

NEW ZEALAND  
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

BULLETIN 172

**The Marine Fauna of New Zealand:  
Spider Crabs, Family Majidae  
(Crustacea, Brachyura)**

by

D. J. G. GRIFFIN

**New Zealand Oceanographic Institute**

**Memoir No. 35**

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SPIDER CRABS, FAMILY MAJIDAE  
(CRUSTACEA, BRACHYURA)



*Photograph: J. J. Whalen*

*Leptomithrax longipes* Thomson

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This publication should be referred to as:  
*N.Z. Dep. sci. industr. Res. Bull. 172.*

*Received for publication August 1963*  
*Published 1966*

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R. E. OWEN, GOVERNMENT PRINTER, WELLINGTON, NEW ZEALAND—1966

## FOREWORD

SINCE the early nineteenth century biological research in New Zealand has been continuous. Up to 1900 over 850 papers on the marine zoology of New Zealand had been published. Most of this and later work has appeared as discrete papers, there being relatively few monographic or serial comprehensive treatments of particular taxonomic groups. Despite some substantial contributions in this form, the lack of detailed accounts enabling the ready recognition of species in many other groups has hampered the development of ecological work dependent on such identification.

Since 1955 the Oceanographic Institute has been developing a programme of research in benthic ecology in the New Zealand region and the effects of this scarcity of systematic monographs of the marine fauna have been particularly evident. However, the opportunities that have arisen in the course of sampling programmes have provided additional material for systematic consideration and a number of specialists in systematic groups have interested themselves in working on the New Zealand fauna.

The author of the present work has based his studies on material in the collections of the Dominion Museum, Wellington; Victoria University Zoology Department; New Zealand Oceanographic Institute; the private collection of Professor L. R. Richardson, Wellington; and supplementary material in the Australian Museum, Sydney.

This study is one of a number of monographs on the marine fauna of New Zealand appearing in this series of memoirs.

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# The Marine Fauna of New Zealand: Spider Crabs, Family Majidae (Crustacea, Brachyura)

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## Abstract

THE NEW ZEALAND majid spider crab fauna comprises a total of 18 species belonging to 11 genera representing four of the seven subfamilies into which the family Majidae is currently divided. The present report treats 17 species extensively, the material on which it is based (almost 400 specimens collected in New Zealand waters) making up 16 of these. Previous work on the group in New Zealand and the general classification of the group on a world-wide scale are briefly reviewed. Keys to genera and species are provided.

The fauna is dominated at the species level by the subfamily Majinae, to which 10 species comprising three genera are referred. Almost all species may be considered primitive in some important respects and are rather uniform morphologically.

From the zoogeographical aspect the fauna presents a strong endemic or restricted element, 12 species and two genera not being found outside New Zealand waters. While there is a strong relationship with the fauna of south-eastern Australia, with which five species and nine genera are shared, there are some important differences between the two. One, and perhaps two, species are shared with Japan. In general, the fauna is an outlying part of the Indo-West Pacific (Malayo-Pacific) region, six of the genera possessing species there in addition to those in Australia. Three of these genera also possess species in the Atlantic and thus constitute a wider, cosmopolitan or Tethyan, element. These relationships are considered to be further evidence for a common origin of some New Zealand and Australian elements in the northern Indo-West Pacific and a shallow water connection with Indonesia during the early Tertiary and perhaps again later.

One genus with three species in New Zealand and two in Australia is represented in the South American fauna by a single species, while two genera, including one restricted to New Zealand, probably find their closest relatives in South or Central American waters. These relationships may be explained by old land connections or, as far as closely related species are concerned, by epiplanktonic larval dispersal.

Within New Zealand waters five species are commonly found intertidally and, with one exception, are universally distributed round the mainland. Three species are restricted to the archibenthal and also seem widely distributed. The 10 species found in true continental shelf depths all extend varying degrees into the archibenthal. While the distribution of at least one of these is very poorly known as yet, two appear to have a very well defined southern distribution, being known from the Subantarctic Islands and the south of the South Island, and two appear to be distributed mainly between Stewart Island in the south and the south of the North Island, being apparently replaced in northern waters by two smaller species. The Chatham Islands are characterised mainly by the absence of several forms common round the mainland of New Zealand.

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## INTRODUCTION

THE superfamily Oxyrhyncha, including the “spider crabs”, at present stands within the Crustacea Brachyura as one of the two subdivisions of the Brachygnatha, the largest of the brachyuran subsections. They are distinguished by the generally elongate-triangular, narrow-fronted carapace and incomplete orbits in contrast to the round or square, wide-fronted carapace and enclosed orbits of the superfamily Brachyrhyncha, the other subdivision of the Brachygnatha. Among the brachyrhynchs the spider crabs find their closest allies in the Cancroidea or cyclo-metopous crabs rather than the Grapsoidea or catometopous types.

The Oxyrhyncha comprise three families of which the Majidae, the subject of the present study, make up the largest in terms of numbers of species and generally attract most interest because of the attachment to their backs of a rich epifauna including seaweed, sponges, sea anemones, small barnacles, and other sessile marine organisms. These are held in position mainly by peculiar curled or hooked hairs found, with few exceptions, only in this family (see Borradaile, 1903a; MacGinitie and MacGinitie, 1949; and Wolff, 1959). Of the other two families of the Oxyrhyncha and Hymenosomidae are small and inconspicuous forms generally found in shallow depths among seaweed on rocky or muddy shores; there is also a single freshwater species. The third family, the Parthenopidae, comprises rather large crabs found intertidally or just offshore. The carapace in the parthenopids is usually much wider than long and sometimes sculptured into unusual shapes. The hymenosomids are a characteristically southern group, though several species are found in Japan; they are represented in New Zealand waters by close on 20 species (Richardson, 1949b), but the parthenopids are now considered to be absent from our fauna.

The majid spider crabs are an entirely marine group frequenting the sea bottom from intertidal areas down to more than 1,000 fathoms, and are found in all oceans and seas except those of polar regions. They range in size from the minute forms such as the species of *Eurynome* and *Podochela* which may measure no more than 8 mm in carapace length to the huge Japanese species of *Macrocheira* which reach up to approximately 4 m across the legs.

While our knowledge of the New Zealand representatives of the Majidae has, up until very recently, been incomplete in many ways, a large amount of new material is now available. In view of this, and the fact that the results of recent work on the group overseas have not yet been applied here, a revision of the group in New Zealand is urgently needed. In addition, the opportunity of

examining Australian material and photographs of type specimens located in overseas institutions has permitted clarification of many previously obscure problems.

In comparison with the amount of intensive taxonomic study which has been devoted over the past 10 to 15 years to some groups of the New Zealand marine fauna, such as the hydroids, polychaetes, molluscs, echinoderms, amphipods, shrimps and prawns, and fish, the brachyuran Crustacea have received but scant attention. The majority of the species have been made known largely through the efforts of overseas expeditions to these waters in the latter half of the last century, and the first two decades of the present one (see “Previous Work”). Few species have been adequately described and even fewer figured. That the majority of the local species are related to, or in some cases identical with, Australian ones, a feature realised for some considerable time in this and other groups, has been of little assistance in the past, since the Australian fauna is itself poorly known. It is not surprising to find, therefore, that the status of many of the local species has remained obscure. As in most lines of taxonomic research the need for detailed descriptions of species, together with accounts of variation, has been realised only comparatively recently. Thus, of the 25 species of majid recorded from New Zealand waters before 1960, the year in which this study was begun, four were known to be synonyms of previously described species, the same being suspected in the case of two others, while two were entirely unidentifiable. Of the 21 remaining species of apparently good taxonomic standing, including the unidentifiable ones, 13 were known from these waters from but a single record, in most cases a single specimen, and five had been considered by most authors to have been erroneously recorded, the specimens on which their records were based having probably been collected in Australia, from where they are comparatively well known.

The value of the material collected recently by the New Zealand Oceanographic Institute, Victoria University of Wellington Zoology Department, and the Dominion Museum, Wellington (see “Sources of Material”), may be appreciated from the fact that whereas Chilton and Bennett (1929) had but a few specimens of two species of *Leptomithrax*, *L. australis* and *L. longimanus*, the Dominion Museum collections now contain 30 specimens of the two, including many females and juveniles, while several more have been taken by the Victoria University zoology department, all of which have enabled the study of growth changes and sexual dimorphism and the sorting out of several previous uncertainties. The same remarks apply equally well to *Chlorinoides filholi*, more than 40 specimens of this species now being available in the three

Wellington collections drawn on in the present study, whereas Dell (1960) stated this to be a poorly known species. As would be expected nearly all the littoral and shallow offshore species, with the exception of *Naxia huttoni*, are now well represented, particularly in the collections of the New Zealand Oceanographic Institute, which among others contains more than 70 specimens of *Leptomithrax longipes*. Furthermore, as a direct result of the intensive collecting during the last decade, two new species have been discovered, and two others, known from Australia, are here established firmly as part of the New Zealand fauna, one having been recorded from only a single specimen some 90 years ago. Just as important, the material has permitted the reduction to synonymy of at least two species which were based on juvenile specimens.

Though the New Zealand fauna comprises rather few species of majids, the application to them of recent innovations in the classification of the group as a whole, brought about by workers in other countries, could result in some rather important changes. During the last 30 or so years concepts of higher taxa, both subfamilies and

genera, in the Majidae have undergone considerable modification stemming mainly from the work of the eminent German carcinologist, Heinrich Balss. So far the results of Balss's (1929) revision have been applied only to the Japanese fauna by Sakai (1938), the Iranian Gulf species by Stephensen (1945), and more recently to the Pacific American forms by Garth (1958). While Bennett (1964) has strictly applied Balss's system of classification to the New Zealand Majidae, refinements in that system introduced by Garth (op. cit.) on the basis of his own studies and also as a result of characters shown to be of considerable taxonomic importance by Shen (1932) working on the Chinese species, and by Stephensen (op. cit.), have not as yet been applied to the New Zealand fauna. Monographs dealing with the South Australian Crustacea by Hale (1927) and the South African Crustacea by Barnard (1950) and the valuable "Guides" to the New Zealand Brachyura by Richardson (1949a-c) while all dealing with majids have, for various reasons, not used Balss's system, but in one form or another have retained that proposed by Alcock (1895) (see "Systematics: Historical Note").

## PREVIOUS WORK

THE history of New Zealand carcinology has been briefly reviewed by Chilton & Bennett (1929), Dell (1960), and in a more detailed and critical manner by Bennett (1964). However, it is considered worth while to reiterate here some of the more important points of historical interest in so far as they concern majids.

The first contribution to our knowledge of the majids of these waters came from four French expeditions interspersed with sporadic collecting on British and American expeditions. The first French expedition was that of Dumont d'Urville in the *Astrolabe* during 1827. The naturalists Quoy and Gaimard collected two new species of majid from New Zealand. The first was described by H. Milne Edwards (1834):

### *Paramithrax gaimardii*

This is now known to be an Australian species of the genus *Leptomithrax* identical with *L. australiensis* Miers, as suspected by Rathbun (1918) on the basis of remarks by Filhol (1886), though the original description was so inadequate that it has long remained unidentifiable. The second was described seven years later by H. Milne Edwards and Lucas (1841):

### *Eurynolambrus australis*

This species has until recently been regarded as a parthenopid, but is now placed in the majid subfamily Pisinae (see Kreff, 1952). A third species, now known to be restricted to New Zealand, was also described by H. Milne Edwards from specimens stated to come from

the "Indian Ocean". This species was the second recorded from these waters by d'Urville's third voyage to New Zealand in the *Astrolabe* and *Zelee*, the so-called "Voyage au Pole Sud", with the naturalists Hombron and Jacquinot. Jacquinot (in Jacquinot & Lucas, 1853) recorded the following species, the first and third being new:

### *Prionorhynchus edwardsii* *Paramithrax peronii* *Maia australis*

The first of these was renamed *Jacquinotia edwardsii* by Rathbun (1915), *Prionorhynchus* being preoccupied, and the third was transferred to *Leptomithrax* by Miers on the setting up of that subgenus of *Paramithrax* (Miers, 1876a, 1876b).

The United States Exploring Expedition under Charles Wilkes visited New Zealand in 1840 and Dana (1852) recorded *Eurynolambrus australis* from the Bay of Islands.

Streets (1870) described a new species of majid from New Zealand:

### *Huenia bifurcata*

This has not been recorded from these waters since.

Six years later the younger Milne Edwards (A. Milne Edwards, 1876a, 1876b) added the following two species:

### *Trichoplatus huttoni* *Acanthophrys filholi*

The first is treated here as a species of *Naxia* following Richardson (1949b), though *Trichoplatus* is retained as

a good genus by Bennett (1964). The second is now regarded as belonging to *Chlorinoides*.

In a preliminary paper in the same year Miers (1876a) described as new to New Zealand, three species. Two of these were:

*Paramithrax latreillei*  
*Leptomithrax longimanus*

The first was reduced to synonymy with *Cancer ursus* Herbst, 1788, by Balss (1929), and the second stands, having become the type of the subgenus shortly afterwards (Miers, 1879c). The third species described as new was *Halimus hectori* which has been recognised by all later workers as the same as A. Milne Edwards's *Trichoplatus huttoni*. In his "Catalogue" published shortly afterward (Miers, 1876b) three species were recorded by Miers from specimens in the British Museum bearing New Zealand locality labels. These were:

*Hyastenus diacanthus*  
*Paramicippa spinosa*  
*Paramithrax sternocostulatus*

All had already been recorded from Australia. The first two retain their original names but the third, actually referred to by Miers as *Paramithrax gaimardii* but corrected later (Miers, 1879b), is now placed in *Leptomithrax*. Miers's catalogue also listed all the species previously described from New Zealand.

Haswell (1879), the noted Australian carcinologist, recorded a single new species from Auckland:

*Stenorhynchus fissifrons*

The identity and New Zealand occurrence of this species has remained obscure until very recently. It is now referred to *Achæus* (a genus previously unknown from these waters) and confirmed as part of the fauna. This species extends to Australia, Japan, and India.

The fourth of the French expeditions mentioned above was the "Mission de l'Île Campbell". From this Filhol (1885, 1886) added one valid species:

*Paramithrax minor*

A second described as new was *Paramithrax cristatus*, considered by most later workers to be identical with Miers's *Paramithrax latreillei*. All previously recorded species were again listed and many figured.

The *Challenger* expedition of 1873–76, of which the Brachyura were treated by Miers (1886), took no crabs from New Zealand.

Two papers by the American carcinologist, Mary J. Rathbun, recorded *Paramithrax peronii*, *Leptomithrax longimanus*, *L. australis*, and *Jacquinotia edwardsii* (as *Prionorhynchus edwardsii*) from New Zealand specimens in the U.S. National Museum (Rathbun, 1892, 1893).

From 1880 onward the Crustacea attracted the attention of workers in this country. T. W. Kirk (1881) described a supposedly new majid, *Halimus rubiginosus*, shown later (Chilton & Bennett, 1929) to be identical with the species herein called *Naxia huttoni*, and Sir

James Hector (1899) briefly mentioned crabs which he called *Paramicippa grandis*, a species identical with *Jacquinotia edwardsii*, though this has not until recently been mentioned in the literature. The most notable of the early local workers on the Brachyura were the Hon. G. M. Thomson, sometime director of the Portobello Marine Station, and Dr Chas. Chilton, later professor of biology at Canterbury University. Thomson worked mostly on the fauna of Otago and added a new majid from offshore waters (Thomson, 1902):

*Paramithrax longipes*

This species is now known as *Leptomithrax longipes* following Richardson (1949b). Chilton discussed the material from several areas including Auckland (Chilton, 1906a), the Chatham Islands (Chilton, 1906b), and the Subantarctic Islands (Chilton, 1909), and also treated the Crustacea from the New Zealand Government 1907 Trawling Expedition on the *Nora Niven* (Chilton, 1911), which worked various stations along the east coast of New Zealand from Otago to Hawke Bay. Chilton's work resulted in a great increase in our knowledge of the distribution of many species.

Two overseas expeditions to these waters in the 1890s, the German Prof. Schauinsland (Lenz, 1901) and the British *Southern Cross* (Hodgson, 1902) which also visited the Antarctic, collected several, by then well authenticated, majids but added no new records.

The British Antarctic (*Terra Nova*) Expedition of 1910 worked several offshore stations round the New Zealand coast, and Borradaile (1916) added three majids:

*Echinomaia hispida*  
*Paramithrax parvus*  
*Leptomithrax affinis*

The first of these was later transferred to *Cyrtomaia* by Balss (1929), the second is reduced to synonymy with *Paramithrax minor* Filhol by Bennett (1964) and together with the other New Zealand species of *Paramithrax* are herein placed in a new genus *Notomithrax*. The third was considered as a possible synonym of *Leptomithrax longimanus* Miers by Chilton and Bennett (1929) and of *L. australis* (Jacquinot) by Balss (1930), though treated as a separate species by Richardson (1949). Chilton and Bennett's opinion has been independently confirmed by the present study and by Bennett (1964).

Dr Th. Mortensen's Pacific Expedition of 1914–16 collected specimens of *Leptomithrax australis* and *Jacquinotia edwardsii* (recorded as *Prionorhynchus edwardsii*) from the Auckland Islands (Stephensen, 1927) and the German Expedition led by Dr L. Kohl-Larsen which visited Stewart Island and the Subantarctic Islands in 1924 collected *Leptomithrax australis* and *Jacquinotia edwardsii* at Campbell Island. Balss (1930) in discussing the decapod Crustacea of the expedition added a new majid from Campbell Island:

*Campbellia kohli*

This species, placed in a new genus by Balss, is now

known to have been based on a juvenile specimen of *Iacquinotia edwardsii*.

Chilton's earlier work on the Brachyura may be regarded as culminating in 1929 with his publication, together with E. W. Bennett, in that year of a paper entitled "Contributions for a Revision of the Crustacea Brachyura of New Zealand". In this paper all the species of majids which had previously been recorded from New Zealand were listed together with data on distribution and synonymy. In effect this represented the first thoroughgoing attempt to evaluate the status of the New Zealand representatives of the group. It is true that records of various species had previously been critically examined but at a time when collecting on a wide scale had hardly begun. The first such criticism was a paper by Hutton (1882), (often referred to as the "black list") in which some of the records in Miers's catalogue were regarded with suspicion.

*Huenia bifurcata* (recorded by Streets (1870)), *Hyastenus diacanthus*, *Paramicippa spinosa*, and *Leptomithrax sternocostulatus* (as *Paramithrax sternocostulatus*) were considered doubtful occurrences in New Zealand. The first two of these four were excluded from the list of species compiled for Hutton's (1904) "Index" by Thomson and Chilton, but the other two together with Haswell's *Stenorhynchus fissifrons* were included, while *Halimus rubiginosus* was listed as a valid species. Chilton and Bennett expressed strong doubts about the occurrence of *Hyastenus diacanthus* and *Huenia bifurcata* and, as mentioned already in this account, *Halimus rubiginosus* was reduced to synonymy and *Leptomithrax affinis* was regarded as possibly a juvenile of *L. longimanus*. On the other hand, *Leptomithrax sternocostulatus* was considered as definitely occurring in New Zealand. The only deficiency in the paper was that the species then placed in *Paramithrax* were but briefly dealt with.

Thirty years after the publication of Chilton and Bennett's paper Richardson (1949b) provided a valuable key to all the species recorded from New Zealand, *Trichoplatus huttoni* and *Paramithrax longipes* being transferred to other genera as noted above. Balss's (1929) findings were not incorporated.

Two papers dealing with New Zealand majids have appeared in the last decade. Krefft's (1952) transference of *Eurynolambrus australis* from the Parthenopidae to the Majidae has already been mentioned. Recently the Chatham Islands 1954 Expedition collected many species of crabs and allowed the compilation of an up-to-date checklist, the only previous one being that of Young (1929) which was based on sporadic collecting only. Dell (1960) added a new majid from deep water on the Chatham Rise:

*Leptomithrax richardsoni*

Apart from those majids already mentioned as having been recorded from both New Zealand and Australian waters, three other species now referred to *Notomithrax*, *N. peronii*, *N. ursus*, and *N. minor*, have also been thought to occur in both countries (Haswell, 1880a, 1882; Hodg-

son, 1902; Fulton and Grant, 1906b; Rathbun, 1918; Balss, 1929; and McNeill, 1953). Only the last two of these are now considered to occur in Australia. The only other member of the local majid fauna reliably known from outside these waters is *Cyrtomaia hispida*, which Balss (1929) recorded from Indonesian waters. Thus up to the time of commencement of this study in 1960 the known New Zealand fauna comprised 20 species of majid brachyuran referred to 12 genera. The type specimens of most of these are located in overseas institutions.

With the publication of the important paper by Bennett (1964)\*, our knowledge of the New Zealand Brachyura begins to reach that of other parts of the world. Many important findings with respect to the Majidae are made known by Bennett and these are briefly listed here with only a few comments. A more detailed discussion of that author's work appears in the systematic part of the present monograph; in each case such comments as are deemed necessary form a separate concluding paragraph. For the time being the changes introduced by Bennett may be divided into four main categories:

1. EXCLUSION OF DOUBTFUL SPECIES: After examination of extensive material Bennett has decided that the following five majids, regarded as doubtful occurrences in New Zealand by other workers on the group, should be excluded from the fauna:

*Hyastenus diacanthus*  
*Leptomithrax sternocostulatus*  
*Paramicippa spinosa*  
*Stenorhynchus fissifrons*  
*Huenia bifurcata*

The first three were recorded from incorrectly labelled material in the British Museum (Natural History), the remaining two likewise resting, according to Bennett, on incorrect locality labels in other museums. The new material to hand proves Bennett to be wrong only in the case of the fourth of the above species, which, as stated earlier in this discussion, is now readmitted to the fauna as a species of *Achaeus*.

2. CORRECTIONS OF LOCALITY RECORDS OF AUTHENTIC NEW ZEALAND SPECIES ALSO RECORDED FROM AUSTRALIA: Bennett concludes that of the three species, herein referred to *Notomithrax*, stated to occur in Australia, the records of *N. minor* only are to be admitted to the lists of that country; according to Bennett *N. ursus* and *N. peronii* are not found in Australia, statements to the contrary stemming, in the case of the second of the two, from erroneous labels on British Museum specimens quoted by Miers (1876a) and later by Haswell (1880a; 1882c) which were retained unchallenged by subsequent workers. The first of the two above species, *N. ursus*, has recently been authentically recorded from Australia by McNeill (1953) as *Paramithrax latreillei*.

\* The initial portions of the present study were concluded before Dr Bennett's manuscript was available for reference.

3. REDUCTION OF SPECIES TO SYNONYMY: Two species described by Borradaile (1916) have been reduced to synonymy by Bennett because they were based on juveniles of previously described species. Thus *Leptomithrax affinis* has become a synonym of *Leptomithrax longimanus* Miers, and *Paramithrax parvus* of *Notomithrax minor* (Filhol), as noted above.

4. NEW SPECIES: Two new species of majid have been described by Bennett:

*Leptomithrax molloch*

*Leptomithrax mortenseni*

It may be noted in passing that each of the above is referred by Bennett to a separate subgenus of *Leptomithrax*, three such subgenera having been set up. Such an arrangement has not been followed in the present report, though this in no way implies the invalidity of such a division. Of the two new species then, the first (referred by Bennett to the subgenus *Zemithrax*) is based on juvenile specimens of *Leptomithrax longipes* as is revealed by

comparison of his description and figures with specimens of the latter species in the collections of the Victoria University zoology department and New Zealand Oceanographic Institute. The second of the new species (referred to *Austromithrax*) proves on comparison of his paratypes with specimens in the collections of the Australian Museum, Sydney, to be only subspecifically distinct from *Leptomithrax tuberculatus* (Whitelegge) and it is retained here as *L. tuberculatus mortenseni*; *L. tuberculatus* was formerly considered to be restricted to Australian waters.

Other differences between Bennett's revision and the present monograph may be attributed in part to the fact that the former was completed in 1936. Thus the Pisinae are regarded by Bennett as unrepresented in New Zealand, *Eurynolambrus australis* being considered a parthenopid; as already stressed, Bennett uses the classification proposed by Balss (1929) without any modification, while in the present report Garth's (1958) modification of the Balssian scheme is followed.

## SCOPE OF PRESENT REPORT

THE present study was undertaken with a view to clarifying the status, both taxonomic and distributional, of the New Zealand majid Brachyura. The present report treats in detail only the New Zealand species; similar studies of some Australian species, which were carried out concurrently, are mentioned in passing and are reported more

fully elsewhere. The territory covered includes most of the New Zealand faunal region as at present recognised;\* the material examined, almost 400 specimens, includes only that in Wellington institutions except for a few specimens in the Australian Museum, Sydney. Almost all the species are fully described and illustrated.

## SOURCES OF MATERIAL

THE principal source of material for this report has been the collections of the Dominion Museum, Wellington, which have been compiled over many decades through the individual efforts of numerous collectors round the New Zealand mainland, the Chatham Islands, and the Subantarctic Islands. During recent years a considerable amount of material has been collected at the Auckland and Campbell Islands, firstly during the years 1941 to 1946 by Messrs J. H. Sorenson, W. H. Dawbin, and R. L. Oliver and Dr R. W. Balham of the Cape Expedition, and during the last decade by Drs R. A. Falla and R. K. Dell and Messrs P. C. Poppleton and R. J. Street. Also a large number of specimens have come to hand through the numerous cruises by the staff of the museum itself on two fishing vessels, the *Alert* and the *Admiral*, made available for that purpose. The material of particular interest here has come from many stations from Mayor Island in the north to the east Otago "Canyons" in the south.

A second source of material has been the Victoria University Zoology Department Cook Strait collections, which originate from numerous expeditions by Professor L. R. Richardson, Dr J. A. F. Garrick, and their co-workers to both deep- and shallow-water areas of Cook Strait. From these have come numerous specimens including some of two previously undescribed species of majid.

Over the past six or seven years the New Zealand Oceanographic Institute has undertaken an extensive programme of biological and physical investigation organised by Mr J. W. Brodie and encompassing the whole of the New Zealand faunal region, not to mention the Ross Sea Surveys and trips to the subtropical waters of Fiji. The material has been collected and sorted on these cruises by nearly all members of staff including Dr D. E. Hurley, Messrs J. Bullivant, E. W. Dawson, and D. G. McKnight. The present report deals with only some of the huge amount of material collected by the Institute, including

that from cruises to the west coast of the North Island in June 1960 and again in October of the same year; to Cook Strait and Kaikoura in July 1956, September and October 1958, and July 1961; to the Chatham Islands in June 1961; to Foveaux Strait and the adjacent Puysegur Bank in May 1960 and July 1961; and to Otago and the Campbell and Auckland Islands in October 1959 and December 1960. A large amount of the material collected in the last eight to twelve months still awaits examination. Material from the above three sources has come from shallow water to depths of over 400 fm.

In addition to the above, offshore collections have been made by Mr John Graham of Oamaru on the MV *Orion*, who has collected large numbers of two species from the continental shelf off the east coast of the South Island; these specimens are now in the Dominion Museum. Valuable efforts in the same direction have been made by Mr F. Abernethy, as recorded by Richardson (1949b), and Mr J. Baxter.

Finally, littoral areas of the New Zealand coastline have provided a valuable source for the collection of majids by individuals too numerous to mention here. The private collections of Professor L. R. Richardson, which have also been examined during the course of this study, have similarly been compiled mostly from intertidal and shallow offshore collecting.

The largest collection of New Zealand Brachyura is held in the Canterbury Museum, Christchurch. Some of this has come from the Chatham Islands 1954 Expedition led by Professor G. A. Knox and has been already treated by Dell (1960). However, the bulk of it, collected before 1936, forms the basis for the recent revision by Dr E. W. Bennett (Bennett, 1964).

\* The New Zealand Region as defined throughout this series (see Bennett, 1964) extends to the 1,500 fathom line round New Zealand thus including the Chatham, Auckland, Campbell, Bounty, and Antipodes Islands.

## ACKNOWLEDGMENTS

I wish to thank Professor L. R. Richardson of Victoria University of Wellington Zoology Department, under whose guidance this study was carried out, for his continued help and for permission to examine the collections of majid Crustacea of that department. I am grateful to the directors and curators of Crustacea in the following institutions for allowing me to examine material in their care: Dominion Museum, Wellington (Drs R. A. Falla, R. K. Dell, and J. C. Yaldwyn); New Zealand Oceanographic Institute, Wellington (Messrs J. W. Brodie and E. W. Dawson); and the Australian Museum, Sydney (Dr J. W. Evans, Mr F. A. McNeill, and Dr J. C. Yaldwyn). For information about, and in some cases photographs of, type material I am indebted to Dr J. Forest, Muséum National d'Histoire Naturelle, Paris, Dr H.-E. Gruner, Institut für Spezielle Zoologie und Zoologisches Museum der Humboldt-Universität, Berlin, and Mr R. W. Ingle, British Museum (Natural History), London.

Thanks are also due to Dr P. M. Ralph and Professor H. B. Fell of Victoria University of Wellington Zoology Department for helpful advice and for reading parts of the

manuscript; to other members of that department and Mr John Graham of Oamaru for help in obtaining material; to Drs E. R. Guiler and J. L. Hickman of the University of Tasmania zoology department, Hobart, for helpful discussion and reading parts of the manuscript; to Dr R. G. Hartnoll, Marine Biological Station, Port Erin, Isle of Man, for help with literature on the biology of the Majidae; and to Mr J. W. Brodie for permitting me to consult the manuscript of Dr E. W. Bennett's monograph prior to publication.

Fig. 5 is reproduced here by kind permission of the Royal Society of New Zealand, and Figs. 6, 7, and 20 (1 and 2) by kind permission of the Editorial Board of *Crustaceana* and the publishers of that journal, Messrs E. J. Brill, Leiden.

Finally, I would like to thank especially Dr John S. Garth, Allan Hancock Foundation, Los Angeles, and Mr F. A. McNeill for their very helpful advice on many problems involved in this study, and Dr John Yaldwyn, whose careful advice and constructive criticism have been a source of constant encouragement throughout this study.

## LIST OF STATIONS

**MATERIAL** from Victoria University Zoology Department Cook Strait collections, Dominion Museum Bottom Stations, and the New Zealand Oceanographic Institute collections is listed here with full station details. Data for all other material are given in full only in the systematic section together with abbreviated station data.

**ABBREVIATIONS:** BT, beam trawl; DC, cone dredge; DIS, salpa pattern dredge; DN, naturalist's dredge; DD, Devonport dredge, a modified naturalist's dredge; GLO, large orange-peel grab; GHO, Hayward orange-peel grab; N4M, net with 4 mm mesh; OT, otter trawl.

### (1) Victoria University of Wellington Zoology Department Cook Strait Collections

**Coll. VUZ 4 (Sta. JIIB)**, off Rangitoto Island, 40°44'30"S, 174°00'E, 17 Dec 1954, 1700–1715 h, 40–50 fm, bryozoa, coarse shell and stones, BT.

*Eurynolambus australis* H. Milne Edwards & Lucas 3 specimens  
*Leptomithrax longimanus* Miers 3 specimens

**Coll. VUZ 15 (Sta. SEB)**, Palliser Bay, 41°21'S, 175°0'15'E, 6 Feb 1955, 100–150 fm, mud, OT.

*Leptomithrax longipes* (Thomson) 3 specimens

**Coll. VUZ (Sta. BOL)**, Cook Strait, 41°30'30"S, 174°48'E, 19 Jan 1956, 0940–1100 h, 70–80 fm, mud and sand, BT.

*Leptomithrax longipes* (Thomson) 1 specimen

**Coll. VUZ 55 (Sta. GUB)**, off Cape Palliser, 41°39'30"S, 175°13'E, 23 Feb 1956, 0630–0830 h, 40–100 fm, sponges, BT.

*Eurynome bituberculata* Griffin 1 specimen  
*Leptomithrax longimanus* Miers 3 specimens  
*Leptomithrax longipes* (Thomson) 12 specimens  
*Chlorinoides filholi* (A. Milne Edwards) 7 specimens

**Coll. VUZ 77 (Sta. GUB)**, off Palliser Bay, 41°38'S, 175°02'E, 23 Dec 1956, 1140–1500 h, 435 fm, grey mud, N4M fished on bottom.

*Leptomithrax garricki* n.sp. 1 specimen

**Coll. VUZ 98 (Sta. COM/N)**, off Cape Palliser, 40°33'S,

174°50'E, 28 Aug 1957, 0945–1050 h, c 150 fm, shell, sand, and gravel, BT.

*Chlorinoides filholi* (A. Milne Edwards) 1 specimen

**Coll. VUZ 113 (Sta. CUD)**, Palliser Bay Shelf, 41°35'S, 175°04'E, 10 Dec 1958, 1550–1630 h, 70–80 fm, sponges, BT.

*Leptomithrax longipes* (Thomson) 3 specimens  
*Chlorinoides filholi* (A. Milne Edwards) 1 specimen

### (2) Dominion Museum (Wellington) Bottom Stations

**B.S. 169**, off Stephens Island, 40°40'6"S, 174°03'2"E, 2 Sep 1951, 11 fm, coarse gravel and shell, DN, MV Alert.

*Leptomithrax longimanus* Miers 1 specimen

**B.S. 178**, off York Bay, Wellington Harbour, 41°15'8"S, 175°53'9"E, 31 May 1953, 9 fm, mud and *Echinocardium*, DN.

*Notomithrax minor* (Filhol) 4 specimens

**B.S. 181**, off Palliser Bay, 41°27'S, 175°03'E, 6 Feb 1955, 100 fm, mud, OT.

*Leptomithrax longipes* (Thomson) 1 specimen

**B.S. 189**, off east Otago coast, edge of Canyon A, 45°38'S, 171°02'E, 14 Aug 1955, 120 fm, BT, MV Alert.

*Leptomithrax longipes* (Thomson) 2 specimens  
*Jacquinotia edwardsii* (Jacquinot) 1 specimen

**B.S. 190**, off east Otago coast, edge of Canyon C, 45°45'4"S, 171°05'E, 16 Aug 1955, 300 fm, BT, MV Alert.

*Leptomithrax longimanus* Miers 1 specimen

**B.S. 191**, off east Otago coast, edge of Canyon B, 45°47'S, 171°07'E, 16 Aug 1955, 250–300 fm, BT, MV Alert.

*Leptomithrax longimanus* Miers 6 specimens  
*Chlorinoides filholi* (A. Milne Edwards) 1 specimen  
*Jacquinotia edwardsii* (Jacquinot) 6 specimens

**B.S. 195**, entrance to Admiralty Bay, Trio Islands,





- 40°50'S, 173°58'E, 3 Jan 1957, 16 fm, sponges, OT, MV *Alert*.  
*Notomithrax minor* (Filhol) 1 specimen  
*Chlorinoides filholi* (A. Milne Edwards) 1 specimen
- B.S. 202**, N.E. of Tairoa Head, Otago Peninsula, 45°44'S, 171°02'E, 23 Jan 1957, 75 fm, bryozoans, OT, MV *Alert*.  
*Jacquinotia edwardsii* (Jacquinot) 1 specimen
- B.S. 210**, N.E. of Mayor Island, Bay of Plenty, 37°10'S, 176°23.5'E, 28 Feb 1957, c 400 fm, OT, MV *Alert*.  
*Achaeopsis ramusculus* (Baker) 1 specimen
- (3) New Zealand Oceanographic Institute (Wellington) Collections**
- Sta. A 444 (x5)**, sample 2, Cook Strait, 41°18.7'S, 174°30.2'E, 5 Oct 1958, 1205–1255 h, 120 fm, sandy shingle, DIS, RNZFA *Tui*.  
*Leptomithrax longimanus* Miers 3 specimens  
*Chlorinoides filholi* (A. Milne Edwards) 3 specimens
- Sta. B 182**, just west of Campbell Island, 52°28.5'S, 168°32'E, 11 Oct 1959, 0845–0130 h, 169 fm, sand and sponge, DN, HMNZS *Endeavour*.  
*Leptomithrax richardsoni* Dell 2 specimens
- Sta. B 196**, Otago, 46°20.6'–46°19.8'S, 170°27.6'–170°28.2'E, 18 Oct 1959, 1515–1615 h, 74 fm, shell and shelly sand, DN, HMNZS *Endeavour*.  
*Leptomithrax longipipes* (Thomson) 13 specimens
- Sta. B 218**, Foveaux Strait, 46°50'S, 168°09.8'E, 21 May 1960, 0830 h, 21 fm (39 fm), coarse yellow sand and shell, GLO, MV *Viti*.  
*Eurynolambrus australis* H. Milne Edwards & Lucas 2 specimens
- Sta. B 220**, Foveaux Strait, 46°40'S, 168°09.8'E, 21 May 1960, 1058–1102 h, 20 fm (37 m), few pebbles, DD, MV *Viti*.  
*Eurynolambrus australis* H. Milne Edwards & Lucas 1 specimen
- Sta. B 224**, Foveaux Strait, 46°45'S, 168°16.5'E, 21 May 1960, 1435 h, 17 fm (32 m), muddy, coarse, shelly sand, GLO, MV *Viti*.  
*Eurynolambrus australis* H. Milne Edwards & Lucas 1 specimen  
*Leptomithrax longipipes* (Thomson) 1 specimen
- Sta. B 225**, Foveaux Strait, 46°50'S, 168°18'E, 21 May 1960, 1525–1530 h, 16 fm (31 m), muddy, coarse, shelly sand, DIS, MV *Viti*.  
*Notomithrax peronii* (H. Milne Edwards) 3 specimens  
*Leptomithrax longimanus* Miers 1 specimen
- Sta. B 228**, Foveaux Strait, 46°45'S, 168°04.5'E, 22 May 1960, 1230–1235 h, 20 fm (38 m), coarse shelly sand, DD, MV *Viti*.  
*Jacquinotia edwardsii* (Jacquinot) 1 fragment
- Sta. B 230**, Foveaux Strait, 46°40'S, 168°04.5'E, 22 May 1960, 1356 h, 14 fm (26 m), finely broken shell and sand, GLO, MV *Viti*.  
*Eurynolambrus australis* H. Milne Edwards & Lucas 2 specimens
- Sta. B 236**, Foveaux Strait, 46°35'S, 168°02.5'E, 22 May 1960, 1437 h, 19 fm (36 m), muddy gravel and sponge, GLO, MV *Viti*.  
*Chlorinoides filholi* (A. Milne Edwards) 1 specimen
- Sta. B 241**, Foveaux Strait, 47°00'S, 168°16.8'E, 24 May 1960, 1530–1535 h, 28 fm (53 m), fine sand and broken shell, DD, MV *Viti*.  
*Leptomithrax longipipes* (Thomson) 1 specimen
- Sta. B 258**, Foveaux Strait, 46°40'S, 168°38.3'E, 27 May 1960, 1233–1240 h, 10 fm (19 m), pebbly, shelly sand and dead shell, DD, MV *Viti*.  
*Notomithrax peronii* (H. Milne Edwards) 2 specimens
- Sta. B 265**, Foveaux Strait, 46°55.6'S, 168°09.8'E, 28 May 1960, 1112–1120 h, 12 fm (23 m), muddy sand, GLO, MV *Viti*.  
*Notomithrax minor* (Filhol) 2 specimens
- Sta. B 272**, Foveaux Strait, 46°44'S, 168°31.4'E, 29 May 1960, 1703–1708 h, 11 fm (21 m), sand, pebbles and rocks, DD, MV *Viti*.  
*Notomithrax peronii* (H. Milne Edwards) 1 specimen
- Sta. B 277**, Foveaux Strait, 46°58.25'S, 168°09.55'E, 31 May 1960, 1430–1530 h, 3–6 fm (6–11 m), soft, grey, spongy mud, GLO, MV *Viti*.  
*Notomithrax minor* (Filhol) 1 specimen
- Sta. B 278**, Foveaux Strait, 46°55'S, 168°38.5'E, 1 Jun 1960, 1101–1105 h, 42 fm (80 m), fine, shelly sand, GLO, MV *Viti*.  
*Leptomithrax longipipes* (Thomson) 2 specimens
- Sta. B 314**, off Cape Egmont, 39°22'S, 171°50'E, 25 Oct 1960, 126–137 fm, fine sandy mud with broken shell, MV *Viti*.  
*Eurynome bituberculata* Griffin 5 specimens

- Sta. B 350**, Auckland Islands, 17 Dec 1960, 1845 h, 20 fm, DN (special), HMNZS *Rotoiti*.  
*Jacquinotia edwardsii* (Jacquinot) 1 specimen
- Sta. B 480**, Doubtful Sound, 45°16·8'S, 166°51·3'E, 5 Jun 1961, 1158–1235 h, 58 fm (110 m), coarse, grey, shelly sand, DC, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 2 specimens
- Sta. B 487**, Puysegur Bank, 46°16'S, 166°03'E, 6 Jun 1961, 1830 h, 102–100 fm (192–189 m), angular encrusted rocks, DD, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 12 specimens
- Sta. B 489**, Puysegur Bank, 46°39'S, 166°09·5'E, 7 Jun 1961, 103 fm (194 m), small encrusted rocks, DD, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 2 specimens
- Sta. C 58**, Cook Strait, 41°21·2'S, 174°30·2'E, 7 Jun 1956, 0645 h, 130 fm, gravel with shell fragments, DN, RNZFA *Isa Lei*.  
*Chlorinoides filholi* (A. Milne Edwards) 1 specimen
- Sta. C 440**, South Taranaki Bight, 40°00'S, 174°02'E, 7 May 1960, 2000 h, 28 fm, shelly sand with trace of mud, GHO, MV *Viti*.  
*Leptomithrax longimanus* Miers 1 specimen
- Sta. C 624**, Chatham Rise, 43°57·5'S, 175°52'W, 7 May 1961, 1400–1430 h, 68 fm (128 m), DD, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 3 specimens  
*Chlorinoides filholi* (A. Milne Edwards) 2 specimens
- Sta. C 683**, Kaikoura, 42°28·1'S, 173°40·7E, 17 Jun 1961, 1240–1315 h, 135–95 fm (254–180 m), grey indurated mud, DD, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 1 specimen
- Sta. C 696**, Kaikoura, 42°35·2'S, 173°33·3'E, 19 Jun 1961, 0845–0945 h, 77–26 fm (150–50 m), grey, sloppy, sandy mud, DD, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 1 specimen
- Sta. C 703**, Kaikoura, 42°42'S, 173°37·8'E, 19 Jun 1961, 1940–2110 h, 85 fm (160 m), large boulders, pebbles, and stiff grey mud, DD, MV *Viti*.  
*Leptomithrax longimanus* Miers 1 specimen
- Sta. C 705**, Kaikoura, 42°27'S, 173°37·4'E, 20 Jun 1961, 0840–0910 h, 85 fm (160 m), stiff grey mud with pebbles, DD, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 1 specimen
- Sta. C 707**, Kaikoura, 42°50'S, 173°27·7'E, 21 Jun 1961, 0715–0845 h, 32 fm (60 m), shelly, sandy mud and rounded pebbles, DD, MV *Viti*.  
*Leptomithrax longipes* (Thomson) 1 specimen

## METHODS

THE most suitable methods for the collection and preservation of crabs have been given in detail by Bennett (1964). Those few specimens collected by myself or by colleagues in the course of this study were taken by hand from intertidal areas or caught in shallow waters in a trap with rectangular sides and square ends in which a circular funnel was mounted. These specimens were preserved in 70–90% isopropyl alcohol or dried after being killed by immersion in fresh water.

Almost all New Zealand species of majid are here completely redescribed and the terminology employed is outlined in the section on morphology. All drawings were prepared with the aid of a camera lucida or by means of scale measurements. A binocular stereomicroscope was used in the study of the male first pleopods.

The characters used in the determination of content and limits of genera and the systematic position of species are discussed in the historical introduction to the systematic section.

The method of treatment of both genera and species follows, in general, that in Garth's (1958) recent monograph. Apart from the following sections, content and layout are self evident.

**SYNONYMIES:** The synonymy of individual taxa immediately follows the first principal mention of the latter. They include all New Zealand references, except those such as Hutton's (1904) "Index" in which only lists of species appeared. In the case of genera new to these waters, or recently revised, full synonymies are given. Otherwise the first description of the genus, a recent treatment of the included species, and faunal monographs treating the group in other geographic regions alone receive mention.

**TYPES:** Letters regarding the safety and whereabouts of the type specimens of New Zealand species were sent to curators of Crustacea in those institutions thought to contain such specimens. The information received is given in this section.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS:** Here are listed all localities from which the species has been recorded in the literature, together with the name of the collector. They are arranged in geographical sequence from north to south in five groups: Northern, including northern part of North Island; Southern, comprising southern part of South Island (including Stewart Island); Central, comprising the remaining part of the mainland; Chatham Islands; and Southern Islands, the Auckland Islands and Campbell Island. Except in the

case of poorly known species only New Zealand localities are given in detail, others being briefly mentioned.

**DESCRIPTION:** Generic descriptions are in most cases taken from the literature, the name of the author from whose work it comes appearing in parentheses at the end; where the description has been altered by rearrangement or by change of terminology to bring it into line with the rest of this monograph, the word "modified" follows the author's name. Unless otherwise indicated, species descriptions are based on a single large adult male, minor variations in other specimens, including females, being incorporated in the body of the description.

**COLOUR:** Except for littoral species, colours given here are taken mainly from the literature or from dried or spirit specimens.

**MATERIAL EXAMINED:** All specimens determined as belonging to the particular species are here listed in geographical sequence from north to south.

**MEASUREMENTS:** The measurements supplied for each species are those taken from the largest available male or female, or both, unless otherwise stated, and follow the system given by Garth (1958, p. 27) as here set out. All measurements were taken with a pair of dividers and a ruler and are given in millimetres.

The length of the carapace is measured along the median line from the posterior margin to a perpendicular connecting the tips of the rostral spines.

The width of the carapace is measured at the widest part, i.e., the branchial in New Zealand species, and is exclusive of lateral spines.

The length of the rostrum is measured along the midline from the level of the anterior margin of the orbit to the tip of the rostrum.

The width of the rostrum is measured at its base, unless the sides are concave in which case it is measured at its narrowest part.

The length of the entire cheliped and of the ambulatory legs is measured along the lower margin from the base of the coxa to the tip of the dactyl. The length of individual segments (merus, carpus, etc.) is measured along the upper margin, as is the length of the chela; the height of the chela is measured at its greatest convexity.

**HABITAT:** Included here are all data on the type of habitat in which the species is found and on camouflage material, taken from specimen labels, literature, and field notes. The bathymetric range of the species is given separately under DEPTH.

**BREEDING:** Information on breeding habits of New Zealand majids consists only of dates at which ovigerous females were taken; such information is not available for all species. Except in the case of those species which are known from only a few specimens and unless otherwise indicated, absence of this section in the systematic section

indicates that no data at all are available.

**REMARKS:** This forms a concluding section for each generic and specific account and comprises a discussion of previous authors' work, systematic position, taxonomic status, and relationships of the particular taxa.

## MORPHOLOGY

THE classification of the Majidae and most other brachyurans depends on an examination of the external morphology in general, but in particular of the regions surrounding the eyestalk, the abdomen, third maxillipeds, and legs. The terminology used in the systematic account is mainly that followed by Rathbun (1925) and recent authors such as Garth (1958) (Figs. 1, 2).

Laterally the carapace is usually armed with spines. The dorsal surface of the carapace is marked by grooves, depressions corresponding in part to muscle insertions, and is thus divided into various *regions*, which are named according to their position. These may be divided into two main series, the medial, including anteriorly the gastrics: a long *mesogastric*, a short *meta-*

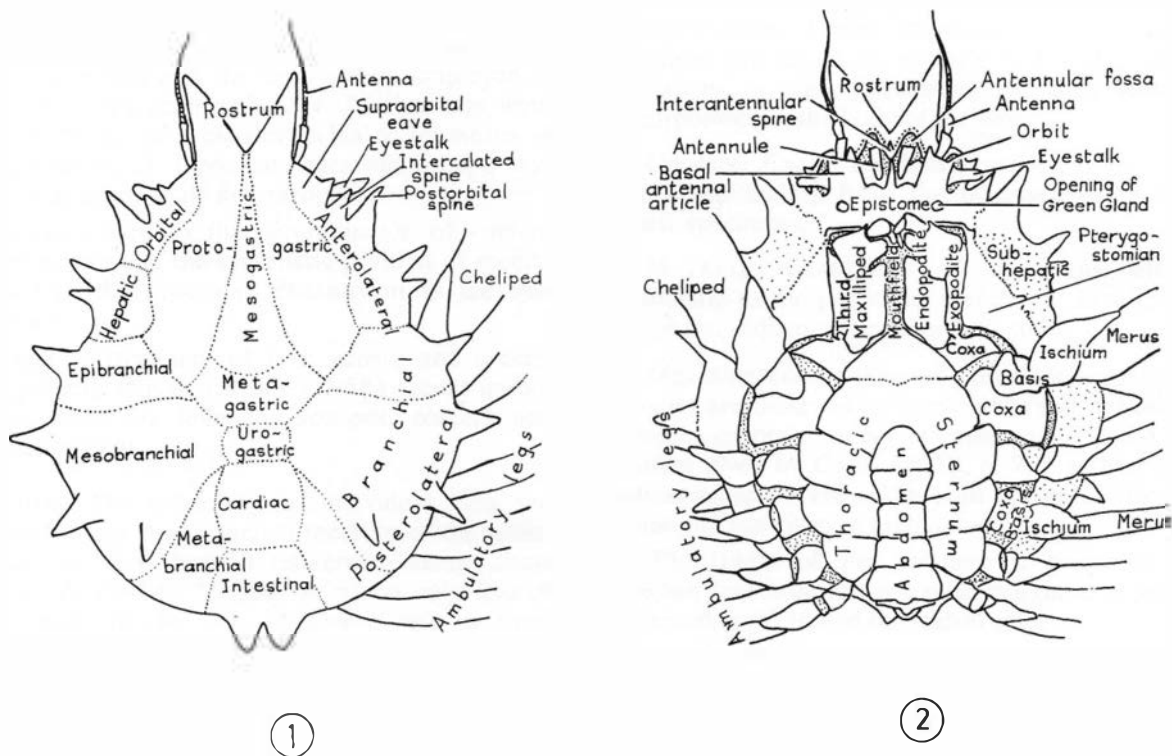


FIG. 1—External morphology of *Notomithrax peronii* showing terms used in descriptions. 1—Dorsal view of carapace. 2—Ventral view of carapace.

The Majidae possess the typical brachyuran facies, the body being divided into a large pyriform to subquadrate cephalothorax or *carapace* and a short, flattened *abdomen* folded under the carapace. Dorsally the carapace coalesces with all the thoracic somites and overhangs on each side enclosing a *branchial chamber* within which the gills, membranous or fleshy accessory appendages of the maxillipeds and legs, are concealed. Anteriorly the carapace is provided with a *rostrum*, a single structure or two distinct cylindrical or flattened spines, formed as a secondary outgrowth during larval development and therefore called the pseudorostrum by Balss (1929) and a few other

*gastric* and *urogastric*, and wide *protogastrics* flanking the mesogastric, and posteriorly the long *cardiac*, and *intestinal*; and the lateral, including the *orbital* immediately behind the rostrum, the *hepatic* behind that, and posteriorly the *branchials*: short wide *epibranchials*, large *mesobranchials*, and narrow *metabranchials* on each side of the cardiac and intestinal regions.

The *eyestalk*, with the *cornea* situated at the distal extremity, is permanently directed laterally and situated anteriorly in a cavity or *orbit* which may be circular or oval. Above the orbit the carapace projects laterally to form a supraocular hood or *supraorbital eave*, which in

“The terminology . . . refers to the position of the pleopod *in situ*, i.e., before it is removed for examination. . . . The concave surface that lies against the thoracic sternal segments is called the sternal surface, a figure showing which is said to be drawn from the sternal aspect. The opposite side, lying against the abdomen, is referred to as the abdominal surface. . . .” The terminal portion of the male first pleopod, being the most important part of this structure from a taxonomic viewpoint, is the only portion figured in this report. The male second pleopod is small and styliform, consisting of two segments, the basal representing the protopodite and the distal, the endopodite. This structure, in the Majidae, is relatively unimportant taxonomically (see Garth, 1958, p. 14) and is neither figured nor described further here.

There are five pairs of legs, each formed by the enlarged endopodites of the fourth to eighth thoracic appendages. The first leg, or *cheliped*, is usually more enlarged than the remaining or *ambulatory* legs and always chelate. Each leg, including the cheliped, consists of seven cylindrical or subcylindrical segments (the term segment is here used to cover both separate rings of the body and of the appendages; a joint is the articulation between two segments). These are a short basal *coxa*, followed by a slightly shorter and more slender *basis*, a longer *ischium*, a very long *merus*, a short *carpus*, a *propodus* generally about as long as the merus, and a terminal *dactyl* which is usually curved and sharply pointed. In the cheliped the propodus is compressed and distally extended parallel and ventral to the dactyl or *movable finger*, as the *fixed finger*. The propodus and dactyl together form the “hand” or *chela*. The chela excluding the fingers is termed the *palm* or *manus*.

The functional morphology of the mouthparts of a brachyrynchous crab (*Carcinus maenas* Linnaeus) has

been thoroughly described by Borradaile (1922). Only the third maxillipeds are here described, the inner mouthparts differing little from genus to genus among the Majidae and therefore being of little systematic value. The third maxillipeds are heavily chitinised, flattened, operculiform, biramous structures almost meeting in the midline. Each consists of a transversely subtriangular, flattened to subcylindrical coxa bearing laterally a variously shaped, elongate, membranous *epipodite* which is fringed with setae and bears near its base a fleshy, subtriangular or rounded *podobranch*. Also arising from the coxa are a lateral *exopodite* and a medial *endopodite*. The exopodite is a narrow structure, tapering distally to bear a slender, multisegmental flagellum which, at rest, is folded beneath the endopodite. The endopodite is very broad and consists of the same six segments as make up the legs: basis, ischium, merus, carpus, propodus, and dactyl. The basis and ischium are fused, the former small, subtriangular to subquadrate, the latter large, subquadrate, slightly longer than wide with the medial half of the distal edge more or less extended anteriorly (==distally) as a flattened process, rounded or sharply angled anteromedially. The medial edge of the ischium is more or less toothed and overlain by a fringe of setae. The ovate to subquadrate merus arises from the lateral distal edge of the ischium, and is usually as wide as the ischium but slightly shorter, rounded or sharply angled laterally, rounded medially. The distal edge of the merus may be rounded or truncate, entire or notched. The remaining three segments of the endopodite—carpus, propodus, and dactyl—together form the *palp*, a cylindrical structure, tapering distally, densely covered by setae, and folded down alongside, and almost as long as, the merus, the palps of the two third maxillipeds being adjacent and posteriorly directed when at rest.

## CHECK LIST OF THE NEW ZEALAND MAJID OXYRHYNCHA

Species new to New Zealand or definitely established herein as part of the fauna are shown in **bold face**

*Platymaia maoria* Dell\*

*Cyrtomaia hispida* (Borradaile)

*Naxia huttoni* (A. Milne Edwards)

***Achaeopsis ramusculus*** (Baker)

***Achaeus fissifrons*** (Haswell)

***Eurynome bituberculata*** Griffin

*Eurynolambrus australis* H. Milne Edwards & Lucas

*Notomithrax peronii* (H. Milne Edwards)

*Notomithrax minor* (Filhol)

*Notomithrax ursus* (Herbst)

*Leptomithrax longimanus* Miers

*Leptomithrax australis* (Jacquinot)

***Leptomithrax garricki*** n.sp.

***Leptomithrax tuberculatus mortenseni*** Bennett

*Leptomithrax longipes* (Thomson)

*Leptomithrax richardsoni* Dell

*Chlorinoides filholi* (A. Milne Edwards)

*Jacquinotia edwardsii* (Jacquinot)

\* This species has recently been described from New Zealand (Dell, 1963, p. 247). Apart from its inclusion in this check list, this species is briefly considered in the general discussion but is not otherwise dealt with in this report. The genus *Platymaia* is included in the key to genera of the subfamily Inachinae.

“The terminology . . . refers to the position of the pleopod *in situ*, i.e., before it is removed for examination. . . . The concave surface that lies against the thoracic sternal segments is called the sternal surface, a figure showing which is said to be drawn from the sternal aspect. The opposite side, lying against the abdomen, is referred to as the abdominal surface. . . .” The terminal portion of the male first pleopod, being the most important part of this structure from a taxonomic viewpoint, is the only portion figured in this report. The male second pleopod is small and styliform, consisting of two segments, the basal representing the protopodite and the distal, the endopodite. This structure, in the Majidae, is relatively unimportant taxonomically (see Garth, 1958, p. 14) and is neither figured nor described further here.

There are five pairs of legs, each formed by the enlarged endopodites of the fourth to eighth thoracic appendages. The first leg, or *cheliped*, is usually more enlarged than the remaining or *ambulatory* legs and always chelate. Each leg, including the cheliped, consists of seven cylindrical or subcylindrical segments (the term segment is here used to cover both separate rings of the body and of the appendages; a joint is the articulation between two segments). These are a short basal *coxa*, followed by a slightly shorter and more slender *basis*, a longer *ischium*, a very long *merus*, a short *carpus*, a *propodus* generally about as long as the merus, and a terminal *dactyl* which is usually curved and sharply pointed. In the cheliped the propodus is compressed and distally extended parallel and ventral to the dactyl or *movable finger*, as the *fixed finger*. The propodus and dactyl together form the “hand” or *chela*. The chela excluding the fingers is termed the *palm* or *manus*.

The functional morphology of the mouthparts of a brachyrynchous crab (*Carcinus maenas* Linnaeus) has

been thoroughly described by Borradaile (1922). Only the third maxillipeds are here described, the inner mouthparts differing little from genus to genus among the Majidae and therefore being of little systematic value. The third maxillipeds are heavily chitinised, flattened, operculiform, biramous structures almost meeting in the midline. Each consists of a transversely subtriangular, flattened to subcylindrical coxa bearing laterally a variously shaped, elongate, membranous *epipodite* which is fringed with setae and bears near its base a fleshy, subtriangular or rounded *podobranch*. Also arising from the coxa are a lateral *exopodite* and a medial *endopodite*. The exopodite is a narrow structure, tapering distally to bear a slender, multisegmental flagellum which, at rest, is folded beneath the endopodite. The endopodite is very broad and consists of the same six segments as make up the legs: basis, ischium, merus, carpus, propodus, and dactyl. The basis and ischium are fused, the former small, subtriangular to subquadrate, the latter large, subquadrate, slightly longer than wide with the medial half of the distal edge more or less extended anteriorly (= distally) as a flattened process, rounded or sharply angled anteromedially. The medial edge of the ischium is more or less toothed and overlain by a fringe of setae. The ovate to subquadrate merus arises from the lateral distal edge of the ischium, and is usually as wide as the ischium but slightly shorter, rounded or sharply angled laterally, rounded medially. The distal edge of the merus may be rounded or truncate, entire or notched. The remaining three segments of the endopodite—carpus, propodus, and dactyl—together form the *palp*, a cylindrical structure, tapering distally, densely covered by setae, and folded down alongside, and almost as long as, the merus, the palps of the two third maxillipeds being adjacent and posteriorly directed when at rest.

## CHECK LIST OF THE NEW ZEALAND MAJID OXYRHYNCHA

Species new to New Zealand or definitely established herein as part of the fauna are shown in **bold face**

*Platymaia maoria* Dell\*  
*Cyrtomaia hispida* (Borradaile)  
*Naxia huttoni* (A. Milne Edwards)  
***Achaeopsis ramusculus*** (Baker)  
***Achaeus fissifrons*** (Haswell)  
***Eurynome bituberculata*** Griffin

*Eurynolambrus australis* H. Milne Edwards & Lucas  
*Notomithrax peronii* (H. Milne Edwards)  
*Notomithrax minor* (Filhol)  
*Notomithrax ursus* (Herbst)  
*Leptomithrax longimanus* Miers  
*Leptomithrax australis* (Jacquinot)  
***Leptomithrax garricki*** n.sp.  
***Leptomithrax tuberculatus mortenseni*** Bennett  
*Leptomithrax longipes* (Thomson)  
*Leptomithrax richardsoni* Dell  
*Chlorinoides filholi* (A. Milne Edwards)  
*Jacquinotia edwardsii* (Jacquinot)

\* This species has recently been described from New Zealand (Dell, 1963, p. 247). Apart from its inclusion in this check list, this species is briefly considered in the general discussion but is not otherwise dealt with in this report. The genus *Platymaia* is included in the key to genera of the subfamily Inachinae.

## SYSTEMATICS

### HISTORICAL NOTE

OF the three oxyrhynch families the Majidae have received by far the greatest systematic attention. The first major work on the Oxyrhyncha, that of H. Milne Edwards (1834), has been followed by four important revisions concerned with the Majidae: those of Dana (1851b), Miers (1879c), Alcock (1895) and Balss (1929). Between each of these reviews the number of known genera was progressively increased, usually by workers other than the reviewers, so that “. . . each reviewer in turn was confronted by a confusion less and less of his own making” (Garth, 1958, p. 7). Further, since each reviewer differed in his opinion as to which characters should be considered most important, each revision involved rather drastic rearrangement of previous generic groupings.

The present day classification of the Majidae is a modification of the scheme of Alcock which involved a reduction in the number of families and subfamilies of the schemes of Dana and Miers through a lowering of those authors' families to subfamilial level, their subfamilies becoming the alliances of Alcock. Thus, whereas Dana had proposed five families and 27 subfamilies, and Miers, three families and 11 subfamilies, Alcock contained all genera within a single family which was divided into four subfamilies. These, the Inachinae, Acanthonychinae, and Maiinae, were subdivided by Balss into eight subfamilies, the Inachinae forming two (the Camposcoidea and Macrocheiroidea), the Pisinae two (Pisinae *sensu stricto* and the Hyasteniinae), and the Maiinae three (the Majinae *sensu stricto*, Mithracinae, and Macrocoelominae), while one of Alcock's alliances, the Stencionopoda, was withdrawn from the Maiinae and renamed the Ophthalmiinae; the Acanthonychinae was retained without subdivision.

The characters which have been used in the classification of the Majidae are of course numerous. Milne Edwards's system was based on the form of the basal antennal article and the length of the ambulatory legs, Dana's mainly on the form of the orbit and rostrum, Miers's on the form of the orbit including the basal antennal article and also the chelipeds, and Alcock's on those characters used by Miers together with the shape of the third maxilliped. Balss used four entirely unrelated characters: supraorbital configuration with particular reference to the presence or absence of an intercalated spine, the degree of development of the interantennular spine, the degree of fusion of the rostral spines, and the amount of coalescence of the abdominal segments. All four characters were considered to be of evolutionary importance

and within each main division genera were arranged accordingly, the most primitive being those with an intercalated supraorbital spine, a well developed interantennular spine, a double rostrum, and seven free abdominal segments. Two further important characters have been introduced since the time of Balss's revision: the shape of the male abdomen by Shen (1932), and the form of the male first pleopod, revived by Stephensen (1945). In addition general shape of the carapace has from time to time been considered important.

In a recent monograph dealing with the Pacific American Majidae, Garth (1958) has, in the main, rejected Balss's divisions of Alcock's subfamilies on the grounds that such a division is based on only one character, viz, the presence or absence of an intercalated supraorbital spine, which “. . . would appear to be inherent in the process of evolution of the orbit, which, according to Balss, is proceeding independently, but along parallel lines, in each of the Alcockian subfamilies. . . . Nor do the groupings suggested by the male first pleopods support (such) a division . . .” (Garth, 1958, p. 8). Thus the Inachinae and Pisinae remain as single subfamilies in Garth's system rather much as Alcock conceived them, while the Mithracinae and Macrocoelominae are amalgamated as a single subfamily under the former name. To the six remaining subfamilies Garth has added a seventh, the Oregoniinae, by uniting, on the basis of pleopod and larval characters, one inachine genus with two pisine genera. Garth's system has been adopted in the present paper.

It may perhaps be considered a fault of the present classification that the division into subfamilies rests mainly on orbital structure. It should be pointed out, however, that genera united on such a basis show a broad agreement in other characters such as form of the third maxillipeds, particularly shape of the merus, and of the male chela, length of the ambulatory legs, and ornamentation of the carapace, and also often more important characters such as form of the rostrum and number of free abdominal segments. For instance inachine genera, which usually have what Balss would call an advanced type of orbit lacking a true intercalated supraorbital spine, agree in having a subtriangular carapace, seldom ornamented with spines or tubercles, a single rostrum and long ambulatory legs, the merus of the third maxilliped is subovate, and there are usually less than seven free abdominal segments. Similarly, majines, which have a primitive orbit with a well developed intercalated spine, generally have a subpyriform, spinous or tuberculated, carapace, a double rostrum, short, stout ambulatory legs, the merus of the



third maxillipeds is generally subquadrate, and the abdomen is always seven-segmented. Further, the male first pleopods also lend support to the present arrangement. Characters such as the degree of enlargement of the chelipeds, relative length of the ambulatory legs, the shape and number of free segments of the abdomen, and the number and modification of the pleopods, while among the most useful characters systematically, should be used with caution since they are subject to sexual dimorphism (Garth, 1958, p. 11). Larval characters, which should throw some light on the interrelationships of the various genera, are as yet poorly known, though considerable attention has been paid them in recent years.

A few final points remain. Firstly, of the numerous faunal monographs which have appeared since the time of Balss's revision, all use some modification of Alcock's system. Bouvier (1940) retains it in its original form, and Barnard (1950) retains it virtually unaltered except that the names of two of the subfamilies are changed (the Pisinae becoming the Blastidae, and the Maiinae the Mamaiidae), all the subfamilies being considered as full families following the earlier work of Stebbing (1905, et seq.). Sakai (1938) and Stephensen (1945) have used Balss's modification of the Alcockian system, as also has Bennett (1964). The views of Garth (1958) have already been mentioned. It may be seen, then, that the characters introduced by Balss and later workers have not yet been applied to the majid fauna of the eastern Atlantic, Indian, or south-western Pacific Oceans.

Secondly, in the recent list of world genera of the Brachyura, Balss (1957) has returned to Alcock's system of classification of the Majidae and only four subfamilies are admitted. This step is hard to explain and can only be considered retrogressive.

#### NOTE ON THE KEYS TO FAMILIES, SUBFAMILIES, ETC.

Throughout the systematic section keys have been included to facilitate identification of the various taxa. The keys have, wherever possible, been arranged so that those taxa believed to be most closely related stand together. The characters used are those considered to be most important from a systematic standpoint. In all cases the keys have the alternatives widely separated. They are to be used in the following way: if the character indicated agrees with the specimen in hand proceed to the next numbered paragraph and continue to do so until a determination is reached; where any character does not agree proceed directly to the alternative character, the number of which is given in parentheses. A final check of the identification should be made by reference to the full description and figures.

#### Order DECAPODA Suborder REPTANTIA Section BRACHYURA

#### Subsection BRACHYGNATHA Superfamily OXYRHYNCHA Latreille, 1803

Brachyura with the carapace more or less narrowed in front and usually produced to form a rostrum; branchial

regions considerably developed, hepatic regions small. Epistome usually large; mouthfield quadrate with anterior margin usually straight. Branchiae always nine in number on either side; their efferent channels opening at the side of the endostome or palate. Antennules longitudinally folded. (Alcock, 1895).

#### KEY TO FAMILIES OF THE OXYRHYNCHA (after Borradaile, 1907)

- 1 (2) Carapace thin and flat. Chelipeds not long or especially mobile or with the fingers bent at an angle from palm. Male openings sternal. No orbits. Second article of antennal stalk slender, fused with epistome but not with front. No hooked hairs.  
..... HYMENOSOMIDAE Stimpson, 1858
- 2 (1) Carapace not thin and flat. Chelipeds either mobile or powerful with bent fingers. Male openings coxal.
- 3 (4) Chelipeds especially mobile, rarely much greater than other legs, or with fingers bent at an angle from palm. Second article of antenna well developed, generally fused with epistome and often with front. Orbits more or less incomplete. Hooked hairs almost always present. .... MAJIDAE Samouelle, 1819
- 4 (3) Chelipeds not especially mobile, usually much longer and heavier than other legs, and with finger bent at an angle from palm toward side on which fixed finger is set. Second article of antenna small, short, and not fused with epistome or front. Orbits well made. Hooked hairs almost always wanting.  
..... PARTHENOPIDAE Miers, 1879

#### Family MAJIDAE Samouelle, 1819

- Maiadae* Samouelle, 1819: 88.  
*Macropodiens* + *Maiens* H. Milne Edwards, 1834: 272.  
*Maiinea* + *Oncininea* Dana, 1852: 76, 77.  
*Maiinea* Miers, 1879c: 640.  
*Majidae* Richters, 1880: 141. Rathbun, 1925: 10.  
Hale, 1927: 121. Sakai, 1938: 202. Garth, 1958: 35.  
*Maiidae* Alcock, 1895: 160. Borradaile, 1907: 480. Bouvier, 1940: 316.  
*Inachidae* Rathbun, 1905: 11.

Oxyrhyncha with chelipeds especially mobile, rarely much greater than other legs, fingers seldom bent at an angle on the hand. Second article of antenna well developed, generally fused with epistome and often with front. Orbits generally more or less incomplete. Hooked hairs almost always present. Male openings coxal. (Borradaile.)

Palp of third maxillipeds articulated either at summit or at anteromedial angle of merus. (Alcock.)

Pleopod 1 of male greatly exceeding pleopod 2 in length. (Garth.)

#### KEY TO SUBFAMILIES OF THE MAJIDAE (after Garth, 1958)

- 1 (10) Eyes either without orbits, or with incomplete or commencing orbits.
- 2 (3) Male abdomen terminally broadened, seventh segment subquadrate and inserted deeply into sixth segment. Male first pleopod longitudinally grooved, with rows of filamentous setae on either side of groove. .... OREGONIINAE Garth, 1958

- 3 (2) Male abdomen not terminally broadened, seventh segment subtriangular and not inserted deeply into sixth segment. Male first pleopod exceedingly varied but not as in 2.
- 4 (5) Eyes without orbits; eyestalks generally long, either non-retractile, or retractile against sides of carapace, or against an acute postorbital spine affording no concealment. Basal antennal article not extremely slender. .... INACHINAE Macleay, 1838
- 5 (4) Eyes with incomplete or commencing orbits. Basal antennal article not extremely slender.
- 6 (9) Eyes without true orbits, lacking a postorbital cup.
- 7 (8) Eyestalks long, orbit partially protected by a horn-like supraorbital spine or by a jagged postorbital tooth or both. Body often truncate in front. .... OPHTHALMIINAE Balss, 1929
- 8 (7) Eyestalks short, little movable, and either concealed by a supraorbital spine, or sunk in sides of rostrum. Basal antennal article truncate triangular. .... ACANTHONYCHINAE Alcock, 1895
- 9 (6) Eyes with commencing orbits having, in addition to the supraorbital spine, a large, cupped, postorbital process into which the eye retracts. Eyestalks short. .... PISINAE Alcock, 1895
- 10 (11) Basal antennal article not especially expanded to form a floor to the orbit, which is formed by a supraorbital hood, intercalated spine and a postorbital cup. .... MAJINAE Balss, 1929
- 11 (10) Basal antennal article expanded to form a floor to the orbit, which is formed by supraorbital hood and postorbital cup, intercalated spine present or absent. .... MITHRACINAE Balss, 1929

#### Subfamily INACHINAE Macleay, 1838\*

*Inachinae* Alcock, 1895: 160, 162, 168. Rathbun, 1925: 11. Hale, 1927: 122. Balss, 1929: 3. Bouvier, 1940: 349. Richardson, 1949b: 61. Garth, 1958: 36.

*Inachidae* Stebbing, 1910: 283. Barnard, 1950: 11.

*Inachinae Camposcoidea* Stephensen, 1945: 218 (incorrect subsequent spelling of *Camposcoidea* Balss).

Eyes without orbits; eyestalks generally long, either non-retractile or retractile against sides of carapace, or against an acute postorbital spine affording no concealment. Basal antennal article extremely slender throughout its extent and usually long. (Alcock, 1895, modified after Garth, 1958.)

Pleopod 1 not very stout; straight or curved, apically tapering but apex varying (hairy, spinose, naked, etc.; acute, blunt, bifid, etc.). Pleopod 2 short. (Stephensen, 1945.)

Balss (1929) proposed two subdivisions of this subfamily: the more primitive *Macrocheiroidea* with an intercalated supraorbital spine and the more advanced *Camposcoidea* without an intercalated spine. These subdivisions were rejected by Sakai (1938) but retained by Garth (1958), though not given subfamilial rank.

The subfamily includes the western North Pacific *Macrocheira* de Haan, the Atlantic *Inachus* Fabricius, and

the Atlantic and Pacific *Podochela* Stimpson and *Stenorhynchus* Lamarck. Richardson (1949b) appropriately included three New Zealand species belonging to three genera in this subfamily, and Bennett (1964) two species and two genera. The number of species and genera is here increased to four by the retention of *Stenorhynchus fissifrons* Haswell, now referred to *Achaeus* Leach, as part of the fauna and the addition of one species of *Achaeopsis* Stimpson. *Echinomaia hispida* Borradaile is included in *Cyrtomaia* Miers, following Balss (1929), and *Trichoplatus huttoni* A. Milne Edwards in *Naxia* Latreille following Richardson (1949b). The difficulty of homologising the supraorbital spine in those inachines in which it is present makes Garth's (1958) arrangement of genera impractical here, at least in so far as the New Zealand representatives are concerned. All the New Zealand species possess a double rostrum.

#### KEY TO NEW ZEALAND GENERA OF THE SUBFAMILY INACHINAE

- 1 (6) Abdomen of seven free segments in both sexes, sixth and seventh segments sometimes incompletely fused.
- 2 (5) Carapace subcircular. Interantennular spine projecting horizontally forward, generally visible in dorsal aspect, rostrum appearing trispinose.
- 3 (4) Basal antennal article freely movable. Propodi and dactyli of posterior three ambulatory legs flattened, blade-like. Carapace with a few short spines or tubercles dorsally. .... **Platymaia** Miers, 1886
- 4 (3) Basal antennal article immovable. Propodi and dactyli of ambulatory legs cylindrical. Carapace generally with several long spines dorsally. .... **Cyrtomaia** Miers, 1886
- 5 (2) Carapace pyriform. Interantennular spine short, not visible in dorsal aspect. .... **Naxia** Latreille, 1825
- 6 (1) Abdomen of six segments in both sexes, segments 6 and 7 completely fused.
- 7 (8) Rostral spine long and slender. Postorbital spine prominent, long, slender. Carapace bearing several prominent spines dorsally. .... **Achaeopsis** Stimpson, 1857
- 8 (7) Rostral spines short, flattened. Postorbital spine absent or spinulose. Carapace smooth dorsally or bearing a few tubercles. .... **Achaeus** Leach, 1817

#### Genus *Cyrtomaia* Miers, 1886

*Cyrtomaia* Miers, 1886: 14. Doflein, 1904: 53. Rathbun, 1916: 532, 1918: 4. Hale, 1927: 126. Sakai, 1938: 239. Barnard, 1950: 32. Bennett, 1964: 29.

*Echinomaia* Borradaile, 1916: 102; type species, by monotypy: *Echinomaia hispida* Borradaile, 1916. Chilton & Bennett, 1929: 741. Richardson, 1949b: 63.

**DESCRIPTION:** Carapace generally subcircular, broader than long, very convex, usually bearing several long spines. Rostrum of two short, closely approximated spines. Interantennular spine projecting horizontally forward, but seldom beyond rostrum, to give the latter a trispinose appearance. Orbit poorly formed, consisting of narrow supraorbital cave and well developed, simple postorbital spine; eyestalks very long, moderately slender, cornea terminal, ovoid. Basal antennal article cylindrical, very slender, not firmly fixed to side of rostrum but immove-

\* Retention of the subfamily name Inachinae depends on the exercising by the International Commission on Zoological Nomenclature of its plenary powers. (See Garth and Holthius, 1963, for details and full synonymy.)

able. Chelipeds spinous, elongate in male. Ambulatory legs very long, slender, cylindrical, spinous. Abdomen of seven free segments in both sexes. (Barnard, modified.)

RANGE: Indo-west Pacific from South Africa to Japan, also Philippine Islands, Australia, and New Zealand.

TYPE SPECIES: It appears from a search of the literature that so far a type species has not been selected for this genus. I refrain from choosing a type species here out of the context of a general revision of the included species, most of which are poorly known.

REMARKS: This genus is most closely related to *Platymaia* Miers, from which it differs in the generally shorter interantennular spine, the more firmly fixed basal antennal article, more spinous carapace, and the cylindrical, rather than flattened, propodi and dactyli of the last three ambulatory legs (see Sakai, 1938). The two genera also differ in the shape of the chelae of the male which are generally enlarged distally in *Cyrtomaia*, whereas those of *Platymaia* species are highest about two-thirds from the base. Species of *Cyrtomaia* are characterised by the presence of a prominent slender spine situated submarginally on the anterior part of each protogastric region. A few species of both *Cyrtomaia* and *Platymaia* possess the enlargement of the basal one or two segments of the antennal flagellum found in the New Zealand representative of *Cyrtomaia*, *C. hispida* (Borradaile).

Borradaile's monotypic genus *Echinomaia* was reduced to synonymy with *Cyrtomaia* by Balss (1929, p. 3) on the grounds that *E. hispida* differs from *C. goodridgei* McArdle, which he considered to be the most closely related species, only in the broadening of the first two segments of the antenna. Balss pointed out that this feature was shown by many coastal oxyrhynchs. A brief but concise review of *Cyrtomaia* and the included species has been given by Bennett (1964). As Bennett emphasises, the genus is in urgent need of detailed revision. So far only the Japanese (see Sakai, 1938) and South African (see Barnard, 1950) species have been adequately treated.

Two species are known from New Zealand and Australian waters.

#### KEY TO NEW ZEALAND AND AUSTRALIAN SPECIES OF *Cyrtomaia*

(New Zealand species shown in **bold face** and treated below)

- 1 (2) Rostrum simply bispinose, interantennular spine not greatly elongated. A pair of very long, slender, forwardly directed protogastric spines. Basal segments of antennal flagellum not enlarged. Palm of chela in male greatly enlarged distally, dactyl with large basal tooth. .... *C. maccullochi* Rathbun, 1918
- 2 (1) Rostrum appearing trispinose, interantennular spine greatly elongated and projecting forward to reach tip of rostrum. A pair of small protogastric tubercles. Basal two segments of antennal flagellum broadened and flattened. Palm of chela in male very weakly enlarged distally, dactyl lacking basal tooth. .... *C. hispida* (Borradaile, 1916)

#### *Cyrtomaia hispida* (Borradaile, 1916)

*Echinomaia hispida* Borradaile, 1916: 104, fig. 13. Chilton & Bennett, 1929: 741. Richardson, 1949b: 63, fig. 24.

*Cyrtomaia hispida*: Balss, 1929: 3. Bennett, 1964: 30, fig. 10-16, 110.

? *Cyrtomaia platypes* Yokoya, 1933: 145, text-fig. 52. Sakai, 1938: 242.

TYPES: Two male syntypes, the larger length 16 mm. British Museum (Natural History), London.

TYPE LOCALITY: Northern New Zealand, S. 14°W [34°S, 172°E], 8 miles from Great King, Three Kings Islands, in 100 fm; British Antarctic (*Terra Nova*) 1910 Expedition Station 90.

LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS: East of Papanui Inlet, Otago, D. H. Graham (Bennett). Atapapa, Timor, SM *Gazelle* (Balss).

DISTRIBUTION: New Zealand, Indonesia, possibly extending north to Japan.

DESCRIPTION: Carapace subcircular in dorsal aspect, slightly broader than long, swollen in profile, margins armed with a few spines and numerous spinules. Rostrum of two short, slender, sharply pointed, hooked spines, adjacent for their entire length, divergent distally only; appearing trispinose in dorsal aspect, interantennular spine very long, projecting forward and downward, between and below, to just beyond tip of, rostral spines. Dorsal surface of carapace with a single medial spine on urogastric region and a pair of prominent submedial cardiac spines; surface otherwise bearing numerous small tubercles. naked; regions well marked, inflated.

Hepatic margin with a single spine, about as long as and connected by a ridge to, postorbital spine. Branchial region with a single long spine, slightly shorter than hepatic spine, situated midway along, and just above, margin; a row of about 15 spinules, or teeth, along anterolateral part of branchial margin, diminishing in size posteriorly.

Orbit consisting above of supraorbital eave and postorbital spine, intercalated spine absent; supraorbital eave prominent, very narrowly subtriangular, lacking preorbital or antorbital spines; postorbital spine remote from orbit. simple, conical, almost as long as rostrum. Eystalks long, entirely visible in both dorsal and ventral view, moderately slender, bulbous basally; cornea large, subterminal. obliquely ventral, a group of two or three small tubercles at distal extremity of eystalk above cornea.

Basal antennal article of moderate width, long, reaching to anterior edge of supraorbital eave, not fused to either epistome or front, but firmly fixed in position, flat ventrally, bearing anteriorly two jagged lobes, basal two segments of antennal flagellum expanded laterally and flattened to form two large, leaf-like flanges.

Epistome wide and short, concave. Mouthfield subrectangular, anterolateral angles projecting strongly, rising into a lobe on each side. Thoracic sternum bearing numerous small tubercles scattered irregularly over surface. a row of larger, sharp spines along anterior edge of each sternite.

Third maxillipeds pediform, ischium wider than merus, palp stout.

Chelipeds moderately long, slightly more than twice length of carapace, reaching to middle of propodus of first ambulatory leg when extended, subcylindrical except for strongly compressed propodus; merus long, about  $\frac{1}{3}$  total length of cheliped, carpus about  $\frac{1}{3}$  merus, chela almost  $\frac{1}{2}$  total length of cheliped, dactyl about  $\frac{1}{2}$  palm. Merus with three longitudinal rows of sharp spines on medial surface and a spine close to distal edge of dorsal surface, carpus with several scattered spines; palm not greatly enlarged, somewhat higher distally with six rows of sharp spines, two dorsal, two ventral, one lateral and one medial; fingers moderately gaping for their entire length, irregularly toothed along inner edges.

Ambulatory legs long, subcylindrical except for compressed dactyli; merus of first leg provided with three rows of spines as on cheliped but shorter, those on carpus and propodus similarly arranged but shorter still; dactyl about  $\frac{1}{2}$  propodus, lacking spines. Third ambulatory leg smooth except for a spine on dorsal surface at distal end of merus.

Abdomen of seven segments, first segment with a prominent spine in middle of segment, second segment with three small spines arranged transversely. (Borradaile, modified.)

**MATERIAL EXAMINED:** None. Photographs of the two syntypes, held in the British Museum (Natural History), London, are discussed below.

**HABITAT:** Probably a sand-dwelling species (Borradaile, 1916).

**DEPTH:** Offshore on the continental shelf, 40–100 fm, or perhaps deeper.

**REMARKS:** According to Balss (1929, p. 3) the female differs very little from the male and possesses the prominent spine on the first abdominal segment as does the male.

The original figure of the species given by Borradaile (1916, fig. 13) is a composite drawing made from the two syntypes, one of which possesses only the right cheliped and right first ambulatory leg, both complete, while the other possesses both chelipeds, complete, together with the right first and left third ambulatory legs, both minus the propodus and dactyl. Examination of the four photographs of these two specimens in both dorsal and ventral aspect, kindly sent to me by Mr R. W. Ingle of the British Museum (Natural History), gives very little more information than can be obtained from the original description. The abdomen, not described in detail by Borradaile, appears widest at the base of the third segment, from which it narrows rather uniformly to the base of the slightly distally widened sixth segment; the seventh segment has a uniformly convex margin. Borradaile states that the prominent spine, which is visible in both dorsal and ventral view, is on the first segment; this is also mentioned by Balss. However, from the photographs it seems possible that this spine is actually on the second segment.

Bennett (1964, p. 30) has given a more detailed description of this species based on actual material. Ac-

ording to his description the carapace is sparsely pubescent dorsally, the third maxillipeds are granular, the spines and granules of the carpus of the cheliped suggest five or six rows, the fixed finger of the chela bears a longitudinal ridge and the dactyl (movable finger) three such ridges. Bennett's material appears to differ from the type material in two main features, his description stating that the merus of the cheliped possesses two rows of spines and two rows of enlarged granules instead of four rows of spines, and that the first three pairs of ambulatory legs have three rows of spines, whereas in the syntypes the third leg is smooth.

Bennett has also pointed out the strong resemblance between *C. hispida* and the Japanese *C. platypes* Yokoya, 1933. After examination of Yokoya's (1933, p. 145, text-fig. 52) description and figure of *C. platypes* I can only agree with Bennett that Yokoya's species is probably conspecific with *C. hispida*. However, a decision on this question depends on examination of actual specimens of *C. platypes*. One difference between the two species mentioned by Bennett, the presence of spines on the third ambulatory leg in *C. platypes*, does not appear to be important since, as noted above, this leg is smooth in the type material of *C. hispida*.

#### Genus *Naxia* Latreille, 1825

*Naxia* Latreille, 1825: 140. Rathbun, 1897: 157. McCulloch, 1913: 327. Hale, 1927: 127. Balss, 1935: 119. Not *Naxia* H. Milne Edwards, 1834 = *Paranaxia* Rathbun. Not *Naxia* Miers, 1879 = *Naxioides* A. Milne Edwards.

*Halimus* Latreille, 1825: 700; type species by monotypy: *Halimus aires* Guérin, 1825. H. Milne Edwards, 1834: 340. Miers, 1879c: 646. Haswell, 1882c: 5. Baker, 1905: 119. McCulloch, 1908: 53. Not *Halimus* Rathbun, 1897 = *Hyastenus* White.

*Trichoplatus* A. Milne Edwards, 1876b: 1; type species by monotypy: *Trichoplatus huttoni* A. Milne Edwards, 1876. Bennett, 1964: 32.

**DESCRIPTION:** Carapace subpyriform, anterolateral margins spinous, dorsal surface weakly tuberculate. Rostrum of two moderately long spines fused basally, weakly divergent. Orbit consisting above of an expanded supra-orbital eave provided with a preorbital or antorbital spine, or sometimes both, intercalated spine and conical post-orbital spine remote from eave. Eyestalk not greatly elongated, visible in both dorsal and ventral view. Basal antennal article slender with prominent anterolateral spine. Merus of third maxilliped subovate to subquadrate, slightly narrower than ischium. Cheliped greatly enlarged in male, carpus with lateral ridge. Ambulatory legs of moderate length, propodi more or less expanded, truncate distally. Abdomen of seven segments in both sexes, sixth and seventh sometimes incompletely fused.

**RANGE:** South-western, south, and south-east Australia including Tasmania, Kermadec Islands, New Zealand.

**TYPE SPECIES:** *Pisa aurita* Latreille, 1825, by monotypy; a southern Australian species.

**REMARKS:** *Naxia* was a manuscript name of Leach, but was first published by Latreille in 1825 to whom the genus

is now correctly attributed. The genus has suffered considerable systematic modification because of the redescription of all the included species under different specific names by various early workers, including Miers (1876a, 1879b), Haswell (1880a), and Baker (1905), and their placing in *Halimus* Latreille by all authors until McCulloch (1913), who amalgamated *Halimus* Latreille with *Naxia* Latreille following his earlier revision of all the species under the former genus (McCulloch, 1908). The restricted New Zealand *Trichoplatus* A. Milne Edwards was reduced to synonymy with *Naxia* by Richardson (1949b), though the single included species had earlier been referred to the synonymic *Halimus* by Miers (1876a, 1876b) and Kirk (1881) under a different specific name. In addition, Rathbun (1897), in attempting to clarify the status of the genera *Halimus* Latreille, *Halimus* H. Milne Edwards, and *Hyastenus* White, confused two species, *Pisa aires* Latreille, which was included in *Hyastenus* by A. Milne Edwards in 1872 and *Halimus aires* Guérin, included in *Halimus* by H. Milne Edwards (1834). Calman (1913) pointed out that the type species of *Halimus* Latreille is Guérin's species, not Latreille's, as stated by Rathbun. Finally, the name *Naxia* was used in three entirely different senses by Latreille, H. Milne Edwards, and Miers. *Naxia* H. Milne Edwards, 1834, included a single species, *Pisa serpulifera* Guérin, which Rathbun (1924) isolated as the monotypic *Paranaxia*, while *Naxia* Miers, 1879, is now regarded as a synonym of *Naxioides* A. Milne Edwards, 1865 (see Balss, 1929, p. 14). The outline of the synonymy of the genus *Naxia* Latreille and the included species by Balss (1935, p. 119) under the name *Naxia* Leach, has been followed here. The status of the monotypic subgenus *Microhalimus* Haswell is uncertain and lies outside the scope of this report.

*Naxia* Latreille stands closest among the inachine genera to the South American *Eurypodius* Guérin, but the Northern Hemisphere *Acanthonyx* Latreille, type genus of the subfamily Acanthonychinae, resembles both *Naxia* and *Eurypodius* in the expansion of the ambulatory propodi. Balss (1929) believed that *Naxia* gave rise to the most primitive member of the Ophthalmiinae, *Pseudomicippe* Heller.

#### KEY TO SPECIES OF *Naxia*

*N. tumida* is included here, though referred to *Naxioides* A. Milne Edwards by Balss, 1957, p. 1625.

(New Zealand species shown in **bold face** and treated below)

- 1 (2) Supraorbital eave rounded laterally. Intercalated supraorbital spine with a small spinule at its base anteriorly. Merus and carpus of chelipeds strongly spinous dorsally. Branchial margin lacking prominent spines. Propodi of ambulatory legs greatly expanded, truncate distally.  
 ----- ***N. huttoni*** (A. Milne Edwards, 1876)
- 2 (1) Supraorbital eave acute or spined at anterolateral or posterolateral angles or both. Intercalated supraorbital spine simple. Merus of chelipeds with few spines or smooth, carpus with a well developed lateral longitudinal ridge. Branchial margin with three prominent spines decreasing in size posteriorly.
- 3 (6) Supraorbital eave rounded anterolaterally, a short spine

at posterolateral corner. Propodi of ambulatory legs greatly expanded and truncate distally.

- 4 (5) Merus of cheliped smooth, carpus with a well developed dorsal longitudinal ridge in addition to the lateral one. Anterolateral spine of basal antennal article simple, not denticulated.  
 ----- *N. spinosa* (Hess, 1865)
- 5 (4) Merus of cheliped with few tubercles dorsally, carpus only ridged dorsally. Anterolateral spine of basal antennal article denticulate laterally.  
 ----- *N. tumida* (Dana, 1852)
- 6 (3) Supraorbital eave acute at both anterolateral and posterolateral angles. Propodi of ambulatory legs hardly expanded distally.
- 7 (8) Rostral spines stout, not greatly divergent, length not exceeding basal width. Carpus of cheliped weakly ridged dorsally, lateral ridge rounded basally. Ambulatory legs moderately stout.  
 ----- *N. aurita* (Latreille, 1825)
- 8 (7) Rostral spines slender, divergent distally, length  $1\frac{1}{2}$  basal width. Carpus of cheliped lacking dorsal ridge, lateral ridge expanded and sharply angled basally. Ambulatory legs very slender.  
 ----- *N. aires* (Guérin, 1825)

***Naxia huttoni*** (A. Milne Edwards, 1876). Figs. 3, 19.

*Trichoplatus huttoni* A. Milne Edwards, 1876a; 1876b: 1. pl. 10. Filhol, 1885: 49; 1886: 352. Hector, 1877: 474. Thomson, 1913: 236. Chilton & Bennett, 1929: 736. Bennett, 1964: 33, fig. 17-20, 111.

*Naxia huttoni*: Richardson, 1949b: 63, fig. 25. Dell, 1960: 6.

*Halimus hectori* Miers, 1876a: 219; type locality: New Zealand—British Museum (Natural History), London: 1876b: 4, pl. 1, fig. 1.

*Halimus rubiginosus* Kirk, 1881: 236; type locality: Wellington—location of type unknown. Filhol, 1886: 352.

**HOLOTYPE:** Male, length 53 mm, width 33 mm. Muséum National d'Histoire Naturelle, Paris.

**TYPE LOCALITY:** Coasts of New Zealand; F. W. Hutton, collector.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS:** Central: Napier, Cape Campbell, T. W. Kirk (Kirk). Cook Strait (Filhol, 1886). Kaikoura (in drift). E. W. Bennett; Sumner, F. W. Hutton; Akaroa Heads. J. W. Arthur (Chilton & Bennett). Akaroa, C. Chilton; Wharenui, near Clarence River, Neilsen (Bennett). Southern: east coast of Otago (Filhol, 1886). Otago Harbour, east coast of Otago (Thomson). Moeraki (in crayfish pot), W. H. Cormack; Dunedin, off Otago Heads, trawled (Bennett). Stewart Island, W. Traill (Chilton & Bennett). Chatham Islands: Kaingaroa, T. Soowich; off Chatham Islands, F. Abernethy (Dell).

**DISTRIBUTION:** New Zealand, mainly southern, including Chatham Islands.

**DESCRIPTION:** Carapace narrowly pyriform in dorsal aspect (width  $\frac{5}{8}$  length), in profile weakly inflated and almost uniformly convex, sloping somewhat more steeply anteriorly than posteriorly. Rostrum of two long slender cylindrical spines (just over  $\frac{1}{4}$  postrostral length of carapace), length twice basal width, weakly divergent distally, as wide at the tips as at base, a small, sharply pointed

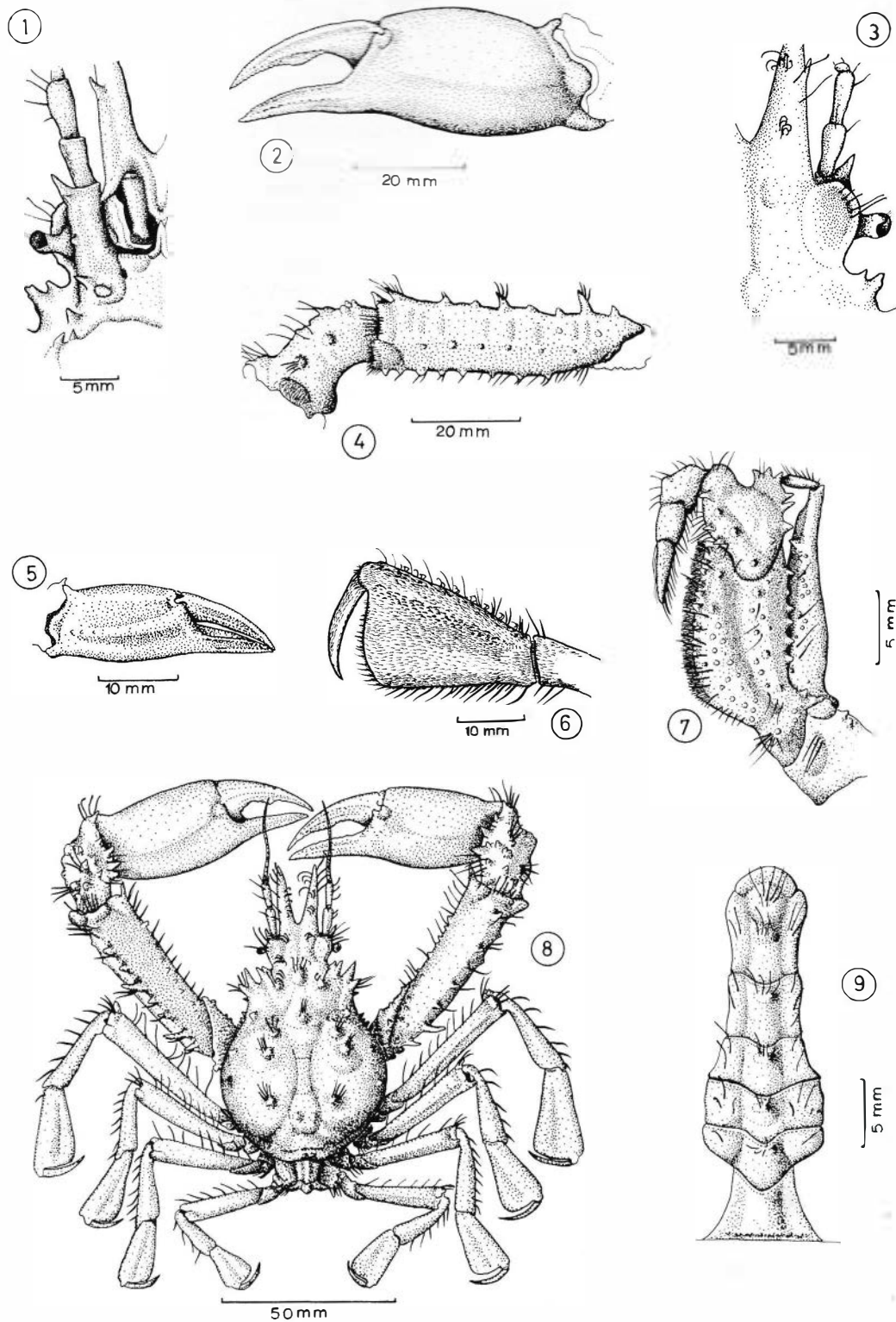


FIG. 3.—*Naxia huttoni* (A. Milne Edwards). 1—Ventral view of orbit. 2—Left chela of male. 3—Dorsal view of orbit. 4—Left cheliped of male, merus and carpus. 5—Right chela of female. 6—Left fourth ambulatory leg, dactyl. 7—Left third maxilliped. 8—Dorsal view of adult male. 9—Male abdomen. 5 from female, carapace length 62 mm, Kaingaroa, Chatham Islands, remainder from 82 mm male, Wellington.

spine on ventrolateral surface about  $\frac{2}{3}$  from base. Short, curled hairs fringing rostral spines medially and in groups dorsally, extending from rostral spines along margin of protogastric regions anteriorly and subdorsally along anterolateral margins of carapace. Very straight, stiff, long hairs scattered along lateral surface of rostral spines and supraorbital eave and arising in tufts from tubercles on the dorsal surface of carapace; basal segments of antennal flagellum bearing similar hairs dorsally. Dorsal surface of carapace otherwise covered by a thick mat of short, fine hairs.

Several prominent spinous tubercles, longer anteriorly, scattered over dorsal surface of carapace. Tubercles arranged in a medial series of two anteriorly, and submedial of two pairs posteriorly, in addition to five pairs more distant from the midline; two prominent medial mesogastric tubercles, the first opposite intercalated spine, the second just behind hepatic marginal spine; cardiac region with a pair of small submedial tubercles in the centre and a smaller pair on posterior intestinal margin. Four prominent protogastric tubercles arranged in pairs, the first immediately in front of first mesogastric, the second more widely separated, midway between the two mesogastric tubercles; six small branchial tubercles likewise arranged in pairs and longitudinally forming an oval with last mesogastric and submedial cardiac tubercles, the first pair close to midline opposite widest part of carapace and followed close behind by a more widely separated pair, the third pair closer to midline and more posterior, immediately in front of cardiac tubercles. Regions moderately well defined by shallow grooves.

Margins of carapace bearing three prominent, conical, outwardly directed spines anterolaterally, two orbital and one hepatic, a smaller spine at base and in front of first, a few small spinous tubercles along branchial margin anteriorly.

Orbit consisting above of supraorbital eave, intercalated spine and postorbital spine remote from orbit; eave weakly expanded and upwardly projecting laterally, rounded, separated from following spines by a wide shallow fissure; intercalated spine short, stout, and sharply pointed, directed weakly downward, bearing anteriorly at its base a similar spine about half its length; postorbital (or first hepatic) spine as far from intercalated spine as latter's distance from eave, scarcely more than twice its length, directed downward and weakly forward. Hepatic spine close behind, just above and slightly longer than, postorbital, sharply pointed. Orbit circular and deep, incomplete below; the stout, moderately long eyestalk visible from its base in ventral aspect extending a short distance beyond eave; cornea terminal, large, ovoid; a small, blunt tubercle above at distal extremity of eyestalk.

Basal antennal article long, narrow, and straight-sided, extending for a very short distance beyond anterior margin of orbit, lateral edge bearing three or four widely spaced, small, spinous tubercles, anterolateral angle armed with a long, stout, sharply pointed, conical spine directed forward and outward; antennal flagellum long, extending for  $\frac{2}{3}$  of its length beyond rostrum, visible in dorsal view on

each side, two basal segments cylindrical, longer and stouter than following.

Antennular fossae large, longitudinally subovate, deep; interantennular spine short, downwardly projecting, sharply pointed; anterior process of epistome slender, bluntly pointed.

Epistome wide and short. Mouthfield subrectangular, slightly narrower posteriorly, anterior margin almost transverse, weakly convex on each side of indented midline. Pterygostomian regions subtriangular, flattened. Elevated round mouthfield to form a narrow ridge with a small, sharply pointed spine at anterolateral corners; a few very small tubercles scattered over surface and along lateral margin. Subhepatic regions weakly inflated and clearly separated by a shallow groove from pterygostomian regions, bearing one or two small spinous tubercles in front and behind marginal hepatic spines. Thoracic sternum large, acutely angled anteriorly to form posterior border of mouthfield in male; first sternite with a subtriangular group of small tubercles in the middle, following sternites margined anteriorly by a row of small tubercles; similar tubercles surrounding abdominal fossa. Short stout hairs surrounding first sternite and fringing remaining sternites posteriorly.

Third maxillipeds almost meeting in midline. Ischium large and broadly subrectangular, slightly longer than wide, a dense fringe of short hairs overlying and almost concealing finely toothed, weakly convex medial edge, longer hairs arranged in an adjacent parallel row; medial half of distal edge expanded anteriorly, anteromedial corner sharply angled, lateral half strongly concave to bear merus; outer surface deeply excavated medially as a narrow longitudinal groove with low, broad-based, spinous tubercles scattered along each side and also along lateral edge, more numerous medially and generally larger distally. Merus narrowly subovate, as broad as, but only slightly more than half length of, ischium, lateral edge prominently expanded close to base as a flattened crest bearing several small spines; outer surface excavated as a shallow longitudinal groove, a few conical spines in a line medial to groove and along medial edge; merus fringed by a few long stout hairs. Palp arising from almost truncate summit, and just over  $1\frac{1}{2}$  length, of merus, cylindrical and stout, the three segments subequal in length, surfaces weakly setose basally, hairs longer and more numerous distally.

Chelipeds very long (slightly more than  $1\frac{1}{2}$  times carapace in adult male), stout, merus long, about  $\frac{1}{3}$  total length of cheliped, carpus  $\frac{1}{2}$  merus, chela barely exceeding merus, dactyl slightly more than  $2\frac{1}{2}$  palm. Merus subtriangular; a row of strong spines along dorsal edge for entire length, three spines longer than rest placed subequidistantly, ventromedial and ventrolateral edges with blunt tubercles or small spines. Surface otherwise weakly tuberculate, a longitudinal row of small tubercles laterally, a sharp spine at distal extremity of ventromedial edge. Carpus subcylindrical, ventrally flattened and smooth, strong, broad-based, spinous or bluntly pointed, tubercles scattered irregularly over surface, more numerous dorsally

forming a poorly defined irregular ridge. Propodus compressed, enlarged in male, palm most inflated  $\frac{1}{2}$  to  $\frac{2}{3}$  from base, dorsal and ventral edges blunt, medial and lateral surfaces weakly ridged longitudinally, a few small spines on dorsal surface close to base, surface otherwise smooth. Fingers acute, weakly curved inward distally, moderately gaping basally in male, closely approximated in female, finely toothed along inner edges for almost entire length, in male teeth of dactyl enlarged  $\frac{1}{3}$  from base; two shallow longitudinal grooves on medial and lateral surfaces of fingers, each bearing short hairs.

Ambulatory legs of moderate length, stout, smooth except for a few small spinules ventrally, covered thickly by mat of short fine hairs, groups of short, curled hairs in a dorsal row on meri, carpi, and propodi, long stout hairs distally surrounding bases and ischia and scattered along dorsal surfaces of meri and carpi. Meri long,  $\frac{1}{2}$  total length of leg, carpi and propodi short, subequal in length, each  $\frac{1}{2}$  meri, dactyli  $\frac{2}{3}$  propodi. First leg the longest (just over  $1\frac{1}{2}$  carapace length), following legs decreasing uniformly in length posteriorly, the last the shortest (just shorter than carapace). Meri weakly compressed in anterior legs, cylindrical in last; carpi cylindrical and somewhat enlarged distally; propodi strongly compressed and greatly expanded toward distal truncate edge which is twice as wide as base in anterior legs, slightly less in posterior, and fringed with short hairs; dactyli strongly curved and bent back on distal edge of propodi (subchelate), terminating in a strong claw.

Abdomen of six segments in male and female, sixth and seventh segments almost completely coalesced. Male abdomen narrow, segment 1 long,  $\frac{1}{6}$  total length of abdomen, segments 2 to 4 just shorter, subequal in length, segment 5  $1\frac{1}{2}$  as long and last twice as long as segment 2. Segment 1 wide basally, narrow distally, segment 2 subtriangular, widening abruptly distally; abdomen widest at base of segment 3, sides of which are subparallel, segment 4, narrowing, at first abruptly, to base of next, remaining segments of uniform width to slightly widened, strongly convex edge of last which is laterally notched subterminally. Surface of abdomen weakly elevated in midline as a rounded longitudinal ridge bearing a small spine distally in all segments except last, which bears a raised circular area close to tip in midline; surface of abdomen otherwise flattened, groups of long stout hairs arising from midline in all segments and also scattered over surface. Abdomen of female broad and subovate.

Male first pleopod slender, bulbous basally, outwardly curved distally and weakly expanded, truncate; aperture terminal, elongate oval, located at end of a narrow groove enclosed by fleshy flaps of expansion, groove curving round from medial surface on to abdominal surface distally to run close to lateral edge just basal to aperture; very stout setae extending sparsely along lateral surface for distal half, slightly longer basally, a few similar setae on medial surface towards tip.

**COLOUR:** Carapace and chelipeds pink to deep red or pale purple, hairs yellow, brown or deep red. Bennett

(1964) gives more detailed colour notes based on preserved material.

**MATERIAL EXAMINED:** A total of nine specimens as follows:

**VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COLLECTIONS:** Wellington, 1 male, 82 mm.

**DOMINION MUSEUM COLLECTIONS:** Cavalli Island, Whangaroa, 1954, J. McDonald, 1 female, 56 mm; Island Bay, Wellington, below low-tide level, 1944, received from A. C. Kaberry, 1 female (Cr. 330), 54 mm; off Barrett's Reef, Wellington, 5 fm, July 1961, 1 male (Cr. 994), 56 mm; Palliser Bay, Cook Strait, washed ashore, March 1952, J. M. Harrison, 1 female (Cr. 441), 52.8 mm; Cook Strait, 30 fm, 22 May 1946, L. Blanchard, 1 male (Cr. 328), 57 mm; off Chatham Islands, 1949, F. Abernethy, 1 female (ovigerous), 41 mm (postrostral); Kaingaroa, Chatham Islands, 25 fm, T. Soowich, 1 female (ovigerous) (Cr. 331), 62 mm; New Zealand (Old Museum Collections), 1 male (Cr. 329), 39 mm.

**MEASUREMENTS:** Largest male: length 82 mm, width 49 mm, rostral length 17 mm, rostral width 10 mm, cheliped 139 mm, chelar length 58 mm, chelar height 23 mm, dactyl 30 mm, first ambulatory leg 117 mm.

Ovigerous female: length 62 mm, width 43 mm, cheliped 67 mm.

**HABITAT:** Exposed rocky coasts.

**DEPTH:** Low tide to offshore at 30 fm.

**BREEDING:** Nothing is known of the breeding habits of this species. Although two ovigerous females are present in the Dominion Museum collections, no dates are attached to the labels.

**REMARKS:** The excellent figures of this species, under the name *Trichoplatus huttoni*, given by A. Milne Edwards (1876b, pl. 10) differs from the material available to me only in a few minor points. Firstly, his figures give the impression of a more spinous species, particularly as far as the intercalated and postorbital spines, basal antennal article and merus of the third maxilliped, and merus and carpus of the cheliped are concerned. Secondly, his fig. 4 shows the sixth and seventh segments of the abdomen as quite distinct, whereas they are fused, though the suture lines remain visible. Thirdly, the spine which I have here called postorbital is interpreted by him as hepatic. The arrangement of tubercles on the dorsal surface of the carapace shown in his figures agrees completely with the specimens to hand.

Miers's (1876b, p. 4, pl. 1, fig. 1) description and figure of the species under the name *Halimus hectori* are far inferior to those of Milne Edwards, the position of spines and tubercles not being at all clear. In general, Miers's figure is too poor to allow accurate comparison with recently collected material. The two spines behind the supra-orbital cave are again interpreted as hepatic, but the sixth and seventh abdominal segments are correctly noted to be fused.

The synonymy of this species has already been outlined by Chilton & Bennett (1929, p. 737) who showed *Halimus rubiginosus* Kirk to be conspecific with *Trichoplatus huttoni* A. Milne Edwards and *Halimus hectori* Miers,



these last two having been considered synonymous since the appearance of Milne Edwards's main description.

Bennett (1964, p. 33) retains the genus *Trichoplatus*, relating it, I think correctly, to the South American *Eurypodius* Guérin, but states on the other hand that the relationships are not with *Naxia*, *Halimus* (presumably an error for *Hyastenus*), or *Acanthonyx*. Since the last two of these genera do not belong in the Inachinae, their lack of close relationship with the species discussed here cannot be denied. However, Bennett's assertion as regard *Naxia* requires some attention.

*Naxia huttoni* resembles the Australian species of *Naxia* most obviously in the terminal broadening of the ambulatory propodi, the presence of sparse groups of stout hairs on the dorsal surface of the carapace and of groups of curled hairs along the dorsal surface of the ambulatories, apart from more general characters such as the pyriform carapace, the double rostrum, etc. Less obvious similarities include the expansion of the supraorbital cave, presence of a spine at the anteroexternal angle of the basal antennal article, lateral expansion of the merus of the third maxilliped, and the shape of the abdomen. On the other hand the Australian species possess a spine at the antero- or posterolateral angle of the eave, three prominent spines on the branchial margin, the merus of cheliped is smooth or only weakly spined, the carpus strongly ridged, at least laterally, and the abdomen is seven-segmented, as opposed to the non-spinous eave, weakly tuberculate branchial margin, strongly spined merus and carpus on the cheliped and six-segmented abdomen of *N. huttoni*. Considering the similarities already outlined, these differences, except in the case of the abdomen, hardly warrant a distinct genus for the New Zealand species, especially since in *N. spinosa* and *N. tumida* the eave is spined posterolaterally only, while the marginal branchial spines of all the Australian species are represented in *N. huttoni* by tubercles.

One character remains to be discussed here, that is the nature of the supraorbital margin behind the eave. In the Australian species the eave is followed by three spines (excluding the branchials), one which is clearly orbital and two which are close together and superficially appear to be hepatic. On this interpretation the spine immediately behind the orbit is the postorbital and there is no intercalated spine present. It is this view which has been taken by Bennett in placing *Trichoplatus* among the group of genera characterised by Balss (1929) as lacking an intercalated spine. In a treatment of the Australian species, then referred to *Halimus*, by Baker (1905) an opposite interpretation is followed. Baker calls the spine behind the eave the intermediate spine (intercalated spine here) and the first hepatic spine is then called the true "postocular". As regards the Australian species the figures given by Baker and also by Hale (1927) do not permit a definite judgment on this point in the case of all the species. In some (e.g., *N. aurita*) the first hepatic spine seems to be truly orbital in nature being separated from the following by a distinct groove, while in others (e.g., *N. spinosa*) it seems to be entirely hepatic. Examination of specimens

of *N. huttoni* shows that all these spines are close together but the situation more nearly approaches that in *N. spinosa*. In view of the above analysis I consider that all the species, including *N. huttoni*, show various stages of a trend involving the movement forward of the first hepatic spine to take up a position above the orbit. Therefore the spine behind the eave is the intercalated spine, while the next after that is the postorbital whether or not it be separated by a groove from the third (hepatic) spine. The genus *Naxia* is therefore characterised by the possession of a supraorbital eave, an intercalated spine, and a postorbital spine and belongs in the more primitive group of the Inachinae as understood by Balss. A similar type of argument removes the difficulty of the difference in the number of abdominal segments, since the fusion of the sixth and seventh segments in *N. huttoni* is somewhat incomplete, at least in the male. In my opinion the relationships of the species herein called *Naxia huttoni* with the Australian species of *Naxia* are much closer than those with *Eurypodius* species, but the two genera form a unique southern assemblage of inachines with a double rostrum, primitive type of orbit and expanded ambulatory propodi. It remains only to point out that in *Eurypodius* the expansion of the propodi is not nearly as great as in *N. huttoni* but more closely parallels the situation in *N. aurita* and *N. aires*, the rostral spines are contiguous for at least part of their length and not divergent, the orbital region is elongated to a much greater extent than in *Naxia*, and finally while the male first pleopod of *E. latreillei* (see Garth, 1958: pl. B fig. 1) is similar to that of *N. huttoni*, those of the Australian species of *Naxia* are as yet undescribed.

#### Genus *Achaeopsis* Stimpson, 1857

*Achaeopsis* Stimpson, 1857: 219; 1907: 21. Miers, 1879c: 645; 1886: 18. Ortmann, 1893: 36. Stebbing, 1910: 285; 1914: 257; 1917: 24. Rathbun, 1911: 247; 1916: 535; 1925: 27. Hale, 1927: 123. Sakai, 1932: 45; 1938: 227. Barnard, 1950: 23.

*Dorynchus* Wyville-Thomson, 1873: 174; type species by monotypy: *Dorynchus thomsoni* Wyville-Thomson, 1873. Rathbun, 1879: 162. Stebbing, 1910: 285. Bouvier, 1940: 349.

*Lispognathus* A. Milne Edwards, 1880a: 349; type species by monotypy: *Lispognathus furcillatus* A. Milne Edwards, 1880 = *Dorynchus thomsoni* Wyville-Thomson, 1873; 1880b: 8. Miers, 1886: 28. A. Milne Edwards & Bouvier, 1900: 148. Doflein, 1904: 75.

**DESCRIPTION:** Carapace ovate-triangular, convex, spinous; interorbital portion narrow; orbit with a supraorbital and postorbital spine. Rostrum usually bifid, not very long. Eyes retractile to sides of carapace. Antennular fossae long and narrow. Basal antennal article very long and narrow, placed in an almost vertical plane; movable portion much longer than rostrum and inserted beside it. Third maxillipeds spinous; merus narrower than ischium, constricted at base, rounded at extremity, palp articulating at summit. Abdomen of six segments in both sexes. Chelipeds strong, spinous; merus trigonal; palm dilated; fingers broad. Ambulatory legs long and very slender. (Rathbun, 1925, modified.)

RANGE: South-west Indian, north- and south-west Pacific (Japan, Philippine Islands, South Australia, New Zealand), and north- and south-east Atlantic Oceans, and Mediterranean Sea.

TYPE SPECIES: *Achaeopsis spinulosus* Stimpson, 1857, by monotypy; a south-west Indian Ocean species.

REMARKS: In Wyville-Thomson's (1873) book, *The Depths of the Sea*, appears the first description of the species now known as *Achaeopsis thomsoni*. It was called *Dorynchus thomsoni* Norman and the description consisted of a few sentences and a figure. From the full synonymy of this species given by Rathbun (1925, p. 29) it is apparent that Norman himself later described this species in 1886 under the name *Lispognathus thomsoni*, while within the intervening 12 years the species had formed the basis for A. Milne Edwards's *Lispognathus* under the specific name *furcillatus*. Rathbun (1897) showed that since *D. thomsoni* and *L. furcillatus* were conspecific and referable to Stimpson's older genus *Achaeopsis*, *Dorynchus* and *Lispognathus* were superfluous. However, later authors, notably Bouvier (1940), continued to use these names. Further, all authors have attributed the genus *Dorynchus* and the species *D. thomsoni* to Norman; as noted above these names were first used by Wyville-Thomson, who must therefore be regarded as the author.

The species of the genus *Achaeopsis* are rather typical inachines similar to species of the American *Podochela* Stimpson and the Atlantic *Inachus* Fabricius. However, if the supraorbital spine found in *Achaeopsis* species is regarded as homologous with the intercalated spine of other majids, *Achaeopsis* becomes widely separated from these genera and takes up a position, in the American fauna, close to the otherwise strongly dissimilar *Eurypodius* Guérin.

Four species formerly placed in this genus, *A. guntheri* Miers, *A. superciliaris* Ortmann, *A. suluensis* Rathbun, and *A. pugnax* de Man have recently been removed to other genera, the first to *Inachus* by Barnard (1950) and the other three to *Achaeus* Leach by Sakai (1938). At present the genus includes four species, of which one, *A. thomsoni*, is virtually cosmopolitan and also very widely ranging bathymetrically. Since the genus is new to New Zealand a key to all four species is included, though only two are known from Australasian waters.

#### KEY TO SPECIES OF *Achaeopsis*

(New Zealand species shown in **bold face** and treated below)

- 1 (4) Rostral spines short, less than  $\frac{1}{2}$  length of carapace. stout basally. Meri of ambulatory legs lacking a distal spine.
- 2 (3) Rostral spines outwardly curved distally, lacking spinules marginally. Supraorbital spine less than  $\frac{1}{2}$  postorbital in length. Epibranchial regions each with a small spine. .... *A. spinulosus* Stimpson, 1857
- 3 (2) Rostral spines strongly convergent distally, lateral surfaces with a few spinules. Supraorbital spine almost as long as postorbital. Epibranchial regions lacking a spine. .... *A. rostrata* Sakai, 1932

- 4 (1) Rostral spines longer than  $\frac{1}{2}$  length of carapace. slender. Meri of ambulatory legs with a well developed distal spine dorsally.
- 5 (6) Rostral spines subparallel, ventral surfaces with a few minute denticles. Protogastric regions each with a single strong spine. Branchial margins with two prominent spines and a few spinules. .... *A. thomsoni* (Wyville-Thomson, 1873)
- 6 (5) Rostral spines divergent, distal width twice basal width. ventral surfaces with two strong spines basally. Protogastric regions lacking a spine. Branchial margins with four prominent spines. .... **A. ramusculus** (Baker, 1906)

#### ***Achaeopsis ramusculus*** (Baker, 1906). Fig. 4.

*Stenorhynchus ramusculus* Baker, 1906: 104, pl. 1, Figs. 1, 1a.  
*Achaeopsis ramusculus*: Hale, 1927: 124, Fig. 121.

HOLOTYPE: Male, length (postrostral) 6 mm, width 4.5 mm, cheliped 8 mm, length of first ambulatory leg 19 mm, South Australian Museum, Adelaide, Australia.

TYPE LOCALITY: Off Neptune Islands, South Australian coast, 104 fm; Dr Vercoe, collector.

LOCALITIES SUBSEQUENTLY REPORTED: Hale (1927) does not mention any new localities for this species.

DISTRIBUTION: South Australia, New Zealand.

DESCRIPTION: Carapace broadly pyriform in dorsal aspect (length about 1.6 times width), inflated and weakly convex in profile, margins with several long spines and numerous spinules. Rostrum of two long spines (almost  $\frac{1}{2}$  length of carapace),  $1\frac{1}{2}$  times basal width, separate from base, straight, divergent, distance between tips twice basal width, slender, conical; two or three short, forwardly curved spinules on ventrolateral surface near base, a few long hairs arising from medial surfaces of spines. A few curled hairs above orbit, and on dorsal surfaces of carapace in longitudinal rows on medial part of protogastric regions and subdorsally along margins of branchial regions. Carapace otherwise naked.

Margins of carapace with 10 prominent spines, one supraorbital, one postorbital, four hepatic and four branchial, the last subdorsal, and several spinules; spines conical and outwardly directed, except the first. Hepatic region with four short spines grouped closely together, about midway along margin, anterior one the largest,  $\frac{1}{2}$  length of postorbital spine, about  $\frac{1}{4}$  length of rostrum, posterior spines small. Branchial margin with an oblique row of three subequal spines, almost as long as first hepatic, situated close together on anterior part of margin at widest part of carapace, the first at a lower level than following spines; a fourth slightly longer spine remote from others situated subdorsally on posterior part of branchial region; a row of minute spinules along posterior margin.

Dorsal surface with two long medium spines, subequal,  $\frac{1}{2}$  length of rostrum, slender, conical, one mesogastric at posterior part of region just behind hepatic spines, and second on posterior tumid part of cardiac region. Carapace otherwise smooth, minutely granular; regions moderately

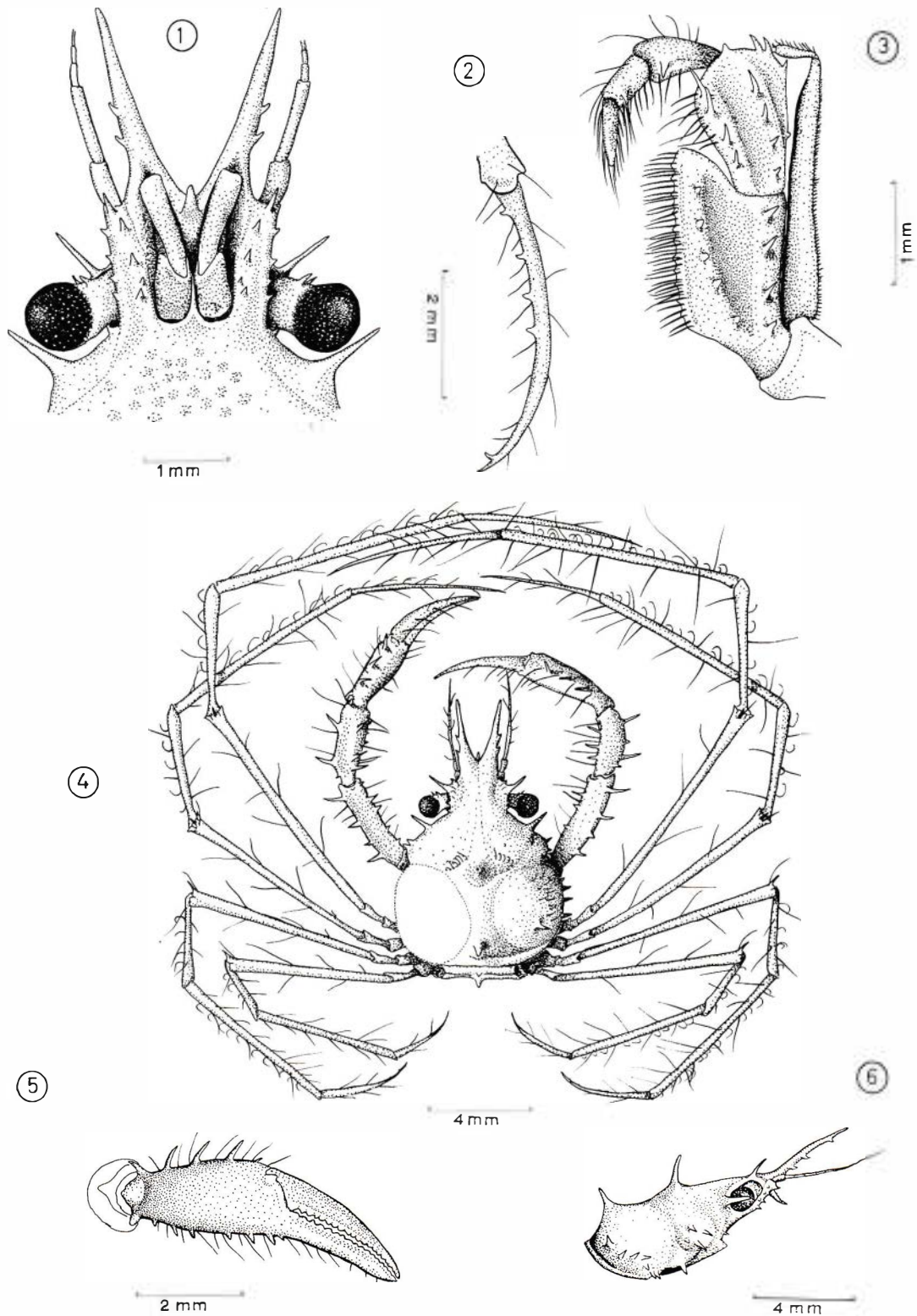


FIG. 4.—*Achaeopsis ramusculus* (Baker). 1—Ventral view of front. 2—Right fourth ambulatory leg dactyl. 3—Left third maxilliped. 4—Dorsal view of female. 5—Left chela of female. 6—Lateral view of carapace. All figs. from female, carapace length 10 mm. NE of Mayor Island, over 40 fm.

well defined, separated by very shallow grooves, branchial regions inflated.

Orbit consisting above of a supraorbital eave and post-orbital spine; supraorbital eave very narrow, hardly expanded laterally, lateral margin weakly convex, bearing midway along a prominent slender spine,  $\frac{1}{3}$  long as rostrum, directed weakly upward and forward; a few small spinules on margin of eave in front and behind supra-orbital spine; postorbital spine remote from orbit, slender, as long as supraorbital spine. Orbit circular and deep, basal antennal article hardly contributing to formation of orbit; eyestalk very stout, long, almost reaching post-orbital spine, completely visible in both dorsal and ventral view, weakly bulbous basally, two small spinules on anterior surface toward emargination of cornea; cornea terminal, large, circular.

Basal antennal article long, very narrow, a short, slender, conical spine directed weakly downward and forward situated close to anterolateral angle; outer surface weakly excavated medially, several short spinules in a longitudinal series close to medial edge and several similar spinules along lateral edge of rostrum; long, extending for almost half its length beyond rostrum, bearing scattered long hairs.

Antennular fossae very large, longitudinally subovate; narrow; interantennular spine long, stout, downwardly projecting and weakly curved, bluntly pointed; anterior process of epistome narrow, sharply pointed.

Epistome slightly wider than long, widening posteriorly. Mouthfield subrectangular, narrowing posteriorly, anterior margin almost transverse, weakly concave medially. Pterygostomian regions subtriangular, separated from hepatic regions by a shallow groove, a single, short, weakly curved spinule midway along lateral edge.

Third maxillipeds almost meeting in midline. Ischium large, broadly subrectangular, small teeth scattered regularly along medial edge, overlain and almost concealed by a dense fringe of long hairs; medial half of distal edge extended anteriorly, long, rounded, anteromedial corner sharply angled, lateral half weakly concave to bear merus; but surface excavated medially as a shallow longitudinal groove, two longitudinal rows of spines, one of short blunt spines medial to groove and another of longer sharp spines lateral to it. Merus longitudinally subovate, slightly shorter than ischium, and narrower, anterolateral angle very slightly expanded laterally, bearing a few long curved spines; outer surface with two longitudinal rows of long, curved spines, one along medial edge and one close to lateral edge, a shallow groove between the two rows; a few long hairs scattered along medial edge. Palp articulating at summit of and just longer than merus, cylindrical, long hairs scattered over surface, a small spine on outer surface of carpus and propodus.

Sternum excavated anteriorly as a pair of shallow depressions, one on each side of midline, surface of sternites granular.

Chelipeds long (slightly longer than carapace in female), spinous, hairy; merus and carpus subtriangular,

propodus compressed. Basis and ischium short, merus long, almost  $\frac{1}{2}$  total length of cheliped, carpus barely  $\frac{1}{2}$  merus, chela about  $\frac{1}{2}$  total length of cheliped, dactyl slightly longer than palm. Ischium with a few spines on medial edge; merus with a row of four equidistant spines on dorsal edge, first and fourth long, subequal, third slightly shorter, second  $\frac{1}{2}$  size of first, five subequidistant, long, subequal spines on lateral edge, medial edge with a long spine toward distal end and one or two small spines, long hairs scattered over surface; carpus bearing six long spines, two lateral and four medial, and several small spines ventrally, a few long hairs along medial edge. Palm slightly enlarged distally with three long spines along dorsal surface in addition to one or two short spinules, several short spinules along ventral surface, long hairs scattered along dorsal and ventral surfaces. Fingers acute, curved inwardly at tips, finely denticulate along adjacent inner edges for entire length, a few long hairs scattered along dorsal surface of dactyl.

Ambulatory legs long, slender. First leg the longest (almost three times length of carapace), following legs decreasing slightly in length posteriorly, fourth leg about twice length of carapace. Bases and ischia short, stout. Meri long, about  $\frac{1}{3}$  total length of leg, carpi  $\frac{1}{2}$  meri, propodi as long as meri, dactyli  $\frac{2}{3}$  propodi; meri with a stout, weakly curved spine overlying distal edge, dactyli weakly curved in anterior legs, unarmed, last two legs with dactyli strongly curved with five small spinules along ventral surface, four equidistant, extending from base to midway along, fifth close to tip. Curled hairs scattered in ill-defined groups along dorsal surfaces on carpi and propodi of all legs, carpi and following segments bearing scattered long hairs.

Female abdomen of six segments, segments 6 and 7 coalesced, long but extending anteriorly only to bases of chelipeds; subovate in shape, widest at base of segment 5, retaining uniform width to base of last segment, tip rounded; a blunt or spinous tubercle situated medially toward distal edge of each segment.

COLOUR: White after preservation.

MATERIAL EXAMINED: One specimen as follows:

DOMINION MUSEUM COLLECTIONS: B.S. 210, N.E. of Mayor Island, over 400 fm, 1 female (Z Cr. 1115), 10 mm.

MEASUREMENTS: Female: length 10 mm, width 6 mm, rostral length 3 mm, rostral width 2 mm, cheliped, 12 mm, first ambulatory leg 28 mm.

REMARKS: The present specimen appears to differ from the holotype (Baker, 1906, p. 104, pl. 1, fig. 1, 1a) only in that the rostral spines are not bifid at the tips. Otherwise the agreement between the two specimens is very close indeed.

The finding of this second specimen at a depth of 400 fm extends the range of this species both geographically and bathymetrically, Baker's specimen having been taken at 104 fm. However, it is by no means the deepest record for the genus, Doflein (1904) having recorded *A. thomsoni* (as *Lispognathus thomsoni*) from depths exceeding 1,000 fm.

## Genus *Achaeus* Leach, 1817

*Achaeus* Leach, 1817: pl. XXII c. H. Milne Edwards, 1834: 281. Miers, 1879c: 643; 1886: 8. Haswell, 1880a: 433; 1882c: 3. Alcock, 1895: 169. Balss, 1929: 5. Sakai, 1938: 209. Bouvier, 1940: 359. Barnard, 1950: 18. Forest & Zariquiey Alvarez, 1955: 63.

*Stenorhynchus*: Haswell, 1879: 408; 1880a: 432; 1882c: 2 (in part). Not *Stenorhynchus* Latreille, 1825 = *Macropodia* Leach, 1814 (fide Garth, 1958). Not *Stenorhynchus* Lamarck, 1818.\*

**DESCRIPTION:** Carapace pyriform to elongate subtriangular, somewhat narrowed behind orbit as a "neck", sometimes bearing a few tubercles but never long spines. Rostrum of two short, acute or rounded spines. Orbit consisting above only of narrow supraorbital eave, laterally spinulated or smooth; postorbital spine, if present, not prominent. Eyestalks long, non-retractile, cornea obliquely subterminal, slightly ventral, large, ovoid. Basal antennal article extremely slender, smooth, weakly tuberculate, spinulous or armed with spines laterally. Merus of third maxillipeds subovate, not notched distally, palp articulating at summit. Chelipeds greatly enlarged in adult male, usually spinous. Ambulatory legs of extreme length and slenderness, dactyli of third and fourth legs usually falcate and ventrally spinulated. Abdomen of six segments in both sexes, male abdomen widest at middle of third segment. Male first pleopod bluntly pointed, aperture located subterminally in a groove.

**RANGE:** East Atlantic Ocean and Mediterranean Sea, Indo-west Pacific (South Africa, India, China, Japan, Australia, and New Zealand).

**TYPE SPECIES:** *Achaeus cranchii* Leach, 1817, by monotypy; a north-eastern Atlantic and Mediterranean species.

**REMARKS:** The genus *Achaeus* is most closely related to the Atlantic *Macropodia* Leach, from which it differs in the much shorter rostral spines, and to *Achaeopsis* Stimpson (see above) and the Atlantic *Inachus* Weber, from both of which it differs in the absence of a prominent postorbital spine. The western Atlantic and eastern Pacific *Podochela* Stimpson is superficially similar to *Achaeus* but differs in the important respect that the rostrum is single and not double. *Achaeus* contains about 20 species inhabiting mostly continental shelf waters. The New Zealand and Australian species are at present under review (see Griffin and Yaldwyn, 1965).

### KEY TO NEW ZEALAND AND AUSTRALIAN SPECIES OF *Achaeus*

(New Zealand species shown in **bold face** and treated below)

- 1 (2) Rostrum of two short acute spines. Supraorbital eave bearing laterally a prominent spine and several minute spinules; several small postorbital spinules present. Carapace weakly tuberculate dorsally; cardiac region with a prominent tubercle **sometimes sur-**

mounted by two spinules, a small tubercle close to posterior margin of carapace.

- ..... ***A. fissifrons*** (Haswell, 1879)
- 2 (1) Rostrum of two rounded lobes. Supraorbital eave usually minutely spinulated but lacking a prominent spine; postorbital spinules lacking. Carapace variously tuberculate or smooth dorsally.
- 3 (4) Carapace smooth, lacking prominent tubercles. Rostral lobes spinulated distally. Dactyli of ambulatories 3 and 4 almost semicircular, ventrally spinulated for distal two-thirds. .... *A. lacertosus* Stimpson, 1857
- 4 (3) Carapace tuberculate. Rostral lobes not spinulated. Dactyli of ambulatories 3 and 4 falcate but not semicircular, ventrally spinulated for entire length.
- 5 (6) Rostrum of two strong lobes separated by a narrow V- or U-shaped hiatus, weakly convergent distally. Cardiac region with two prominent submedial tubercles, a smaller medial intestinal tubercle close behind. Chelipeds smooth except for a few tubercles on medial and lateral surfaces of merus and carpus and dorsal surface of propodus. .... *A. brevirostris* (Haswell, 1879)
- 6 (5) Rostrum of two pointed lobes each with a small, sharp, distal projection. No intestinal tubercle, carapace otherwise with a strong gastric tubercle. Female cheliped with ischium and merus prominently spinulated. .... *Achaeus* sp., possibly new

### ***Achaeus fissifrons*** (Haswell, 1879). Figs. 5, 19.

*Stenorhynchus fissifrons* Haswell, 1879: 409; 1880a: 432; 1880b: 145; 1882c: 2. Chilton & Bennett, 1929: 735. Bennett, 1930: 255. Richardson, 1949b: 63.

*Achaeopsis fissifrons*: Miers, 1886: 6, 18.

*Achaeus tenuicollis* Miers, 1886: 9, pl. 1 figs. 3a-c; type locality: Port Phillip, Victoria, 33 fm. *Challenger*—British Museum (Natural History). London. Whitelegge, 1900: 140. Rathbun, 1918: 4. Stephensen, 1945: 97, fig. 18a, b.

*Achaeus elongatus* Sakai, 1938: 223, fig. 13; type locality: between Ito and Hatusima, Japan, 100 metres, *Misago*.

**HOLOTYPE:** Female, length 8 mm. Macleay Museum, University of Sydney (see Griffin & Yaldwyn, 1965).

**TYPE LOCALITY:** Auckland, New Zealand.

**LOCALITIES SUBSEQUENTLY REPORTED:** Several localities in south-eastern Australia (Haswell; Miers; Whitelegge; and Rathbun); also Japan (Sakai) and probably Andaman Islands, north-western Indian Ocean (Alcock) and Iranian Gulf (Stephensen).

The species has not been recorded from New Zealand since the time of Haswell; Bennett (1964) has doubted its occurrence in these waters.

**DISTRIBUTION:** New Zealand, eastern Australia, Japan, perhaps extending to north-west Indian Ocean.

**DESCRIPTION:** Carapace elongate, subtriangular in dorsal aspect (length 1.3 times width), almost truncate anteriorly, branchial regions inflated; margins with few prominent spines and several spinules, dorsal surface weakly tuberculate, sparsely pubescent.

Rostrum of two very short, slender, acute, spines ( $\frac{1}{16}$  length of carapace), widely separate from base, distance between tips barely exceeding basal width of rostrum.

\* See Garth and Holthuis (1963) for note on validity of *Stenorhynchus* and related genera.

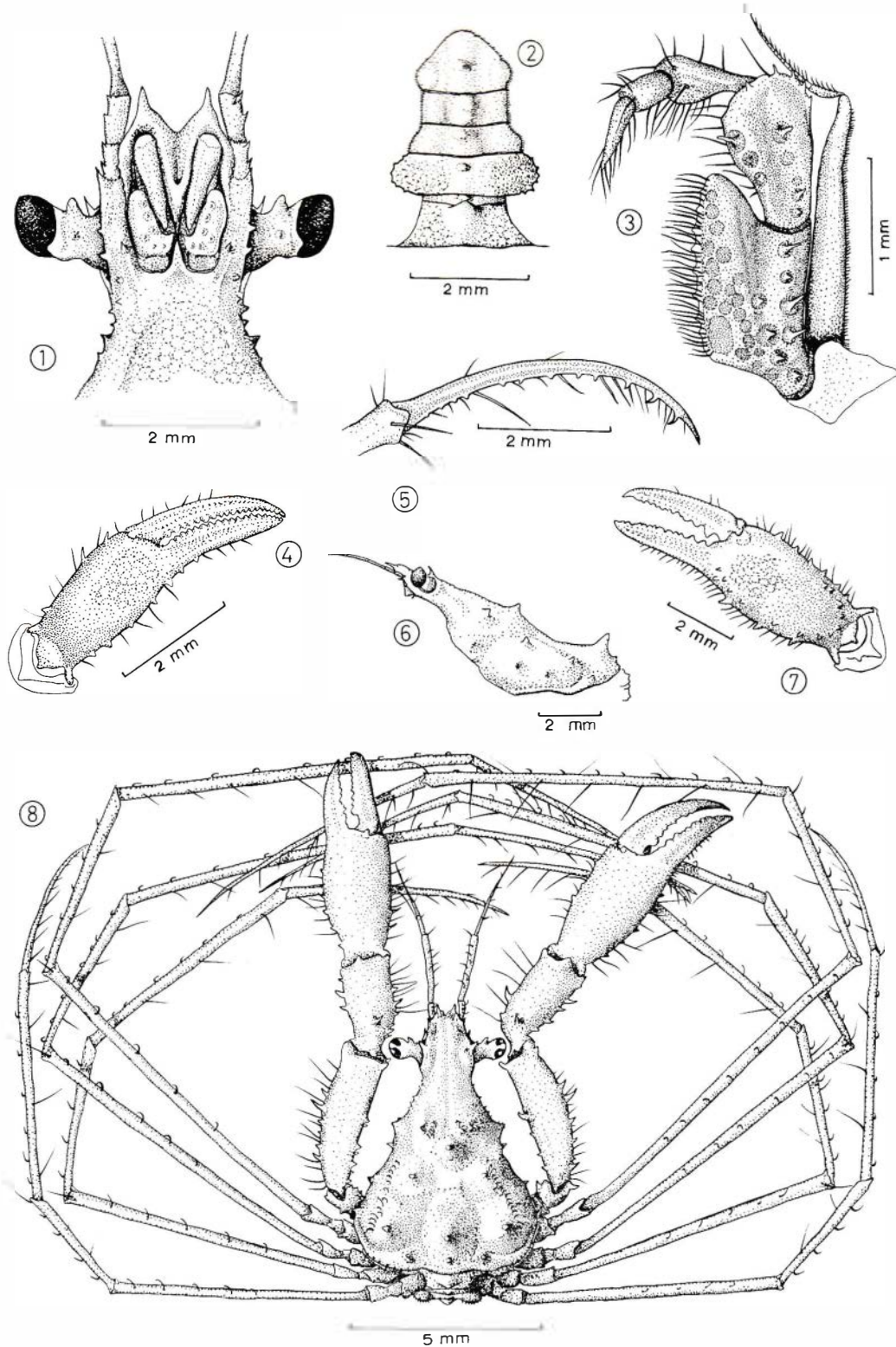


FIG. 5—*Achaeus fissifrons* (Haswell). 1—Ventral view of front. 2—Male abdomen. 3—Left third maxilliped. 4—Right chela of female. 5—Right fourth ambulatory leg, dactyl. 6—Lateral view of carapace. 7—Left chela of male. 8—Dorsal view of male. 4 from female, carapace length 7.2 mm; 8 from 8 mm male, remainder from 8.2 mm male, between Foxton and Wanganui, 50 fm.

Hepatic margin bearing a prominent acute spine surrounded basally by several smaller spinules of which one may be subequal with main spine. Branchial margin bearing two subequal spines toward posterior part of anterolateral margin, slightly longer than hepatic spine, the first at a lower level than other marginal spines.

Dorsal surface of carapace bearing a few prominent, scattered tubercles including a medial series of three: one far back on mesogastric region, one centrally surmounting tumid cardiac region sometimes bearing two small submedial spinules, and one very small intestinal; and a submedial series of two rather distant from midline: one protogastric anterior to mesogastric tubercle and one close to posterior margin of carapace on either side of intestinal tubercle; two further tubercles on branchial region on each side of midline and about midway between it and margin: one anteriorly not far behind mesogastric tubercle and one immediately in front of cardiac tubercle. Surface otherwise granular, smooth; regions moderately well demarcated.

Orbit consisting above only of narrow supraorbital eave bearing midway along a prominent, slender, supraorbital spine, weakly curved upward and forward, one or two smaller spinules both in front and behind main spine, and several small postorbital spinules of which one is noticeably larger than the others; incomplete below, eyestalk completely visible in both dorsal and ventral view, long and stout, bulbous basally, bearing midway along anterior surface a large blunt tubercle, a small tubercle opposite on both dorsal and ventral surfaces; cornea obliquely subterminal, slightly ventral, large, ovoid, a very small tubercle above at distal extremity of eyestalk.

Basal antennal article long and slender, subrectangular, anterolateral angle armed with a single, strong, forwardly directed spine, a small spinule close to medial edge near base, lateral edge armed with several spinules; outer surface weakly excavated as a wide shallow groove. Antennal flagellum completely visible on each side of rostrum, very long (about  $\frac{1}{2}$  length of carapace), slender; basal two segments short, stouter than following, bearing several short spinules laterally; third segment very long (almost  $\frac{1}{2}$  total length of flagellum); remaining segments diminishing.

Antennular fossae very large, longitudinally subovate; interantennular spine strong, projecting downward as a blunt tooth, anterior surface deeply excavate; anterior process of epistome short and slender, sharply pointed.

Epistome large; pterygostomial regions hardly separated from subhepatic regions, a small tubercle, visible in dorsal view behind marginal hepatic spine, midway along lateral margin.

Third maxillipeds almost meeting in midline. Ischium large, broadly subrectangular, medial half of distal edge greatly extended, rounded; medial edge coarsely toothed, teeth overlaid but not concealed by fringe of very long hairs; outer surface covered basally and toward medial and lateral edges by irregular flattened plates, basal and lateral plates bearing short, sharp spinules, distal medial

surface a shallow groove. Merus longitudinally subovate, as long as ischium and distally as wide as it, anterolateral edge bearing about four spinules; outer surface with a shallow longitudinal groove medially, a few plates and short spines bordering groove. Palp articulating at summit of and slightly longer than merus; cylindrical, stout, densely setose medially and laterally.

Chelipeds very long (almost twice length of carapace in adult male), stout, surfaces granular, spines and long hairs scattered along dorsal and ventral surfaces, a row of long and short spines along ventrolateral surface of merus and carpus, a long spine midway along dorsal surface of merus and several long spines near base of carpus toward, or on, dorsal surface, short spines along dorsal and ventral surfaces of palm. Merus about  $\frac{1}{3}$  total length of cheliped, carpus  $\frac{2}{3}$  merus, chela slightly less than  $\frac{1}{2}$  total length of cheliped, dactyl almost as long as palm in adult male, slightly longer in female; merus and carpus subtrigonal, ventral surface flat, propodus compressed, palm highest midway along. Fingers acute, curved inward distally, adjacent inner edges toothed irregularly for entire length, teeth larger basally.

Ambulatory legs of extreme length and slenderness. First leg the longest (almost 5 times carapace length), following legs decreasing, fourth the shortest (3 times carapace length); meri and propodi very long, dactyli almost straight in anterior legs, weakly falcate in posterior legs and ventrally spinulated for entire length, spinules small basally, larger and curved distally; short curled hairs scattered singly along dorsal surface of meri, carpi, and propodi, carpi and following segments bearing in addition scattered long hairs.

Abdomen of six segments in both sexes. Male abdomen with segments wider than long, segments 3 to 5 subequal, segment 2 very short, remaining segments about twice as long as segment 3; abdomen widest at middle of very wide, strongly convex segment 3, segment 4 narrowing abruptly, segment 5 with sides subparallel, last segment subtriangular, greatly widened basally; surface of abdomen elevated medially as a ridge surmounted distally in segment 1 and 3 to 5 by a strong tubercle, segment 2 lacking a tubercle, last segment with tubercle central; lateral surfaces of segment 3 elevated, spinulous, lateral surfaces of last elevated, smooth.

Male first pleopod slender, bulbous basally, outwardly curved, compressed and weakly expanded distally, fleshy flaps of expansion enclosing a long narrow groove on sternal surface somewhat medially, aperture subterminal, at end of groove; tip of pleopod narrowing abruptly, bluntly pointed; surface naked except for a few minute setae along abdominal surface close to tip.

COLOUR: Preserved specimens a dull creamy white.

MATERIAL EXAMINED: A total of 12 specimens apart from the holotype from New Zealand and a large series from Australia, as follows:

DOMINION MUSEUM COLLECTIONS: Between Foxton and Wanganui, 50 fm, bottom of mud and coralline alga and sponge, trawled. MT *Admiral*, 7 Jun 1956, 10 males. 2 females (Z.Cr.

1113, 1114), male 6.5-8.2 mm, female 5, 7.2 mm (two males from this series are now in the Australian Museum, Sydney). From Cape Brett to Farewell Spit (five localities) (Griffin and Yaldwyn 1965).

AUSTRALIAN MUSEUM COLLECTIONS: 33 specimens (11 males, 22 females (17 ovigerous)), from ten localities from 11 miles SE of Crowdy Head, New South Wales, to Bass Strait.

MEASUREMENTS: Study male: length 8 mm, width 6 mm, rostral length 0.5 mm, rostral width 1 mm, cheliped 16 mm, chelar length 7 mm, chelar height 2 mm, dactyl 3.5 mm, first ambulatory leg 38.5 mm.

Female: length 7.2 mm, cheliped 10 mm.

HABITAT: The ecology of this species is discussed elsewhere (Griffin and Yaldwyn, 1965).

DEPTH: Continental shelf, down to 92 fm.

REMARKS: The synonymy of this species is discussed in detail elsewhere (see Griffin and Yaldwyn, 1965). The recently collected New Zealand material proves, on comparison with Haswell's holotype of *Stenorhynchus fissifrons*, to be conspecific with that species although comparison with his description (Haswell, 1879) alone was inconclusive. No important differences exist between *A. fissifrons* and *A. tenuicollis* Miers, 1886, according to the original and later descriptions of that species. Sakai (1938) described a new species from Japan, *A. elongatus*, after comparison with Australian material of *A. tenuicollis* from the Australian Museum. Examination of the remainder of the series, from which the material lent to Sakai was selected, shows that the supposed differences between the two are absent or else not important enough to warrant full specific status for Japanese material.

*A. fissifrons* is somewhat variable in a few features which have previously been considered sufficient to warrant the setting up of distinct species. While most specimens possess numerous postorbital spinules, in some there are only one or two; the prominent cardiac tubercle is occasionally surmounted by two small submedial spinules; in the fourth ambulatory leg the distal two, rarely three, spines of the dactyl are clearly larger than the other more proximal (basal) ones, while sometimes the proximal series may be reduced or absent.

The most closely related species appears to be the much stouter Japanese *A. akanensis* Sakai.

#### Subfamily OREGONIINAE Garth, 1958

*Inachinae* Alcock, 1895 (part: *Oregonia*) + *Pisinae* Alcock, 1895 (part: *Hyas* + *Chionocoetes*).

*Oregoniinae* Garth, 1958: 134.

Male abdomen terminally broadened, last segment subquadrate or transversely ovate, invaginated into sixth segment, its outer border emarginate or introverted.

Male first pleopod lanceolate, longitudinally grooved, provided with numerous filamentous setae, and having a bulbous base. (Garth.)

In addition to the above two characters, evidence for the close relationship of the three genera has been found

in the larval stages. Further details of the subfamily are given by Garth (1958, p. 134). The distribution of the subfamily is circum-Arctic; there are no representatives in New Zealand.

#### Subfamily OPHTHALMIINAE Balss, 1929

*Stenocionopinae* Miers, 1879c: 652.

*Stenocionopoida* Alcock, 1895: 161, 166.

*Ophthalmiinae* Balss, 1929: 6 (Name substituted for *Stenocionopinae* Miers to conform with substitution of *Ophthalmias* for *Stenocionops* Latreille by Rathbun, 1897: 157). Sakai, 1938: 243. Garth, 1958: 161.

Orbit consisting, if complete, of supraorbital eave and postorbital spine, intercalated spine absent. . . . Longer accessory spinules or spine-like growths usually present on supraorbital eave and postorbital spine. Carapace elongate; anteriorly somewhat narrow or constricted, posteriorly often with a median spine or tubercle. (Balss, modified after Garth.)

This subfamily differs from Alcock's alliance in content only, Rathbun (1925) having placed *Eucinetops* Stimpson in the Inachinae and Balss (1929) having removed *Paramicippa* H. Milne Edwards to the Mithracinae. Balss considered the genera of this subfamily to be derived from the inachine *Naxia* and to include *Pseudomicippe* Heller, *Picroceros* A. Milne Edwards, *Silbo-gnathus* von Martens, *Tyche* Bell, *Cyclocoeloma* Miers, and several others. The subfamily is represented in the eastern Pacific by two genera, in the western Atlantic by three genera, and there are several Indian Ocean genera. The New Zealand fauna possesses no representatives.

#### Subfamily ACANTHONYCHINAE Alcock, 1895

*Acanthonychinae* Alcock, 1895: 160, 164, 190. Rathbun, 1925: 140. Hale, 1927: 132. Balss, 1929: 8. Sakai, 1938: 252. Bouvier, 1940: 347. Stephensen, 1945: 99, 218. Richardson, 1949b: 63. Garth, 1958: 181.

*Acanthonychidae* Stebbing, 1910: 286. Barnard, 1950: 35.

Eyes without true orbits; eyestalks very short or sometimes even obsolescent, either concealed beneath a forwardly produced supraorbital spine, or sunk in the sides of a huge, beak-like rostrum; postorbital spine or process sometimes present, but not excavated for reception of retracted eyestalk. Basal antennal article truncate-triangular. External maxillipeds with merus as broad as ischium. Dactyli of ambulatory legs prehensile or subchelate; last three pairs of legs often disproportionately short compared with first pair. (Alcock.)

Rostrum either simple or two-spined. Palp of external maxillipeds arising from anteromedial angle of merus. (Rathbun.)

Pleopod 1 medium stout, apex most varying (hammer-shaped, divided into three or four lobes, etc.). Pleopod 2 short. (Stephensen.)

This subfamily is best represented in the western Atlantic, eastern Pacific and north-western Indo-Pacific regions. The New Zealand fauna contains no representa-



tives. Reasons for removing *Huenia bifurcata* from the New Zealand list have been given by Bennett (1964).

#### Subfamily PISINAE Alcock, 1895

*Pisinae* Alcock, 1895: 165, 200. Rathbun, 1925: 193. Hale, 1927: 134. Balss, 1929: 11. Bouvier, 1940: 326. Richardson, 1949b: 63. Garth, 1958: 248.

*Pisinae sensu stricto* Balss. + *Hyasteniinae* Balss, 1929: 11, 14. Sakai, 1938: 266, 277. Stephensen, 1945: 218.

*Blastidae* Stebbing, 1905: 25. Barnard, 1950: 48.

Eyes with commencing orbits, one of the most characteristic parts being a large, blunt, usually isolated and cupped, postorbital tooth or lobe into which the eye is retractile, but never to such an extent as to completely conceal cornea from dorsal view; also almost always a prominent supraorbital eave, anterior angle sometimes produced forward as a preorbital spine. Eyestalks short. Basal antennal article broad, at least at its base, its anterior angle produced to form a tooth or spine. Merus of third maxillipeds, owing to expansion of anterolateral angle, broader than ischium, palp arising from antero-medial angle. Rostrum two-spined. Legs often very long. (Alcock, modified after Garth.)

Pleopod 1 medium stout to slender, usually apically somewhat tapering, but apex extremely varying (blunt, acute, filiform, straight, geniculate, etc.). Pleopod 2 short. (Stephensen.)

Garth (1958) has found that the division of the Pisinae into two, on the basis of presence or absence of an intercalated supraorbital spine, by Balss (1929) is not supported by pleopod characters. While the American genera may be divided into two major groups more or less equally distributed between the two subdivisions of Balss, a third small group showing some affinities with two mithracine genera remained. Moreover, in one species, *Notolopos lamellatus* Stimpson, the presence or absence of an intercalated spine was found to be subject to geographical variation. The subdivisions of Balss are therefore not accepted.

The Pisinae is one of the largest of the majid subfamilies in terms of numbers of genera. Richardson (1949b) included three genera of this subfamily each with single species from New Zealand, *Jacquinotia*, *Hyastenus*, and *Acanthophrys*. *Jacquinotia* is currently placed in the Mithracinae following its inclusion as *Prionorhynchus* in the Periceridae by Miers (1879c: 622) and later authors. *Hyastenus*, though remaining in this subfamily, is no longer regarded as represented in New Zealand, though several species are known from Australia. The species formerly placed in *Acanthophrys* is herein referred to *Chlorinoides* Haswell, a majine genus. Bennett (1964) regarded the subfamily Pisinae as absent from New Zealand, but *Eurynolambrus australis* Milne Edwards & Lucas, treated as a parthenopid by all authors until recently, has been transferred to the Pisinae by Kreff (1952). Very recently a single new species of the genus *Eurynome*, formerly unknown from these waters, has been found in deep water in Cook Strait. The New Zealand

fauna thus includes two pisine genera each represented by a single species.

#### KEY TO NEW ZEALAND GENERA OF THE SUBFAMILY PISINAE

- 1 (2) Rostrum of two distinct spines. Intercalated spine reaching rim of supraorbital margin. Basal antennal article truncate anteriorly. Carapace pyriform, longer than broad. .... **Eurynome** Leach, 1814
- 2 (1) Rostrum of two short, closely approximated lobes fused basally. Intercalated spine excluded from rim of supraorbital margin. Basal antennal article produced as a rounded lobe anteriorly. Carapace broadly subtriangular, much wider than long. .... **Eurynolambrus** H. M. Edw. & Lucas, 1841

#### Genus *Eurynome* Leach, 1814

*Eurynome* Leach, 1814: 431; 1815a: 325. Miers, 1879c: 659. Balss, 1929: 12. Bouvier, 1940: 340. Barnard, 1950: 54. Hartnoll, 1961: 172. Griffin, 1964: 196.

**DESCRIPTION:** Carapace pyriform or subpyriform, ornamented with boletate (mushroom-shaped) tubercles and spines. Rostrum of two distinct, acute spines separated by a U-shaped hiatus. Supraorbital margin comprising eave, intercalated spine and postorbital spine, intercalated spine usually reduced in the adult. Basal antennal article as wide as long, narrowed and truncate anteriorly. Infraorbital margin formed by basal article and a small infraorbital spine. Chelipeds in male much longer than ambulatory legs, only slightly longer in female; longitudinal rows of spines on merus, carpus, and propodus. Abdomen of seven distinct segments in both sexes. Male first pleopod with a slight S-bend, tip pointed, recurved laterally just basal to tip. (Hartnoll, modified.)

**RANGE:** East Atlantic, Mediterranean, Indo-west Pacific.

**TYPE SPECIES:** *Cancer asper* Pennant, 1777, by monotypy; an east Atlantic species.

**REMARKS:** In a recent review of the genus (Griffin, 1964) the nine species at present included have been divided into four groups or sections. Of the nine species it has been recommended that one, the Red Sea *E. verhoeffi* Balss, 1929, be excluded, since it differs from all the other species in the number of free abdominal segments, and also in the form of the rostrum, basal antennal article, and eyestalk. Another species, at present placed in a separate genus, *Chionognathus reini* (Balss, 1924), shows many similarities to the sole Australian representative of the genus, *E. granulosa* Baker, 1906, and should probably therefore be transferred back to *Eurynome* in which genus it was originally placed. The small pyriform carapace covered by groups of flat-topped tubercles or plates, or in some cases simple tubercles, is generally taken as the diagnostic character of the genus, but the male first pleopods are known in but a few species and may be expected to throw some light on their interrelationships.

The precise status of several species still remains uncertain.

Only two species are known from New Zealand and Australian waters.

KEY TO NEW ZEALAND AND AUSTRALIAN SPECIES OF THE GENUS *Eurynome*

(New Zealand species shown in bold face and treated here)

- 1 (2) Carapace covered by flat-topped tubercles arranged in definite groups. Chelipeds and ambulatory legs strongly tuberculate on all surfaces, a double row of larger tubercles on dorsal surface of ambulatories. First segment of abdomen in both sexes with a pair of large, smoothly rounded tubercles visible in dorsal view. .... ***E. bituberculata*** Griffin, 1964
- 2 (1) Carapace covered by simple, round or oval tubercles arranged in groups in midline only. Chelipeds and ambulatory legs smooth. First segment of abdomen with a single medial tubercle. .... *E. granulosa* Baker, 1906

***Eurynome bituberculata*** Griffin, 1964. Figs. 6, 7, 20.

HOLOTYPE: Female, length 11.5 mm, in the collections of the Dominion Museum, Wellington (Dom. Mus. No. Z.Cr. 1067—specimen in spirit).

TYPE LOCALITY: Off Glen Burn (East Wairarapa Coast, North Island, New Zealand), in 100 fm; R. A. Wilten, collector (12 Sep 1961).

PARATYPES: A total of eight specimens, apart from the holotype, have been examined, and are located in the following collections:

VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COOK STRAIT COLLECTIONS: Coll. VUZ 55, off Cape Palliser. 40–100 fm, 1 female, 13 mm.

DOMINION MUSEUM COLLECTIONS: 2 females, 9–11.5 mm with the same data as that of the holotype.

N.Z. OCEANOGRAPHIC INSTITUTE COLLECTIONS: Sta. B314, off Cape Egmont, 126–137 fm, 5 males, 9–11.5 mm.

DESCRIPTION: Carapace pyriform in dorsal aspect (length almost 1.2 times width), anterolateral margins barely longer than posterolateral, surface setose, bearing flat-topped tubercles, flattened lobes and short conical spines; weakly swollen and almost uniformly convex in profile. Rostrum of two short, flattened truncate lobes ( $\frac{1}{2}$  length of carapace), separated from base by a U-shaped hiatus, margins weakly expanded laterally to within a short distance of the tip and weakly convergent, distance between tips half basal width. Lateral margins of carapace with three prominent, subequal, triangular, flattened lobes situated subequidistantly, one postorbital, one hepatic and one branchial at the widest part of carapace; a fourth branchial lobe, slightly less flattened, situated subdorsally behind marginal lobe and surrounded by flat-topped tubercles. Surface and margins of carapace bearing numerous short tubercles with expanded, subcircular, irregularly crenulate, flat tops, those of dorsal surface arranged in groups on gastric, cardiac, intestinal, branchial and hepatic regions, groups separated from each other by wide, smooth areas; mesogastric region with seven medial

tubercles increasing irregularly in size posteriorly, the fourth with a tubercle on each side of it and just behind, the second to last with two tubercles in a line on each side of it so forming the apex of an upright V, last median tubercle with two tubercles on each side of it, one just in front and one just behind; protogastric region with a single tubercle at base of intercalated supraorbital spine; cardiac region with a group of eight large, closely spaced tubercles arranged in a double row; branchial regions each with two main groups of tubercles, one, of six or more, situated posteriorly, and a smaller group of four

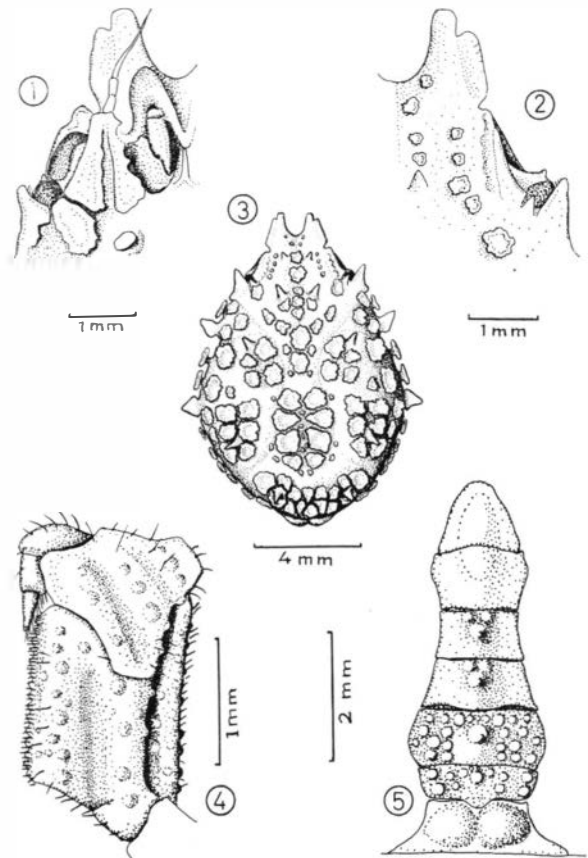


FIG. 6—*Eurynome bituberculata* Griffin. 1—Ventral view of orbit. 2—Dorsal view of orbit. 3—Dorsal view of carapace. 4—Left third maxilliped. 5—Male abdomen. 4 from female paratype, carapace length 13 mm, off Cape Palliser, 40–100 fm; 5 from 11.5 mm male paratype, off Cape Egmont, 126–137 fm; remainder from holotype female.

anteromedially, several other tubercles along lateral margin; hepatic region with three subdorsal tubercles, two submarginal and one between, so forming a transverse V. Lateral margin of carapace with 9 or 10 flat-topped tubercles, one between postorbital and hepatic lobes, two between hepatic and branchial lobes, and 6–7 along posterolateral margin. Dorsal surface of carapace also bearing three pairs of short, conical, submedial spines; two protogastric, the first at base of rostral spines and the second opposite postorbital lobe; and one intestinal almost at widest part of intestinal tubercles; a pair of widely

paced similar tubercles situated subdorsally on anterior part of branchial region just behind marginal hepatic lobe.

Orbit consisting above of supraorbital eave, intercalated spine and postorbital lobe, the three closely approximated and separated only by narrow fissures; supraorbital eave narrow, lacking spines; intercalated spine small, flattened, triangular; postorbital lobe flattened, wide-based and acuminate, anterior edge excavated, edge of excavation fringed by hairs. Eyestalk stout, bulbous basally, cornea terminal, circular, a small tubercle above at distal extremity of eyestalk. Orbit completed below by basal antennal article and an irregularly shaped infraorbital plate.

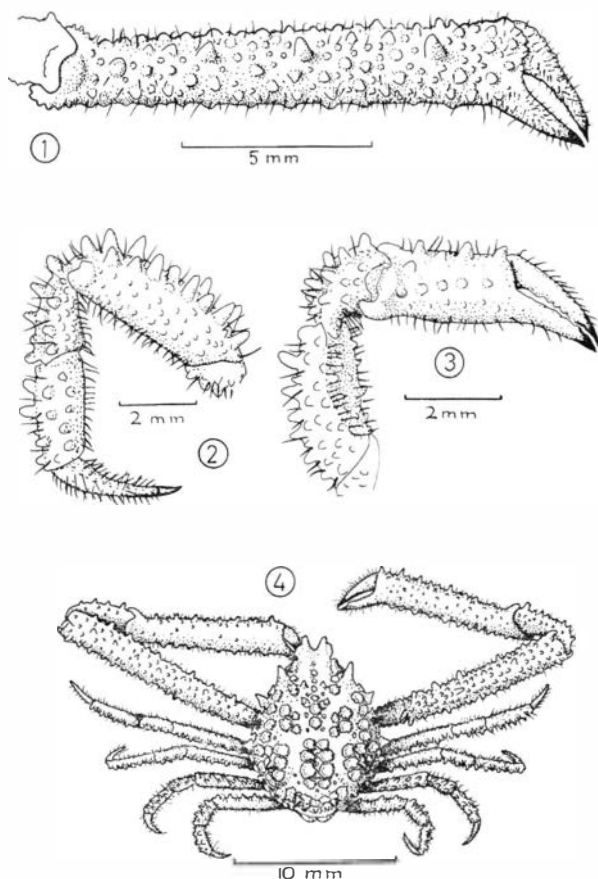


FIG. 7—*Eurynome bituberculata* Griffin. 1—Right chela of male. 2—Left first ambulatory leg. 3—Right cheliped of female. 4—Dorsal view of male. 1 from 11.5 mm male paratype; 2 and 3 from 13 mm female paratype; 4 from 11 mm male paratype.

Basal antennal article subtriangular, truncate anteriorly, medial edge irregularly emarginate, surface deeply excavated medially as a narrow, longitudinal groove; flagellum short, extending for a short distance beyond rostrum, mostly concealed in dorsal aspect, basal two segments longer and stouter than following.

Antennular fossae subovate, anterior rim extended downward and forward as a flattened curved crest; interantennular spine short, downwardly projecting, bluntly

pointed; anterior process of epistome narrow, sharply pointed.

Epistome as wide as long; rim of opening of green gland elevated. Mouthfield subquadrate, anterior margin transverse, anterolateral angle elevated and extended laterally as a flattened, subtriangular plate. Pterygostomian regions subtriangular, a row of three small flat-topped tubercles along lateral margin. Subhepatic regions weakly inflated, separated from pterygostomian regions by a prominent groove, bearing two flat-topped tubercles of which anterior is larger. Sternum densely setose.

Third maxillipeds almost meeting in midline. Ischium subrectangular, medial half of distal edge greatly extended anteriorly and rounded, lateral half weakly concave to bear merus, medial edge finely toothed, overlain and almost concealed by a fringe of short hairs, short hairs also scattered over surface. Merus subquadrate, as wide as, but slightly shorter than, ischium, anterolateral corner sharply angled and strongly expanded laterally, medial edge rounded, distal edge weakly notched, outer surface with a shallow longitudinal groove, blunt tubercles scattered along each side of groove, a few long hairs arising close to lateral edge. Palp arising from middle of distal edge of, and slightly shorter than, merus, subcylindrical and moderately stout, long hairs scattered along lateral surface.

Chelipeds very long (3 times carapace length in adult male), slender, subcylindrical except for weakly compressed propodus, covered by numerous blunt tubercles. Ischium extending along ventral surface of merus for a short distance; merus very long, nearly  $\frac{1}{2}$  total length of cheliped, carpus about  $\frac{1}{6}$  merus, chela slightly shorter than merus, dactyl slightly less than  $\frac{1}{3}$  palm; fingers acute, smooth along inner edges in adult male, otherwise weakly toothed, moderately gaping, meeting only at blackened tips. Chelipeds no longer than carapace in female.

Ambulatory legs short, cylindrical, somewhat compressed, meri rather flattened ventrally, all surfaces covered by short blunt tubercles, longer blunt tubercles arranged in two longitudinal rows on dorsal surface. First leg the longest, as long as, or slightly longer than, carapace, following legs decreasing in length posteriorly, last slightly more than  $\frac{1}{2}$  length of carapace; meri about  $\frac{1}{3}$  total length of leg, carpi and propodi subequal, about  $\frac{1}{2}$  length of meri; dactyli  $\frac{1}{2}$  propodi, smooth, terminating in a sharp claw.

Abdomen of seven segments in both sexes, segment 1 wide basally, narrowing distally, surface almost entirely occupied by a pair of very large, smoothly rounded, transversely subovate tubercles visible in dorsal aspect. Male abdomen narrow, segments longer than wide, segments 3 to 7 subequal in length, segment 2 slightly shorter; widest close to base of segment 3, following segments narrowing, abruptly at first, to base of slightly distally widened segment 6, segment 7 elongate subtriangular. Segments 2 to 5 bearing several tubercles arranged in a prominent group occupying medial distal part of segment, lateral areas of segments 2 and 3 densely covered by numerous small tubercles, segment 6 weakly elevated in

midline, surface of abdomen otherwise smooth. Female abdomen broad, covering sternum, subovate, elevated in midline as a longitudinal ridge.

Male first pleopod S-shaped, weakly compressed, bulbous basally, slender and outwardly curved distally, tip diverging as two short, pointed lobes, medial lobe continuing on for short distance after divergence, lateral lobe weakly recurved; aperture subterminal, lateral, at divergence of two lobes, almost concealed by a short, spoon-shaped process which extends out just basal to it; basal half of lateral surface and basal third of medial surface fringed by very long plumose setae, a patch of long simple setae on lateral surface of medial divergent lobe, distal third of sternal surface with minute setae close to medial and lateral surfaces. (Note: In the original description of this species in *Crustaceana* 6(3), 1964:202, the figures of the male first pleopods are incorrectly designated—fig. 10 is of the abdominal aspect (not sternal) and fig. 11 of the sternal aspect.)

**COLOUR:** Preserved specimens a pale salmon pink, tubercles white.

**MEASUREMENTS:** Female holotype: length 11.5 mm, width 8.5 mm, cheliped 10 mm, first ambulatory leg 11 mm.

Largest male (N.Z.O.I. Sta. B 314): length 11.5 mm, width 8 mm, rostral length 2 mm, rostral width 3 mm, cheliped 33.5 mm, chelar length 14 mm, chelar height 2 mm, dactyl 3.5 mm, first ambulatory leg 16.5 mm.

**HABITAT:** So far this species has been taken on bottoms of sponges, and on muddy sand with broken shell.

**DEPTH:** Lower continental shelf and upper archibenthal, 40 to 140 fm.

**REMARKS:** This species shows constancy in number and position of the principal tubercles of the carapace as does *E. aspera* (see Hartnoll, 1961, p. 173). The smaller tubercles vary in number and size, though to what extent is uncertain at present. Those tubercles showing variation in number include those along the posterolateral margins and the anteromedial protogastric ones. The larger tubercles also vary in size, e.g., of the four forming a group near the anteromedial part of the branchial region, the medial two are larger than the others in the holotype (female), while precisely the opposite is the case in the males from the collections of the N.Z. Oceanographic Institute. The latter specimens also have the rostral spines finely serrate along the medial edge and not entire as in the holotype. Changes associated with growth in *E. bituberculata* include a blunting of the emarginations of the flat-topped tubercles of the carapace and a decrease in the prominence of the spines of the propodus of the cheliped and in the coarseness of the teeth of the fingers of the chelae. The relative length of the spinous tubercles which form dorsal rows along the ambulatory legs remains almost unchanged, differing little in young and adult specimens. The most outstanding features of this species are the truncate rostral spines and the pre-

sence of the two tubercles on the first abdominal segment from which it derives its specific name. As these two tubercles are visible in dorsal view and are usually rather pale in comparison with the rest of the carapace, field identification of this species is a simple matter.

*E. bituberculata* appears closely related to the Atlantic species, *E. aspera*, but surprisingly not to the South Australian, *E. granulosa*. However, a species of *Eurynome*, *E. erosa* A. Milne Edwards, 1873, is known from Samoa, and as suggested elsewhere (Griffin, 1964) is probably conspecific with *E. aspera*.

#### Genus *Eurynolambrus* H. Milne Edwards and Lucas, 1841

*Eurynolambrus* H. Milne Edwards and Lucas, 1841: 479. Miers, 1876b: 12; 1879c: 669. Chilton and Bennett, 1929: 59. Richardson, 1949b: 61. Krefft, 1952: 574. Bennett, 1964: 63.

**DESCRIPTION:** Carapace subtriangular, much broader than long, branchial regions expanded laterally over ambulatory legs, depressed. Rostrum of two short, triangular lobes, closely approximated, fused basally, separated by a narrow V-shaped hiatus distally. Supraorbital margin consisting of eave, intercalated spine and postorbital lobe, the three closely approximated, intercalated spine completely excluded from rim of orbit. Basal antennal article broad basally, narrow distally and produced as a small lobe. Ambulatory legs expanded laterally and medially as prominent, sharp, longitudinal crests. Abdomen of seven segments in both sexes.

**RANGE:** New Zealand, restricted.

**TYPE SPECIES:** *Eurynolambrus australis* H. Milne Edwards and Lucas, 1841, by monotypy; a restricted New Zealand species.

**REMARKS:** Because of the very broad carapace, this monotypic genus has, until very recently, been considered to belong in the Parthenopidae, although Miers (1879c, p. 669) believed it more closely allied to the genus *Cancer*, a brachyrhynchous type, than to any oxyrhynch. However, Krefft (1952) undertook a detailed study of the early post-larval stages of *E. australis*, which showed conclusively that *Eurynolambrus* belonged most appropriately amongst the pisine genera of the Majidae. These early postlarval stages have a pyriform carapace bearing groups of hooked or curled hairs, and a double rostrum, while the first pleopod of the male is long and the second short. All of these characters are in strong contrast to those shown by parthenopid genera. During growth the carapace changes considerably in shape, becoming very broad, smooth and almost completely devoid of curled hairs, while the two spines of the rostrum become almost completely fused to form a very short, distally bifid lobe.

Close study of the adult of *E. australis* confirms Krefft's conclusions. The basal antennal article is fused to the epistome and the front, as in nearly all majids, and is typically pisine in shape, i.e., broad basally, narrow distally; the antennules fold longitudinally, not obliquely.

and as already pointed out the male pleopods are unequal in length as in other majids.

***Eurynolambrus australis*** H. Milne Edwards and Lucas, 1841. Figs. 8, 19.

*Eurynolambrus australis* H. Milne Edwards and Lucas, 1841: 481, pl. 28 figs. 14, 15. Dana, 1852: 141, pl. 6 figs. 9a-c. Miers, 1876b: 12. Filhol, 1885: 8; 1886: 371, pl. 43 figs. 7-9, Lenz, 1901: 458. Thomson, 1913: 237. Chilton and Bennett, 1929: 743. Richardson, 1949b: 61, fig. 38. Krefft, 1952: 575, figs. 1-12. Dell, 1960: 5. Bennett, 1964: 63, fig. 127.

**HOLOTYPE:** Male, length 1 in. (25.5 mm), width 1½ in. (42 mm). Muséum National d'Histoire Naturelle, Paris.

**TYPE LOCALITY:** New Zealand.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS:** New Zealand (Miers). Northern: Cape Maria van Diemen (Chilton and Bennett). Bay of Islands (Dana). Central: Kapiti Island (Chilton and Bennett). Wellington, F. G. Maskell; Cook Strait; Blind Bay to Golden Bay, *Doto* Exped. (Bennett). Cook Strait; Massacre Bay (Filhol). French Pass; Akaroa (Lenz). Sumner, Banks Peninsula, F. W. Hutton (Chilton and Bennett). Southern: Otago coast, very occasionally met with (Thomson). Near Oamaru, 20 fm. Capt. Bollons; Moko Hinau, C. R. Gow (Chilton and Bennett). Off Otago Heads, D. H. Graham; Foveaux Strait (Bennett). Stewart Island (Filhol; Chilton and Bennett). Chatham Islands: Chatham Islands, F. W. Hutton, W. M. Young, Miss S. D. Shand, Otago Inst. 1924 Exped. (Chilton and Bennett; Bennett). Wharekauri (Young, 1929). Chatham Islands 1954 Exped. *Sta's 26* (Waitangi, low tidal), 49 (Port Hutt) (Dell).

**DISTRIBUTION:** New Zealand, from Cape Maria van Diemen to Stewart Island, also Chatham Islands; restricted.

**DESCRIPTION:** Carapace very broadly subtriangular (width almost 1.6 times length), depressed, branchial regions greatly expanded laterally on each side to overhang ambulatory legs, scalloped. Rostrum subtriangular, of two short lobes ( $\frac{1}{20}$  length of carapace), weakly flattened, fused basally, depressed distally, separated by a narrow groove basally and a V-shaped hiatus distally; basal width 4 times distance between tips, twice length of rostrum.

Dorsal surface of carapace naked, sloping steeply anteriorly and posteriorly, weakly concave medially. Anterolateral margins rounded, posterolateral margins coarsely scalloped to form four short, subequidistant, flattened, sharply pointed teeth, posterior intestinal margin weakly concave. Regions of dorsal surface poorly marked; four large shallow depressions, two on each side of the midline, a pair of small rounded protogastric depressions and a pair of larger crescent-shaped branchial depressions, surface of the carapace densely covered everywhere except in the depressions by small tubercles.

Orbit consisting above of supraorbital eave, intercalated spine and postorbital lobe; supraorbital eave wide, lateral margin weakly concave; intercalated spine small, triangu-

lar, completely excluded from rim of orbit; postorbital lobe not laterally produced, excavated anteriorly to receive cornea of eyestalk. Orbit circular and deep, incompletely formed below by basal antennal article, eyestalk almost completely visible in ventral aspect; cornea terminal, circular.

Basal antennal article wide basally, narrow distally, lateral edge concave, anteriorly produced as a rounded tubercle; flagellum arising from anteromedial angle of basal article, slender, short, as long as basal article, first two segments longer and stouter than following.

Antennular fossae subtriangular; interantennular spine weakly developed, downwardly produced, bluntly pointed; anterior process of epistome narrow, bluntly pointed.

Epistome wider than long. Mouthfield subrectangular, narrowing slightly posteriorly. Pterygostomian regions subtriangular, separated from inflated subhepatic regions by a very deep groove; surface, and especially lateral margins, covered by short hooked hairs. Anterior part of subbranchial regions very deeply excavated as a round depression, lower margins covered by hooked hairs.

Third maxilliped almost meeting in midline. Ischium large, subrectangular, medial edge coarsely toothed, overlain and completely concealed by several fringes of long and short hairs, medial half of distal edge weakly extended anteriorly, rounded, lateral half straight to bear merus; outer surface irregularly pitted, a shallow wide longitudinal groove medially, scattered short hairs on surface. Merus subquadrate, as wide as ischium but slightly shorter, anterolateral corner rounded, very weakly expanded laterally, medial edge rounded, distal edge deeply notched, a minute blunt tooth at lateral angle of notch; outer surface pitted; short hairs along lateral edge and outer surface close to anterolateral, distal, and medial edges. Palp arising from notch of merus, barely longer than merus, subcylindrical, moderately stout; lateral surface covered by hairs, long basally, short distally, a dense fringe of long hairs arising from medial surface.

Sternum broadly triangular anteriorly to form posterior border of mouthfield, excavated anteriorly in front of abdominal fossae as a rounded depression, following sternites excavated anteriorly as transversely oval pits, pit occupying anterior part of each sternite, anterior edge of pit formed by posterior edge of preceding sternite.

Chelipeds stout, long (1.8 times carapace length in male), subcylindrical except for compressed propodus, surfaces irregularly tuberculated and ridged. Basis and ischium short, ischium extending along ventral surface of merus for  $\frac{1}{2}$  length of that segment. Merus long, hardly more than  $\frac{1}{2}$  total length of cheliped, carpus  $\frac{1}{2}$  length of merus, chela about twice merus, palm enlarged distally in male, diminishing distally in female, weakly compressed, surfaces irregular, covered by low ridges. Fingers acute, weakly curved inward at tips, closely approximated, inner edges finely toothed for their entire length; dactyl as long as palm.

Ambulatory legs short, weakly compressed, the lateral and medial surfaces of all segments except dactyli greatly

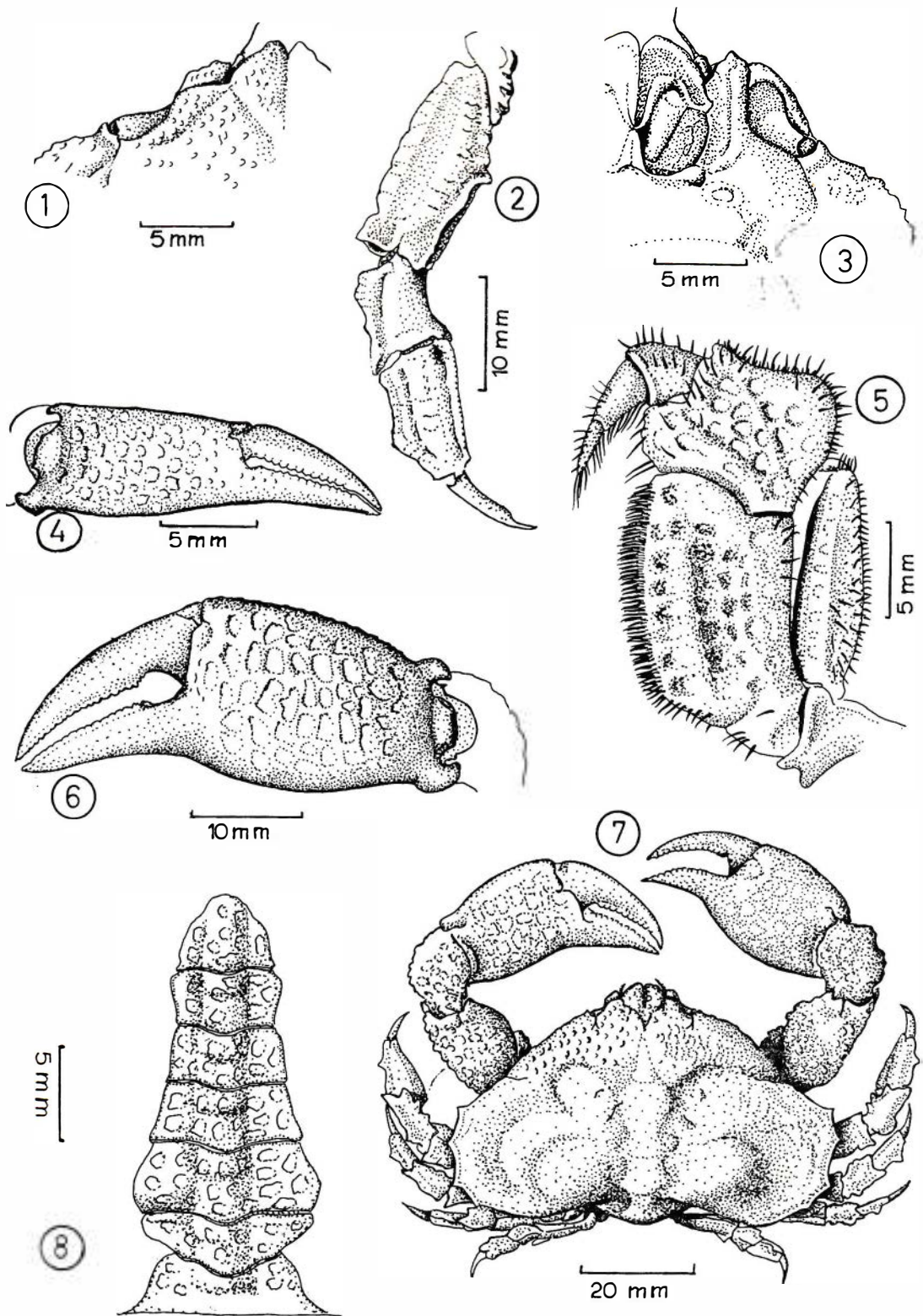


FIG. 8.—*Eurynolambrus australis* H. Milne Edwards & Lucas. 1—Dorsal view of orbit. 2—Right first ambulatory leg. 3—Ventral view of orbit. 4—Right chela of female. 5—Left third maxilliped. 6—Left chela of male. 7—Dorsal view of male. 4 from female, carapace length 32 mm, remainder from 41.5 mm male, Lyall Bay, Wellington.

expanded laterally as sharp, irregularly emarginate crests, meri of first two legs with a few blunt tubercles along dorsal surface. Bases and ischia short, meri long, about  $\frac{1}{3}$  total length of leg, carpi  $\frac{1}{2}$  length of meri, propodi barely longer than carpi, dactyli not quite as long as propodi, cylindrical, terminating in a sharp claw.

Abdomen of seven segments in both sexes. Male abdomen narrow, segments wider than long, subequal in length, segment 1 wide basally, narrow distally, segment 2 subtriangular, widening abruptly distally; abdomen widest at middle of laterally convex segment 3, thereafter narrowing, abruptly at first, to base of segment 6, margins of which are subparallel, segment 7 subtriangular, tip convex; surface weakly elevated in midline in all segments as a low, rounded ridge, further elevated distally as a wide tubercle, surface otherwise pitted. Female abdomen broad, subovate.

Male first pleopod bulbous basally, outwardly curved distally, moderately stout, medial portion extended distally as a slender, weakly recurved process, lateral portion widely expanded distally to form a wide flap of tissue lying close beneath medial portion and covered thickly by minute setae, aperture located subterminally between slender medial portion and expanded lateral portion; setae extending down medial surface, becoming longer basally; a groove extending down abdominal surface toward medial surface.

**COLOUR:** Claws purple, inner margins white (Hutton, ms. in Chilton and Bennett, 1929). Bright red with lighter yellow markings (Graham ms. in Bennett, 1964). Most specimens I have seen were pale orange to red, flecked with white.

**MATERIAL EXAMINED:** A total of 19 specimens as follows:

**VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COOK STRAIT COLLECTIONS:** Coll. VUZ 4, off Rangitoto Island, 40–50 fm, 3 females, 14–20 mm.

**DOMINION MUSEUM COLLECTIONS:** Ex trawlers, Napier, A. G. Clark, pres. J. C. Yaldwyn, 1 male (Cr. 701), 39.5 mm; Lyall Bay, Wellington, 28 Dec 1948, under rocks at extreme low tide, R. K. Dell, 1 male, 41.5 mm, 2 females, 22, 32 mm; Lyall Bay, Wellington, 8 Jan 1950, R. K. Dell, 1 male, 19 mm; Island Bay, Wellington, 7 Apr 1951, J. M. Moreland, 1 male (Cr. 350), 27 mm; Island Bay, Wellington, 27 May 1957, P. Harper, 1 male (Z.Cr. 680), 35 mm; Pickersgill Island, Queen Charlotte Sound, 19 Jan 1958, 1 fm, W. L. Hall, 1 male (Z.Cr. 768), 41 mm; outside Pegasus, Stewart Island, 12 Jul 1948, R. A. Falla, 1 female (Cr. 438), 26 mm; Waitangi, Chatham Islands, 1 female (Cr. 335), 18 mm.

**NEW ZEALAND OCEANOGRAPHIC INSTITUTE COLLECTIONS:** Sta. B 218, Foveaux Strait, 21 fm, 1 male, 27 mm, 1 female, 28 mm; Sta. B 220, Foveaux Strait, 20 fm, 1 female, 29 mm; Sta. B 224, Foveaux Strait, 17 fm, 1 female, 25 mm; Sta. B 230, Foveaux Strait, 14 fm, 2 females, 16, 17.5 mm.

**MEASUREMENTS:** Largest male: length 41.5 mm, width 65 mm, rostral length 2 mm, rostral width 7.5 mm, cheliped 73 mm, chelar length 38.5 mm, chelar height 18 mm, dactyl 22.5 mm, first ambulatory leg 49 mm.

Largest female: length 32 mm, width 49 mm, cheliped 36 mm.

**HABITAT:** *E. australis* is a typically littoral species frequenting mostly muddy shores which are covered by scattered small stones or pebbles. It has, however, been taken offshore on shelly or sandy as well as pebbly or muddy bottoms and is frequently associated with bryozoans. Owing to the general lack of the special hooked hairs found in other majids, *E. australis* is never covered by seaweed, but small polychaete tubes are sometimes found on the dorsal surface of the carapace.

The large pits on the underside of the branchial regions are of unknown significance. The regions round these pits are the only part of the animal bearing hooked hairs.

**DEPTH:** Intertidal and offshore to 40–50 fm.

**BREEDING:** Nothing has been published on the breeding habits of this species.

**REMARKS:** The splendid coloured illustrations of this species given with the original description by Milne Edwards and Lucas (1841, p. 481, pl. 28, figs. 14 and 15) left no room for later erroneous identification. According to these figures Milne Edwards and Lucas's material differs from that available to me only very slightly in the shape of the male abdomen and in that the bases of the fingers of the cheliped are shown as adjacent rather than gaping. Such a difference is very likely due to age. The rather generalised description makes no mention of an intercalated spine, but a supraorbital fissure is noted.

Filhol (1886) also provided a very good figure of this species, but proposed a variety, *E. australis* var. *stewarti*, characterised by a punctulated condition of the carapace, and supposedly restricted to Stewart Island. This variety was not upheld by Chilton and Bennett (1929, p. 59), who showed that such punctulations were also present in specimens from Oamaru, while in a specimen from Stewart Island they were absent. Bennett (1964, p. 63) states that specimens from the same locality show all gradations of this character. Lenz (1901) considered that the outline of the carapace varied with age, but Bennett (1964) states that this suggestion lacks support. Bennett's statement would not appear to agree with Krefft's findings (see above).

#### Subfamily MAJINAE Balss, 1929

*Majinae* Alcock, 1895: 161, 166, 236 (part: *Maioida*).

*Majinae* Rathbun, 1925: 335. Hale, 1927: 134. Bouvier, 1940: 319. Richardson, 1949b: 64. Bennett, 1964: 35.

*Majinae, sensu stricto* Balss, 1929: 16, 20. Sakai, 1938: 296. Garth, 1958: 340.

*Mamaiidae* Stebbing, 1910: 290. Barnard, 1950: 58.

Orbit formed by (1) a supraorbital cave, the posterolateral angle of which is often produced as a spine, (2) a sharp postorbital spine, and (3) a spine intercalated between the two. Basal antennal article broad but not specially produced to form a floor to the orbit; usually armed at both anterior angles with a strong spine. (Alcock, modified after Garth.)

Pleopod 1 as in the Pisinae Alcock. Pleopod 2 short. (Stephensen.)

Alcock's subfamily Maiinae contained three alliances, the Maioida, the Stenocionopoida and the Periceroida. Balss (1929) withdrew the Stenocionopoida as a separate subfamily, the Ophthalmiinae, retained the Maioida as a restricted subfamily, and divided the Periceroida into two subfamilies: the Mithracinae and the Macrocoelominae. Garth (1958) has retained the Ophthalmiinae and Majinae as Balss conceived them, but the Mithracinae and Macrocoelominae have been united as a single subfamily, the Mithracinae. The subfamily Majinae as here understood contains but a few genera confined mainly to the Indo-West Pacific. However, the number of species is rather large and most of the New Zealand majids find their place here. Richardson (1949b), following Alcock's system, included four genera from New Zealand, *Paramiccippa* H. Milne Edwards, *Campbellia* Balss, *Paramithrax* H. Milne Edwards, and *Leptomithrax* Miers. *Paramiccippa* belongs, under the present system, to the Mithracinae, and is unrepresented in New Zealand (Bennett, 1964, p. 14). *Campbellia*, supposed by Balss to form a transition between the Majinae and the Mithracinae, has been reduced to synonymy with the mithracine *Jacquinotia* Rathbun (Griffin, 1963a). *Paramithrax*, still considered a majine genus, is now restricted to include a single Australian species formerly known as *Gonatorhynchus tumidus* (or *G. barbicornis* (see Griffin, 1963b)), and the New Zealand species until now included in this genus have been transferred to a new genus, *Notomithrax*. *Leptomithrax* is retained in the Majinae, being one of the most typical genera of the subfamily. To the two genera *Notomithrax* and *Leptomithrax* is added a third, *Chlorinoides* Haswell, the single New Zealand species here placed in that genus having been previously included in *Acanthophrys* A. Milne Edwards, which was placed in the Pisinae by Richardson. The New Zealand spider crab fauna thus includes three majine genera.

## Genus *Notomithrax* Griffin, 1963

- Paramithrax* H. Milne Edwards, 1834: 323 (part: *Paramithrax peronii* H. Milne Edwards).  
*Paramithrax* (*Paramithrax*) Miers, 1876a: 219; 1879c: 655.  
 Alcock, 1895: 240. Rathbun, 1893: 66.  
*Paramithrax*: Rathbun, 1918: 17; 1925: 338. Balss, 1929: 18. Richardson, 1949b: 65. Garth, 1958: 344. Bennett, 1964: 37.

**DESCRIPTION:** Carapace pyriform, densely tuberculate or spinous dorsally. Rostrum of two divergent spines separate from their base. Supraorbital region consisting of an eave, intercalated spine and postorbital spine, the three separated by wide, deep fissures; eave laterally rounded, bearing a prominent antorbital spine and sometimes a small preorbital spine; postorbital spine long, conical, remote from orbit. Eystalks slender, never reaching postorbital spine, cornea small, terminal. Basal antennal article broad, subrectangular, of even width throughout, lateral edge straight to weakly concave, not notched, anteromedial and anterolateral angles each produced into a well developed spine of which at least the anteromedial is forwardly directed. Merus of third maxilliped not greatly expanded laterally, deeply notched distally, a sharp, prominent spine at lateral angle of notch. Chelipeds much longer than carapace in adult male, merus with a few spines or tubercles dorsally, carpus with two longitudinal ridges converging proximally, usually one dorsal and one obliquely crossing lateral surface, palm enlarged distally in male, fixed finger more or less strongly excavate basally, fingers thus gaping. Abdomen of seven distinct segments in both sexes. Male abdomen widest at middle of segment 3; segment 7 subtriangular to subquadrate, basal width greatly exceeding length, distal edge weakly convex.

**RANGE:** New Zealand, south-east Australia, Norfolk Island, extending eastward to Juan Fernandez off the coast of Chile.

**TYPE SPECIES:** *Paramithrax peronii* H. Milne Edwards, 1834, by original designation; a New Zealand species.

**REMARKS:** The name *Paramithrax* has become established in the literature for a genus of seven species of intertidal majines with an apparent centre of distribution in New Zealand (see Griffin, 1963b). As originally defined it included species now placed in the closely related *Leptomithrax*. While Milne Edwards (1834) had divided *Paramithrax* into two sections on the basis of orbital characters, Miers (1876a; 1876b) in setting up two subgenera used characters associated with the cheliped. In a later paper (Miers, 1879c) Miers nominated *Paramithrax peronii* H. Milne Edwards as the type of the subgenus *Paramithrax* and *Leptomithrax longimanus* Miers of the subgenus *Leptomithrax*. When the two subgenera were eventually raised to full generic status, Rathbun (1918) noted that Milne Edwards's basis of division was the more suitable.

### KEY TO NEW ZEALAND GENERA OF THE SUBFAMILY MAJINAE

- 1 (4) Supraorbital eave with a prominent antorbital lobe, a preorbital lobe seldom present. Postorbital lobe a simple spine or cupped. Basal antennal article with anterolateral lobe forwardly directed. Carapace bearing numerous spines or tubercles, or both, never lobes.
  - 2 (3) Supraorbital eave, intercalated spine and postorbital spine widely separated from each other, postorbital spine simple, remote from orbit; eystalk short, slender, cornea small. Carpus of cheliped with two longitudinal ridges converging proximally, one dorsal and one obliquely crossing lateral surface.
 

..... **Notomithrax** Griffin, 1963
  - 3 (2) Supraorbital eave, intercalated spine and postorbital lobe closely approximated, postorbital lobe excavated anteriorly; eystalk stout, cornea very large. Carpus of cheliped generally lacking prominent ridges.
 

..... **Leptomithrax** Miers, 1876
  - 4 (1) Supraorbital eave with both preorbital and antorbital lobes well developed. Postorbital lobe excavated anteriorly. Basal antennal article with anterolateral lobe directed laterally. Carapace bearing a few spines or lamellate lobes or both.
 

..... **Chlorinoides** Haswell, 1880



Meanwhile, Haswell (1880a) had described a new genus and species from Australia, *Gonatorhynchus tumidus*. Balss (1929) showed that this species was conspecific with *Paramithrax barbicornis* (Latreille) and retained for it Haswell's genus. This was in agreement with the earlier creation by Filhol (1885; 1886) of the genus *Lobophrys* to accommodate Latreille's species. However, Ward (1933) noted that *Paramithrax barbicornis* had been designated type species of *Paramithrax* by Desmarest (1858). Thus, the genera *Gonatorhynchus* and *Lobophrys* are simple synonyms of *Paramithrax*.

The setting up of a new genus to accommodate five of the species formerly placed in *Paramithrax* has been necessitated by the confirmation that *Paramithrax barbicornis* is not congeneric with them (see Griffin, 1963b); in addition, *Paramithrax parvispinosus* Ward, an Australian species, has been transferred to *Leptomithrax* (see Griffin, 1963b), while Bennett (1964) has shown *Paramithrax parvus* Borradaile to be a synonym of *P. minor* Filhol. Thus, at present, the new genus includes five species. The Norfolk Island *N. spinosus* (Miers) and the Juan Fernandez species *N. baeckstroemi* (Balss) differ in some details of the orbit from the other species and Bennett (1964) has expressed doubts about their relationships. As *Notomithrax* may be regarded as merely replacing *Paramithrax* as previously understood, *Paramithrax peronii* H. Milne Edwards is retained as the type species of the new genus.

Bennett (1964) has analysed the New Zealand and Australian species of the genus from an evolutionary standpoint and finds that on the basis of numbers of marginal spines and some other characters *N. peronii* is the most primitive, from which two series progress, one, leading to *N. minor*, involving addition of spines and the other, leading to *N. ursus*, loss of spines.

#### KEY TO NEW ZEALAND AND AUSTRALIAN SPECIES OF THE GENUS *Notomithrax*

- 1 (4) Carapace with both spines and tubercles dorsally. Two hepatic spines. More than three marginal branchial spines extending on to dorsum of carapace posteriorly.
- 2 (3) Protogastric regions smooth or only faintly tuberculate. Seven marginal branchial spines. Merus of cheliped smooth dorsally, carpus with dorsal ridge poorly developed, tuberculate, lateral ridge well developed, sharp, entire. .... *N. minor* (Filhol, 1885)
- 3 (2) Entire surface of carapace covered by tubercles and spines leaving no smooth areas. Five marginal branchial spines. Merus of cheliped with a few spines and tubercles dorsally; carpus with dorsal ridge entire, blunt, lateral ridge well developed, blunt, entire. .... *N. peronii* (H. Milne Edwards, 1834)
- 4 (1) Carapace covered by tubercles only. Three hepatic spines. Three marginal branchial spines extending posteriorly only as far as widest part of carapace. Merus of cheliped with dorsal row of laterally compressed spines; carpus with dorsal ridge serrate, lateral ridge serrate proximally. .... *N. ursus* (Herbst, 1788)

***Notomithrax peronii*** (H. Milne Edwards, 1834). \* Figs. 9, 21.

- Paramithrax peronii* H. Milne Edwards, 1834: 324. Jacquinot and Lucas, 1853: 10, pl. 1, fig. 3.  
*Paramithrax peroni*: Filhol, 1885: 4. Bennett, 1964: 38, fig. 21-24, 33, 112.  
*Paramithrax (Paramithrax) peronii*: Miers, 1876a: 219; 1876b: 5. Rathbun, 1893; 66, 81.  
*Paramithrax peronii*: Filhol, 1886: 354. Lenz, 1901: 454. Chilton, 1906a: 265. Thomson, 1913: 236. Chilton and Bennett, 1929: 738. Young, 1929: 151. Richardson, 1949b: 65, fig. 35. Not *Paramithrax peronii*: Haswell, 1880a, and subsequent Australian authors, nor Chilton, 1911 = *Notomithrax minor* (Filhol, 1885) (fide Bennett, 1964). Not *Paramithrax peroni*: Lenz, 1902 = *Notomithrax baeckstroemi* (Balss, 1924) (fide Rathbun, 1925; Garth, 1958).

HOLOTYPE: Female: length 63 mm, width 44 mm. Muséum National d'Histoire Naturelle, Paris.

TYPE LOCALITY: Indian Ocean (H. Milne Edwards, 1834); presumably an error for New Zealand.

LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS: Northern: 10 miles NW of Cape Maria van Diemen, and Bay of Islands, *Hinemou* Exped.; Auckland, H. Suter; off Kohimara, Point Chevalier, Narrow Neck and Birkenhead, D. H. Graham; Waitemata Harbour, D. H. Graham; Ponui Island, W. J. Barr (Bennett). Channel Island, Hauraki Gulf, 25, 30 fm (Chilton). Central: Cook Strait, 30 fm (Filhol, 1886). French Pass (Lenz). Wellington; Lyall Bay, Wellington, drift on beach; Golden Bay, W. R. B. Oliver; Kaikoura, H. Millar, Miss M. E. Herriott; Lyttelton Harbour, J. Drummond; Port Levy, Banks Peninsula, C. Robinson; Sumner (Bennett). Southern: Bluff to Cape Campbell (Thomson). Moeraki; Warrington, Otago Peninsula, and Otago Harbour, D. H. Graham; Portobello; off Otago Heads, trawled; Bluff, C. Chilton; Lee Bay, Stewart Island, rock pools, W. R. B. Oliver (Bennett). Coasts of Stewart Island, between Port Williams and Kupfer Island (Filhol, 1886). Chatham Islands: in stomach of blue cod (Young).

DISTRIBUTION: New Zealand, from Cape Maria van Diemen to Stewart Island, also Chatham Islands; restricted to New Zealand. Records from Australian waters by Miers (1876a) and Haswell (1880a) and subsequent authors refer to *Notomithrax minor* (fide Bennett, 1964).

DESCRIPTION: Carapace broadly pyriform in dorsal aspect (length 1.4 times width), swollen and almost uniformly convex in profile, margins and dorsal surface spinous. Rostrum of two moderately long ( $\frac{1}{2}$  length of carapace) acuminate spines, separate from the base, weakly divergent, distance between tips just greater than basal width of rostrum, about equal to the margins, strong and

\* According to Opinion 8 of the International Commission on Zoological Nomenclature (see Schenck and McMasters, 1936, p. 42) the specific name of this species should be retained as *peronii*, rather than *peroni*, contrary to the note by Bennett (1964), since the former was the original spelling.

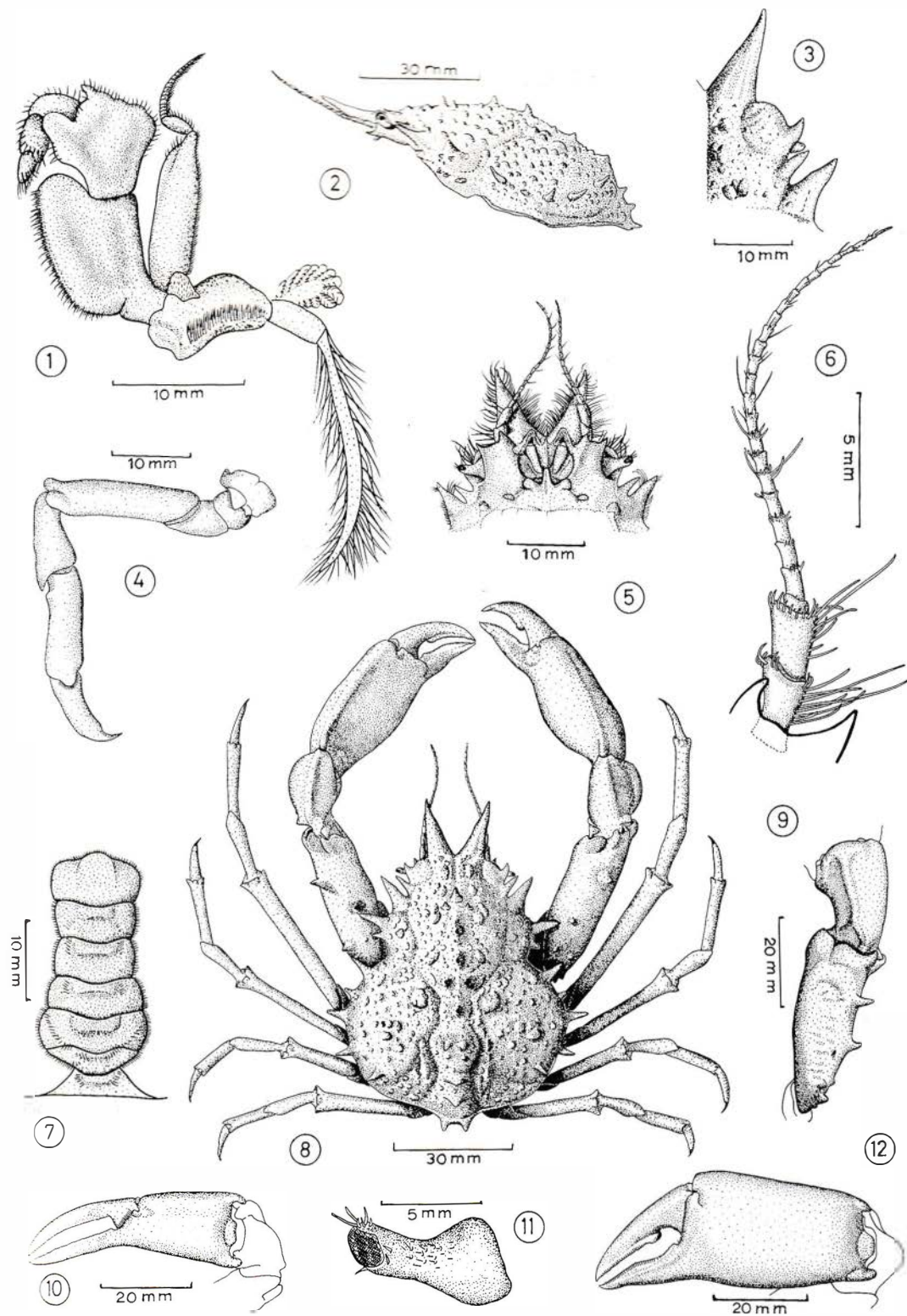


FIG. 9.—*Notomithrax peronii* (H. Milne Edwards). 1—Left third maxilliped. 2—Lateral view of carapace. 3—Dorsal view of orbit. 4—Left fourth ambulatory leg. 5—Ventral view of front. 6—Ventral view of left antenna. 7—Male abdomen. 8—Dorsal view of male. 9—Left cheliped of male, merus and carpus. 10—Left chela of female. 11—Posterior view of left eyestalk. 12—Left chela of male. 10 from ovigerous female, carapace length 57 mm, remainder from 77 mm. male, Paremata Harbour.

dorsoventrally flattened, directed anteriorly, not depressed. Long, stout, hooked hairs along dorsal surface of, and almost obscuring, rostral spines, also present on dorsal surface of carapace and above first hepatic and first two branchial spines borne on large tubercles; carapace otherwise sparsely covered by small, simple hairs in clumps on tips of spines and lesser tubercles.

Margins of carapace with 10 outwardly directed spines, three supraorbital, two hepatic, and five branchials, branchial spines forming a semi-ellipse, last two subdorsal; all spines except fifth and seventh prominent; supraorbital spines dorsoventrally flattened, others conical. Anterior hepatic spine about  $\frac{1}{2}$  rostrum in length, posterior spine small. First branchial spine as long as first hepatic, following spines shortening gradually toward fifth, subequidistant; second branchial spine small, situated midway between first and third spines.

Dorsal surface of carapace densely covered by spines and tubercles. Spines arranged in alternating medial and submedial groups; six generally well developed medial spines, three mesogastric, one small urogastric, and two intestinals; anterior intestinal short, wide and flattened anteroposteriorly, posterior intestinal well developed, conical, four pairs of small submedial spines, one protogastric, one metagastric, one on tumid cardiac region, and one on posterior intestinal margin; dorsal surface of carapace otherwise entirely covered by numerous large and small tubercles, large tubercles grouped irregularly together particularly on mesobranchial and protogastric regions. Regions of dorsal surface moderately well defined.

Orbit consisting above of supraorbital cave, intercalated spine and postorbital spine, the three separated by wide, deep fissures; supraorbital eave wide, rounded laterally, bearing a small antorbital spine; intercalated spine slightly longer than antorbital, triangular; postorbital spine long,  $\frac{2}{3}$  length of rostrum, remote from orbit, conical, wide basally. Orbit oval and deep, inferior border incompletely formed by basal antennal article; eyestalk almost entirely visible in ventral view. Eyestalk short, when pressed back reaching only to tip of intercalated spine, slender, bulbous basally; cornea small, terminal, round; a tuft of short hairs arising from tip of eyestalk above cornea.

Basal antennal article broad, elongate subrectangular, anterior angles with two spines, anteromedial spine small, sharp, anterolateral spine slightly larger than anteromedial, both spines forwardly directed, subconical; flagellum excluded from orbit by stout process of antennal article, not concealed from dorsal view, extending for half its length beyond rostrum, setose; two basal segments longer and stouter than following.

Antennular fossae subrectangular, apex lateral; interantennular spine well developed, downwardly curved, bluntly pointed; anterior process of epistome narrow, bluntly pointed.

Epistome wide and short. Mouthfield subrectangular, slightly narrower posteriorly, anterior margin almost transverse, very weakly concave medially. Pterygostomian regions subtriangular, flattened, clearly separated from subhepatic regions by a shallow groove. two to four very

small tubercles on lateral margin; three to seven similar tubercles along lateral part of subhepatic regions.

Third maxilliped almost meeting in midline so as to cover mouthfield. Ischium of endopodite large, subrectangular, slightly longer than wide, medial edge finely toothed, teeth almost concealed by a dense fringe of long and short hairs; medial half of distal edge extended anteriorly, rounded, lateral half straight to bear merus. Merus subquadrate, as broad as, but slightly shorter than, ischium; anterolateral margin obtusely crenate, posterolateral margin entire, a fringe of short hairs scattered along anterolateral and anterior half of posterolateral edge, medial edge rounded, entire, a few short hairs on outer surface overlying edge; distal edge deeply notched, a small triangular tooth at outer angle of notch. Palp arising from notch of, and slightly longer than, merus, stout, setose; carpus and propodus subequal, dactyl slightly shorter.

Chelipeds long (nearly twice length of carapace in adult male), subcylindrical except for compressed propodus, naked. Ischium extending along ventral surface of merus for about  $\frac{1}{3}$  length of latter; merus long, slightly less than  $\frac{1}{3}$  total length of cheliped; carpus  $\frac{1}{2}$  merus; chela about  $\frac{1}{2}$  total length of cheliped, dactyl as long as palm. Merus with several spines and tubercles scattered over dorsal surface; carpus with two longitudinal ridges converging basally, a very blunt dorsal ridge and a sharper but uneven lateral oblique ridge. Palm very high and slightly enlarged distally in male, low and diminished distally in female, upper surface carinate basally, blunt distally. Fingers acute, toothed along inner edges for entire length, moderately gaping only basally in male, for almost entire length in female; dactyl in male with a large basal tooth.

Ambulatory legs long, slender, cylindrical, entirely lacking spines, dorsal surfaces with groups of hooked hairs, legs otherwise finely setose. First leg the longest (almost  $1\frac{1}{2}$  times carapace length), following legs decreasing slightly and uniformly to the last (slightly shorter than carapace). Bases and ischia short; meri and propodi subequal, each barely  $\frac{1}{3}$  total length of leg, carpi about  $\frac{1}{2}$  meri, dactyli  $\frac{1}{2}$  propodi. Meri with distal articulations moderately acute, carpi weakly depressed, shallowly grooved longitudinally on dorsal surface, dactyli terminating in a sharp claw.

Abdomen of seven segments in both sexes. Male abdomen narrow, all segments subequal in length except the second which is shorter and the seventh which is slightly longer than the others. Segment 1 wide basally, narrow distally, segment 2 subtriangular, widening sharply distally; abdomen widest at middle of laterally convex segment 3, narrowing slightly to base of distally widened segment 6, segment 7 weakly convex distally; distal medial portion of surface of each segment weakly elevated as a broadly subrectangular platform. Female abdomen broadly subovate.

Male first pleopod long, bulbous basally, slender, outwardly curved distally, tip finely pointed; aperture located on medial surface, distant from tip, distal lip of aperture weakly expanded, expansion tapering to form a short

sharp ridge, basal lip more expanded than distal; long setae scattered along lateral surface for entire length, except round aperture, medial surface setose basal to aperture.

**COLOUR:** The dorsal surface of the carapace and the chelipeds and ambulatories are a deep brownish orange to dark red and the tips of the fingers of the chelipeds white; the thoracic sternum is slightly paler orange or yellow. The hairs of the carapace and legs are brownish.

**MATERIAL EXAMINED:** A total of 32 specimens as follows:

VICTORIA UNIVERSITY OF WELLINGTON ZOOLOGY DEPARTMENT COLLECTIONS: Paremata Harbour, on mud flats at low tide level. 24 Feb 1957, W. F. Ponder, 1 male, 77 mm; Paremata Harbour, on mud flats at low tide level, Sept 1959, J. H. Choat, 1 male, 69 mm; Rona Bay, Wellington Harbour, in fish trap off wharf in 1 fm, Jan 1959, M. M. Büchler, 1 ovigerous female, 57 mm; Rona Bay, Wellington Harbour, in fishermen's net, Nov 1959, M. M. Büchler, 2 males, 57 mm, 60 mm, 1 female, 48 mm; York Bay, Wellington Harbour, in fish trap, 1 fm, Feb 1959, M. M. Büchler, 1 male, 73 mm; Evans Bay, Wellington Harbour, in fish trap, off wharf in 2 fm, 9 March 1961, J. H. Choat, 1 ovigerous female, 43 mm.

COLLECTIONS OF PROFESSOR L. R. RICHARDSON: Westmere, Hayman's Bay, 7 Jan 1951, L. R. Richardson, 1 female, 24 mm; Ringa Ringa, Stewart Island, under stones, 16 Jan 1951, L. R. Richardson, 1 female, 26 mm; channel between Cooper Island and Bradshaw Peninsula, Paterson Inlet, Stewart Island [location probably Dusky Sound, not Paterson Inlet, Stewart Is.]. 18 fm. W. H. Dawbin, 1 female, 29 mm.

DOMINION MUSEUM COLLECTIONS: Waiheke Island, Auckland, G. Chamberlain, 2 females (Cr. 310), 35 mm, 45 mm; Long Bay, Auckland, on fishing line, 3 fm, December 1950, R. K. Dell, 1 male (Cr. 341), 66 mm; Wellington (Old Museum Collection), 3 males, 1 ovigerous female (Cr. 343), males, 70–80 mm, female, 47.5 mm; Wellington (Old Museum Collection), 1 male, 1 ovigerous female (Cr. 344), male, 75.5 mm, female, 55 mm; Days Bay, Wellington Harbour, in net, 1 Feb 1953, R. K. Dell, 2 males, 36, 55 mm, 2 females, 48, 50 mm; Tory Channel, Cook Strait, in fishing net, Sept 1958, R. Baxter, 1 male, 68 mm; off Bench Island, Foveaux Strait, Nov 1955, pres. Mrs C. Smith, 1 male, 43 mm.

N.Z. OCEANOGRAPHIC INSTITUTE COLLECTIONS: Sta. B 255, Foveaux Strait, 15 fm, 1 male, 20 mm, 2 females (1 ovigerous), 34.2, 45 mm; Sta. B 258, Foveaux Strait, 11 fm, 2 males, 21, 36.5 mm.

**MEASUREMENTS:** Large male: length 77 mm, width 54 mm, rostral length 14 mm, rostral width 13 mm, cheliped 123 mm, chelar length 63 mm, chelar height 24 mm, dactyl 31 mm, first ambulatory leg 107 mm.

Ovigerous female: length 57 mm, width 41.5 mm, cheliped 53 mm.

**HABITAT:** On sand or mud, occasionally in rock pools. Individuals of this species are usually thickly covered by green algae, particularly *Ulva*, as well as brown and sometimes red algae and are often found associated with *Notomithrax minor*.

**DEPTH:** Intertidal to 30 fm, most common just offshore at 2–3 fm.

**BREEDING:** Ovigerous females are generally found from late January to the end of March.

**REMARKS:** This species is one of the commonest of the shallow water spider crabs and also one of the largest.

*N. peronii* is similar in several features to *N. minor* (Filhol) from which it differs in the shorter eyestalks, the more spinous merus and more strongly ridged carpus of the cheliped, the spinous rather than flattened nature of the anterolateral tooth of the basal antennal article, the less numerous marginal branchial spines, the tuberculate nature of the protogastric regions of the carapace, and the greater adult size. Garth (1958) has given an account of the several differences between *N. peronii* and *N. baeckstroemi* Balss.

According to Bennett (1964) this species has been comparatively well understood in New Zealand since the time of its original description, due mainly to the fine illustration given by Jacquinot and Lucas (1853). Bennett has further discussed probable causes of confusion in Australia over this species and has noted inaccuracies in the description given by Filhol (1886).

**Notomithrax minor** (Filhol, 1885). Figs. 10, 21.

*Paramithrax* (*Paramithrax*) *peronii*: Haswell, 1880a: 440; 1880b: 146; 1882c: 13.

*Paramithrax peronii*: Whitelegge, 1890: 86. Fulton and Grant, 1906b: 17. Grant and McCulloch, 1906: 28. Chilton, 1911: 288.

*Paramithrax peroni*: Hodgson, 1902: 231. Not *Paramithrax peronii* H. Milne Edwards, 1834.

*Paramithrax minor* Filhol, 1885: 3; 1886: 356, pl. 40, figs. 4, 5 and 7. Rathbun, 1918: 18, pl. 8. Chilton and Bennett, 1929: 738. Richardson, 1949b: 65, fig. 36. Bennett, 1964: 40, fig. 25–28, 113, 114.

*Paramithrax parvus* Borradaile, 1916: 105, fig. 15; type locality: 7 miles east of North Cape, 70 fm—British Museum (Natural History) London. Chilton and Bennett, 1929: 738. Richardson, 1949b: 65, fig. 37.

**TYPES:** Nine syntypes, lectotype male (J. Forest), length 30 mm, width 24.5 mm. Muséum National d'Histoire Naturelle, Paris.

**TYPE LOCALITY:** Massacre Bay, Cook Strait, 15–20 fm, H. Filhol, collector.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS:** Northern: 10 miles NW of Cape Maria van Diemen, 50 fm, *Hinemoa* Exped.; Kaipara; Auckland; Ponsonby Reef, Auckland, W. R. B. Oliver; Ponui Island, W. J. Barr; north of Ponui Island, dredged, G. Archey; Little Barrier Island and Hauraki Gulf, *Hinemoa* Exped.; off Cuvier Island, Hauraki Gulf, 32 fm, dredged Capt. Bollons; Bay of Plenty to Hauraki Gulf, Mahia Peninsula to Hicks Bay, *Doto* Exped.; Puhoi Beacon and New Plymouth, *Hinemoa* Exped. (Bennett). Central: *Nora Niven* Sta's 44 (23 miles SW of Akaroa, 9 Jun 1907, 30–24 fm, sand and shell), 74 (Palliser Bay, 13 Aug 1907, 20–29 fm, fine sand) (Chilton, as *P. peronii*). Island Bay, Wellington; Nelson; Kaikoura, E. W. Bennett; Godley Heads, Banks Peninsula, W. R. B. Oliver, E. W. Bennett; Sumner, off Akaroa and Taylor's Mistake, Banks Peninsula, E. W. Bennett (Bennett). Southern: Blueskin

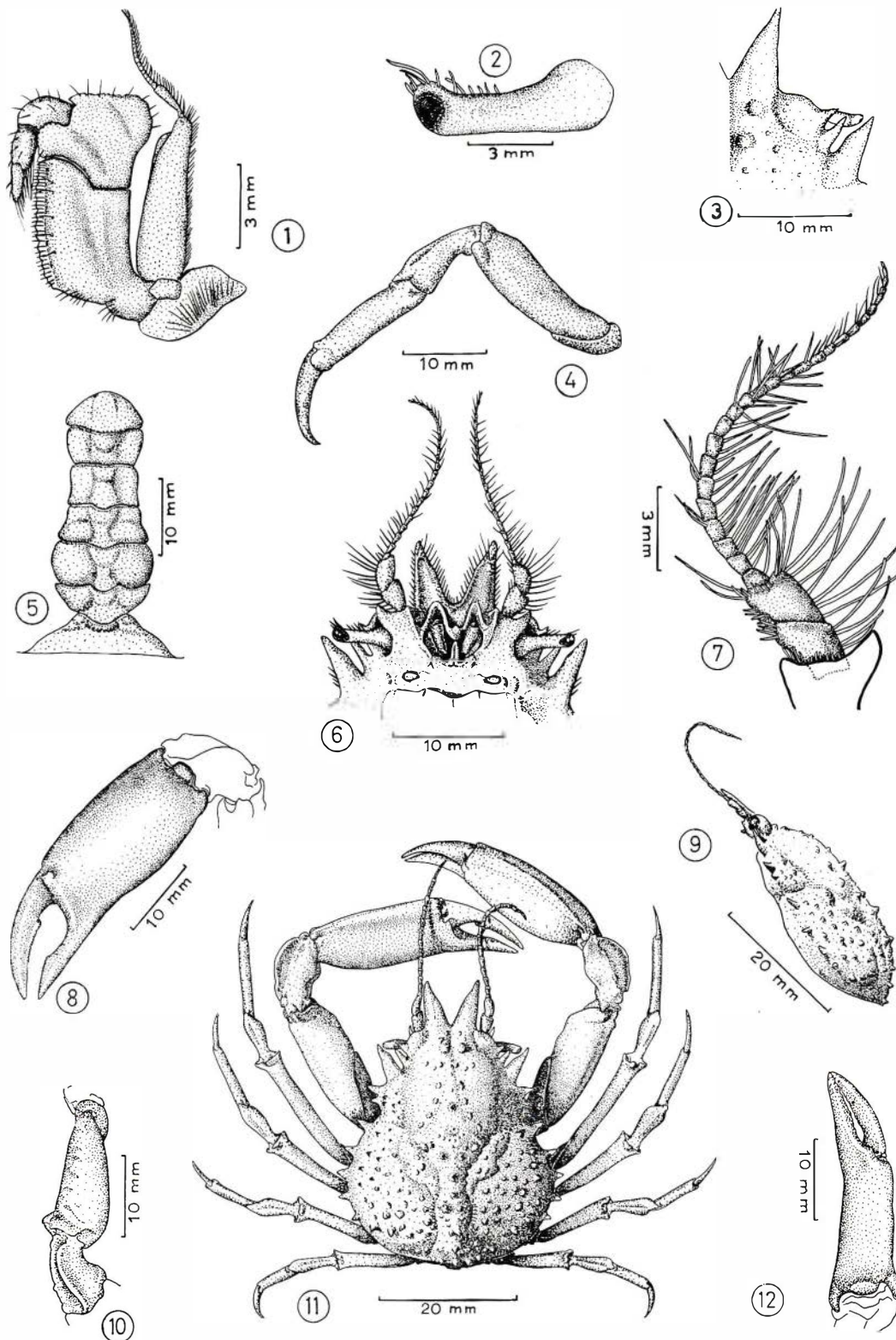


FIG. 10—*Notomithrax minor* (Filhol). 1—Left third maxilliped. 2—Posterior view of left eyestalk. 3—Dorsal view of orbit. 4—Left fourth ambulatory leg. 5—Male abdomen. 6—Ventral view of front. 7—Ventral view of left antenna. 8—Left chela of male. 9—Lateral view of carapace. 10—Left cheliped of male, merus and carpus. 11—Dorsal view of male. 12—Left chela of female. 12 from ovigerous female, carapace length 27 mm, remainder from 40 mm male, Rona Bay, Wellington Harbour.

Bay and Channel near Quarantine and Goat Islands, Otago Harbour, east of Papanui Inlet, 40 fm, and Warrington, Otago Peninsula, 7 miles ENE of Otago Heads, D. H. Graham; Preservation Inlet, F. W. Hutton; Stewart Island, W. Traill (Bennett). Stewart Island (Filhol, 1886).

Also several localities from Port Curtis, Queensland to Tasmania, eastern Australia (Haswell, 1880a; Hodgson, 1902; Fulton and Grant, 1906b; Grant and McCulloch, 1906; Rathbun, 1918; all, except for Rathbun, recorded as *Paramithrax peronii*).

**DISTRIBUTION:** New Zealand from Cape Maria van Diemen to Stewart Island, unknown from Chatham Islands; south-east Australia including Tasmania.

**DESCRIPTION:** Carapace broadly pyriform in dorsal aspect (length 1.4 times width), swollen and almost uniformly convex in profile, margins and dorsum spinous. Rostrum of two short acuminate spines ( $\frac{1}{2}$  length of carapace), separate from base, moderately divergent, distance between tips scarcely exceeding basal width of rostrum. Short, hooked hairs borne on small tubercles scattered over dorsal surface of carapace and above marginal spines; posterior part of carapace covered by short simple hairs.

Margins of carapace with 12 generally short and outwardly directed spines: three supraorbital, two hepatic, and seven branchial, branchial spines forming a semi-ellipse, curving on to dorsum posteriorly, last three subdorsal; anterior seven to eight spines weakly dorsoventrally flattened; posterior spines conical. Anterior hepatic spine about twice as long as the second, about one-third length of rostrum. First branchial spine the longest, almost as long as first hepatic, following spines decreasing slightly in length posteriorly, third, fifth, and seventh slightly longer than intervening spines.

Dorsal surface of carapace covered by small spines and tubercles. Larger spines arranged in a series of alternating medial and submedial groups: five medial spines, two mesogastric, one urogastric, and two intestinal, one close to anterior margin of intestinal region and one midway along; three pairs of submedial spines, one each on protogastric, metagastric, and tumid cardiac regions; posterior intestinal margin bearing three spines, one medial and one on each side. Protogastric regions smooth except for small tubercles flanking mid-dorsal regions; carapace posteriorly densely covered by small spines and tubercles. Regions of carapace generally well defined.

Orbit consisting above of supraorbital eave, intercalated spine, and postorbital spine, all three separated by wide, deep fissures; supraorbital eave wide, rounded laterally, bearing a small triangular antorbital spine; intercalated spine scarcely exceeding antorbital in length, triangular; postorbital spine very long, almost as long as rostrum, remote from orbit, wide basally, anterior edge weakly concave distally. Orbit oval and deep, inferior border incompletely formed by basal antennal article. Eyestalk long, when pressed back reaching almost to tip of postorbital

spine, slender, bulbous basally; cornea, small, subterminal, obliquely ventral, circular.

Basal antennal article large, broad, elongate subrectangular, lateral edge weakly concave, anterior angles toothed, anteromedial tooth spinous, small, forwardly directed, anterolateral tooth flattened, large, at least twice length of anteromedial, triangular, outwardly directed; flagellum excluded from orbit by a stout process of basal antennal article, completely visible in ventral view, extending for  $\frac{2}{3}$  of its length beyond rostral spines, densely setose; first two segments longer and stouter than following, subequal.

Antennular fossae subtriangular; interantennular spine well developed, downwardly projecting, curved, bluntly pointed, anterior face weakly excavated; anterior process of epistome narrow, bluntly pointed.

Epistome wide and short. Mouthfield subrectangular, slightly narrower posteriorly, anterior border transverse. Pterygostomial regions subtriangular, flattened, clearly separated by a shallow groove from subhepatic regions. Two or three small tubercles on lateral margin. Subhepatic regions flattened, three or four small tubercles laterally.

Third maxillipeds meeting in midline so as to completely cover mouthfield. Ischium of endopodite subrectangular, slightly longer than wide, medial edge coarsely toothed, overlaid by a scattered fringe of long hairs, a few longer hairs arising from outer surface of basis and ischium some distance from medial edge; medial half of distal edge of ischium extended anteriorly, rounded, lateral half straight, bearing merus. Merus subquadrate, as wide as, but slightly shorter than, ischium, anterolateral edge minutely crenulate, overlaid by a fringe of scattered hairs, anterior third of posterolateral edge obtusely crenate, overlaid by scattered hairs, posterior two-thirds entire, naked; medial edge strongly concave, anteriorly minutely crenulate, overlaid by a few scattered hairs; distal edge deeply notched, a small broad, triangular, flattened tooth at outer angle of notch. Palp arising from middle of notch of, and about  $1\frac{1}{2}$  times as long as, merus, stout, the three segments subequal in length, densely setose.

Chelipeds long (1.5 times length of carapace in male), enlarged, subcylindrical except for slightly compressed propodus, naked except for a mass of short hairs on dorsal surface of merus. Ischium extending along ventral surface of merus for about  $\frac{1}{2}$  length of latter, merus long, about  $\frac{1}{3}$  total length of cheliped, carpus  $\frac{2}{3}$  merus, chela slightly more than  $\frac{1}{2}$  total length of cheliped, dactyl almost as long as palm. Merus nodulated dorsally at base, otherwise smooth. Carpus bearing two longitudinal ridges, almost converging basally, dorsal ridge poorly developed, irregular tuberculated, lateral oblique ridge well developed, sharp, entire. Palm of only moderate height in male, highest about midway along, low and diminished distally in female; dorsal surface carinate basally, blunt distally. Fingers acute, finely toothed along inner edges, fixed finger for distal half and dactyl for entire length, fingers gaping moderately basally in male, adjacent in female.

Ambulatory legs long, slender, cylindrical, smooth.

First leg the longest (about as long as carapace), following legs decreasing slightly and uniformly to the last (about  $\frac{2}{3}$  carapace length); dorsal surface of legs bearing a double longitudinal row of hooked hairs arranged in opposing groups, surfaces of legs otherwise covered by rows of simple hairs. Meri and propodi subequal, long, each about  $\frac{1}{3}$  total length of leg, carpi about  $\frac{1}{2}$  meri, dactyli hardly as long as carpi. Meri with a small spine dorsally overlying distal articulating edge, carpi weakly depressed, a shallow longitudinal groove on dorsal surface terminating in a sharp claw.

Abdomen of seven distinct segments in both sexes. Abdomen narrow in male; all segments subequal in length except the last which is slightly longer than the others, segments wider than long. Segment 1 wide basally, narrow distally, segment 2 subtriangular, widening sharply distally; abdomen widest at middle of laterally convex segment 3, narrowing slightly to base of segment 6, then widening slightly distally, segment 7 strongly convex distally. Distal medial portion of first five segments weakly elevated as a broadly subrectangular platform, segment 6 elevated in midline as a rounded ridge, segment 7 flat, except for weakly raised distal medial portion, lateral portions of segments 2, 3, and 4 inflated.

Male first pleopod bulbous basally, slender, outwardly curved distally; aperture located on medial surface distant from tip, basal lip of aperture strongly expanded, distal lip weakly expanded as a short ridge; long setae extending along lateral surface to just short of tip, a few short setae on lateral surface between aperture and tip.

**COLOUR:** The whole animal is pale yellowish, the dorsal surfaces of the chelae are a dark red or purple. The tips of the fingers of the chelipeds are white. The thoracic sternum is yellowish white. The animal is thickly covered by brownish hairs.

**MATERIAL EXAMINED:** A total of 39 specimens as follows:

VICTORIA UNIVERSITY OF WELLINGTON ZOOLOGY DEPARTMENT COLLECTIONS: Rona Bay, Wellington Harbour, in fisherman's net, 25 Nov 1959, D. J. Griffin, 2 males, 35.5 mm, 40 mm, 2 ovigerous females, 25, 27 mm; Rona Bay, Wellington Harbour, in net, 1 fm on muddy bottom, 9 Apr 1960, G. C. Hewitt, 2 males, 35 mm, 42 mm, 3 ovigerous females, 28–30.5 mm; Rona Bay, Wellington Harbour, in fisherman's net, 17 Mar 1961, G. C. Hewitt, 1 male, 38 mm, 1 ovigerous female, 28.5 mm; off Petone Beach, Wellington Harbour, 3 Apr 1960, 3 fm, on muddy bottom, P. H. J. Castle, 1 male, 33 mm; off Kau Bay, Wellington Harbour, 3 Apr 1960, 4 fm, on muddy bottom, P. H. J. Castle, 1 ovigerous female, 22 mm.

DOMINION MUSEUM COLLECTIONS: North of Kapiti Island, 30 fm, 5 Jan 1956, F. Abernethy, 1 female, 16 mm; B.S. 178, off York Bay, Wellington Harbour, 9 fm, R. K. Dell and J. Moreland, 2 males, 32, 34.5 mm, 2 females, 24, 28.5 mm; Days Bay, Wellington Harbour, in net, 1 Feb 1953, R. K. Dell, 2 males, 38.5, 41 mm, 2 females, 23, 29 mm; B.S. 195, Trio Islands, entrance to Admiralty Bay, 16 fm, 1 female (Z.Cr. 688), 15 mm; Tasman Bay, Nelson, Nov 1934, M. Young, 6 males, 15.5–26 mm; off Kaikoura, May 1953, 50 fm, F. Abernethy, 1 male, 28.5 mm.

COLLECTIONS OF PROFESSOR L. R. RICHARDSON: Milford Reef, Auckland, Feb 1949, L. R. Richardson, 2 ovigerous females, 19, 19.5 mm; Westmere, Haymans Bay, 7 Jan 1951, L. R. Richardson, 1 male, 18.5 mm; Pelorus Sound, 25–30 fm, bottom of shell,

detritus, 26 Dec 1951, L. R. Richardson, 1 ovigerous female, 23 mm; West Beach of Adele Island, Tasman Bay, low tide, bottom of sand and mud, 31 Dec 1951, W. H. Dawbin, 1 female, 21 mm; Channel between Cooper Island and Bradshaw Peninsula, Paterson Inlet, Stewart Island [location probably Dusky Sound, not Paterson Inlet, Stewart Is.], 18 fm, no date, W. H. Dawbin, 1 male, 10.5 mm.

N.Z. OCEANOGRAPHIC INSTITUTE COLLECTIONS: Sta. B 265, Foveaux Strait, 12 fm, 2 females (1 ovigerous), 18, 20.5 mm; Sta. B 277, Foveaux Strait, 3–6 fm, 1 male, 23 mm.

**MEASUREMENTS:** Large male: length 40 mm, width 31.5 mm, rostral length 6.5 mm, rostral width 7 mm, cheliped 60 mm, chelar length 34.5 mm, chelar height 11 mm, dactyl 16 mm, first ambulatory leg 45 mm.

Ovigerous female: length 30.5 mm, width 24 mm, cheliped 25 mm.

**HABITAT:** On sand or mud, usually associated with *Notomithrax peronii*. Individuals of *N. minor* are often covered with green or brown algae but more usually by sponges which sometimes reach a size larger than, and thus obscuring, the crab itself.

**DEPTH:** Intertidal and offshore, 1–20 fm, occasionally to 50 fm.

**BREEDING:** Ovigerous females have been taken in November, December, February, March, and April; the species presumably breeds throughout the summer months.

**REMARKS:** The description and figure of this species given by Filhol (1886, p. 356, pl. 40, figs. 4, 5, and 7) are in general accurate and call for only the following few comments. Filhol's fig. 4 shows the postorbital spine somewhat longer and the branchial margin less tuberculate than in the material available to me, though his description mentions seven marginal branchial spines, the correct number; his fig. 5 does not show the prominent small spine at the lateral angle of the notch of the merus of the third maxilliped; and fig. 7 shows the toothed portion of the dactyl of the cheliped as beginning further from the base than it actually does.

Rathbun (1918) gave a shorter description of this species and two excellent figures. Rathbun's material and other specimens from Australia (not listed here) which I have examined are clearly referable to this species, i.e., they are conspecific with New Zealand specimens, and it is therefore difficult to understand the significance of Ward's (1933, p. 392) inference that *Paramithrax minor* Filhol and *P. minor* Rathbun are distinct.

Bennett (1964, p. 41) has shown *Paramithrax parvus* Borradaile to be a synonym of Filhol's species. In his description of *P. parvus*, Borradaile (1916, p. 105) listed five differences in which his species differed from *P. minor*: (1) rostral spines shorter ( $\frac{1}{2}$  length of carapace) and stouter; (2) postorbital spine shorter, not reaching tip of spine of supraorbital eave (antorbital spine); (3) gastric regions only faintly tuberculate; (4) last spine on hepatic regions smaller than the one before it; (5) basal antennal article with a strong spine directed forward as well as outward and serrate laterally. Of these, (1) is of no consequence, since it is within the range of variation of *N. minor*; (2) has been noted by Rathbun as

being the situation in *N. minor*; (3) and (4) are correct for *N. minor*, though Filhol stated the posterior spine to be the longer; and (5) is a feature present in numerous small specimens of *N. minor* from New Zealand (as pointed out to me by Dr J. C. Yaldwyn) and Australia. Two apparent differences from *N. minor* are present in Borradaile's species according to the figure given by him but are not mentioned in his description, viz, the eyestalk is tuberculated distally dorsal to the cornea and the marginal spines are secondarily spinulated. The second of these features is found in numerous small specimens from Australian localities (in Australian Museum, Sydney—not listed here) which are clearly referable to *N. minor*; the tubercles of the eyestalk may be hairs. In general then, those characters in which *P. parvus* supposedly differs from *N. minor* are shown by juveniles of the latter species, and as Bennett points out are also the ones in which Filhol's description was most inaccurate. I therefore agree with Bennett that *Paramithrax parvus* Borradaile, 1916 is a synonym of *Paramithrax minor* Filhol, 1885.

**Notomithrax ursus** (Herbst, 1788). Figs. 11, 21.

- Cancer (Mithrax) ursus* Herbst, 1788: 217, pl. 14, fig. 86.
- Paramithrax ursus*: Gerstaecker, 1856: 111. Balss, 1929: 18. Bennett, 1964: 42, fig. 29–32, 115, 116. Not *Mithrax ursus* Bell, 1835 = *Mithrax (Mithrax) belli* Gerstaecker, 1856 (fide Garth, 1958).
- Paramithrax (Paramithrax) barbicornis*: Miers, 1876a: 219; 1876b: 6, pl. 1, fig. 2. Haswell, 1880a: 440; 1882c: 13. Not *Pisa barbicornis* Latreille, 1825.
- Paramithrax (Paramithrax) latreillei* Miers, 1876a: 220; type locality: New Zealand—British Museum (Natural History), London; 1876b: 6. Rathbun, 1893: 66, 82. Borradaile, 1916: 104.
- Paramithrax latreillei*: Chilton, 1906b: 269; 1911: 289. Young, 1929: 150. McNeill, 1953: 92. Dell, 1960: 4.
- Paramithrax latreilli*: Thomson, 1913: 236; 1921: 97. Chilton and Bennett, 1929: 738. Richardson, 1949b: 65, fig. 34. (Incorrect subsequent spelling of *P. latreillei* Miers, 1876.)
- Paramithrax cristatus* Filhol, 1885: 5; type locality: New Zealand—Muséum National d'Histoire Naturelle, Paris; 1886: 358, pl. 41, fig. 11. Lenz, 1901: 454.

**HOLOTYPE**: Female, length 38 mm. Institut für Spezielle Zoologie und Zoologisches Museum der Humboldt-Universität, Berlin (No. 2039).

**TYPE LOCALITY**: Pacific Ocean.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS**: Northern: Doubtless Bay, L. T. Griffin; Whangarei, W. Fraser; Auckland, C. Chilton (Bennett). Elmsley Bay (Borradaile). Central: French Pass (Lenz). Lyall Bay, Wellington (among weeds in intertidal pool), E. W. Bennett; Port Elizabeth, Westland, E. W. Bennett; Cape Campbell, G. F. Pirritt; Kaikoura, E. W. Bennett; Sumner, Banks Peninsula, F. W. Hutton (Bennett). Southern: Otago coast (Thomson, 1913). Timaru, E. W. Bennett; Moeraki and Warrington, Otago Peninsula, W. B. Benham; Dunedin, F. W. Hutton; Port Chalmers and Parakanui; Portobello, east of Papanui Inlet and Otago Heads,

D. H. Graham; Stewart Island, *Nora Niven* Expedition (Bennett). Chatham Islands: Te Whakura, Miss Shand (Chilton, 1906b). Common round coast in stomach of blue cod (Young). Chatham Islands 1954 Expedition Sta's 9 (Glory Bay, Pitt Island, shore collecting), 11 (Owenga, shore collecting), 16 (Kaingaroa, 26 (Waitangi Beach), 49 (Port Hutt) (Dell). Chatham Islands, W. R. B. Oliver, W. B. Benham (Bennett).

Australia: four localities in New South Wales (Balss, 1929; McNeill, 1953).

**DISTRIBUTION**: New Zealand mainland and Chatham Islands; south-east Australia.

**DESCRIPTION**: Carapace broadly pyriform in dorsal aspect (length 1.3 times width), swollen in profile; surface strongly tuberculate, margins spinous anterolaterally. Rostrum of two short, acuminate, dorsoventrally flattened spines (about  $\frac{1}{6}$  length of carapace), separate from base, weakly convergent distally, margins subparallel, distance between tips slightly less than basal width of rostrum. Short, stout, hooked hairs on dorsal surface of rostral spines and carapace; very long close-set hairs along lateral margins of rostrum and also covering carapace, especially numerous anteriorly, almost concealing hooked hairs.

Anterolateral margins with nine spines: three supra-orbital, three hepatic, and three branchial; spines equidistant within each group, distance separating corresponding spines of adjacent groups same in all cases; spines sharp, conical, outwardly directed except the third which is weakly dorsoventrally flattened and forwardly directed. First hepatic spine the longest of hepatics, almost  $\frac{2}{3}$  length of rostrum, following spines decreasing slightly and uniformly to the third. First branchial spine longest of branchials, as long as second hepatic, following spines decreasing uniformly to the last, smallest of lateral spines, situated at widest part of carapace.

Dorsal surface of carapace entirely lacking spines, densely covered by numerous large and small tubercles. Tubercles very large in gastric and hepatic regions and along anterior border of branchial regions. Regions of dorsal surface of carapace generally poorly demarcated.

Orbit consisting above of supraorbital eave, intercalated spine, and postorbital spine widely separated by deep fissures; supraorbital eave wide, rounded laterally, bearing a small antorbital spine; intercalated spine slightly longer than antorbital; postorbital spine long, almost as long as rostrum, remote from orbit, acuminate. Orbit oval and deep, inferior border incompletely formed by basal antennal article, eye almost entirely visible in ventral view; eyestalk short, slender, when pressed back reaching only to tip of intercalated spine, bulbous basally; cornea subterminal, slightly ventral, small; a tuft of a few short hairs above cornea.

Basal antennal article broad, elongate subrectangular in shape, anterior angles armed with forwardly projecting teeth, anteromedial tooth spinous, small, conical, anterolateral tooth flattened, large, twice length of anteromedial, triangular; flagellum long, extending for almost  $\frac{2}{3}$  of its length beyond rostral spines, entirely visible from above,



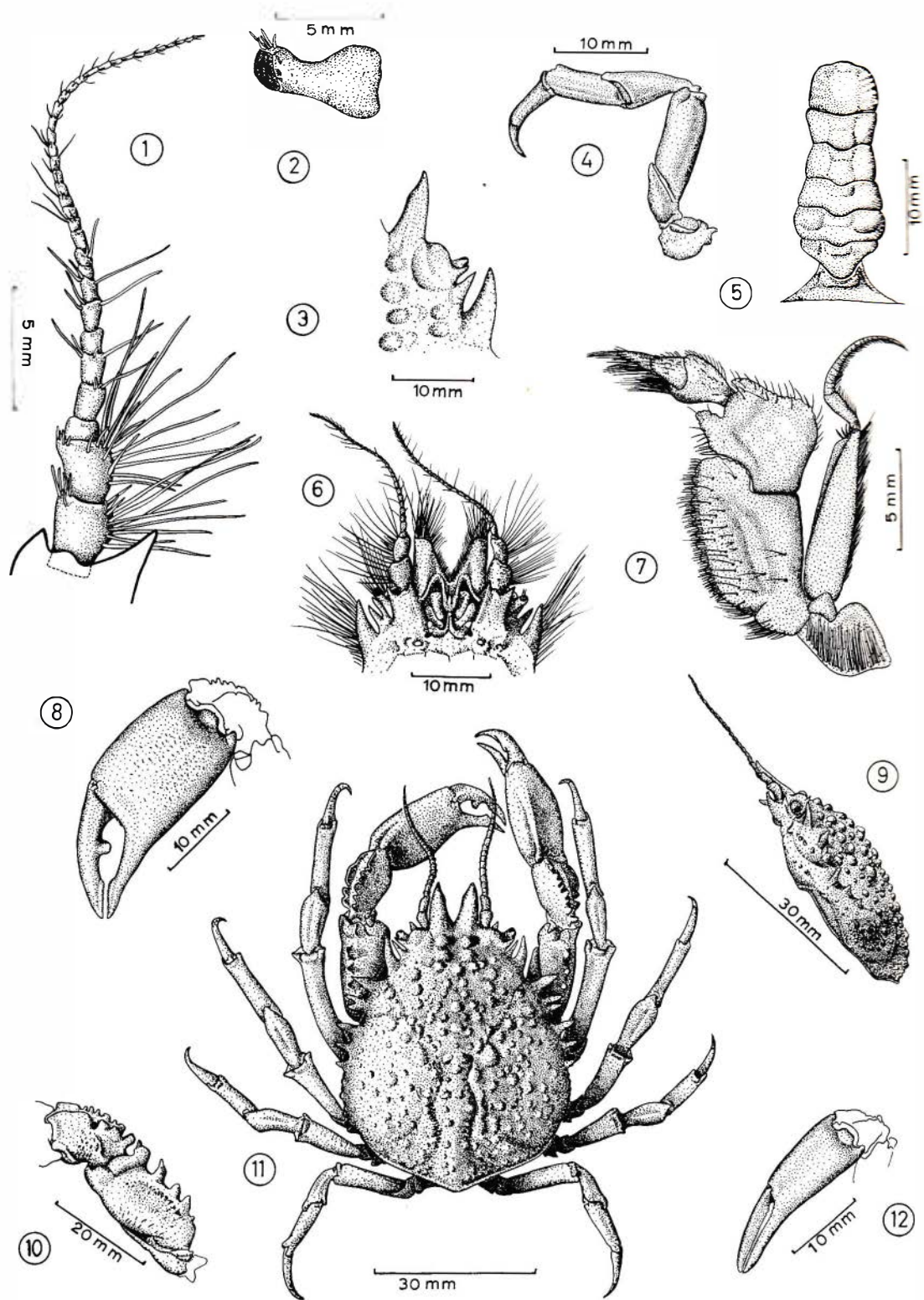


FIG 11—*Notomithrax ursus* (Herbst). 1—Ventral view of left antenna. 2—Posterior view of left eyestalk. 3—Dorsal view of orbit. 4—Left fourth ambulatory leg. 5—Male abdomen. 6—Ventral view of front. 7—Left third maxilliped. 8—Left chela of male. 9—Lateral view of carapace. 10—Left cheliped of male, merus and carpus. 11—Dorsal view of male. 12—Left chela of female. 12 from female, carapace length 43 mm, remainder from 52 mm male, Lyall Bay, Wellington.

excluded from orbit, by stout process of basal article, densely setose; two basal segments very stout, the first slender basally.

Antennular fossae subtriangular, apex lateral; interantennular spine well developed, downwardly projecting, curved, sharply pointed, anterior face weakly excavated; anterior process of epistome narrow.

Epistome short, very broad. Mouthfield subrectangular, slightly narrower posteriorly, anterior margin almost transverse, medially indented as a very shallow V. Pterygostomian regions subtriangular, flat, very clearly separated from subhepatic regions by a deep groove, two to four tubercles about midway along lateral edge. Subhepatic regions bearing three to seven slightly larger tubercles below postorbital and hepatic spines.

Third maxillipeds almost meeting in midline. Ischium large, subrectangular, slightly longer than wide, medial edge coarsely toothed, almost concealed by a fringe of long hairs, distal edge with medial half extended anteriorly, rounded, crenulate, lateral half straight to bear merus. A few scattered long hairs arising from outer surface of ischium especially toward medial edge. Merus subquadrate, as wide as, but slightly shorter than, ischium, narrow basally, distal edge deeply notched, a broad sharp spine at outer angle of notch, anterolateral edge and distal third of posterolateral edge crenulate, medial edge rounded and crenulate. A fringe of scattered hairs extending along medial, distal and anterolateral edges and part way down posterolateral edge, a few long hairs scattered on outer surface of merus close to anterolateral edge. Palp long, stout, cylindrical, hairy.

Chelipeds of moderate length (almost twice length of carapace in adult male), subcylindrical except for compressed propodus, naked. Basis and ischium short, ischium extending along ventral surface of merus almost to tip of latter. Merus short, about  $\frac{1}{2}$  total length of cheliped, carpus  $\frac{2}{3}$  merus, chela almost  $\frac{2}{3}$  total length of cheliped, dactyl slightly longer than palm. Merus with dorsal surface armed with a crest of broad flattened spines which increase in length distally; carpus with two prominent longitudinal ridges almost converging basally, one dorsal made up of distinct spines and tubercles, one crossing lateral surface semi-obliquely, slightly tuberculate basally, entire distally. Palm in male very high, of uniform height throughout, in female slender and much diminished distally, upper surface carinate basally, blunt distally. Fingers acute, in male widely gaping, toothed along inner edges for distal third only, in female adjacent and toothed for entire length; dactyl in male with a large inwardly projecting tooth, absent in female, about  $\frac{1}{3}$  length of dactyl from base.

Ambulatory legs long, slender, cylindrical, smooth, dorsal surface with a longitudinal row of short, hooked hairs, obscured by very long straight hairs scattered irregularly over surface. First leg the longest (slightly longer than carapace), following legs decreasing gradually and uniformly in length to last (slightly shorter than carapace). Bases and ischia very short, meri long, more than  $\frac{1}{4}$  total length of leg, carpi  $\frac{1}{2}$  meri, propodi barely exceed-

ing carpi, dactyli as long as carpi. Meri with distal articulations moderately acute, carpi slightly depressed, a prominent, shallow, longitudinal groove on dorsal surface.

Abdomen consisting of seven segments in both sexes. Male abdomen narrow, all segments broader than long, subequal in length except segment 7, which is nearly  $1\frac{1}{2}$  times length of other segments; abdomen widest at middle of segment 3, narrowing slightly to base of segment 6 and widening again to base of strongly convex segment 7. Distal medial portion of first four segments weakly elevated as a broadly subrectangular platform, last three segments with entire medial portion elevated as a low, rounded ridge, lateral portions of segment 3 weakly inflated.

Male first pleopod long, bulbous basally, tip slender, outwardly curved. Aperture situated on medial surface distant from tip, almost concealed by a flap of tissue which extends round each side of it, basal lip of aperture weakly expanded, distal lip extending toward tip as a poorly developed ridge, medial surface between aperture and tip covered by long setae, some of which are setose at tips; more slender setae along lateral surface close to tip, very minute setae along medial surface immediately basal to aperture.

**COLOUR:** The dorsal surface of the carapace, chelipeds and legs are orange to deep red, the ventral surface of the carapace pale orange to white. The hairs of the carapace and legs are brownish.

**MATERIAL EXAMINED:** A total of 22 specimens as follows:

**VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COLLECTIONS:** Lyall Bay, Wellington, tidal pools, 5 Jun 1960, M. M. Büchler, 1 male, 45.5 mm; Island Bay, Wellington, off rocks in fish trap, 7 Feb 1959, D. J. Griffin, 1 female, 47.5 mm; Island Bay, Wellington, off rocks, Jan 1959, M. M. Büchler, 1 male, 39 mm, 1 female, 40.5 mm; York Bay, Wellington Harbour, off rocks in fish trap, 7 Feb 1959, D. J. Griffin, 1 female, 48 mm.

**DOMINION MUSEUM COLLECTIONS:** Cavalli Islands, Whangaroa, Feb 1953, J. E. MacDonald, 1 male, 21.5 mm; Kapiti Island, 1940, A. S. Wilkinson, 2 females (Cr. 340), 28 mm, 35.5 mm; Cook Strait, 30 fm, 22 May 1946, L. Blanchard, 1 male (Cr. 338), 42 mm; Ngauranga, Wellington Harbour, Aug 1952, W. Heapy, 1 male, 62 mm; Worser Bay, Wellington Harbour, 1922, W. R. B. Oliver, 1 male, 3 females (Cr. 370), male 34.5 mm, females 27–39.5 mm; Lyall Bay, Wellington, R. K. Dell, 1 male, 1 female (Cr. 339), male 35.5 mm, female 34 mm; Pitt Island, Chatham Islands, no collector, no date, 1 male (Cr. 336), 60 mm; Owenga, Chatham Islands (Chatham Islands 1954 Expedition Sta. 11), 1 male (Z.Cr. 897), 30 mm.

**COLLECTIONS OF PROFESSOR L. R. RICHARDSON:** Westmere, Haymans Bay, 7 Jan 1951, L. R. Richardson, 1 female, 32 mm.

**MEASUREMENTS:** Adult male: length 52 mm, width 39 mm, rostral length 8 mm, rostral width 8 mm, cheliped 69 mm, chelar length 40 mm, chelar height 16.5 mm, dactyl 22 mm, first ambulatory leg 62 mm.

Adult female: length 43 mm, width 36 mm, cheliped 38 mm.

**HABITAT:** In rock pools among seaweed. The whole animal is usually thickly covered by seaweed.

DEPTH: Intertidal. According to Bennett (1964, p. 44) this species extends down to 40 fathoms.

BREEDING: No ovigerous females are present in the above collections. Bennett (1964, p. 45) examined six such specimens, but a date is available for only one of these collected at Kaikoura in August 1927.

REMARKS: The conspecificity of *Paramithrax cristatus* Filhol and *P. latreillei* Miers has been well established in the literature. Balss (1929) has brought to the attention of recent workers the fact that this species was first described by Herbst (1788) as *Cancer ursus* and transferred to *Paramithrax* by Gerstaecker (1856). Although Herbst's original description was short, taken with the figure it is certainly adequate for comparison with later ones. Having examined the former and photographs sent to me by Dr H.-E. Gruner, Zoologisches Museum der Humboldt-Universität, there can be no doubt that Balss was correct in regarding *Paramithrax latreillei* Miers as conspecific with Herbst's species. The holotype differs from the majority of the New Zealand specimens of this species that I have seen only in the less cristate nature of the chelipeds. Miers's (1876b, pl. 1, fig. 2) figure of this species under the name of *P. barbicornis* shows only two marginal hepatic spines instead of three, but is otherwise accurate. Miers's figure does show the strong inward projection of the dactyl of the chela, a feature characteristic of adult males of this species but not mentioned by Herbst or Filhol (1886) in the later description of *P. cristatus*.

The name *Paramithrax barbicornis*, given by Miers (1876a) and previous workers to New Zealand as well as Australian specimens, is now recognised as applicable only to an Australian species formerly known as *Gonatorhynchus tumidus* Haswell (see Balss, 1929). The early confusion between the two species is easy to understand, since both are about the same size, have a pyriform carapace thickly covered with long hairs, short ambulatories also covered with hairs, while the dactyl of the cheliped in *P. barbicornis* possesses a strong inwardly projecting tooth as in *N. ursus* (see Griffin, 1963c).

Bennett (1964, p. 44) has discussed at some length inaccuracies in Filhol's (1886) description and figure of *P. cristatus*.

The disposition of the marginal spines of the carapace in three series of three, the tuberculate, non-spinous nature of the dorsal surface of the carapace, the long hairs and the cristate merus and carpus of the chelipeds serve to distinguish this species easily from any other New Zealand spider crab.

Attention must be drawn to McNeill's (1953) record of this species from three localities in south-east Australia, since Bennett (1964) has doubted its occurrence in Australia.

### Genus *Leptomithrax* Miers, 1876

*Paramithrax* H. Milne Edwards, 1834: 323 (part: *Paramithrax gaimardii* H. Milne Edwards).

*Paramithrax (Leptomithrax)* Miers, 1876a: 220; 1879c: 655. Rathbun, 1893: 66. Yokoya, 1933: 160.

*Leptomithrax*: Rathbun, 1918: 19. Hale, 1927: 135. Balss, 1929: 18. Sakai, 1938: 301. Richardson, 1949b: 64. Bennett, 1964: 45.

DESCRIPTION: Carapace pyriform, densely spinose or tuberculate. Rostrum of two rather short, not greatly divergent spines separate from base. Orbits fairly complete, consisting of eave, intercalated spine and post-orbital lobe, the three closely approximated, eave generally with a well developed anterior orbital spine, a pre-orbital spine seldom present, postorbital lobe excavated anteriorly, margins of excavation fringed with hairs; eye-stalk short, very stout, cornea large, ovoid, subterminal. Basal antennal article large, moderately broad, anterior angles toothed, flagellum excluded from orbit by stout process of article. Third maxillipeds deeply notched, a spine at lateral angle of notch. Merus and carpus of cheliped with tubercles or spines seldom grouped to form ridges. Abdomen of seven segments in both sexes; male abdomen widest at base of third segment.

RANGE: Japan, China, Philippine Islands, eastern and southern Australia, New Zealand.

TYPE SPECIES: *Paramithrax (Leptomithrax) longimanus* Miers, 1876 by subsequent designation of Miers (1879c, p. 665); a restricted New Zealand species.

REMARKS: As both Rathbun (1918) and Bennett (1964) have emphasised, a division between the species of *Paramithrax* (herein called *Notomithrax*) and *Leptomithrax* is best made on the basis of orbital characters as outlined by H. Milne Edwards (1834), rather than on the characters of the cheliped as proposed by Miers (1876a). In general the form of the orbit, including the eyestalk, is so characteristic in *Leptomithrax* that species of the genus may be recognised at a glance. In addition, the usually spinous or tuberculate nature of the carapace and chelipeds serves to distinguish members of this genus from species of the closely related *Notomithrax* and *Chlorinoides*. Three species of *Leptomithrax* appear to be close to the borderline between this genus and the two previously mentioned. The Australian *L. parvispinosus* (Ward) in having a sparsely tuberculate carapace, smooth chelipeds, and only weakly excavate postorbital lobe approaches *Notomithrax* species (see Griffin, 1963b), while the Japanese *L. bifidus* Ortmann, in the long, slender and outwardly curved rostral spines, and the New Zealand *L. richardsoni* Dell, in the well developed preorbital spine, resemble species of *Chlorinoides*.

Bennett (1964) has given a detailed list of the species of *Leptomithrax*. From an earlier list given by Balss (1929) *L. affinis* Borradaile, now recognised as conspecific with *L. longimanus* Miers, has been deleted, while *L. longipipes* (Thomson), recently transferred from *Paramithrax* by Richardson (1949b), has been independently added by Bennett together with two new species from New Zealand, *L. molloch*, here recognised as conspecific with *L. longipes*, and *L. mortensenii*, which is here shown to be only subspecifically distinct from the Australian

*L. tuberculatus* (Whitelegge); the recently described *L. richardsoni* Dell is included. From Bennett's list must be deleted *L. australiensis* Miers, now known to be conspecific with *L. gaimardii* (H. Milne Edwards) (see Griffin, 1963c), as strongly suggested by Bennett. To the list must be added *L. parvispinosus* (Ward), a poorly known Australian species previously referred to *Paramithrax* (see Griffin, 1963b), and a new species here described from New Zealand, *L. garricki*. Thus, at present *Leptomithrax* contains a total of 17 species and subspecies, of which six are known from New Zealand waters.

The genus *Leptomithrax* has been divided by Bennett into three subgenera, viz, *Leptomithrax* s.s. (type species *L. longimanus* Miers), *Austromithrax* (type species *L. (A.) mortenseni* Bennett, i.e., *L. tuberculatus* (Whitelegge)), and *Zemithrax* (type species *L. longipes* (Thomson)). Such an arrangement is not adopted here for the reasons now outlined. Briefly, Bennett's subgenera are distinguished on the basis of four groups of characters: the form of basal antennal article and the relationships of the antennal flagellum to the orbit, the form of the supraorbital margin, the degree of development of a swelling on the third maxillipeds at the junction of the ischium and merus, and the presence or absence of excavations in the sternum and abdomen. The first two of these groups of characters are of undoubted value in separating the included species, and strict application of them would probably lead to the recognition of natural groups of species. The third and fourth characters are diagnostic in only two of the subgenera and are surely of minor importance. Although realising that the presence or absence of a swelling on the third maxillipeds is not very important, Bennett nevertheless discusses this feature in some detail from an evolutionary standpoint, regarding the absence of a swelling as primitive. In addition, an important difference between the various species in the form of the sternal excavations is not mentioned, these pits being intersegmental in *L. longipes* and *L. tuberculatus* but wholly segmental in *L. sternocostulatus*; furthermore, rimmed pits are found in the piscine *Eurynolambrus australis*. Considering only the first two of Bennett's groups of characters, two of the subgenera, *Leptomithrax* s.s. and *Zemithrax*, are still relatively widely separated from each other, but the other, *Austromithrax*, which would appear to contain all the remaining species known to Bennett, is much less distinct and uniform. Some of them, including *L. tuberculatus*, are surely closer to *Zemithrax* in the closed nature of the supraorbital border than to other species placed in *Austromithrax*, while in the strongly anterolaterally spined basal antennal article they are distinct from all other species of *Leptomithrax* s.l. If this last group of species, *L. tuberculatus*, *L. sternocostulatus* (H. Milne Edwards), and also probably *L. parvispinosus*, are removed, three Australian species remain which in the form of the basal antennal article and supraorbital border resemble species of *Leptomithrax* s.s., but are quite distinct from all others in the tuberculate or spinulous nature of the postorbital lobe. The arrangement outlined above thus gives four groups of species at least as far as Australian and New

Zealand species are concerned. To these must be added a fifth, containing only *L. richardsoni*, which is characterised by the presence of a strong preorbital spine, a feature not known in any other species of *Leptomithrax*.

Summarising, it can be seen that species of *Leptomithris* s.l. can be arranged in several groups or sections showing various lines of development in characters of the orbit and basal antennal article, while some species have developed peculiar features such as a swelling at the junction of the ischium and merus of the third maxillipeds, and sternal excavations. Division of genera into subgenera, which as far as majids are concerned are later often raised to full generic status as in the case of *Leptomithrax* itself and *Chlorinoides* which was also long regarded as a subgenus of *Paramithrax*, should be undertaken in an attempt to simplify the previously existing arrangement. Yet, if Bennett's subgenera were accepted, four species, *L. longimanus*, *L. australis* and the closely related *L. garricki*, and *L. longipes*, would be isolated as two small subgenera or genera leaving an assemblage of species equally as diverse as before the subgenera were set up. Finally, while characters now considered to be extremely important in the classification of majids, such as the shape of the male abdomen and the form of the male first pleopods, are still largely undescribed for species of this genus, and while the precise relationships with the genera *Notomithrax*, *Chlorinoides*, and possibly also with others such as *Maja* Lamarck and *Schizophrys* White, are still not fully understood, its division into subgenera, even if such a subdivision should ever be found necessary, must surely be considered premature.

#### KEY TO NEW ZEALAND AND AUSTRALIAN SPECIES OF *Leptomithrax*

(New Zealand species shown in **bold face** and treated below)

- 1 (2) Supraorbital eave bearing a strong preorbital spine. Postorbital lobe with two adjacent small tubercles one-third from base on posterior edge, otherwise simple. .... **L. richardsoni** Dell, 1960
- 2 (1) Supraorbital eave lacking a preorbital spine. Postorbital lobe simple or variously spinulose, tuberculate or truncate.
- 3 (12) Intercalated spine markedly shorter than antorbital, almost excluded from outer rim of supraorbital margin by distal approximation of antorbital spine and postorbital lobe.
- 4 (11) Sternum or abdomen, or both, in male excavated to form rimmed pits. Three or four prominent marginal branchial spines.
- 5 (10) Both sternum and abdomen excavated, pits intersegmental. Postorbital lobe simple, acuminate. Four marginal branchial spines.
- 6 (7) Anterior teeth of basal antennal article weakly developed, subequal. Third maxillipeds densely hairy, swollen at junction of ischium and merus as a prominent, rounded, naked swelling. .... **L. longipes** (Thomson, 1902)
- 7 (6) Anterior teeth of basal antennal article well developed, anterolateral tooth a narrowly triangular flattened lobe twice anteromedial in length, outwardly directed. Third maxillipeds sparsely hairy, merus only weakly swollen.

- 8 (9) Mesogastric, urogastric, and cardiac regions of carapace bearing prominent spines; metabranchial and intestinal regions almost smooth. .... *L. tuberculatus* (Whitelegge, 1900)
- 9 (8) Mid-dorsal regions of carapace bearing only low, blunt tubercles; metabranchial and intestinal regions densely granular. .... *L. tuberculatus mortenseni* Bennett, 1964
- 10 (5) Sternum only excavate, rimmed pits wholly segmental. Postorbital lobe truncate distally. Three marginal branchial spines. Anterolateral tooth of basal antennal article narrowly triangular, flattened, three times anteromedial in length, outwardly directed. .... *L. sternocostulatus* (H. Milne Edwards, 1851)
- 11 (4) Sternum and abdomen smooth. Two marginal branchial spines. Basal antennal article with anterolateral tooth well developed, flattened, rounded or bilobate distally, outwardly directed. .... *L. parvispinosus* (Ward, 1933)
- 12 (3) Intercalated spine as long as antorbital, reaching outer rim of supraorbital margin.
- 13 (18) Postorbital lobe bearing spinules or tubercles on posterior edge. Third maxillipeds elevated at junction of ischium and merus.
- 14 (15) Carapace narrowly pyriform. Rostral spines slender. Postorbital lobe with tip acuminate adjacent spinule on posterior edge small in both juvenile and adult, posterior edge of lobe bearing a few small tubercles at base, otherwise unarmed. Third maxillipeds with merus only swollen. .... *L. globifer* Rathbun, 1918
- 15 (14) Carapace broadly pyriform. Rostral spines stout. Postorbital lobe with adjacent spinule on posterior edge subequal with tip, at least in juvenile, a second tubercle midway along posterior edge, lobe otherwise almost smooth. Third maxillipeds with ischium at least weakly swollen.
- 16 (17) Postorbital lobe with adjacent spinule large in juvenile, small in adult, tip acuminate. Mid-dorsal regions of carapace thickly covered by both spines and tubercles. .... *L. gaimardii* (H. Milne Edwards, 1834)
- 17 (16) Postorbital lobe markedly bifid distally, adjacent spinule on posterior edge subequal with tip in both juvenile and adult. Mid-dorsal regions of carapace smooth except for a few prominent spines. .... *L. waitei* (Whitelegge, 1900)
- 18 (13) Postorbital lobe lacking spinules or tubercles on posterior edge. Third maxillipeds not elevated at junction of ischium and merus.
- 19 (20) Carapace in male covered by numerous, closely spaced tubercles, in female by a few prominent spines. Postorbital lobe lacking a spinule on anterior edge. Merus and carpus of chelipeds in male with numerous tubercles on all surfaces, smooth in female. .... *L. longimanus* Miers, 1876
- 20 (19) Carapace in male covered by short spines, in female by spines or tubercles. Postorbital lobe generally with a prominent spinule or tubercle on upper anterior edge.
- 21 (22) Carapace in both male and female covered by a few spines. Merus and carpus of chelipeds bearing numerous spines on all surfaces. Postorbital lobe with a small tubercle on upper anterior edge about one-third from base, a larger additional spinule seldom present. .... *L. garricki* n. sp.
- 22 (21) Carapace in male densely covered by spines, in

female by numerous tubercles. Merus and carpus of chelipeds in male with spines restricted to upper and outer surface, lower surface smooth. Postorbital lobe with a strong spinule on upper anterior edge about midway along, a small tubercle basal to spinule sometimes present. .... *L. australis* (Jacquinot, 1853)

**Leptomithrax longimanus** Miers, 1876. Figs. 12, 14, 22.

*Paramithrax (Leptomithrax) longimanus* Miers, 1876a: 220; 1876b: 6. pl. 1 fig. 3. Rathbun, 1893: 82.

*Leptomithrax longimanus*: Filhol, 1885: 49; 1886: 364, pl. 39 figs. 4, 5. Chilton & Bennett, 1929: 739. Richardson, 1949b: 65, fig. 33.

*Leptomithrax (Leptomithrax) longimanus*: Bennett, 1964: 47 figs. 37-40, 117.

*Paramithrax (Leptomithrax) affinis* Borradaile, 1916: 104, fig. 14; type locality: north of New Zealand, 100 fm—British Museum (Natural History), London.

*Leptomithrax affinis*: Chilton & Bennett, 1929: 739. Balss, 1929: 18. Richardson, 1949: 64.

HOLOTYPE: Male, length 45 mm, width 38.5 mm. British Museum (Natural History), London.

TYPE LOCALITY: New Zealand.

LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS: Northern: Near Three Kings Islands; 10 miles NW of Cape Maria van Diemen and Little Barrier Island, Hauraki Gulf, 35 fm, C. Chilton (Chilton & Bennett). Northern New Zealand, 180 metres (93 fm), *Gazelle* (Balss, as *L. affinis*). Central: Stephens Islands, T. B. Smith; Sumner, F. W. Hutton (Chilton & Bennett). Wellington, F. G. Maskell; Blind Bay to Golden Bay, east coast of South Island, *Doto* Exped.; Akaroa, H. Suter (Bennett). Southern: Timaru (drift on beach), E. W. Bennett; of Cape Saunders, 60 fm (D. H. Graham, ms.); Sandfly Bay (in stomach of sea perch, *Helicolenus percooides*) and east of Papanui Inlet, 40 fm, D. H. Graham (Bennett). Puysegur Point, T. B. Smith (Chilton & Bennett). Stewart Island (Filhol, 1886).

DISTRIBUTION: New Zealand, from Three Kings Islands to Stewart Island; restricted.

DESCRIPTION: Carapace broadly pyriform in dorsal aspect (length 1.3 times width), swollen and almost uniformly convex in profile, lateral margins spinous. Rostrum of two short spines (about  $\frac{1}{4}$  length of carapace), subconical, slender, weakly convergent distally, distance between tips half basal width of rostrum, forwardly directed, not depressed. Short hooked hairs fringing inner margins of rostral spines and also occurring on dorsal surface of rostral spines and carapace borne on small rounded tubercles; surface of carapace, including rostral spines, otherwise sparsely covered by short simple hairs.

Margins of carapace bearing a series of six generally very short conical, equidistant spines, one postorbital, one hepatic, and four branchial spines forming a semi-ellipse curving on to dorsal surface posteriorly, the last subdorsal. Hepatic spine about  $\frac{1}{4}$  length of rostrum, slightly upcurved



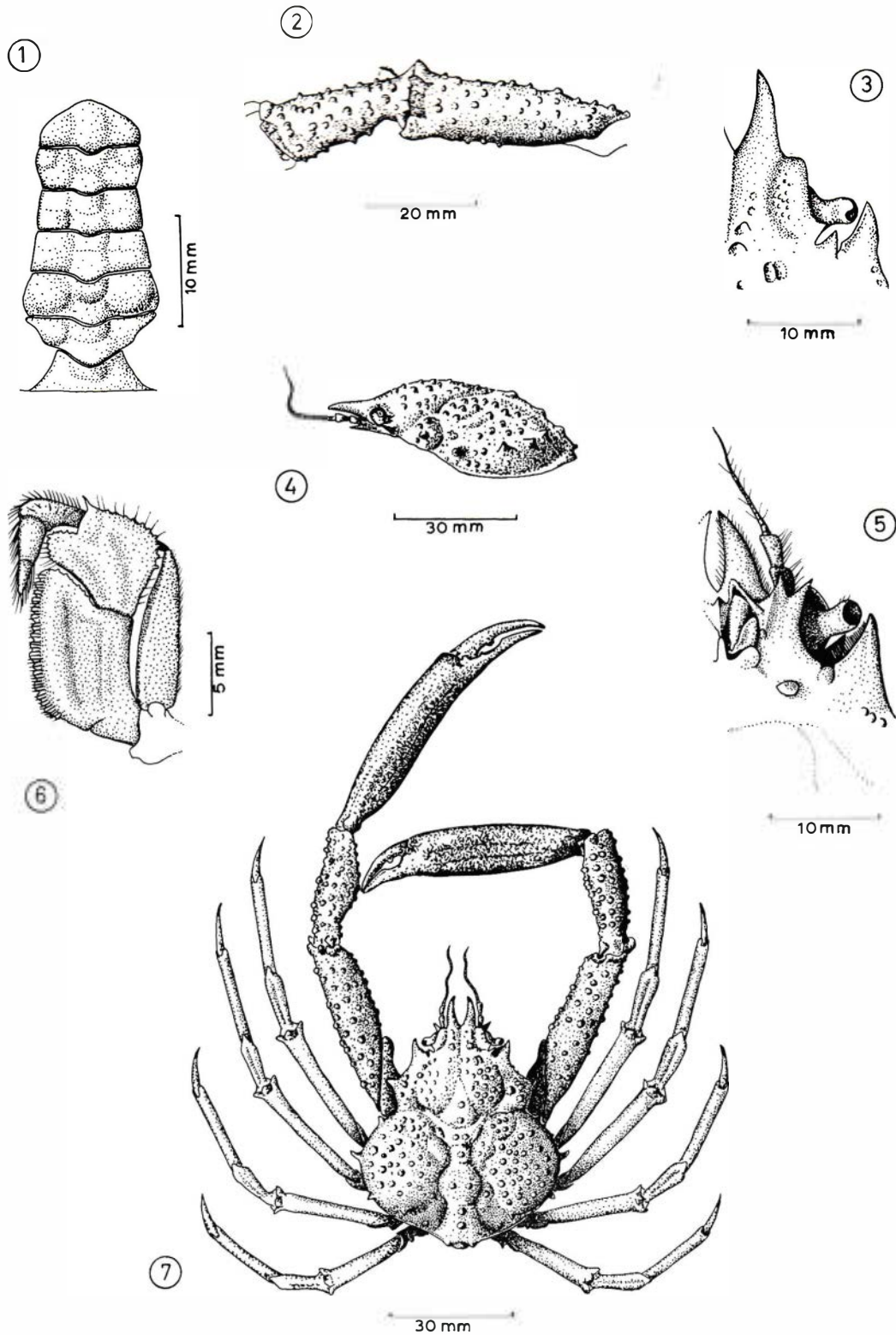


FIG. 12—*Leptomithrax longimanus* Miers. 1—Male abdomen. 2—Left cheliped of male, merus and carpus. 3—Dorsal view of orbit. 4—Lateral view of carapace. 5—Ventral view of orbit. 6—Left third maxilliped. 7—Dorsal view of male. All figs. from male, 60.5 mm, Castlepoint, 8 fm.

at tip, a very small tubercle sometimes close behind. First and third branchial spines half as long as hepatic spine, second as long as hepatic spine, fourth slightly shorter than third, the shortest in the lateral series; first and second branchial spines weakly upcurved at tips.

Dorsal surface of carapace densely covered by small rounded tubercles. Several slightly larger spinous tubercles in midline, five medial, two mesogastrics set well back on region, a single urogastric tubercle in middle of region, intestinal region with a tubercle close to anterior border partially subdivided into two and a second further back in middle of region. Three pairs of submedial tubercles, one metagastric, one cardiac, and one on posterior intestinal margin. Regions of dorsal surface of the carapace very well defined, mid-dorsal, branchial, and hepatic regions inflated and separated from each other by prominent, deep grooves.

Orbit consisting above of supraorbital eave, intercalated spine and postorbital lobe, the three closely approximated, separated by very narrow, deep fissures, all three forming rim of orbit; supraorbital eave narrow, anterolateral corner sharply angled, a small, flattened, triangular antorbital spine; intercalated spine short, intermediate in length between antorbital spine and postorbital lobe, flattened, triangular; postorbital lobe long, about half length of rostrum, wide basally, weakly forwardly directed, anterior face moderately excavate, a fringe of short hairs surrounding rim of excavation; anterior upper edge with a very small tubercle close to base, edges otherwise lacking accessory spinules. Orbit circular and deep, inferior border incompletely formed by basal antennal article so as to leave eye almost entirely visible in ventral view. Eye-stalk short, when pressed back not quite reaching tip of postorbital lobe, very stout, bulbous basally, covered dorsally by very short scattered hairs; cornea ovoid, large, subterminal slightly ventral.

Basal antennal article large, narrowly subrectangular, anterior angles each with a single long, conical, forwardly directed spine, spines subequal in length, anteromedial spine slightly further advanced than anterolateral; medial edge bearing one to three very small tubercles basally, a slightly larger tubercle situated between base of article and base of postorbital lobe; flagellum excluded from orbit by a short, stout process of basal article, long, extending for half its length beyond rostrum, visible from above.

Antennular fossac subtriangular, apex anterior. Interantennular spine long, downwardly curved, pointed, anterior face weakly excavated. Anterior process of epistome narrow, bluntly pointed.

Epistome wide, short. Mouthfield large, subrectangular, anterior margin transverse, weakly concave medially. Pterygostomian regions subtriangular, slightly excavated at posteromedial angle, clearly separated by a shallow groove from weakly inflated subhepatic regions, lateral border bearing a row of several small tubercles. Subhepatic regions bearing several slightly larger tubercles on middle of lateral surface. Thoracic sternum large, wide, obtusely angled anteriorly to form posterior border

of mouthfield, surface smooth and flat except for a pair of very shallow excavations anteriorly between bases of chelipeds.

Third maxillipeds almost meeting in midline. Ischium large, subrectangular, slightly longer than wide, medial edge coarsely toothed, teeth distinct but of irregular shape, overlain and almost concealed by a fringe of long hairs; medial half of distal edge extended anteriorly as a rounded crenulate process, anteromedial corner broadly acute, medial half of distal edge straight, bearing merus; outer surface weakly excavated medially as a wide, longitudinal groove. Merus subquadrate, as wide as ischium but slightly shorter, narrow basally, lateral edge sharply angled, anterolateral portion bearing a few small, blunt spines, posterolateral portion minutely crenulate, distal edge deeply notched, a well developed sharp, triangular spine at outer angle of notch, medial edge rounded, crenulate distally; outer surface bearing two shallow longitudinal grooves; lateral and medial edges fringed by short scattered hairs. Palp arising from middle of distal edge of, and as long as, merus, stout, lateral surface bearing a fringe of long hairs, medial edge also bearing long hairs which extend beyond tip of palp.

Chelipeds very long (about 2.2 times length of carapace in adult male), subcylindrical except for compressed propodus, merus and carpus covered on all surfaces by numerous small tubercles. Basis and ischium short, ischium extending along ventral surface of merus for about  $\frac{1}{3}$  length of latter. Merus long, about  $\frac{1}{4}$  total length of cheliped, carpus slightly longer than  $\frac{2}{3}$  merus, chela very long, almost  $\frac{1}{2}$  total length of cheliped, dactyl,  $\frac{1}{3}$  palm. Merus with a blunt tubercle dorsally overlying distal articulating edge; palm of uniform height throughout, upper surface blunt for entire length. Fingers acute, widely gaping basally in male and coarsely toothed along inner edges for distal half in both fixed finger and dactyl, junction of excavation and distal toothed portion of fixed finger sharply angled, dactyl with a large tooth about  $\frac{1}{3}$  from base; fingers in female gaping and toothed along inner edges for entire length, dactyl without a prominent basal tooth.

Ambulatory legs long, slender and subcylindrical except for weakly depressed carpi, dorsal surfaces bearing a double row of opposing groups of hooked hairs. Legs otherwise bearing short simple hairs. First leg the longest, about 1.3 times carapace length, following legs decreasing gradually and uniformly to the last (barely longer than carapace). Bases and ischia short, meri long, nearly  $\frac{1}{2}$  total length of leg, carpi about  $\frac{1}{2}$  meri, propodi slightly longer than carpi, dactyli about  $\frac{1}{2}$  propodi; meri with a prominent dorsal tubercle or spine distally overlying articulating edge; carpi with a prominent longitudinal groove dorsally; dactyli terminating in a sharp claw.

Abdomen consisting of seven distinct segments in both sexes. Male abdomen narrow, all segments much broader than long, subequal in length; segment 1 wide basally, narrow distally; segment 2 widening sharply to base of segment 3, widest part of abdomen, following segments narrowing gradually to base of distally widened segment 6, segment 7 with a strongly convex margin; surfaces of all

segments elevated medially as a low, rounded, longitudinal ridge, further weakly elevated distally in all segments except 1 and 7; lateral areas of segments 2 and 3 and lateral distal areas of segment 6 weakly inflated.

Male first pleopod bulbous basally, very slender and outwardly curved distally, aperture subterminal, medial surface immediately basal to it expanded as a short ridge, abdominal and sternal surfaces expanded on each side of aperture as a thin flap of tissue, expansion continuing to slender, pointed tip and enclosing a long canal; long setae extending along lateral surface for about basal two-thirds, a few short setae along lateral surface between aperture and tip.

**COLOUR:** The whole of the carapace and legs are a dull yellowish brown, the chelipeds in adult males a dark brown with yellowish markings on the propodus. Females paler in colour than the males.

**MATERIAL EXAMINED:** A total of 22 specimens as follows:

**VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COOK STRAIT COLLECTIONS:** Coll. VUZ 4, off Rangitoto Island, 40-50 fm, 3 females, 19-25 mm; Coll. VUZ 55, off Cape Palliser, 70-80 fm, 1 male 20.5 mm, 2 females, 24, 33.5 mm.

**COLLECTIONS OF PROFESSOR L. R. RICHARDSON:** Hauraki Gulf, in dogfish stomach, Jun 1948, L. R. Richardson, 1 incomplete specimen; channel between Cooper Island and Bradshaw Peninsula, Paterson Inlet, Stewart Island [location probably Dusky Sound, not Paterson Inlet, Stewart Is.], 18 fm, W. H. Dawbin, 1 male, 20.5 mm, 1 female, 19.5 mm.

**DOMINION MUSEUM COLLECTIONS:** Castlepoint, crayfish pot, 8 fm, Mar 1957, B. Harris, 1 male (Z. Cr. 991), 60.5 mm; Wellington Harbour Patent Slip, 7 Nov 1901, M. K. Mestayer, 1 female (Cr. 335, part), 37 mm; Torrent Bay, Nelson, 24 Dec 1950, P. A. Lush, 1 female, (Cr. 342), 34 mm; B.S. 169, off Stephens Island, 11 fm, 1 female, 34 mm; B.S. 190, off east Otago coast, 300 fm, 1 female (Z. Cr. 605), 47.5 mm; B.S. 191, off east Otago coast, 250-300 fm, 4 females (Z. Cr. 568) 36-46 mm; 1 male, 1 female (Z. Cr. 606), male 36 mm, female 50 mm; Oyster beds, Foveaux Strait, Jul 1958, pres. Mrs C. Sansom, 1 male (Z. Cr. 934), 37 mm.

**OCEANOGRAPHIC INSTITUTE COLLECTIONS:** Sta. A 444, Cook Strait, 120 fm, 1 male, 25 mm, 2 females (1 ovigerous), 28, 29.8 mm; Sta. B 225, Foveaux Strait, 16 fm, 1 ovigerous female, 30.5 mm; Sta. C 440, off Cape Egmont, 28 fm, 1 female, 8 mm; Sta. C 603, Kaikoura, 85 fm, 1 female, 15.5 mm.

**MEASUREMENTS:** Largest male: length 60.5 mm, width 49 mm, rostral length 7 mm, rostral width 8 mm, cheliped 134 mm, chelar length 66 mm, chelar height 8 mm, dactyl 23.5 mm, first ambulatory leg 81 mm.

Largest female: length 47.5 mm, width 34 mm.

**HABITAT:** Although occasionally found in rock pools, this species is much more common offshore. Specimens in the N.Z. Oceanographic Institute Collections have been taken on muddy or sandy bottoms in association with polychaetes, bivalve molluscs, sponges, and bryozoans.

Bennett (1964, p. 49) notes that a few specimens carry on the carapace and legs serpulid tubes, sponges, and sometimes a great amount of mud. Adornment of this kind is also common in *Notomithrax minor*.

**DEPTH:** Littoral to offshore at 300 fm, most common between 10 and 120 fathoms.

**BREEDING:** Two ovigerous females are present in the collections available, both taken by the N.Z. Oceanographic Institute, one in Cook Strait in October 1958 and the other in Foveaux Strait in April, 1960.

**REMARKS:** The original description of this species (Miers, 1876a, p. 220) was very short, but together with the figure (Miers, 1876b, pl. 1 fig. 3) has been, in most cases, sufficient for the identification of material collected since. Only a few of the features mentioned in Miers's description and shown in his figure require consideration. Though the description states that the anterolateral margin lacks spines, the figure clearly shows two hepatic spines and four branchials; in most material I have examined only one hepatic spine is present, though a small tubercle is often developed close behind. The figure does not show the pair of submedial tubercles or spines on the posterior intestinal margin and the dactyl and fixed finger of the chela are both shown with a strong inwardly projecting tooth; in all the material available to me only the dactyl possesses such a tooth, though the fixed finger is prominently excavated for the basal half and the junction with the distal toothed portion is characteristically very sharp in adult males.

The much better figure of this species given by Filhol (1886, pl. 39 figs. 4, 5) agrees in nearly all respects with the material available to me, except that the fixed finger of the chela is shown as coarsely toothed for its entire length with no prominent angular bump midway along.

Borradaile's (1916) *Paramithrax (Leptomithrax) affinis* described from a single female specimen, 34 mm in carapace length, was originally regarded as closely related to, but specifically distinct from, *Leptomithrax longimanus*. Specimens of a similar size and from the same locality as Borradaile's species were examined by Chilton & Bennett (1929) and referred at first to *L. longimanus* but later to *L. affinis*, although it was considered very likely that the latter was a synonym of the former. Balss (1929) also retained *L. affinis* as a valid species at first, later (1930), after examination of small specimens from Campbell Island, regarding it as conspecific with *L. australis* (Jacquinot). Of the four differences between *L. affinis* and *L. longimanus* enumerated by Borradaile all are due to age or sex or are non-existent. Until recently few adult females and juveniles of *L. longimanus* and *L. australis* have been available for comparison with Borradaile's species.

Borradaile's species agrees with *L. longimanus* and differs from *L. australis* in two important characters: the presence of a sharp spine above the distal articulating edge of the meri of the ambulatory legs, and the absence of a spinule or tubercle from the upper anterior edge of the postorbital lobe. The only distinct difference between *L. affinis* and both of the other two species is the general absence of tubercles or spines from the carpus of the cheliped. However, this feature is characteristic of juveniles males and females and adult females of *L. longimanus*; in *L. australis* the carpus of the cheliped is strongly tuber-



culated in juveniles and adult females (see under *L. australis*). Thus there can be no doubt that *Leptomithrax affinis* Borradaile, 1916 is conspecific with, and is therefore a junior objective synonym of, *Leptomithrax longimanus* Miers, 1876.

Bennett (1964) has drawn attention to the mainland distribution of *L. longimanus* in contrast to the southern distribution of *L. australis*; the former is not known from the southern islands, of which the latter is characteristic and *L. australis*, except for one specimen taken in Wellington Harbour and one at the Chatham Islands, does not occur north of Otago.

**Leptomithrax australis** (Jacquinot, 1853). Figs. 13, 14, 22.

*Maia australis* Jacquinot, in Jacquinot and Lucas, 1853: 11, pl. 2 fig. 1.

*Paramithrax (Leptomithrax) australis*: Miers, 1876a: 220; 1876b: 7. Rathbun, 1893: 82.

*Leptomithrax australis*: Filhol, 1885: 49; 1886: 361, pl. 38. Chilton, 1909: 607. Thomson, 1913: 237; 1921: 97. Stephensen, 1927: 292. Chilton & Bennett, 1929: 738. Balss, 1930: 199. Richardson, 1949b: 65, fig. 32. Dell, 1960: 6.

*Leptomithrax (Leptomithrax) australis*: Bennett, 1964: 49, figs 34, 41-45, 118.

**HOLOTYPE**: Female. Muséum National d'Histoire Naturelle, Paris.

**TYPE LOCALITY**: Auckland Islands; Hombron & Jacquinot, collectors.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS**: Southern: Otago coast (Thomson). Dunedin (Chilton & Bennett). Cape Saunders; east of Papanui Inlet, 40 fm, D. H. Graham (Bennett). Stewart Island, 30 fm (Filhol, 1886). Chatham Islands: Pitt Strait, 30 fm, F. Abernethy (Dell). Southern Islands: Auckland Islands (Chilton; Stephensen). Perseverance Harbour, Campbell Island, 42 metres, dredged, L. Kohl-Larsen, *Gazelle* (Balss).

**DISTRIBUTION**: Southern New Zealand including Otago, Foveaux Strait, and Stewart Island, perhaps extending north to Cook Strait and east to Chatham Islands, also Auckland and Campbell Islands; restricted.

**DESCRIPTION**: Carapace broadly pyriform in dorsal aspect (length 1.1 times width), moderately swollen and uniformly convex in profile, lateral margins strongly spinous. Rostrum of two short subconical spines ( $\frac{1}{2}$  length of carapace), separate from base, weakly convergent distally, distance between tips half basal width of rostrum, weakly downwardly flexed at tips. Short, hooked hairs fringing inner margins of rostral spines and also occurring on dorsal surface of carapace borne on small rounded tubercles. Surface of carapace, including rostrum, otherwise sparsely covered by short simple hairs.

Margins of carapace with six prominent, conical, equidistant spines, one postorbital, one hepatic and four bran-

chials forming a semi-ellipse, curving on to dorsal surface posteriorly, the last remote from margin; postorbital and following three spines subequal.  $\frac{1}{2}$  length of rostrum. weakly upcurved at tips. the last two progressively shorter: hepatic and branchial spines generally surrounded at base by several spinous tubercles.

Dorsal surface of carapace densely covered by small spinous tubercles. Five slightly larger median spines, two mesogastrics set well back on region, a single, small urogastric spine, intestinal region with a low, rounded tubercle partially subdivided into two close to anterior margin of region, a much larger spinous tubercle in middle of region: three pairs of submedial spines, one metagastric, one cardiac, and a pair of poorly developed submedial spinous tubercles situated on posterior intestinal margin. Regions of carapace moderately well defined, branchial region weakly inflated.

Orbit consisting above of supraorbital eave, intercalated spine and postorbital lobe, closely approximated, separated by narrow, deep fissures, all three forming upper rim of orbit; supraorbital eave wide, anterolateral corner sharply angled, a small, sharp, flattened antorbital spine at posterolateral corner; intercalated spine intermediate in length between antorbital spine and postorbital lobe. flattened, triangular; postorbital lobe long,  $\frac{1}{2}$  length of rostrum, wide basally, weakly forwardly directed, anterior face slightly excavated, a fringe of short hairs surrounding rim of excavation; a prominent accessory spinule situated about midway along anterior, upper edge. Orbit circular and deep, inferior border incompletely formed by basal antennal article so as to leave eye almost entirely visible in ventral view. Eystalk short, when pressed back not quite reaching postorbital lobe, very stout, bulbous basally, covered dorsally by very short scattered hairs; cornea subterminal, slightly ventral, very large.

Basal antennal article large, narrowly subrectangular. anterior angles each with a single, long, conical, forwardly directed spine; medial spine slightly further advanced; medial edge bearing one to three small tubercles about midway along, lateral edge with a small spine basally; a small spine situated between base of antennal article and base of postorbital lobe; flagellum excluded from orbit by a short, stout projection of basal article. long, extending for half its length beyond rostral spines. visible from above, setose.

Antennular fossae subtriangular; interantennular spine long, downwardly curved, pointed, anterior face weakly excavated; anterior process of epistome narrow, bluntly pointed.

Epistome wide, short. Mouthfield large, subrectangular. anterior margin transverse, very weakly concave medially. Pterygostomial regions subtriangular, weakly excavated at posteromedial corner, clearly separated by a shallow groove from weakly inflated subhepatic regions, lateral border bearing a row of several small spinous tubercles. Subhepatic regions bearing several longer spines on middle of lateral surface. Thoracic sternum large, wide, obtusely angled anteriorly to form posterior border of mouthfield, surface smooth and at except for a pair of

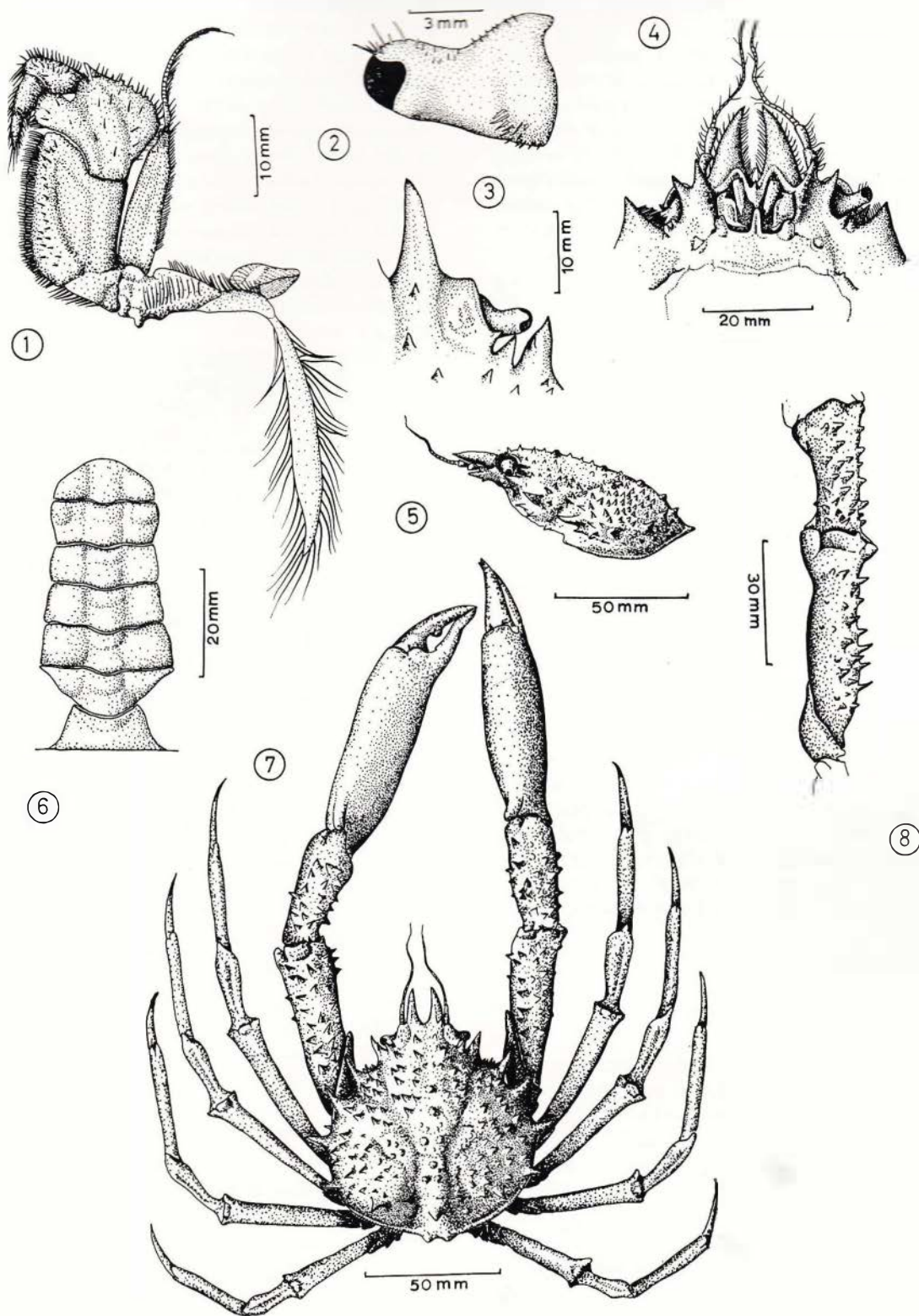


FIG. 13—*Leptomithrax australis* (Jacquinot). 1—Left third maxilliped. 2—Posterior view of left eye-stalk. 3—Dorsal view of orbit. 4—Ventral view of front. 5—Lateral view of carapace. 6—Male abdomen. 7—Dorsal view of male. 8—Left cheliped of male, merus and carpus. All figs. from male, carapace length 88.5 mm, off Otago Heads.

very shallow excavations anteriorly between bases of chelipeds.

Third maxillipeds almost meeting in midline, naked except for a few scattered hairs. Ischium of endopodite large, subrectangular, slightly longer than broad, medial edge coarsely toothed, the teeth distinct but of irregular shape, overlain and almost concealed by a fringe of long setae; medial half of distal edge extended anteriorly as a long, rounded crenulate process, anteromedial corner broadly acute, medial half of distal edge straight, bearing merus; outer surface weakly excavated medially as a wide longitudinal groove. Merus subquadrate, as wide as, but slightly shorter than, ischium, narrow basally, lateral edge sharply angled, anterolateral portion bearing a few very small, blunt spines, posterolateral portion minutely crenulate, distal edge deeply notched, a well developed, sharp, triangular spine at outer angle of notch, medial edge rounded, crenulate distally; outer surface bearing two shallow, longitudinal grooves. Lateral and medial edges of merus fringed by scattered short hairs. Palp arising from middle of distal edge of, and as long as, merus, stout, lateral surface bearing a fringe of long hairs, medial surface also hairy.

Chelipeds very long (2.3 times carapace length in male), subcylindrical except for somewhat compressed propodus, merus, and carpus covered by small, closely set conical spines, very small and widely scattered on lateral surface, ventral surface smooth, entirely lacking spines. Basis and ischium short, ischium extending along ventral surface of merus for about  $\frac{1}{3}$  length of latter. Merus long, slightly more than  $\frac{1}{4}$  total length of cheliped, carpus about  $\frac{2}{3}$  merus, chela very long, about  $\frac{1}{2}$  total length of cheliped, dactyl slightly less than  $\frac{1}{3}$  palm. Merus with a small spine dorsally overlying distal articulating edge; palm slightly enlarged distally in male, diminished slightly distally in female, upper surface blunt for entire length. Fingers acute, widely gaping basally in male, fixed finger toothed along inner edge for distal two-thirds, junction of excavation and distal portion smoothly rounded, dactyl toothed for distal half with a large basal tooth; fingers finely toothed and gaping for entire length in female, dactyl without a prominent basal tooth.

Ambulatory legs long, slender, and subcylindrical except for weakly depressed carpi, dorsal surfaces bearing a double row of opposing groups of hooked hairs, legs otherwise sparsely covered by short simple hairs. First leg the longest (barely more than 1.4 times carapace length), following legs decreasing gradually and uniformly to the last (scarcely longer than carapace). Bases and ischia short; meri long, nearly half total length of leg, carpi short, about  $\frac{1}{2}$  meri, propodi slightly longer than carpi, dactyli hardly more than  $\frac{1}{2}$  propodi, terminating in a sharp claw.

Abdomen consisting of seven distinct segments in both sexes. Male abdomen narrow with all segments much broader than long, subequal in length; segment 1 wide basally, narrow distally, segment 2 widening sharply to base of segment 3, widest part of abdomen, following segments narrowing gradually to base of segment 6 which widens slightly distally to be almost as wide as base

of third, segment 7 with a strongly convex margin. Surface of abdomen elevated medially as a low, rounded, longitudinal ridge, further weakly elevated distally in all segments except 1 and 7; lateral areas of segments 2 and 3, and lateral distal areas of segment 6 weakly inflated.

Male first pleopod long, slender, bulbous basally, outwardly curved distally. Aperture located on medial surface some distance from tip, surface basal to aperture raised as a short, blunt ridge, surrounded on each side by thin expansions of sternal and abdominal surfaces, that of sternal surface continuing distal to aperture but only for a very short distance basal to it, that of abdominal surface much less prominent, not continuing distally beyond aperture; minute setae extending along lateral surface beside aperture and curving on to sternal surface basal to it to become slightly longer; very minute setae scattered along lateral surface in region of aperture.

**COLOUR:** The whole animal is orange-red to very deep red; the propodus of the chelipeds is finely marked with white and the teeth of the fixed finger and dactyl and the tips of the fingers are white.

**MATERIAL EXAMINED:** A total of 18 specimens as follows:

**DOMINION MUSEUM COLLECTIONS:** Patent Slip, Wellington, 7 Nov 1901, M. K. Mestayer, 1 female (Cr. 335, part), 46.5 mm; off Otago Heads, on hand line, Oct 1952, J. Moreland, 1 male (Z. Cr. 992), 88.5 mm; off Bench Island, Foveaux Strait, in craypot, 30 fm, 8 Dec 1955, pres. Mrs. C. Smith, 2 males (Z. Cr. 608), 95 mm, 102 mm; cast up on shore, east coast of Enderby Island, Auckland Island, 19 Aug 1943, W. H. Dawbin (Cape Expedition), 5 males, 24-40 mm, 5 females, 26-49 mm; Port Ross, Enderby Island, Auckland Islands, in tidal pool on algae, 17 Mar 1954, R. K. Dell, 1 female, 60 mm; Ranui Cove, Auckland Islands, on rocks at low tide mark, 8 Nov 1954, R. A. Falla, 1 female, 62 mm; Windlass Bay, Campbell Island, cast ashore, 20 Apr 1945, J. H. Sorenson (Cape Expedition), 1 male (Cr. 466), 79 mm; Venus Bay, Campbell Island, cast ashore, 7 Apr 1946, J. H. Sorenson (Cape Expedition), 1 male (Cr. 467), 70 mm.

**MEASUREMENTS:** Largest male: length 102 mm, width 88 mm, rostral length 16 mm, rostral width 14.5 mm, cheliped 238.5 mm, chelar length 121.5 mm, chelar height 27 mm, dactyl 47.5 mm, first ambulatory leg 146 mm.

Largest female: length 62 mm, width 48 mm.

**HABITAT:** Little is at present known of the ecology of this species. Bennett (1964, p. 50) states that it is not common, and also mentions that some of the few specimens available to him had the carapace and legs densely covered by tubes of polychaetes, *Spirorbis*, and sometimes cirripedes, sponges, and hydroids. None of the specimens I have seen possessed camouflage material.

**DEPTH:** Offshore to about 50 fm, occasionally intertidal, especially in the southernmost part of its range.

**REMARKS:** This species has been comparatively well understood since its original description and has been free from synonymic complications as noted by Bennett (1964). Discrepancies in the figure of this species provided by Filhol (1886, pl. 38) are discussed by Bennett.

Adult males of this species are easily separable from

adult male *L. longimanus*, but the juvenile and adult females of the two species present a rather more difficult problem since they are so different from the males. Chilton & Bennett (1929, p. 738) gave a short list of differences between the two species based on adult males. Formerly the only reliable character separating juveniles and females of the two species has been the presence (in *L. australis*) or absence (in *L. longimanus*) of a very prominent, sharp spinule on the upper anterior edge of the postorbital lobe; in both species a very small tubercle is sometimes present on the upper anterior edge of the postorbital lobe close to the base. The main differences between the two species, adults and juveniles of both sexes, may now be enumerated:

1. CARAPACE SHAPE: Broadly pyriform in adult male *L. australis*, narrowly pyriform in juveniles of *L. australis* and both juvenile and adult *L. longimanus*.

2. DORSAL SURFACE OF CARAPACE: Densely covered by short spines in adult male *L. australis*, the regions separated by shallow grooves; densely covered by small tubercles, the regions clearly delimited by deep grooves in adult male *L. longimanus*; in juvenile and female *L. australis* the surface is covered by small tubercles, in *L. longimanus* juveniles and females, the carapace is almost smooth, bearing a few sharp spines and some very small tubercles.

3. ROSTRAL SPINES: Short, slender, subconical, somewhat depressed and weakly convergent distally in adult males of both species; short, stout, and not divergent in juveniles and females of *L. australis*; short, slender and very slightly divergent in juveniles and females of *L. longimanus*.

4. MARGINAL SPINES: One hepatic and four branchials in both species; in adult males of *L. australis* as long as, or longer than, postorbital lobe and sharp; in adult male *L. longimanus* very much shorter than postorbital lobe and bluntly pointed. Juveniles and females of *L. longimanus* possess, in addition, a series of two spines on the dorsal surface of the branchial regions posteriorly, extending obliquely anteromedially from the last marginal spine.

5. MERUS OF CHELIPED: In adult male *L. australis* covered by closely spaced small spines on dorsal and medial (anterior) surfaces, lateral (posterior) surfaces with scattered spines, ventral surface smooth; covered by very closely spaced small tubercles on all surfaces in adult male *L. longimanus*; in juvenile and female *L. australis* weakly tuberculate dorsally and medially; strongly tuberculate on all surfaces except generally smooth ventral surface in *L. longimanus* juveniles and females.

6. CARPUS OF CHELIPED: As for merus in adult males; in juvenile and female *L. australis* all surfaces tuberculated except ventral; in *L. longimanus* juveniles and females weakly tuberculate or more usually smooth.

7. CHELA: Enlarged distally in adult males and short and diminished distally in juveniles and females of *L. australis*; of even height throughout the length in adults and juveniles of both sexes in *L. longimanus*.

8. FINGERS OF CHELA: In adult male *L. australis* fixed finger dentate for distal two-thirds, excavated basally, junction of excavation and toothed portion smoothly rounded; in adult male *L. longimanus* fixed finger dentate for distal half, excavated basally, junction of excavation and distal portion sharp; in adult males of both species the dactyl bears a prominent, large tooth close to the base and is dentate for the distal half. In juvenile and females the fingers are weakly toothed and practically adjacent throughout their length.

9. MERI OF AMBULATORY LEGS: Completely lacking a distal spine or tubercle in adults and juveniles of both sexes in *L. australis*; a prominent blunt tubercle in adult male *L. longimanus* and a small sharp spine in juveniles and females dorsally overlying the distal articulating edge.

Bennett (1964, p. 47) has included Balss's (1930) *L. australis*, taken at Campbell Island, in the synonymy of *L. longimanus* Miers. Since Bennett has also emphasised the mainland distribution of the latter as opposed to the southern distribution of *L. australis* I maintain that Balss's material was of the latter species, though the specimens are difficult to place from his description. *Leptomithrax australis*: Balss, 1930 therefore appears under the synonymy of *Leptomithrax australis* (Jacquinot, 1853) in the present report.

**Leptomithrax garricki** n.sp. Figs. 14, 22; Plates 1, 2.

HOLOTYPE: Male, length 100 mm. Dominion Museum, Wellington.

TYPE LOCALITY: Off Kaikoura, South Island, New Zealand, Aug 1956, in trap at 220 fm; J. Baxter, collector.

PARATYPES: A total of four specimens, apart from the holotype, have been examined, and are located in the following collections:

VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COOK STRAIT COLLECTIONS: Coll. VUZ 77, off Palliser Bay, 435 fm, 1 male, 68.5 mm.

DOMINION MUSEUM COLLECTIONS: 2 males and 1 female with same data as that of holotype, males 89.5 mm, female 67 mm.

DESCRIPTION: Carapace broadly subpyriform in dorsal aspect (length 1.3 times width), inflated and weakly convex in profile, margins strongly spinous. Rostrum of two short subconical spines ( $\frac{1}{2}$  length of carapace), weakly convergent distally, distance between tips hardly as great as basal width of rostrum, directed forward, not deflexed at tips. Dorsal surface of carapace finely pubescent, slender hooked hairs fringing margins of rostral and marginal spines and in groups on protogastric and branchial regions; surface otherwise covered by very short simple hairs.

Margins of carapace with seven strong, outwardly directed spines, one postorbital, two hepatic, and four branchials forming a semi-ellipse, the last distant from margin, all except postorbital conical; first hepatic and first two branchials subequal in length, almost  $\frac{2}{3}$  length of

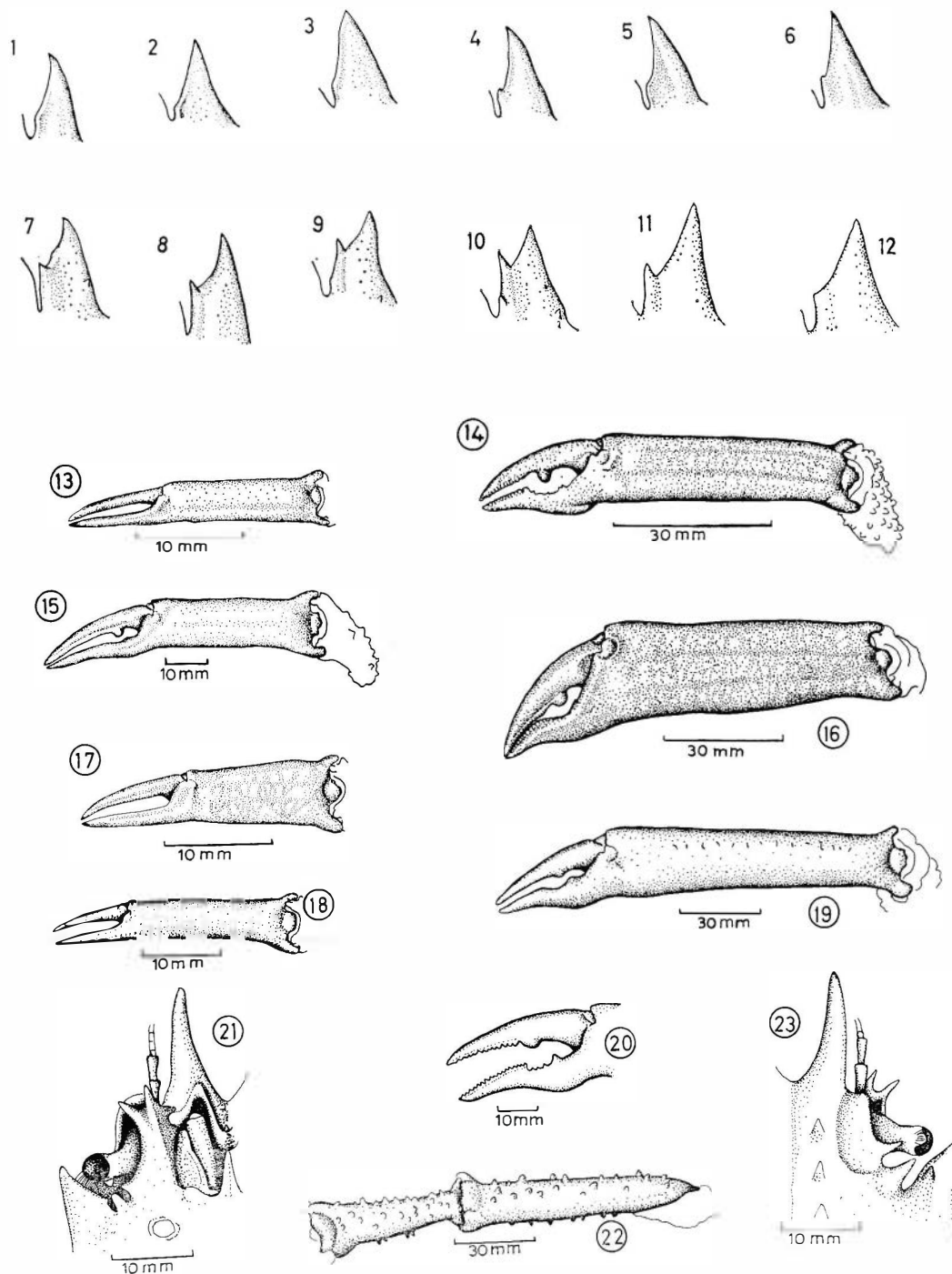


FIG. 14—*Leptomithrax longimanus* Miers, *Leptomithrax australis* (Jacquinot) and *Leptomithrax garricki* n.sp.

1-6—*L. longimanus*, postorbital spines: 1—37 mm female, (Cr. 335), Patent Slip, Wellington; 2—50 mm female (Z. Cr. 606), off east Otago coast, 250-300 fm; 3—60.5 mm male (Z. Cr. 991), Castlepoint, 8 fm; 4—34 mm female (Cr. 342), Torrent Bay, Nelson; 5—37 mm male (Z. Cr. 934), Foveaux Strait; 6—47 mm male (Z. Cr. 605), off east Otago coast, 300 fm.

7-10—*L. australis*, postorbital spines: 7—46.5 mm female (Cr. 335), Patent Slip, Wellington; 8—79 mm male (Cr. 466), Windlass Bay, Campbell Island; 9—88.5 mm male (Z. Cr. 992), off Otago Heads; 10—95 mm male (Cr. 608), off Bench Island, Foveaux Strait, 30 fm.

11, 12—*L. garricki*, postorbital spines; 11—89.5 mm male; off Kaikoura, 220 fm; 12—89.5 mm male, off Kaikoura, 220 fm.

13-20—*Leptomithrax* species, left chelae. 13, 14—*L. longimanus*: 13—50 mm, female, off east Otago coast (Z. Cr. 606); 14—60.5 mm male (Z. Cr. 991), Castlepoint.

15-17—*L. australis*: 15—79 mm male (Cr. 446), Windlass Bay, Campbell Island; 16—88.5 mm male (Z. Cr. 992), off Otago Heads; 17—49 mm female, Enderby Island, Auckland Islands. 18-20—*L. garricki*: 18—67 mm female, off Kaikoura, 220 fm; 19—90-100 mm male, off Kaikoura, 220 fm; 20—89.5 mm male, off Kaikoura, 220 fm (fingers only).

21-23—*Leptomithrax garricki* n.sp., 100 mm male holotype: 21—ventral view of orbit; 22—left cheliped, merus and carpus; 23—dorsal view of orbit.

rostrum, weakly curved upward at tips; second hepatic spine small,  $\frac{1}{3}$  length of first; third and fourth branchial spines also short, the fourth the shortest, hardly longer than second hepatic spine. Two prominent spines extending obliquely anteromedially from fourth marginal branchial spine on dorsal surface of branchial regions.

Dorsal surface of carapace sparsely covered by short spines and tubercles. Four medial spines: two mesogastrics set well back on region, one urogastric and one intestinal in middle of region. Nine pairs of submedial spines: five subequidistant protogastrics, a single pair of metogastrics and cardiacs; intestinal region with a pair of small spines close to anterior margin and another more widely separated pair on posterior intestinal margin. Several slightly longer spines arranged subdorsally round margins of carapace above marginal spines; surface of carapace otherwise almost smooth. Regions of dorsal surface well defined.

Orbit consisting above of supraorbital eave, intercalated spine and postorbital lobe, the three closely approximated but distinct; supraorbital eave wide, sharply angled anteriorly, bearing at posterolateral corner a strong antorbital spine,  $\frac{1}{3}$  length of rostrum; intercalated spine slightly longer than antorbital, flattened, narrowly triangular; postorbital lobe very long,  $\frac{2}{3}$  length of rostrum, broad-based, acuminate, somewhat flattened, anterior surface excavated, rim of excavation fringed by short hairs, a small accessory tubercle on upper anterior edge about  $\frac{1}{3}$  from base. Orbit circular and deep, incompletely formed below by basal antennal article, eyestalk almost entirely visible in ventral view. Eyestalk short, very stout, bulbous basally; cornea subterminal, circular, very large, a small tubercle above at distal extremity of eyestalk.

Basal antennal article of moderate width, subrectangular, lateral edge strongly concave, anterior angles each with a strong spine, subequal in length, anteromedial spine directed anteriorly, anterolateral directed slightly outward, a small tubercle on medial edge about  $\frac{1}{3}$  from base; flagellum excluded from orbit by a slender process of article, extending for  $\frac{2}{3}$  of its length beyond rostrum, visible in dorsal view, weakly setose. A small spine between basal article and postorbital lobe.

Antennular fossae subtriangular; interantennular spine stout, downwardly directed, bluntly pointed; anterior process of epistome narrow, sharply pointed.

Epistome wide, short. Mouthfield subrectangular, anterior margin weakly concave. Pterygostomian regions subtriangular, separated from subhepatic regions by a deep groove, two or three small spines, larger posteriorly, on lateral margin; subhepatic regions inflated, an oblique row of three or four small tubercles across surface and several immediately below first marginal spine. Sternum weakly excavated anteriorly in front of abdominal fossa as a shallow depression on each side of midline, otherwise flat and smooth.

Third maxillipeds meeting in midline. Ischium large, subrectangular, longer than wide, medial edge coarsely toothed, overlain but not concealed by a sparse fringe of

short hairs, medial half of distal edge extended anteriorly, rounded, lateral half straight to bear merus; outer surface excavated medially as a very wide, shallow depression. Merus subquadrate, as wide as, but slightly shorter than, ischium, anterolateral corner weakly expanded, rounded, medial edge rounded, crenulate distally; distal edge deeply notched, a prominent sharp tooth at lateral angle of notch; outer surface with two shallow longitudinal grooves. Palp stout, slightly longer than merus, segments subequal, lateral and medial surfaces fringed with long hairs.

Chelipeds very long (3 times length of carapace in adult male), subcylindrical except for compressed propodus, merus and carpus spinous. Basis and ischium short, ischium extending along ventral surface of merus for about  $\frac{1}{4}$  length of latter. Merus very long, almost  $\frac{1}{3}$  total length of cheliped, carpus  $\frac{2}{3}$  merus, chela almost  $\frac{1}{2}$  total length of cheliped, dactyl hardly  $\frac{1}{2}$  palm. Merus covered on all surfaces by short spines, closely spaced dorsally and medially, sparse laterally and ventrally, ventral surface sometimes smooth. Carpus with short spines covering surfaces as on merus, ventral surface similarly smooth or only sparsely tuberculate. Palm enlarged somewhat distally in male, weakly diminished distally in female, lacking spines or tubercles, dorsal and medial surfaces finely granular, medial surface irregularly and very weakly ridged, ridges orange in colour. Fingers acute, moderately gaping for basal half in male, for entire length in female, inner edges finely toothed in both sexes, excavation of fixed finger smoothly rounded, a prominent basal tooth on both fingers in male but not in female; dactyl hardly  $\frac{1}{2}$  propodus.

Ambulatory legs of moderate length, cylindrical, smooth, faintly pubescent. First leg the longest (almost  $1\frac{1}{2}$  times length of carapace), following legs decreasing to the last (just longer than carapace). Bases and ischia short; meri long, barely more than  $\frac{1}{3}$  total length of leg, carpi short,  $\frac{1}{2}$  meri, propodi  $\frac{2}{3}$  meri, dactyli about  $\frac{2}{3}$  propodi, terminating in a sharp claw; meri with a blunt tubercle overlying distal edge.

Abdomen of seven segments in both sexes. Abdomen in male narrow, segments subequal in length, widest at base of segment 3, following segments narrowing slightly to base of distally widened segment 6, segment 7 with margin strongly convex; surface weakly elevated in midline as a rounded ridge, further elevated distally in all segments except seventh as a wide tubercle, lateral surfaces of segment 3 and lateral distal surfaces of segment 6 inflated. Female abdomen broadly subovate.

Male first pleopod bulbous basally, slender and outwardly curved distally, aperture terminal; sternal and abdominal surfaces expanded on each side of aperture as thin flaps of tissue; long setae extending along lateral surface for basal two-thirds.

**COLOUR:** Whole animal pale yellowish to greeny white, medial surface of the chelipeds patterned with pale orange. (These notes are based on preserved material.)

**MATERIAL EXAMINED:** A total of five specimens (see *Holotype* and *Paratypes*).

**MEASUREMENTS:** Holotype male: length 100 mm, width 77 mm, rostral length 14 mm, rostral width 13 mm, cheliped 298 mm, chelar length 140 mm, chelar height 24 mm, dactyl 42 mm, first ambulatory leg 154 mm.

Adult female (paratype): length 67 mm, width 53 mm, cheliped 69 mm.

**HABITAT:** The only habitat data for this species concern the male collected off Palliser Bay in 435 fm by Victoria University of Wellington Zoology Department. The whole of the carapace of this specimen was completely covered by a single large sea anemone. The species is one of our deepest-living spider crabs.

**DEPTH:** Below 200 fm to over 400 fm (220 and 435 fm are the only known depths for the species).

**REMARKS:** Together with *L. longimanus* and *L. australis* this new species forms one of the closest assemblages of southern hemisphere majids. It closely resembles both the other species in the arrangement of spines and tubercles on the carapace, details of the orbit, shape of the basal antennal article and third maxillipeds, in the pronounced elongation of chelipeds in the adult male in contrast to the rather short ambulatories, in the presence of a prominent inwardly projecting basal tooth on the dactyl of the male cheliped, and in the shape of the male abdomen and form of the male first pleopod. It resembles *L. australis* and differs from *L. longimanus* in that the carapace is spinous rather than tuberculate, in the presence of a spine or tubercle on the upper anterior edge of the postorbital lobe, and in the large size. In the following rather variable features *L. garricki* differs from *L. australis*:

1. The intercalated supraorbital spine is slightly narrower.
2. The spine or tubercle of the upper anterior edge of the postorbital lobe is not as well developed.
3. The hepatic margin possesses a small spine behind the principal marginal hepatic spine; in *L. australis* the main spine is usually surrounded by several small spinules.
4. A small spine between the first and second marginal branchial spines is generally absent in *L. garricki*, but present in *L. australis*.
5. The merus and carpus of the cheliped in the adult male are sparsely covered by tubercles and a few spines, the tubercles extending on to the ventral surface, thus contrasting with the absolutely smooth appearance of this surface in *L. australis* adult males.

In a further seven constant features *L. garricki* is distinctly different from *L. australis*.

(1) The carapace is narrower: length 1.3 times width, compared with 1.1 times width in *L. australis*; this is valid only for adult males.

(2) The spines of the dorsal surface of the carapace in adult males are less numerous and bluntly pointed; the carapace of the female in *L. garricki* is closely similar to that of the male, thus contrasting with that of female *L. australis* in which the carapace is densely tuberculate. The marginal spines of the carapace are also much blunter and slightly shorter in *L. garricki* and there is an oblique row

of two spinous tubercles extending anteromedially from the last marginal branchial spine.

(3) The rostral spines are subconical, not flattened or deflexed at the tips, but straight and forwardly directed.

(4) The antorbital spine is almost as long as the intercalated spine; in *L. australis* it is barely half as long as the intercalated spine.

(5) The male chela is much longer and more slender, hardly enlarged distally, and patterned only on the medial (anterior) surface; the fixed finger of the chela in the adult male bears a tooth, slightly smaller and more basal than that of the dactyl.

(6) The meri of the ambulatory legs bear a distal dorsal tubercle, as in *L. longimanus*.

(7) The two species are widely different in colouring, *L. garricki* being pale yellowish, *L. australis* generally orange or deep red.

In the smallest male of *L. garricki* the teeth of the fixed finger of the chela start abruptly, the junction of the distal toothed portion and basal excavate portion being sharp as in *L. longimanus*, while in the larger males the appearance of the fingers is closely similar to those of *L. australis*, the junction of the basal excavate portion with the distal toothed portion smoothly rounded.

It is possible that depth alone may be cited as diagnostic for the species, since *L. australis* is not known from depths exceeding 50 fm while the new species comes from below 200 fm.

The new species is named for Dr J. A. F. Garrick of Victoria University of Wellington, who has been extremely active in the organisation of the Cook Strait expeditions of the zoology department of that university, his efforts being partly responsible for the securing of one individual of the new species from over 400 fathoms.

### **Leptomithrax tuberculatus** (Whitelegge, 1900)

This species, originally referred to *Paramithrax* (see Whitelegge, 1900, p. 146, pl. XXIV figs. 1, 2) and transferred to *Leptomithrax* by Rathbun (1918, p. 22), has formerly been recorded only from eastern Australia. It is now considered to occur in New Zealand waters as a subspecies, recently described as a distinct species by Bennett (1964, p. 52 (see below)). Whitelegge's description was based on 16 specimens collected by the *Thetis* expedition in February and March 1898 off the coast of New South Wales. However, no specimen was selected by Whitelegge as holotype. Consequently, following examination of the type series, all of which must be considered syntypes, in the Australian Museum, Sydney, in conjunction with Dr J. C. Yaldwyn a lectotype is here selected for this species.

**LECTOTYPE:** Male ((G. 2325) figured, Whitelegge, 1900, pl. XXXIV fig. 2), length 44 mm, width 31 mm; right cheliped now missing, specimen in spirit.—*Thetis* Exped. Sta. 35, off Port Hacking, N.S.W., 1½-2 miles offshore, 22-38 fm on sand, 10 March 1898.

**PARALECTOTYPES:** The 13 remaining specimens (two specimens of the original type series cannot now be located) all in spirit. Whitelegge gives the following *Thetis* Expedition stations for this species: 10, 35, 37, 41 and 42. Re-examination of the series gives the additional stations: 21, 25, 36 and 47. The series includes 4 males and 7 females (+ 2 specimens now in Bernice P. Bishop Museum, Hawaii). (For *Thetis* Expedition Station details see Waite, 1899.)

**MATERIAL EXAMINED:** Selected for special study and comparison with New Zealand material were eight specimens in the collections of the Australian Museum, including the lectotype and four others from the type series: *Thetis* Expedition Sta's 21, 25, 35, 36 and 47, 2 males (44 mm), 3 females (30-48 mm).

Off Botany Bay, N.S.W., 60-70 fm, trawled S.T. *Gunundaal*, pres. F. A. McNeill, June 1920, 1 female (P. 4711), 27.5 mm; off Botany Bay to Wata Mooli, N.S.W., c 50 fm, Oct 1924, trawled m.v. *Thistle*, pres. C. W. Mulvey, 1 female (P. 7572), 41.5 mm; off Botany Bay, N.S.W., 45-75 fm, 31 Aug 1959, trawled m.v. *Challenge*, T. Garrard, 1 male (P. 13538).

The New Zealand subspecies is now discussed in detail.

***Leptomithrax tuberculatus mortenseni* Bennett, 1964, n. comb. Fig. 20.**

*Leptomithrax (Austromithrax) mortenseni* Bennett, 1964: 52, figs. 36, 46-48, 119, 120.

**TYPES:** Male holotype, length 30 mm, width 21 mm. Canterbury Museum, Christchurch. Paratypes in Canterbury Museum (20 specimens) and Australian Museum, Sydney (2 specimens, see below).

**TYPE LOCALITY:** Off Little Barrier Island, Hauraki Gulf, 35 fm, *Hinemoa* Expedition.

**DISTRIBUTION:** Apparently northern part of North Island from Hauraki Gulf to Cape Maria van Diemen.

**DESCRIPTION:** Carapace narrowly pyriform in dorsal aspect (length almost 1.4 times width), somewhat depressed and uniformly convex in profile, surface granular, tuberculate, and sparsely spinous, margins strongly spinous. Rostrum of two moderately short (about  $\frac{1}{4}$  length of carapace), weakly divergent, subconical, acuminate, weakly depressed spines separate from base, basal width slightly greater than distance between tips and length of rostral margin. Hooked hairs fringing margins of rostral spine and scattered in groups on dorsal surface of carapace, close to midline anteriorly and to margins posteriorly, also above marginal branchial spines.

Margins of carapace with two hepatic spines and four branchials, all conical and outwardly directed except the last. Hepatic spines very short, the first slightly longer than second. Branchial spines increasing very slightly in length posteriorly, the last the longest (about  $\frac{2}{3}$  length of rostrum), arranged in a semi-ellipse curving on to dorsal surface posteriorly, last subdorsal, all weakly uncurved at tip, the last directed backward and upward.

Dorsal surface with a series of four medial spinous tubercles: two far back on mesogastric region, one urogastric, and one in middle of intestinal region, sometimes poorly developed; four pairs of generally short submedial tubercles: one protogastric close to midline in front of first mesogastric, one metagastric, one pair in middle of very tumid cardiac region, one in middle of intestinal region, and one short pair in posterior intestinal margin. Dorsal surface of carapace otherwise covered by numerous small, low rounded tubercles and granules, intestinal region densely granular, metabranchial region also granular, especially close to lateral margin; posterolateral margin of carapace being a series of small but nevertheless prominent, subequidistant granules. Regions of dorsal surface poorly defined; two pairs of depressions close to midline, one anteriorly opposite junction of hepatic and branchial regions and lateral to mid-dorsal regions, and one posteriorly on each side of intestinal region.

Orbit consisting above of eave, intercalated spine, and postorbital lobe; the three closely approximated; distinct, intercalated spine separated from eave by narrow fissure, closely pressed to postorbital lobe, almost excluded from rim of orbit; eave rounded laterally, very wide, a moderately long, flattened, triangular antorbital tooth at posterolateral angle projecting laterally toward postorbital lobe; intercalated spine narrowly triangular, not quite as long as antorbital; postorbital lobe large, elongate, triangular, about  $\frac{2}{3}$  length of rostrum, flattened, anterior edge excavated, edges lacking tubercles or spinules, tip broadly triangular, pointed, posterior edge sharp, weakly concave midway along. Orbit circular and deep, incompletely formed below by basal antennal article; eyestalk almost entirely visible in ventral view, moderately long, reaching to excavation of postorbital lobe, very stout, bulbous basally; cornea large, ovoid, obliquely subterminal, slightly ventral.

Basal antennal article large, subrectangular, longer than broad, surface weakly concave, separated from post orbital lobe by a narrow V-shaped fissure, lateral edge weakly concave, one or two small tubercles close to base; anterior angles each with a strong, flattened, triangular tooth: anteromedial short, directed downward and forward, anterolateral tooth almost  $2\frac{1}{2}$  times length of anteromedial, directed upward and outward, one or two small tubercles on anterior edge distant from tip.

Antennular fossae longitudinally subovate, deep; interantennular spine well developed, stout, downwardly curved, sharply pointed; anterior process of epistome slender, rounded distally.

Mouthfield subrectangular, slightly narrower posteriorly, anterior margin medially forming a very shallow V. Pterygostomian regions subtriangular, strongly depressed, smooth, separated from inflated subhepatic regions by a very shallow groove. Subhepatic regions strongly tuberculate, tubercles small, rounded.

Sternum in male excavated anteromedially as a deep depression, posteriorly and lateral to abdominal fossa as three pairs of deep narrow, transversely subovate, inter-



segmental pits; anterior rim of each pit straight, posterior rim weakly concave; pits widest close to lateral extremity.

Third maxillipeds meeting in midline, covering mouth-field. Ischium broadly subrectangular, longer than broad, anterolateral corner laterally expanded, rounded; medial edge coarsely toothed, overlaid and almost concealed by a fringe of fine hairs; medial half of distal edge moderately produced, strongly convex, lateral half straight; surface excavated longitudinally close and parallel to medial edge as a shallow groove occupied by very short hairs. Merus subquadrate, hardly wider and slightly shorter than ischium, lateral edge rounded, entire; medial edge sharply angled midway along; posterolateral edge concave; anterolateral straight; distal edge deeply notched, a prominent triangular tooth at lateral angle of notch; surface flat except for a low rounded swelling at junction with ischium, most of surface of merus sparsely pubescent except for naked white swelling. Palp arising from notch of, and as long as, merus, stout basally, tapering distally, three segments subequal in length, sparsely hairy on medial and lateral surfaces.

Chelipeds naked, moderately long (1.1 times carapace length in male), subcylindrical, propodus compressed, merus and carpus densely tuberculate. Ischium extending ventrally for almost  $\frac{1}{3}$  length of merus, merus about  $\frac{1}{3}$  total length of cheliped, carpus about  $\frac{2}{3}$  merus, chela about  $\frac{1}{2}$  total length of cheliped, dactyl about  $\frac{2}{3}$  palm. Merus with three larger tubercles in a row ventrally, dorsally three in a row close to base, one more distal and a distally curved spinous tubercle overlying distal edge; carpus with tubercles larger dorsally close to base, two weak longitudinal ridges convergent basally, one dorsal, one obliquely crossing lateral surface, surface between ridges almost smooth; palm somewhat diminished distally in male, greatest convexity one-third from base, diminishing uniformly distally in female, dorsal surface bluntly carinate basally. Fingers acute, with an oval gape basally in both male and female, inner edges finely toothed for distal two-thirds in male, smooth in female; fixed finger with a small tubercle at base in male, not in female, dactyl with a slightly more distal tubercle, the two tubercles almost touching when fingers closed.

Ambulatory legs moderately long, slender, smooth, dorsal groups of hooked hairs except on dactyl, otherwise very sparsely pubescent. First leg the longest (about  $1\frac{1}{2}$  times length of carapace), following legs decreasing in length to last (about  $\frac{2}{3}$  length of carapace). Meri long (about  $\frac{1}{3}$  total length of leg), carpi slightly more than  $\frac{1}{3}$  meri, propodi slightly more than  $\frac{2}{3}$  meri, dactyli  $\frac{2}{3}$  propodi, finely pointed, weakly curved.

Abdomen of seven segments in both sexes. Male abdomen widest at base of segment 3, narrowing to base of slightly distally widened segment 6, segment 7 with margin strongly convex; segments 1 to 6 subequal in length, segment 7 slightly longer. Surface of abdomen in male excavated laterally as intersegmental pits at junctions of segments 4 and 5, 5 and 6, and 6 and 7, leaving a strong longitudinal ridge in midline and a ridge across middle

of segments 5 and 6; segment 3 and basal part of segment 4 inflated; segment 7 with surface weakly elevated except round margin; distal medial portions of segments 3 to 6 further elevated as wide subrectangular platform.

Male first pleopod slender, bulbous basally, tapering and outwardly curved distally, tip bluntly pointed; aperture subterminal, lateral, a narrow, longitudinal slit at end of groove which extends from medial surface at base across abdominal surface to lateral surface near tip; long, simple setae scattered along lateral surface for basal two-thirds, short stout setae along abdominal margin of, and grouped just basal to, aperture, also along lateral surface between aperture and tip.

COLOUR: Uniformly white after preservation (Bennett).

MATERIAL EXAMINED: Two specimens (paratypes) in the Australian Museum Collections:

Hauraki Gulf, 32-50 fm, Dec 1914. *Hinemoa* Exped., pres. E. W. Bennett, 1 male, 1 female (P 9962).

MEASUREMENTS: Male (paratype): length 33.5 mm, width 23 mm, rostral length 6 mm, rostral width 5 mm, cheliped 34 mm, chelar length 17 mm, chelar height 6.5 mm.

Female (paratype): length 26.5 mm, width 18.5 mm, cheliped 21 mm.

HABITAT: Bottom data are not available for the known localities of this species. Bennett (1964) states that specimens are free from attached organisms except for small quantities of sponge, serpulid, and polyzoans.

DEPTH: Apparently upper continental shelf, 32 to 50 fathoms.

REMARKS: The two specimens examined agree with all Australian material of *L. tuberculatus* (Whitelegge) in all important characters such as form of the rostrum and orbit, basal antennal article, third maxillipeds, shape of male abdomen and chela, arrangement of pits on sternum and abdomen in male and ornamentation of carapace and chelipeds, and number and arrangement of major tubercles on dorsal surface of carapace. There can be little doubt, then, that the New Zealand form is conspecific with the Australian. However, in several less important characters there are some distinct differences between the two:

1. The mesogastric, urogastric, and cardiac spines are much blunter, in fact only low tubercles, in contrast to the large conical spines of Australian material. Whereas in large Australian specimens there are three prominent intestinal tubercles (two submedial followed by one medial), in small specimens from Australia these are hardly discernible as in the two New Zealand specimens.

2. The dorsal surface of the carapace including the metabranchial and intestinal regions are more uniformly granular. In Australian specimens, except for the few prominent tubercles, the surface is rather smooth, especially posteriorly, the intestinal and metabranchial regions almost completely devoid of tubercles except for a few small ones

scattered near the posterolateral margins beneath and between the third and fourth branchial spines and lateral to the depression bordering the intestinal margin on each side. In the two New Zealand specimens these regions are densely covered by very small tubercles concentrated near the posterolateral margin.

3. The four marginal branchial spines are slightly longer and more slender. In *L. tuberculatus* these spines are rather more than twice their length apart (Whitelegge, 1900), while in New Zealand specimens the distance between the spines is about equal to their length. The spines are equally disposed in both.

4. In the male specimen from New Zealand the antorbital spine is rather longer than in any other specimens available, being about equal to the intercalated spine and quite sharp, while in the others it is not much more than half the length of the intercalated spine and rather blunt. However, the extent to which the antorbital spine extends beyond the intercalated is about the same in all specimens.

5. It is possible that the Australian form grows to a greater size. The largest specimen mentioned by Bennett is 39 mm in length compared with the 48 mm female from *Thetis* Exped. St. 36. Further, in the 30.5 mm female from *Thetis* Exped. St. 25 (G, 2177) the abdomen is rather narrow, while the 26 mm female from New Zealand is quite mature, the abdomen almost circular and extending right to the bases of the ambulatories.

Of these differences 3 is a character which would usually be regarded as juvenile. For instance, the marginal branchial spines in *Leptomithrax longipes* (Thomson) and *L. richardsoni* Dell are very much longer in juveniles. However, examination of juvenile Australian specimens shows that this condition does not obtain here. Moreover, in *L. longipes* and *L. richardsoni* all the carapace spines are longer in juveniles than in the adults, while in Bennett's admittedly smaller, but definitely adult, specimens the dorsal spines are very much shorter. The difference in size of the dorsal spines could be explained by regarding Australian material to hand as recently moulted and New Zealand material as being far advanced in their particular moult stage. However, as Dr J. C. Yaldwyn (pers. comm.) has pointed out, this interpretation can hardly be correct.

Provided that the remainder of Bennett's material agrees with the two specimens before me, the difference in granulation and in the relative size of the mid-dorsal tubercles sets the New Zealand material apart as a distinct geographical subspecies. There is nothing in Bennett's description to contradict such a supposition, for the mid-dorsal regions are described by Bennett as bearing ". . . rounded nodules, . . . two blunt erect median gastric spines on large bases (and) a complement pair (of nodules) at the apex of the very high cardiac region . . ." and the posterior parts of the dorsum of the carapace are described as follows ". . . behind the second (branchial) spine the lower margin and adjacent infra marginal slope are granular."

Bennett describes the postorbital lobe as bluntly trun-

cate at the tip and the third maxillipeds as lacking a "boss" at the junction of the ischium and merus. Examination of the two paratypes of Bennett's species proves the second statement incorrect, while the postorbital lobe is broad and rounded distally rather than truncate.

*L. tuberculatus* is regarded by both Whitelegge (1900) and Bennett as most closely related to *L. sternocostulatus* (H. Milne Edwards), while Bennett's *L. (Austromithrax) mortenseni* forms the basis for his subgenus *Austromithrax*. However, in the form of the orbit (the intercalated spine almost excluded from the outer rim of the supraorbital margin, the postorbital lobe lacking marginal tubercles), in the intersegmental nature of the sternal and abdominal pits, and in the shape of the male abdomen, *L. tuberculatus* (including the New Zealand form) stands closest to *L. longipes* (Thomson), the type species of Bennett's *Zemithrax* from which, however, it differs in the conical rather than flattened form of the rostral spines, the much less prominent raised swelling on the third maxillipeds, and the very different shape of the basal antennal article.

### **Leptomithrax longipes** (Thomson, 1902). Figs. 15, 23.

*Paramithrax longipes* Thomson, 1902: 362, pls. 7, 8; 1913: 236; 1921: 97. Chilton. 1911: 289, pl. 57. Chilton & Bennett, 1929: 738. Young, 1929: 150.

*Leptomithrax longipes*: Richardson, 1949: 64, fig. 31. Dell, 1960: 2, fig. 2.

*Leptomithrax (Zemithrax) longipes*: Bennett, 1964: 54, fig. 35, 49-51, 121.

*Leptomithrax (Zemithrax) molloch* Bennett, 1964: 56, fig. 52-54, 122, 123; type locality: off east coast of Otago, 20 fm—Portobello Marine Biological Station, Dunedin (now in Canterbury Museum, Christchurch).

**TYPES:** Male holotype, length 70 mm, width 62 mm; female paratype, length 55 mm, width 40 mm. Location of types unknown.

**TYPE LOCALITY:** Ten miles off Cape Saunders, 50 fm; Mr Ayson, collector.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS:** Central: Blind Bay to Golden Bay, 8-17 fm, *Doto* Exped. (as *L. (Z.) molloch*); Kaikoura (in stomach of ling taken in 200 fm), A. Hanson; Taylor's Mistake, Banks Peninsula (in drift), C. Chilton (Bennett). Southern: *Nora Niven* Sta's 4 (21½ miles NE of Wreck Reef, 12 Jun 1907, 50-54 fm, soft sand), 5 (50 miles east of Wreck Reef, 13 Jun 1907, 65-183 fm, soft sand), 7 (5 miles south of Chasland's, 19 Jun 1907, 43 fm, fine sand), 17 (8 miles NE of Cape Saunders, 25 Jun 1907, 55-102 fm, sand), 23 (4 miles SSE of Moeraki, 1 Jul 1907, 24-13 fm, sand), 26 (19½ miles south of Oamaru, 2 Jul 1907, 19-22 fm, fine sand), 30 (18 miles ENE of Oamaru, 3 Jul 1907, 35 fm, ooze) (Chilton). Otago coast, taken by trawlers (Thomson, 1913). East coast of South Island, *Doto* Exped. (as *L. (Z.) molloch*); Timaru, (in fish trawl), C. Chilton; between Oamaru and Cape Saunders; east of Tairoa Heads, 30-50 fm, *Doto* Exped.; off east coast of Otago, 20 fm (as *L. (Z.) molloch*), and east of Papanui Inlet, 40 fm, D. H. Graham; Otago Harbour (Bennett).

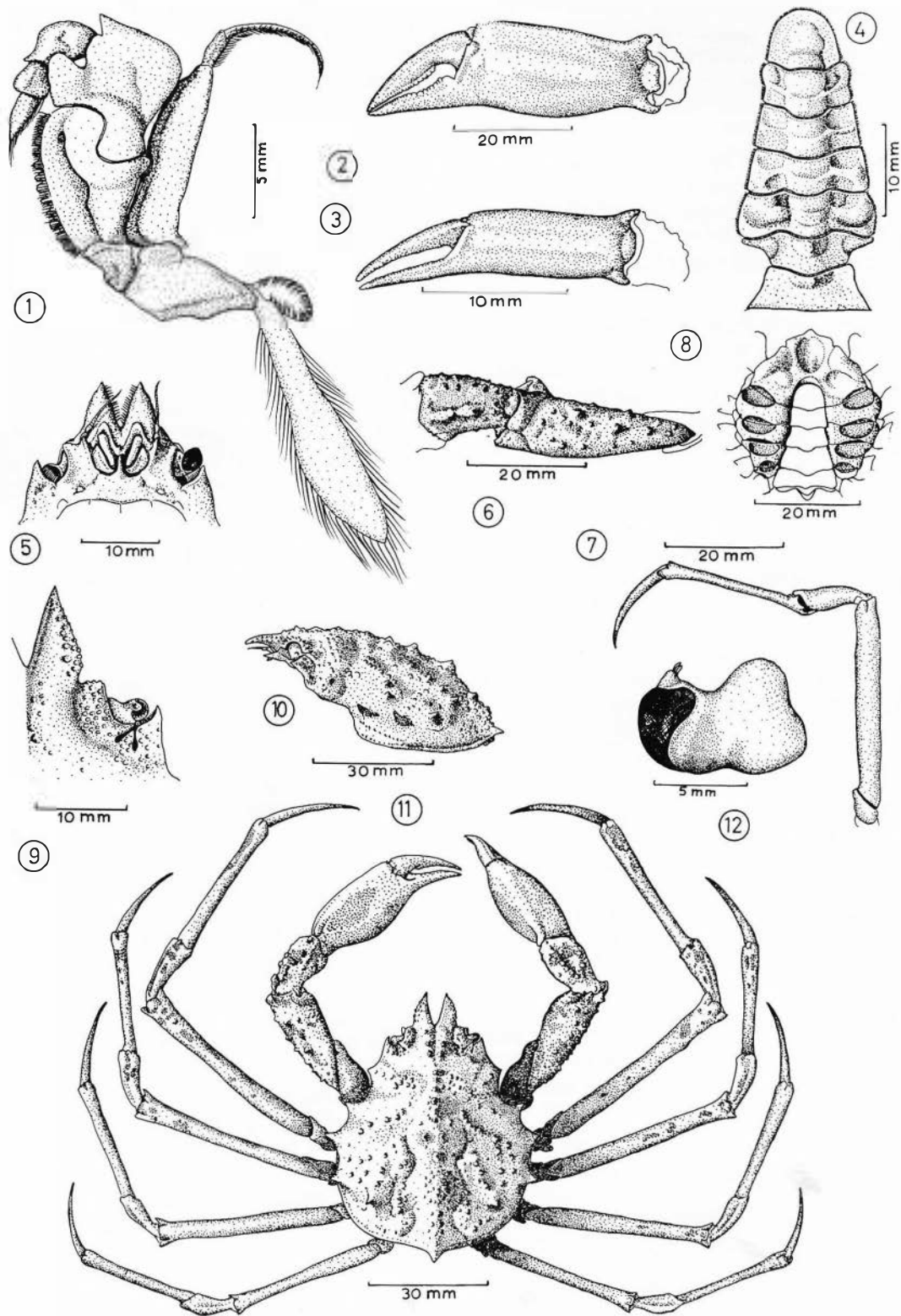


FIG. 15—*Leptomithrax longipes* (Thomson). 1—Left third maxilliped. 2—Left chela of male. 3—Left chela of female. 4—Male abdomen. 5—Ventral view of front. 6—Left cheliped of male, merus and carpus. 7—Left fourth ambulatory leg. 8—Sternum of male. 9—Dorsal view of orbit. 10—Lateral view of carapace. 11—Dorsal view of male. 12—Posterior view of left eyestalk. 5 from ovigerous female, carapace length 42 mm, remainder from 65 mm male. off Oamaru, 15-60 fm.

Chatham Islands: Chatham Islands, fragments on beach (Young). Chatham Islands 1954 Expedition Sta. 29 (43°55.5'S, 177°08'W, Petre Bay, 94 fm) (Dell). Southern Islands: Macquarie Island, *Aurora* Exped. (Bennett).

**DESCRIPTION:** Carapace broadly pyriform in dorsal aspect (length 1.3 times width), swollen and almost uniformly convex in profile, margins spinous. Rostrum of two short, dorsoventrally flattened, subtriangular spines ( $\frac{1}{10}$  length of carapace), distally depressed, separate from base, margins weakly convergent distally, distance between tips slightly less than basal width of rostrum. Short, hooked hairs fringing inner margins of rostral spines and also present on dorsal surface of carapace borne on small tubercles close to midline anteriorly and to lateral margins posteriorly, also extending subdorsally round posterolateral margin above marginal branchial spines.

Margins of carapace with a series of six short, conical, wide-based spines: one postorbital, one hepatic, and four branchials, the latter forming a semi-ellipse, the last subdorsal; spines equidistant. Hepatic spine very short ( $\frac{1}{4}$  length of rostrum). First branchial spine moderately long (about  $\frac{1}{3}$  length of rostrum), second slightly longer, third and fourth spines shorter, fourth the shortest, slightly longer than hepatic.

Dorsal surface of carapace covered by groups of large and small tubercles separated by large smooth areas. Carapace elevated in midline as a ridge of numerous small, closely spaced tubercles occasionally enlarged as short spines. Nine medial spines and two pairs of submedials; medial series comprising four equidistant mesogastrics extending from opposite postorbital lobe to opposite first marginal branchial spine, a single urogastric, a single cardiac in centre of tumid cardiac region, and three intestinals, the first close to anterior border of region, last on posterior intestinal border, first two intestinals short, last large, weakly depressed; first pair of submedial spines on protogastric region opposite antorbital spine, second pair on metagastric region opposite first marginal branchial spine. Branchial regions bearing small tubercles grouped into two rows on each side of midline, one extending from above second marginal branchial spine to anterolateral corner of metagastric region and the other from above fourth marginal branchial spine to posterolateral corner of metagastric region. Regions of dorsal surface of carapace very poorly defined.

Orbit consisting above of supraorbital eave, intercalated spine, and postorbital lobe, the three closely approximated and separated only by narrow, deep fissures; intercalated spine excluded from rim of supraorbital margin by close approximation of antorbital spine and postorbital lobe distally; supraorbital eave narrow, anterolateral corner sharply angled, posterolateral corner bearing a broadly triangular, flattened antorbital spine; intercalated spine shorter than antorbital, triangular; postorbital lobe, large, broad-based, terminating in a small, sharp spine, anterior face excavated, margin of excavation fringed by short hairs. Orbit circular and deep, inferior border incompletely formed by basal antennal article, eyestalk

almost completely visible in ventral view, when retracted concealed in dorsal view. Eyestalk short, very stout, bulbous basally; cornea very large, terminal, ovoid, a small tubercle above at distal extremity of eyestalk.

Basal antennal article large, broad, subrectangular, anterior angles toothed, anteromedial tooth spinous, small, conical, forwardly directed, anterolateral tooth flattened, rounded, outwardly directed, tuberculated; flagellum short, slender, extending just beyond, and visible on each side of, rostrum, excluded from orbit by a short, stout process of basal article; two basal segments longer and stouter than following segments.

Antennular fossae subovate; interantennular spine short, downwardly projecting, curved, sharply pointed, anterior face weakly excavated; anterior process of epistome very narrow, bluntly pointed.

Epistome wide and short. Mouthfield large, subrectangular, slightly narrower posteriorly, anterior border almost transverse, weakly concave. Pterygostomial regions subtriangular, weakly excavated, clearly separated by a shallow groove from inflated, granular subhepatic regions. Thoracic sternum large, obtusely angled anteriorly to form posterior border of mouthfield, surface in male excavated to form rimmed pits; a single shallow pit in anterior medial portion of sternum immediately anterior to abdominal fossae; a weak excavation at base of each cheliped; four pairs of broadly oval pits between bases of chelipeds and each ambulatory leg, each pit occupying posterior part of one sternite and most of following one, decreasing rapidly but uniformly in size posteriorly, last pit about  $\frac{1}{2}$  width of first.

Third maxillipeds meeting in the midline, completely covering mouthfield, densely covered by short hairs which extend to margin of each segment, leaving naked a prominent, rounded swelling at junction of ischium and merus. Ischium large, subrectangular, slightly longer than wide, medial edge coarsely but distinctly toothed, teeth of irregular size, almost concealed by a fringe of long hairs; medial half of distal edge extended anteriorly, rounded, lateral distal half weakly concave, bearing merus; outer surface with a prominent deep groove extending almost parallel to medial edge, lateral portion raised distally as posterior part of swelling. Merus subquadrate, as broad as, but slightly shorter than, ischium, medial and lateral edges entire, distal edge deeply notched, a small flattened triangular spine at lateral angle of notch, surface raised basally as posterior part of swelling. Palp arising from notch of, almost as long as, but usually obscured by, merus, densely setose, carpus about  $\frac{1}{2}$  total length of palp; propodus and dactyl subequal.

Chelipeds of moderate length (almost  $1\frac{1}{2}$  times length of carapace in adult male), subcylindrical except for compressed propodus, naked, dorsal lateral surfaces of merus and dorsal, lateral and medial surfaces of carpus covered densely by small tubercles. Basis and ischium short, ischium extending along ventral surface of merus for about  $\frac{1}{2}$  length of latter. Merus long, almost  $\frac{1}{3}$  total length of cheliped, carpus  $\frac{1}{2}$  merus, chela slightly more

than  $\frac{1}{2}$  total length of cheliped, dactyl about as long as palm. Carpus with two blunt, poorly developed longitudinal ridges almost converging basally, one dorsal and one obliquely crossing lateral surface. Palm high in male, weakly enlarged distally, of uniform height throughout in female, upper surface carinate basally, blunt distally. Fingers in male gaping moderately for basal half, toothed along inner edges for entire length, teeth coarse, larger basally; moderately gaping for entire length in female, meeting only at tips, finely toothed.

Ambulatory legs very long, slender, cylindrical except for weakly dorsoventrally compressed carpus, naked. First leg the longest (2.2 times length of carapace), following legs decreasing gradually and uniformly to the last (1.6 times the carapace). Bases and ischia short; meri long (hardly more than  $\frac{1}{3}$  total length of leg), carpi hardly more than  $\frac{1}{3}$  meri, propodi about  $\frac{1}{4}$  total length of leg, dactyli  $\frac{1}{2}$  propodi. Carpi with a small, blunt spine on medial surface of distal articulating edge in anterior legs, disappearing in posterior legs; dactyli terminating in a sharp claw.

Abdomen of seven distinct segments in both sexes. Male abdomen narrow, all segments much broader than long, subequal in length. Segment 1 wide basally, narrow distally, a wide, anteroposteriorly flattened ridge or spine situated on medial surface overlying distal articulating edge; segment 2 widening sharply distally, abdomen widest at base of segment 3, narrowing gradually to strongly concave margin of segment 7; segment 2 with lateral and medial distal surfaces elevated; lateral surfaces of following segments excavated at their junction to form pits corresponding in position with those of sternum and leaving a rounded, longitudinal ridge extending length of abdomen and a ridge extending transversely across each segment from the midline; segment 7 with medial portion only elevated. Abdomen in female broadly subovate.

Male first pleopod long, slender, bulbous basally, outwardly curved distally, tip very slender, bluntly pointed, aperture on lateral surface distant from tip, elongate oval, edge of aperture toward abdominal surface fringed by very short setae; small, stout setae in a patch on lateral surface just basal to aperture and along lateral surface between aperture and tip, simple setae, long basally but shortening distally, scattered along lateral surface from base to just short of aperture.

**COLOR:** The whole animal is a very pale yellowish white. The chelipeds and ambulatory legs are spotted with irregularly shaped patches of dark red; a large patch of red is always present on the inner surface of the propodus close to the upper edge.

**MATERIAL EXAMINED:** A total of 122 specimens as follows:

VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COOK STRAIT COLLECTIONS: Coll. VUZ 15, Palliser Bay, 100-150 fm, 1 male, 22.5 mm, 2 females, 24.0, 28.5 mm; coll. VUZ 43, Cook Strait, 70-80 fm, 1 female, 29 mm; Coll. VUZ 55, off Cape Palliser, 40-100 fms, 10 males, 15-27 mm, 2 females, 20.29.5 mm; Coll. VUZ 113, Palliser Bay shelf, 70-80 fm, 2 males, 12 mm, 21 mm, 1 female, 26.5 mm.

DOMINION MUSEUM COLLECTIONS: Off Cape Campbell 40 fm, 7 Nov 1942, F. Abernethy, 1 male, 16.5 mm; NE of Cape Campbell, approx. 41°40'S, 174°30'E. 60 fm, April 1957, F. Abernethy, 1 male (Z. Cr. 681), 23 mm; B.S. 181, off Palliser Bay, 100 fm, VUZ., 1 male, 22 mm; Cook Strait, in trawl, 1959, 1 male (Z. Cr. 885), 45 mm; off Kaikoura, 40 fm, May 1953, 1 male, 37 mm; 35 miles east of Banks Peninsula, 70-200 fm (probably over 100 fm), 27 Aug 1959, B. R. Tunbridge, 1 male (Z. Cr. 971), 43 mm; between Moeraki and Oamaru, 40-60 fm, Nov 1952, J. Moreland, 5 males, 47-70 mm; B. S. 189, off east Otago coast, edge of Canyon A, 120 fm, 2 males. (Z. Cr. 603), 42 mm. Off Oamaru, mid Feb 1961, 15-60 fm, trawled, Feb 1961, J. Graham, M.V. *Orion*, 11 males, 47-65 mm, 1 female (ovigerous), 42 mm. Off Oamaru, March 1961, 15-60 fm, trawled, March 1961, J. Graham, M.V. *Orion*, 5 males, 48-53 mm.

N.Z. OCEANOGRAPHIC INSTITUTE COLLECTIONS: Sta. B. 196, Otago, 74 fm, 1 male, 39 mm, 12 females (11 ovigerous), 36-46 mm; Sta. B. 224, Foveaux Strait, 17 fm, 1 female, 38 mm; Sta. B. 278, Foveaux St., 42 fm, 2 males, 16, 22.5 mm; Sta. B. 480, Doubtful Sound, 58 fm, 1 male, 52.8 mm, 1 female, 46 mm; Sta. B. 487, Puysegur Bank, 102-100 fm, 12 females (10 ovigerous), 40.5-50 mm; Sta. B. 489, Puysegur Bank, 103 fm, 2 ovigerous females, 41, 49 mm; Sta. C. 624, Chatham Rise, 68 fm, 3 females, 46-49.5 mm; Sta. C. 683, Kaikoura, 135-95 fm, 4 males, 42-57 mm, 35 females (25 ovigerous), 37.8-48.5 mm; Sta. C. 696, Kaikoura, 77-26 fm, 1 female, 26 mm; Sta. C. 705, Kaikoura, 85 fm, 1 female, 40 mm; Sta. C. 707, Kaikoura, 32 fm, 1 ovigerous female, 49 mm.

**MEASUREMENTS:** Largest male: Length 65 mm, width 48 mm, rostral length 8 mm, rostral width 10 mm, cheliped 90.5 mm, chelar length 49.5 mm, chelar height 15 mm, dactyl 23.5 mm, first ambulatory leg 139 mm.

Ovigerous female: Length 42 mm, width 30 mm, cheliped 42 mm.

**HABITAT:** This species is usually found on muddy or sandy bottoms in association with sponges, sea anemones, polychaetes, and less often hydroids, bivalve molluscs, and asteroids. Individuals are almost always thickly covered by epizoites. Most of the specimens taken off Oamaru by Mr J. Graham were covered by sea anemones, the carapace being generally completely obscured. Most of the specimens obtained by the New Zealand Oceanographic Institute were covered by sponges, polyzoans, and sometimes by polychaetes. One large adult specimen supported two barnacles, two oysters, hydroids, polyzoans, and tubicolous polychaetes, while another supported one barnacle as well as hydroids, polyzoans, and polychaetes. In specimens examined by Chilton (1911) the carapace was generally covered by sponges, compound ascidians, *Spirorbis*, polychaetes, and particularly barnacles (*Balanus decorus*).

**DEPTH:** Offshore, 10 to 200 fm, most commonly between 20 and 100 fm.

**BREEDING:** Ovigerous females in February.

**REMARKS:** In the original description of this species by Thomson (1902) as *Paramithrax longipes* the precise structure of the orbit is not discussed and is not clear from the figures provided, the three parts of the supra-orbital margin appearing completely fused; the rostral spines are shown as broadly triangular and separated by a wide V-shaped hiatus, a lateral ridge of the carpus

of the cheliped is not mentioned and the fingers of the cheliped are described as smooth internally. In addition the abdomen is described as six-segmented, though examination of Thomson's plate VII shows the correct number of segments. In the adult specimens available to me the rostral spines are separated by a narrow V, a faint lateral ridge is evident on the carpus of the cheliped and the fingers of the chelae are toothed along their inner edges. As far as this last point is concerned however, the large size of Thomson's specimens almost certainly accounts for the smooth appearance of the fingers, the teeth having been worn down.

As noted by Chilton (1911), the juveniles of *L. longipes* are very different from the adults in appearance. Young specimens about 10 mm in carapace length have the rostral spines long, slender, acuminate, and strongly divergent, and the spines of the dorsal surface and margins of the carapace also long and slender. As in other species, the chelipeds in these small specimens are very short and the chelae similar in shape to those of the adult female. Individuals reach maturity at a carapace length of about 50 mm, the rostral spines then being short, broad basally and somewhat convergent distally, the other spines of the carapace becoming short and blunt. The female loses the excavations of the sternum as the abdomen expands to cover the sternum. In addition the carapace in both sexes becomes rather more tuberculate and, again as in other species, the male chelae become very inflated. However, whatever the size of the specimens, this species is easily recognised by the dense clothing of hairs on the third maxillipeds and the prominence of the naked, round, white swelling at the junction of the ischium and merus.

Bennett (1964) describes under the name *Leptomithrax (Zemithrax) molloch* small specimens which differ from *L. longipes* only in the features outlined above as characteristic of juveniles of the latter. Bennett's species is therefore a junior subjective synonym of *Paralomis longipes* Thomson 1902.

***Leptomithrax richardsoni* Dell, 1960. Figs. 16, 23; Plates 3, 4.**

*Leptomithrax richardsoni* Dell, 1960: 2, fig. 3, pl. 2.

**TYPES:** Female holotype, length 38.9 mm, width 19.7 mm, Canterbury Museum, Christchurch. Paratype (females), Canterbury Museum and Dominion Museum, Wellington.

**TYPE LOCALITY:** Chatham Rise, between Banks Peninsula and Chatham Islands, CIE Sta. 52, 44°04'S, 178°04'W, 10 Feb 1954, 260 fm, Chatham Islands 1954 Expedition (R. K. Dell, pers. comm).

**DISTRIBUTION:** New Zealand, known only from Chatham Rise and Campbell Plateau.

**DESCRIPTION:** Carapace pyriform in dorsal aspect (length almost 1½ times width), margins and dorsal surface set with moderately long, conical spines and

sparse raised tubercles. Rostrum of two long, slender, conical, acuminate spines (almost ¼ length of carapace), separate from base, divergent, distance between tips about 1¼ basal width, almost equal to margins. Dorsal surface of carapace with scattered groups of long hairs.

Margins of carapace with eight prominent, outwardly directed spines: two orbital, two hepatic, and four branchial, the branchials forming a semicircle, fourth spine subdorsal; a smaller submarginal spine situated between and above first and second marginal branchial spines. Hepatic spines arising close together, first the longer, almost ¼ length of rostrum, second less than ½ first. First branchial spine longest of the marginals, barely exceeding first hepatic, following spines decreasing very slightly to last, slightly shorter than first.

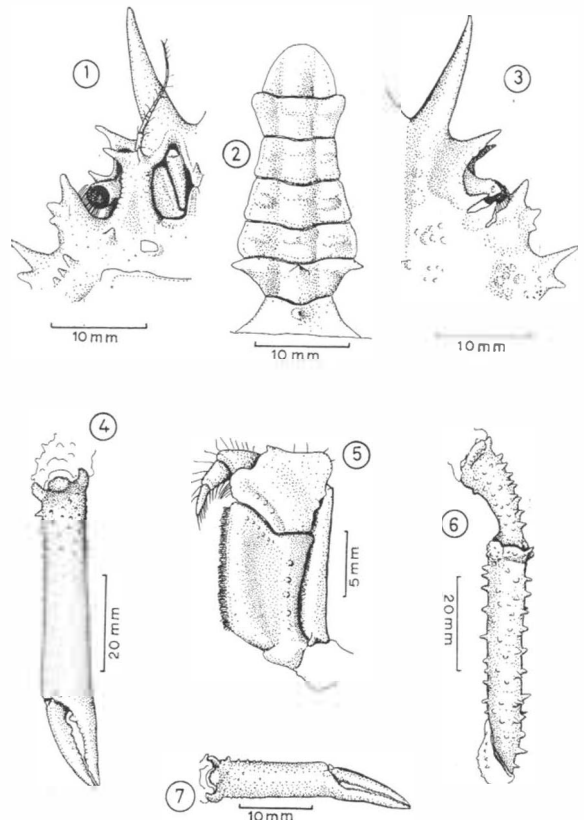


FIG. 16—*Leptomithrax richardsoni* Dell. 1—Ventral view of orbit. 2—Male abdomen. 3—Dorsal view of orbit. 4—Left chela of male. 5—Third left maxilliped. 6—Left cheliped of male, merus and carpus. 7—Right chela of female. 7 from ovigerous female, carapace length 52 mm, remainder from 65 mm male, just west of Campbell Island.

Dorsal surface of carapace with four subequal median spines: two mesogastrics far back on region, subequal in length, slightly shorter than first marginal branchial spine, one urogastric, and one intestinal overlying posterior margin; and four pairs of submedian spines or tubercles: one very small protogastric pair just anterior to first mesogastric spine, one very small metagastric pair,



one large pair in centre of tumid cardiac region, and a single intestinal pair, larger than other submedials, close to anterior margin of region. Several groups of tubercles on carapace, about 20 scattered anteriorly and several scattered groups on hepatic and branchial regions. Regions of dorsal surface moderately well defined.

Orbit consisting above of supraorbital eave bearing a preorbital and antorbital spine, intercalated spine, and postorbital lobe; supraorbital eave moderately expanded laterally, preorbital and antorbital spines subconical, preorbital the longer,  $\frac{1}{4}$  length of rostrum, weakly directed upward and forward, antorbital spine about  $\frac{1}{3}$  preorbital, outwardly directed; intercalated spine small, slightly longer than antorbital, narrowly triangular, sharply pointed; postorbital lobe large, about  $\frac{1}{3}$  rostrum, broad-based, bluntly pointed, a small tubercle on anterior edge near base, two adjacent small tubercles on posterior edge near base; anterior face of lobe excavated, margin of excavation bearing long setae. Orbit circular and deep, incompletely formed below. Eystalk almost completely visible in ventral view, moderately long, almost reaching postorbital lobe, very stout, bulbous basally; cornea terminal, circular, very large, a small tubercle above at distal extremity of eystalk.

Basal antennal article of moderate width, subrectangular, lateral margin weakly concave, two prominent subequal, conical spines at anterior angles, anteromedial spine short, directed downward and forward, anterolateral long, directed mainly outward, a small spinule midway along medial edge and a minute tubercle just anterior to it; surface excavated medially as a shallow groove narrowing anteriorly.

Antennular fossae subtriangular; interantennular spine large, downwardly projecting, curved, sharply pointed; anterior process of epistome narrow, bluntly pointed.

Epistome barely wider than long. Mouthfield subrectangular, anterior margin weakly concave medially. Pterygostomian regions separated from subhepatic regions by a shallow groove, several small tubercles along outer margin. Subhepatic regions with an oblique row of three tubercles. Sternum with a few tubercles.

Third maxillipeds almost meeting in midline. Ischium subrectangular, medial edge coarsely toothed, sparsely overlain by setae, medial half of distal edge moderately expanded as a subtriangular process, lateral half straight to bear merus; outer surface deeply excavated medially as a wide shallow longitudinal groove, a few tubercles lateral to groove. Merus subquadrate, as wide as, but slightly shorter than, ischium, anterolateral edge weakly expanded, medial edge weakly crenate, distal edge deeply notched, a small sharp spine at lateral corner of notch; junction of ischium and merus weakly swollen. Palp stout, as long as merus, segments subequal in length, moderately setose.

Chelipeds very long (more than twice length of carapace in adult male), slender, subcylindrical except for compressed propodus, merus and carpus strongly tuber-

culate. Basis and ischium short, ischium extending along ventral surface of merus for  $\frac{1}{3}$  length of latter. Merus very long,  $\frac{1}{3}$  total length of cheliped. carpus  $\frac{1}{2}$  merus, chela almost  $\frac{1}{2}$  total length of cheliped. dactyl scarcely  $\frac{1}{2}$  palm. Merus covered on all surfaces by long and short spinous tubercles, longer tubercles in four longitudinal rows, two dorsal, two ventral, a short spine overlying distal articulating edge. Carpus with tubercles arranged as on merus. Propodus weakly expanded distally in male, of even height throughout in female, a few tubercles, large dorsally, on all surfaces near base. Fingers acute, very coarsely toothed along inner edges for their entire length, moderately gaping basally in male, adjacent in female, a large basal tooth on both fixed finger and dactyl.

Ambulatory legs of moderate length, cylindrical. First leg the longest ( $1\frac{1}{2}$  times length of carapace), following legs decreasing in length to the last (barely exceeding carapace). Bases and ischia short; meri long,  $\frac{1}{3}$  total length of leg, carpi  $\frac{2}{3}$  meri, propodi almost as long as meri, dactyli almost as long as propodi. Meri with a broad-based, blunt tubercle dorsally overlying distal edge; carpi weakly depressed, medially grooved dorsally, a few small tubercles along medial surface; terminating in a sharp claw.

Abdomen of seven segments in both sexes. Abdomen narrow in male, segments wider than long, subequal, segment 7 slightly longer than the others. Segment 1 wide basally, narrow distally, segment 2 subtriangular widening abruptly distally; abdomen widest at base of segment 3, sides subparallel, abdomen narrowing at first to base of distally widened segment 6, margin of segment 7 convex. Surface of abdomen elevated in midline in all segments, a sharp spine distally in first two, blunt tubercles distally in segments 3 to 6; lateral surface bearing a transverse ridge in middle of segments 3 to 5, elevated in segment 6.

Male first pleopod bulbous basally, moderately stout, outwardly curved distally, tip finely pointed; aperture subterminal, lateral, surface below aperture expanded as a thin flap of corrugated tissue; a fringe of setae extending along lateral surface to just short of aperture, short stout setae extending from aperture to tip, medial surface with a few short setae.

COLOUR: Dull creamy white after preservation.

MATERIAL EXAMINED: Two specimens as follows:

NEW ZEALAND OCEANOGRAPHIC INSTITUTE COLLECTIONS: Sta. B 182, just west of Campbell Island, 169 fm. 1 male, 1 female (ovigerous).

MEASUREMENTS: Adult male: length 65 mm, width 48 mm, rostral length 12 mm, rostral width 10.5 mm, cheliped 134 mm, chelar length 64 mm, chelar height 9.5 mm, dactyl 20 mm, first ambulatory leg 95 mm.

Ovigerous female: length 52 mm, width 40 mm, cheliped 64 mm.

HABITAT: At the four Chatham Islands 1954 Expedition stations from which this species was first recorded

the bottom in all cases consisted of fine sandy mud—at two the mud was grey and at two green. The present specimens were taken on a bottom of sand and sponge.

**DEPTH:** In addition to the present material taken at a depth of 169 fm, the original material gives depths ranging between 220 and 330 fathoms.

**REMARKS:** Up to this time this species has been known only from juvenile females which in many respects show a strong resemblance to juveniles of *Leptomithrax longipes* (Thomson). In both species the changes with growth appear to proceed along very similar lines, the pronounced shortening of the spines of the carapace, extremely long in juveniles, being one of the more noticeable features. The larger size and shorter spines of the carapace, and the shorter and much less divergent rostral spines are the only differences between the new specimens and the type material.

In several important features *L. richardsoni* differs strongly from other species at present referred to the genus *Leptomithrax*. Three of these features may be mentioned in particular—the strong preorbital spine, the outwardly directed anterolateral spine of the basal antennal article, and the expansion of the lateral surface of the male first pleopod immediately basal to the aperture. In all of these features there is a close resemblance to species of *Chlorinoides*. It must therefore be emphasised that in other respects—the strongly tuberculate, rather than smooth, carapace and chelipeds and the relatively short spines of the carapace, including those forming the rostrum—this species is a typical *Leptomithrax*.

#### Genus *Chlorinoides* Haswell, 1880

*Acanthophrys* A. Milne Edwards, 1865: 140 (part: *Acanthophrys aculeatus* A. Milne Edwards, 1865); 1876: 4. Bouvier, 1906: 485. Balss, 1929: 19 (part: not *A. spinosus* (Miers, 1884)). Sakai, 1938: 307. Barnard, 1950: 61. Bennett, 1964: 57. Not *Acanthophrys*: Miers, 1879c: 656 = *Hyastenus* White, 1847.

*Chlorinoides* Haswell, 1880a: 442; 1882c: 17. Miers, 1886: 51. Rathbun, 1906: 881.

*Paramithrax* (*Chlorinoides*) Miers, 1884: 192, 552. Alcock, 1895: 240.

*Acanthophrys* Filhol, 1886: 365 (incorrect subsequent spelling of *Acanthophrys* A. Milne Edwards, 1865).

*Prismatopus* Ward, 1933: 391; type species by monotypy: *Prismatopus albanyensis* Ward, 1933.

**DESCRIPTION:** Carapace subpyriform, inflated, margins and dorsum with a few spines or lamellate lobes, or both. Rostrum of two long, divergent spines separate from base. Supraorbital region comprising eave, intercalated spine and postorbital lobe, the three closely approximated; eave with two, usually salient, spines or lamellate lobes; postorbital lobe excavated anteriorly. Eyestalk moderately long and slender, almost completely retractile to excavation of postorbital lobe; cornea terminal, small. Basal antennal article leaving orbit incomplete below, longitudinally subrectangular, anterior angles toothed, spiniform or lamellate, lateral tooth directed outward. Third maxillipeds with merus as broad as ischium, sub-

quadrate, anterolateral angle not greatly expanded, distal edge notched, a small spine at lateral angle of notch. Merus, carpus, and propodus of cheliped sometimes provided with longitudinal ridges or crests. Ambulatory legs slender, longer than carapace, meri usually with a distal spine. Abdomen of seven distinct segments in both sexes.

**RANGE:** Indo-west Pacific, including Hawaii, Japan, China, Indonesia, Australia, New Zealand, India, east coast of South Africa.

**TYPE SPECIES:** *Chlorinoides tenuirostris* Haswell, 1880, by monotypy; a north-east Australian species.

**REMARKS:** Elsewhere (Griffin, in press) the limits of the genus *Chlorinoides* have been discussed and the status of the included species reviewed. The genus *Acanthophrys* A. Milne Edwards is based, through the valid type designation of Miers (1879c), on *A. cristimanus* A. Milne Edwards, 1865. After his restriction of *Acanthophrys* in 1879, Miers (1886) transferred to *Chlorinoides* Haswell, of which the type species is *C. tenuirostris* Haswell, 1880, all those species which had hitherto been placed in the former genus, and some from the genera *Chorinus* Latreille and *Paramithrax* H. Milne Edwards. That the majority of these species, including *C. tenuirostris*, are congeneric has not since been questioned. Alcock (1895) and a few other authors followed Miers in retaining *Chlorinoides* for this group of species but regarded it merely as a subgenus of *Paramithrax* H. Milne Edwards. Bouvier (1906) on the other hand stated that according to a manuscript note by A. Milne Edwards *A. cristimanus* did not belong to the genus *Acanthophrys*. Bouvier therefore resurrected *Acanthophrys* and used it for the group of species which Miers had placed in *Chlorinoides*, and *Acanthophrys aculeatus* A. Milne Edwards, 1865, now known to be conspecific with *Paramithrax spatulifer* Haswell, 1882 (herein called *Chlorinoides spatulifer*) was named as the type species of *Acanthophrys*. With few exceptions (Rathbun, 1918; Hale, 1927; Yokoya, 1933) later authors followed Bouvier in the retention of *Acanthophrys*, despite the fact that Rathbun (1906) had pointed out that any decision as to whether or not the genera *Chlorinoides* and *Acanthophrys* were synonymous depended on comparison of *C. tenuirostris* with *A. cristimanus*, not with *A. aculeatus* A. Milne Edwards. Balss (1929) added *Entomonyx spinosus* Miers, 1884, to *Acanthophrys*, and in this was followed by Sakai (1938), and later (Balss, 1935) included *A. cristimanus* in a list of species of *Hyastenus* while retaining *Acanthophrys*.

Examination of the figures and descriptions of *A. cristimanus* given by A. Milne Edwards (1865) supports the contention published by Bouvier that this species belongs to *Hyastenus* White, 1847. Therefore, as this species is also the type species of *Acanthophrys* (see above), the latter genus must be reduced to synonymy with *Hyastenus*. Attempts by Bouvier to retain the name *Acanthophrys* are quite invalid and *A. aculeatus* A. Milne Edwards cannot be accepted as the type species. Consequently the only valid generic name remaining for the



group of species under discussion is *Chlorinoides* Haswell.

The genus *Prismatopus* Ward, 1933, founded on *Prismatopus albanyensis* Ward must also be considered a synonym of *Chlorinoides*, since examination of Ward's description and figure of that species (Ward, 1933, p. 391, pl. xxiii fig. 3) shows that it possesses only two differences, both of a minor nature, from the other species here included in *Chlorinoides* (see Griffin, in press).

Two species formerly included here, *Entomonyx spinosus* Miers, 1884 (= *Macrocoeloma nummifer* Alcock, 1895) and *Acanthophrys paucispina* Miers, 1879, do not belong in the genus *Chlorinoides* as here constituted; their affinities are discussed elsewhere (Griffin, in press). This leaves a total of 12 species of good taxonomic standing, six of which have so far been recorded from Australia and New Zealand. The single New Zealand species, *C. filholi*, is restricted to these waters.

KEY TO NEW ZEALAND AND AUSTRALIAN SPECIES OF  
*Chlorinoides*

- 1 (6) Preorbital and antorbital lobes spinous, not markedly expanded as lamellate lobes.
- 2 (3) Preorbital spine more than three times antorbital in length, vertically directed upward from base, acuminate. Hepatic margin with a single long spine extending laterally beyond postorbital lobe. Rostral spines almost  $\frac{1}{2}$  length of carapace, straight. .... *C. tenuirostris* Haswell, 1880
- 3 (2) Preorbital spine less than  $1\frac{1}{2}$  times antorbital in length, outwardly directed at least basally. Hepatic margin with a small bilobate lamella. Rostral spines scarcely more than  $\frac{1}{3}$  carapace length, outwardly curved distally.
- 4 (5) A single preorbital spine. A single cardiac spine. Intestinal region with two median spines. Spines of carapace, including rostral spines, usually lacking terminal knobs. .... *C. aculeatus* (H. Milne Edwards, 1834)
- 5 (4) Two preorbital spines distinct from base. A pair of widely divergent submedial cardiac spines. Intestinal region with a single spine. Spines of carapace, including rostral spines, usually bearing terminal knobs. .... *C. longispinus* (de Haan, 1839)
- 6 (1) Preorbital or antorbital lobe, or both, a wide, flat-tended lamella.
- 7 (8) Posterior intestinal margin with an acuminate spine. Ambulatory legs trigonal in section. .... *C. albanyensis* (Ward, 1933)
- 8 (7) Posterior intestinal margin with a prominent lamellate lobe. Ambulatory legs cylindrical.
- 9 (10) Preorbital lobe lamellate, wide, summit truncate or concave; antorbital lobe a short spine. Medial margins of rostral spines armed with several short spines. Posterior intestinal lobe widest midway from base, summit rounded. .... *C. spatulifer* (Haswell, 1882)
- 10 (9) Preorbital lobe slender, spinous, acuminate; antorbital lobe lamellate, distally expanded and anteriorly directed. Medial margins of rostral spines lacking spines. Posterior intestinal lobe widest at base, summit truncate to concave. .... *C. filholi* (A. Milne Edwards, 1876)

***Chlorinoides filholi*** (A. Milne Edwards, 1876). Figs. 17, 20.

*Acanthophrys filholi*. A. Milne Edwards, 1876a: 1876b: 4, Chilton, 1911: 290. Thomson, 1913: 237; 1921: 97. Chilton & Bennett, 1929: 741. Richardson, 1949b: 64, fig. 64. Dell, 1960: 2, figs. 1, 4-6, pl. 1. Bennett, 1964.  
*Acanthophrys filholi*: Fihol, 1885: 49; 1886: 365, pl. 39 figs. 1-3, pl. 40, figs. 6, 8 (incorrect subsequent spelling of *Acanthophrys filholi* A. Milne Edwards).

**TYPES:** Two syntype females, lectotype (J. Forest), length 43 mm, width 30 mm; the 60 mm male mentioned by A. Milne Edwards (1876b) is presumably no longer extant. Muséum National d'Histoire Naturelle, Paris.

**TYPE LOCALITY:** Stewart Island, deep rock pool; H. Filhol, collector.

**LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS:** Northern: 10 miles NW of Cape Maria van Diemen, off West King, Three Kings Islands, 60-65 fm, C. Chilton (Chilton & Bennett). Central: Blind Bay to Golden Bay, *Doto* Exped. (Bennett). New Brighton, Banks Peninsula, H. Suter (Chilton). Southern: *Nora Niven* Sta's 17 (8 miles NE of Cape Saunders, 25 Jun 1907, 55-102 fm, sand), 26 (19½ miles south of Oamaru, 2 Jul 1907, 40-43 fm, fine sand), 44 (23 miles SW of Akaroa, 9 Jul 1907, 30-24 fm, sand and shell) (Chilton). Between Oamaru and Cape Saunders, 20-30 fm; east coast of Otago, *Doto* Exped.; Otago Harbour, Otago Heads, and Papanui Inlet (8 localities), 20-40 fm, D. H. Graham (Bennett). Chatham Islands: Chatham Islands 1954 Exped. Sta's 14 (44°00'S, 176°21'W, Hanson Bay, 15 fm), 24 (43°36.2'S, 176°45.8'W, south of the Sisters, 38 fm) (Dell).

**DISTRIBUTION:** New Zealand, mainly southern, including Chatham Islands; restricted.

**DESCRIPTION:** Carapace narrowly pyriform in dorsal aspect (length 1.6 times width), in profile inflated and almost uniformly convex. Rostrum of two long acuminate spines ( $\frac{1}{2}$  length of carapace), weakly flattened and forwardly directed, separate from base, widely divergent, distance between tips  $1\frac{1}{2}$  basal width, inner and outer margins entire. Hooked hairs fringing margins of rostral spines, also occurring on dorsal surface of carapace in a line curving backward and outward from base of rostral spines on to dorsal surface of branchial regions posteriorly; also extending submarginally round carapace above lateral lobes and spines.

Dorsal surface of carapace with spines and tubercles. Three median spines, two mesogastrics close together at posterior end of region, subequal in length, first opposite hepatic lobe, slender, conical, second opposite first branchial lobe, laterally compressed; cardiac region tumid, bearing centrally a single long, anteroposteriorly flattened spine bifid for distal third, edges weakly concave or straight; posterior intestinal margin with a wide, medial spatuliform plate directed backward, summit truncate or weakly concave, plate widest basally. Surface also with a few low tubercles, scarce anteriorly close to midline,

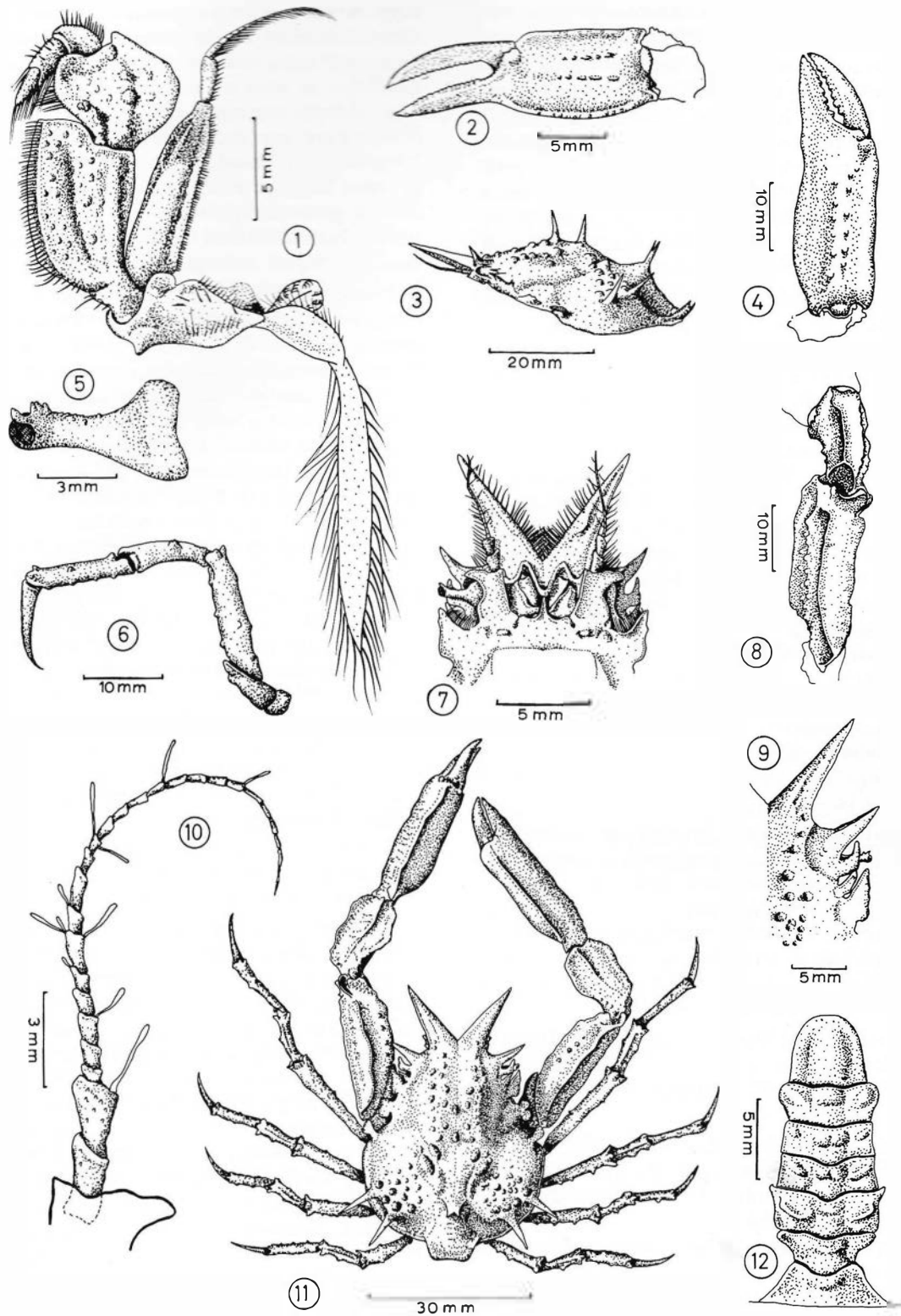


FIG. 17—*Chlorinoides filholi* (A. Milne Edwards). 1—Left third maxilliped. 2—Left chela of female. 3—Lateral view of carapace. 4—Left chela of male. 5—Posterior view of left eyestalk. 6—Left fourth ambulatory leg. 7—Ventral view of front. 8—Left cheliped of male, merus and carpus. 9—Dorsal view of orbit. 10—Ventral view of left antenna. 11—Dorsal view of male. 12—Male abdomen. 2 from female, carapace length 40 mm, 1, 4, 5, and 8 from 48 mm male, remainder from 52 mm male, off Oamaru, 15-60 fm.

numerous and crowded posteriorly close to margins. Surface otherwise smooth; regions clearly defined.

Margins of carapace with eight spinous or lamellate lateral projections; four supraorbital, one hepatic, and three branchial. Hepatic lobe quite wide, divided distally into two small, subequal, rounded lobes. A small flattened, distally expanded, branchial lobe close to hepatic lobe, obliquely placed, upper surface sloping downward anteriorly. Two slender flattened branchial spines close together subdorsally on posterior part of mesobranchial region; spines subequal, long,  $\frac{2}{3}$  length of rostrum.

Orbit consisting above of supraorbital eave, intercalated spine, and postorbital lobe: supraorbital eave rounded laterally, bearing a preorbital and antorbital projection; preorbital spinous, long, almost  $\frac{1}{2}$  length of rostrum, slender, outwardly directed, weakly upcurved at tip; antorbital lobe lamellate, short,  $\frac{1}{2}$  length of preorbital lobe, expanded and truncate distally, reaching anteriorly; intercalated spine short, flattened, no longer than antorbital lobe and weakly forwardly directed so as to almost touch it, wide basally, narrow distally, anterior edge straight, posterior edge curved; postorbital lobe closely approximated to intercalated spine, large, lamellate, subtriangular, anterior edge thickened slightly and weakly excavated, a thick fringe of longer hairs along lower border of excavation. Orbit circular and deep, inferior border very incompletely formed by basal antennal article. Eyestalk almost completely visible in ventral view, when retracted almost completely hidden from dorsal view; long, slender, bulbous basally; cornea terminal, small, ovoid; several large and small tubercles above at distal extremity of eyestalk.

Basal antennal article large, broadly subrectangular, anterior angles toothed: anteromedial tooth spinous, small, sharp; anterolateral tooth flattened, outwardly directed, broadly subtriangular. Lateral margin of basal antennal article deeply concave; flagellum completely excluded from orbit, of moderate length, extending to tip of rostrum or just beyond, visible from above, weakly setose, two basal segments longer and stouter than following.

Antennular fossae subtriangular, deep; interantennular spine short, downwardly projecting, curved, bluntly pointed; anterior process of epistome narrow, bluntly pointed.

Epistome wide and short. Mouthfield large, subrectangular, anterior border transverse. Pterygostomial regions triangular, clearly separated from subhepatic regions by a shallow groove, flattened, weakly excavated postero-medially. Subhepatic regions weakly inflated, bearing a group of three or four small tubercles. Thoracic sternum large, in male broadly subtriangular to form posterior border of mouthfield. Margin of abdominal fossa raised up on each side anteriorly as a compressed crest, a small, deep pit in sternum on each side of crest.

Third maxillipeds meeting in midline so as to completely cover mouthfield. Ischium large, subrectangular, slightly longer than broad, medial edge lacking teeth, overlain by a thick fringe of long hairs, medial half of distal

edge weakly extended anteriorly, rounded, lateral half straight, bearing merus; outer surface excavated medially as a very wide, shallow, longitudinal groove. Merus subquadrate, as wide as ischium but slightly shorter, lateral edge sharply angled, entire, medial edge rounded, very finely emarginate about midway along and bearing a short fringe of hairs, distal edge notched, a small rounded tooth at outer angle of notch; outer surface bearing two longitudinal grooves separated by a low, rounded ridge. Palp arising from middle of distal edge of merus, the three segments subequal in length, subcylindrical, densely setose.

Chelipeds long (slightly more than  $1\frac{1}{2}$  times length of carapace in adult male), naked. Ischium extending along ventral surface of merus for about  $\frac{1}{3}$  length of latter, a sharp longitudinal crest along ventral surface, continuous with ventromedial crest of merus. Merus long, nearly  $\frac{1}{3}$  total length of cheliped, carpus scarcely more than  $\frac{1}{2}$  merus, chela almost  $\frac{1}{2}$  total length of cheliped, dactyl  $\frac{2}{3}$  palm. Merus subquadrate in cross section, bearing four sharp longitudinal crests dorsolaterally, dorsomedially, ventromedially, and ventrolaterally, dorsomedial crest distally expanded as a rounded lobe; a few small tubercles scattered over medial and lateral surfaces between crests. Carpus subtriangular in cross section bearing three longitudinal crests: one dorsomedial, one dorsolateral, and one extending obliquely across lateral surface somewhat ventrally; dorsomedial and dorsolateral crests poorly developed basally, lateral crest well developed. Palm in male very compressed and of uniform height throughout; low and slightly narrowed distally in female; two sharp crests extending entire length, one mid-dorsal and one mid-ventral, a few small tubercles scattered along middle of lateral surface. Fingers acute, cylindrical, moderately gaping basally, coarsely toothed along inner edges for entire length, teeth larger basally in male, finely and uniformly toothed in female; dactyl stout basally.

Ambulatory legs of moderate length, much shorter than chelipeds, slender; carpi slightly depressed, legs otherwise subcylindrical, covered by scattered small spines and tubercles; long, hooked hairs scattered in groups along dorsal and ventral surfaces except on bases and ischia, dactyli covered by a dense clothing of short hairs; meri long, about  $\frac{2}{3}$  total length of leg, carpi about  $\frac{1}{2}$  meri, propodi about  $1\frac{1}{2}$  carpi, dactyli barely as long as propodi. First leg the longest (barely exceeding carapace), following legs decreasing gradually and uniformly to the last ( $\frac{2}{3}$  carapace length). Meri with distal articulations acute, a small, broadly triangular, medial spine overlying distal articulating edge; carpi with a shallow groove extending the length of dorsal surface, distal articulating edge made up of three flattened flanges, one dorsal, one medial, and one lateral; propodi with a small, compressed flange dorsally overlying distal articulating edge; dactyli terminating in a sharp spine.

Abdomen of seven distinct segments in both sexes, surface covered by scattered groups of long, simple hairs borne on rounded tubercles. In male all segments wider than long, subequal in length except seventh which is nearly twice length of others. Segment I flattened, wide

basally, narrow distally, abdomen widening from base of segment 2, subtriangular, widening distally; abdomen widest at distal edge of segment 3, segments 4 and 5 narrowing slightly to base of segment 6, which is expanded distally and laterally into rounded lobes; segment 7 strongly convex distally; medial portions of all segments except the first slightly raised as a low rounded ridge, further elevated distally except in the seventh as a rounded tubercle, partially divided into a pair of tubercles in segments 4 and 5; segments 3 and 4 with oblique ridge extending across middle of lateral surfaces; segments 5 and 6 laterally elevated as small tubercles; surface of abdomen otherwise generally pitted.

Male first pleopod long, slender, bulbous basally, outwardly curved distally, tip finely pointed; aperture subterminal, lateral, concealed by a wide, distally truncate flap of tissue which extends out below aperture; a fringe of long setae extending along lateral surface to just short of aperture and also obliquely across sternal surface from lateral surface to just short of aperture; very short setae grouped together on abdominal surface close to aperture and on lateral surface between aperture and tip.

**COLOUR:** The dorsal surface of the carapace is orange, paling at the posterolateral margins. The ventral surface of the carapace is pale orange to white. The chelipeds are mostly reddish orange, the propodus red, the dactyl and under surface of the cheliped purple at the base of each segment. The ambulatory legs are pale orange.

**MATERIAL EXAMINED:** A total of 38 specimens as follows:

**VICTORIA UNIVERSITY ZOOLOGY DEPARTMENT COOK STRAIT COLLECTIONS:** Coll. VUZ 55, off Cape Palliser, 40-100 fm, 3 males, 10-29 mm, 4 females (2 ovigerous), 15.5-29 mm; Coll. VUZ 98, off Cape Palliser, c 150 fm, 1 male, 31 mm; Coll. VUZ 113, Palliser Bay Shelf, 70-80 fm, 1 male, 33.5 mm.

**DOMINION MUSEUM COLLECTIONS:** North of Kapiti Island, 5 Sep 1956, 30 fm, 1 male (Z. Cr. 646), 36 mm; NE of Cape Campbell, 41°40'S, 174°30'E, April 1957, 60 fm, F. Abernethy, 1 male (Z. Cr. 682), 23 mm; B.S. 195, entrance to Admiralty Bay, Trio Islands, 16 fm, 1 female, 19.5 mm; B.S. 191, off east Otago coast, 250-300 fm, 1 male (Z. Cr. 582). Off Oamaru, mid February 1961, 15-60 fm, J. Graham, M.V. *Orion*, 3 males, 47-52 mm, 3 females, 30.5-40 mm; off Oamaru, March 1961, 15-60 fm, J. Graham, M.V. *Orion*, 9 males, 34-58.5 mm, 4 females (2 ovigerous), 32.5-43.5 mm.

**NEW ZEALAND OCEANOGRAPHIC INSTITUTE COLLECTIONS:** Sta. A 444, Cook Strait, 120 fm, 3 females, 12-33.5 mm; Sta. B. 236, Foveaux Strait, 19 fm, 1 male, 29 mm; Sta. C 58, Cook Strait, 130 fm, 1 female, 33 mm; Sta. C 624, Chatham Rise, 68 fm, 1 male, 19 mm, 1 female, 20 mm; Sta. C 703, Kaikoura, 85 fm, 3 females, 14.5-53 mm.

**MEASUREMENTS:** Largest male: length 58.5 mm, width 39 mm, rostral length 13 mm, rostral width 11 mm, cheliped 108 mm, chelar length 50 mm, chelar height 16.5 mm, dactyl 22 mm, first ambulatory leg 58 mm.

Ovigerous female: length 43.5 mm, width 30 mm, cheliped 40 mm.

**HABITAT:** On sand, mud, or muddy gravel, amongst seaweed and sponges. Numerous specimens collected by

Mr J. Graham off Oamaru have the carapace covered by very large sponges, while others bear the tubes of tubicolous polychaetes, encrusting polyzoa, and brown algae. Specimens in the collections of the Dominion Museum carry small shells of *Spirorbis*, and several in the V.U.Z. Cook Strait Collections are covered by hydroids. No specimens were examined which carried sessile compound ascidians, though these were noted on specimens of this species by A. Milne Edwards (1876b) and Chilton (1911). One specimen in the collections of the New Zealand Oceanographic Institute bears on its back a large, beautifully sculptured colony of polyzoans.

**DEPTH:** Continental shelf, 15 to 300 fathoms, most common between 40 and 80 fm.

**BREEDING:** Ovigerous females from March to June.

**REMARKS:** The description of this species given by A. Milne Edwards (1876b) was short and lacked a figure. However, apart from the posterior intestinal lobe being described as rounded rather than truncate, there is almost complete agreement with the material before me. The first figures of the species were given by Filhol (1886). There has in the past been some confusion over which figures were of this species, as Filhol stated that only pl. 39 fig. 1 and pl. 40 fig. 8 were of *A. filholi*. References to the actual plates in Filhol's work leave no doubt that figs. 2 and 3 of pl. 39 and fig. 6 of pl. 40 are also of this species and not of *Paramithrax minor* (herein *Notomithrax minor*) as stated by Filhol. Complete agreement throughout Filhol's figures is lacking, but there are several minor differences between them and the material I have examined, including the shape and relative lengths of several of the spines and lobes of the carapace. All of these differences can be accounted for by individual variation.

Bennett (1964, p. 57) is in error in giving A. Milne Edwards (1865, p. 141, pl. 5 fig. 3) as the first description and figure of *C. filholi*. The species referred to by Bennett is *Acanthophrys cristimanus* A. Milne Edwards, 1865, now referred to the genus *Hyastenus* White (see above under *Chlorinoides*).

*C. filholi* stands closest among the species of *Chlorinoides* to the east Australian *C. spatulifer* (Haswell) from which it differs in having the margins of the rostral spines entire, the posterior intestinal lobe truncate distally, not rounded; also there is a marked difference in the shape of the preorbital and antorbital lobes, the former being spinous and the latter lamellate in *C. filholi*, while in *C. spatulifer* the preorbital lobe is lamellate and the antorbital spinous. *C. filholi* shows a reasonable degree of individual variation, the rostral spines becoming outwardly curved at the tips in large specimens, and, while the cardiac lobe is usually bifid for only the distal third, in some specimens the cardiac region bears two separate spines arising close together but divergent for their entire length. Bennett (1964) notes considerable variation in almost all the spines and lobes of the carapace in this species.

Subfamily MITHRACINAE Balss, 1929.

*Majinae* Alcock, 1895: 161, 166, and 236 (part: the *Periceroidea*).

*Majinae* Rathbun, 1925: 335.

*Mithracinae* Balss, 1929 + *Macrocoelominae* Balss, 1929: 16, 20. Sakai, 1938: 312, 318.

*Mithracinae* Garth, 1958: 346.

Carapace broadened anteriorly by outstanding, often tubular, orbits; orbits formed by (1) an arched supra-orbital eave, or semitubular horn; (2) a hollowed postorbital process; and (3) a remarkable broadening, or a prolongation, of anterior part of basal antennal article affording complete concealment to retracted eye. Rostrum often more or less deflexed. (Alcock.)

Pleopod 1 like that in the Pisinae Alcock. Pleopod 2 short. (Stephensen.)

As in the other subfamilies of Balss, Garth has not accepted the subdivisions of that author because of lack of support from the form of the male first pleopods.

This subfamily is represented by numerous genera in the west Atlantic, east Pacific, and Indian Oceans, but as in the case of all the other subfamilies except the *Majinae*, is poorly represented in the New Zealand fauna, only one genus and one species being known from these waters. *Jacquinotia* was referred to the Pisinae by Richardson (1949b), and appears in the list of genera of that subfamily given by Balss (1957).

Genus *Jacquinotia* Rathbun, 1915.

*Prionorhynchus* Jacquinot, in Jacquinot & Lucas, 1853:8 (name preoccupied). Miers, 1876b: 11; 1879c: 622. Chilton & Bennett, 1929: 742.

*Jacquinotia* Rathbun, 1915: 142. Balss, 1930: 199. Richardson, 1949b: 63. Bennett, 1964: 60.

*Campbellia* Balss, 1930: 200; type species, by monotypy: *Campbellia kohli* Balss, 1930 = *Jacquinotia edwardsii* (Jacquinot). Bennett, 1964, 59.

DESCRIPTION: Carapace subpyriform, dorsal surface granular. Rostrum short, of two wide lamellae fused except distally, directed obliquely downward. Orbit consisting of supraorbital eave, intercalated spine, and postorbital lobe, the three closely approximated, almost fused, postorbital lobe excavated anteriorly. Basal antennal article greatly expanded laterally, completing orbit ventrally, bearing three short, spinous lobes anteriorly; flagellum minute. Merus of third maxilliped notched distally. Chelipeds enlarged in male, fingers almost smooth along inner edges in adult. Abdomen of seven distinct segments in both sexes.

RANGE: New Zealand, restricted.

TYPE SPECIES: *Prionorhynchus edwardsii* Jacquinot, 1853, by monotypy; a restricted southern New Zealand species.

REMARKS: The name of this genus was changed by Rathbun (1915) who pointed out that at the time of its

proposal by Jacquinot in 1853 *Prionorhynchus* was already in use for a genus of insect. It has recently been shown (Griffin, 1963a) that the monotypic *Campbellia* Balss, 1930 was based on a juvenile specimen of *Jacquinotia edwardsii*, and *Campbellia* is therefore a junior objective synonym of *Jacquinotia*. The genus includes only one recent species.

It is believed to be clear from the generic description given above that this genus belongs correctly in the Mithracinae along with the American *Mithrax* to which it is probably most closely related.

*Jacquinotia edwardsii* (Jacquinot, 1853). Figs. 18, 23.

*Prionorhynchus edwardsii* Jacquinot, in Jacquinot & Lucas, 1853: 8, pl. 1 fig. 1. Miers, 1876b: 11. Filhol, 1886: 367, pl. 42, figs 1-4. Rathbun, 1892: 243. Hodgson, 1902: 320. Chilton, 1909: 608; 1911: 290. Thomson, 1913, 237; 1921: 97. Stephensen, 1927, 292. Chilton & Bennett, 1929: 742.

*Prionorhynchus edwardsii*: Filhol, 1885: 8.

*Jacquinotia edwardsii*: Balss, 1930: 200. Richardson, 1949b: 63, fig. 26. Griffin, 1963a: 237, figs 1-4.

*Jacquinotia edwardsii*: Bennett, 1964: 61, figs. 58-61, 125, 126.

*Paramiccippa grandis* Hector, 1899: 423; type locality: Campbell Island—Dominion Museum, Wellington.

*Campbellia kohli* Balss, 1930: 200, figs 1-4; type locality: Perseverance Harbour, Campbell Island, 42 metres—Senckenberg Museum, Frankfurt. Richardson, 1949b: 64, fig. 29. Bennett, 1964: 60.

HOLOTYPE: Male, length 90 mm. Muséum National d' Histoire Naturelle, Paris.

TYPE LOCALITY: Auckland Islands; MM Hombron and Jacquinot, collectors.

LOCALITIES SUBSEQUENTLY REPORTED, WITH COLLECTORS: Southern: off Otago coast (Chilton, 1909). *Nora Niven* Sta's 5 (50 miles east of Wreck Reef, 13 Jun 1907, 65-183 fm, soft sand), 15 (8 miles ESE of Otago Heads, 24 Jun 1907, 48-38 fm, coarse sand), 17 (8 miles NE of Cape Saunders, 25 Jun 1907, 55-102 fm, sand), 20 (6 miles east of Jones Head, 1 Jul 1907, 20-22 fm, fine black sand), 47 (16 miles ENE of Sail Rocks, 11 Jul 1907, 39-44 fm, sand and shell), 48 (21 mile NE of Sail Rocks, 11 Jul 1907, 44-46 fm, sand and shell) (Chilton, 1911). Off Otago Heads (Thomson, 1913). Stewart Island (Chilton, 1909; Chilton & Bennett). Southern Islands: Auckland Islands (Rathbun; Chilton, 1909; Stephensen). Campbell Island (Filhol, 1886; Hodgson; Balss).

DISTRIBUTION: Southern New Zealand (Otago and Stewart Island), Auckland Islands, Campbell Island; restricted.

DESCRIPTION: Carapace very broadly pyriform in dorsal aspect (length 1.01 times width), swollen and almost uniformly convex in profile, margins with blunt spines, surface granular and weakly tuberculate. Rostrum short ( $\frac{1}{2}$  length of carapace), strongly deflexed, flattened, wide basally, narrow distally, margins convex; consisting of two

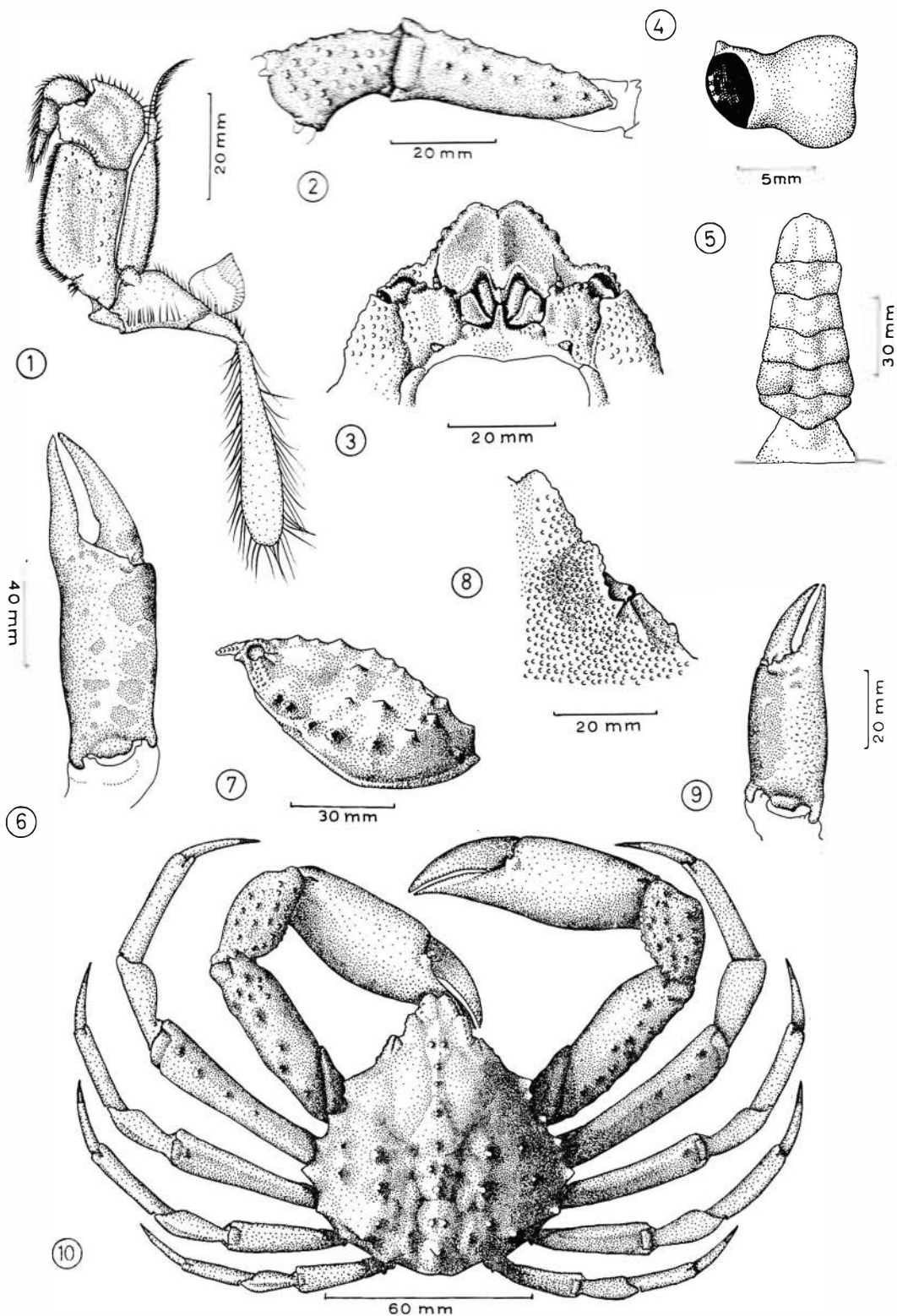


FIG. 18—*Jacquinotia edwardsii* (Jacquinot). 1—Left third maxilliped. 2—Left cheliped of male, merus and carpus. 3—Ventral view of front. 4—Posterior view of left eyestalk. 5—Male abdomen. 6—Left chela of male. 7—Lateral view of carapace. 8—Dorsal view of orbit. 9—Left chela of female. 10—Dorsal view of male. 9 from female, carapace length 109 mm, remainder from 148 mm male, Perseverance Harbour, Campbell Island.

lobes fused for almost their entire length, separated only by a small V-shaped indentation at tip. Dorsal surface and margins of rostrum covered by small tubercles. Carapace completely lacking hairs in adult.

Margins of carapace ornamented by a series of 7 subequidistant conical, wide-based, sharply pointed spinous tubercles, 2 hepatic and 5 branchial, branchials forming a semi-ellipse, last two subdorsal. All marginal spines except second and fourth subequal, second small, third branchial spine larger than others. Hepatic spines arising close together.

Dorsal surface of carapace with a few large tubercles scattered along midline and on branchial regions. Six medial tubercles, three to five small mesogastrics, a single, slightly larger, centrally placed urogastric, and a single very large, centrally placed intestinal tubercle; two pairs of submedial tubercles, a small pair of metagastrics and a slightly larger pair on tumid cardiac region; posterior intestinal margin weakly indented medially. Branchial regions with two small tubercles below last two marginal spines and three large tubercles in a semi-ellipse round medial margin, the third opposite fourth marginal spine, second opposite third marginal, and first opposite second marginal; two much smaller tubercles midway between second and third marginal spines and first and second medial tubercles. Regions of dorsal surface of carapace fairly well demarcated, especially posteriorly, branchial regions inflated.

Orbit consisting above of supraorbital eave, intercalated spine, and postorbital lobe, the three adjacent, not separated by fissures; supraorbital eave with a short, flattened, triangular antorbital spine; intercalated spine slightly longer than antorbital, triangular; postorbital lobe large, deeply excavated anteriorly. Orbit round and deep, completed below by laterally expanded basal antennal article. Eyestalk concealed in both dorsal and ventral view when retracted, short, very stout, bulbous basally; cornea rounded, terminal; a small tubercle above at distal extremity of eyestalk.

Basal antennal article very large, subrectangular, very wide, separated basally by a very shallow groove from surrounding areas, distal edge armed with several small tubercles, a slightly larger one at anteromedial angle, anterolateral angle, and on lateral edge at base; flagellum very short, hardly extending beyond anterior part of orbit and concealed from dorsal view.

Antennular fossae subtriangular, apex anterior. Interantennular spine short, downwardly curved, sharply pointed. Anterior process of epistome narrow, tip rounded.

Epistome wide and short. Mouthfield large and subrectangular, slightly narrower posteriorly, anterior margin almost transverse, weakly concave medially. Pterygostomian regions subtriangular, weakly excavated postero-medially, separated from subhepatic regions by a very deep groove, one or two small tubercles on lateral margin. Subhepatic regions with two or three small tubercles on lateral surface anterior to marginal spines.

Third maxillipeds almost meeting in midline. Ischium

large, subrectangular, medial edge entire, untoothed, overlain by a dense fringe of short hairs, medial half of distal edge moderately extended anteriorly, lateral half straight; outer surface bearing a few small scattered tubercles, a wide, very shallow, longitudinal groove medially. Merus subquadrate, as wide as, but much shorter than, ischium, lateral edge rounded, not sharply angled, entire, medial edge rounded, entire basally, a few very small teeth equidistantly scattered along distal portion; distal edge deeply notched, a sharp, triangular spine at lateral angle of notch; outer surface with two very shallow, longitudinal grooves, a series of small tubercles along basal part of medial edge corresponding to a similar series along medial half of distal edge of ischium; anterior two-thirds of lateral edge bearing a scattered fringe of long hairs. Palp arising from notch of, and slightly longer than, merus, stout, segments subequal, lateral and medial surfaces with a dense fringe of long hairs.

Chelipeds very long (almost twice length of carapace in adult male), subcylindrical except for compressed propodus, naked, surfaces granular. Basis and ischium short, ischium extending along ventral surface of merus for about  $\frac{1}{3}$  length of latter. Merus long, about  $\frac{1}{3}$  total length of cheliped, carpus  $\frac{1}{2}$  merus, chela almost  $\frac{1}{2}$  total length of cheliped, dactyl almost as long as palm. Merus and carpus with tubercles scattered all over surface, tubercles slightly larger on dorsal and lateral surfaces, more closely spaced on carpus. Palm very high in male and slightly enlarged distally, slender and of even height throughout in female, upper surface weakly carinate basally, blunt distally, very small tubercles on all surfaces basally. Fingers acute, very bluntly toothed or smooth along inner edges, moderately gaping for entire length in both male and female, more widely gaping basally in male.

Ambulatory legs very long, stout, cylindrical, minutely granular, dorsomedial surfaces of merus and carpus bearing a row of scattered small tubercles, one or two tubercles about midway along dorsal surface of propodus. First leg the longest (about  $1\frac{1}{2}$  times carapace length), following legs decreasing uniformly to last (about as long as carapace). Bases and ischia short, meri long, about  $\frac{1}{3}$  total length of leg, carpi about  $\frac{1}{3}$  meri, propodi about twice length of carpi, dactyli almost  $\frac{1}{2}$  propodi.

Abdomen of seven distinct segments in both sexes. Male abdomen narrow, all segments wider than long, subequal in length except for segment 7 which is slightly longer than others. Segment 1 wide basally, narrow distally, segment 2 widening sharply distally, abdomen widest close to base of segment 3, following segments narrowing gradually and slightly to base of distally widened segment 6, segment 7 narrowing distally, margin convex; surface of abdomen elevated in midline and a low rounded longitudinal ridge, weakly elevated further distally in all segments except the last.

Male first pleopod bulbous basally, outwardly curved distally, bluntly pointed; aperture subterminal, lateral, protected from below, and almost obscured, by a thin flap of tissue; short setae extending along lateral surface, and

a sparser fringe on medial surface, between aperture and tip, several similar setae also grouped together on abdominal surface adjacent to aperture, longer and more slender setae extending along lateral surface from base almost to aperture.

**COLOUR:** The carapace is brick red, the chelae brighter red to yellowish white, often marbled or blotched with red on the outer surface; dull brown after preservation (Bennett, modified).

**MATERIAL EXAMINED:** A total of 28 specimens as follows:

**DOMINION MUSEUM COLLECTIONS:** B.S. 189, off east Otago coast, 120 fm, 1 male (Z. Cr. 591), 21 mm; B.S. 191, off east Otago coast, edge of Canyon C, 250-300 fm, 1 male (Z. Cr. 607), 36 mm, 2 males, 3 females (Z. Cr. 567), males 37, 38 mm, females 34-49 mm; B.S. 202, off Tairua Head, Otago Peninsula, 75 fm, 1 male 16 mm; off Otago, trawled, 1953, pres. A. Black, 1 male, 71 mm, 1 female 74 mm. Campbell Island, (no date), J. Hector, 1 male (Cr. 426) 195 mm; Campbell Island, (no date), (Petherick Collection), 1 male (Cr. 429) 160 mm; Campbell Island, (no date), (no collector), 3 males (Cr. 430) 118-153 mm; Campbell Island, 1943, J. H. Sorenson (Cape Expedition), 1 male (Cr. 468) 99 mm; Shoal Point, Perseverance Harbour, Campbell Island, 8 Dec 1944, R. L. Oliver (Cape Expedition), 2 males (Cr. 428) 111, 165 mm; Shoal Point, Campbell Island, 8 Dec 1944, R. W. Balham (Cape Expedition), 1 male (Cr. 889) 120 mm; Perseverance Harbour, Campbell Island, Nov. 1956, P. C. Poppleton, 2 males, 2 females (1 ovigerous), males 140, 148 mm, females 105, 109 mm; Perseverance Harbour, Campbell Island, Feb 1958, in crayfish pot, R. J. Street (pres. Marine Department), 1 male (Z. Cr. 780) 156 mm; Campbell Island, 1958-59, P. C. Poppleton, 1 male (Cr. 854), 150 mm; Campbell Island, Feb 1958, R. J. Street, 1 male (Cr. 870) 119 mm. Ranui Cove, Auckland Islands, 8 Nov 1954, on rocks at low water. R. A. Falla, 1 female (ovigerous) 117 mm.

**NEW ZEALAND OCEANOGRAPHIC INSTITUTE COLLECTIONS:** Sta. B. 228, Foveaux Strait, 20 fm, portion of fixed finger; Sta. B 350, Auckland Islands, 20 fm, 1 female 88.5 mm.

**MEASUREMENTS:** Largest male: length 195 mm, width 178 mm, rostral length 16 mm, rostral width 31 mm, cheliped 398 mm, chelar length 194 mm, chelar height 55 mm, dactyl 90 mm, first ambulatory leg 361 mm.

Ovigerous female: Length 117 mm, width 104 mm, cheliped 107 mm.

**HABITAT:** On Campbell Island and the Auckland Islands this species is commonly found in rock pools amongst seaweed or on sandy beaches. Filhol (1886), Thomson (1913), and Chilton (1911) have all given accounts of the swarming of this species, Chilton mention-

ing that great numbers were seen walking about on the beaches by settlers at Stewart Island about 1908 (Bennett, 1964, p. 62). Bennett states that the swarming is sporadic and is a phase of migratory movement not understood.

The carapace and upper surfaces of the legs are often covered by dense clusters of polychaete tubes and sometimes fragments of green and brown algae. Bennett notes that small specimens sometimes bear sponges. Polyzoans may also be present.

**DEPTH:** Intertidal in the southern islands to offshore waters round Otago and Stewart Island, sometimes extending to 300 fm.

**BREEDING:** Ovigerous females in November and December.

**REMARKS:** Because of the good figures and descriptions given by Jacquinot (in Jacquinot & Lucas, 1853) and Filhol (1886) and also simply because of the large size (see Bennett, 1964, p. 62) and southern distribution, this species has suffered little taxonomic modification. Bennett (1964 p. 62) has discussed the name, *Paramicippa grandis*, given by Hector (1899) to specimens from Campbell Island. Although Hector's description was very short, it was sufficient to identify the crab as the present species.

It has recently been found upon examination of very small specimens of this species (see Griffin, 1963a) that *Campbellia kohli* Balss, 1930 is conspecific with *Jacquinotia edwardsii*, the former species being based on juveniles of the latter. These juveniles differ from the adults in the relative prominence of the spinous lobes of the rostral and supraorbital margin, marginal spines of the carapace, in the number and arrangement of the mid-dorsal tubercles of the carapace, in the possession of prominent lobes on the ambulatory legs and in the more distinct intercalated supraorbital spine, in addition to the usual features associated with smaller size in all crabs, such as relatively shorter chelae. From the specimens available it is possible to trace the changes in these characters from the juvenile to the adult, the rostral and supraorbital margins becoming weakly tuberculate, the marginal spines of the carapace short, the ambulatory legs weakly tuberculate, and the eave, intercalated spine, and postorbital lobe all tightly pressed together.

As in the case of *Notomithrax peronii*, the specific name of this species is to be retained as originally spelt, i.e., with two i's.



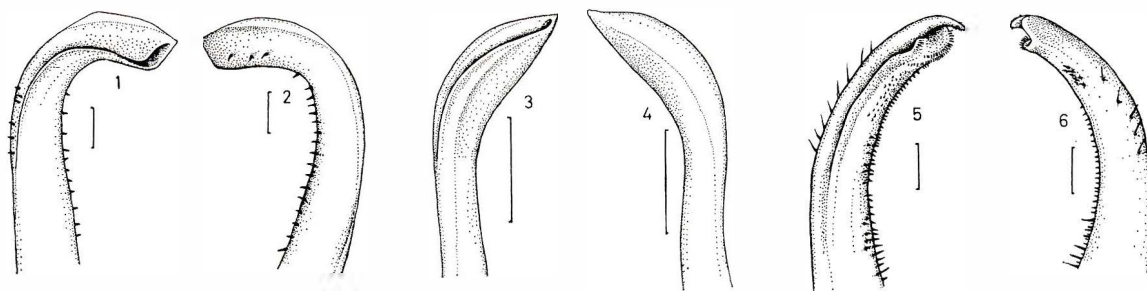


FIG. 19—Male left pleopods of Inachinae and Pisinae.

1—*Naxia huttoni* (A. Milne Edwards), carapace length 55 mm, off Barrett's Reef, Wellington Harbour, abdominal aspect. 2—Same, sternal aspect. 3—*Achaeus fissifrons* (Haswell), carapace length 7.5 mm, between Foxton and Wanganui, abdominal aspect. 4—Same, sternal aspect. 5—*Eurynolambrus australis* H. Milne Edwards & Lucas, carapace length 41 mm, Pickersgill Island, Queen Charlotte Sound, abdominal aspect. 6—Same, sternal aspect. Scale—0.5 mm.

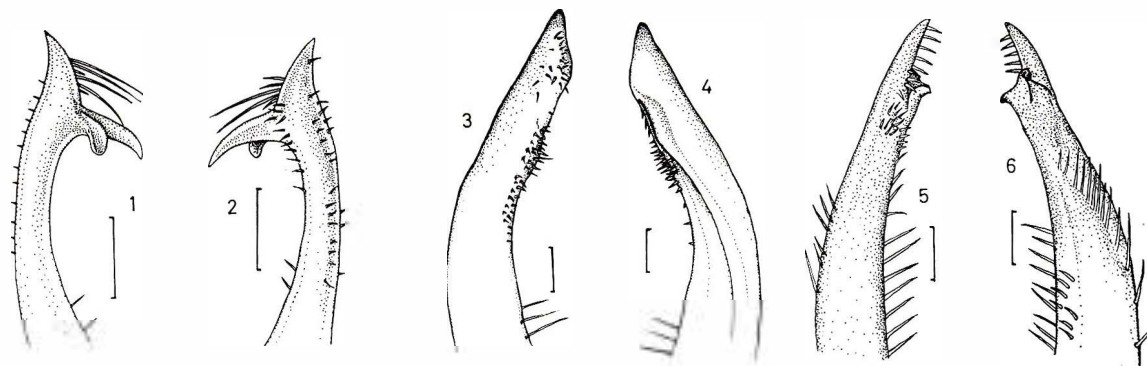


FIG. 20—Male left first pleopods of Pisinae and Majinae.

1—*Eurynome bituberculata* Griffin, carapace length 11.5 mm (paratype), off Cape Egmont, abdominal aspect. 2—Same, sternal aspect. 3—*Leptomithrax tuberculatus mortenseni* Bennett, carapace length 33.5 mm (paratype), Hauraki Gulf, abdominal aspect. 4—Same, sternal aspect. 5—*Chlorinoides filholi* (A. Milne Edwards), carapace length 52 mm, off Oamaru, abdominal aspect. 6—Same, sternal aspect. Scale—0.5 mm.

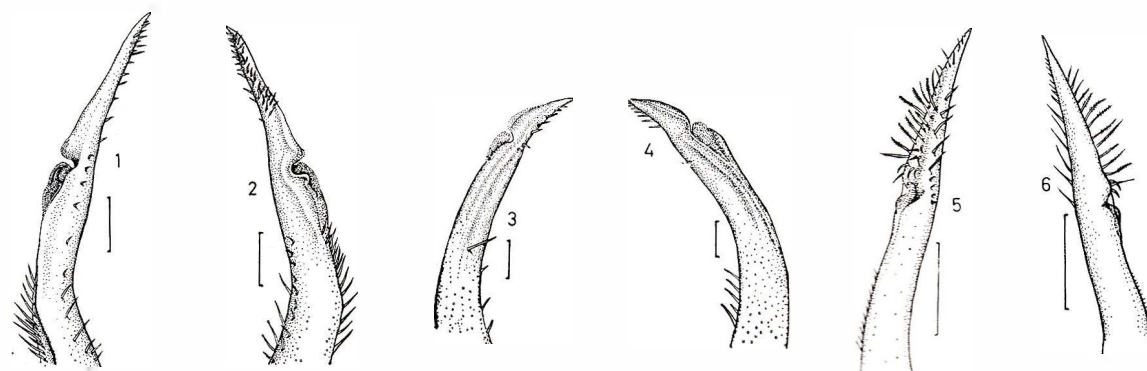


FIG. 21—Male left first pleopods of Majinae.

1—*Notomithrax peronii* (H. Milne Edwards), carapace length 62 mm, Rona Bay, Wellington Harbour, abdominal aspect. 2—Same, sternal aspect. 3—*Notomithrax minor* (Filhol), carapace length 33 mm, off Petone Beach, Wellington Harbour, abdominal aspect. 4—Same, sternal aspect. 5—*Notomithrax ursus* (Herbst), carapace length 49 mm, Lyall Bay, Wellington, abdominal aspect. 6—Same, sternal aspect. Scale—0.5 mm.

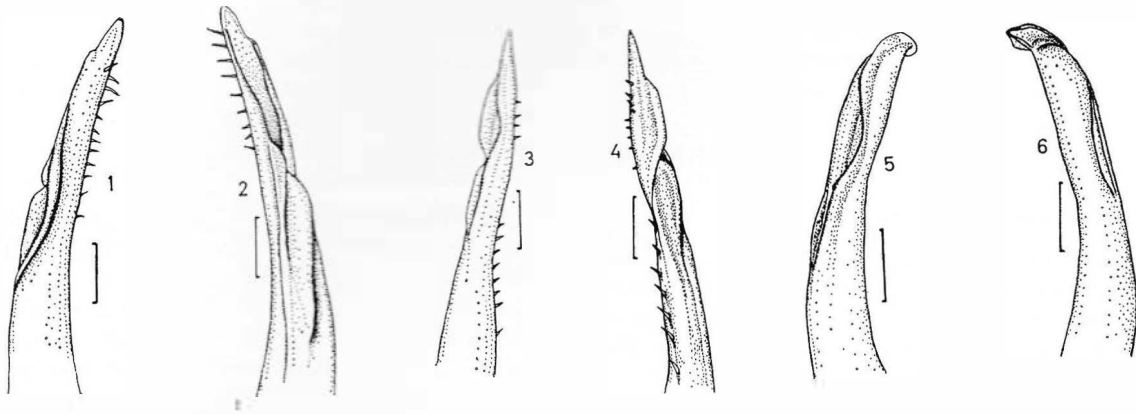


FIG. 22—Male left first pleopods of Majinae.

1—*Leptomithrax longimanus* Miers, carapace length 60.5 mm, off Castlepoint, abdominal aspect. 2—Same, sternal aspect. 3—*Leptomithrax australis* (Jacquinot), carapace length 98 mm, off Bench Island, Foveaux Strait, abdominal aspect. 4—Same, sternal aspect. 5—*Leptomithrax garricki* n.sp., carapace length 89.5 mm (paratype), off Kaikoura, abdominal aspect. 6—Same, sternal aspect. Scale—1.0 mm.

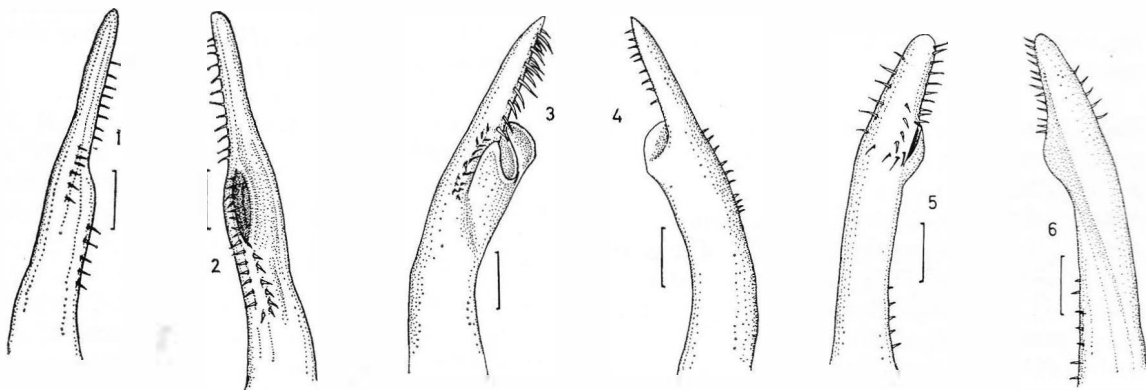


FIG. 23—Male left first pleopods of Majinae and Mithracinae.

1—*Leptomithrax longipes* (Thomson), carapace length 65 mm, off Oamaru, abdominal aspect. 2—Same, sternal aspect. 3—*Leptomithrax richardsoni* Dell, carapace length 65 mm, just west of Campbell Island, abdominal aspect. 4—Same, sternal aspect. 5—*Jacquinotia edwardsii* (Jacquinot), carapace length 37 mm, off east Otago coast, abdominal aspect. 6—Same, sternal aspect. Scale—0.5 mm.

## GENERAL DISCUSSION

### COMPOSITION OF THE FAUNA

THE majid spider crab fauna of New Zealand comprises a total of 18 species belonging to 11 genera and distributed among four of the seven subfamilies into which the family Majidae is currently divided. Except in the case of two genera, *Leptomithrax* with six species and *Notomithrax* with three, each genus possesses a single species. The species and genera are not uniformly distributed among those subfamilies represented in New Zealand, the two relatively large genera mentioned above together with *Chlorinoides*, comprising the Majinae, which, in numbers of species, is the subfamily best represented. However, the Inachinae, with five diverse genera, is best represented at the generic level, while the Pisinae, with two genera and species, and the Mithracinae with one, are but poorly represented. The Ophthalmiinae and the Acanthonychinae are absent from New Zealand as is also the boreal Oregoniinae.

The species show a considerable degree of uniformity from a morphological point of view, especially with regard to the form of the rostrum, orbital configuration, and so on. Thus, in none is the rostrum single, almost all possess an orbit with a well formed upper border of three parts, and the abdomen is seldom reduced to less than seven free segments. In other words, in the Balssian sense (see Balss, 1929), they are mostly primitive. There is, however, a reasonable degree of variety in the shape of the carapace and in less important morphological features such as ornamentation of the carapace; there is also considerable range in size, from small forms like *Achaeus fissifrons* (carapace length 8 mm) to huge species such as *Leptomithrax australis* (carapace length up to 100 mm) and *Jacquiniotia edwardsii* (carapace length more than 190 mm).

### GEOGRAPHIC AND BATHYMETRIC DISTRIBUTION

Precise data on distribution for the New Zealand Brachyura are, for a variety of reasons, still not available. While some areas such as the east coast of the South Island, Cook Strait, and the Chatham Rise are relatively well known, others such as the northern coast of the North Island and the whole of the west coast of both the North and South Islands have only recently been sampled, as have the archibenthal waters exceeding 100 fathoms.

Although several very small species have not so far been reported from some areas which have been reasonably well studied, it could be that they are nevertheless present, but have been missed because of the collection techniques or have been overlooked simply because of their small size.

Distribution data in any marine group are most suitably analysed if forms are grouped according to their bathymetric ranges. The continental shelf round New Zealand supports a total of 14 species. Five of these, *Naxia huttoni*, *Eurynolambrus australis*, *Notomithrax peronii*, *N. minor*, and *N. ursus*, are common in shallow offshore depths and often extend into the intertidal. With the exception of *Naxia huttoni* which, apart from one record from North Auckland, is not known north of Cook Strait, these five species are universally distributed round the coastline of the New Zealand mainland from North Cape to Stewart Island. Except for *N. minor* they are also known from the Chatham Islands. Two other species, *Leptomithrax australis* and *Jacquiniotia edwardsii*, are known from the intertidal zone in the southernmost part of their range at Campbell and Auckland Islands; their distribution is further discussed below.

Nine species which occur on the continental shelf do not usually extend into the intertidal zone and exhibit the following distribution patterns. One species, *Leptomithrax longimanus*, is known throughout the New Zealand mainland but is absent from the Chatham Islands. Two species, *L. australis* and *J. edwardsii*, have a very well defined southern distribution, being known from the Auckland and Campbell Islands, Foveaux Strait and eastern Otago. *J. edwardsii* is not known north of Otago, but one specimen of *L. australis* has been collected at Wellington and another at the Chatham Islands. Since Bennett's record of *Leptomithrax longipes* from Macquarie Island is, as he admits, very doubtful and since, also, his statement (see Bennett, 1964, p. 42) that *N. minor* occurs at the Auckland and Campbell Islands has not been substantiated by other workers, *L. australis* and *J. edwardsii*, together with the archibenthal *L. richardsoni*, are the only majids known from the southern or Subantarctic Islands of New Zealand. Two species, *L. longipes* and *Chlorinoides filholi*, which are perhaps the most characteristic majids of the shelf within their geographic range, appear to be mainly southern also. Apart from one record of the latter from the north of the North Island (see Chilton & Bennett, 1929; Bennett, 1964), neither occurs north of the region round Cook Strait. Two species, *Achaeus fissifrons* and *Leptomithrax tuberculatus mortenseni*, appear to be mainly northern, the first extending to Cook Strait, while the second has been taken in several parts of the Hauraki Gulf and also off the north of the North Island.

Five shelf species, *Eurynome bituberculata*, *L. longimanus*, *L. longipes*, *C. filholi*, and *J. edwardsii*, are known from depths exceeding 100 fm and at two of the east Otago coast stations worked by the Dominion Museum, Wellington, three of these five, *L. longimanus*, *C. filholi*,

and *J. edwardsii*, were collected at depths of 250 to 300 fm. The New Zealand goneplacid crab, *Ommatocarcinus macgillivrayi* White, also has a similarly wide distribution (see Dell, 1960). Dell (1956) likewise gives a list of 36 species of mollusc with similarly wide bathymetric ranges from well up on the shelf down to 300 fm. *E. bituberculata* is known from Cook Strait, off the south-east coast of the North Island and off Cape Egmont at depths of about 40 to 130 fm. Only at one of the localities, in Cook Strait, has this species been taken in less than 100 fm and possibly it might more properly be considered as an upper archibenthal species which occasionally extends on to the shelf.

The remaining shelf species, *Cyrtomaia hispida*, is known from only two localities in New Zealand, off Cape Maria van Diemen in the north at a depth of 100 fm and off Otago in the south in 40 fm.

Three species, all known from but a few records, appear to be restricted to the archibenthal. *Achaeopsis ramusculus* is known in New Zealand only from the northern Bay of Plenty at a depth of over 400 fm, *Leptomithrax garricki* only from Cook Strait and nearby Kaikoura at depths of 220 to 435 fm and *L. richardsoni* from several localities on the Chatham Rise between 220 and 330 fm and one near Campbell Island at a depth of almost 170 fm. Both Dell (1956, 1962) and Fell (1960) have emphasised the widespread nature of the archibenthal fauna, and the existence of *L. richardsoni* on the Chatham Rise and the Campbell Plateau supports this view. Fell (1960) doubts whether the New Zealand archibenthal echinoderm fauna is distinct from that of the Pacific as a whole. The new record of *Achaeopsis ramusculus* from New Zealand, a species previously known only from South Australia, would seem to indicate that the same is true of the Brachyura, especially when it is remembered that the goneplacid *Carcinoplax victoriensis* Rathbun, known from off Victoria, Australia, has recently been recorded from New Zealand also (see Dell, 1960, 1963), at depths of over 200 fm on the Chatham Rise. The existence of these two archibenthal brachyurans, and perhaps others such as *Ommatocarcinus macgillivrayi*, which is eurybathic, on both sides of the Tasman, parallels the situation existing in the two echinoderms, *Cosmasterias dyscrita* H. L. Clark and *Paramaretia multituberculata* Mortensen (see Fell, 1960, p. 57).

Limited though the data are, these various distributions outlined above do not appear to fit clearly into the arrangement currently favoured by some students of other marine groups such as molluscs (see Powell, 1961) and echinoderms (see Pawson, 1961), who consider that the littoral and shelf parts of the New Zealand region may be divided into various faunal subregions or "provinces". Three subregions are defined for the New Zealand mainland (for details see Knox, 1960; Powell, 1961; and Pawson, 1961), a northern Aupourian, a central Cookian, and a southern Forsterian, while the Chatham Islands are considered by some as a separate province, the Moriorian (Powell, 1961), but by others (Fell, 1960; Pawson, 1961) only as an outlying part of the Cookian. The Subantarctic Islands to the south of the mainland constitute the Anti-

podean (formerly Rossian) subregion. Considering only the shelf species, as is appropriate, the Majidae are in very few cases stenozonal. Two species are perhaps restricted to only one province, *L. tuberculatus mortenseni* to the Aupourian and *F. bituberculata* to the Cookian. The remaining species are all known from two or more provinces. According to a recent review by Hedgpeth (1957) the precise delineation of provinces is seldom possible. Dell (1962, p. 49) has strongly criticised the present arrangement of provinces in New Zealand pointing out that, "... no clear boundaries can be defined for any of the mainland littoral provinces, that shelf distribution patterns do not by any means coincide with those for littoral forms, and that the concept of provinces as regards the mainland of New Zealand has largely outlived its usefulness." Knox (1960, p. 618), also reviewing the New Zealand marine provinces, suggests that there are two main centres of distribution, a warm water one in the north and a cold water one in the south, each with endemic and non-endemic species confined to them, from which other species extend varying degrees north and south, forming an extensive transition zone which is related to fluctuating hydrological conditions. This interpretation, based on evidence afforded by other groups, would seem also to be true of the Brachyura, or at least the Majidae. It should be kept in mind however, that, as Pawson (1961, p. 9) implies, major boundaries in distribution suggested by one group of animals may be quite different from those indicated by others.

The main features in distribution which would seem to be indicated from the present study are, then, that there is a general decrease in numbers of species with increasing latitude, a replacement on the continental shelf from south to north of the relatively large forms like *Leptomithrax longipes* and *Chlorinoides filholi* by the slightly smaller *Leptomithrax tuberculatus mortenseni* and perhaps the very small *Achaeus fissifrons*, a mixing of species round the central part of the mainland, and lastly that for the most part of the universal component in the majid fauna is made up of the intertidal forms.

#### ZOOGEOGRAPHICAL RELATIONSHIPS

Attention has already been directed to the large number of New Zealand majids belonging to the subfamily Majinae and in particular to the genera *Leptomithrax* and *Notomithrax*. Mention has also been made of the considerable degree of uniformity in the more important morphological features and of the fact that many species are eurybathic. It is appropriate to consider now the degree of restriction or endemism of the species and genera and their relationships to the majid faunas of other regions. Of the 18 New Zealand species, 13, or slightly more than 70%, are not found outside New Zealand, while of the 10 genera only two are endemic. The New Zealand biota as a whole is recognised as containing three main elements, the Indo-west Pacific or Malayo-Pacific, the Australian, and the Austral (Fleming, 1962, 1963). Various components of these three have become restricted to New Zealand and comprise the mixed endemic element, while

a cosmopolitan element is present but difficult to analyse.

The most important element in the New Zealand majid fauna is undoubtedly the Indo-west Pacific. Seven of the nine non-endemic genera possess species in the Indo-west Pacific outside Australasia. These include *Cyrtomaia*, *Platymaia*, *Achaeopsis*, *Achaeus*, *Eurynome*, *Leptomithrax*, and *Chlorinoides*. The Indo-west Pacific element was a dominant influence in the New Zealand environment during the early Tertiary (Fleming, 1963, p. 18). Shortly before this, during the Cretaceous, land could have extended north from New Zealand toward New Caledonia (Fleming, 1962, p. 105) along what is now the Norfolk Island Ridge or the Lord Howe Rise. The climate of New Zealand at this time was undoubtedly considerably warmer than at present and may have approached tropical conditions (see Fell, 1954; Fleming, 1962; Squires, 1958). Fell (1953, 1954) has suggested that Australian and New Zealand Tertiary echinoderm faunas stem from a common origin in the northern Indo-Pacific, the Indo-Malayan archipelago, or its Tertiary equivalent, probably providing the shallow water migration route; migration was mainly southward, into New Zealand, but some migration out of New Zealand could have taken place from the Miocene onward. A similar northern origin for *Chlorinoides* and perhaps *Leptomithrax* would most suitably explain the similarity of the endemic New Zealand and Australian species of these genera. Three quite diverse species of *Leptomithrax* are known from New Zealand Upper Miocene and Lower Pliocene deposits (Glaessner, 1960) and these appear to stand closer to present day Australian, rather than New Zealand, species of the genus. A more southern origin for *Leptomithrax* could be envisaged since the majority of the living species, 14 in all, are found in Australasia, while only five are known from the present day faunas of China, Japan, and the Philippines. The remaining four genera must have reached New Zealand quite recently. Three of these, *Achaeus*, *Achaeopsis*, and *Eurynome*, possess species in the eastern Atlantic, the second being known also from the western Atlantic. These three are undoubtedly Tethyan forms which arose some time during, or immediately prior to, the Cretaceous. However, each would seem to present a slightly different problem. *Achaeus* includes about 20 species inhabiting the continental shelf; the two Atlantic species and most of the Japanese species of this genus are endemic, but species from other regions from which the genus is known are widely distributed. The New Zealand species is shared with eastern Australia and Japan and may extend west to the Andaman Islands; hence it is presumably a recent immigrant to New Zealand. *Achaeopsis* includes relatively few species, many of which are extremely widely ranging both geographically and bathymetrically; the New Zealand species is shared with South Australia. *Eurynome* possesses at least seven species, all showing a rather strong degree of restriction, the New Zealand species being distinct but closely related to an Atlantic species which in turn may be identical with a poorly known species from Samoa. The facts seem to suggest that *Eurynome* arrived in New Zealand waters some time before either *Achaeus* or *Achaeop-*

*sis*. The remaining Indo-west Pacific genus, *Cyrtomaia*, possesses one species in New Zealand which is probably identical with a Japanese species and also occurs in the eastern Indian Ocean at Timor. It probably arrived in New Zealand about the same time as did *Achaeus*. During the late Tertiary, faulting probably affected submarine ridges to the north of New Zealand and may have extended land (see Fleming, 1962, p. 105). The four genera discussed above, *Cyrtomaia*, *Achaeopsis*, *Achaeus*, and *Eurynome*, are most likely to have reached New Zealand about this time. It should be emphasised that it is assumed throughout this discussion that the rates of evolution are roughly the same for equivalent taxa.

Three genera, *Naxia*, *Notomithrax*, and *Jacquinotia*, including among them five species in New Zealand, exhibit relationships distinct from those of the Indo-west-Pacific genera discussed above. They probably constitute among the majid fauna what Fleming (1962, 1963) has called the "Austral" element (formerly Antarctic, South American, etc.), forms distributed by the West Wind Drift of air and water masses, and possibly also those distributed via Antarctica. *Naxia* and *Notomithrax* both possess species in southern and south-eastern Australia, the former with a species common to Australia and the Kermadec Islands, the latter with a species on Norfolk Island and another on Juan Fernandez off the coast of Chile. *Naxia* seems most closely related to the South American *Eurypodius* Guérin, a genus with two species, one inhabiting the shelf and one the archibenthal. *Jacquinotia* appears to stand closest to *Mithrax* Desmarest, a central American genus comprising numerous species found in the intertidal and offshore areas on both sides of the continent. *Naxia*, with a single New Zealand species endemic and quite different from any of the other species of the genus, and *Jacquinotia*, monotypic and endemic, are both undoubtedly very old elements in the fauna. *Notomithrax*, on the other hand, is probably of recent origin.

Although Antarctica was temperate and vegetated for long periods before the Quaternary glaciations (Fleming, 1962, p. 105), evidence from stratigraphy goes against any suggestions that there was a recent land connection between the Antarctic and New Zealand. At present the Campbell Plateau, extending southward from New Zealand, is separated by relatively deep water from the Macquarie Rise and associated outliers of the Antarctic continent. Fell (1953, 1961) has shown that Antarctic and Magellanic (South American) influences are virtually absent from the New Zealand echinoderm fauna. Further, in all groups so far studied the relationships of the Subantarctic Islands of New Zealand which stand on the Campbell Plateau are Neozelanic and not Antarctic. Bennett (1964, p. 90), discussing the Antarctic influence in the New Zealand Brachyura as a whole, gives a list of 12 genera with species in Australasia and South America. However, except in the case of grapsids such as *Plagusia* Latreille, *Leptograpsus* H. Milne Edwards, *Hemigrapsus* Dana, and *Cyclograpsus* H. M. Edw., as well as cancrids, portunids, and others which could easily have been dispersed by epiplanktonic larvae, on drifting weed, or by

their own swimming power in the case of portunids. relationships with the South American fauna are very distant. Earlier, Bennett (1930, p. 258) found almost no evidence in the Brachyura of any land connection between New Zealand and South America. Further, if there was a connection in late Tertiary times it would be expected that, so far as the Majidae are concerned, advanced genera such as *Stenorhynchus* Lamarck, the subfamily Acanthonychinae and macrocoelomine mithracines would be present in New Zealand today.

Fleming has divided the Austral element into an old "Paleoaustral" and a young "Neoaustral". The former influenced the New Zealand biota throughout a considerable interval of Mesozoic and Tertiary time during which circumpolar dispersal must have been easier than it is now; its influence evidently ceased long ago. The Neoaustral element however is still being distributed across the sea by special dispersal mechanisms; the methods of dispersal of the two elements were quite different. If in fact *Naxia* and *Jacquinotia* are regarded as part of the Austral element then they are undoubtedly Paleoaustral, as inferred above.

*Notomithrax*, at present considered to comprise five species, presents some problems. The sharing of two New Zealand species with southeastern Australia seems to infer that at least these two species are of recent origin. One of them, *N. minor*, has been recorded (as *Paramithrax minor*) from the Upper Pleistocene of New Zealand (Glaessner, 1960). On the other hand, New Zealand possesses a third species which is restricted to these waters and the two remaining species of the genus, which are rather distinct from the others, are found on Norfolk Island and Juan Fernandez far to the east of Australasia. This evidence surely suggests a much older origin for the genus. The most suitable interpretation would seem to be that the genus arose in either Australia or New Zealand, probably in late Tertiary times, that it spread then either from Australia to New Zealand or vice versa, and that after a considerable time it reached Juan Fernandez; dispersal in all cases was probably by epiplanktonic larvae.

The degree of relationship between the New Zealand majid fauna and that of Australia has been mentioned throughout the above discussion. It is to be stressed, however, that the relationship is with southern and southeastern Australia and not with Australia as a whole. It

seems clear that this similarity is due to a variety of reasons including a common origin in the north, availability of shallow water connections during the Tertiary, and the fact that several species are extremely eurybathic and perhaps part of a generalised Pacific archibenthal fauna. Similarity to the Australian fauna should not obscure the important differences between the two, such as the absence from Australia of the *longimanus* section of the genus *Leptomithrax*, the dissimilarity of the species of *Eurynome*, and the absence from New Zealand of numerous inachines, pisines, and mithracines and of the subfamilies Ophthalmiinae and Acanthonychinae. Needless to say, many Australian genera are typical of regions of warmer temperatures than can be found in present-day New Zealand and therefore might not extend into New Zealand, even if a shallow water migration route between the two land masses were present over a long period of time. This does not detract from the importance of the absence of the many forms mentioned above nor of the high degree of endemism, both of which are a reflection mainly of the long isolation of New Zealand. In addition, the extinction of forms consequent upon the cold conditions obtaining during the Quaternary glaciations may be responsible for some absences from the New Zealand fauna. All that can be said on this point is that there is as yet no paleontological evidence to support such a contention.

One genus, *Eurynolambrus*, remains to be discussed. The relationships of this genus are indeed difficult to work out and it seems to stand far apart from any other known majid genus. Together with the other endemic New Zealand genus, *Jacquinotia*, *Eurynolambrus* contributes toward the fact that the New Zealand majid fauna is as distinct as that of any other region.

Needless to say, future studies will bring some changes in majid nomenclature, but it seems unlikely that these will alter the major conclusions to be drawn from recent work. However, before any great progress is to be made in the understanding of the origins of New Zealand majid spider crabs and their distributions, several aspects of their biology need investigation. The absence of complete distribution data, of any detailed knowledge of larval histories, and even of elementary ecological data such as population densities is obvious. Finally, little can be gained from a taxonomic viewpoint while the fauna of nearby Australia continues to be so inadequately known.

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\* Not seen during the course of this study.

## PLATES



PLATE 1—*Leptomithrax garricki* n. sp. Holotype male.  
Above: Dorsal view. Below: Ventral view.





PLATE 2—*Leptomithrax garricki* n. sp. Paratype female.  
Above: Dorsal view. Below: Ventral view.

—Photographs: F. O'Leary,  
courtesy Dominion Museum



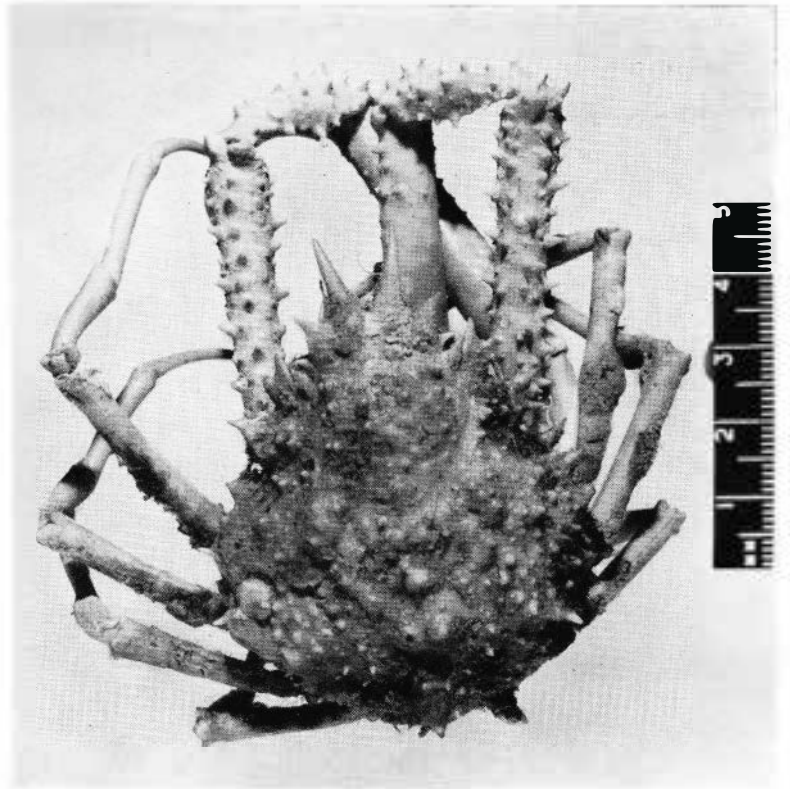
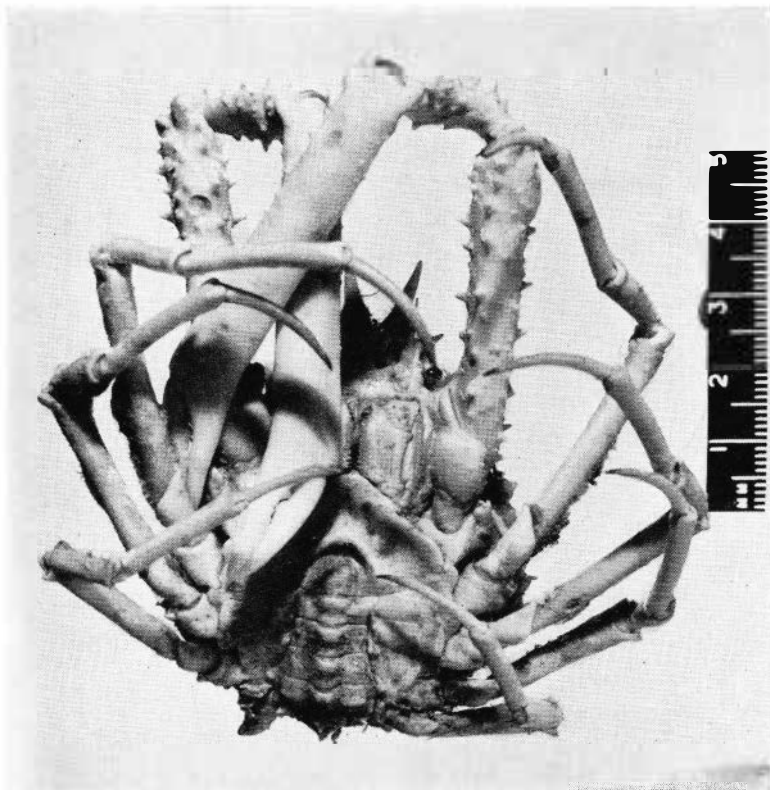


PLATE 3—*Leptomithrax richardsoni* Dell. Adult male from Sta. B. 182.  
Above: Dorsal view. Below: Ventral view.



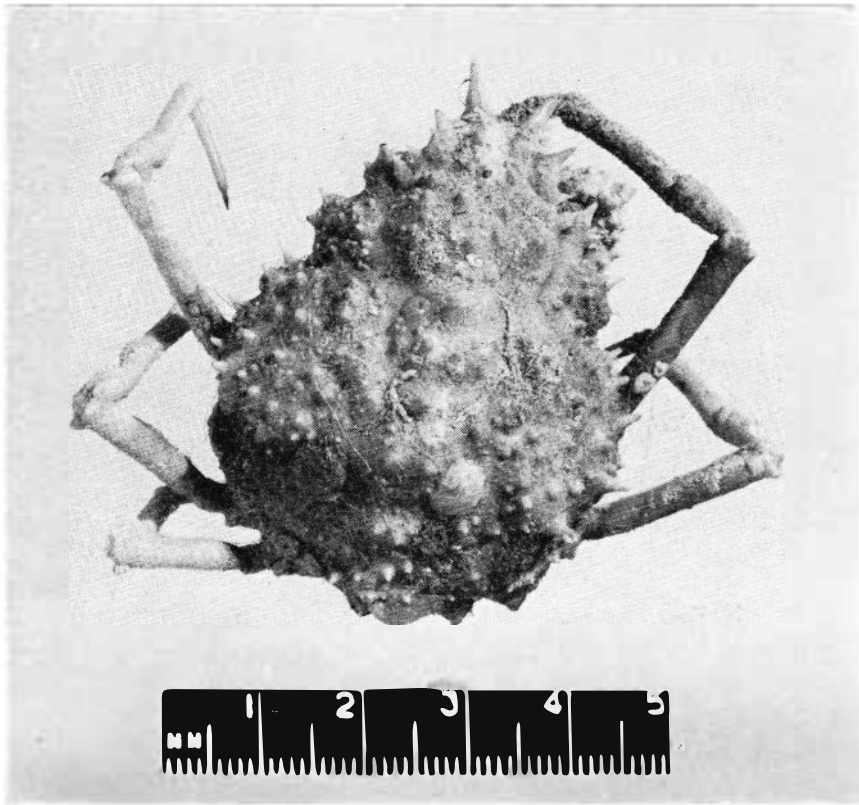
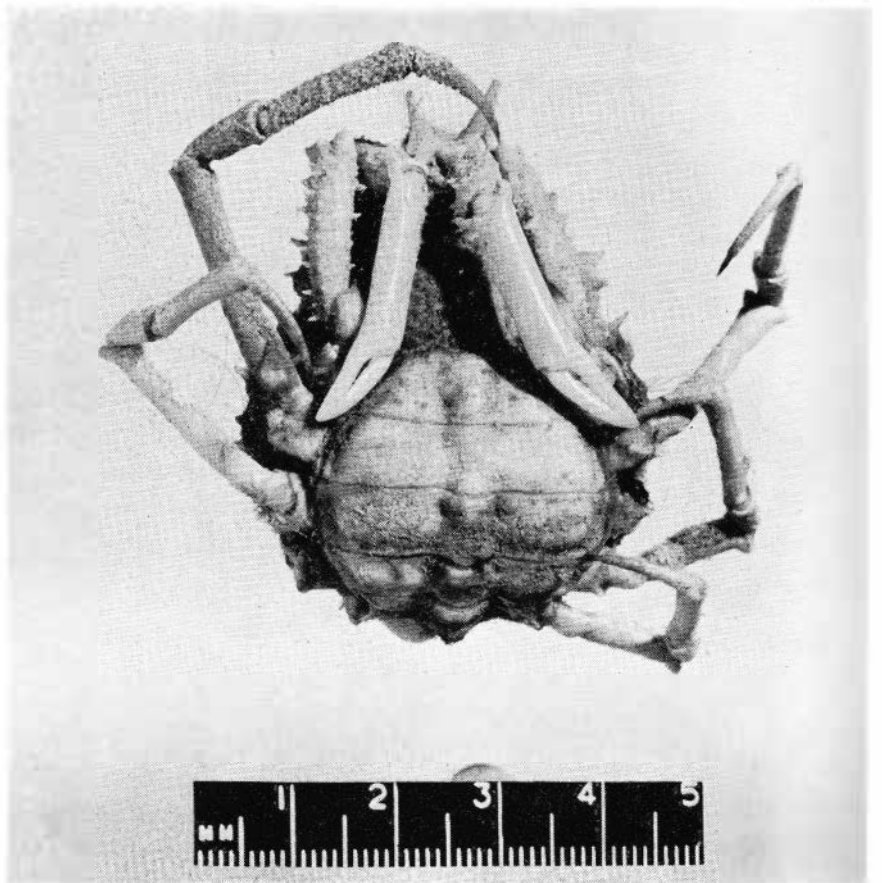


PLATE 4—*Leptomithrax richardsoni* Dell. Adult female from Sta. B. 182. Above: Dorsal view. Below: Ventral view.

—Photographs: J. J. W. *Ward*



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