

*Remarks*

From the above it can be seen that *C. semistriatus* is also a protandrous hermaphroidte, though, as in Rasmussen's (1953) material of *Pandalus borealis,* the transitional length for sex reversal differs from locality to locality. The form of the appendix masculina and its reduction to the stylamblys in the female parallels very closely the description for *C. rathbunae*. As in the latter species the rostrum of the male is only slightly upcurved towards the tip, while in the female it is strongly curved dorsally.

The variation in the rostral formulae is 4 to 5/3 and 4/4, with 2 of these dorsal teeth invariably on the carapace behind the orbit. Of the 38 specimens available with undamaged rostra, 79% have 4/3 teeth, the other formulae being found as follows:

| | | | | |
|---|---|---|---|---|
| Ventral | 4 | 1 | | |
| Teeth | | | | |
| Rostral | 3 | 30 | 7 | |
| | | 4 | 5 | |

Dorsal Rostral Teeth

The carapace and abdomen of the syntypes are covered with short setae, as described by Holthuis (1952, p. 68) for his more recent specimens, and are not smooth and polished as stated by Bate.

**Campylonotus vagans** Bate 1888

Restricted synonymy

1888 *Campylonotus vagans* Bate, Challenger Exped. Rep. 24: 775, pl. 122, fig. 3.

1891 *Anchistiella hyadesi* A. M.-Edwards, Miss. Sci. Cap Horn 6: 38, pl. 4, fig. 1.

1891 *Anchistiella seneuili* A. M.-Edwards, Miss. Sci. Cap Horn 6: 42, pl. 3, fig. 2.

1952 *Campylonotus vagans* Holthuis, Lunds Univ. Arssk. 2, 47 (10): 70, fig. 16.

*Material Examined*

Challenger Sta. 308, as above: 1 ♀ 35 mm.

The small tooth, above the pointed apex on the posterior margin of the pleuron of the 5th abdominal segment, mentioned by Holthuis (1952, p. 71), is present on the holotype, but on the left side only.

**Campylonotus capensis** Bate, 1888

1888 *Campylonotus capensis* Bate, Challenger Exped. Rep. 24: 773, pl. 128, fig. 3.

1910 *Campylonotus capensis* Sollaud, Bull. Mus. Nat. Hist. Nat. 1910: 381.

1926 *Campylonotus capensis* Schmitt, Biol. Rec. Endeavour 5 (6): 373.

*Material Examined*

Challenger Sta. 122, 9°5′S., 34°50′W., off Pernambuco, Brazil; 10/9/1873; trawled from bottom of red mud at 350 fm – 2 ♂♂ 9–10 mm. Sta. 145, 46°43′S., 38°4′30″E., off Marion Island; 27/12/1873; dredged from bottom of volcanic sand at 140 fm – 4 ♂♂ 7·5–12 mm, 1 ovigerous ♀ 17 mm.

Though all the above specimens are syntypes, I select Sta. 145 as the restricted type locality. I have not selected a lectotype, leaving that to the author who redescribes this species; however, neither the only female (illustrated by Bate, pl. 128, fig. 3) nor the largest male are suitable, as the rostra of both have been damaged. It is unfortunate that Bate illustrated this damaged and regenerating rostrum as in the undamaged state this structure is, contrary to the statements in the keys of Sollaud (1910) and Schmitt (1926), longer than the distal extremity of the scaphocerite, and closely resembles that of *C. semistriatus,* being armed, however, with two additional dorsal and one additional ventral tooth. Thus the rostral formula in all the specimens available, with the exception of the two damaged specimens mentioned above, is 6/4, the first dorsal tooth being subapical and 2 dorsal teeth being situated on the carapace behind the orbit. The damaged specimens have a formula of 5/4.

In the middorsal line of the carapace, close to the posterior margin, there is a tubercle, similar to that described for *C. semistriatus* by Holthuis (1952). Also contrary to the statements in Sollaud's and Schmitt's keys, the scaphocerite does not narrow gradually towards the anterior end and terminate in a point, as in *C. vagans,* but has a broad and rounded distal margin as in *C. rathbunae* and *C. semistriatus.* Finally the endopod of the male 1st pleopod is unlike that of *C. semistriatus* (Holthuis, 1952, fig. 15), being distinctly longer and narrower.

## Superfamily PANDALOIDA

### Family PANDALIDAE

**Notopandalus** nov. gen.

*Definition*

Pandalidae with long, immovable rostrum armed dorsally with movable teeth only, though small, subapical, fixed teeth may be present. Eyes large, much wider than ocular peduncles. Stylocerite tapering and rounded at tip. Posterior lobe of scaphognathite bluntly rounded. No exopodite on 3rd maxilliped. No laminar expansion of the inner border of ischium of 1st pereiopod. 2nd pereiopods subequal and carpus with more than 3 subsegments. Arthrobranchs on 1st to 4th pereiopods and epipods on 1st and 2nd pereiopods.

*Type species:* **Pandalus magnoculus** Bate, 1888

*Notopandalus,* here regarded as monotypic, clearly belongs to that group of genera which is distinguished, in de Man's (1920) and Holthuis' (1955) keys to the family Pandalidae, by having the carpus of the 2nd pereiopods multiarticulate, the carapace smooth, the rostrum immovable, the eyes large and the 3rd maxillipeds without an exopod. This group, which can be conveniently called the *"Pandalus"* group, includes *Pandalus* Leach, 1814; *Pandalopsis* Bate, 1888; *Pandalina* Calman, 1899; *Peripandalus* de Man, 1917 and *Austropandalus* Holthuis, 1952. *Notopandalus* can be immediately separated from all other genera in the *"Pandalus"* group by the relatively long, tapering stylocerite. The diagnostic characters of the 6 genera are as follows:

| | *Pandalopsis* | *Pandalina* | *Pandalus* | *Austro-pandalus* | *Peri-pandalus* | *Noto-pandalus* |
|---|---|---|---|---|---|---|
| Dorsal rostral teeth | movable* | fixed and movable | movable* | fixed and movable | fixed | movable* |
| Antennular stylocerite | short and rounded | broad and rounded | broad and rounded | short and rounded | pointed and rounded at tip | tapering and rounded at tip |
| Proximal lobe scaphognathite | † | truncate | acute | truncate | † | broadly rounded |
| Exopod of 3rd maxilliped | absent | absent | absent | absent | absent | absent |
| Ischial expansion on 1st pereiopods | present | absent | absent | absent | absent | absent |
| 2nd pereiopods | subequal | unequal | unequal | unequal | † | subequal |
| Arthrobranchs on pereiopods | 1st–4th | absent | 1st–4th | 1st–4th | † | 1st–4th |
| Epipods on pereiopods | 1st only | 1st–4th | 1st–4th | 1st–4th | absent | 1st–2nd only |

* Not including small subapical fixed tooth.
† Information not available to author.

De Man (1920: 101) stated that "the species of the genus *Pandalus* . . . are found either north of the tropic of Cancer or south of the tropic of Capricorn and have not been observed between the tropics. The majority of the species of this genus are found in the North Atlantic and the North Pacific, but do not occur in the Mediterranean, while only four are known from the southern hemisphere." These four were *P. leptorhynchus* Stimpson, 1860 from Australia; *P. magnoculus* Bate from New Zealand; *P. modestus* Bate, 1888 from off South Africa and *P. paucidens* Miers, 1881 from the coasts of Chile. Stimpson's *P. leptorhynchus* belongs to *Chlorotocella* Balss (see Dakin and Colefax, 1940), and Bate's *P. modestus* is regarded as a synonym of *Pandalina brevirostris* (Rathke) by Barnard (1950) and Miers' *P. paucidens* is synonymous with *Austropandalus grayi* (Cunningham), see Holthuis (1952). Thus the removal of *N. magnoculus* from the genus *Pandalus* leaves this as a strictly northern hemisphere genus of about 20 species.

**Notopandalus magnoculus** (Bate, 1888)

1888 *Pandalus magnoculus* Bate, Challenger Exped. Rep. 24:667, pl. 115 fig. 1.

1901 *Pandalus magnoculus* Thompson, Cat. Crust. Dundee: 21 (listed).

1903 *Pandalus magnoculus* Thomson, Trans. Linn. Soc. Lond. Zool. 8 (11):446 (listed).

1904 *Pandalus magnoculus* Hutton, Index Faunae N.Z. p 255 (listed).

1920 *Pandalus magnoculus* de Man, Siboga Exped. 39a3:103 (listed).

1937 *Pandalus magnoculus* Hesse, Allee, & Schmidt, Ecological Animal Geogr., 259, fig. 69d (after Bate).

Since the specimens taken by the *Challenger* Expedition in New Zealand waters were described by Bate (1888) no further specimens of this pandalid have been recorded in the literature. It was apparently taken in quantity by the *Challenger* in 1874 as Murray (1895), in his narrative of the expedition, states for Sta. 166 that "the shrimps (*Pandalus magnoculus*) came up in great numbers in both hauls and subsequently made their appearance on the dinner-table", a situation which was repeated on the *Alert* in 1957 in the case of B.S. 209.

*Material Examined*

*Chatham Islands 1954 Expedition:* Sta. 6 – 3 ♂♂ 12·5–13 mm, 5 ♀♀ 10–13 mm; Sta. 34 – 19 ♂♂ 5–12 mm, 29 ♀♀ 5–7 mm; Sta. 40 – 14 ♂♂ 5–13 mm; 11 ♀♀ 5–14 mm (1 ovigerous 11 mm); Sta. 41 – 1 ♂ 13 mm, 2 ♀♀ 4·5–5·5 mm, 1 damaged 3·5 mm; Sta. 44 – 3 ♂♂ 7–9 mm, 7 ♀♀ 5·5–12 mm (1 ovigerous 12 mm); Sta. 52 – 41 ♂♂ 8–14 mm; 27 ♀♀ 9–13 mm (6 ovigerous 11–13 mm); Sta. 58 – 1 ♀ 12 mm; Sta. 59 – 48 ♂♂ 9–13 mm; 40 ♀♀ 9–12 mm (9 ovigerous 9·5–11 mm); Sta. 60 – 467 specimens; a sample of 100 consisted of 34 ♂♂ 7·5–11 mm, 66 ♀♀ 9–13 mm (41 ovigerous 9–12·5 mm).

*British Museum (Natural Mistory):*

*Challenger* Sta. 166, 38°50'S., 169°20'E., between Australia and New Zealand, about 200 miles from Cape Farewell; 23/6/1874; depth 275 fm; bottom globigerina ooze – 7 specimens 13–15 mm (1 ovigerous ♀ 14 mm). Syntypes of *Pandalus magniculus* Bate. Thompson (1901) records specimens from this station in the University Museum, Dundee.

*Challenger* Sta. 167, 39°32′S., 171°48′E., about 120 miles north-west of Stephen's Island, N.Z.; 24/6/1874; depth 150 fm; bottom blue mud – 15 specimens 7–12 mm (2 ovigerous ♀ ♀ 11 mm). Syntypes of *Pandalus magnoculus* Bate.

*Victoria University Zoology Department Cook Strait Collections:*

Coll. VUZ 14 (Sta. SEB) 41°28′30″S., 175°0′30″E., 6/2/55, BT on mud bottom at 80–100 fm – 1 ♂ 10 mm.

VUZ 22 (Sta. COS) 41°33′S., 174°58′30″ E., 13/5/55, 1010 h, BT on bottom at 250–300 fm – 3 ♂ ♂ 11–12 mm, 1 ♀ 11 mm; VUZ 99 (Sta. DOJ) 41°34′30″S., 174°43′30″E., 29/8/57, 1115–1230 h, BT on bottom of dead shell and sand at about 150 fm – 1 ovigerous ♀ 12 mm.

*Dominion Museum Collection:*

Off Kaipara Bar, North Auckland; prawn trawl, about 100 fm. M.T. *Sandra,* 1955. Pres. Marine Department – 12 damaged specimens.

Hauraki Gulf, trawled, 24/10/56. Coll. S. G. Hume – 1 ovigerous ♀ 12 mm.

Marine Department – V.U.C. Zoology Dept. Northern Prawn Investigations Sta. 7, 37°33′S., 176°32′E., off Plate Is. – Astrolabe Reef, Bay of Plenty; 16/8/56; 2145–0015 h, OT on bottom at 70–100 fm – 3 damaged specimens from stomach of smooth hound, *Mustelus antarcticus.*

Northern Prawn Investigations Sta. 8, 37°15′ S., 176°12′E., off Mayor Is., Bay of Plenty 19/8/56; 1640–1745 h, prawn trawl on sand and rock bottom at 80–120 fm – 1 ♀ 10·5 mm.

B.S. 209, off Mayor Is., Bay of Plenty, 37°′20·5′S., 176°26·5′E., 27/2/57; 1544–1640 h, OT at 270 fm, m.v. *Alert* – 393 specimens (including 6 ovigerous ♀ ♀ 12–13 mm); a sample of 30 consisted of 16 ♂ ♂ 8–13·5 mm, 14 ♀ ♀ 9–13 mm.

V.U.C. Zoology Dept. *Kotuku* Dredging Expedition. Metre net, towed at about 60 fm over 200–300 fm, 20/5/52, at night (near Sta. 4, 39°55′30″S., 177°29′30″E., off Cape Kidnappers, Hawke Bay, — 1 ♂ 7·5 mm, 2 ♀ ♀ 8 mm.

Off Castlepoint, trawled in 60 fm, 17/9/56, coll. F. Abernethy, M.T. *Thomas Currell* – 1 ♀ 13·5 mm.

Off Cape Palliser, fish stomach, 10/7/53, S.T. *Maimai* – 1 ovigerous ♀ 12 mm.

Cape Campbell trawling grounds, Cook St., coll. F. Abernethy, M.T. *Thomas Currell,* 14/11/52, 40 fm – 1 ovigerous ♀ 12 mm; 5/2/54, 60 fm – 1 ♂ 11 mm, 1/4/54, 30–60 fm – 3 ♂ ♂ 9–11 mm, 3 ♀ ♀ 11–12 mm (1 ovigerous 12 mm); Cape Campbell middle ground (just S. of Mt. Benmore) 7/11/56, 40 fm – 1 ♂ 10 mm; 5/12/56, 40 fm – 3 ♂ ♂ 5–10 mm, 8 ♀ ♀ 3–14 mm (3 ovigerous 11·5–14 mm), B.S. 214, approx. 41°40′S., 174° 30′E., N.E. of C. Campbell in about 60 fm –/3/57. – 1 ♂ 8·5 mm, 1 ♀ 7·5 mm.

Cook St. trawling grounds, coll. S. G. Hume, N.Z. Geol. Surv.: –/11/56 – 2 ovigerous ♀ ♀ 10–11 mm; Jan.-Feb. 1957 – 3 ♂ ♂ 8–12 mm, 4 ♀ ♀ 4–11 mm (2 ovigerous 11 mm); 28/3/57 – 1 ♂ 8 mm, 2 ovigerous ♀ ♀ 11·5–13·5 mm.

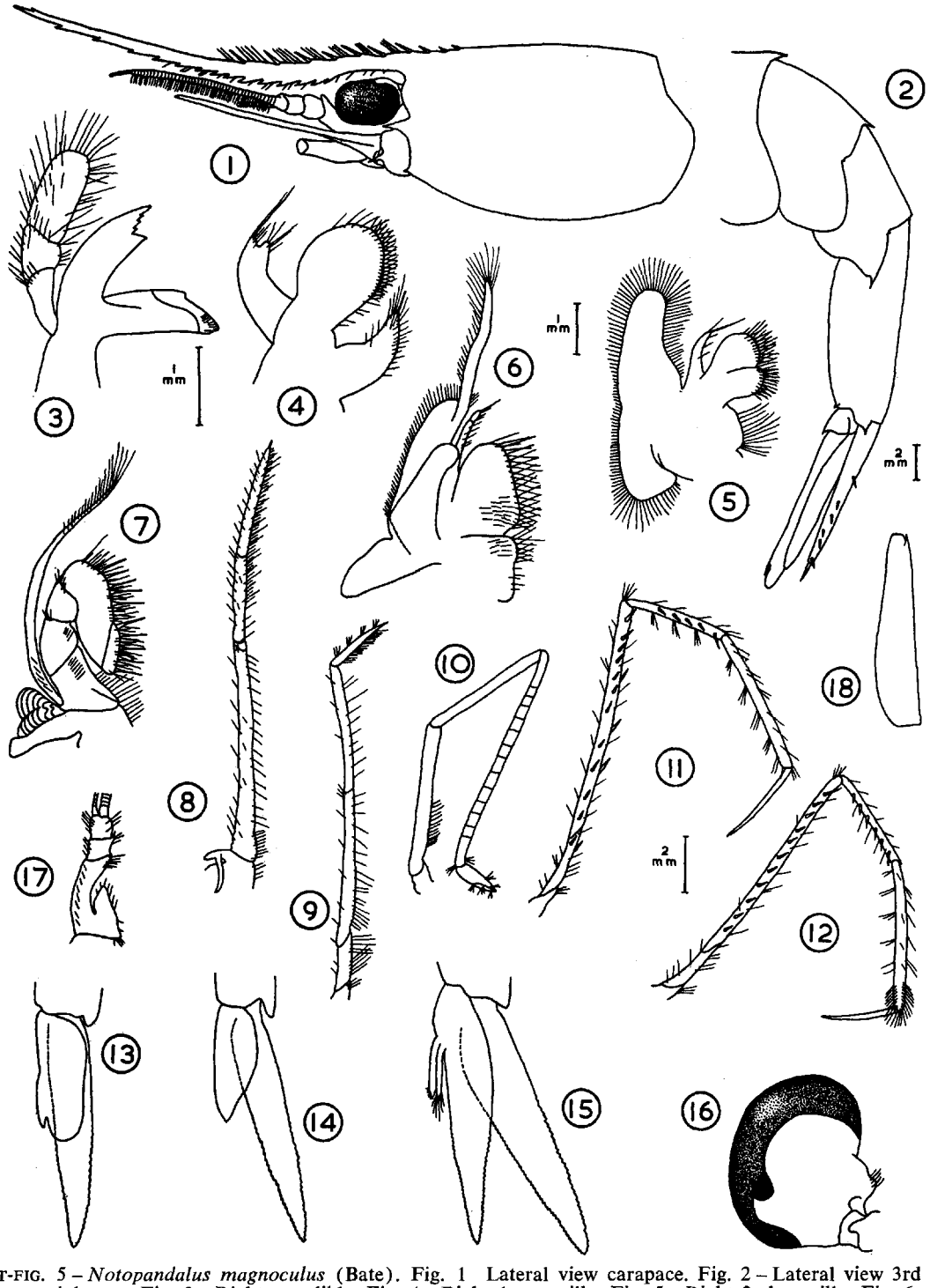
*Description*

This description is mainly based on a male specimen, with carapace length 12·5 mm, from Dominion Museum B.S. 209.

A relatively small, slender shrimp with a narrow, elongate rostrum and prominent reniform eyes.

Rostrum long and slender, between 1·5 to just under 2 times length of carapace, initially downcurved but distal 2/3 trends weakly dorsally so that distal acute tip is slightly above dorsal line of carapace. Armed dorsally with small subapical fixed tooth (rarely 2–4 fixed teeth) and proximal series of 8–12 movable teeth, of which posterior 3–4 are situated on carapace behind orbit. Dorsal margin between subapical tooth and 1st of movable series, more than half rostrum, is unarmed. Ventral margin bears from 9–19 fixed teeth, 1st being at a distance from tip slightly greater than that between others, which become closer together posteriorly. Carapace, except for short postrostral carina, smooth, and armed with strong antennal and small pterygostomial spines. Minute body scales are present on carapace, abdomen and most appendages.

Third abdominal segment with dorsal midline produced posteriorly into strong, but short, spine; 4th segment with similar, but shorter, spine. Pleura of 1st to 4th segments broadly rounded, that of 5th segment terminating in slender spine. 6th segment twice length of 5th, with pleuron produced into spine and small but distinct spine on posterolateral angle. Telson about 3/4 length of




TEXT-FIG. 5 – *Notopandalus magnoculus* (Bate). Fig. 1 Lateral view carapace. Fig. 2 – Lateral view 3rd to 6th segments abdomen. Fig. 3 – Right mandible. Fig. 4 – Right 1st maxilla. Fig. 5 – Right 2nd maxilla. Fig. 6 – Right 1st maxilliped. Fig. 7 – Right 2nd maxilliped. Fig. 8 – Right 3rd maxilliped. Fig. 9 – Right 1st pereiopod. Fig. 10 – Right 2nd pereiopod. Fig. 11 – Right 3rd pereiopod. Fig. 12 – Right 5th pereiopod. Fig. 13 – Right male 1st pleopod. Fig. 14 – Right female 1st pleopod. Fig. 15 – Right male 2nd pleopod. Fig. 16 – Dorsal view left eye. Fig. 17 – Dorsal view antennular peduncle. Fig. 18 – Dorsal view scaphocerite. Figs. 1, 2, 17, 18 to same scale; 3, 4 to same scale; 5–7, 13–16 to same scale; 8–12 to same scale. Figs. 14 and 16 from female, carapace length 12.5 mm, remainder from study male.

6th segment and armed with 5 to 8 pairs of dorsal spines, the 1st pair being further from anterior margin than distance between any other pair. Telson terminates posteriorly in median point and 3 pairs of spines, the inner and outer pairs being considerably shorter than the long intermediate pair.

Eyes large, much wider than ocular peduncles, reniform, with flattened dorsal surface bearing an ocellus incompletely separated from cornea.

Antennular peduncle with first segment slender, bearing relatively long, tapering stylocerite with rounded tip. Second and third segments subequal and together shorter than first. Outer flagellum with about 40 basal segments thickened. Antennal scaphocerite long and slender, being more than 4 times as long as broad, with straight lateral margin terminating in short tooth which does not project beyond rounded apex of the lamella.

Mandible with incisor process terminating in 5 teeth, strong molar process with prominent distal ridges and with large, 3-segmented palp overreaching incisor process. 1st maxilla with narrow, tapering proximal endite, broad distal endite and endopod with bifid tip. 2nd maxilla with proximal endite reduced, distal endite well developed and strongly biloped, endopod simple and tapering, and scaphognathite large with distal lobe bluntly rounded rather than truncate. 1st maxilliped with endites clearly separated and epipod large and bilobed. 2nd maxilliped with distal segment articulated distomedially with penultimate and with well developed podobranch and epipod. 3rd maxilliped does not quite reach distal end of scaphocerite but is a little longer than 1st pereiopod. Distal segment of 3rd maxilliped, terminating in strong spine, is longer than penultimate segment and with this latter segment is subequal to antepenultimate. Antepenultimate segment bears small distolateral spine. Epipod and 2 arthrobranchs present but exopod absent.

First pereiopod non-chelate, with dactyl microscopic, propodus little more than half length of carpus, which is little shorter than merus. 2nd pereiopods subequal, reaching beyond scaphocerite with chela. Carpus about 5½ times length of chela and subdivided into about 14 subsegments, which become less distinct proximally. First and last subsegments are longer than any of the subequal remainder. Merus is a little more than half length of carpus and a little shorter than ischium. 3rd pereiopod overreaches scaphocerite by dactyl, 4th by about half dactyl, while 5th reaches to distal end of scaphocerite. Dactyl of 3rd pereiopod is narrow, attenuated, weakly curved and unarmed, it is more than half length of unarmed propodus and subequal to carpus. Carpus bears row of about 5 spines; merus, 2½ times length of carpus, bears two irregularly spaced rows of spines, a lateral of about 9–11 and a posterior of about 3 spines. Ischium, about 2/3 length of carpus, bears 1 laterodistal spine and 1–2 posterior spines. 4th pereiopod is intermediate between 3rd and 5th pereiopods. Dactyl of 5th pereiopod is as in 3rd pereiopod; propodus bears a compact bunch of setae distally and is unarmed; carpus is little longer than dactyl and bears a row of about 6 spines; merus, a little over twice length of carpus, has a lateral row of about 11 spines and no posterior row; ischium is half length of carpus and unarmed.

First pleopod of male with endopod large and broad, its distal margin broadly rounded and its distomedian angle produced as blunt projection giving distal margin an unequally bilobed appearance. First pleopod of female with endopod relatively short and tapering to acute distal end. 2nd to 5th pleopods of both males and females with well developed appendix interna, 2nd pleopod of male with appendix masculina subequal in length to appendix interna. Uropods elongate, endopod subequal with telson and exopod little longer; lateral margin of exopod terminates in distinct tooth with longer movable spine immediately median to it.

Eggs numerous and small, measuring, after preservation, 0·56 to 0·61 × 0·44 to 0·49 mm.

*Branchial Formula*

| | Maxillipeds | | | Pereiopods | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 4th | 5th |
| Pleurobranchiae | – | – | – | 1 | 1 | 1 | 1 | 1 |
| Arthrobranchiae | – | – | 2 | 1 | 1 | 1 | 1 | – |
| Podobranchiae | – | 1 | – | – | – | – | – | – |
| Epipodites | 1 | 1 | 1 | 1 | 1 | – | – | – |
| Exopodites | 1 | 1 | – | – | – | – | – | – |

*Colour in Life*

Specimens caught off Cape Campbell on 1/4/54 were brought in fresh to the laboratory by Mr Abernethy and the following detailed colour notes were taken from them. The Chatham Islands Expedition material was examined alive and field notes on its colour-pattern agree closely with the records of the Cape Campbell specimens.

*General colouration:* Transparent, with light scattering of red over carapace and abdomen. Intense scarlet gastrohepatic gland very prominent within the carapace, especially when viewed dorsally. Mouth parts red.

*Detailed colour-pattern:* Three distinct types of chromatophores are present:

1. Simple red chromatophores.

2. Compound red and yellow chromatophores. The two pigments, each arranged in a separate stellate pattern, are superimposed, the red over the yellow.

3. Compound red and opaque yellow-white chromatophores. The red pigment occupies the greater part of the stellate chromatophore and the yellow-white forms the centre.

The rostrum has a large number of red chromatophores especially concentrated in the distal half; there is a single chromatophore characteristically at the base of each dorsal tooth. Carapace scattered with red chromatophores and irregular patches of the compound red and yellow type. An irregular red band of concentrated chromatophores extends from the posterodorsal portion diagonally across the carapace to a point just posterior to the anteroventral angle, then is continued across those mouth parts visible below the carapace and finally across the meropodites of the 3rd maxilliped and 1st pereiopod.

The abdomen is scattered with both simple and compound chromatophores, the compound more especially in irregular patches, with a prominent row around the posterior margin of the 6th segment. The telson and uropods are scattered with both simple and compound types, with a conspicuous row along the dorsolateral edges of the telson and exopodites of the uropod.

Eyes iridescent black with dorsal surface of the cornea-bearing, distal segment of peduncle, scattered with simple red chromatophores, and a characteristic dense patch of red pigment adjacent to the corneal margin just lateral to the almost independent ocellus. Antennular peduncle with both simple and compound red chromatophores, but rows of the former only on both flagella. No chromatophores on the antennal flagella and only a few on the peduncle, though the scaphocerite has a single row of compound red chromatophores along the median margin.

Mouth parts red, some simple chromatophores present, but most of the red appears to be non-chromatophoric pigment. The two distal segments of the 3rd maxilliped have four alternate areas of simple and compound red chromatophores; meropodite with scattered simple chromatophores, the continuation of the carapace-mouthpart band and also some non-chromatophoric red. 1st pereiopod with less intense continuation of the band and only very scattered simple red chromatophores. Other pereiopods with some widely spaced rows and patches of simple and both compound types of chromatophores. Some large simple chromatophores on anterior and lateral faces of the protopodites of all, and the endopod of the 1st, pleopods, but no chromatophores on the exopods or endopods of the 2nd to 5th pleopods.

Eggs opaque blue-green in colour.

*Distribution*

Apparently restricted to New Zealand waters, where it has been taken, between about 30 and 330 fm, from off Kaipara Bar (about 36°30'S.) in the north to the Chatham Rise (44°35'S.) in the south. Usually found on the bottom though it was taken in a midwater haul at about 60 fm over 200–300 fm at night during the *Kotuku* expedition in Hawke Bay.

*Variation in Rostral Formula*

One hundred apparently undamaged specimens of *N. magnoculus* from B.S. 209 were examined for rostral formula variation. Only specimens with fixed, dorsal, subapical teeth were used, as the absence of these teeth is almost definitely a sign of incomplete regeneration after damage. 89% of these hundred specimens had one such subapical tooth, 9% of these had 2, 1% had 3 and 1% had 4. In the formulae given below these teeth have been omitted. Thus the number of dorsal teeth refers to the proximal, movable series only, of which 3–4 are situated on the carapace behind the orbit. No sexual significance was observed in this variation.

| Dorsal Rostral Teeth | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | | | | | | 1 | | | | | |
| 9 | | 1 | 1 | 4 | 1 | | 4 | 1 | | | |
| 10 | 1 | 3 | 6 | 7 | 10 | 14 | 7 | 1 | 4 | 1 | |
| 11 | 1 | | 3 | 4 | 6 | 5 | 2 | 3 | 1 | | |
| 12 | | | 1 | 1 | | 2 | 1 | | | | 1 |

Ventral Rostral Teeth

Of the hundred specimens, only 14% have the commonest formula, 10/14, the others being scattered over 29 other formulae. With the ex-

ception of 10/13 (10%), no other formula accounts for more than 7% of the rostra. No idea of the variation can be given by any one compound formula, though undamaged rostra with more than 12 or less than 8 dorsal teeth and more than 19 or less than 9 ventral teeth are apparently rare. As has been shown for *Palaemon affinis* (Yaldwyn, 1957a) collections of *N. magnoculus* from different areas tend to show different patterns of rostral variation. Thus out of 36 specimens with undamaged rostra from CIE 52 the commonest formula was 11/14 (28%) while only 8% had 10/14 and less than 3% had 10/13.

Bate (1888) in the type description of *N. magnoculus* states, "rostrum a little longer than the carapace . . . dorsally armed with from ten to twelve movable spines, intermingled with a fringe of ciliated hairs, and on the under side with six rigid teeth. . . ." In his observations on this species he goes on to say, "a considerable number of specimens were taken, some with and some without ova. With them were several specimens of a very decided variety, in which the rostrum is longer, straighter, and armed with twelve spines on the upper side for half the distance between the orbit and the apex of the rostrum, and on the under surface with fifteen or sixteen teeth continued from the base to the apex. . . . In all other respects this form corresponds with the type, almost hair for hair and spine for spine."

I have been quite unable to relate these data to the actual *Challenger* syntypes in the British Museum (N.H.). Bate states that there were 9 specimens from Sta. 166 and 14 from Sta. 167. In 1955 I found that 7 were labelled Sta. 166 and 15 labelled Sta. 167, no existing specimens had 6 ventral teeth, the smallest number present, even on broken rostra, being 10, though 4 had their rostra completely absent. Only 3 specimens had 12 dorsal teeth, none of these having 15 or 16 ventral teeth, indeed the latter number does not occur in the material at all. In view of Bate's statement about the "very decided variety" I consider it necessary to give the rostral formula variation for those 18 syntypes that have the major part of the rostrum still present. It is to be understood that the dorsal, subapical tooth, if present, is not included and though in every case the dorsal count given is complete, some of the lower ventral counts are due to the tip of the rostra being absent.

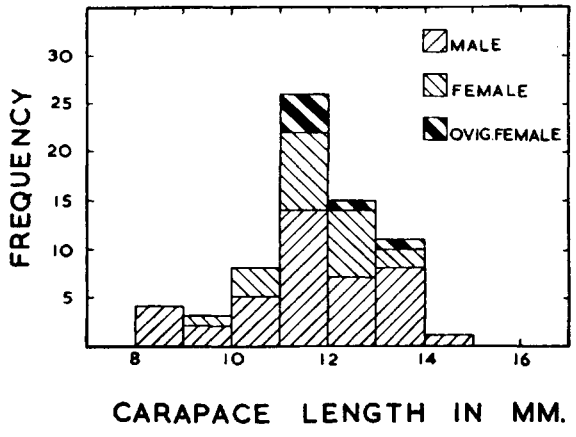
| Dorsal Rostral Teeth | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|
| 9 | 1 | | 1 | | | |
| 10 | | | 1 | 2 | 1 | |
| 11 | 1 | 3 | 1 | 2 | | 2 |
| 12 | | 1 | 1 | 1 | | |

Ventral Rostral Teeth

The ovigerous female illustrated by Bate (1888, pl. 115, fig. 1), with a rostrum a little more than 1·5 times the length of the carapace, a formula of 11/at least 10 and what I take to be a dorsal subapical tooth, demonstrates a typical undamaged adult rostrum. A study of these rostra, in B.S. 209, in the process of regenerating after serious damage (about 10%) supported the general conclusion arrived at previously (Yaldwyn, 1957a) that regeneration of rostral length usually precedes regeneration of rostral ornamentation (i.e. dentition).

*Notes on Life History*

A size frequency graph of the 41 males and 27 females from CIE 52 is given in text-fig. 6. This shows clearly that *N. magnoculus* is not a protandrous hermaphrodite as a number of species of *Pandalus* have been found to be. The commonest size range was a carapace length between 11 and 11·9 mm, 38% (14 ♂♂ and 12 ♀♀) of the sample being within this range. The largest specimen seen was a female from *Challenger* Sta. 166 with carapace length of 15 mm; the smallest was an individual too damaged to be sexed from CIE 41 with carapace length of 3·5 mm. Others from this latter station could be clearly sexed at 4·5 mm.




TEXT-FIG. 6 – *Notopandalus magnoculus* (Bate). Size frequency graph for CIE Sta. 52 specimens.

The smallest ovigerous females found were several from CIE 60 with carapace lengths of 9 mm and this may be taken as the size at maturity. Ovigerous females with eggs in various stages of development have been taken in every month except May and September; thus, it would appear that there is no fixed breeding period in this species. The small proportion of ovigerous females in some collections, e.g., B.S. 209 with 9 (just over 2%) of the 393 specimens (about 50% female) ovigerous, is unexpected, especially as other collections in February show quite high percentages carrying eggs.

*Ecology*

On the Chatham Rise *N. magnoculus* occurred invariably on a bottom of fine sand and/or mud almost always associated with the natant *Campylonotus rathbunae* Schmitt. In the Cook Strait area it has been taken on a variety of bottoms, varying from the soft mud of the Cape Campbell trawling grounds, where it is by far the most abundant shrimp found, to the dead shell and sand bottom of VUZ 99. In the Bay of Plenty, at B.S. 209, it was taken in great numbers on a mud bottom associated with numerous specimens of a large penaeid prawn, *Hymenopenaeus sibogae* (de Man), new to New Zealand waters. Similarly it was taken by the *Sandra* off Kaipara Bar associated with another large penaeid prawn, *Aristaeomorpha foliacea* (Risso), also new to New Zealand waters.

*Parasitism*

Several specimens (at least 5%) from B.S. 209 carried a large dajid isopod on the dorsal surface of the carapace. This almost certainly belongs to *Holophryxus* Richardson, recorded from natant decapods. As illustrated by Stephensen (1913) for specimens on *Acanthephyra purpurea* and *Sergestes arcticus*, the parasite on *N. magnoculus* had its head towards the posterior of the host and had also formed distinct punctures in the integument with its mouthparts and pereiopods. Although these isopods were up to 12 mm in length no noticeable effect could be seen in the host.

## Superfamily CRANGONOIDA

## Family CRANGONIDAE

### Genus **Sclerocrangon** G. O. Sars, 1883

1885 *Sclerocrangon* Sars, Norwegian N.-Atlantic Exped. 1876–78 Crust. I: 14.

1950 *Sclerocrangon* Barnard, Ann. S. Afric. Mus. 38: 804.

*Definition*

Crangonidae with rostrum compressed and expanded below, or spiniform. Carapace sculptured, dentate and carinate. Eyes well developed. Stylocerite distally acute. 1st pereiopod without exopod. 2nd pereiopod subequal with 1st, chelate, with fingers less than half palm. Dactyls of 4th and 5th pereiopods not dilated. Endopods of pleopods shorter than exopods, no appendix interna on any pleopod. Gills: pleurobranchs on 1st to 5th pereiopods only, ventral apices directed posteriorly. Arthrobranchs absent. Eggs large. (After Barnard, 1950.)

*Type species:* **Cancer boreas** Phipps, 1774, a northern, circumpolar form.

More than 20 species are recognised in this bathymetrically wide-ranging genus, all, with one exception, restricted to arctic and temperate waters of the northern hemisphere. The exception is *S. bellmarleyi* Stebbing described from South African waters. It is thus of great interest to describe two further species, both from New Zealand waters, one of which is closely related to the southern form, *S. bellmarleyi.*

The New Zealand species have been compared with all other species of the genus *Sclerocrangon* listed in the *Zoological Record* up until 1956.

**Sclerocrangon knoxi** n.sp.

*Material Examined*

*Chatham Islands 1954 Expedition:* Sta. 6 – 1 ♂ 7 mm, 21 ♀ ♀ 5·5–12 mm (4 ovigerous 10–12 mm); Sta. 7 – 1 ♂ 6·5 mm, 6 ♀ ♀ 6–9 mm; Sta. 52 – 5 ♂ ♂ 5–8 mm, 7 ♀ ♀ 6·5–10 mm; Sta. 59 – 2 ♀ ♀ 9–10 mm (1 ovigerous 10 mm).

*Description*

This description is based mainly on the holotype, a female specimen with carapace length 9 mm, from CIE 6. The remainder of the specimens available are all paratypes.

A relatively robust shrimp with sculptured carapace bearing prominent postrostral and strongly-hooked middorsal spines.

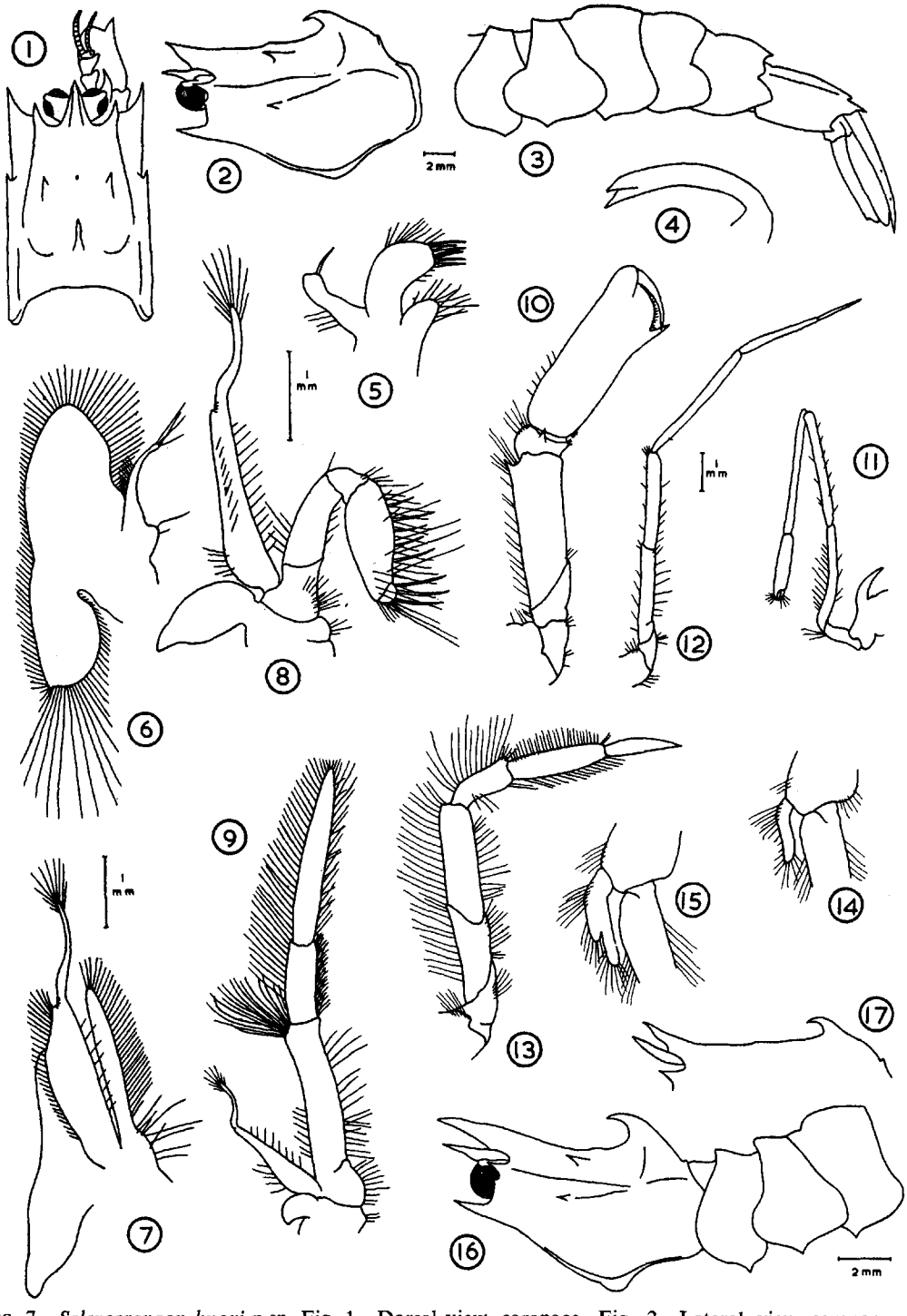
Rostrum rather narrow in lateral view, tapering to acute apex, which reaches well beyond anterior margin of eye and a little beyond the prominent branchiostegal spine. Anterior margin of carapace with strong suborbital, small antennal, and branchiostegal spines. A small spine (? pterygostomial) is present on medial margin of branchiostegal spine as described by Barnard (1950) for *S. bellmarleyi*. Carapace with dorsal carina produced into 2 very prominent spines. The first, immediately postrostral, reaches as far anterior as, and is broader than, the rostrum, while the second is a very large, strongly-hooked spine whose broad base occupies entire posterior third of carapace. This latter spine characteristically dominates the carapace ornamentation in this species. A little anterior to dorsal midpoint there is a very small acute tubercle (not always visible in small specimens). Laterally on carapace, at level of rostrum, there is a strong gastric spine a little anterior to midpoint. Ventral and slightly anterior to this spine there is an hepatic spine, while between the two there is a weak ridge extending across carapace from base of suborbital spine to below the prominent posterior middorsal spine. Three other ridges converge on the same area, but none, however, intersect; one extends ventrally from the base of posterior middorsal spine, one slightly dorsally from hepatic spine, while the third extends across carapace from posterior margin. A few scattered long setae on carapace; surface of abdomen virtually naked.

Abdomen with discontinuous, rounded, dorsal carina on 1st to 5th segments. On 1st and 2nd restricted to anterior portion, on 3rd to 4th present on entire surface except for extreme anterior portion. 6th segment with no dorsal carina but two pairs of dorsalateral carinae; a dorsal pair immediately on each side of the middorsal line, and another more lateral pair. 1st to 3rd segments with each pleuron produced ventrally into a blunt tooth, 4th with pleuron broadly rounded, 5th with pleuron rounded ventrally but with posterolateral margin produced into blunt tooth, and 6th with posterolateral margin produced into a prominent dorsal and a weaker ventral tooth. Telson nearly twice length of 5th abdominal segment, with weakly sulcate dorsal surface armed laterally with three pairs of minute spines. Distal end of telson tapers to a simple acute point.

Eyes normal. Proximal segment of antennular peduncle long, reaching well beyond eyes, two distal segments short. Stylocerite with anterior margin produced into a long slender tooth extending as far as anterior margin of proximal antennular segment. Scaphocerite relatively short and broad with sinuous outer margin produced into a broad triangular spine which projects well beyond distal edge of lamella.

Mouth parts are of usual crangonid type and are similar to those of *Sclerocrangon salebrosa* (Owen) illustrated by Sars (1885). Mandible consists of molar process only and terminates in 2 strong teeth. 1st maxilla has rounded proximal endite, distal endite with stout bristles and endopod with truncate tip armed medially with a stout bristle. 2nd maxilla has one reduced endite, slender, simple endopod, and broad, rounded scaphognathite. All maxillipeds have large and prominent exopods, consisting of two parts, peduncle and flagellum, articulated at distinct angle to one another. 1st maxilliped with no endites, a long, narrow endopod, broad-based exopod and large, triangular epipod. 2nd maxilliped with distal segment articulated diagonally across end of penultimate segment, a long exopod and large, weakly-pointed epipod. 3rd maxilliped reaches with about half distal segment beyond anterior margin of scaphocerite. Distal segment little more than twice penultimate and subequal with antepenultimate. A reduced, chitinised epipodial process is present.

Pereiopods without exopods and, except for 2nd, without epipods. 1st pereiopod reaches to anterior margin of scaphocerite, 2nd is a little shorter than 3rd which reaches almost as far as 1st, 4th reaches to distal end of propodus of 3rd and 5th reaches to distal end of merus of 4th. Chela of 1st pereiopod broad, about 3 times as long as wide, subchelar spine relatively short and simple. Carpus short, bearing a lateral spine, merus 3/4 chela and armed with one spine distolaterally. Ischium and basis short and unarmed. 2nd pereiopod slender, with free finger equal to fixed and 1/5 palm, carpus nearly twice hand and little longer than merus, which itself is a little longer than ischium. A curved, slender, acute epipodial process is present (see Barnard, 1950: 802, 804 for reference to this process in *S. bellmarleyi*). 3rd pereiopod long and slender, dactyl about 3/5 propodus, which is a little less than 2/3 carpus. Merus subequal to ischium and 3/4 carpus. 4th pereiopod stout with flattened, acute dactyl 4/5 propodus, which is subequal with ischium. Carpus 2/3 propodus and 3/5 merus. 5th pereiopod similar to, but shorter than, 4th.




TEXT-FIG. 7 – *Sclerocrangon knoxi* n.sp. Fig. 1 – Dorsal view carapace. Fig. 2 – Lateral view carapace. Fig. 3 – Lateral view abdomen. Fig. 4 – Right mandible. Fig. 5 – Right 1st maxilla. Fig. 6 – Right 2nd maxilla. Fig. 7 – Right 1st maxilliped. Fig. 8 – Right 2nd maxilliped. Fig. 9 – Right 3rd maxilliped. Fig. 10 – Right 1st pereiopod. Fig. 11 – Left 2nd pereiopod. Fig. 12 – Right 3rd pereiopod. Fig. 13 – Right 4th pereiopod. Fig. 14 – Right male 1st pleopod. Fig. 15 – Right male 2nd pleopod. Fig. 16 – Lateral view carapace & 1st to 3rd abdominal segments. Fig. 17 – Lateral view dorsal outline of carapace. Figs. 1–3 and 17 to same scale; 4 and 5 to same scale; 6–8, 14 and 15 to same scale; 9–13 to same scale; 14–16 from male paratype, carapace length 7 mm; 17 from female paratype, carapace length 11 mm; remaining figs. from holotype.

1st pleopod male and female with short, distally rounded endopod; 2nd to 5th pleopods male and female with tapering endopods, becoming progressively smaller posteriorly. Appendix interna absent from all pleopods male and female; male 2nd pleopod with small, but distinct, appendix masculina. Uropod with both exopod and endopod relatively broad and rounded distally.

Male with sternal spines on 2nd to 5th thoracic and 1st to 5th abdominal sternites, those on 1st to 4th abdominal sternites long and slender, that on 5th small. Non-ovigerous female with sternal spines on 2nd and 5th thoracic and 1st to 4th abdominal sternites, while 5th abdominal has low tubercle. Ovigerous female with no sternal processes or spines on thoracic or abdominal sternites.

*Sexual differences:* As well as those differences mentioned above, males appear to be usually smaller than females and have the anterior middorsal carapace spine extending slightly beyond the rostrum, the posterior middorsal carapace spine more prominent and the ventral tooth of each of the 1st to 3rd abdominal segments acute (text-fig. 7, fig. 16).

*Branchial Formula*

| | Maxillipeds | | | Pereiopods | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 4th | 5th |
| Pleurobranchiae | – | – | – | 1 | 1 | 1 | 1 | 1 |
| Arthrobranchiae | – | – | – | – | – | – | – | – |
| Podobranchiae | – | – | – | – | – | – | – | – |
| Epipodites | 1 | 1 | p | – | p | – | – | – |
| Exopodites | 1 | 1 | 1 | – | – | – | – | – |

p = epipodial process (see Barnard, 1950, p. 804).

*Colour in Life*

Specimens from CIE 6 when alive were described as white in colour speckled irregularly with red over the abdomen and with the carapace a darker red. Material from CIE 7, which had been preserved in alcohol for a short while, had the carapace scattered with dark, blue-red, stellate chromatophores especially concentrated on the two middorsal spines. The eyes were dark brown and the remainder of the body was scattered with darker red chromatophores.

*Systematic Position*

*Sclerocrangon knoxi* belongs to the second of the two main sections into which the genus *Sclerocrangon* is divided by Ortmann (1895) and Kemp (1910). This section is characterised by having only two middorsal spines on the carapace; the lateral carinae of the carapace smooth rather than granulate or rugose, and the abdomen smooth, or with smooth longitudinal carinae, rather than sculptured with longitudinal carinae and transverse furrows. Within this section *S. knoxi* is related to a group of species with the following characters: The anterior middorsal carapace spine projects anteriorly or anterodorsally nearly as far as, or further than, the rostrum, which is spiniform; the posterior middorsal carapace spine is prominent and strongly hooked; often a rudimentary third middorsal carapace spine is present between the two well developed ones; two spines are present on the lateral surface of the carapace, and (where known) the pleurae of at least the 1st and 2nd abdominal segments are produced into a ventral tooth. The following species belong to this group: *S. jacqueti* (A. M.-Edw., 1881); *S. procax* Faxon, 1893; *S. bellmarleyi* Stebbing, 1914; *S. ochotensis* Kobyakova, 1955, and possibly the species described as *Crangon acclivis* by Rathbun (1902). Owing to Rathbun's brief description it is not known for certain if the latter species belongs to the genus *Sclerocrangon* or not. However, its similarity to members of this genus, in particular to the species in what I propose to call the *"S. jacqueti"* group, makes it fairly certain that a re-examination of Rathbun's material will justify my suggested placing of this species. Rathbun (1904) herself states that it is allied to *Crangon munita* Dana, a species long accepted as belonging to the genus *Sclerocrangon* (see Ortmann, 1895; de Man, 1920).

*S. knoxi* differs from the other species of the *"S. jacqueti"* group in having the posterior middorsal carapace spine more prominent and closer to the posterior margin of the carapace. The anterior middorsal carapace spine does not project as far as the tip of the rostrum in the female, or as far beyond the tip in the male, as it does in *S. jacqueti* and *S. ochotensis,* it is not as spiniform nor directed as much dorsally as it is in *S. procax* and *S. bellmarleyi,* and finally it is longer and more prominent than in *S. acclivis*. The rostrum is not as spiniform nor directed as much dorsally as it is in *S. bellmarleyi,* and the antennal spine is not as close to the rostrum in lateral view as it is in *S. acclivis.*

*Distribution*

*Sclerocrangon knoxi* has been taken only from the Chatham Rise (43°38'S. to 44°4'S.), between about 220 and 290 fm.

*Variation in Carapace Spinulation*

In addition to the sexual differences described above, there is considerable variation within strict limits in the shape and angle of elevation of the rostrum and of the anterior middorsal spine. Text-fig. 7, fig. 17 shows an extreme in the narrowness of the anterior spine and in the elevation of the rostrum. The presence or absence of the minute spine or tubercle between the two middorsal spines has been discussed above.

*Notes on Life History*

Ovigerous females, with eggs measuring, after preservation, 1·5 to 1·8 × 1·2 to 1·4 mm, were taken in the months of January and February. The eggs in this genus are large and a female with carapace length of 11 mm carried c. 45. The smallest ovigerous female observed had a carapace length of 10 mm.

**Sclerocrangon richardsoni** n.sp.

*Material Examined*

*Victoria University Zoology Department Cook Strait Collections:*

Coll. VIZ 83 (Station JUG) 41°42′30″S., 175°9′E., 17/2/57, 1430–2030 h, BT on bottom of mud with mixture of shell, rock and gravel at c. 550 fm – 1 ♀ 9 mm.

*Description*

This description is based entirely on the holotype, which is the unique female specimen with carapace length 9 mm, from VUZ 83.

A relatively robust shrimp with sculptured carapace bearing two prominent and subequal middorsal spines.

Rostrum relatively deep, tapering to a minutely trifid* tip and reaching a little beyond anterior margin of eye but not as far as the prominent branchiostegal spine. Anterior margin of carapace with strong suborbital and branchiostegal spines. A small spine is present on medial margin of the latter spine as in *S. knoxi*. Carapace with dorsal carina produced into 2 prominent spines. The first, on anterior half of carapace, does not reach as far anterior as posterior margin of orbit, while the second is situated in posterior half of carapace. Laterally on carapace at level of orbit and a little anterior to midpoint there is a gastric spine. Ventral and slightly anterior to this spine there is an hepatic spine, while between the two there is a weak ridge extending across the carapace from base of suborbital spine to below a point a little posterior to posterior middorsal spine. Another ridge, from base of posterior middorsal spine extends ventrally to same area but does not intersect this first ridge. There is also a short ridge extending across carapace from base of gastric spine. Fine clothing of short setae on carapace; surface of abdomen, except for a few scattered long setae, naked.

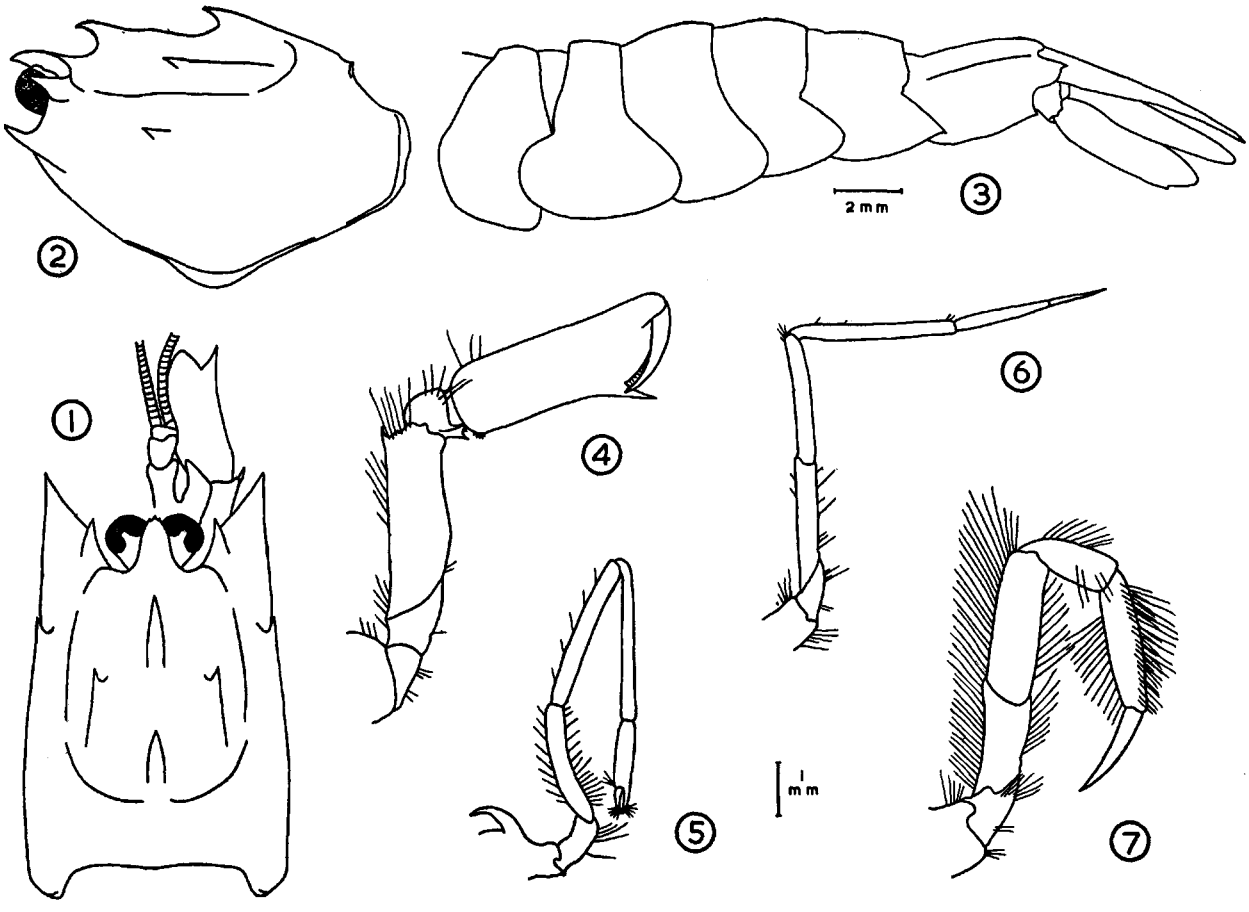
Abdomen with 1st to 4th segments dorsally smooth; a weak, rounded, dorsal carina present on 5th, and 2 pairs of dorsolateral carinae present on 6th. 1st to 4th segments with pleura broadly rounded, 5th with pleuron rounded ventrally but with posterolateral margin produced into acute tooth, and 6th with posterolateral margin produced into a broad-based dorsal and a weaker ventral tooth. Telson about one and a half times length of 5th abdominal segment, with weakly sulcate dorsal margin armed laterally with two pairs of small spines, one pair a little posterior to midpoint and the other pair subterminal. Distal end of telson tapers to simple acute point.

Eyes normal. Proximal segment of antennular peduncle long, the two distal segments short. Stylocerite produced anteriorly into stout, bluntly-pointed tooth extending as far as anterior margin of proximal antennular segment. Scaphocerite relatively short and broad with weakly concave outer margin produced into stout spine projecting slightly beyond distal edge of lamella.

Mouth parts are practically identical with those figured and described above for *S. knoxi*. 3rd maxilliped reaches with entire distal segment beyond anterior margin of scaphocerite.

Pereiopods similar to those of *S. knoxi*, without exopods and, except for 2nd, without epipods. 1st pereiopod reaches as far as midpoint of distal segment of 3rd maxilliped, 2nd to distal end of propodus of 3rd which is subequal with 1st, 4th is subequal to 1st, and 5th is shorter than 4th. Chela of 1st pereiopod a little more than three times as long as wide, subchelar spine slender and simple. Carpus short bearing a lateral and a

* Possibly caused by damage during life as apex is slightly asymmetrical.




TEXT-FIG. 8 – *Sclerocrangon richardsoni* n.sp. Fig. 1 – Dorsal view carapace. Fig. 2 – Lateral view carapace. Fig. 3 – Lateral view abdomen. Fig. 4 – Right 1st pereiopod. Fig. 5 – Right 2nd pereiopod. Fig. 6 – Right 3rd pereiopod. Fig. 7 – Right 4th pereiopod. Figs. 1–3 to same scale; 4–7 to same scale. All figs. from holotype.

ventral spine, merus 3/4 chela and armed with one spine distolaterally. Ischium and basis short and unarmed. 2nd pereiopod slender, with free finger equal to fixed and 1/4 palm, carpus nearly twice hand and a little longer than merus, which itself is 4/5 ischium. A slender epipodial process is present as described above for *S. knoxi*. 3rd pereiopod long and slender, dactyl about 3/5 propodus, which is 3/5 carpus. Merus subequal to ischium and 4/5 carpus. 4th pereiopod stout with flattened, acute dactyl 3/4 propodus which is subequal to merus. Carpus subequal with ischium and 2/3 merus. 5th pereiopod similar to, but shorter than, 4th.

1st pleopod with short, distally rounded endopod; 2nd to 5th pleopods with tapering endopods, becoming progressively smaller posteriorly. Appendix interna absent from all pleopods. Uropod with both exopod and endopod relatively broad and rounded distally.

2nd to 5th thorarcic sternites with bluntly-pointed sternal tubercles, that on the 2nd sternite bearing an acute tooth; 1st to 4th abdominal sternites with sternal spines, 5th with blunt tubercle.

*Branchial Formula*

As for *Sclerocrangon knoxi*.

*Colour in Life*

The unique specimen was examined shortly after capture and no chromatophores were observed on body or appendages. The carapace was a dark pink while the abdomen and tail fan were lighter in colour. The eyes were black, the anterior

appendages and the 1st to 4th pereiopods were pink, while the 5th pereiopod and the pleopods were almost colourless.

*Systematic Position*

*Sclerocrangon richardsoni* belongs, with *S. knoxi,* to the second section of the genus *Sclerocrangon,* with characters as listed before. Within this section *S. richardsoni* is closely related to *S. munita* (Dana, 1852) and forms with this species what I propose to call the *"S. munita"* group. This group of species is characterised by: the two middorsal carapace spines being subequal and the anterior not overlapping the rostrum; the rostrum depressed, not spiniform; two spines present on the lateral surface of the carapace; the pleurae of the 1st to 3rd abdominal segments not dentate ventrally and the 1st to 4th abdominal segments dorsally smooth.

*S. richardsoni* differs from the North Pacific *S. munita* (re-described by Rathbun, 1904) in having the suborbital spine projecting anteriorly with a straight dorsal margin instead of projecting anterodorsally with a convex dorsal margin; no minute antennal spine; the anterior middorsal spine more prominent and the scaphocerite with the distolateral spine slightly overreaching the distal edge of the lamella.

*Distribution*

The unique specimen of *Sclerocrangon richardsoni* was taken off Palliser Bay, Cook Strait (about 41°43′S.) from c. 550 fm.

## Genus **Pontophilus** Leach, 1817

1900 *Philocheras* Stebbing, Mar. Invest. S. Afri. 1: 48.

1920 *Pontophilus* de Man, Siboga Exped. 39a3: 252 (key to species).

1950 *Pontophilus* Barnard, Ann. S. Afri. Mus. 38: 805.

*Definition*

Crangonidae with rostrum depressed. Carapace with or without dentate carinae. Eyes well developed. Stylocerite distally truncate, rounded or acute. 3rd maxilliped with or without epipod. 1st pereiopod with or without exopod; 2nd pereiopod shorter than 1st, fingers longer or shorter than palm. Dactyls of 4th and 5th pereiopods not dilated. Endopods of pleopods variable, with or without appendix interna: Gills: pleurobranch present or absent on 3rd maxilliped and present on 1st to 5th pereiopods, ventral apices directed posteriorly. Arthrobranch present or absent on 3rd maxilliped. (After Barnard, 1950.)

*Type species:* **Crangon spinosus** Leach, 1815, from European waters.

About 45 species are recognised in this cosmopolitan, deep and shallow-water genus. Several species have been recorded from New Zealand waters.

### **Pontophilus acutirostratus** n.sp.

*Material Examined*

*Chatham Islands 1954 Expedition:* Sta. 7 – 2 ♂♂ 5·5–7 mm; Sta. 40 – 2 ♀♀ 5–5·5 mm; Sta. 41 – 6 ♂♂ 3–5 mm, 5 ♀♀ 2·5–7·5 mm (1 ovigerous 4·5 mm), 6 damaged 3·5–4 mm; Sta. 52 – 1 ♂ 6 mm, 1 ♀ 8 mm; Sta. 59 – 3 ♀♀ 5·5–6·5 mm (1 ovigerous 5·5 mm).

*Victoria University Zoology Department Cook Strait Collections:*

Coll. VUZ 48 (Station BOL) 41°31′30″S., 174°48′E., 22/2/56, 1210–1330 h, BT on ? sand bottom at 70 fm – 1 ♀ 4 mm, associated with specimens of *Pontophilus pilosoides.*

*Discovery Expedition Collections:*

Sta. 939. Off W. coast of the North Auckland Peninsula, N.Z., about 35°50·5′S., 173°28′E.; 18/8/32; from N4-T attached to DC on bottom at 87 m (about 47 fm) – 2 ♂♂ 2·5–3 mm, 2 ♀♀ 3 mm.

*Dominion Museum Collections:*

B.S. 189. Off E. Otago coast, edge canyon A, 45°38·5′S., 171°02·E.; 14/8/55; BT on bottom at 120 fm – 1 ♂ 5 mm, 1 ♀ 6 mm.

B.S. 190. Off E. Otago coast, canyon B, 45°45·4′S., 171°05′E.; 16/8/55; BT at 300 fm – 4 ovigerous ♀♀ 7–8 mm.

B.S. 209. Off Mayor Is., Bay of Plenty, 37°20·5′S., 176°26·5′E.; 27/2/57; 1544–1640 h, OT at 270 fm. M.V. *Alert* – 4 ♂♂ 3–3·5 mm, 4 ♀♀ 2–4·5 mm.

B.S. 210. N.E. of Mayor Is., Bay of Plenty, 37°10′S., 176°23·5′E.; 28/2/57; OT on bottom at c. 400 fm. M.V. *Alert* – 1 ♂ 4 mm, 1 ♀ 6 mm.

–/11/56, from Cook Strait trawling grounds, coll. S. G. Hume – 3 ♂♂ 4–5 mm.

*Portobello Marine Biological Station Collection, Dunedin:*

Station *Alert* 55·8, off E. Otago coast, canyon C; 16/8/55; BT on bottom at about 350 fm – 5 ♂♂ 3·5–6·5 mm, 10 ♀♀ 4–8·5 mm (7 ovigerous 5–8·5 mm).

*Description*

This description is based mainly on the holotype, a male specimen with carapace length 7 mm, from CIE 7. The paratypes are the remainder of the CIE material only.

A relatively long and slender shrimp with three prominent middorsal carapace spines and a smooth abdomen.

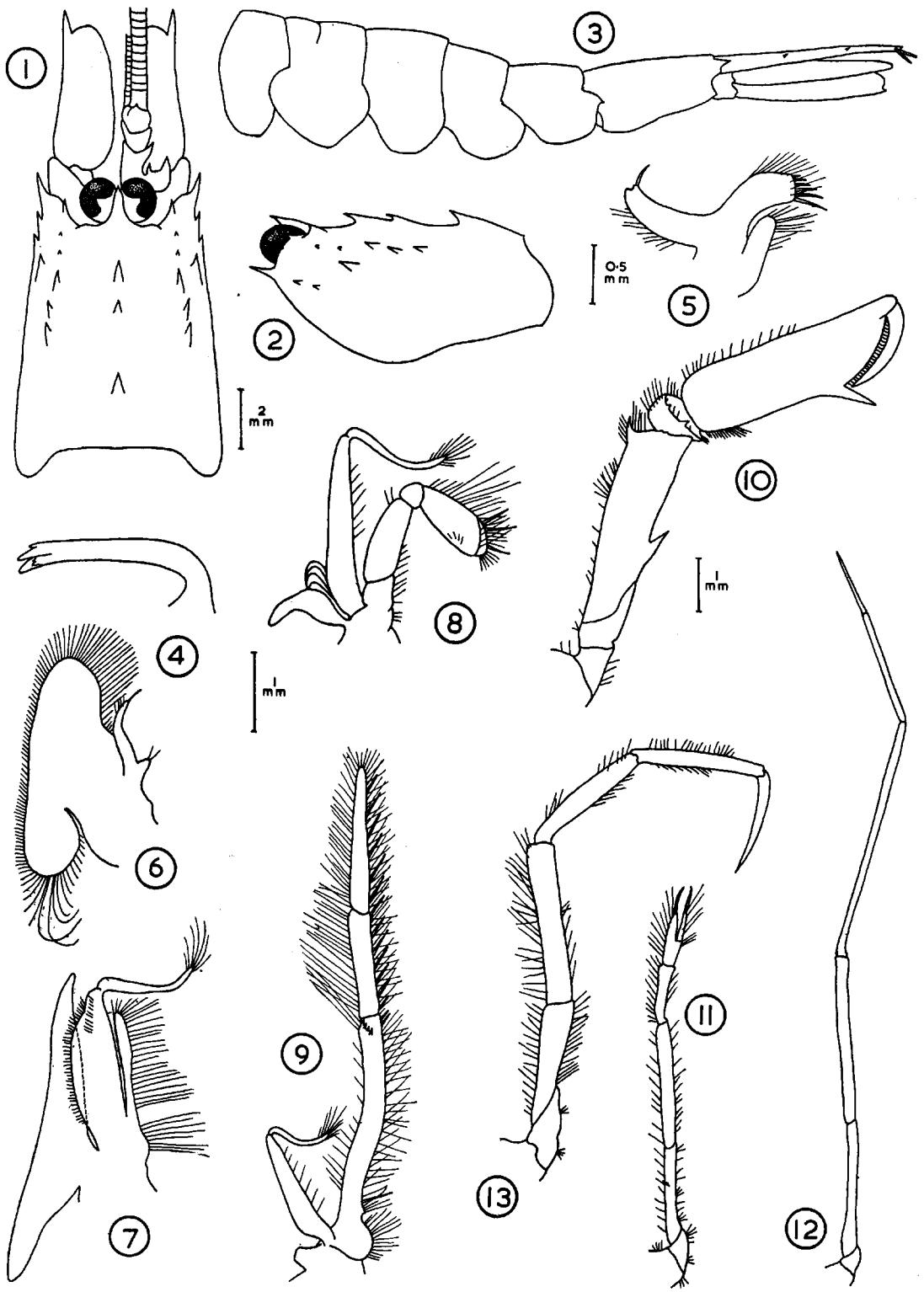
Rostrum rather broad, tapering to acute apex, which almost reaches to anterior margin of eye. Lateral margins of distal portion of rostrum bear several long setae. Anterior margin of carapace with suborbital and strong branchiostegal spines. Carapace armed dorsally with 3 strong spines, the first in anterior third; the second, the weakest, close behind first, and the third, the strongest, at posterior third of carapace. Laterally on carapace, at level of suborbital spine, there is a row of 5 spines, made up of 2 very small (sometimes minute or absent) spines anteriorly, followed by 3 large spines. Ventral to this row there is a strong hepatic spine, and finally at level of branchiostegal spine there are 2 spines, both anterior to hepatic spine. No dorsal or lateral carinae present on carapace. Both carapace and abdomen with sparse clothing of fine setae.

No distinct sculpturing on abdomen, though a weak, rounded, longitudinal carina is present dorsolaterally on each side of 5th and 6th segments. 1st to 4th segments with pleura broadly rounded, 5th with pleuron rounded ventrally but with posterolateral margin produced into small tooth and margin between the articulation point and this tooth convex. 6th segment nearly twice 5th, with posterior margin produced dorsolaterally into strong tooth. Telson nearly three times length of 5th abdominal segment, with weakly sulcate dorsal surface armed with 2 pairs of small spines. The narrow posterior margin is produced into distinct medial spine and 2 pairs of long lateral spines, of which the inner pair are strongest. A pair of small spines overlaps dorsally bases of outer pair of these spines.

Eyes normal. Proximal segment of antennular peduncle long, reaching well beyond eyes, 2 distal segments short. Stylocerite broad with anterior margin produced into 2 teeth, a small inner and a larger outer. Scaphocerite relatively broad and long with unarmed outer margin weakly concave and produced into strong spine which projects well beyond distal edge of lamella.

Mouth parts are of the usual crangonid type. Mandible consists of molar process only and terminates in 3 principal teeth and several smaller ones. 1st maxilla has proximal endite with straight medial margin, distal endite with stout bristles and endopod with weakly biloped tip, the inner lobe being armed with a stout bristle. 2nd maxilla has one reduced endite and well developed, simple endopod and scaphognathite. All maxillipeds have large and prominent exopods, consisting of two parts, peduncle and flagellum, articulated at distinct angle to one another. 1st maxilliped with no endites, long, narrow endopod, broad-based exopod and large, narrow epipod. 2nd maxilliped with distal segment articulated diagonally across end of penultimate segment and with epipod and small podobranch. 3rd maxilliped reaches with half distal segment beyond anterior margin of scaphocerite. Distal segment longer than penultimate and about 3/5 antepenultimate. A reduced epipod present.

Pereiopods without epipods or exopods. 1st pereiopod reaches with small portion of chela beyond scaphocerite, 2nd pereiopod reaches to proximal part of chela of 1st, 3rd reaches with dactyl and propodus beyond scaphocerite, 4th reaches with dactyl beyond scaphocerite and 5th is a little shorter than 4th. Dactyl of 1st pereiopod relatively stout, subchelar spine long and simple, and chela about 3·5 times as long as broad. Carpus short, bearing two spines, merus a little shorter than chela and armed with one spine distolaterally and a very prominent spine near the middle of inner margin. Ischium and basis are short and unarmed. 2nd pereiopod with free finger slightly longer than fixed and subequal with palm, carpus a little longer than hand, and half length merus, which is 4/3 ischium. 3rd pereiopod very long and slender, dactyl 3/5 propodus, which is a little less than 1/2 carpus. Propodus 2/3 merus and a little less than ischium. 4th and 5th pereiopods subequal; in 4th, dactyl simple, tapering, acute, and about 3/4 unarmed propodus. Carpus subequal with propodus and ischium though a little shorter than merus.




TEXT-FIG. 9 – *Pontophilus acutirostratus* n.sp. Fig. 1 – Dorsal view carapace. Fig. 2 – Lateral view carapace. Fig. 3 – Lateral view abdomen. Fig. 4 – Right mandible. Fig. 5 – Right 1st maxilla. Fig. 6 – Right 2nd maxilla. Fig. 7 – Right 1st maxilliped. Fig. 8 – Right 2nd maxilliped. Fig. 9 – Right 3rd maxilliped. Fig. 10 – Right 1st pereiopod. Fig. 11 – Right 2nd pereiopod. Fig. 12 – Right 3rd pereiopod. Fig. 13 – Right 4th pereiopod. Figs. 1–3 to same scale; 4 and 5 to same scale; 6–8 to same scale; 9–13 to same scale. All figs. from holotype.

The endopods of male pleopods are small and approximately subequal, with an appendix interna present on 2nd to 5th pleopods. These appendices decrease in size posteriorly, that on 5th pleopod being very small. Endopod of 1st male pleopod tapers to a distinct point distally, while that of 2nd male pleopod bears a large appendix masculina. Endopods of female pleopods decrease in size posteriorly and none bear an appendix interna. Rami of the uropods are elongate, with endopod reaching as far posteriorly as distal tip of telson and with exopod a little shorter. Outer margin of exopod terminates in minute fixed tooth with small movable spine immediately medial to it.

*Branchial Formula*

| | Maxillipeds | | | Pereiopods | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 1st | 2nd | 3rd | 4th | 5th |
| Pleurobranchiae | – | – | 1 | 1 | 1 | 1 | 1 | 1 |
| Arthrobranchiae | – | – | 1 | – | – | – | – | – |
| Podobranchiae | – | 1 | – | – | – | – | – | – |
| Epipodites | 1 | 1 | r | – | – | – | – | – |
| Exopodites | 1 | 1 | 1 | – | – | – | – | – |

r represents a reduced epipod.

*Colour in Life*

The specimens from CIE 40 and 41 when alive had several white patches laterally on the carapace and abdomen, while the remainder of the animal appeared to be irregularly blotched with red-brown, brown and brown-black chromatophores. The following more detailed notes were made from CIE material which has been preserved in alcohol for a short while.

Dark, blue-red, stellate chromatophores scattered more or less symmetrically over the dorsal surface of the carapace and abdomen. Some yellow chromatophores are present on the carapace and become more abundant on the abdomen where they replace the blue-red posteriorly. Tail fan with red chromatophores. There is a prominent dark band across the posterior portion of the 4th abdominal segment which extends a little on to the anterior portion of the 5th segment. Red-brown chromatophores are scattered on the thoracic appendages and the pleopods while the palm of the 1st pereiopod is pink with scattered red chromatophores.

Specimens from VUZ 48 and B.S. 209 after some time in alcohol had scattered, red-brown, stellate chromatophores on carapace and abdomen, while the *Alert* 55.8 collection was described as being mottled "tan and grey" by Dr E. Batham.

*Systematic Position*

In de Man's key (1920) to the genus *Pontophilus, P. acutirostratus* belongs to that group with the outer margin of the scaphocerite not toothed, the first four abdominal segments dorsally smooth and three spines on the middorsal line of the carapace. Of the several species of *Pontophilus* described since de Man's paper, only one, *P. pilosoides* Stephensen, 1927, from the Subantarctic Islands of New Zealand, also belongs to this group. Neither *P. pilosoides* nor *P. acutirostratus* belongs to any of de Man's subgroups of this group. They can both be separated out under the following new heading, "carapace laterally with an hepatic spine and two rows of spines, one at level of suborbital spine with at least 4 spines, and another at level of pterygostomial with at least two spines".

*P. pilosoides* has been found to occur (unpublished records) at many localities around the New Zealand continental shelf, and ranges bathymetrically from about 9 fm in Wellington Harbour, where it is associated with the sublittoral and shallow-water species *P. australis* (Thomson), to about 70 fm in Cook Strait, where it was taken at VUZ 48 in association with P. *acutirostratus.*

Though *P. pilosoides* and *P. acutirostratus* are very similar, they can be clearly distinguished by the following features:

1. *P. acutirostratus* has an acute rostrum, while that of *P. pilosoides* is broad and rounded.
2. *P. acutirostratus* normally has 3 large and 2 small spines in the lateral carapace row at the level of the suborbital spine, while *P. pilosoides* normally has 2 large and 2 small spines in this row. (See below for variation in these spines for *P. acutirostratus.*)
3. The margin of the pleuron between the articulation point and the posterolateral tooth on the 5th abdominal segment in *P. acutirostratus* is normally convex, while in *P. pilosoides* it is normally straight.
4. *P. pilosoides* is a shallow-water and continental shelf species (9 to about 70 fm), while *P. acutirostratus* is a continental shelf and slope species (47 to about 400 fm).

In 1916 Kemp divided the species of *Pontophilus* into 5 groups on the degree of development of the endopod and appendix interna on the pleopods of both sexes (see review of these groups by Lebour, 1954). Both *P. acutirostratus* and *P. pilosoides* belong to Kemp's group III with "endopod of last four pairs of pleopods comparatively well developed in male, reduced in female. Appendix interna present on all four pairs in male, but entirely absent in female". Within this group they appear to be closely related to *P. pilosus* Kemp, though as Stephensen (1927) states for *P. pilosoides,* they can be clearly distinguished by the different lateral spinulation of the carapace, the presence of the spine on the merus of the 1st pereiopod and the different shape of the scaphocerite.

*Distribution*

*Pontophilus acutirostratus* has been taken off the coast of New Zealand, between about 47 and 400 fm from off the west coast of the North Auckland Peninsula (about 35°50′S.) in the north to off Otago Heads (about 45°51′S.) in the south.

*Variation in Carapace Spinulation*

While examining the above material of *P. acutirostratus* a specimen was seen with 2 large and 2 small spines laterally on the carapace at the level of the suborbital spine, i.e. the normal condition in *P. pilosoides*. Consequently the number of spines in this row was examined in each of the 65 specimens available, and the following variation found: 51 specimens (78·5%) had the normal arrangement of 3 large and 2 small, expressed as (3 + 2), on both sides of the carapace; of the 14 specimens (21·5%) varying from the normal arrangement, 10 had (3 + 2) on one side only; thus 61 specimens (94%) had (3 + 2) on at least one side of the carapace; of the 10 variants with (3 + 2) on one side only, 7 had (4 + 2) on the other side, 1 had (4 + 3) and 2 had (2 + 2); of the 4 remaining variants 2 had (4 + 2) on both sides, 1 had (4 + 2) on one side and (5 + 2) on the other, and 1 had (2 + 2) on both sides. The latter, unique in this respect, had only 2 middorsal spines on the carapace, but an examination of other features showed it unquestionably to belong to *P. acutirostratus*. Thus only 3 specimens (4·6%) had the *P. pilosoides* condition of (2 + 2) on one or both sides of the carapace. One specimen was seen with 3 spines laterally on the carapace at the level of the branchiostegal spine.

No variations in the rostral profile of *P. acutirostratus,* in particular no intermediate between the condition in this species and that in *P. pilosoides* were observed.

*Notes on Life History*

Ovigerous females, with eggs measuring, after preservation, 0·7 to 0·8 × 0·5 to 0·65 mm, were taken in the months of February and August. The smallest ovigerous female observed had a carapace length of 4·5 mm, thus we may assume that females and probably males become mature at a carapace length of about 4 mm.

## Genus **Prionocrangon** Wood-Mason & Alcock, 1891

1891 *Prionocrangon* Wood-Mason & Alcock, Ann. Mag. Nat. Hist. ser. 6, 8: 361.

1901 *Prionocrangon* Alcock, Cat. Ind. Deep-sea Crust.: 123.

1916 *Prionocrangon* Kemp, Rec. Ind. Mus. 12: 383.

1920 *Prionocrangon* de Man, Siboga Exped: 39a3: 308 (key to species).

*Definition*

Crangonidae with cornea absent and ocular peduncles reduced to single segment. Rostrum spiniform. Carapace with middorsal carina only. Stylocerite distally acute. 1st pereiopod without exopod. 2nd pereiopod non-chelate. Dactyls of 4th and 5th pereiopods broad. Endopods of pleopods shorter than exopods, no appendix interna on any pleopod. Gills: pleurobranchs on 1st to 5th pereiopods only, ventral apices directed posteriorly. Eggs large.

*Type species:* **P. ommatosteres** Wood-Mason & Alcock, 1891, from the Indian Ocean and Indonesian waters.

Three other species are now recognised: *P. dofleini* Balss from Japanese waters, *P. pectinata* Faxon from the West Indies and a new species *P. curvicaulis* from New Zealand waters.

Kemp (1916) regards *Prionocrangon* as a "very highly specialised form", derived with *Crangon, Sclerocrangon* and *Argis* from Group V of *Pontophilus*. The additional anatomical details given below appear to fully support this hypothesis.

**Prionocrangon curvicaulis** n.sp.

*Material Examined*

*Chatham Islands 1954 Expedition:* Sta. 6 – 1 ♂ 6 mm, 2 ♀♀ 7·5–9 mm (1 ovigerous 9 mm); Sta. 7 – 3 ♀♀ 7–8 mm (2 ovigerous 8 mm); Sta. 41 – 1 ♀ 8 mm; Sta. 52 – 2 ♀♀ 8–9 mm (1 ovigerous 8 mm).

*Description*

This description is based mainly on the holotype, an ovigerous female specimen with carapace length of 9 mm from CIE 6. The remaining specimens are all paratypes.

A medium-sized, relatively stout shrimp with degenerate eye-stalks and short rostrum.

Rostrum a short, acute, spine-like process, weakly concave dorsally and extending as far anteriorly as pterygostomial spine. Anterior margin of carapace with small suborbital and strong pterygostomial spines. Carapace with middorsal carina on anterior 2/3 armed in holotype with 9 spines (in female paratypes with 7–9 spines, in male paratype with 11 spines), of which most anterior is largest and others subequal. No other carinae or spines on carapace. Numerous long setae on frontal, orbital and antennal regions of carapace, but remainder of carapace and abdomen naked.

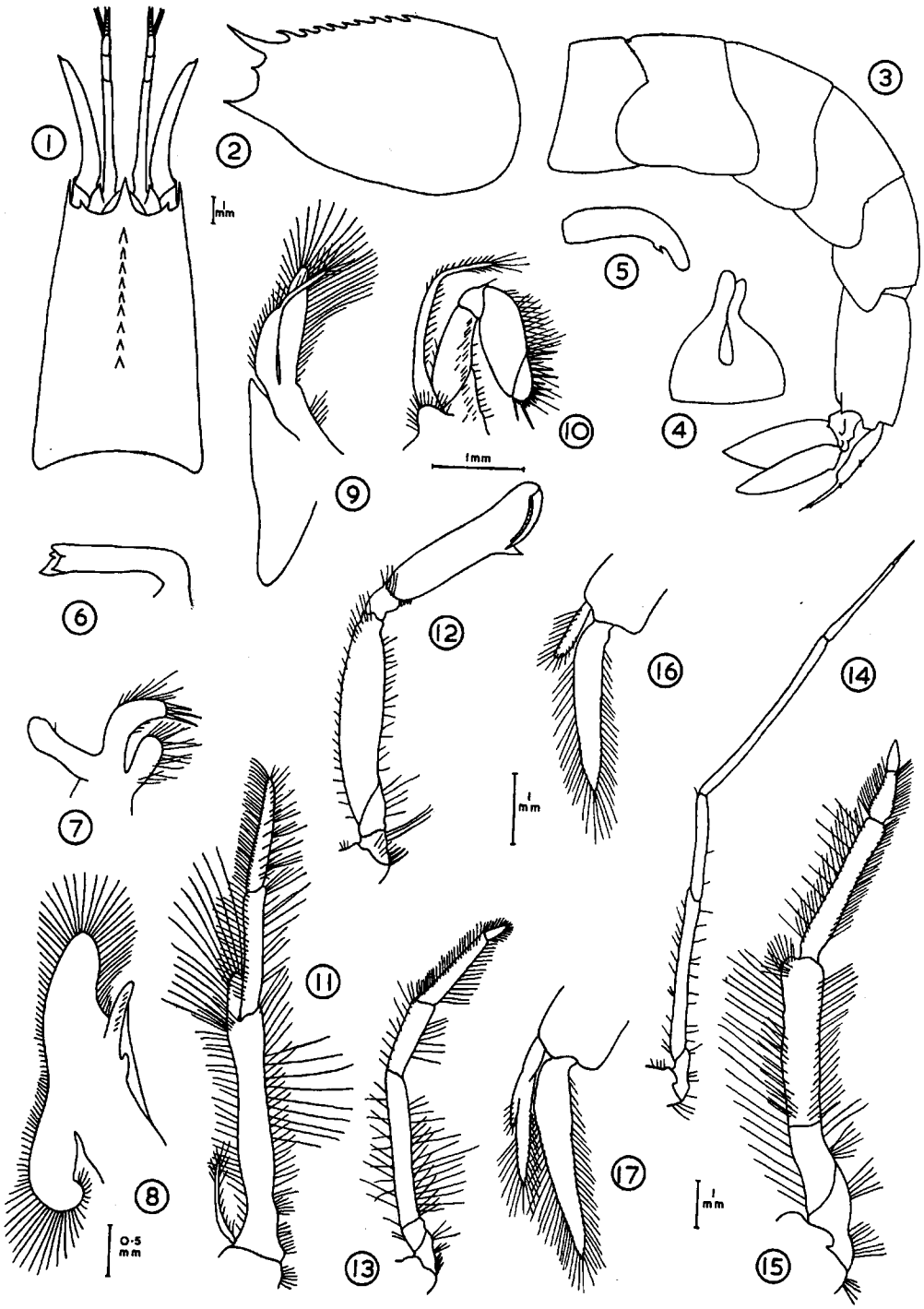
No sculpturing on abdomen. 1st to 5th segments with pleura bluntly rounded. 6th segment a little longer than 5th, with blunt posterolateral projection and small acute pleuron. Telson subequal with 5th abdominal segment, but not extending as far posteriorly as the uropods. In dorsal view the lateral margins are expanded slightly at their mid-point and the distal margin is broadly rounded and armed with 3 long slender spines on each side of microscopic medial tooth. Dorsal surface of telson bears 3 pairs of spines, one pair slightly above and one pair slightly below lateral expansion, and third pair close to distal margin.

Ocular peduncles greatly reduced, unsegmented and not extending as far anteriorly as tip of rostrum. The two peduncles curve inwards to meet below rostrum, the unpigmented distal ends curving ventrally between antennules. These distal ends are bluntly rounded, show no trace of a cornea and bear a small curved tooth ventrally. In the pair illustrated (text-fig. 10, fig. 4) the peduncles are distinctly asymmetrical distally.

Proximal segment of antennular peduncle very long, about 5 times as long as 2nd segment which is subequal to 3rd. Both flagella simple and shorter than peduncle. Stylocerite small and produced anteriorly into single tooth. Scaphocerite long, narrow, extending anteriorly as far as distal end of second segment of antennular peduncle, and with concave outer margin produced into small spine projecting entirely beyond narrow distal end of lamella. Distal segment of antennal peduncle very long and extending beyond distal end of scaphocerite.

Mandible with molar process only, terminating in 3 principal teeth and some smaller ones. 1st maxilla with lobe-like proximal endite, distal endite with about 3 stout bristles and endopod with slightly expanded unarmed tip. 2nd maxilla has one reduced endite and well developed, simple endopod and scaphognathite. All maxillipeds have relatively small and slender exopods not divided into peduncle and flagellum. 1st maxilliped with no endites, long endopod, simple exopod hardly longer than endopod, and large triangular epipod. 2nd maxilliped with distal segment articulated diagonally across end of penultimate segment and rudimentary epipod. 3rd maxilliped reaches a little beyond distal end of antennular peduncle. Distal segment subequal with penultimate and about 1/2 antepenultimate. This latter segment is produced anteromedially into a lobe-like projection a little more than 1/3 length of penultimate segment. This projection like all segments of 3rd maxilliped bears large numbers of long setae.

Pereiopods without epipods or exopods. 1st pereiopod reaches to distal margin of scaphocerite, 2nd reaches to proximal part of chela of 1st, 3rd reaches with dactyl beyond scaphocerite, 4th reaches as far as 1st, and 5th reaches to distal end of merus of 4th. Dactyl of 1st pereiopod overlaps the broad-based, simple subchelar spine, while chela is nearly 5 times as long as broad. Carpus short, unarmed merus a little longer than chela. Ischium and basis short and unarmed except for few stout bristles proximomedially on latter. Several small bristles are present medially at articulation of propodus and carpus. 2nd pereiopod non-chelate, propodus 3½ times length of broad, short dactyl, a little longer than carpus and equal to half merus and ischium combined. Ischium subequal to dactyl. 3rd pereiopod very long and slender, dactyl 1/3 propodus, which is 1/2 carpus. Propodus subequal with merus and 2/3 ischium, 4th pereiopod stout, heavy, with




TEXT-FIG. 10 – *Prionocrangon curvicaulis* n.sp. Fig. 1 – Dorsal view carapace. Fig. 2 – Lateral view carapace. Fig. 3 – Lateral view abdomen. Fig. 4 – Dorsal view ocular peduncles. Fig. 5 – Lateral view right ocular peduncle. Fig. 6 – Right mandible. Fig. 7 – Right 1st maxilla. Fig. 8 – Right 2nd maxilla. Fig. 9 – Right 1st maxilliped. Fig. 10 – Right 2nd maxilliped. Fig. 11 – Right 3rd maxilliped. Fig. 12 – Right 1st pereiopod. Fig. 13 – Right 2nd pereiopod. Fig. 14 – Right 3rd pereiopod. Fig. 15 – Right 4th pereiopod. Fig. 16 – Right male 1st pleopod. Fig. 17 – Right male 2nd pleopod. Figs. 1–3 to same scale; 4–8 to same scale; 9, 16 and 17 to same scale; 11–15 to same scale. Figs. 4 and 5 from female paratype, carapace length 7.5 mm; figs. 16 and 17 from male paratype, carapace length 6 mm; remaining figs. from holotype.