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NEW ZEALAND
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

BULLETIN 153

The Marine Fauna of New Zealand: Crustacea Brachyura

by

E. W. BENNETT
15 Coney Hill Road
St. Clair, Dunedin

New Zealand Oceanographic Institute
Memoir No. 22

April 1964

Photograph by courtesy of the Dominion Museum, Wellington.

Frontispiece: Captain J. P. Bollons.

Captain John Peter Bollons, I.S.O., J.P. (1862–1929), Master of the Government Steamers *Hinemoa* (1898–1922) and *Tutanekai* (1922–29) is famous in New Zealand natural history as an indefatigable collector and well-informed amateur naturalist. Many of the specimens on which this bulletin is based were collected by him or from the *Hinemoa*, notably a new species of *Leptomithrax* taken during Dr Th. Mortensen's Expedition (1914–15) in the Hauraki Gulf. He is shown here collecting at Anita Bay, Milford Sound, 22 October 1926.

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FOREWORD

THIS volume constitutes the results of a study carried out by the author in partial fulfilment of the requirements for the degree of D.Sc. of the University of New Zealand. The extensive work on which it is based was carried out during various periods between 1927 and 1936 in what was then the Biology Department of Canterbury University College and as well in the Canterbury Museum.

In 1961 Dr Bennett offered the manuscript of his D.Sc. thesis for publication. It is of very considerable value to have this comprehensive study now available, and it is hoped that it will not only provide a major reference work but will be a stimulus for future work in this group.

Because of the long interval that has elapsed between the completion of this work and its publication a particular attempt has been made to ensure that the form of publication should take into account work done on the New Zealand Brachyura since the manuscript was written and that the relationship to later expressed views on questions of classification should be clear. To this end the original manuscript has not been amended. Footnotes have been supplied wherever some additional information or comments have seemed desirable.

A check list of the New Zealand Brachyura as at 1936, with annotations to 1962, has been provided. Similarly a list of references to papers on New Zealand crabs since 1936 has been added to Dr Bennett's comprehensive bibliography.

Balss's (1957) treatment of the Brachyura, and Garth's (1958) modifications of Balss's (1929) arrangement of the oxyrhynchous crabs, have been taken as the latest authoritative references and it will be apparent that Dr Bennett's classification closely accords with these systems.

Acknowledgment is made here of the generous contribution of both their time and their experience made by Dr R. K. Dell and Dr J. C. Yaldwyn, of the Dominion Museum, Wellington, in providing editorial assistance and in offering suggestions for footnotes.

In the course of this study the types of the new species described here were deposited by Dr Bennett in the Canterbury Museum and their present existence in that collection has been confirmed.

This memoir is a contribution towards the series of monographs on the marine fauna of New Zealand. Technical editing of the manuscript and general preparation for publication have been carried out by Mr E. W. Dawson, N.Z. Oceanographic Institute.

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

CONTENTS

FIGURES

Abstract

THIS is the first comprehensive account of the New Zealand crab fauna, following the preliminary review by Chilton and Bennett published in 1929. The material used consists of specimens available to the author, at the time of study, in New Zealand museums. Four new species, belonging to the genera *Lyreidus*, *Leptomithrax*, and *Pilumnus*, and two new subgenera of *Leptomithrax*, have been proposed. The many dubious records of species of non-neozelanic origin in the fauna have been critically examined.

Based on the state of collections made by previous workers details are given of improved methods of collection and preservation.

The Systematic section gives full descriptions and figures of all the recognised species of New Zealand crabs. Although based on a study concluded in 1936, this section has been annotated in such a way as to give a modern detailed account of the New Zealand Brachyura. A full check list is also given.

The geographical distribution of the crabs and its implications is dealt with. The brachyurous fauna of the southern islands of New Zealand indicates that the Auckland and Campbell Islands are not subantarctic but strictly neozelanic. Ten species which might suggest antarctic connections are equally represented on the mainland. On the mainland a few species are exclusively southern while others are chiefly northern. The boundaries formed by the distribution patterns include the three districts (1) Southern Islands, (2) Southern Mainland, with Stewart Island and the Chathams as outlying extensions, and (3) Northern Mainland, northwards from Kaikoura and Westport and not including the Kermadecs.

In explanation of external zoogeographical relationships, the agency of currents, floating kelp and wood, and ships, as well as of paleogeographical links, is discussed, with three examples of accidental acclimatisation. The agency of whales is also suggested.

After purging the list of many erroneous records a strong Australian element is still found, but several groups conspicuous in Australia are absent and the relationship is qualified with respect to the Majidae. The relationships, though theoretically explicable in part in terms of trans-oceanic dispersal, are in the main better accounted for in terms of a common Papuan relationship, as indicated also by other groups of animals.

The Majidae are of southern origin, the two southern districts being a focus for the more primitive members (*Paramithrax*, *Leptomithrax* s. str.), the higher members spreading freely to Australia and eastern Asia.

The modern Brachyura arose after the severance of any former geographic connection with South America, hence the four species common to the two areas must be otherwise accounted for; but five genera with no species in common suggest a more ancient and perhaps a fairly direct link.

The Marine Fauna of New Zealand: Crustacea Brachyura

CHECK LIST OF THE NEW ZEALAND BRACHYURA

Subsection **OXYSTOMATA** de Haan

Family LEUCOSIIDAE Dana
- *Ebalia* Leach
  - *E. laevis* (Bell, 1855)
  - *E. tuberculosa* (Milne Edwards, 1873)
- *Merocryptus* Milne Edwards
  - *M. lambriformis* (Milne Edwards, 1873)

Subsection **GYMNOPLEURA** Bourne

Family RANINIDAE Dana
- *Lyreidus* de Haan
  - **L. fossor** n. sp.

Subsection **DROMIACEA** de Haan

Family LATREILLIDAE Alcock
- *Latreillopsis* Henderson
  - *L. petterdi* Grant, 1905

Family DROMIIDAE Dana
- *Petalomera* Stimpson
  - *P. wilsoni* (Fulton & Grant, 1902)

Subsection **BRACHYGNATHA**

Superfamily OXYRHYNCHA Latreille

Family MAJIDAE Alcock

Subfamily INACHINAE Alcock

Series MACROCHEIROIDEA Balss*
- *Cyrtomaia* Miers
  - *C. hispida* (Borradaile, 1916)

Series CAMPOSCIOIDEA Balss*
- *Trichoplatus* Milne Edwards
  - *T. huttoni* Milne Edwards, 1876

Subfamily MAJINAE Alcock restr. Balss
- *Paramithrax* Milne Edwards
  - *P. peroni* Milne Edwards, 1834
  - *P. minor* Filhol, 1886
  - *P. ursus* (Herbst, 1788)
- *Leptomithrax* Miers†
  - *Leptomithrax* Miers s.str. (str.nov.)
  - *L. (L.) longimanus* Miers, 1876
  - *L. (L.) australis* (Jacquinot, 1853)
  - **Austromithrax** n. subg.
    - **L. (A.) mortenseni** n. sp.
  - **Zemithrax** n. subg.
    - *L. (Z.) longipes* (Thomson, 1902)
    - **L. (Z.) moloch** n. sp.
- *Acanthophrys* Milne Edwards
  - *A. filholi* Milne Edwards, 1865
- *Campbellia* Balss
  - *C. kohli* Balss, 1930

Subfamily MITHRACINAE Balss
- *Jacquinotia* Rathbun
  - *J. edwardsi* (Jacquinot, 1853)

Family PARTHENOPIDAE Milne Edwards (Miers)
- *Eurynolambrus* Milne Edwards & Lucas
  - *E. australis* Milne Edwards & Lucas, 1841

Family HYMENOSOMIDAE

Omitted in present work, but list of described species added from Chilton and Bennett (1929) and from Richardson (1949b).
- *Halicarcinus* White
  - *H. planatus* (Fabricius, 1775)
  - ‡*H. tridentatus* Jacquinot, 1853
  - ‡*H. huttoni* Filhol, 1886
  - *H. innominatus* Richardson, 1949
- *Hymenicus* Dana
  - ‡*H. varius* Dana, 1851
  - *H. pubescens* Dana, 1851
  - ‡*H. edwardsi* Filhol, 1886
  - §*H. cooki* Filhol, 1886
  - §*H. haasti* Filhol, 1886
  - §*H. marmoratus* Chilton, 1882
- *Hymenosoma* Desmarest
  - *H. depressum* Jacquinot, 1853
  - §*H. lacustris* Chilton, 1912

*"*Stenorhynchus*" *fissifrons* Haswell, 1879, should be added, following the discovery of the existence of the type from New Zealand by Dr J. C. Yaldwyn in 1962. (However, it should perhaps be more properly located in *Achaeus* Leach, 1817, or in *Achaeopsis* Stimpson, 1857.)

†A new species, *L. richardsoni*, described by Dell, 1960, p. 2.
‡Listed by Chilton and Bennett, 1929, but not by Richardson, 1949b.
§Listed under *Halicarcinus* by Richardson, 1949b.
Listed under *Hombronia* by Richardson, 1949b: 67.

Elamena Milne Edwards
E. quoyi Milne Edwards, 1837
**E. whitei* Miers, 1876
E. longirostris Filhol, 1886
†*E. kirki* Filhol, 1886
E. producta Kirk, 1878

Superfamily BRACHYRHYNCHA

Family CANCRIDAE Miers

Cancer Linnaeus
C. novaezelandiae (Jacquinot, 1853)

Family PORTUNIDAE Miers
Ovalipes Rathbun
O. punctatus (de Haan, 1833)
Liocarcinus Stimpson
L. corrugatus (Pennant, 1777)
Nectocarcinus Milne Edwards
N. antarcticus (Jacquinot, 1853)

Family XANTHIDAE Alcock

Section HYPEROLISSA Alcock
Heterozius Milne Edwards
H. rotundifrons Milne Edwards, 1867

Section HYPEROMERISTA. Alcock

Subfamily MENIPPINAE Ortmann emend. Balss
Pseudozius Dana
P. sp.
Ozius Milne Edwards
O. truncatus Milne Edwards, 1834

Subfamily PILUMNINAE Ortmann
Pilumnus Leach
P. novaezelandiae Filhol, 1886
var. *spinosa* Filhol, 1886
P. lumpinus n. sp.

Family GONEPLACIDAE Dana

Subfamily GONEPLACINAE Miers
Ommatocarcinus White
O. macgillivrayi White, 1852

Family PINNOTHERIDAE Dana
** Pinnotheres* Latreille
P. novaezelandiae Filhol, 1886
P. schauinslandi Lenz, 1901
? *Pinnixa* sp.

Family GRAPSIDAE Dana

Subfamily GRAPSINAE Dana
Leptograpsus Milne Edwards
L. variegatus (Fabricius, 1793)
Planes Leach
P. minutus (Linnaeus, 1758)

Subfamily VARUNINAE Alcock
Hemigrapsus Dana
H. crenulatus (Milne Edwards, 1837)
H. sexdentatus† (Milne Edwards, 1837)

Subfamily SESARMINAE Dana
Helice de Haan
H. crassa Dana, 1852
Cyclograpsus Milne Edwards
C. lavauxi Milne Edwards, 1853
C. whitei Milne Edwards, 1853

Subfamily PLAGUSIINAE Dana
Plagusia Latreille
P. chabrus (Linnaeus, 1764)

Family OCYPODIDAE Ortmann
Hemiplax Heller
H. hirtipes (Jacquinot, 1853)

*Belongs to the genus *Halicarcinus*, *fide* Gordon, 1940, p. 78.
Listed under *Halicarcinus* by Richardson, 1949b.
†Listed by Chilton and Bennett, 1929, but not by Richardson, 1949b.

* But *cf.* Direction 45. in *Op. int. Comm. zool. Nom. 1* (D) (D9) : 233–42.
Apparently more correctly known as *H. edwardsi* (Hilgendorf, 1882) *fide* Richardson, 1949c : 130.

INTRODUCTION

THE New Zealand Brachyura have been neglected to an almost inexplicable degree, and the knowledge of the group has remained much more incomplete than that of most other major groups of invertebrates or of the Brachyura of other areas. The list of species has long been known to be provisional in the highest degree and the present study has fully confirmed the expectation that it includes many erroneous entries, some of them hardy perennials which, in spite of openly expressed doubts, have survived for half a century or more. Some of the mistakes arose through geographic errors, others from faulty taxonomy, including some misidentifications and more especially an unwarranted multiplication of specific names. Excluding the Hymenosomidae, the family in which revision is most urgently necessary,[1] it now appears that of the 58 species recorded by Miers (1876) from specimens of allegedly New Zealand origin in the British Museum, no less than 35 are to be excluded, while of the 73 species in Filhol's list (Filhol 1886), 45 meet with the same fate. No collected account of the group has been published, save for an incomplete review by Chilton and Bennett (1929); no comprehensive bibliography has ever been prepared, and little has been done to correct these errors in distribution and identification. It is not surprising that mistakes have occurred in every paper published up to 1936 dealing with the Brachyura of New Zealand, and many points such as the interrelationships of the genera still remain uncertain.

The early phase of the history of New Zealand carcinology closed with Filhol's comprehensive treatment in 1885, which included important additions but made no effort to correct the errors originating with Heller (1868), Miers (1876), and others.

The rest of the century was unproductive save for a few references by the late Hon. G. M. Thomson and the occasional mention of species in the *Challenger* volumes (Miers 1886, Henderson 1888). Notices of the group during the present century may be summarised as follows:

(1) Lenz (1901) described the crabs collected by Schauinsland in 1896–97, including a new but imperfectly described *Pinnotheres* and a mistaken record of an overseas species (see below, *Cyclograpsus whitei*).

(2) Chilton in a long series of papers (1882–1919), dealing chiefly with lower groups of Crustacea, dealt with Brachyura from Auckland and the Chatham Islands (and the Kermadecs, which, however, are Australian rather than neozelanic), and also described collections from the New Zealand Government expedition in 1906–7 in the trawler *Nora Niven*, and those of the expedition to the southern islands organised by the Philosophical Institute of Canterbury. Additions to the list included *Hymenicus marmoratus*, *Hymenosoma lacustris* (correctly transferred by Kemp, 1917, p. 243, to *Halicarcinus*), and a *Lyreidus* which he considered cospecific with the Japanese *L. tridentatus* de Haan; he was however more inclined to unite species, derating *Elamena kirki* Filhol as a synonym of *E. producta* Kirk, *Halicarcinus tridentatus* (Jacq.) as a variety of *H. planatus* (Fabr.), *Ommatocarcinus huttoni* Filhol as identical with *O. macgillivrayi* White, and doubtfully *Pinnotheres schauinslandi* Lenz as the male of *P. novaezealandiae* Filhol. This tendency was based on a sound appreciation of the general position, but the particular decisions reached were unfortunate; he may have been correct with respect to *Ommatocarcinus* and his own *Hymenicus marmoratus*, which however, as he used to state verbally and probably correctly, was merely based on a colour variation of *H. varius* Dana. A separate memoir was devoted to *Hymenicus* or *Hymenosoma depressus*, incorrectly located in *Halicarcinus* by Kemp (1917), an isolated species for which the name *Hombronia* is here revived. No attempt by Chilton to revise the whole group was made, attention being paid rather to other Crustacea, but material was collected assiduously for many years and stored for ultimate study, he used to say, by one of his pupils. It has been the present author's privilege to benefit from this disinterested zeal.

(3) G. M. Thomson (1902a, 1913) described the majid *Paramithrax longipes*, which however is a *Leptomithrax*, and provided much information on the biology of the crabs of Otago Harbour. (See also Thomson and Anderton, 1921.) A handbook on the New Zealand Crustacea was unfinished at the time of his decease, the section on Brachyura being only sketched in outline. (See Thomson 1932, p. 57.)

(4) Borradaile (1916) in describing the Brachyura of the British Antarctic Expedition has placed undue reliance on the work of Filhol, and his conclusions require considerable emendation.

(5) Stephensen (1927) included a few species in his report on the Crustacea collected by Dr Th. Mortensen at Campbell Island in 1914; part at least of the dredgings from the mainland were retained by Dr C. Chilton and Dr G. E. Archey, and are dealt with below, under the general title *Hinemoa* Expedition.

(6) Balss (1929) has referred to some New Zealand species in his revision of the Oxyrhyncha, and has since (1930) dealt with Kohl-Larsen's collections from Campbell Island, including the new majid *Campbellia kohli*.[2] The author of these excellent contributions was unfortunately

[1] Note especially Garth (1958, p. 10).

[2] And (1933) with the genus *Pilumnus*.

unaware of contemporary work by Chilton and the present author.

(7) Young (1929) dealt with part of the material collected during the expedition to the Chatham Islands by the Otago Institute in 1924. It now appears, in confirmation of previously expressed doubts (Bennett 1930, p. 258), that while some species were omitted, others were incorrectly identified, and others again cannot be checked because of the destruction of much of the material.

(8) A paper by Chilton and Bennett (1929), important as the only comprehensive attempt to deal with the group since the time of Filhol, was limited to the collections of the respective authors and those of the Canterbury Museum, and omitted the Dromiidae, Raninidae, Leucosiidae, *Paramithrax*, Hymenosomidae, *Pilumnus*, and *Pinnotheres*; a few supplementary notes by the present writer (Bennett 1930, 1932) scarcely filled these gaps. The present work covers all Brachyura except Hymenosomidae, and is based on a close study of all known collections of Brachyura in New Zealand (except for a small dried series listed below as Dr). The collections here reported upon are incomparably more extensive and more representative of latitudinal and altitudinal range than those available to any previous author.

The completeness of the study, which has for example entailed visits to all of the New Zealand museums and other institutions possessing collections of Brachyura justifies and indeed necessitates a sweepingly critical viewpoint, and in particular the principle that no species may be retained in the list unless its occurrence in New Zealand waters is fully proved; the only proof accepted, with very few exceptions, is the presence of specimens of authentic neozelanic origin in the collections examined by the writer. There is no longer any point in listing some of the species that have hitherto survived, as for example in Hutton's "Index" of 1904, merely because of the difficulty of proving a negative, for no more favourable opportunity for a long overdue purging of the list is likely to arise. The exceptions to the principle above are as follows: (1) *Ebalia tuberculosa* (M.Edw.), retained on the evidence of an isolated record from a deep-water *Challenger* station not since investigated; (2) *Campbellia kohli* Balss from Campbell Island, of which the circumstances of collection and the present location of the holotype are known, and the description is adequate – a conspicuous contrast to the hazy uncertainties of the past; and (3) *Latreillopsis petterdi* Grant, an Australian species adequately known to the author by a photograph and an independent identification, as explained below.

One example, which could easily be multiplied, may serve to illustrate the grounds for the sweeping decisions in other cases. Those arising from the spurious source of much of the material on which Miers based his catalogue of 1876, or the carelessness of Heller or of those responsible for the material on which he depended have already been mentioned (Chilton and Bennett, 1929, p. 732), and the example here selected is that of *Uca*, known in New Zealand literature by the invalidated name *Gelasimus*. A species was described by Kirk (1881) under the name *G. thomsoni*, allegedly from Wellington, and another by Filhol (1886) under the name *G. huttoni*; neither species has been seen again, and the types are lost. The crabs of this genus are conspicuous and of striking appearance, and where they occur are usually accessible and present in great numbers, for they are gregarious intertidal crabs of tropical and subtropical mud flats. Kirk explained that "Two males and one female . . . were brought to me some time ago by one of the local fishermen," the type locality being a city port. Filhol's specimen was given to him by Hutton, but the circumstances of collection are not recorded save for the locality – which again was allegedly a city port. In one of the museums the writer found specimens of *Uca* on the same shelf as New Zealand and Fijian crabs without any direct indication of the place of origin, and inviting a repetition of a mistake which has evidently been already made twice in this same genus. Even if a species of *Uca* is yet to be found, for example in the mangrove swamps of North Auckland, nothing is lost by striking out both names until there is valid evidence to the contrary.

The disproof of errors resulting from faulty taxonomy, as distinct from geographic errors as in the case of *Uca*, is usually easier as it does not require the disproof of a negative. Grounds for freeing *Ebalia*, *Paramithrax*, and *Pilumnus* from their burdens of superfluous specific names, and for similar taxonomic corrections will be found in detail in the text below.

The material examined requires the introduction of only a few new names, as follows:

> Subgenera: *Zemithrax*, *Austromithrax* (both in the genus *Leptomithrax*).
>
> Species: *Lyreidus fossor*, *Leptomithrax* (*Zemithrax*) *moloch*, *Leptomithrax* (*Austromithrax*) *mortenseni*, *Pilumnus lumpinus*.

The elimination of superfluous records and validation of the authentic ones are more difficult but much more important tasks than the addition of new species; for example, of the 68 species other than hymenosomids enumerated by Hutton (1904), only 16 have survived without nomenclatural alteration. In the final list there are six non-brachygnathous species representing three subtribes, and in the Brachygnatha there are 21 brachyrhynchous species, one parthenopid, and 13 Majidae, a total of only 41 species of New Zealand Brachyura other than Hymenosomidae; of the latter, 16 species have been distinguished, but the number is quite unreliable. The crab fauna therefore proves to be distinctly limited in numbers, and to stand in contrast to that of such an area of Queensland, continuous with other Indo-Pacific areas and in spite of the richness of known species still prolific of new forms.

The terminology used in the following report is that explained and figured by Rathbun (1918, p. 6, and 1925, p. 1), with the following slight qualifications[3]: (1) The

[3]*Cf.* also, Garth (1958, p. 8).

term *dorsum*, favoured by Stimpson (1907), is used for the dorsal surface of the carapace. (2) The term "*Interkalardorn*", used by Balss (1929) for the spine between the eave of the orbit and the post-orbital spine in the Majidae, has been translated as *intercalary spine*. (3) The term *linear gape* is introduced to refer to a condition frequent in the oxyrhynchs, especially in females and small males, in which the fingers of the chela neither gape widely nor meet along the inner margins when closed, but leave a narrow slit through about half of the length or more, narrowing distally and uninterrupted by a distinct basal excavation or tubercle. (4) The term *pseudorostrum* is used for the structure usually referred to as the rostrum; it is of secondary origin, the rostrum of the zoea in oxyrhynchs having been shown by Cano (1893) to become absorbed in the interantennulary septum.

SPECIES TO BE EXCLUDED

THE following lists are based on the check list compiled by Thomson (in Hutton 1904) and do not revert to earlier well founded eliminations by Hutton (1882) and Thomson (1882). The grounds for doubting the authenticity of these species have already been sufficiently indicated by Chilton and Bennett (1929). The present overhaul confirming the conclusion that all are to be excluded.

(1) Species, mostly Australian, recorded by Miers from specimens of which some at least had been purchased by the British Museum:

Halimus diacanthus (de Haan)
Paramithrax sternocostulatus M. Edw.
Paramicippa spinosa Stimpson
Leptodius nudipes Dana
L. eudorus (Herbst)
Pilumnus tomentosus (Latr.)
Pilumnopeus serratifrons (Kinahan)[4]
Portunus pelagicus (Linn.)
P. sayi (Gibbes)
Thalamita sima M. Edw.
Heloecius cordiformis (M. Edw.)
Chasmagnathus subquadratus Dana
C. laevis Dana
Percnon planissimum (Herbst)

(2) Other species described or recorded by overseas authors from Australian or other material incorrectly alleged to have been collected in New Zealand:

Calappa hepatica (Linn.), recorded by Heller – Chilton and Bennett's (1929, p. 775) account should be corrected accordingly.
Stenorhynchus fissifrons Haswell[16]
Huenia bifurcata Streets
Megametope rotundifrons (M. Edw.)
Panopeus otagoensis Filhol
Nectocarcinus integrifrons (Latr.)
Ruppellioides convexus M. Edw.
Gelasimus huttoni Filhol
Grapsus grapsus (Linn.)
Hemigrapsus maculatus (M. Edw.)
Sesarma catenata Ortmann
Pachygrapsus transversus Gibbes

[4]Richardson (1949c, p. 130) has recorded specimens from Auckland as *P. serratifrons*, "the first positive record since 1876."

No reasons for naming New Zealand in the distribution of the last named are given by Lenz and Strunck (1914, p. 284).

(3) Species depending on unsubstantiated records by local naturalists:

Gelasimus thomsoni Kirk (types lost, presumably foreign)
Ovalipes ocellatus (west Atlantic, Hector's record from New Zealand being probably based on *O. punctatus*)
Xantho spinotuberculata Lockington (=*Paraxanthias taylori* (Stimpson), a common Californian species; Kirk's specimens in the Dominion Museum seen by the author)

(4) Bad species or wrong identifications (first column), redistributed (second column) for reasons discussed in the section on systematics.

Ebalia cheesmani Filhol	= *E. laevis* (Bell)
Ebalia tumefacta Kirk, not of Montagu	= *E. laevis* (Bell)
Cryptodromia lateralis Heller, not of Gray	= *Petalomera wilsoni* (Fulton & Grant)
Lyreidus tridentatus Chilton, not of de Haan	= *L. fossor* n. sp.
Halimus rubiginosus Kirk	= *Trichoplatus huttoni* M. Edw.
Paramithrax parvus Borradaile	= *P. minor* Filhol
Paramithrax latreillei Miers	= *P. ursus* (Herbst)
Paramithrax cristatus Filhol	= *P. ursus* (Herbst)
Leptomithrax affinis Borradaile	= *L. longimanus* Miers
Paramicippa grandis Hector	= *Jacquinotia edwardsi* (Jacquinot)
Portunus pusillus Kirk, not of Leach	= *Liocarcinus corrugatus* (Pennant)
Portunus borradailei Bennett	= *Liocarcinus corrugatus* (Pennant)
Pilumnus vespertilio Miers, not of Fabricius	= *P. novaezelandiae* Filhol
Pilumnus maori Borradaile	= *P. novaezelandiae* Filhol
Pinnotheres pisum Heller *et alii*, *nec* Linn.	= *Pinnotheres novaezelandiae* Filhol
Epigrapsus politus Lenz, not of Heller	= *Cyclograpsus whitei* M. Edw.
Sesarma pentagona Hutton	= *Leptograpsus variegatus* (Fabr.)
Helice lucasi (M. Edw.)	= *H. crassa* Dana
Ommatocarcinus huttoni Filhol	= *O. macgillivrayi* White (see Chilton & Bennett 1929, p. 757)
Hemiplax hirtipes Heller 1865 *Cleistostoma*(?) *hirtipes* Jacq. 1853	= *Hemiplax hirtipes* (Jacq. & Lucas) Chilton & Bennett 1929, p. 759

SOURCES OF MATERIAL

EIGHT code letters are assigned as follows to the various collections on which the report is based.

C. Canterbury Museum, Christchurch.

a. Miscellaneous, chiefly from the Canterbury district.
b. Hutton collection; small and old but of historic interest.
c. Philosophical Institute of Canterbury expedition to the southern ("subantarctic") islands in 1907; small series.
d. *Nora Niven* collections, dredged off the east coast from Foveaux Strait to Bay of Plenty and at the Chatham Islands in 1907 (see E. R. Waite, *Rec. Canterbury [N.Z.] Mus. 1* : 46, 1909, for narrative).
e. *Hinemoa* Expedition during the visit of Dr Th. Mortensen in 1914–15; mainland material, chiefly dredged in the Hauraki Gulf and northern Auckland, retained by Dr C. Chilton and Dr G. E. Archey.

Ch. Chilton collection, now in Canterbury Museum.

f. Large series from all parts of New Zealand, including part of e above, also collections by H. Suter at Campbell Island and from the mainland, by Miss S. D. Shand at the Chatham Islands, by Capt. Bollons (dredgings) from the mainland and various islands, by several lighthousekeepers, etc.

B. Author's collection, now in Canterbury Museum.

g. Chiefly littoral collections from Canterbury and Westland, trawled material from off Akaroa, dredgings from Port Nicholson, etc. (Material not personally collected is included in a above.)

O. Otago University Museum, Dunedin.

h. Miscellaneous; large series, littoral and dredged, mostly collected by Prof. W. B. Benham in Otago and determined by the late Hon. G. M. Thomson.
i. Hutton collection; small and old but of historic interest.
j. *Doto* collections, dredged in 1900 and 1901, chiefly off the east coast of the South Island and west coast of the North Island (see Waite 1909; *Rec. Canterbury [N.Z.] Mus. 1* : 46–7); valuable series not hitherto described.[5]
k. Otago Institute Expedition to the Chatham Islands, 1924–25 (part).
l. Stewart Island collections by W. Traill, partly duplicating f (see previous column).

T. G. M. Thomson collection, in Otago University Museum.

m. Small selected series.

P. Marine Fish Hatcheries and Investigation Station, Portobello.

n. Valuable series, recent but extensive, collected by D. H. Graham in and around Otago Harbour in 0–120 fathoms.

D. Dominion Museum, Wellington.

o. Miscellaneous; small series.
p. Kirk collection; small series, of historic interest.
q. Hector collection; small series, of historic interest.
r. (A series collected and owned by Dr W. R. B. Oliver was not studied; see Oliver, 1923, p. 496.)

A. Memorial Museum, Auckland.

s. Small series, mostly recently collected.
t. Suter collection; small collection, without data except identifications of some by Chilton.
u. Manukau Harbour collections by D. H. Graham, 1926–27.
v. Waitemata Harbour survey collections; large and valuable series, representative of northern and sheltered waters, mostly shallow; collected by D. H. Graham and A. W. B. Powell, 1926–31.

Of this material, Chilton has reported on c (1909), d (1911a), and part of f (1906b); the collections in the Canterbury Museum, with the exception of certain groups as already noted (C, Ch, and B) have been discussed by Chilton and Bennett (1929); b and i have been reported upon by Hutton (1875, 1879, 1882), p by Kirk (1879, 1881), and most of k by Young (1929). In all cases, however, revisions were urgently needed. The remaining collections include especially fine material in e (oxyrhynchs), f (oxyrhynchs and Hymenosomidae), h, j, n, and v. The present review is supplementary to that by Chilton and Bennett (1929), whose locality lists, for example, are not repeated here, though most of the material has been re-examined.

[5]See also Appendix to the Journal of the House of Representatives; 1900. H. 15A. L. F. Ayson, Report on Experimental Trawling: 1–24 (Brachyura, p. 22).

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LIST OF STATIONS

LOCALITIES from which much material has been secured are here designated stations as listed below. In the text the station number is cited after the code letter; thus "O, 20" after a record implies that the material to which it refers was collected during the *Doto* Expedition between Kaipara and New Plymouth in March 1901, and is now in the Otago University Museum. This "station" represents some 200 miles of coast.

1. Portobello, Otago Harbour.
2. Port Chalmers, Otago Harbour.
3. Channel near Quarantine and Goats Islands, Otago Harbour; collected by D. H. Graham, 1929–30.
4. Otago Harbour, localities other than 1–3.
5. Stewart Island.
6. Warrington, Otago Peninsula; collected by D. H. Graham, 1930–31.
7. Brighton, Otago.
8. Lyttelton Harbour, Banks Peninsula.
9. Sumner, Banks Peninsula.
10. Kaikoura, North Canterbury.
11. Point Elizabeth, Westland; collected by the author, 30/1/31.
12. Cape Foulwind, Westland; collected by the author, 1/2/31.
13. Westport, Westland; collected by the author, 2-3/2/31.
14. Port Nicholson, Wellington; 3–10 fm, collected by the author, 13–14/2/31.
15. Lyall Bay, Wellington.
16. *Doto* Expedition, Blind Bay to Golden Bay, 8–17 fm, June 1900.
17. *Doto* Expedition, Bay of Plenty and Hauraki Gulf, 1901.
18. *Doto* Expedition, Mahia Peninsula to Hicks Bay, 1901.
19. *Doto* Expedition, East of Taiaroa Heads, 30–50 fm, 7/4/1900.
20. *Doto* Expedition, Kaipara to New Plymouth, March 1901.
21. *Hinemoa* Expedition, off Little Barrier Is., Hauraki Gulf, 35 fm, 1914.
22. Narrow Neck, Waitemata Harbour, Auckland; rocky pools; collected by D. H. Graham, 21/7/26.
23. Birkenhead, Waitemata Harbour; collected by D. H. Graham, 29/7/26.
24. Northcote, Waitemata Harbour, littoral.
25. North Head, Waitemata Harbour, littoral; collected by D. H. Graham, 21/7/26.
26. Motuihi Channel, Waitemata Harbour, 8–10 fm.
27. St Heliers, Waitemata Harbour, littoral reef.
28. Rangitoto Island, Waitemata Harbour; littoral, near the beacon.
29. Manukau Harbour, Auckland; collected by D. H. Graham, 1926–7.
30. Waitemata Harbour, localities other than 22–28.

COLLECTION AND PRESERVATION OF CRABS

THE main habitats in which crabs should be sought are as follows:

(1) Under stones and among weeds and on sand on intertidal reefs.

(2) At higher levels, including apparently barren spots, either exposed to waves or sun (*Leptograpsus variegatus*) or among debris (*Cyclograpsus lavauxi*).

(3) Among shells of mussel beds (Hymenosomidae, Porcellanidae).

(4) In large mussels and other bivalve molluscs (*Pinnotheres* spp., not yet known in New Zealand from other hosts).

(5) In estuaries, brackish lagoons, tidal rivers, muddy foreshores; under stones or burrowing (*Hemigrapsus* spp., *Helice crassa*, *Hemiplax hirtipes*), sometimes semi-terrestrial (*Hemigrapsus crenulatus*).

(6) In fresh water (*Halicarcinus lacustris*).

(7) Below low-water mark, all bottoms.

(8) Fish stomachs.

(9) Drift on beaches (*Trichoplatus huttoni*, *Ovalipes punctatus*, *Paramithrax* spp.; the first named is known only from this source); drift kelp or Polyzoa or ascidians (Hymenosomidae).

(10) Open sea, as plankton (zoeae) or pseudoplankton (*Planes minutus* on drift kelp, etc.).

(11) Tertiary fossil beds.[6]

In addition to hand collecting from shore localities, the chief methods are by dredging and trawling, tow-netting for zoeae, and the use of lobster pots (*Leptomithrax* spp., etc.), casting nets (*Ovalipes*), set nets (*Paramithrax* spp.), seine nets (*Ovalipes*), and for the larger wary rock-frequenting and swimming species (*Plagusia chabrus*, *Ovalipes*) a baited string without a hook; for bait, chitons or pauas (*Haliotis*) may be used, but mussels (*Mytilus*, *Modiolus*) tear too readily; a landing net, as used also for lobsters (*Jasus lalandei* M. Edw.), etc., is useful in conjunction with a line, but not essential. The use of a light at night has scarcely been tried.

Undoubtedly the most promising method of securing rarities is by trawling or preferably dredging below low-water mark, especially from the neighbourhood of 40 fathoms, where there are rich feeding grounds frequented by Majidae and rare Hymenosomidae. These crabs are inconspicuous among the weeds and sedentary animals and possess concealment devices. In both families all movement is very slow, but the other devices differ; for whereas the majids are masked by a blanket of organisms attached to the carapace or limbs, or in the case of *Paramithrax ursus* by a covering of hairs, the hymenosomids are too small to support an epifauna, but rely rather on varied colours and mottled designs. It is necessary to examine a haul with extreme care, and the smallest specimens (Hymenosomidae) should not be rejected as juveniles but preserved with especial care. Undoubtedly our knowledge of the group could be greatly extended by cooperation with trawl fishermen, but dredges are preferable to trawls, especially if provided with a tripping mechanism that makes it possible to operate on bottoms where trawls cannot be used. Fragments of stone, wood, and coke (the latter from coastal steamers) occasionally brought up by line fishermen are the source of a few specimens, but only enough to hint at the ungleaned harvests beyond the customary range of trawls or dredges. The brief operations by the *Doto*, the *Nora Niven*, and the *Hinemoa* fall far short of the exploration of the lower littoral that is needed, and only the most fragmentary knowledge of even the feeding grounds of the edible fishes is at present available. So trivial have been the attempts to explore these depths that during the half century since the time of Filhol several authentic species of hymenosomids have not been recorded by later writers; four species (*Merocryptus lambriformis*, *Lyreidus fossor*, *Latreillopsis petterdi*, *Pseudozius* sp.) have been taken on one occasion only, and *Cyrtomaia hispida* twice; two species (*Ebalia tuberculosa*, *Campbellia kohli*) are not represented in collections in New Zealand. Only two species of zoeae have been described from the plankton, of which one appears to represent a genus not otherwise known from New Zealand (see below under *Pinnotheres*). These occasional gleanings serve to indicate that probably many further important discoveries remain to be made, including probably further important data as to the origins of the Majidae and Hymenosomidae.

An examination of material of which descriptions have been published shows that directions for the elementary matter of preparing specimens for study is not superfluous in the present discussion. It is essential that crabs whose carapaces or limbs are concealed by hairs, mud, weed, or sessile animals should be meticulously cleaned over at least one half before conclusions are drawn; the author for example devoted about a week to the cleaning of specimens of *Paramithrax* in the Canterbury Museum before venturing upon a serious study of the genus. Useful instruments for the purpose include mounted needles, a fine knife or scalpel, and a small stiff brush; the needles should be stout but ground on a wheel to a needle-point and then lightly curved, and one may be ground to a small oblique cutting

[6]See Glaessner (1960) for detailed account of New Zealand fossil crabs.

edge. If sufficient specimens are available, the work of preparation may be greatly shortened by drying some until the hairs become brittle. Uniform methods are desirable in the study of the specimens, measurements being taken for example in the way described by Rathbun (1918, 1925, 1930). Constant use of magnification is necessary, measurement of small specimens or small parts being taken and also read under magnification with the aid of needle-pointed incurved calipers. The camera lucida and the pantograph, with repeated measurements of the proportions, are aids to accuracy in drawing. It is not helpful to sacrifice accuracy to artistry, as Filhol's artist has done.

Fresh water is commonly recommended for killing species whose legs are liable to become detached, but it is rarely at hand, and a better method is to wrap the specimens in stiff paper and preserve in spirit a few hours later; the limbs remain in place and are quite supple, allowing arrangement in any desired way before they are stiffened by the preservative; even the largest specimens are unable to tear stout brown paper if tightly wrapped; a minimum of mud and body-water is added to the preservative, and the method reduces the risks involved in carrying bulky glassware among rocks. The standard medium for killing and fixing is alcohol. Large specimens or those with large chelae should not be placed alive in receptacles containing delicate material. Formalin is decidedly inferior to spirit; it makes specimens so brittle that breakage is inevitable, and unless neutralised with a trace of borax it leads to slow decalcification and ultimate disintegration. If formalin must be used, the crabs should be preserved for a day or two at most in a solution not above 4%, then soaked in water overnight to remove most of the formalin and make handling possible, then cleaned and arranged in the position required, then dried or replaced in the preservative. Methylated spirit may not be used if the denaturant forms a white precipitate when water (including diluted spirit) is added. Much the best preservative is 70% spirit with a water-soluble denaturant, and a little glycerine to keep the limbs supple. Large specimens should be injected, or the body cavity may be opened by a slit between the hinder edge of the carapace and the first abdominal segment or by holes made with a drill through the abdominal sternites. The spirit should be changed at least once, for its strength is reduced by the addition of body water along with specimen; used spirit may be kept for the first soaking of the next catch.

A representative series for rapid comparative work or for museum exhibition may be dried after soaking for a week, or if large for a fortnight, in Sayce's solution (4 parts of 50% alcohol, 3 parts of glycerine, 0·001 part of corrosive sublimate), or, better, the solution may be saturated with sublimate and the poison removed from exposed parts with a brush when the specimen is dried. Metal dishes or instruments such as forceps must not be used if strong sublimate is used. Prolonged soaking in a large volume of this or other fluid is necessary, not only to ensure penetration (which is very slow in the case of crabs) but to remove the sea salt, which on account of the presence of magnesium chloride is deliquescent and after the specimen has been dried leads to softening and discoloration. Flaked naphtha or moth balls as an alternative to sublimate are inferior, and paint or varnish render the specimens almost useless unless for exhibition purposes.

For temporary preservation, sufficient to allow material to be sent through the post, specimens may be soaked in any non-acid non-staining preservative and posted either (1) in the preservative, (2) moist, wrapped in paper and packed in a tin with moist cotton wool or sphagnum, or (3) dried and packed in paper in a box. Under no circumstances should cotton wool come in contact with the specimens, whether wet or dry, for the limbs will inevitably become broken; paper is preferable to muslin for the same reason.

Dried specimens may be stored in boxes, preferably glass topped, and not gummed to cards or glass unless intended for exhibit in sealed cases without handling. The receptacles for spirit specimens are wide jars and assorted flat-bottomed glass tubes at least half an inch in diameter. An attempt to economise in space will lead to breakage, partly because the limbs are awkwardly folded and partly because the specimens are crowded and have to be removed from the jar for every trivial examination. The mouth of the jar should occupy the whole width, and only a slight constriction of the mouth is permissible in the case of large jars. The stoppers for the tubes should be of cork or preferably rubber, or of pith if the tubes are stored upside down on a rubber or other pad in a jar of preservative, a rather cumbersome method, which, however, reduces risk of drying by evaporation and is at least much superior to sealing with paraffin or vaseline. The jars should have glass tops resting directly on a rubber band; mason jars with the metal exposed to vapours inside the jar are very inferior, especially if formalin is used; the internal surfaces should be glass and rubber only; wire clamps are less satisfactory than a flat steel bar crossing the top diametrically, as used by Chilton, or a wholly external metal threaded rim which screws into place as in a mason jar, as used in the Australian Museum, and which has an appreciable advantage in being easily removed.

Data as to locality, depth, collector, and date, recorded in pencil or Indian ink on a stiff paper label, should be placed with the specimens inside the receptacle (gummed labels are most unsatisfactory), and if notes on colour, habits, frequency, oviposition, etc., are too lengthy for inclusion on the label they may be recorded in a field notebook or a card catalogue; the history of New Zealand carcinology should however provide sufficient warning against the recommendation of some authors that specimens be provided only with an index number and all data be recorded in the book; this may serve in some private collections, but not in a museum. A guiding rule, eliminating cryptic remarks and abbreviations, is that all records should be as intelligible to others as to the recorder.

The extraordinary confusion among the Hymenosomidae can scarcely be explained except on the assumption that

authors have been satisfied with methods and instruments that may be adequate for most crabs, but that they would not think of using for, say, the Amphipoda, with which Hymenosomidae are comparable in size and delicacy. An especially fine set of needles, calipers, and brushes is necessary for these small specimens, and non-inverted magnifications up to 24 diameters. In taking measurements the limb is stretched along the finger, which may have a small thimble of black paper, and the calipers are applied under magnification. Microscopic mounts of dactyli, facial appendages, etc., are essential, experiment having repeatedly shown that impressions gained by a single lens without dissection may be quite erroneous. Detail in parts not requiring dissection becomes visible after partial drying of the specimen, so that there is no free moisture on the part examined; although this has no doubt been the general practice, the resultant curling and buckling of the thinly calcified carapace has not hitherto been mentioned, yet it is part of the explanation of the discrepancies in the figures of species of *Elamena* and persistent statements that the carapace margins are upturned. In the same genus the carapace is described as smooth, but this is merely because the regional markings are obscure in wet specimens, and commonly hidden by the white precipitate formed on partial drying, and in any case liable to be confused with outlines of viscera showing through the thin carapace. The dorsum is easily cleaned and the detail made clear by means of a camel-hair brush and a little ether, a method which equally assists in determining the number of abdominal segments and similar fine detail.

SYSTEMATICS

Subsection **OXYSTOMATA** de Haan

Family LEUCOSIIDAE Dana

Genus **Ebalia** Leach

Ebalia Leach, Malac. Podoph. Brit., text of pl. 25; 1817.
Rathbun, *Bull. U.S. Fish Comm. 1900*, 2 : 87; 1901.

Ebalia laevis (Bell), Figs. 1-4, 107

Phlyxia laevis Bell, *Trans. Linn. Soc. Lond. 21* : 305, pl. 34, figs. 3–3*c*; 1855.
Bell, Cat. Leucosiidae Brit. Mus., p. 18; 1855.
Miers, Cat. Crust. N.Z., p. 56; 1876.
Filhol, Mission de l'Ile Campbell, p. 406; 1886.
Phlyxia tumefacta Kirk, *Trans. N.Z. Inst., 11* : 395; 1878 (not of Mont.)
Phlyxia cheesmani Filhol *l.c.*, p. 407, pl. 43, figs. 3, 4 (*lapsus* for *cheesemani*).
Ebalia laevis Miers, *Challenger* Brachyura, p. 306; 1886.
Chilton, *Trans. N.Z. Inst. 38* : 266; 1906.
Chilton, *Rec. Cant. Mus. 1 (3)* : 296; 1911.
Young, *Trans. N.Z. Inst. 60* : 153; 1929.

Regions (fig. 1, 107) well marked, less prominently swollen in the female than in the male; branchials much swollen, separated from the cardiac and posterior gastric regions by a broad depression, in which there are two pits on each side, and some irregularities opposite and posterior to a transverse groove in a transverse depression in front of the cardiac region; the latter elevated, almost conical; two white spots on each side of the rather narrow median post-frontal ridge, on a depressed area which merges into the distinct but scarcely elevated hepatic regions.

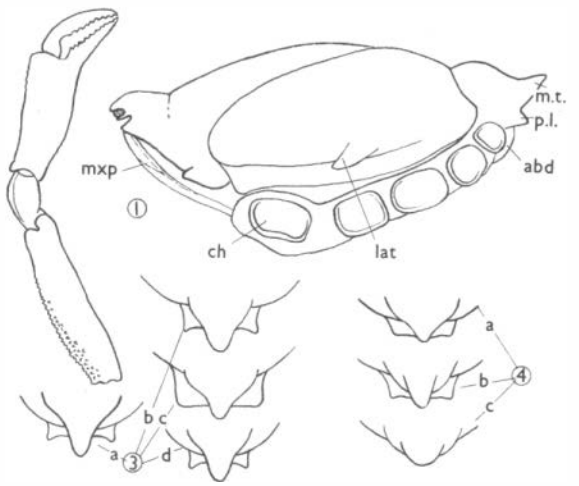


FIG. 1-4: *Ebalia laevis* (Bell); 1, male in profile, × 6, mxp. maxilliped, ch. socket of cheliped, lat. lateral tooth, m.t. median posterior tooth, p.l. postero-lateral tooth, abd. abdomen; 2., cheliped of male, × 3; 3a-d, variations in outline of posterior margin, males from Colville Channel; 4a-c, females from same series.

Hepatic region moderately convex in dorsal view, subhepatic region elevated with a conical point. The anterior branchial margin commences more or less abruptly, forming in some specimens an angle with the hepatic margin, inflated, forming a quadrant of a circle, terminated by a prominent conical point at half the carapace length. Postero-lateral margin less strongly convex.

The posterior projections (a median cardiac and a marginal pair) are highly variable, and more prominent in the males (fig. 3a–d). In males the laterals are nearly equilateral triangles, hinder side strongly oblique to the transverse axis or nearly transverse, tip acute, never as much as a right angle, median projection stronger, blunt, usually extending much further back. The posterior margin is broader in females (fig. 4a–c), with the projections weaker, laterals obtuse, median obtuse and extending little or not at all beyond the posterior margin or exceptionally approaching the male condition.

Granulation (fig. 107) is very variable and roughly of two types, which however merge into one another; (1) granules very low, flat, dense, fairly uniform but more prominent around the orbits and on the outer maxillipeds and towards the sternal and abdominal margins; (2) less uniform, prominent on projecting parts and almost suppressed elsewhere, with a median dorsal series and a paired oblique series from the mesogastric regions to the postero-lateral margins, prominent along the latter and along the posterior margin. Male abdomen granulated, less so at base; female abdomen commonly almost smooth except marginally, where in some specimens the granules are very prominent; anterior sternites the most strongly granulated part of all. Merus of third maxilliped strongly granulated with a pitted appearance, ischium and exognath usually smooth but not in all; buccal margin granulated, front granulated and in some specimens corroded.

Front concave in dorsal view with a median linear groove which may form a deep suture, especially if the granules are prominent; front angulated at corner of orbit; the latter minute, circular, with two sutures above which more or less completely disappear in large specimens.

Chelipeds (fig. 2, 107) granular all over, granules mostly flat and obscure except marginally. Merus trigonal, upper margin distinctly angular with variable granulation, granules of two sizes, the larger ones more numerous basally, where they are inclined to spread over the anterior surface. Carpus rounded above, obscurely granular. Palm

sharply angled above, with sharp granules varying in number and size but tending to form 2–4 longitudinal rows in some cases; $2\frac{1}{4}$ times as long again as high; fixed finger inclined, the lower margin very sharp, inner and outer surfaces each with two inconspicuous longitudinal ridges; movable finger similar and of equal width, upper margin subcarinate. Gape narrow, nearly half the length of the fingers, movable finger with small basal excavation opposite a slight angulation on the fixed finger; denticles distinct, sharp, reflexed. Chelipeds of female shorter but equally stout, palm more sharply carinate above, fingers without a gape, opposed margins nearly straight.

Legs with similarly distributed granules, inconspicuous except marginally, commonly subspinuliform on upper margin of merus; dactylus straight, linear, not greatly flattened, smooth. Merus in some cases (perhaps in last pair, but constancy indeterminable on account of almost invariable detachment of the legs) densely covered below with spherical beadlike or spiniform granules; in some (perhaps in last pair of females) the lower margin of the merus is considerable expanded.

Male abdomen (fig. 107) broad basally, base consisting mainly of two large oblique tumid areas. Basal joint tapering rapidly, second nearly parallel-sided with small median conical elevation, last joint narrowly triangular, nearly twice as long as broad, tip acutely rounded. Female abdomen broader distally than at the base, the three fused sutures visible right across, last joint with sides convex, tip pointed, length one-third greater than breadth.

VARIATION: The 72 specimens examined were obtained from 12 or 13 localities ranging vertically from 10 to 60 fathoms and latitudinally from Stewart Island to Hauraki Gulf, and although very imperfectly preserved the collection is much more representative than the small series which have led to the multiplication of names implied by the synonymy. Nevertheless a close study has failed to distinguish more than the one species. The sexual dimorphism prominently affects the chelipeds, postero-dorsal projections, inflation of regions, abdomen and sternum, and in addition there is a high degree of variability, especially with respect to the postero-dorsal projections, the antero-lateral outline, and the granulation; but intermediates between the extremes not only occur, but are present in one and the same collection, so that it does not appear possible even to correlate the observed differences with depth or latitude. This latter conclusion has been made somewhat insecure, and the whole study much more difficult, by the detachment of all the limbs in almost all the specimens.

HISTORICAL: The original description and figures provided by Bell (1855) are mutually discrepant, especially with respect to the dorsal granules and the length, shape, and granulation of the chelipeds; but collectively his account represents some of the variation already noted. Kirk's identification of local specimens with *E. tumefacta* Montagu has not been substantiated. Filhol (1886) in characteristic style recorded both names, and did not hint that they might both refer to his own *E. cheesmani*; this latter name, which is evidently a misspelling (the intention no doubt having been to honour the late T. F. Cheeseman), is superfluous, and Chilton, though refraining from comment in 1906 and 1911, was undoubtedly right in an MS note dated 1893 in questioning the validity of Filhol's species.

HABITS: The vertical range as far as known is 10–60 fathoms, but may well extend to greater depths. The crabs are probably burrowers, like their congeners, and the large *Hinemoa* series merely results from the use of an efficient dredge capable of biting well into the bottom. Chilton's remark that "the species is common" means only that occasionally it has been taken in numbers. One or two specimens are somewhat concealed by sand grains cemented over the dorsum, and one has epizoic Hydrozoa on the legs. Females are ovigerous chiefly in December and January, but there is one record also in May.

COLOUR: Uniformly whitish in spirit.

MATERIAL EXAMINED:

1 female ovig., 7/1/30 (P, 3).
1 female, 7 miles NE of Otago Heads, 40 fm, coll. D. H. Graham. 9/2/31 (P).
1 male, E of Papanui Inlet, 40 fm. coll. D. H. Graham, 23/4/30 (P).
2 males, 1 female, Paterson's Inlet, coll. E. Jennings (O, 5).
3 males, 1 female immature, Dusky Sound, over 40 fm (T). (Labelled *E. tuberculosa* by Thomson.)
2 males, 2 females (1 ovig., 1 imm.), Golden Bay, 22/5/10 (T, 5).
2 males, 1 female, Wanganui Bar. 10–30 fm, coll. S. H. Drew, /5/93 (T).
18 males, 3 females (1 ovig.), Colville Channel, 37 fm, *Hinemoa* Exped. 22/12/14 (C).
4 males, 3 females ovig., 3 miles E of Gannet Island, 25 fm, *Hinemoa* Exped. 11/1/15 (Ch).
12 males, 4 females ovig., 50 fm, –/12/14: 1 male, Little Barrier, 35 fm, 29/12/14; 7 males, 1 female imm., no data (C, 2).
1 male, 1 female, Cuvier Island, 40 fm, sandy bottom, coll. Capt. Bollons, 16/11/08 (Ch).

PREVIOUS RECORDS:

New Zealand (Bell, Miers 1876); Challenger Station 167, lat. 39° 32′ 0″S, long. 171° 48′ 0″E, 150 fm and Challenger Station 167A, Queen Charlotte Sound, near Long Island, 10 fm (Miers 1886).
Cook Strait (Kirk, *E. tumefacta*).
Otago Heads (Filhol, *E. cheesmani*).
Channel Island. 25 fm, Poor Knights Islands, 60 fm (Chilton 1906).
Chatham Islands, coll. W. Traill, 16/10/20 (Chilton, MS).
Chatham Islands (Chilton 1911).
Chatham Islands, stomach of blue cod (Young, 1929).

TYPE: British Museum, if extant; type loc., New Zealand.

DIMENSIONS (mm):

	Male	Female
Length with posterior spine	11·5	13
Breadth	12·5	14
Cheliped	28	23
Hand	13	11
Movable finger	7	6

[1]Dell (1960, p. 4) determined *Ebalia cheesmani* in the Chatham Islands fauna and commented: "All the specimens that the writer has seen from Cook Strait, Wellington Harbour, and the Chathams are easily referable to *E. cheesemani*. Richardson had similarly seen nothing to substantiate the records of *laevis* Bell, *tumefacta* Mont., and *tuberculosa* Milne-Edwards."

These dimensions are exceptional, few specimens exceeding 8 mm in length.

DISTRIBUTION: Endemic, from Hauraki Gulf to Stewart Island and the Chatham Islands.

Ebalia tuberculosa (A. Milne Edwards)

Persephona tuberculosa A. M. Edw., *J. Mus. Godeffroy 1* (*4*) : 10, 86; 1873.
Haswell, Cat. Aust. Crust., pp. 86, 132; 1882.
? *Phlyxia granulosa* Haswell, *Proc. Linn. Soc. N.S.W. 4* : 54, pl. 6, fig. 3: 1880.
Ebalia tuberculosa Miers, *Challenger Rep. Zool. 17* : 305, 306, pl. 25, fig. 1; 1886; also in Narrative, *ibid. 1* (*2*) 587: 1885.
Whitelegge, *Mem. Aust. Mus. 4* : 161; 1900
Grant, *Proc. Linn. Soc. N.S.W. 30* : 315; 1905.
Rathbun, *Bull. U.S. Fish Comm. 1903*, pt. 3, p. 889; 1906.
Rathbun, *Biol. Res.* "*Endeavour*" *5* (*3*) : 134, pl. 35, figs. 1, 2; 1923.
Hale, Crust. S. Aust., p. 197, fig. 198; 1927.

This species is the only one admitted to the list without contemporary verification. The record by Miers (1886) from *Challenger* material, unlike those from the older museum collections described by him in 1876, is not open to *a priori* suspicion, and no similar locality has been explored since. The record by Thomson to which Chilton (1906b, p. 266) refers has not been published; in any case Thomson's specimens labelled *E. tuberculosa* prove to be *E. laevis*, and specimens similarly identified by Chilton are *Merocryptus lambriformis*.

PREVIOUS RECORD: Off New Zealand, *Challenger* Station 167, 150 fm, about 150 miles W of New Plymouth (Miers 1886).

DISTRIBUTION: Australia, Hawaii, South Africa, Agulhas Bank, New Zealand.

Genus **Merocryptus** A. Milne Edwards

Merocryptus A. M. Edw., *J. Mus. Godeffroy 4* : 85; 1873.
Von Martens, *Zool. Rec.*, 1874, p. 206.
Miers, *Challenger Rep. Zool. 17* : 319; 1886.

Branchial regions prolonged into cylindrical appendages overlapping the base of the three hinder pairs of ambulatory feet (von Martens). The type species is the following.

Merocryptus lambriformis A. Milne Edwards, Fig. 108

Merocryptus lambriformis A. M. Edw., *J. Mus. Godeffroy*, *4* : 85, pl. 13, fig. 1–1c; 1873.
Miers, *Challenger Rep. Zool. 17* : 320; 1886.
Whitelegge, *Mem. Aust. Mus. 4* (*2*) : 162; 1900
Balss, *Arch. Naturges. 88* : 126; 1922
Rathbun, *Biol. Res.* "*Endeavour*" *5* (*3*) : 133, pl. 32, fig. 2, 3; 1923.
Hale, Crust. S. Aust., p. 201, fig. 202; 1927.
Ebalia rugulosa Yokoya, *J. Coll. Agric., Tokyo Imp. Univ. 12*, i, p. 124, fig. 43; 1933.
Merocryptus lambriformis Sakai, *Sci. Rep. Tokyo Bunrika Daig. B*, *1* (*25*) : 285, 289; 1934.

This distinctive little crab, whose identity is scarcely in doubt even though no Australian material is available for comparison, adds a genus and species to the New Zealand fauna and a further link with Australia and Japan.[8]

MATERIAL EXAMINED: 1 male, 3 females, 35 fm, off Little Barrier, 29/12/24; (Ch, 21).

DISTRIBUTION: Australia, Japan, New Zealand.

[8] N.Z. figures and discussion of this species by R. Serene, 1955 (*Treubia 23*: 145, and figs. 1, 2).

Subsection **GYMNOPLEURA** Bourne

Gymnopleura Bourne, *J. Linn. Soc. Lond.* (*Zool.*) *35* : 25, 55; 1922a.
Bourne, *Nature, Lond.*, *109* : 108; 1922b.

Family RANINIDAE Dana

Genus **Lyreidus** de Haan

Lyreidus de Haan, Fauna Japonica, p. 140; 1841.
Henderson, Challenger Rep., *Zool. 27* : 33; 1888.
Alcock, *J. Asiat. Soc. Bengal* (*2*) *45* : 294; 1896

A solitary specimen with a symmetrical arostrate front caused much trouble in identification until recognised as an abnormal member of this genus; normal rostrate specimens have since been seen. Wood-Mason was misled by an Indian specimen, which he described as *L. gracilis*, but which proves to be only an arostrate specimen of his own species *L. channeri* (see Alcock 1896, pp. 294, 295). These deceptive and curiously parallel cases appear less likely to represent variation or dimorphism than to be traumatic consequences of the habits, for as inferred by Bourne (1922a), members of this family probably burrow into the microlithic substrata which they frequent, and protrude only the tip of the snout for respiration.

Cosmonotus Adams and White (1847, pp. 227; 1848, p. 60; Henderson 1888, p. 32; Alcock 1900, p. 291) differs from *Notopus* de Haan (1850, p. 137; Dana 1852, p. 404; Henderson 1888, p. 31; Alcock 1900: 290) chiefly in the absence of a rostrum. Although Alcock and Bourne noted that these two genera (and *Ranilia*, united by Bourne with *Notopus*) differ from all other Raninidae in possessing an elongated antennary flagellum and are otherwise closely allied, these authors have not suspected that the absence of a rostrum in the one case may have been due to breakage.

The confusion of two species through difficulty in recognising trauma suggests that in a third case an unnecessary generic distinction was made (cf. classification by Ortmann, 1892). It may however be noted that in the local species of *Lyreidus*, the antennary flagellum is more vulnerable than the rostrum, being partly or completely lost in all of the specimens seen except one, which had undergone ecdysis shortly before preservation.

There has been no opportunity "to make observations and experiments on the living animals", as desired by Bourne (1922a, p. 71), but in confirmation of his very plausible inference that an inhalant respiratory current enters the orbits and passes between the antennules and the antennae (fig. 8), attention may be drawn to the presence, in the New Zealand species at least, of a notch at the side of the "spout" of the antennary sternite, and the concavity of the ventral surface of the adjacent subantennary lobe of the pterygostome; this provides the requisite continuation of such a passage, the floor being the tip of the merus of the third maxilliped, which in this genus extends forwards to an exceptional degree.

Bourne (1922a, p. 58) stated that in *Ranina* the basi-ischiopod of the cheliped is immovably fused to the merus; although only dried specimens are available to the author this observation is probably in error as there appears to be some movement; in *Lyreidus* there is the usual slight movement. The axes of rotation of the joints of the cheliped, represented diagrammatically in fig. 9, are remarkable in that they lie in three planes, each at right angles to the adjacent ones. The actual movements are shown in fig. 5, in which the right chela is extended outwards to almost the maximum extent possible; by the movement of the basi-ischiopod on the coxa the limb can be rotated from this position upwards until it is well above the dorsum, and also strongly downwards; the rotation of the carpus on the merus carries the wrist and hand still further downwards, until (even with the merus bent up to the utmost) the wrist and hand are vertical with the fingers pointing outwards. The position of the left chela shows the way in which the hand rotates inwards or outwards on an axis that is longitudinal when the limb is outstretched, carrying the fingers through a vertical downward position in the process. This is similar to the movement in *Ranina*, where according to Bourne (1922a, p. 59) the purpose is to "rake sand or other material from beneath the anterior part of the carapace, the raking action being facilitated by the five large spines (three in *Lyreidus*) on the lower margin of the propodus. Thus a more or less clear water-way is kept on the under side of the anterior part of the thorax". In that case the similarity between the two genera in the structure and movement of the limbs is not accounted for, because in *Lyreidus*, as stated by Bourne, the posterior branchial orifices of *Ranina* are undoubtedly missing, and no such water-way is needed. But it becomes necessary if an inhalant stream supplementary or alternative to that mentioned above is assumed to enter at the sides of the third maxillipeds; the exopod and merus of these joints are fringed with hairs, and there is a line of sparser hairs in a corresponding position along the pterygostome. In the material examined a slight amount of fine silt was found among these hairs. There are similar hairs in *Ranina*, where also there is a narrow median gape, expanded at the insertion of the palps, and bridged by hairs. But observation of living specimens is imperative before the course of the currents, which may be expected to prove complex, can be stated with any degree of assurance; it might be, for example, that the main current is through the orbits, and that the passage is periodically cleaned by a backrush of water in the opposite direction, the water required for this jet being taken in below the maxillipeds.

The genus, which requires revision,[9] includes the following species:

1. *Lyreidus tridentatus* de Haan 1841, p. 140, pl. 35, fig. 6, and pl. J; Ortmann 1893, p. 574; Parisi 1914, p. 306; Balss 1922, p. 121; Yokoya 1933, p. 110; Sakai 1934, p. 283.

[9]But see Sakai (1937, *Sci. Rep. Tokyo Bunrika Daig., B, 2* : 169); all known species considered.

Type loc., Japan; further distribution doubtful (the records from Australia and New Zealand being incorrect, that from New Caledonia is highly doubtful, and those from Fiji and Dar-es-salaam – the latter a Tanganyikan locality – at least require revision).

1b. *L. elongatus* Miers 1879, p. 46; type loc., Kada Bay, Manchukuo; considered by Henderson (1888, p. 34) to be a valid species, but united by Yokoya (1933, p. 110) and others with the preceding.

2. *L. politus* Parisi 1914, p. 34, pl. 13, fig. 5; Gordon 1931, p. 532; Yokoya 1933, p. 112; Sakai 1934, p. 283, pl. 18, fig. 5.
Type loc., Japan; further distribution, China (Gordon).

3. *L. integra* Terazaki, cited by Shen 1931b, p. 190, text-fig. 7, pl. 12, fig. 2. (The page numbered 190 in this publication should precede that numbered 189, of which the text and figures refer to the present species. The *Zoological Record* has been searched in vain for the original reference.)
Distribution, China and Japan.

4. *L. channeri* Wood-Mason, *Proc. Asiat. Soc. Bengal*, 1885, p. 104; Wood-Mason, *J. Asiat. Soc. Bengal 56* : 206, pl. 1, 1887; Alcock 1896, p. 294; syn., *L. gracilis* Wood-Mason *tom. cit.* 1887, p. 376.
Type loc., India.

5. *L. australiensis* Ward 1933, p. 377, pl. 23, fig. 10; syn., *L. tridentatus auct. austr. nec* de Haan (Haswell 1882c, p. 144; Henderson 1888, p. 33; Whitelegge 1889, p. 231, and 1900, p. 165; Bourne 1922, p. 25 *et seq.*, pl. 4, figs. 4, 10, pl. 6, figs. 25, 38, 39, pl. 7, figs. 51, 52, 53; perhaps also Doflein 1902, p. 654, and 1904, p. 52).
Type loc., New South Wales; further distribution south-eastern Australia and presumably New Caledonia.

6. *L. bairdi* Smith, *Proc. U.S. nat. Mus. 3* : 420, 1888, and *6* : 24, 1883.
Type loc., New England, U.S.A. (fossil).

7. *L. alseanus* Rathbun, *J. Wash. Acad. Sci. 22* : 239; from the Oligocene of Washington.

8. *L. fastigiatus* Rathbun, *Carnegie Inst. Publ. 291* : 168, 1918; from the Oligocene of Anguillas, West Indies.

9. The following species; in addition, the family and probably the genus are represented by local fossil material collected by the author.[10]

Lyreidus fossor n. sp., fig. 5–9, 106

Lyreidus tridentatus Chilton, *Trans. N.Z. Inst. 38* : 266; 1906 (*nec* de Haan).

Outline of carapace (fig. 5, 106) straight or faintly convex in front of the lateral spines, longitudinal behind the latter and converging thereafter to the broadly rounded postero-lateral corners. The lateral spines project distinctly beyond the outlines of the carapace; the outer margin is convex and the inner strongly concave, tip acute and directed forwards or slightly inwards. Rostrum triangular, acute, flat above, broader than long, reaching the same level as the orbital spines or a trifle longer, orbits deeply incised above, extending well back into the dorsum as in *L. australiensis*. The orbit is distinctly notched above at the base of the orbital spine; the latter has the outer margin straight and a little convergent, obscurely ridged, inner side strongly concave; orbits densely fringed with hairs inside the margins.

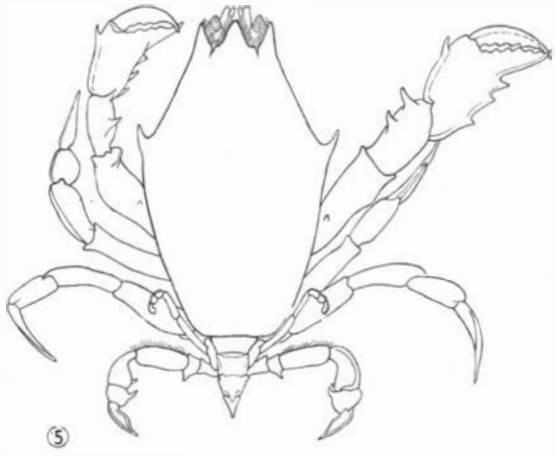
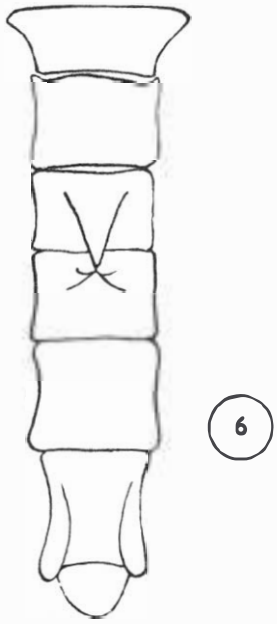


FIG. 5: *Lyreidus fossor* n.sp.; male in dorsal view, × 1¾.



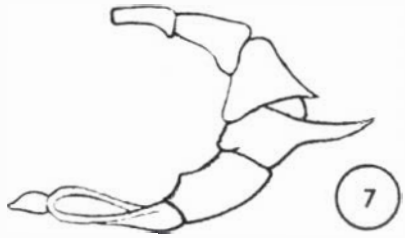


FIG. 6–7: *Lyreidus fossor* n. sp.: 6, male abdomen, dorsal, × 4; 7, male abdomen, lateral, flexed in normal position, × 4.

[10] See Glaessner 1960, p. 17 – *Lyreidus elegans*, from the New Zealand Miocene, "the ancestor of the living *L. tridentatus*, which is represented in Australian and New Zealand waters by *L. australiensis* Ward".

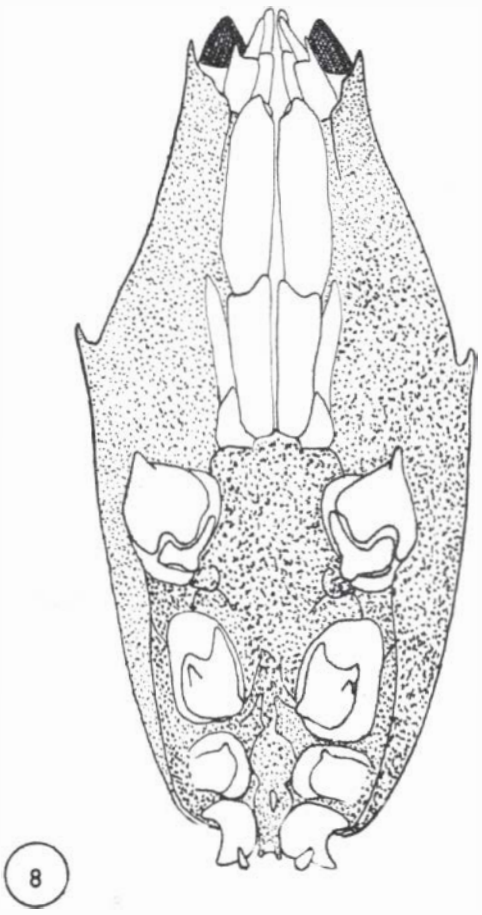


FIG. 8: *Lyreidus fossor* n. sp.; large male in ventral view, showing fusion of pleura with sternum behind chelipeds and legs 1–2, limbs and limb bases unshaded, × 4.

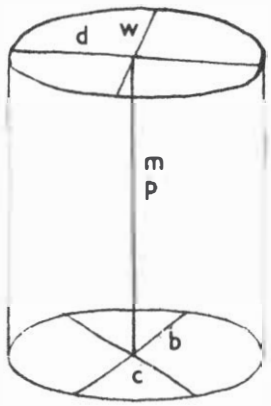


FIG. 9: *Lyreidus fossor* n. sp.; axes of rotation of male cheliped, b. basis, c. coxa, m.p. merus and propod, w. wrist, d. dactylus.

The dorsum is finely and uniformly punctulated; the postero-lateral margin is defined by a fine minutely granulated ridge, which increases posteriorly; the sides below the margins are finely granulate, the granules spreading up over the margin in front, where they are seen in profile to be acute and forwardly directed. Rostrum punctulated like the rest of the dorsum. The sternum, abdomen, outer maxillipeds, and thoracic epimera below the branchiostegite are almost smooth. The carapace is devoid of hairs.

The eyestalks and corneae taper to a pointed tip; cornea oval from below, triangular above, small, slightly surpassing the rostrum or orbital spines when extended. Second joint of antenna convex and granular below, with a prominent outer distal blunt tooth; excluding the latter, the joint is overlapped through seven-eighths of its length by the outer maxillipeds.

The first segment of the male abdomen (fig. 6, 7) is much wider at the base than any other, the sixth much narrower than the rest except the seventh, which is rounded-triangular and very small. Segments 5 and 6 equal in length, 2 and 4 somewhat shorter, 3, 1, and 7 decreasing in that order. The spinule of the third segment is on the posterior margin of the latter, overhanging it, small, acute. The spine of the fourth segment is situated on the front half of the segment, strong, acute, as long as the segment, slightly upturned but otherwise horizontal when the abdomen is fully flexed. The sixth segment is winged throughout its length, the "wings" expanding into elongate sockets for the reception of the pterygoid processes of the sternite of the first pair of pereiopods. The abdomen of the female is very slightly wider, joints 6 and 7 longer; spinule on third segment a blunt obsolescent point.

Chelipeds (figs. 5, 106) short, fingers just reaching the tips of the orbital spines in the male, falling short of this in the female, of which the cheliped is also a little slenderer. All joints beyond the basal ones are minutely and uniformly punctulate-granulate. The merus is a little flattened within, otherwise nearly cylindrical to about three-quarters of the length, where it is highest and widest; thereafter it narrows somewhat. Carpal spines conical, acute, pointing a little forwards, distal one 1½ times the proximal. The upper margin of the palm is occupied by a crest, which commences at the articulation, and at three-quarters of the length of the joint is terminated by the large upper spine; crest of the lower margin obsolescent except basally and on the finger; there are three lower spines, the distal one three times as high as the proximal and the middle one intermediate; the anterior margins of the spines are straight and at right angles to the joint. The outer margins of the fingers are cristate, the inner bear blunt triangular teeth increasing distally, smaller on the movable finger (where in fact they are almost absent in the only female in the collection possessing complete hands), about four in the male not counting the long smooth and strongly crossed terminal unguis; the teeth of the fixed finger alternate but continue further distally, the unguis shorter and strongly hooked; a narrow basal gape.

Walking legs smooth, the order of length 2, 1, 3, 4. First two pairs glabrous and unarmed; merus of third hairy above and carpus with reflexed spine near but not on the lower margin; carpus of fourth pair fringed below with hairs, distal three joints shortly fringed above, dactylus

serrated above. Carpus of legs 1–3 a little crested above, propod and dactylus strongly crested above and below. Dactylus of second leg twisted into a plane at right angles to the normal, the posterior margin becoming external and similar in outline to the anterior (internal), the crests of both upturned. Ischium of fourth pair at least as long as the merus; basal joint produced into a flat plate, which ends in a spine extending nearly to the end of the second abdominal segment; in the male there is also an inner lobe as long as the spine but covered by the abdomen, and giving rise to the external spermiduct (fig. 8).

HISTORY AND RELATIONSHIPS: The Australian species, long considered identical with the Japanese *L. tridentatus* de Haan, has been separated by Ward (1933, p. 377), and the New Zealand species, which was similarly identified by Chilton, appears to differ from both. It agrees with *L. australiensis* and differs from *L. tridentatus* in the width of the carapace, provided the lateral spines are excluded, and in the extent to which the orbits cut into the frontal margin. It differs from *L. australiensis* in that the lateral spines project well beyond the outline of the carapace, the cheliped is shorter but the merus stouter, the movable finger is much more slender, and the outline of the dactylus of the third leg is different. Ward states that in *L. australiensis* the fifth abdominal segment of the male is almost twice as long as the fourth, but in his figure, as also in *L. fossor*, they appear nearly equal; possibly the intention was to refer to the sixth segment, which is long and narrow in *L. fossor* and according to Bourne in *L. australiensis* also. Bourne (1922: pl. 6, fig. 38) represents the third joint of the protopod of the antennule as distinctly shorter than the second; in *L. fossor* they are equal in length.

The relationships of *L. fossor* appear to be with *L. australiensis*, but the descriptions of the various species lack uniformity and a general revision is desirable.[11]

MATERIAL EXAMINED: 2 males, 2 females (1 ovig.), and a large arostrate male exoskeleton possibly from the same series; Bay of Plenty, N of Whale Island, 67 fm, *Hinemoa* exped., 19/12/14 (C).

PREVIOUS RECORD: Hauraki Gulf, 60 (?) fm (Chilton 1906b).

TYPE: A male from the above series (C).[12]

OVIGEROUS FEMALE: The berried specimen has more than 1,000 eggs, about 0·5 mm in diameter; the abdomen is outstretched in line with the carapace, except that the last two joints are bent vertically downwards; the abdominal sulcus is full of compact sand.

DIMENSIONS: Length, type, 35 mm approx.; large male, 45 mm approx.

DISTRIBUTION: Endemic, Hauraki Gulf and Bay of Plenty.

[11]Dell (1956) recorded a Dominion Museum specimen of *Lyreidus* as *L. tridentatus* de Haan 1841, following McNeill's (1953) confirmation of the identity of *L. australiensis* Ward with *L. tridentatus* de Haan based on comparison of Japanese and Australian forms. Richardson and Kreft (1949) have also recorded it from Cook Strait (as *L. australiensis*) and Powell (1949) listed a number of occurrences in the Bay of Plenty (as *L. tridentatus*).

[12]In Canterbury Museum 1962; C. M. Crus. 2.

Subsection **DROMIACEA** de Haan

Dromiacea de Haan, Crust. Japon., p. 102; 1850.
Henderson, *Challenger Rep., Zool. 27* : 2; 1888 (refs.).
Borradaile, *Ann. Mag. nat. Hist.* (*7*), *19* : 480; 1907.

Family LATREILLIDAE Alcock[13]

Latreillidae Alcock, *J. Asiat. Soc. Bengal* (*2*) *68* : 130; 1899. Cat. Crust. Ind. Mus., pt. 1, fasc. 1, p. 70; 1901.

Genus **Latreillopsis** Henderson

Latreillopsis Henderson, *Challenger Rep., Zool. 27* : 21; 1888.
Alcock, *tom. cit.*, 1899 : 165, and 1901 : 72.

In addition to the following species, which adds a genus and species to the New Zealand fauna, the following species have been described, the first named being the type:

1. *L. bispinosa* Henderson 1888, p. 22, pl. 2, fig. 3; Alcock 1900, p. 166; Alcock 1901, p. 73, pl. 7, fig. 26; Doflein, *Abh. Akad. Wiss., 21* : 650, pl. 4, figs. 3, 4, 1902; Ihle, Die Decapode Brachyura der Siboga Exp., I, Dromiacea, Mon. 39 *b* : 77, 1913; Balss 1922, p. 115; Yokoya 1933, p. 103; Sakai 1934, p. 282.
   Type loc., Phillippine Islands; further distribution, Andamans, Japan.
2. *L. multispinosa* Ihle, *Tijdschr. ned. dierk. Ver.* (*2*), *12* : 211, 1912, and *Ibid.* 1913 : 78.
   Type loc., Malay Archipelago.
3. *L. alcocki* Stebbing, *Ann. S. Afr. Mus. 17* : 254, pl. 103; 1920.
   Type loc., South Africa.
4. *L. hawaiiensis* Edmondson, *Occas. Pap. Bishop Mus. 9* (*24*) : 5 (figs.); 1932.
   Type loc., Hawaii.

Latreillopsis petterdi Grant, Fig. 109

Latreillopsis petterdi Grant, *Proc. Linn. Soc. N.S.W. 30* : 317, pl. 10, figs. 2, 2a, 2b; 1905.
McCulloch, *Rec. Aust. Mus. 6* : 353, pl. 65; 1907.
Rathbun, *Biol. Res. "Endeavour" 5* : 140, pl. 36; 1923.
Hale, Crust. S. Aust., p. 114, fig. 112; 1927.

The only specimen known from New Zealand waters was taken in March 1929 at Cape Palliser and was presented by the New Zealand Trawling Company to the Dominion Museum, Wellington.[14] It adds another genus and species to the New Zealand fauna. The above identification is from a photograph (fig. 109) by Mr C. J. Lindsay, and confirms an earlier unpublished identification by Dr A. W. B. Powell, with a few small reservations.

The agreement with regard to the spinulation of the legs, chelipeds, and hepatic regions is not free from doubt, and there is no sign of the conspicuous spine described and figured by McCulloch close below the supra-orbital horn; in comparison with McCulloch's figure, the upper distal spine of the merus of the legs is less strong, the dactyli shorter and stouter, and the eyestalks shorter; the third and fourth pairs of legs are also shorter, and although the first pair agree in total length the merus is longer. Rathbun's measurements of the rostrum and supra-orbital horn are difficult to understand; they would imply that these structures are much shorter in the New Zealand specimen, which, however, agrees well with McCulloch's figure in this respect. The horns are distinctly parallel; McCulloch and Hale represent them as divergent, but Rathbun's figure suggests that they are convergent; perhaps the shape as well as the relative length varies with age. Rathbun's statement that there are six rows of hairs on the dactyli of the legs appears to be a slip, as she enumerates only five, the number mentioned by McCulloch.

TYPE: An immature male, Australian Museum; type loc., 250–300 fm, about 28 miles E from Port Jackson Heads.

DISTRIBUTION: Southern and south-eastern Australia, New Zealand.

Family DROMIIDAE Dana

Dromiidae Borradaile, *Ann. Mag. nat. Hist.* (*7*) *11* : 297; 1903.

Genus **Petalomera** Stimpson

Petalomera Stimpson, *Smiths. Misc. Coll. 49* : 179; 1907.

Petalomera wilsoni (Fulton and Grant), Fig. 141

Cryptodromia lateralis Heller, *Novara Exped. Zool. 2* (*3*) : 71; 1868 (not of Gray, in part at least).
Miers, Cat. Crust. N.Z., p. 57; 1876 (not of Gray).
Thomson, *Trans. N.Z. Inst. 31* : 170, pl. 20, figs. 1, 2; 1899 (not of Gray).
Cryptodromia wilsoni Fulton and Grant, *Proc. roy. Soc. Victoria, n.s., 15* : 61, pl. 9; 1902.
Cryptodromia lateralis Chilton, *Trans. N.Z. Inst. 44* : 129; 1911 (not of Gray).
Dromia pseudogibbosa Parisi, *Atti Soc. ital. Sci. nat. 54* : 5, pl. 2, figs. 1, 2; 1915.
Petalomera wilsoni Rathbun, *Biol. Res. "Endeavour" 5* (*3*) : 154, pl. 42, fig. 1; 1923.
Hale, Crust. S. Aust., p. 113, fig. 111; 1927.

The following slight qualifications to McCulloch's admirable description published by Rathbun (1923) refer to Australian and New Zealand specimens. The upper margin of the hand has a few granules; all three margins of the merus of the cheliped have small granules, or the upper may be smooth; the upper subhepatic tubercle is distinct but may not be acute; the tubercle on the ridge behind the cervicle groove, though moderately developed in some specimens, is scarcely recognisable in others; the dactyli of the anterior two pairs of walking legs have several sharp spinules on the lower margin.

[13]=Fam. Homolidae, *fide* Balss 1957.

[14]This record has been published in some detail by Dell (1956), and Richardson (1949b, p. 61) briefly mentioned it.

The peculiar pits in the tomentum are due to the distribution, relative lengths, and directions of the hairs; they consist of small bare patches surrounded by short hairs, which are shortest near the patches. In dried specimens the hairs lie away from the patches and the pits become conspicuous, but in spirit specimens the pits may be covered by hairs lying across them and scarcely recognisable. Similarly the hairs bend away from the base of a furrow and lie up against an elevation. On the limbs, including the third maxillipeds, they are directed distally and converge along the ridges and around the nodules; the submarginal hairs point forwards and upwards, the dorsal ones stand erect except around the pits and posterodorsally where they are overlain by the last legs and point forwards. In addition to the anterior row of pits, there is a ring on the gastric region (2 pairs and 2 median) and others of varying sizes on the branchial region and on the female abdomen, more numerous than indicated by McCulloch.

The carpus of the second and third walking legs has one nodule and the propod two, including one at the side of the admirable articulatory mechanism. In both sexes a calcareous plate is intercalated on each side of the abdomen between the sixth and seventh segments.

HISTORICAL: The four specimens examined are the only dromids reliably known from New Zealand. The Australian species that they add to the New Zealand list ousts the record of *Cryptodromia lateralis* (Gray) (*Dromia lateralis* Gray, Zool. Miscell., p. 40, 1831; *Cryptodromia lateralis* Stimpson 1858, p. 77; Henderson 1888, p. 5 – refs.; *Petalomera lateralis* Rathbun 1923, p. 153 – refs.; *Paradromia lateralis* Balss 1922a, p. 104), first recorded from New Zealand by Heller (1868) and doubtfully confirmed by Miers (1876b), the record having always been very insecurely founded on account of the unreliability of both authors with respect to the sources of their material, and their admitted uncertainty as to the identity of their specimens. Chilton (1911) recorded *C. lateralis* from Hauraki Gulf, but his specimen (fig. 141) proves on examination to be *P. wilsoni* (F. and G.), and no reliable grounds remain for retaining *Petalomera* (or *Paradromia*) *lateralis* (Gray) in the New Zealand list, or for knowing whether Heller and Miers made a taxonomic or a geographic error, or whether Heller's records of *C. lateralis* from Sydney may apply to *P. wilsoni*.

HABITS: The New Zealand specimens were obtained from 23–35 fathoms. There is no indication of the usual mask of ascidians or sponges.

MATERIAL EXAMINED:

1 female, small, Moko Hinau, 30 fm, coll. C. R. Gow, –/3/15 (C).
1 female, Hauraki Gulf, 22 fm, coll. Capt. Bollons; det. by Chilton as *C. lateralis*. (Ch).
1 male, –/12/14 (C, 21).
1 female juv., Little Barrier, 35 fm, 29/12/14 (C, 21).

DISTRIBUTION: Australia, New Zealand.

Subsection **BRACHYGNATHA**

Superfamily OXYRHYNCHA Latreille

Oxyrinques, Oxyrinchi, Latr., Hist. Nat. Crust. et Insect., Vol. 6, p. 85.
Majoidea or Oxyrhyncha Dana, *U.S. Explor. Exped.*, Crust. pt. 1, pp. 66, 67, 75; 1852.
Oxyrhyncha Alcock, *J. Asiat. Soc. Bengal (2) 64 (2)* : 159; 1895 (literature).
Rathbun, *Bull. U.S. nat. Mus. 129* : 9; 1925 (literature).
Balss, *Denkschr. Akad. Wiss. Wien 12* : 1; 1929.

Carapace more or less narrowed in front, and usually produced to form a pseudo-rostrum; branchial regions considerably developed, hepatic regions small. Epistome usually large; buccal cavity quadrate, with the anterior margin usually straight. Branchiae almost always nine on either side; their efferent channels open at the sides of the endostome or palate. Antennules longitudinally folded.

Family MAJIDAE Alcock

Maiidae Alcock, *J. Asiat. Soc. Bengal (2) 64 (2)* : 160, 162, 168; 1895.
Majidae Rathbun, *Bull. U.S. nat. Mus. 129* : 10; 1925 (literature).
Balss, *Denkschr. Akad. Wiss. Wien 12* : 2; 1929 (literature).

Chelipeds especially mobile, rarely much greater than the other legs or with fingers bent at an angle on the hand. Second joint of antenna well developed, generally fused with epistome and often with the front. Orbits generally more or less incomplete. Hooked hairs almost always present. Male apertures coxal. The palp of the external maxillipeds is articulated either at the summit or at the antero-internal angle of the merus.

Subfamily INACHINAE Alcock

Inachinae Alcock, *J. Asiat. Soc. Bengal 64* : 160, 162, 168; 1898.
Rathbun, *Bull. U.S nat. Mus. 129* : 11; 1925.
Balss, *Denkschr. Akad. Wiss. Wien 102* : 3; 1929.

The eyes are without orbits; the eyestalks are generally long, and are either non-retractile or retractile against the sides of the carapace or against an acute post-ocular spine, which affords no concealment. The basal article of the antenna is extremely slender throughout its length and is usually long.

Series I. MACROCHEIROIDEA Balss

Macrocheiroidea Balss, *Denkschr. Akad. Wiss. Wien 102* : 3; 1929

An intercalary spine is present.

Of the two alliances distinguished by Alcock, the Leptopodioida are primitive with respect to the basal joint of the antenna (free and cylindrical) and third maxillipeds (subpediform, merus narrower than ischium), while the Inachoida are more specialised in both respects. The new grouping, as also among the Pisinae and Majinae, allows recognition of such evolutionary trends, more or less parallel in the two subdivisions, and of other trends with respect to the rostrum and pseudorostrum and the freedom or fusion of abdominal joints.

Genus **Cyrtomaia** Miers

Cyrtomaia Miers, *Challenger Rep., Zool. 17* : 14; 1886.
Doflein, *Wiss. Ergeb. Valdivia, 6* : 53; 1904.
Alcock, Deep Sea Brachyura, p. 44; 1899.
Balss, *Arch. Naturg. 90* : 23; 1924.
Echinomaia Borradaile, *Brit. Ant. Exped. 1910, 3* : 102; 1916.
Cyrtomaia Balss, *Denkschr. Akad. Wiss. Wien 102* : 3; 1929.

Carapace subcircular, strongly convex with the hinder two-thirds tumid, dorsum prominently spinose. Rostrum persistent, partially deflexed; pseudorostrum consisting of two short and usually blunt and slightly divergent lobes. Ocular peduncles long and slender, or short and stout; cornea with one or more spinules. Basal joint of antenna fixed and spinose; like the two succeeding peduncular articles, it may be cylindrical or lamellate. Buccal cavern square; third maxillipeds subpediform, ischium and merus subspinulous; merus longer than broad and much shorter and narrower than ischium, antero-lateral angle a spinulous lobe; palp terminal on the truncate distal extremity; exognath long and slender. Abdomen seven-segmented in both sexes, spinulose. Sternum spinulose. Chelipeds long, slender, strongly spinulose, palm and fingers elongate and compressed, gape usually linear if any. Ambulatory legs longer and more slender than the chelipeds, first two pairs strongly spinulose, spines obsolescent or absent on third and fourth pairs except for terminal spinule on upper margin of merus.

This new generic diagnosis is only a provisional and temporary substitute for the connected study of the genus that is required, for although the New Zealand species is the only one that has so far been the victim of synonymic complications, the lack of uniformity in description leaves the validity of some species an open question. There are prominent differences in the number and distribution of the dorsal spines, in the size of the ocular peduncles, and in the shape of the basal and peduncular joints of the antennae. The obscure pubescence on the anterior part of the dorsum in *C. hispida* and evidently several other species is easily overlooked and may occur in all. The palp of the third maxilliped scarcely arises from the antero-internal angle of

the merus, as asserted by Miers. A census of the species and subspecies so far claimed includes the following sixteen names:

1. *C. murrayi* Miers 1886, p. 15, pl. 3, fig. 1.
2. *C. suhmi* Miers 1886, p. 16, pl. 3, fig. 2.
3. *C. smithi* Rathbun 1893, p. 229; Rathbun 1906, p. 877, pl. 6, text-figs. 34, 35.

3b. *C. smithi* var. *tenuipedunculata* Ihle and Ihle-Landenberg, *Zool. Anz.*, 1931, p. 153.

4. *C. lamellata* Rathbun 1906, p. 879, text-fig. 36.
5. *C. septemspinosa* Rathbun, *Proc. biol. Soc. Wash. 45* : 30; 1932; Yokoya 1933, p. 144; Sakai 1934, p. 294.
6. *C. horrida* Rathbun 1916, p. 532; Yokoya 1933, p. 145.

6b. *C. horrida* var. *japonica* Balss 1924a, p. 23.

6c. *C. horrida* var. *pilosa* Ihle and Ihle-Landenberg, 1931, p. 154.

7. *C. echinata* Rathbun 1916, p. 533.
8. *C. goodridgei* McArdle, *Ann. Mag. nat. Hist.* (*7*) *6* : 472, 1900; McGilchrist, *ibid.*, *15* : 251, 1905; Alcock and Anderson, 1902, pt. 10, pl. 59, figs. 1–1c, and 1907, pt. 12, pl. 78, figs. 2–2a; Balss 1929, p. 4; Rathbun 1916 : 533.
9. *C. maccullochi* Rathbun 1918a, p. 4, t. figs. 1, 2, pts. 1, 2. Hale 1927, p. 126, fig. 124.
10. *C. hispida* Borradaile 1916 (refs. below).
11. *C. bicornis* Ihle and Ihle-Landenberg, 1931, p. 156.
12. *C. balssi* Ihle and Ihle-Landenberg, 1931, p. 157.
13. *C. platypes* Yokoya 1933, p. 145, text-fig. 32; Sakai 1934, p. 294.

Cyrtomaia hispida (Borradaile), Fig. 10–16, 110

Echinomaia hispida Borradaile, *Brit. Ant. Exped. 1910*, *Zool. 3* : 104, fig. 13; 1916.

Cyrtomaia hispida Balss, *Denkschr. Akad. Wiss. Wien. 102* : 3; 1929.

? Cyrtomaia platypes Yokoya, *J. Coll. Agric., Tokyo Imp. Univ. 12* : 145, text-fig. 52; 1933.

Sakai, *Sci. Rep. Tokyo Bunrika Daig. 1* : 294; 1934.

Rostrum (fig. 10, 16) strongly deflexed, truncate, tip as wide as ocular peduncle and minutely notched. Pseudorostral spines small, sharp, horizontal, arising acuminately from slightly diverging granulate and sparsely haired cigar-shaped lobes, which are joined by low granulous ridges, close together at the sides of the median groove, to the apex of a triangle defined by three rows of granules on the mesogastric region. Orbits strongly arched, granular, without a pre- or supra-orbital spine. Most of the anterior half of the carapace is sparsely pubescent, and parts of the abdomen and sternum.

The dorsal spines (fig. 10, 110) are serrated, the branchials hooked forwards at the tip; the largest spines are the post-oculars, branchials, and perhaps paired gastrics (broken). The oculars are joined by a strong ridge which passes through a U-shaped curve behind the gastric region, with a median gastric spine at the narrowly rounded hindmost part; the remaining pair of gastric spines lies close between the two ridges (which are reduced hereabouts almost to a row of granules) and the above-mentioned triangular outline of granules. There is a spine on the margin of the well defined inflated hepatic region, and on each side one branchial and a slightly enlarged granule nearly midway between it and the posterior margin (an obsolete

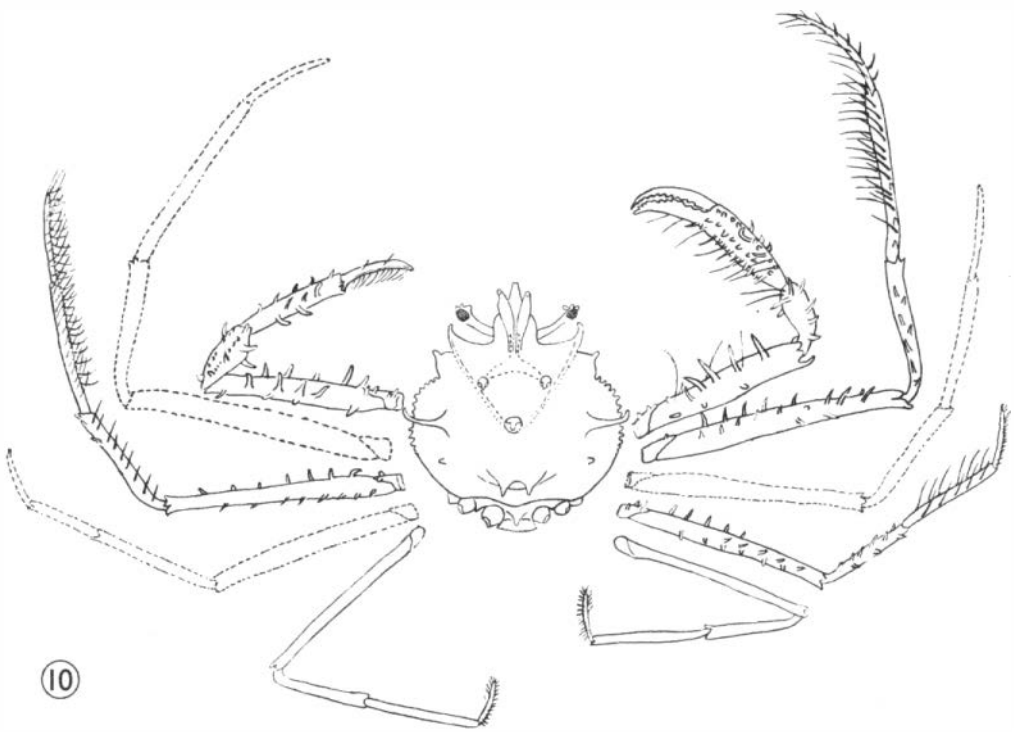


FIG. 10: *Cyrtomaia hispida* (Borradaile), male from Otago, dorsal, × 2½.

second branchial spine ?); the cardiac region is a strongly raised transverse lobe as high as the pair of spines which it bears, broadly U-shaped between them. The carapace is irregularly sprinkled with low granules, the frontal and most of the hepatic region forming a smooth track. The margin of the branchial region has 14–15 spinulose granules.

Subhepatic region with subspinulous granules; on the sternites corresponding to the walking legs are scattered granules and a transverse row of larger ones, replaced on the cheliped sternite by a symmetrical forwardly pointing V. The abdomen of the male (fig. 13) has a few submedian granules, a large serrated spine on the first segment, three on the second, and a small one on the penultimate.

The eyestalks are long, slender, cylindrical; eyes wider, with a terminal granule, another in front opposite the cornea, and a third one below. Antennule with basal joint enlarged, flat below, flagellum arising from inner side and folding into a shallow fossa below the pseudo-rostrum. Antenna (fig. 15) with basal joint flattened below with a terminal and a subterminal spinule, outer margin cristate with a distal lateral lamella cut into about seven spinules, visible from above and three spines further back. The two following peduncular joints are produced on the outer side into a broad papery lamella, quadrilateral, margins entire; flagellum as long as the buccal frame.

Epistome lozenge-shaped, sunken, twice as broad as long. Buccal frame square, postero-lateral margins a slightly raised smooth rim, anterior corners produced into a shovel-like lamella, visible from above, with about 10 spinulous granules around the margin; anterior margin further back and much sunken.

Third maxillipeds (fig. 12) with exposed surfaces granulated, inner margin of ischium finely denticulate, a little curved, somewhat produced at distal corner, outer margin straight, length twice the breadth; merus half as long and narrower, with a prominent five-toothed lamella on the outer side; otherwise the joint is oval with the coarse palp inserted almost terminally, a little towards the inner side. Exognath slender, not concealed, produced well up into the anterior corner of the buccal frame.

Merus of cheliped with two rows of spines, one above and towards the inner surface, the other below; upper and posterior surfaces granulated, with a few enlarged granules in two rows; a subterminal posterior spine. Carpus with scattered spines and granules, suggesting five or six rows. Hand and fingers (fig. 11) compressed, together as long as merus; palm with two rows of spines above, two below, one on outer surface, with some granules in these rows and also above and below; fingers smooth and white, fixed finger deflexed, movable finger nearly straight, gape linear, teeth low and triangular; fixed finger with a longitudinal ridge, movable finger with three. There are a few stout hairs, especially on the inner surface of the carpus and dactylus.

Legs 1–4 decreasing in length and spinulation. Merus of first three pairs with terminal spine and three rows of spines, carpus and propod with two rows, dactylus unarmed but with long hairs, which are prominent also on the propod; on the third pair the spines are so greatly reduced that only two rows on the merus are at all prominent. Fourth leg smooth and glabrous except for terminal spine on merus.

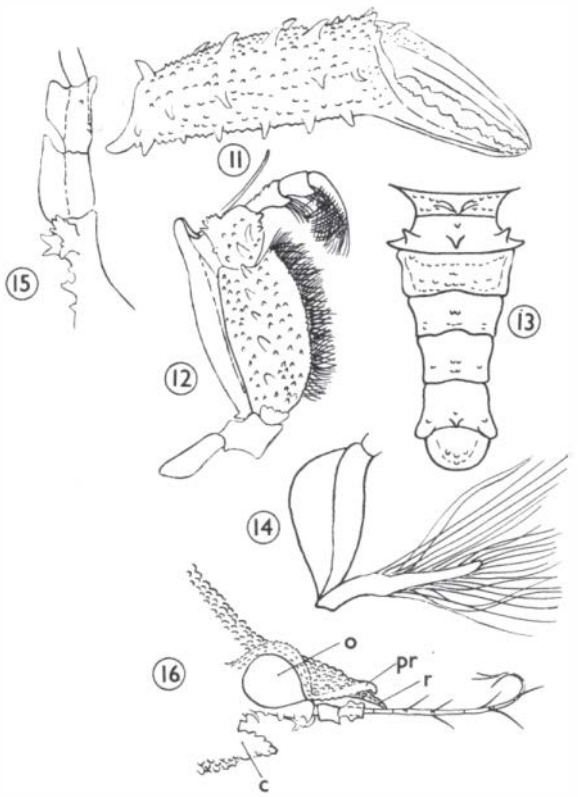


FIG. 11–16: *Cyrtomaia hispida* (Borradaile); 11, hand, × 6; 12, third maxilliped, × 8 (merus deflexed and longer than shown); 13, abdomen, × 6; 14, scaphognathite; 15, basal joint of antenna, seen obliquely from below and from inner side, showing spines of basal joint and lamellae of first and second peduncular joints, × 12; 16, orbital and rostral region in lateral view, × 6, o. orbit, pr. pseudorostrum, r. rostrum, c. antero-lateral margin of buccal frame; the denticulate lobe of the merus of mxpd. 3 fits against the flange and closes the respiratory aperture.

MATERIAL EXAMINED: One male, 40 fm, east of Papanui Inlet, Otago; coll. D. H. Graham, 23/4/30 (P).

OTHER RECORDS:

One female, Atapopa, Timor, *Gazelle* coll., Berlin; "therefore either Stn. 98, 2055 fm, *cf.* 'Narrative', 1, p. 154, or the '*Cyclax* sp. aff. *spinicinctus*' Heller, *ibid.*, Vol. 3, p. 216, littoral" (Balss 1929).

? *C. platypes* Yokoya (1933, p. 145), 14 specimens including both sexes from 10 localities in Japan.

TYPE: *Echinomaia hispida* Borradaile, two males in British Museum, 1916.[15] Type loc., *Terra Nova* Station 90; 100 fm off North Cape, New Zealand.

[15]In spirit collection (reg. No. 1917.1.29.157–158), British Museum (Nat. Hist.), 1962, Dr I. Gordon (pers. comm.).

RELATIONSHIPS: Balss (1929) justly regarded the genus *Echinomaia* as superfluous, but the limits of *Cyrtomaia* remain doubtful until an overhaul of the species has been made. The description of the Japanese *C. platypes* agrees with that of *C. hispida* except that the eyestalk is said to have only two tubercles (against which it is to be noted that the lower one in *C. hispida* is inconspicuous), and the third leg is without spines or setae (a character known in the case of *C. smithi* to vary with age). The hepatic spine and second branchial spinule are figured as more prominent, this however being equally a growth difference in *C. smithi* (Rathbun 1893, p. 228). Much more significant is the agreement with respect to the lamellate outgrowths from the peduncular joints of the antennae, which contrast with all the other known species except *C. lamellata*, in which however the lobes are lamellate in three directions. Yokoya does not refer to *C. hispida*, but claims that *C. platypes* is related to *C. lamellata* and *C. septemspinosa*; Balss states that *C. hispida* is nearest to *C. goodridgei*.

The record from Timor is surprising, but suggests that whether the specimens from these three widely distant localities are conspecific or not, a connecting form occurs at a depth of over two miles in tropical waters about midway between the northern and southern shallow-water habitats.

DIMENSIONS (mm):

	Borradaile	*Balss*	*Otago Specimen*
Length	16	11·5	11
Breadth	...	11·8	11
Cheliped – merus	...	8·9	9·5
carpus	...	3·8	4
propod	...	8·4	9·5
dactylus	...	4·6	4·3

The dimensions of the Otago specimen here quoted refer to the right cheliped, which is a trifle longer than the left. The chelipeds appear to be a trifle longer in the male than in the female.

DISTRIBUTION: Timor, Japan, New Zealand.

Series II. CAMPOSCIOIDEA Balss

Camposcioidea Balss, *Denkschr. Akad. Wiss. Wien 102* : 3; 1929.

There is no intercalary spine.

Only one species is known from New Zealand, for *Stenorhynchus fissifrons* Haswell (1879, p. 409; 1880a, p. 432; 1882c, p. 2) is not represented in any of the collections and must be excluded.[16] The types, which are now lost (*cf.* Chilton and Bennett 1929, p. 735; Bennett 1930, p. 255), were reputedly collected at Auckland, but the mention of this locality evidently depended on a label in the McLeay collection in Sydney, where however the author was unable to trace the specimens; Haswell shortly afterwards recorded the species from Port Jackson, his specimens from that locality being now in the Australian Museum, and the second record may be regarded as a partial retraction of a geographic mistake.

[16]Dr J. C. Yaldwyn, Curator of Crustacea and Corals at the Australian Museum, Sydney, has now found the type of *Stenorhynchus fissifrons* Haswell, from New Zealand, in the Macleay Museum, University of Sydney (pers. comm., 4 June 1962). However, following Balss's (1957, p. 1621) removal of this species to another genus, as originally proposed by Miers (1886, p. 18), on account of the rostral characters, it should perhaps be listed under *Achaeus* Leach, 1817, or *Achaeopsis* Stimpson, 1857; *cf.* also *Macropodia* Leach, 1814.

Genus **Trichoplatus** Milne Edwards

Trichoplatus Milne Edwards, *Ann. Sci. nat.*, (6) *4* : 2, pl. 10; 1876.
Miers, *J. Linn. Soc.* (*Zool.*) *14* : 647; 1879. (*Erichoplatus* no doubt a *lapsus* for *Trichoplatus*).
Alcock, *J. Asiat. Soc. Bengal* (*2*) *64* : 164; 1895.

Carapace pyriform, large, mostly covered (as are also the walking legs) with a short close tomentum, which conceals the carapace but not the deeply impressed regional markings; dorsum with low tubercles, each capped with a tuft of stiff coiled hairs. Rostrum strongly reflexed and invisible from above, pseudorostrum consisting of two stout diverging spines. Orbits strongly arched, without preocular or distinct supra-ocular spines; postocular spine distant, conical; no intercalary spine; eyestalks short and stout, not nearly reaching the postocular. Basal joint of antenna cylindrical, a little flattened below, scarcely widened basally, with antero-external spine. Buccal cavern widest in front; third maxillipeds subpediform, ischium and merus spinulous, merus oblique-oval with a spinulous lobe on the outer side, longer than broad and scarcely as wide as the ischium; palp terminal. Abdomen six-jointed in both sexes. Chelipeds massive in the male, merus and carpus spinulous, hands greatly enlarged, inflated, smooth, fingers finely denticulate with a slight basal gape. Legs shorter than chelipeds, steadily decreasing in length and stoutness, subchelate, terminal width of propod exceeding length of dactylus.

TYPE SPECIES: *Trichoplatus huttoni* Milne Edwards; genus monotypic and endemic to New Zealand.

In founding the genus, Milne Edwards (1876, pl. 10, fig. 4) made the surprising mistake of characterising and figuring the male abdomen as seven-jointed; the sixth and seventh joints are fused in both sexes and in the male (fig. 20) the suture is obliterated except for a marginal notch on each side. This somewhat lessens the similarity pointed out by him to *Eurypodius* Guerin (Rathbun 1925, p. 80), a South American genus with two doubtfully distinct species, in which moreover the pseudorostral horns are more or less contiguous; there are nevertheless marked similarities in the outline, the characters of the antennae and third maxillipeds, in the pubescence and spinulation, and in the flattening and expansion of the propods of the walking legs. This Magellanic affinity, at least as important as any other among the Brachyura, has been overlooked by authors who have discussed the geographic distribution of the group. The relationships are not with *Halimus* and *Acanthonyx*, as implied by Miers (1879b), nor with *Naxia* as supposed by Balss (1935).

Trichoplatus huttoni A. Milne Edwards,[17] Figs. 17–20, 111

Trichoplatus huttoni M. Edw., *Bull. Soc. philom.*; 7/1876.
M. Edw., *Ann. Sci. nat.*, (6) *4* : 1, pl. 10; 1876.
Halimus hectori Miers, *Ann. Mag. nat. Hist.* (*4*) *17* : 219; 1876.
Miers, Cat. Crust. N.Z., p. 4, pl. 1, fig. 1; 1876.
Halimus rubiginosus Kirk, *Trans. N.Z. Inst. 13* : 236; 1881.
Filhol, Mission de l'Ile Campbell, p. 352; 1885.
Trichoplatus huttoni Filhol, *tom. cit.*, p. 352; 1885.
Hector, *Trans. N.Z. Inst. 9* : 474; 1877.
Thomson, *ibid. 45* : 236; 1913.
Chilton and Bennett, *ibid.*, *59* : 736; 1929.
? *Naxia* (*Halimus*) *rubiginosus* Balss, *J. roy. Soc. W.A. 21* : 121; 1935.

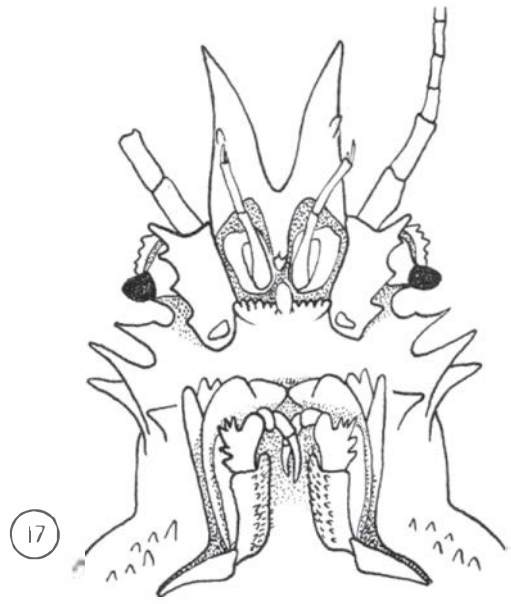


FIG. 17: *Trichoplatus huttoni* Milne Edwards; facial region, × 2.

Carapace (fig. 111) large, convex from side to side with the branchial regions inflated and their lateral margins scarcely defined, very slightly convex fore and aft except that the front is declined. Regions well defined, the deeply impressed grooves around the cardiac and urogastric regions forming a decanter-shaped outline. Tomentum very short, dense, velvety; hepatic and frontal regions bare. Dorsum beset with large blunt tubercles, each capped by a tuft of coarse bristles; the anterior bare track and pseudorostral horns bear tufts of strongly hooked hairs.

Dorsal tubercles include two median ones and a pair on the mesogastric region, forming a diamond-shaped outline; a submedian cardiac pair, a mesobranchial and two epibranchial pairs; there are four on the branchial margin, the first two minute with hooked hairs, third large, fourth small. Omitting the marginals and the three foremost gastrics, the remaining nine form a circle. In front of the posterior margin are three slight elevations, without long hairs; the median one, on the cardiac region, may be broken up into a few granules. The bare track in front bears two pairs of mesogastric and one pair of obsolescent frontal tubercles with hooked hairs. There is a long slender hepatic spine without hairs, and a second smaller spine placed behind and more dorsally, sometimes confluent at the base, with hairs on the upper side, and a third distant obsolescent tubercle in line with the two spines and bearing hooked hairs. There is a subhepatic spinule and another near the corner of the buccal frame. A narrow bare pterygostomial strip bears irregular spinulose granules, some being confluent, continuing into a row of small tubercles above the bases of the chelipeds and first legs; the dorsal tomentum spreads down to this line. Posterior margin a little concave in the middle, with a multiple row of granules continued round the sides above the walking legs.

Rostrum (fig. 17) strongly reflexed, parallel sided, tip acuminate and vertical. Pseudorostrum consisting of two stout horizontal horns, longer than the frontal width, separated by a narrowly rounded U, strongly tapering, and therefore divergent even though the outer sides are usually parallel; a ventral spine beyond the mid-length; scattered straight bristles and two tufts of two or three hooked hairs on each horn.

Basal joint of antenna (fig. 17) long, slender, fused with front but not so intimately as to modify the shape of the joint; distal half cylindrical, parallel-sided, under surface convex; basal half a little expanded with a faint longitudinal sulcus. The whole distal end of the joint is more lateral than the outer margin of the pseudorostral horn and is visible in dorsal view. A prominent outer distal spine with a ventral spinule at its base in line with two or three conical granules on the under surface. The two following joints are stout, cylindrical, tomentose, reaching to the under spine of the pseudorostral horn, flagellum three times the length of the latter.

Orbital eave strongly arched, higher than long, with conical spinule and tuft of bristles above; postocular spine small, conical, acute, distant from the eave, with a conical granule on the base in front. Eyestalk globular at the base, narrowing quickly to half the diameter, very short and not nearly reaching the postocular spine; eye terminal, exposed, a small tuft of hairs above the cornea.

Epistome (fig. 17) smooth, flat, expansive, longer than broad, limited in front by a stout granulated transverse lobe on either side of the base of the interantennulary septum. Buccal frame with two spinules at the anterior margin; the latter with crescent-shaped lamellate rim across the middle, divided by a median suture and overhanging a narrow deep median cavity of which the floor is a continuation of the epistome.

Ischium of third maxillipeds with a row of granules, which distally become spinose, separated by a smooth track from a longitudinal row of spinules on the outer half; there are other granules near the inner and outer margins; a strong acute antero-internal projection; merus a little more than half as long, oblique, with two rows of spinules, that on

[17]The generic name *Naxia* has been used for specimens from the Chatham Islands in the Dominion Museum (Dell, 1960, p. 6) and for local specimens in the Canterbury Museum; Richardson (1949b, p. 63) had earlier listed "*Naxia huttoni*" without further comment.

the outer margin passing up on to a prominent lamella on the distal half. This lamella and the oblique position give the joint the appearance of being as wide as the ischium, but in reality it is distinctly narrower. The distal end is truncate, with the coarse bristly palp inserted terminally.

The male chelipeds are equal, massive, twice the median length of the carapace; ischium spinulous below; merus trigonal, inner and lower surfaces nearly flat and smooth, separated by two rows of spinules, the terminal one of the upper row a stout spine. Outer surface convex, obscurely ridged with a few low tubercles, lower margin with a row of spinules, upper with a row of spines, of which the second, fourth, and seventh (the latter distal and subterminal) are very stout. Carpus with four rows of tubercular spines, some with granulate or spinulose bases. A few bristles, mostly straight, on the spines of the merus and carpus, terminal articulatory bosses tomentose. Hand (fig. 18) longer than the merus, uniformly and minutely granulous all over, with three spinules at base of upper margin and a minute one near base of inner surface; both surfaces inflated, with a massive blunt ridge. Fixed finger not deflexed, straight; movable finger strongly curved; inner margins finely serrate with a narrow basal gape less than a third of the length.

Cheliped of the female much smaller, stouter than the walking legs, as long as the third pair. Merus and carpus otherwise as in the male except for tomentum on the merus; hand bluntly ridged on both surfaces; outer ridge with a row of hairs, upper and lower margins each with three rows, outer surface tomentose; fingers hairy with faint linear gape.

First walking legs nearly as long as male cheliped, succeeding ones decreasing but fourth still longer than carapace and pseudorostrum. Merus of first and second pairs with a row of hairs on upper and lower margin, some upper ones hooked, outer surface tomentose between the rows. Inner surface with three rows, of which one, almost on the lower margin, includes a row of spinules. Carpus and propod with four rows of hairs, some on upper margin hooked, outer surface tomentose, inner sparsely so; propod (fig. 19) greatly flattened and widened, especially distally, the truncate distal end equal in width to the length of the dactylus; the latter is narrow, strongly curved, tomentose above with a glabrous ridge on each surface and a row of stubbly reflexed hairs below, which grip against the dense and coarse bristles of the distal end of the propod; the dactylus folds back across the latter and is distinctly subchelate. Third and fourth pairs similar except that there are no long hairs or spinules on the merus, and few or no long hairs on the propod or dactylus, but uniform tomentum over all parts of merus, carpus, and propod.

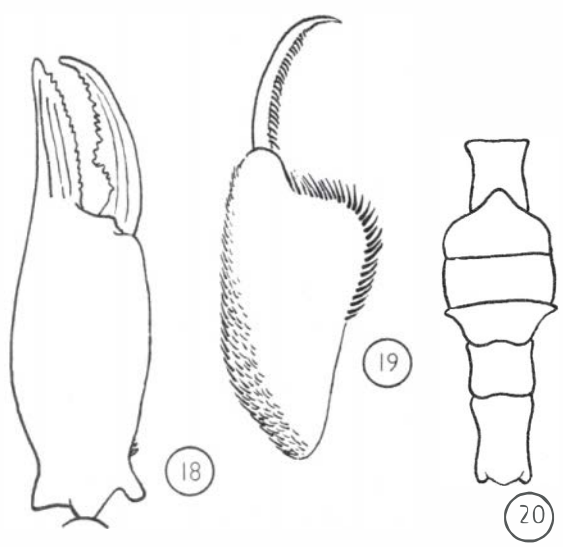


FIG. 18–20: *Trichoplatus huttoni* Milne Edwards; 18, male chela, × ½; 19, subchelate propod and dactylus of first walking leg, × ½; 20, male abdomen, outstretched, × ½.

Male abdomen (fig. 20) with first segment narrower than long, with a proximal transverse row of granules, second and third segments the widest, sixth and seventh fused with the sutures obliterated except for a marginal notch beyond an elevated marginal lobe; tip angled; a bristly tubercle at the middle of each segment and tomentum on segments 1–4. Female abdomen with first segment wider than long, succeeding segments expanded over the bases of the legs, No. 1–4 with tomentose bristly median tubercles, No. 1–5 tomentose with a few long hairs which become dense on the distal segments; sixth and seventh fused with the suture obliterated, the remaining sutures distinct but the segments with at most only the faintest power of independent movement. Tip notched.

Male sternum with bristly nodules, sternite of cheliped segment sharply granular. Female sternum completely occupied by the marsupium except immediately behind the buccal cavern.

HISTORICAL: The history and synonymy of the species have been discussed by Chilton and Bennett (1929, p. 736); Milne Edwards' name has priority by a few days over Miers', and Kirk's is a simple synonym. The figure given by Milne Edwards (1876, pl. 10) is imperfect in that some dorsal tubercles are omitted and the posterior and postero-lateral margins are shown as double. The poor description and figure by Miers were based on a mutilated female (not male, as stated by him in 1876b, p. 219). The statement (Miers 1879b, p. 647) that the "third joint of the outer maxillipeds [is] notched at its distal end" is an error.

HABITS: As far as known, all specimens yet collected have been picked up singly on beaches after having been stranded there, save for two Otago specimens, one trawled in an unknown depth and the other taken in a crayfish pot. The crab evidently does not occur above low-water mark.

There are usually a few fragments of weed hooked on to the coiled hairs; the tomentum perhaps prevents infestation by sessile animals, and though unimpressive as a means of concealment when the crab has been removed from the water is perhaps effective enough under natural conditions, especially as the weed always consists of Phaeophyceae and is therefore of the same brown colour as the [illegible]

hooked hairs, after preservation in spirit at least, are very rigid; a large male with massive chelipeds and saturated with spirit can be suspended from two hairs hooked over a needle, and a female from one.

COLOUR: After brief preservation, frontal and facial regions reddish chestnut; tomentum yellowish grey except on propods of legs, which are light straw-coloured, almost yellow; longer hairs almost yellow. Articulations and under surfaces chestnut to flesh-pink, female cheliped chestnut under the hairs, finger tips bright flesh pink. After long preservation the front and spines become red, fading to brown and blackish purple.

MATERIAL EXAMINED:

1 male, Akaroa Heads, coll. J. W. Arthur, 1916 (Ch).
1 male, Akaroa (C).
1 female, ovig., Wharenui, near Clarence River, coll. – Neilsen, –/1/31 (C).
1 female, coll. W. Traill, 1916 (Ch, 5).
1 female, *ex* Hutton coll. (C, 9).
1 male, 1 female, without data (C).
1 female, drift, 1927 (B, 10).
1 male, Mocraki, taken in crayfish pot, W. H. Cormack (O).
1 male, off Otago Heads, trawled, 1899 (O).
1 male, Dunedin (O).
1 female, 7/1/29 (O, 4).

PREVIOUS RECORDS:

New Zealand (Milne Edwards, Miers).
Wellington, Cape Campbell, Napier (Kirk).
Cook Strait; east coast of Otago (Filhol).
Otago Harbour (Thomson).
Sumner, Akaroa, Kaikoura, Stewart I. (Chilton and Bennett).

TYPE: Paris Museum, if extant[18]; of *H. hectori*, British Museum (Miers).

DIMENSIONS (mm):

	Male	*Female*
Length	84	55
Breadth	51	37
Cheliped	141	52
Hand	62	23
Legs 1–4	121, 103, 98,90	66, 61, 57, 51
Propod 1st leg, height	15	10

DISTRIBUTION: Endemic to New Zealand mainland; rather rare, especially so in the north.

Subfamily OPHTHALMIINAE Balss

Ophthalmiinae Balss, *Denkschr Akad. Wiss. Wien 102* : 6; 1929.

Not represented in New Zealand.

Subfamily ACANTHONYCHINAE Alcock

Acanthonychinae Alcock, *J. Asiat. Soc. Bengal (2) 64* : 160, 164, 190; 1895.

Not represented in New Zealand. *Huenia bifurcata* Streets (1870, p. 107) was allegedly based on New Zealand material, but the absence of the species from the collections supports the suggestion of Hutton (1882, p. 263) and of Chilton and Bennett (1929, p. 735) that it should be excluded. Miers (1886, p. 35) suggested that it might be a *Simocarcinus*, a genus unknown in New Zealand, or alternatively it may be the highly variable *Huenia proteus* de Haan of Australia and the Indian Ocean. An earlier list by Miers (1884, p. 191) ignores the species without comment.

Subfamily PISINAE Alcock[19]

Pisinae Alcock, *J. Asiat. Soc. Bengal (2) 64* : 160, 165, 200; 1895.

Since *Acanthophrys* belongs to the Majinae and not to the Pisinae as supposed by Alcock, the subfamily is unrepresented in the New Zealand fauna. Balss proposes to restrict the subfamily to genera possessing an intercalary spine (subfam. Pisinae Alcock restr. Balss), and to found the subfamily Hyasteniinae for those lacking this structure.

Subfamily MAJINAE Alcock emend. Balss

Majinae Alcock, *J. Asiat. Soc. Bengal (2), 64* : 161, 166, 236; 1895 (part).
Mamaiidae Stebbing, *Mar. Invest. S. Afr. 4* : 22; 1905 (part).
Majinae Rathbun, *Bull. U.S. nat. Mus. 129* : 335; 1925 (part).
Balss, *Denkschr. Akad. Wiss. Wien 102* : 16; 1929.

The roof of the orbit is fairly complete, entirely concealing the fully retracted cornea in dorsal view, and consists of (1) an arched supra-ocular eave of which the postero-external angle is often produced as a spine, (2) an intercalary spine, and (3) a postocular spine which may be conical or hollowed out in front to receive the cornea. The basal joint of the antenna is very broad and is usually armed at both of its anterior angles with a strong spine. The rostrum is persistent but strongly reflexed, forming a stout interantennulary spine; the pseudorostrum is bicornuate. The merus of the third maxillipeds is at least as wide as the ischium. The abdomen is seven-segmented in both sexes.

TYPE GENUS: *Maia* (*Maja*) Lamarck.

INTERRELATIONSHIPS: The subdivision of the Majinae has been a cause of profound diversity of opinion. The family Periceridae of Miers (1879b) appears in Alcock's classification (1895) as an "alliance" Periceroida within the subfamily Majinae, but the group has generally been regarded as composite; the basic similarity, due to the formation of an orbital floor by an expansion of the basal antennary joint, is deceptive in that it represents the culmination of several distinct evolutionary lines, more or less parallel, but interdigitated by the older systematists, who grouped together the apical or periceroid members of the upper ends of the various evolutionary branches. Rathbun (1925) has ignored the older subfamilies, but Balss (1929) has endeavoured to distinguish four evolutionary lines and his treatment is provisionally followed here. Of

[18]Type seen in Paris Museum by E. W. Dawson, 13/4/56.

[19]But contains the genus *Jacquinotia*, *fide* Balss (1957, p. 1625), and probably also *Eurynolambrus*, *fide* Krefft (1952).

Alcock's three alliances of Majinae, the Maioida become the subfamily Majinae s. str., the Stenocionopoida form the subfamily Ophthalmiinae, and the Pericerοida are mostly shared by the Majinae s. str., the Mithracinae, and the Macrocoelominae. As Balss has not formally characterised these subfamilies, the above diagnosis is largely new.

It remains to be determined whether the presence or absence of an intercalary spine provides a character of such basic importance as supposed by Balss, or whether it is of a class with the characters of the orbital floor. The New Zealand members are too few to show whether allied genera are accurately brought together in the new system, and the only developmental point brought to light is perhaps rather adverse; viz., in *Paramithrax* the intercalary spine is represented in very young specimens by a minute conical granule, scarcely recognisable and easily overlooked, but increasing more rapidly than the postocular and the spine of the eave until in mature specimens it is equally prominent.

"*Maja* and *Majella* (Ortmann 1893, one sp. in Japan) occupy the most primitive place in this group Majinae s. str., since the flagellum of the antenna arises within the orbit. I distinguish a series, including *Paramithrax*, *Leptomithrax*, and *Acanthophrys*, in which an almost closed orbit gradually arises through the hollowing out of the post-ocular spine (*Leptomithrax* and *Acanthophrys*); and through the fusion of the basal article of the antenna with the front the flagellum becomes excluded from the orbit" (Balss 1929, p. 16; transl.). The latter tendency is illustrated in figs. 33–36 and 56. A parallel series may be traced through the non-neozelanic genera *Cyclax*, *Schizophrys*, and *Maiopsis*. To the former series must be added *Campbellia*, so that by the division of *Leptomithrax* into three subgenera a close genetic sequence of six genera and subgenera is recognisable with New Zealand as the centre of distribution and a further range in Australia, the tropical western Pacific, and eastern Asia, with an outlier in South America.

Paramithrax, the basal member of this series, is distinguished not only by (1) the conical form of the post-ocular spine, but also by (2) the distance of this spine from the short-stalked eye and from the other orbital spines and the basal joint of the antenna, so that in ventral view it scarcely appears to belong to the orbit at all; and by (3) the widely open supra- and infra-orbital fissures. As indicated in figs. 33–36, however, the structure of the basal joint of the antenna is not unlike that in *Leptomithrax* s. str. In the higher genera the post-ocular spine becomes flattened or hollowed out in front, i.e., on the side internal to the orbit, and the cornea folds against it when the eye is retracted; in varying degrees it approaches the basal antennary joint, and the upper fissures are more or less completely closed. These several tendencies are traced below through the series, concurrently with the modification of the basal joint of the antenna.

Habits: The members of the most primitive genus, *Paramithrax*, occur abundantly in New Zealand in shallow water, and are covered by dense hairs, to which are attached tufts of Phaeophyceae; the weeds are not growing but are fragments hooked on to the hairs, and only occasionally are hydroids or polyzoans found attached to the carapace. The members of the more specialised genera however are confined almost exclusively to deeper water, and there is a strong tendency for the hairs to be lost and the blanket of weeds to be replaced by a mass of sessile animals, growing on the carapace and limbs and forming a small but distinct ecological community; they include sponges, polyzoans, serpulids, hydroids, anemones, cirripedes, lamellibranchs, and a rich epifauna of mobile animals living among these. Since it does not appear likely that *Paramithrax* has migrated upwards from the lower to the upper littoral and has there acquired a covering of hairs, by means of which it is able to utilise the algal flora of the upper levels, the inference is that the specialised genera have migrated from shallow to deeper water, where the hairy covering has in varying degrees become vestigial in accordance with the substitution of an epifauna for the original pseudo-epiflora. In the intertidal zone, only those animals which could tolerate the alternations of submergence and emergence indulged in by the crab are available; moreover animals could not afford such complete concealment as weeds except by hopelessly overweighting the crab; the bulky animals, many with massive shells (lamellibranchs, balanids), which are supported comfortably enough at levels below low-water mark, would be intolerable in the intertidal zone, where neither the crab nor its epifauna are buoyed up by the water during low tide, and where there is serious exposure to wave movements. The use of weed appears to have been a preliminary step, and an essential one, in the cultivation of the epifauna characteristic of the specialised genera of the lower littoral. An interesting divergence, reminiscent of the contrasting trends in the atrophy and hypertrophy of the eye among organisms invading the abysses, occurs in *Paramithrax* in which the hairy covering, so far from becoming obsolescent, has developed to an extraordinary extent, possibly unparalleled among the Brachyura.

A bibliography on the functions of the mask and on associated habits has been given by Rathbun (1925, p. 6).

Key to New Zealand Genera and Subgenera

I Postocular spine conical, not hollowed out to receive the eye, distant from the basal joint of the antenna and leaving the orbit undefined below. Orbit long, eyestalks moderately long. Flagellum of antenna narrowly excluded from the orbit. . . . . **Paramithrax**

II Postocular spine hollowed out in front, the eye when retracted folding against or into the hollow. Orbit and eyestalks short.

A. Orbit less widely open below than in I but not closed by the approximation of the postocular spine to the basal joint of the antenna; upper orbital fissures at least partially open. Pseudorostrum of two conical spines, at most slightly flattened. Legs not nodulose.

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A. Orbit less widely open below than in I but not closed by the approximation of the postocular spine to the basal joint of the antenna; upper orbital fissures at least partially open. Pseudorostrum of two conical spines, at most slightly flattened. Legs not nodulose.

1. Flagellum of antenna large, narrowly excluded from the orbit, inserted on the outer side of the distal end of the basal antennary joint, and separating the outer distal spine of the latter from the eave, which fuses with the joint by a linear process. ..... **Leptomithrax** s. str.

2 Flagellum of antenna small, widely excluded from the orbit, inserted on or towards the inner side of the basal antennary joint.

(a) Outer distal spine of basal joint of antenna strong, much longer than the inner, acute, and fused through most of its length with the orbital cave. ..... **Austromithrax**

(b) Outer distal spine of basal joint of antenna absent or equal to inner or else blunt and lamellate, in any case not fusing with the eave, which fuses with the joint itself.

(i) No supra-ocular spine other than the spine of the eave. Pseudorostrum consisting of two short flat slightly divergent horns; postocular spine not lamellate, hepatic absent. Third maxillipeds with prominent white circular button at junction of ischium and merus. Male sternum with deep pits separated by strong transverse ridges. ..... **Zemithrax**

(ii) Two strong supra-ocular spines. Pseudorostrum consisting of two long conical strongly diverging horns; postocular and hepatic spines lamellate. Third maxillipeds and male sternum without deep pits, ridges, or bosses. ..... **Acanthophrys**

B. Orbit almost closed below, the postocular spine reaching the basal joint of the antenna at the base of a V-shaped notch; upper orbital fissures closed, the intercalary spine being in contact with the postocular and with the eave. Pseudorostrum consisting of two short flat deflexed triangular plates with spinulose margins. Legs strongly nodulose. . . **Campbellia**

Genus **Paramithrax** Milne Edwards

Paramithrax Milne Edwards, Hist. Nat. Crust., Vol. 1, p. 323; 1834 (part).
Miers, *J. Linn. Soc. London, Zool. 14* : 655; 1879 (part, *Paramithrax* s. str.).
Rathbun, *Biol. Res. "Endeavour" 5* : 17; 1918.
Rathbun, *Bull. U.S. nat. Mus. 129* : 338; 1925.
Balss, *Denkschr. Akad. Wiss. Wien 102* : 18; 1929.

Carapace oblong-triangular, spinous or nodulous above; pseudorostrum of two conical spines diverging at the base. Orbits long, oval, with a forward aspect, consisting of a supra-orbital cave terminating posteriorly in a spine (no preocular spine in Australasian species), an intercalary spine, and a postocular spine, the two intervening fissures deep and widely open, the postocular in line with the preceding spines; orbit undefined posteriorly. Postocular spine conical, remote from the orbit in ventral aspect, its base not approaching that of the basal antennary joint, nor hollowed out in front; orbit widely open below. Eyestalk short, moderately stout, usually not reaching the post-orbital spine. Basal joint of antenna much enlarged, with two subequal distal spines; peduncular article inserted towards the outer distal corner, and narrowly excluded from the orbital cavity by a linear process of the basal article which fuses with the eave. Merus of outer maxillipeds notched at the antero-internal angle, with a distal spinule. Chelipeds strong, fingers pointed. Ambulatory legs cylindrical, dactyli unarmed.

The genus *Paramithrax* was founded by Milne Edwards (1834, p. 323) to include the following species:

1. *Paramithrax peronii* (refs. *infra*); specified as type species by Miers (1879b, p. 656). The spelling is corrected below to *peroni*.
2. *Pisa barbicornis* Latreille (1828, p. 141); the name *Lobophrys barbicornis* was later used on a museum label by Milne Edwards and published by Filhol (1886b, p. 360), but this generic name is anticipated by *Gonatorhynchus* Haswell (1880, p. 439), a genus created for the Australian species *G. tumidus* (Haswell 1880, p. 439, pl. 25, fig. 4, and 1882, p. 10), which in turn was recognised by Balss (1929, pp. 17, 18) as synonymous with *Pisa barbicornis* Latr. The correct name is therefore *Gonatorhynchus barbicornis* (Latr.), with however a most unfortunate qualification, viz, that (as pointed out by Ward 1933, p. 392) *Pisa barbicornis* Latr. was specified as type of *Paramithrax* by Desmarest, in Chenu, Encycl. Hist. Nat., 1858, p. 14, antedating by many years the specification of *P. peroni* by Miers. In that case *Lobophyrys* and *Gonatorhynchus* would become synonyms of *Paramithrax*, the latter being monotypic with the species *P. barbicornis* (Latr.), while the species now included in *Paramithrax* would be left without a generic name. Such a drastic upsetting of the familiar nomenclature seems to carry no compensating advantage and until such a course is proved quite inevitable, *P. peroni* M. Edw. is regarded as the type species as hitherto.
3. *Paramithrax gaimardii* M. Edwards (1834, p. 325), alleged by Quoy and Gaimard to be a New Zealand species but probably identical with the Australian *Leptomithrax australiensis* Miers, and in any case not a *Paramithrax* (see below).
4. *Cancer ursus* Herbst (1788, p. 217), doubtfully referred to *Paramithrax* by Milne Edwards, and later doubtfully and incorrectly identified by Miers (1876a, b) with *P. barbicornis* and alternatively but superfluously named *P. latreillei* by the same author, and *P. cristatus* by Filhol (1886, p. 358); the correct name being *Paramithrax ursus* (Herbst), *q.v. infra*.
5. *Cancer pipa* Herbst; Seba, Locuplet. rerum nat., Vol. 3, pl. 18, fig. 7; 1734–1765 – not binomial nomenclature; *Cancer pipa* Herbst, 1788, p. 217, pl. 17, fig. 97; *Maja pipa* Bosc, 1801, p. 258; doubtfully and apparently incorrectly referred by Milne Edwards (1834, p. 325) to *Paramithrax*.

Of the original five species, therefore, only *P. peroni* and *P. ursus* remain within the genus. Miers separated the species known to him in 1876 into the two subgenera *Paramithrax* s. str. and *Leptomithrax*, now recognised as requiring full generic status; unfortunately Miers ignored the grouping of the species of *Paramithrax* by Milne Edwards in terms of the structure of the orbit (see below, *Leptomithrax*), and distinguished his subgenera by trivial characters (cheliped structure), with the result that the boundaries have been persistently misunderstood and *Paramithrax* has been overburdened with species which should be referred to *Leptomithrax* or even quite different genera. The following is a partially corrected list:

1. *P. peroni* Milne Edwards 1834; New Zealand; provisionally accepted as the type species (refs. below).
2. *P. ursus* (Herbst 1788); New Zealand (refs. below).
3. *P. minor* Filhol 1886; New Zealand and perhaps Australia (refs. below). If, as claimed by Ward, the Australian species long known as *P. peroni* and latterly as *P. minor* is not Filhol's species, it is as yet nameless and lengthens the list (see below under *P. minor*).

4. *P. parvispinosus* Ward (1933, p. 392, pl. 23, fig. 41); Queensland. The brief description and small figure scarcely substantiate the generic location; the reduction of hairs, spines and granules, and the correlative habit of masking with living sponges, point rather to *Leptomithrax*, and the presence of a broad spine on the basal joint of the antenna, visible from above, suggests *Austromithrax*.
5. *P. spinosus* Miers 1879; Norfolk Island; not here studied, its generic location remaining doubtful.
6. *P. backstromi* Balss 1923; Chile and Juan Fernandez. The traditional error in identifying this solitary South American species with *P. peroni*,[20] and its frequent citation as a faunistic link with New Zealand, has been corrected by Balss (1923, p. 336, text-fig. 3), who has recognised it as distinct; Rathbun (1925, p. 339, pl. 123) considers it a close relative, but it differs from all undoubted species of *Paramithrax* in that it possesses a strong pre-orbital spine, so that its generic location is doubtful. The magnificent figure of *P. peroni* given by Jacquinot and Lucas (1853, pl. 1, fig. 5) seems to show a pre-orbital spine on the left side; but as obscurely indicated on the right, the spine arises from the basal joint of the antenna.

It follows that (1) only the first three species are free from doubt; (2) all three occur in New Zealand; (3) there is an Australian species, possibly identical with the New Zealand *P. minor*, but probably the Australian *P. parvispinosus* will prove to be an *Austromithrax*; (4) the general locations of the magellanic *P. backstromi* and of the Norfolk Island *P. spinosus* are doubtful; (5) the genus is distinctly of a southern temperate distribution with its centre in New Zealand and in spite of current assertions is not represented in the northern Pacific. The author's extensive collections from Western Australia include no specimens, the ecological equivalents (i.e., intertidal Majidae masked with weeds) being four species of *Naxia*, and especially *Naxia tumida* Dana; similarly it is unknown from intertidal stations elsewhere in Australia. (c.f. Hale 1927b, p. 127; Balss 1935b, p. 120).

KEY TO NEW ZEALAND SPECIES

A. Two hepatic spines, more than three branchial; intercalary spine not reaching beyond that of the eave; eyestalk stouter than first movable joint of outer antenna; fingers of male chela with long gape but not deep, tubercle on movable finger flattened; hairs short; two or more spines on posterior margin.
   1. Four large branchial spines and one small one; merus of male cheliped with 3-4 large spines and some small ones, not all in a row; wrist with two entire crests; posterior margin with two spines. ..... **P. peroni**
   2. Seven small branchial spines; merus of cheliped granular and hairy but not spinous; wrist of male with the upper crest broken into nodules; posterior margin with about five nodules. ..... **P. minor**

B. Three hepatic spines and three branchial; intercalary spine of adult reaching beyond that of the eave; eyestalk slenderer than first movable joint of antenna; merus of male cheliped with five spines, including the terminal lamella, spines strictly scriate; upper crest of wrist with numerous teeth; outer with three nodules; hand with long deep gape, tubercle conical; hairs very long; posterior margin without spines. ..... **P. ursus**

[20] *Cf.* Garth, 1958, pp. 344-6.

The possession of two hepatic and five branchial spines is so general among the less specialised Majinae that it may be taken as a primitive characteristic (not necessarily the most primitive condition), and as a starting point for an increase or decrease in the number. In that case *P. peroni*, which has the typical number, is primitive; in *P. minor* the hepatic spines are typical but the branchials have increased by two, and the smallness and the variability in size and spacing of the fourth and sixth in some females suggests that these may be the extra ones; in *P. ursus* there is an extra hepatic spine, no doubt the small posterior one, and the branchials are reduced to three, their position suggesting that the lost ones are the fourth and fifth. In that case the marginal spines may be thus tabulated:

	Hepatic Spines		Branchial Spines				
	I	II	I	II	III	IV	V
P. peroni	×	×	×	×	×	×	×
P. minor	×	×	×	×	××	××	×
P. ursus	×	××	×	×	×	—	—

Similar tendencies may be traced in the spinulation of the cheliped and posterior margin of the carapace, agreeing with and supporting the view that *P. peroni* is primitive and intermediate.

Paramithrax peroni Milne Edwards,[21] Figs. 21–24, 33, 112.

Paramithrax peroni Milne Edwards, Hist. Nat. Crust., 1, p. 324; 1834.
White, Crust. Brit. Mus., p. 7; 1847.
Jacquinot in Jacq. & Lucas, *Voy. Pole Sud. Zool. 3* : Crust. p. 10, pl. 1, fig. 5; 1853.
Miers, *Ann. Mag. nat. Hist. (4), 17* : 219; 1876.
Miers, Cat. Crust. N.Z., p. 5; 1876.
Miers, J. *Linn. Soc. London, 14* : 656; 1879.
Filhol, *Bull. Sci. philom.* **9** : 26; 1885.
Filhol, Mission de l'Ile Campbell, p. 354; 1885.
Aurivillius, *K.Sv. Vet.-Akad. Handl. 23* : 48, pl. 4, fig. 3; 1889.
Rathbun, *Proc. U.S. nat. Mus. 16* : 81; 1893.
Lenz, *Zool. Jb., Syst. 14* : 454; 1901.
Chilton, *Trans. N.Z. Inst. 38* : 265; 1906.
Thomson, *ibid. 45* : 236; 1913.
Chilton & Bennett, *ibid. 58* : 738; 1929.
Balss, *Denkschr. Akad. Wiss. Wien 102* : 18; 1929.
Young, *Trans. N.Z. Inst. 60* : 151; 1929.

Not *P. peroni* Haswell, Fulton and Grant, Lenz 1902, etc.

Carapace (figs. 21, 112) reaching a large size, rather wide, pseudorostral horns and lateral spines prominent. Regions moderately well marked and inflated. Dorsum covered with low rounded nodules and smaller hemispherical or flattened granules, which become spinous only along the median line. Carapace and legs densely covered with coarse hairs, including stout hooked hairs on upper surfaces of legs and on pseudorostral horns and dorsal tubercles. The merus and following joints of the cheliped, the corresponding sternite, and the facial region are glabrous.

Pseudorostrum a quarter as long as rest of carapace, horns relatively slender, divergent, meeting in a V, inner margin equal to distal width; outline commonly irregular,

[21] Garth (1958, pp. 344-6) has compared and differentiated *P. peroni* of New Zealand and *P. bäckströmi* of Juan Fernandez.

but tip not acuminate; horizontal or with tip slightly depressed. The rostrum proper is strongly reflexed, tip sharp and curving forwards, the rim a raised edge.

Basal article of antenna (fig. 22) very large, flattened below, distal spines small and equal, outer one visible from above but not prominent; peduncular joints and flagellum steadily tapering and together twice as long as the pseudorostrum.

The eave of the orbit (fig. 21) is well arched, semicircular, its spine arising through a distinct obtuse angle, front margin straight, hinder convex. Intercalary spine separated by a narrow V, divergent from that of the eave, more slender and more narrowly conical, but reaching to the same level or nearly so. Postocular spine separated by a narrow U, anterior margin parallel nearly as far as tip of intercalary, then contracting; distal half of posterior margin convex, tip bluntly pointed. Eyestalk slender, eye of same width, not reaching beyond intercalary spine when reflexed; a small blunt tubercle with tuft of hairs above the cornea.

Hepatic region small, tumid, well defined, with two spines; first spine larger than any other except postocular, almost transverse, subcylindrical through half the length, then tapering; second small, conical, less than half as long. Below there are three submarginal spinules and about eight small granules. Branchial region moderately inflated, outline rounded, with five long sharp spines, subequal and equidistant except that the second is distinctly smaller and nearer to its neighbours; one or two submarginal spinules. Posterior margin with two short sharp spines, close together, margin produced between them.

Chelipeds of male (fig. 23) very massive, ischium extending two-fifths of length of merus, which is cylindrical and very stout; two subspinose conical nodules on proximal half internally to upper margin, which bears a row of six more, second and third stout, sixth a stout spine on the distal half; the row ends in a terminal erect longitudinal lamella which may end in a forwardly projecting spine. Carpus stout, irregular, with two ridges; upper ridge blunt and ill-defined, outer strongly elevated, blunt, not toothed but in some specimens irregularly notched at the base. Palm smooth, very high, swollen on both faces, upper margin narrowly rounded, lower broadly so. Fingers smooth, fixed finger a little deflexed; gape moderately deep, reaching the middle or in large males extending nearly to the tip; tubercle on movable finger usually very low and flat, sometimes distinct; distal denticulations on both fingers very fine.

Female cheliped with spines of merus reduced in number and size, ridges of wrist less conspicuous, hand tapering and very much smaller, fingers with linear gape nearly to the tip.

First walking leg much the longest, second longer than carapace with pseudorostrum, fourth smallest. All joints cylindrical, unarmed; dactyli long, slender, strongly curved.

Abdomen unarmed, first segment in male (fig. 24) narrow, second suddenly expanding, third widest, seventh pentagonal, very broadly rounded with the distal corners projecting and lamellate.

HISTORICAL: This unmistakable crab, with its distinctive lateral spines and armature of the wrist and arm, has been comparatively well understood in New Zealand since the description by Milne Edwards in 1834, especially as a fine illustration was given by Jacquinot and Lucas in

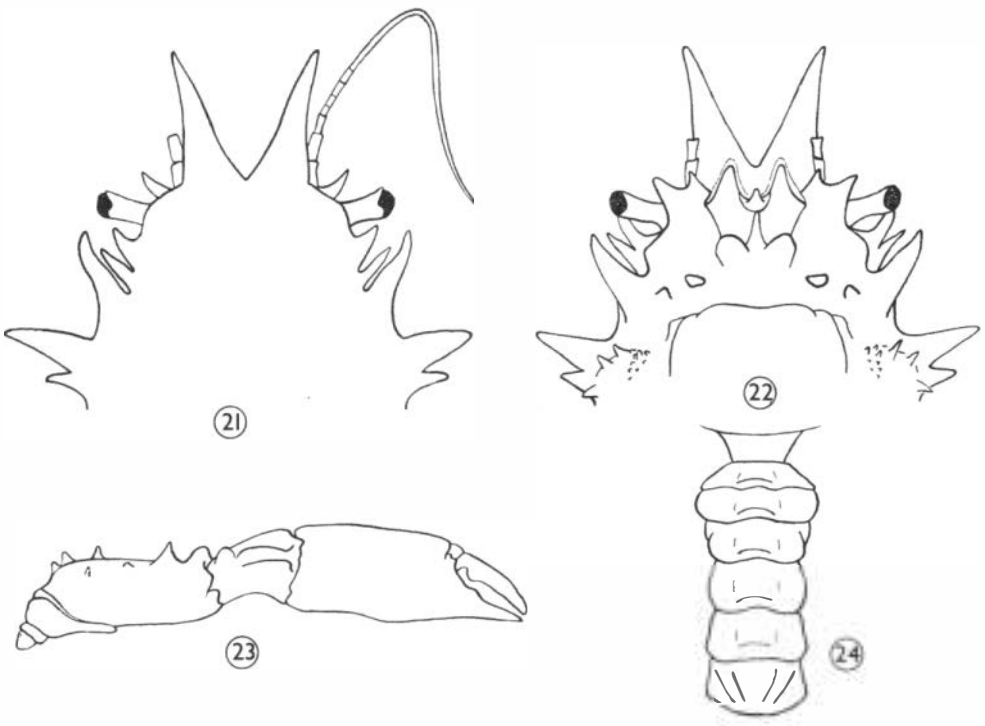

FIG. 21–24: *Paramithrax peroni* Milne Edwards; 21, frontal region, nat. size; 22, facial region, n.s.; 23, male cheliped, n.s.; 24, male abdomen, n.s.

1853. An ambiguity in this figure, as already mentioned, may have been largely responsible for the incorrect identification of the magellanic *P. backstromi* Balss with the New Zealand species, but this does not account for the confusion in the case of the Australian species, which though long considered to be *P. peroni* is either *P. minor* Filhol (see below) or a close relative and in any case quite unlike *P. peroni*. Filhol's description (1886, p. 355) is imperfect; "pattes" in line 3 should be "antennes", the second last line is incorrect in that the fingers of the female are denticulate, and his account of the submarginal spines is confused.

HABITS: The species is not very common in the collections, and there are only one or two from each locality; yet the crab is large and not likely to be overlooked by collectors. It does not necessarily follow that the crab is solitary in its habits, for although there are a number of records from shore localities there is no proof that the crab was living in these intertidal stations. There are records (Filhol, Chilton) from depths of 30 fathoms, and Portobello material from Cape Saunders doubles this figure. Some specimens are covered with large pieces of algae, others are densely blanketed by animals – e.g., hydroids, polyzoa, sponges, perhaps according to the depth. The legs are covered as well as the dorsum, but not the chelipeds, which are smooth and glabrous, and conspicuous unless folded. Only in one specimen was the arm covered by a sponge which concealed the spines of the upper margin; small serpulid tubes however occur freely on the chelipeds.

GROWTH CHANGES: In small specimens the eyestalks are relatively long, reaching the postocular spine, which is lamellate in front; pseudorostral horns strongly divergent, lateral spines long and slender, distal spines of basal antennary joint bi- or tri-fid. In still smaller specimens (6 mm long) the intercalary spine is represented by a minute scarcely recognisable granule, and its subsequent increase with age can be traced through a progressive series.

MATERIAL EXAMINED:

1 male, 1 female, Pigeon Bay; 5 males, Sumner; 1 female, Wellington; *ex* Hutt. coll (C).
2 females, Auckland; coll. H. Suter (C).
1 male, coll. H. Millar, 1933 (C, 10).
1 male, coll. J. Drummond, 25/8/23 (Ch, 8).
2 males, Port Levy, Banks Peninsula; coll. C. Robinson, 7/8/20 (Ch).
1 female, coll. Miss M. E. Herriott, –/6/07 (Ch, 10).
1 male, Bluff, coll. C. Chilton (Ch).
1 female, Golden Bay, coll. W. R. B. Oliver (Ch, 5).
1 male, Ponui Island; coll. W. J. Barr (Ch).
4 females (2 small, 2 juv.), 10 miles NW of C. Maria, *Hinemoa* Exped., 5/1/15 (Ch).
1 female immature, Lee Bay, rock pools; coll. W. R. B. Oliver (Ch, 5).
1 male, Bay of Islands, *Hinemoa* Exped., 1/1/15 (Ch).
1 female, Lyall Bay, drift on beach, 23/12/30 (B).
1 male, Portobello, –/5/29; 1 male, Portland, coll. – Robson; 1 male, off Otago Heads, trawled, 1899; 1 male, Bluff; 1 male, Moeraki, 1929; 2 males, off Otago Harbour, 1890 (O).
1 male, trawled among weeds, 4 fm, 12/2/30; coll. D. H. Graham (P, 6).
1 female ovig., –/3/30 (P, 6).
1 female ovig., off Kohimarama, 3 fm, 27/2/29 (A).
1 female ovig., Point Chevalier, 30/5/30 (A, 30).
1 male (A, 22), 2 females ovig. (A, 23).

PREVIOUS RECORDS:

Akaroa (Jacquinot and Lucas).
Cook Strait and Stewart Island, 30 fm (Filhol).
French Pass and Banks "Island" (Peninsula) (Lenz).
Channel Island, Hauraki Gulf, 20–30 fm (Chilton).
Otago, "occasionally met with along the coast" (Thomson).
Chatham Islands (Young; identification open to doubt).
Bluff (Rathbun).

TYPE: Paris Museum (Milne Edwards);[22] type locality, Indian Ocean – no doubt an error for New Zealand.

DISTRIBUTION: Throughout the New Zealand mainland; one unreliable record from Chatham Islands. Records from the following localities are incorrect: Indian Ocean (Milne Edwards), Australia (Miers) and Tasmania (Hodgson), South America (*P. backstromi*).

Paramithrax minor Filhol, Figs. 25–28, 113, 114

Paramithrax peroni Haswell, *Ann. Mag. nat. Hist.* (5), *5* : 146; 1880 (not of M. Edw.).
Haswell, *Proc. Linn. Soc. N.S.W. 4* : 440; 1880 (not of M. Edw.).
Haswell, *Cat. Aust. Crust.*, p. 13; 1882 (not of M. Edw.).
Paramithrax minor Filhol, Mission de l'Ile Campbell, p. 356, pl. 40, figs. 4, 5, 7 (not 6); 1886.
Paramithrax peroni Whitelegge, *Rec. Aust. Mus. 1* : 86; 1890 (not of M. Edw.).
Hodgson, Rep. "Southern Cross", p. 231; 1902 (not of M. Edw.).
Grant & McCulloch, *Proc. Linn. Soc. N.S.W. 31* : 28; (1906–7), 1906 (not of M. Edw.).
Chilton, *Rec. Cant. Mus. 1* : 288; 1911 (not of M. Edw.).
Paramithrax parvus Borradaile, *Brit. Ant. Exped. 1910, Zool. 3* : 105, fig. 15; 1916.
Paramithrax minor Rathbun, *Biol. Res.* "*Endeavour*" *5* (*1*) : 18, pl. 8, figs. 1, 2; 1918.
Chilton & Bennett, *Trans. N.Z. Inst. 58* : 738; 1929.

Carapace (figs. 25, 113) small, short and broad; gastric region inflated, branchial regions moderately so but strongly depressed posteriorly; antero-lateral margins depressed. Hairs of dorsum short, a few hooked, numerous but scarcely dense enough to form a close tomentum; abdomen and sternum with very short stubbly hairs and long scattered clavate hairs, extremely long and much more numerous on the legs. Subhepatic region with close hairs; lines of hairs occur also on the facial region and on the upper margin of the merus of the cheliped and on the corresponding sternite.

The dorsum has a median series of paired and unpaired tubercles, many obsolescent; one or two pairs between the orbits are prominent, and there are five subspinulous gastric tubercles of which the second is enlarged and the next two paired; also a double row of low flat granules usually connects these with the interorbital ones. Cardiac region with three pairs, the last confluent; intestinal region with two transverse rows, the median one of the anterior row enlarged; posterior margin regularly curved with 5–7 conical tubercles, of which two are larger than the median one or three between them, or rarely six, or some reduced with only two conspicuous. The dorsum and sides of the

[22] Material from Stewart Island and Cook Strait Filhol [illegible] Paris Museum, E. W. Dawson, 13/4/56.

carapace are sprinkled with small blunt tubercles, the gastric region however being smooth except for the median series.

The pseudorostral horns are broad, flattened, one-fifth as long as the rest of the carapace, outer margins parallel nearly to the tip, inner convex and forming a narrow V at the base; narrowing suddenly towards the almost acuminate tip; the horns are depressed with the tips horizontal. True rostrum as in *P. peroni*.

The basal joint of the outer antenna (fig. 26) is very broad, outer and upper margins strongly concave, outer distal spine much stronger than the inner, blunt, prominent from above. Eave of the orbit (fig. 25) well rounded, only moderately projecting; its posterior spine is joined to it by a broad curve, almost transverse, usually pointing to the tip of the postorbital spine, posterior margin twice as long as front margin even though fused for some distance with the intercalary spine. The latter is close to the spine of the eave, reaching nearly the same level, front margin straight, hinder convex and approaching the postorbital spine more nearly at the middle of the latter than at the base. Postorbital separated by a broad U at the base, much the stoutest spine of all, flat and triangular, base broad, anterior margin convex.

Eyestalk narrow, cylindrical, anterior margin hairy; cornea somewhat ventral, reaching to the postorbital spine; a subterminal tuft of hairs above it.

Hepatic spines two, transverse, cylindrical, the first large and nearly twice as long as the second. Branchial region with a curved row of seven subequidistant short spines, the last two dorsal; the first is the largest, fourth and sixth small, seventh distant from margin. There is a small tubercle below the intercalary spine and near the corner of the buccal cavern, and a row of four subhepatic granules behind it. Near the base of the cheliped there is another row of four, three below the subhepatic and one below the first lateral spine.

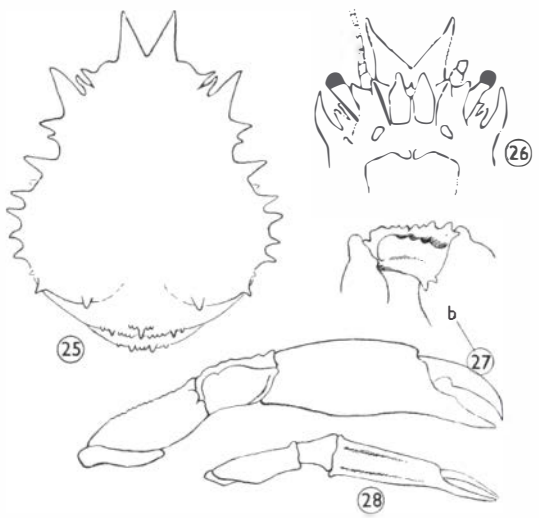

FIG. 25–28: *Paramithrax minor* Filhol: 25, carapace, × 1½; 26, facial region, × 1½; 27, male cheliped, × 1½, b, wrist of young male enlarged and seen more from above; 28, female cheliped, × 2.

The male cheliped (fig. 27) is long and moderately stout. The ischium extends more than half the length of the merus, which is roughened and hairy on the upper margin but without spines or tubercles. The wrist (figs. 27, 27b) has a high sharp lamella along the outer surface, sigmoid in outline, entire but inclined to be crenulate proximally. On the upper margin there is a crest, more or less continuous at the ends but breaking up into about seven nodules; the rows from the two ends do not meet in the middle, and are not quite in line. In old males especially, the upper crest may be obsolete except at the ends. The palm is similar to that of *P. peroni* but more narrowly rounded below. In fully adult males the fingers gape widely through half their length; fixed finger excavated to the middle, thereafter straight and denticulate; movable finger excavated at the base but only half as far, with or without a small tubercle, inner margin denticulate, straight, longer than that of the fixed finger; the latter faintly bent down from the palm.

The chelipeds of the female (fig. 28) are small, the carpus a little roughened but not crested, hand small and tapering; fingers slender, nearly straight, denticulate along the whole length of the inner margins, with a linear gape through most of the length.

HISTORICAL: As already mentioned, this very common crab has not been recognised since the description half a century ago by Filhol, save for records from Australia by Rathbun in 1918. Ward (1933, p. 392) denies this latter identification, and it is difficult to believe that a species so abundant in the one area should be so rare in the other, and apparently absent from the Australian intertidal zone altogether. The confusion with *P. peroni* by Australian authors arose from the mention of Australia by Miers (1876b, p. 5), who found a specimen bearing a label to that effect in the British Museum; the record was quoted by Haswell (1880a, 1880b, 1882c) and Whitelegge (1890), and when specimens of *P. minor* (if such it be) were found in Australia by Grant and McCulloch (1906) and in Tasmania by Hodgson (1902) the same name was used.

Rathbun (1918, p. 18) has pointed out another source of confusion and continued misidentification, viz, Filhol's fig. 6 refers not to this species but to *Acanthophrys filholi*; and this in turn explains Filhol's insistence on the absence of a spine on the outer distal corner of the basal joint of the antenna – he has described his wrongly-labelled diagram. The spine is well developed and larger than the inner.

The New Zealand records are easily interpreted. The *Nora Niven* specimens identified as *P. peroni* prove to be *P. minor*. Thomson (1913) does not record the species from Otago, where however it occurs. Borradaile's *P. parvus* is the young of *P. minor*; of the five supposed differences listed by him, one is the above-mentioned antennary spine, and all five are precisely those in which Filhol's figure (fig. 4) is most imperfect.

HABITS: Although as shown by the synonymy this species has been scarcely recognised by New Zealand authors, it is much the commonest of all the oxyrhynchs,

and ranges from intertidal levels to a depth of 50 fathoms at least. In the upper levels the crabs are especially fond of coralline beds, and deck themselves with the same weeds; much mud also collects among the hairs, as in *Pilumnus*, suggesting that a study of the long clavate hairs similar to those of *Pilumnus* (cf. figs. 113, 133) might demonstrate tactile or other functions correlated with the mud-collecting habit. Hydroids and polyzoans as well as weeds are commonly attached to the hairs and in some cases they appear to be attached to the carapace and apparently growing. The method of collecting among corallines is to run the hand over clumps of low-growing weed and examine any tuft that is easily detached, by which means about a hundred were taken in one afternoon in a locality where their presence remained unsuspected by previous collectors unacquainted with the method. Specimens from deeper levels may carry a mass of sponges or ascidians larger than the crabs themselves, in the fashion of a dromid, but the dense mixed animal community characteristic of *Leptomithrax*, growing freely over the whole dorsum, does not occur, and the hairs are not reduced as in that genus. Misconceptions on this point are being perpetuated in new carcinological literature; for example, Chilton (1927, p. 176) quotes as an example of rock-pool crabs "*Paramithrax peronii*, which conceals its presence by encouraging a growth of seaweed, sponges, etc., on its carapace"; the rock-pool species however is *P. minor*, and in this habitat it is not covered with sponge; nor does any species "encourage a growth of seaweed", for the weed consists of fragments hooked on to the larger coiled hairs.

The dactyli of the walking legs are highly mobile, and can be bent back till they form an angle of 60° with the carpus. In life as well as after preservation the merus of the cheliped is held forward, the carpus transversely with the large crest projecting forwards to the level of the tip of the rostrum, and the long hands are flexed backward in a longitudinal direction. The attitude is precisely that of a parthenopid. The palms quite conceal the face from below, only the tips of the rostral horns being visible; but the chelae are conspicuous from below, and the attitude represents a concealment of, rather than by, the chelipeds. So constant is this attitude, and so conspicuously different from that in *P. peroni*, that these little crabs may prove to feed on small organisms captured while the chelipeds are in the position described; the habits can readily be studied in aquaria.

Colour: After brief preservation in spirit, bright red; later, carapace salmon-pink, chelipeds pale below, fingers white beyond the base, hairs yellowish grey.

Growth Difference: In specimens 4 mm long the intercalary spine is a mere granule, as in *P. peroni* of comparable size.

Material Examined:

1 female, Sumner, 8/5/96; 1 female ovig., Preservation Inlet; *ex* Hutton coll. (C).
31 males, 14 females (11 ovig.), Auckland (C).
1 male, *Nora Niven* station 44; 2 females, *Nora Niven* station 74; *P. peroni* Chilton, not of M. Edw. (C).
1 female juv., 10 miles NW from C. Maria, 50 fm, *Hinemoa* Exped., 5/1/15 (C).
4 females (2 ovig.), Hauraki Gulf, 50 fm, –/12/14; 1 female ovig., Little Barrier, 35 fm, 29/12/14; *Hinemoa* Exped. (Ch).
1 female, off Cuvier Island, Hauraki Gulf, 32 fm, dredged by Capt. Bollons (Ch).
1 female ovig., Puhoi Beacon, 29/12/14; 1 male, New Plymouth, 8 fm, 12/1/15; *Hinemoa* Exped. (Ch).
1 female ovig., Ponsonby Reef, coll. W. R. B. Oliver (Ch).
1 female ovig., Ponui Island, coll. W. J. Barr (Ch).
1 female, coll. W. Traill, 1/3/17 (Ch. 5).
1 female ovig., Godley Heads, Banks Penin., coll. W. R. B. Oliver, 10/7/10 (Ch).
1 male, Kaipara, 8/1/15 (Ch).
45 males and females (many more seen), Taylor's Mistake, Banks Peninsula; among weeds, especially corallines, in intertidal pools; 1926–7 (B).
1 female ovig., Godley Heads, 26/11/27; 1 female ovig., Sumner, 1923; 1 female ovig., off Akaroa, 20–40 fm, 1927; 1 female, Kaikoura, –/8/27 (B).
1 male, 1 female ovig., littoral, coll. D. H. Graham, 1930 (P).
1 male, 1 female ovig., 7/1/30, and 1 male, 3/3/30 (P, 3).
1 male, 7 miles NE of Otago Heads, 40 fm, coll. D. H. Graham, 9/2/31 (P).
1 male, 1 female ovig., 20 fm, Otago, coll. D. H. Graham, 1930 (P).
1 male, 3 females ovig., E of Papanui Inlet, 40 fm, coll. D. H. Graham, 5/2/30 (P).
1 male, 3 females (2 ovig.), among weed, 4 fm, coll. D. H. Graham, 12/2/30 (P, 6).
1 female ovig., 27/1/31, and 8 juv., 5–12 fm, 7/9/31; coll. D. H. Graham, Blueskin Bay (P).
3 males, 3 females ovig. (O, 18).
7 males, 6 females (3 ovig.), (O, 17).
1 female, small, dry, Nelson (O).
25 males, 17 females (7 ovig.), in 24 lots, 0–10 fm, coll. D. H. Graham, 1926–7, and A. W. B. Powell, 1927–30 (A).
1 female ovig., dredged N of Ponui Island, coll. G. Archey, 12/11/27 (A).
1 male, Island Bay, 27/11/29; Victoria College, Wellington.

Previous Records:

Cook Strait and Massacre Bay, 8–11 fm; Stewart Island (Filhol).
Nora Niven stations 44, 74 (as *P. peronii*) (Chilton).
Off North Cape, 70 fm (*as P. parvus*) (Borradaile).

Type: Paris Museum.[23]

Dimensions (mm): Adult male: length 34; breadth 26; cheliped 42; hand 24; legs 1–4 respectively 35, 30, 26, 22.

Distribution: Common throughout the New Zealand mainland; doubtfully in south-eastern Australia.

Paramithrax ursus (Herbst), Figs. 29–32, 115, 116

Cancer (*Mithrax*) *ursus* Herbst, Naturg. Krabben u. Krebs, 1 Bd., p. 217; pl. 14, fig. 86; 1788.
Maja ursus Latr., Hist. Nat. Crust., Vol. 16, pl. 101; "An. XI".
Inachus ursus Fabr., *Ent. Syst. Suppl.*, p. 356, No. 5; 1798.
Paramithrax ursus Gerstäcker, *Arch. Naturg. 22 (1)* : 111; 1856.
Paramithrax barbicornis Miers, *Ann. Mag. nat. Hist. (4)*, Vol. 17, p. 219; 1876 (not of Latr.).
Miers, Cat. Crust. N.Z., p. 6, pl. 1, fig. 2; 1876 (not of Latr.).
Miers, *Ann. Mag. nat. Hist. (5)*, *4* : 8; 1879 (not of Latr.).
Paramithrax latreillei Miers, *Ann. Mag. nat. Hist. (4)*, 17 : 219; 1876.
Miers, Cat. Crust. N.Z., p. 6; 1876.
Miers, *Ann. Mag. nat. Hist. (5)*, *4* : 6; 1879.

[23]Types seen in Paris Museum by E. W. Dawson, 13/4/56.

Paramithrax cristatus[24] Filhol, *Bull. Soc. philom. 9* : 26; 1885. Mission de l'Ile Campbell, p. 358, pl. 41, figs. 9–12; 1885.
Paramithrax latreillei Rathbun, *Proc. U.S. nat. Mus. 16* : 6, 82; 1893.
Paramithrax cristatus Lenz, *Zool. Jb., Syst. 14* : 454; 1901.
Paramithrax latreillei Chilton, *Rec. Cant. Mus. 1* : 289; 1901.
Thomson, *Trans. N.Z. Inst. 45* : 236; 1913.
Borradaile, *Brit. Ant. Exped. 1910, Zool. 3* : 104; 1916.
Chilton and Bennett, *Trans. N.Z. Inst. 58* : 738; 1929.
Young, *Trans. N.Z. Inst. 60* : 150; 1929.
Paramithrax ursus Balss, *Denkschr. Akad. Wiss. Wien 102* : 18; 1929.

In males at least 40 mm long, the carapace (figs. 29, 115) is large, inflated, with the regional markings not impressed; dorsum covered with flattened tubercles of varying sizes, some very broad, symmetrical on the two sides but not forming a distinct median series; large and small tubercles over the anterior half, steadily becoming smaller posteriorly; hinder margin a little produced at the middle but without tubercles.

The dorsum and walking legs are covered with exceptionally long barbed hairs (figs. 32, 115, 116) and shorter smooth hooked ones, the long hairs arising from the tubercles of the dorsum. Chelipeds glabrous save for slight transverse fringe on upper distal articulatory margin of merus. Subhepatic and facial regions glabrous, subbranchials nearly so, under surface glabrous save for abdomen and last two thoracic sternites.

Pseudorostrum (fig. 29) moderate, the horns flattened above and depressed; outer margins straight and a little convergent, inner forming a narrow V; there is a strong ventral submedian nodular inflation on the distal half with a strong tuft of hairs on its anterior side, causing the inner margins to appear suddenly contracted distally and the tip to become almost acuminate.

Basal joint of the antenna (fig. 30) very broad, outer margin broadly concave, distal spines horizontal, outer one stouter and turned obliquely outward, readily visible in dorsal view. The outer margin of the joint (not the spine alone, as in other species) narrows the orbit opposite the spine of the eave, and spreads towards the intercalary spine.

Orbital eave lightly curved, meeting basal joint of antenna at an acute angle, with a deep intervening fissure. Spine of eave moderate, conical, anterior margin transverse, meeting the eave in a broadly rounded obtuse angle; separated by a deep U from the intercalary spine, which is long, conical, sharp, reaching to or beyond the level of the spine of the eave. Postorbital spine much the largest of all, separated from the intercalary by a wide and very deep U, which is parallel-sided to the tip of the intercalary; postorbital acute, curving forward till nearly parallel to pseudorostral horn.

The eyestalk is slender with an anterior short line of hairs ending in an upper subterminal tuft; cornea somewhat ventral, reaching when reflexed to the middle of the intercalary spine.

Hepatic region small, rather indistinct, with three closely-set spines; the anterior spine the largest, conical; second and third large with cylindrical bases. Branchial region with three conical spines, the first largest and equal to the second hepatic, first and second acute, third low and blunt, situated at a level between chelipeds and first legs. Subhepatic region with a row of four conical tubercles, third or

[24]Type, from Stewart Island, seen in Paris Museum by E. W. Dawson 13/4/56.

FIG. 29–32: *Paramithrax ursus* (de Haan); 29, fronto-orbital area, × 1½; 30. facial region, × 1½; 31, male cheliped. × 1½; 32 a-c, hairs, a, a long hair with part further enlarged to show serrulations. b. hooked hair. c. stubbly ventral hairs and hair bosses.

fourth both enlarged; a blunt tubercle near anterior corner of buccal cavern and two in front of the cheliped.

Cheliped (fig. 31) stout, of moderate length; ischium extending along two-fifths of the length of the merus; the latter with a few small granules near the base of the upper margin, in line with a row of usually four stout spines, increasing in size distally, the row terminating in a stout vertical lamella which is also usually produced forwards into a spine. The ridges on the carpus meet proximally in a blunt spine, diverging into a strong acute ridge on the outer surface, proximally crenulated or cut into two or three lobes, and a cristate ridge on the upper margin, cut into seven or eight irregular triangular lobes near the base bu becoming continuous distally.

The palm is massive, microscopically granulate, otherwise smooth, narrowly rounded above and below, inner and outer surfaces equally inflated, height decreasing distally. Fixed finger short, slender, a little deflexed, deeply excavated through more than half the length; movable finger long, curved, slender, deeply excavated, with a large conical tubercle beyond the middle of the gape. The opposed margins beyond the gape are finely denticulate.

First walking leg as long as cheliped and longer than carapace with pseudorostrum, the following pairs decreasing; smooth below the hairs, joints cylindrical except the carpus, which is transversely compressed and grooved above; dactyli nearly straight with the strongly hooked claw set at an angle.

First abdominal segment of male narrow, second suddenly widening, third and fourth equal and only slightly contracting, sixth with outer distal inflations above the sternal peg on which it locks, seventh hemispherical.

VARIATIONS: The fully mature form described above is not completely assumed until a late stage, so that there is an exaggerated appearance of variability among moderate sized and fully grown specimens. In females and semi-mature males there is commonly a heavier blanket of weed and more mud than in the trim looking large specimens; the sternum and abdomen are more hairy; the tips of the pseudorostral horns may become horizontal and so appear slightly upturned; the intercalary spine is shorter, reaching to or nearly to the level of the spine of the eave. The teeth of the upper crest of the wrist may be confluent. The hand is proportionally smaller, the gape is narrow, and the tubercle low; the whole inner surface of the fixed finger is denticulate, that of the movable finger is denticulated from the tubercle.

In the female the palm tapers still more distinctly than in young males; the fingers are more slender and are nearly straight, with a linear gape through at least half the length or nearly to the tip, finely denticulate throughout; the ridges on the wrist are reduced, low, blunt. The specimens from Lyall Bay have the pseudorostral horns and the orbital spines stout and the intervening spaces correspondingly narrow; the eye is stout and nearly reaches the postocular spine. The Kaikoura specimen has the pseudorostral horns broken, asymmetrical, overlapping. No early post-megalopa material is available, but small specimens suggest a late development of the intercalary spine, as in the other species.

HISTORICAL: The history of the species has been partly recounted by Chilton (1911). Miers (1876) doubtfully and incorrectly identified some New Zealand specimens with *Paramithrax barbicornis* (Latr.), at the same time pointing out differences and suggesting the conditional alternative name *latreillei*, later adopted by Rathbun and New Zealand authors. Although the identity of Latreille's species with *Gonatorhynchus tumidus* Haswell, as discussed above, has only recently been recognised, Filhol's name *cristatus* for the New Zealand species is superfluous; there is nothing in his account to show that he had more than a single abnormal specimen, perhaps broken, with one of the hepatic spines missing on one side (the intercalary and postocular being interpreted by him as hepatic). He is also in error in stating that the hepatic spines are subequal, and that the second joint of the antenna occupies the inner orbital hiatus; for the eave is fused with the basal joint as usual and the flagellum stands erect outside the hiatus. As Lenz (1901) points out, he omits in his fig. 11 the spine of the eave.

Balss (1929, p. 18) has examined the type of *Cancer ursus* Herbst in the Berlin Museum; it is a female, carapace 38 mm long; "*Mithrax ursus* Herbst nee Bell, mare, pacificum, Herbst, 2039". The relationships with *Paramithrax* were recognised by Milne Edwards (1834, p. 325) and the transference to that genus made by Gerstäcker (1856). And now this old and obscure species proves to be identical with *P. latreillei* Miers, and the name takes precedence.

HABITS: Apart from the *Nora Niven* collection and three records due to D. H. Graham, the crab is known only from intertidal reefs and from drift specimens on beaches, but the range extends to 40 fathoms at least, and the habitat is similar to that of the much commoner *P. minor*. As in the latter species, the fairly dense covering of weeds in the case of intertidal specimens is commonly intermixed with hydroids and polyzoans, and the hairs collect considerable quantities of mud; yet the two species contrast strongly in size and in the length and denseness of the hairs. The larger specimens in the collections are those from deeper water, and most are free from weeds or an epifauna; the length of the hairs however is sufficient to disguise the outlines of the crab. The Otago specimen from 40 fathoms has small pieces of no less than 12 species of algae, together with *Zostera* and hydroids, so that there is some doubt whether the depth mentioned can be correct. A larger series might possibly justify recognition of a deep-water variety.

The hairs (fig. 32a–d) are of two kinds. The long ones have four rows of microscopic spinulations, about 66 in a row, on the distal half, and are harsh to the touch; the short ones are hooked or nearly straight, usually smooth but in some cases with hints of serrations. On the sternum and abdomen are very short stubbly hairs, each arising from a globular boss, and also bosses without hairs.

COLOUR: After a year in spirit, the hairs are dull straw-coloured, carapace and chelipeds bright red, carpus however a decidedly dark red; white patches on sternum and bases of appendages, including antennae and third maxillipeds, fingers white. The red later fades to pink and ultimately whitish grey.

MATERIAL EXAMINED:

1 female, *ex* Hutton coll. (C, 9); 1 male, Dunedin, *ex* Hutton coll. (C).
1 male, 1 female ovig., Auckland; 1 male, 2 females, Lyall Bay (C).
3 males, 3 females, *Nora Niven* Exped. (C, 5).
6 males, Chatham Islands, coll. W. R. B. Oliver. 8/12/09 (C).
14 males, 13 females (1 ovig.), dried; Chatham Islands, coll. Miss Shand, 1904 (Ch).
2 males, 3 females (1 ovig.), no loc. (Ch).
2 males, Cape Campbell, coll. G. F. Pirritt, –/9/15 (Ch).
1 male (B, 11); 1 female ovig., –/8/27 (B, 10); 2 females, drift, Timaru, 12/8/25 and 12/6/27 (B).
1 female, Lyall Bay, among weed in intertidal pool, 23/12/30 (B).
1 male, 1 female, 1929 (O, 1); 2 males (O, 2); 1 male, Purakanui, 1930 (O).
1 male, coll. W. B. Benham, 4/2/00 (O, 6).
4 females (2 ovig., 2 imm.), Moeraki; coll. W. B. Benham, 1899 (O).
1 male, Chatham Islands, coll. W. B. Benham, 1907 (O).
13 males, 4 females, Chatham Islands; Otago Institute Exped., 1924 (O).
1 female, 20 fm, off Otago Heads, coll. D. H. Graham, 1930 (P).
1 male, 1 female, trawled, 5 fm, –/2/30 (P, 6).
1 male, 40 fm, east of Papanui Inlet, coll. D. H. Graham, 23/4/30 (P).
1 male, Whangarei, coll. W. Fraser, 7/7/30 (A).
1 female, small, Doubtless Bay; coll. L. T. Griffin, 13/3/31 (A).

PREVIOUS RECORDS:

Mare pacificum (Herbst, type loc.).
N.Z. (Miers, Filhol).
Otago, very common (Thomson 1913).
French Pass (Lenz).
Chatham Islands (coll. Schauinsland, det. Lenz 1901, verified Balss 1929).
Chatham Islands (Chilton 1907, Young 1929; both verified by author).

Balss also identifies with this species a male 28 mm in length in the Berlin Museum, differing from the other Berlin Museum material only in having a more hairy carapace – a character not likely to distinguish it from true *P. ursus*; it is described as having been collected by Overbeck at Liverpool, New South Wales, but as pointed out by Mr F. A. McNeill in a personal communication, there are no other Australian records, and Liverpool is some 25 miles inland. The extension of the range to Australia cannot therefore be admitted.[25]

TYPE: Berlin Museum (see above).

DIMENSIONS (mm): Large male from Port Chalmers: length 65; breadth 44; cheliped 90; hand 54; legs 1–4 respectively 79, 64, 56, 49. Chilton (1907) includes the base of the abdomen in measuring the length.

DISTRIBUTION: New Zealand mainland and Chatham Islands; apparently common in littoral habitats at the Chathams, commoner on the southern mainland than in the north.

[25]But see McNeill (1953, p. 92); *P. latreillei* from New Zealand and south-eastern Australia.

Genus **Leptomithrax** Miers

Paramithrax subg. *Leptomithrax* Miers, *Ann. Mag. nat. Hist.* (*4*), *42* : 20; 1876.
Leptomithrax Rathbun, *Biol. Res.* "*Endeavour*" *5* (*1*) : 19; 1918.
Balss, *Denkschr. Akad. Wiss. Wien 102* : 18; 1929.

Carapace ovate-triangular, spinous or nodulous above; pseudorostrum of two conical or flattened spines diverging at the base. Orbits short, deep, nearly circular, with a forward aspect, consisting of (1) a supra-orbital eave which terminates posteriorly in a spine or tooth, (2) an intercalary spine, and (3) a postocular spine arising at about the same level in the longitudinal direction as the intercalary, but lower down, forming the hinder and part of an inferior wall; the upper fissures closed or narrowly open, the floor with a wide and deep notch but much less imperfectly defined than in *Paramithrax*. The postocular spine is trigonal, the inner or anterior face flattened or somewhat hollowed to accommodate the retracted cornea; eyestalks short and stout. Basal article of antenna much enlarged, with two distal spines of which the inner is small and the outer small or large; peduncular article narrowly or widely excluded from the orbit by a fusion of the eave with the basal article or its outer spine. Merus of third maxillipeds notched at the antero-internal angle, with a distal spinule. Chelipeds strong, fingers pointed. Ambulatory legs cylindrical, dactyli unarmed.

As already noted, the characters quoted by Miers (1876) to distinguish the subgenus *Leptomithrax* from *Paramithrax* s. str. were those of the chelipeds; this basis of division breaks down on all sides, but the issue is somewhat clarified by the specification of type species for both by Miers in 1879. The type of *Leptomithrax* is *P.* (*L.*) *longimanus* Miers 1876, specified by Miers 1879, p. 656. The two sections in the genus *Paramithrax* distinguished by Milne Edwards (1834) were defined in terms of the orbital structure; one section included "species in which the orbit is very incomplete below, and in which the eyes do not reach the external angle", and the examples specified were the species now known as *P. peroni* M. Edw. and *Gonatorhynchus barbicornis* (Latr.); the other section contained "species in which the orbits have only a notch below and in which the eyes when retracted reach the external angle", with the species *P. gaimardi*. The latter species has not since been recognised with certainty, but as shown below it is close to or identical with *Leptomithrax australiensis*. It has been generally assumed that the subgeneric and ultimately generic names introduced by Miers are defined by Milne Edwards in the above sections, but it now appears that the second section, if *P. gaimardi* is the same as *L. australiensis* or close to it, belongs to at least a different subgenus from *L. longimanus*.

The following species belong to *Leptomithrax* as now understood:

1. *Paramithrax* (*Leptomithrax*) *australiensis* Miers 1876a, p. 220; Haswell 1882c, p. 16; Fulton and Grant 1906, p. 6; Hale 1927, p. 135, fig. 135. *Leptomithrax spinulosus* Haswell 1880, p. 441, pl. 25, fig. 3; Haswell 1882, p. 16; Rathbun 1918, p. 20, pl. 9; Balss 1935b, p. 125.

2. *Maia australis* Jacq. (refs. and synon. *infra*).
3. *Leptomithrax bifidus* Ortmann 1893, p. 52, pl. 3, fig. 6; Parisi 1915, p. 290, pl. 7, fig. 2; Sakai 1934, p. 298. *Paramithrax* (*Leptomithrax*) *bifidus* Yokoya 1933, p. 161.
4. *Paramithrax* (*Leptomithrax*) *brevirostris* Miers.
5. *Paramithrax* (*Leptomithrax*) *compressipes* Miers; the accounts of this and the preceding species have not been traced in the present study.
6. *Maja* (*Paramithrax*) *edwardsii* de Haan 1839, p. 92, pl. 21, fig. 2; *P. edwardsii* Adams and White 1848, p. 14; *P.* (*L.*) Miers 1876a, p. 220; *P. edwardsii* Ortmann 1893, p. 52; Rathbun 1894, pp. 66, 81; Parisi 1915, p. 289; *L. edwardsii* Doflein 1902, p. 656; *P.* (*L.*) *edwardsi* Yokoya 1933, p. 160; *L. edwardsii* Sakai 1934, p. 298. The correct name, not hitherto given accurately, is *Leptomithrax edwardsi* (de Haan).
7. *Paramithrax gaimardi* M. Edw., 1834, p. 325; Filhol 1885, p. 356; *Leptomithrax gaimardii* Rathbun 1918, p. 21.
8. *Leptomithrax globifer* Rathbun 1918, pp. 20, 23, pls. 11, 10; Hale 1927, p. 136, fig. 136.
9. *Paramithrax* (*Leptomithrax*) *longimanus* Miers 1876 (refs. and synon. *infra*).
10. *Paramithrax longipes* Thomson 1902 (refs. and synon. *infra*).
11. *Leptomithrax* (*Zemithrax* n. subg.) *moloch* n. sp. (*infra*).
12. *Leptomithrax* (*Austromithrax* n. subg.) *mortenseni* n. sp. (*infra*).
13. *Leptomithrax sinensis* Rathbun 1916, p. 555.
14. *Paramithrax sternocostulatus* M. Edw. 1851, p. 71, 291, pl. 10, figs. 3, 3a, 3m, 4; *P. gaimardii* Miers 1876b, p. 6 (not of M. Edw.); *P. sternocostulatus* Miers 1879, p. 9; Rathbun 1894, p. 82; Grant and McCulloch 1906, p. 28, pl. 3, figs. 2, 2a; *Leptomithrax sternocostulatus* Rathbun 1918, pp. 19, 22; Hale 1927b, p. 137, fig. 137; Balss 1935b, p. 125.
15. *Paramithrax tuberculatus* Whitelegge 1900, p. 146, pl. 34, figs. 1, 2; *Leptomithrax tuberculatus* Rathbun 1918, pp. 20, 22.
16. *Chlorinoides waitei* Whitelegge 1900, p. 143, pl. 33; *Leptomithrax waitei* Rathbun 1918, pp. 19, 23.

Of these 16 species, No. 1, 9, 10, 11, and 12 occur in New Zealand, No. 2, 8, 14, 15, and 16 are Australian, No. 3 and 6 are Japanese; No. 5 was described from Canton and No. 13 from the Philippines; the locality for No. 4 is unknown, while No. 7 was originally recorded from New Zealand but is more likely to be Australian. The list differs considerably from that compiled by Balss (1929, p. 19) but is by no means final.[26] Probably *Paramithrax parvispinosus* and possibly *P. spinosus* should be added. A reconsideration of *L. australiensis* Miers and the cluster of related or synonymous species is especially urgent. A case is made out below for regarding *L. gaimardi* M. Edw. as the same species, in which case *L. australiensis* lapses as a synonym; *L. spinulosus* Haswell is a synonym of *L. australiensis*, as determined by Fulton and Grant through an examination of the types of both; and *L. globifer* Rathbun differs only in slight and perhaps variable characters and may represent only a deepwater form of the common species. To the original records of *L. globifer* may be added: 1 male, length 67 mm, off Eucla, Great Australian Bight, 90 fathoms; coll. D. L. Serventy, Perth, Feb. 1930.

Within the assemblage of species enumerated above there are profound differences with respect to a number of characters, which for the most part may be arranged into four groups: (1) The basal joint of the antenna and its relation to the eave of the orbit, and the form and position of the outer distal spine and of the flagellum (figs. 34–36); (2) the upper orbital margin, the form of the spine or tooth of the eave and the intercalary and postocular spines, and the fissures or foramina between them; (3) the inflation in some species of the proximal articulation of the merus of the third maxillipeds, or of the ischium and merus, to form a conspicuous projecting hemispherical boss; and (4) the occurrence or otherwise of deep excavations in the sternum and abdomen, especially of the male. It is now proposed to distinguish three subgenera on the basis of these differences, all three being represented in New Zealand and two perhaps endemic.

Subgenus **Leptomithrax** s. str.

Flagellum of antenna long with stout peduncular articles, narrowly excluded from the orbit by a narrow fusion of the eave with the upper distal margin of the basal joint of the antenna; the outer distal spine is separated from the eave by the peduncular articles, which are large; eave with a conical spine as in *Paramithrax*; upper orbital margin with two widely open fissures; postocular spine simple and acute; third maxillipeds without a swollen boss at articulation of ischium and merus; abdomen and sternum not excavated.

TYPE SPECIES: *Leptomithrax longimanus* Miers.

DISTRIBUTION: New Zealand, perhaps exclusively so.

The subgenus is distinctly more primitive than the others and nearer to *Paramithrax*; the antenna (fig. 34) and orbit are not widely different from the condition in that genus (fig. 33), the postocular spine is flattened in front, though not hollowed out to the same degree as in the other subgenera, and is situated further forward, so that the orbit is shortened from behind. The lower margin of the postocular spine approaches the basal joint of the antenna at a wide angle, leaving a broad V-shaped gap in the lower margin of the orbit; at the (inverted) apex of the V there is a conical granule, which in the other subgenera becomes obsolescent and crowded out of the margin by the closer approximation of the sides of the V. The pseudorostral horns, the spine of the eave, the intercalary and postocular and marginal spines are simple, conical, and acute, whereas in the more specialised subgenera they are variously modified. The chelipeds are massive but the walking legs not necessarily long. Hooked hairs are relatively numerous, though less so than in *Paramithrax*. There is a pair of small spinules above the posterior margin.

[26] A new species, *L. richardsoni*, has since been described by Dell (1960) from the Chatham Islands 1954 Expedition.

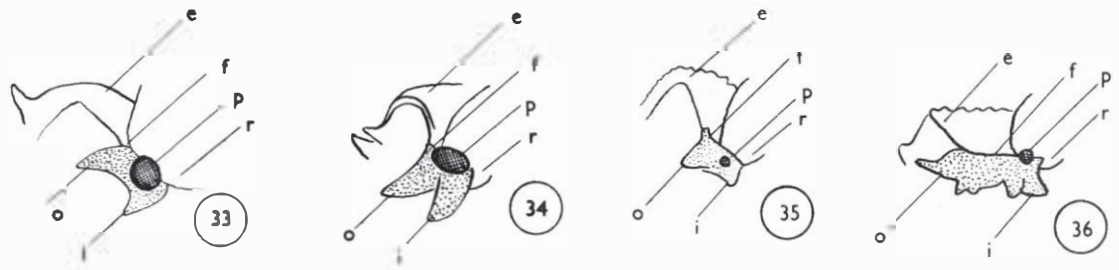

FIG. 33–36: *Paramithrax* and *Leptomithrax* s.l., basal article of antenna seen in end (frontal) view, × 6/7; 33, *Paramithrax* (*P. peroni*); 34, *Leptomithrax* s. str. (*L. australis*); 35, *Zemithrax* (*L.* (*Z.*) *longipes*); 36, *Austromithrax* (*L.* (*A.*) *mortenseni*); e. eave, r. pseudorostrum, i. inner spine of basal joint, o. outer spine of basal joint, p. peduncle, f. fusion with eave.

KEY TO SPECIES

A. Postocular spine without an accessory spinule; arm and wrist tuberculate all over; basal excavation of fixed finger of male defined distally by an angulation, denticulations not extending into the gape; carapace length scarcely exceeding 2½ in. ..... **L. longimanus**

B. Postocular spine with an accessory spinule on the upper margin; arm and wrist granulated on upper and outer surfaces only; excavation on fixed finger of male passing by a broad curve into the distal inner margin; denticulations spreading into the gape; carapace length up to 4 in. ..... **L. australis**

Leptomithrax (Leptomithrax) longimanus Miers, Figs. 37–40, 117.

Paramithrax (*Leptomithrax*) *longimanus* Miers, *Ann. Mag. nat. Hist.* (*4*) *17* : 220; 1876.
Miers, Cat. Crust. N.Z., p. 8, pl. 1, fig. 3; 1876.
Miers, *J. Linn. Soc. Lond., Zool. 14* : p. 656; 1879.
Filhol, Mission de l'Ile Campbell, p. 364, pl. 39, figs. 4, 5; 1885.
Rathbun, *Proc. U.S. nat. Mus. 16* : 66, 82; (1893) 1894.
Paramithrax (*Leptomithrax*) *affinis* Borradaile, *Brit. Ant. Exped. 1910, Zool. 3* : 104; text-fig. 14a–c; 1916.
Balss, *Denkschr. Akad. Wiss. Wien. 102* : 19; 1929.
? *Leptomithrax affinis* Chilton & Bennett, *Trans. N.Z. Inst. 59* : 740; 1929.
Leptomithrax longimanus Chilton & Bennett *tom. cit.*, p. 739.
Leptomithrax australis Balss, *Senckenbergiana 12* : 199; 1930 (not of Jacq.).

Carapace (figs. 37, 117) of moderate size, antero-lateral margins rather regular and tapering, outline somewhat triangular. Regions well marked; gastric region inflated, standing higher than the branchial and well above the hepatic regions; cervical groove broad and deep, forming a deep broad pit in front of an epibranchial inflation. Branchial regions inflated, except the depressed metabranchial; sides vertical. (The inflation of the branchial regions and the depth of the regional grooves are exaggerated in the photograph through some accident in the lighting.)

The dorsum is covered with conical tubercles of varying sizes; one on the epibranchial region forms an erect spine, and those of the following median and submedian series are mostly enlarged: five frontal and gastric pairs (first and fifth small, one or two more obsolete pairs in front), forming two distinct parallel rows; then two median gastric ones, a close pair, and finally one (or three confluent) on hinder gastric boundary; a prominent close cardiac pair; a small confluent intestinal pair, a large median one, and a strong pair near the posterior margin.

Upper and lower surfaces with short close velvet-like tomentum, becoming longer on the legs. Facial region smooth; male cheliped like the dorsum except that the hand is glabrous beyond the base. Pseudorostral horns with an inner basal row of hooked hairs. The eye shelters behind two fringes of long hairs arising from upper and lower margins of postocular spine.

Pseudorostral horns (figs. 37, 38, 117) long and slender, outer margins parallel but converging near the tip, inner concave; horizontal or depressed. The eave is high and strongly arched, semicircular, margin nearly longitudinal; its spine arises abruptly, forming a clear-cut right angle; spine short, blunt, its posterior margin four times as long as anterior, passing by a U-curve to the distant and parallel anterior margin of intercalary spine; latter acute, flattened, reaching beyond level of spine of eave, hinder margin convex or subangled. Postocular separated by a fairly wide U-fissure, basally parallel to intercalary and thereafter tapering; twice as high as any other spine, sharp, keeled behind, upper and lower surfaces equal, flat, smooth.

Basal joint of outer antenna (fig. 38) oblique, comparatively slender, inner margin with two or three conical tubercles, outer margin concave and expanding below into a rectangular lobe, below which there is a strong blunt tubercle in the floor of the orbit, almost bridging the gap between the basal joint and the postocular spine, but separated by narrow notches. Distal spines long, acute, the inner one the longer, both visible in dorsal view.

Hepatic region with a long slender acute spine, curving forwards; branchial margin with three spines (first and third moderate, second long and curving upwards) and two dorsal blunt tubercles continuing the curve well forward and inward. Subhepatic region with four to five large conical tubercles and some smaller ones (variable); an irregular row of about eight extends from the anterior corner of the buccal frame to the side of the cheliped; a subbranchial row and some irregular tubercles, mostly small. Posterior margin produced and smooth.

Cheliped of male (fig. 39) very long, comparatively slender, merus two-thirds the carapace length, ischium extending half way along merus or decidedly less in large specimens. Ischium nearly smooth; merus cylindrical, covered uniformly all over with conical tubercles, which are mostly larger than those of the dorsum, save that those of a

distal patch above and below are much smaller; wrist long, cylindrical, similarly granulated; hand very long, not as stout as merus, strongly and evenly inflated on both surfaces and nearly cylindrical, with minute rounded granules, smaller without than within or below; granules uniformly scattered above and below but on the inner and outer surfaces they are confined to a reddish anastomosing pattern of which the interspaces are white and smooth. Hands smooth distally; fingers (fig. 40) smooth; fixed finger with oblique ridge at base of lower margin, which is therefore out of line with lower margin of palm; inner margin deeply excavated through half the length, with a stout conical tubercle in the gape and close to the base, but tending to become obsolete in old males. Movable finger lightly curved with a stouter conical tooth beyond that of the fixed finger. Both fingers finely denticulate over the distal half.

Legs long and slender, steadily decreasing, last pair nearly equal to carapace with pseudorostrum; carpus flattened and grooved above, other joints cylindrical, merus with a blunt upper terminal spine, dactyli nearly straight as far as the claw.

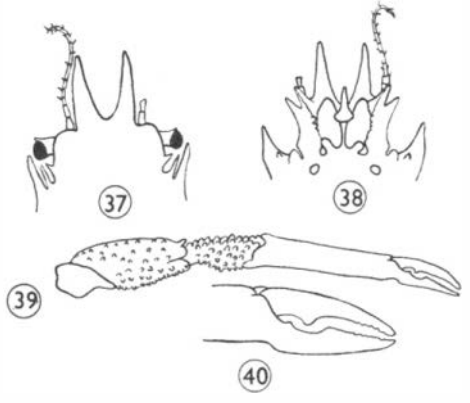

FIG. 37–40: *Leptomithrax longimanus* Miers, adult male; 37, fronto-orbital area, × ⅔; 38, facial region, × ⅔; 39, cheliped, × ⅓; 40, fingers, nat. size.

VARIATIONS: Among the available specimens the females are much smaller than the males, with a maximum median carapace length of only 25 mm, and another one only 18·5 mm long is already ovigerous. In several respects, as usual, the females resemble small males.

The regions in the female are very clearly marked, the grooves not obscured by tubercles, which are mostly obsolete; of the median and submedian tubercles, only the following are prominent: the last gastric pair, the two median gastrics, the cardiac pair, the median intestinal and the pair near the posterior margin; the latter pair are erect conical spines, the others are mostly low spinules except the blunt cardiac pair; the epibranchial spinule is distinct. The lateral spines are large, acute, slender, the hepatic larger than the four branchials, of which the last is small and erect, the others longer, subequal, acute, nearly horizontal with upturned tips; five to six acute subhepatic spinules, none recognisable as a second hepatic; a small spinule behind the first branchial, though visible from above, belongs to a reduced submarginal series rather than to the lateral row.

Pseudorostral horns slender, more divergent, tips a little upturned. Dorsum, legs, and merus of cheliped with short tomentum, which is still shorter but dense on lower surface (including abdomen and third maxillipeds); wrist and hand naked; a line of longer hairs on upper margin of merus of legs.

Cheliped of female about equal in length to first walking leg, merus about as stout, merus and carpus stouter in young male; tubercles of merus spinulous above, lower margin smooth; carpus glabrous with blunt tubercles on proximal half and chiefly towards the upper margin; hand smooth, very slender; fingers slender, nearly straight, denticulate, with a slight basal gape not occupied by tubercles. The meral spine of the legs is strong.

In the smallest specimen, 10 mm long, there is a minute spinule above the cornea; the intercalary spine is formed, and in contrast to *Paramithrax* shows no sign of post-megalopa origin.

HISTORICAL: This very distinctive species has been too infrequently met with to have given rise to much confusion, save that Borradaile has treated the juvenile female as a distinct species. The four supposed differences between *P.* (*L.*) *affinis* Borradaile and "*P.* (*L.*) *longimanus*" Miers are easily accounted for: (1) The shortness of the cheliped in the former is due to age and sex; (2) the slender divergent pseudorostral horns are normal for the younger stages; (3) the distal spine on the upper margin of the merus occurs in the adult *L. longimanus*; and (4) the spine on the merus of the third maxilliped is common to all New Zealand species of *Paramithrax* and *Leptomithrax*. Specimens in the Canterbury Museum, of the same size as Borradaile's, agree with *P. affinis* save in a few trivial and variable characters (cheliped and first leg subequal, wrist a little tuberculated), and also agree sufficiently with *L. longimanus* to leave no doubt but that *P.* (*L.*) *affinis* is a simple synonym. The only notable difference is the smoother dorsum.

Balss has identified with Borradaile's species an ovigerous female 16 mm in length, collected north of New Zealand by the *Gazelle*, 27/10/1875 (Balss 1929), and three males, about 14 mm in length, dredged by Dr L. Kohl-Larsen in Perseverance Harbour, Campbell Island, –/4/24 (Balss 1930); and in the later paper he considers them to belong also to *L. australis* (Jacq.), of which in that case *L. affinis* becomes a synonym. The characters however shared with *L. australis* are equally common to *L. longimanus*, and Balss' description links his specimens with the above-described juveniles, and therefore with *L. longimanus*. On the other hand, the northern localities of the *Gazelle* and *Terra Nova* specimens contrast with the strictly southern distribution of *L. australis*.

Miers erred in referring to the absence of spines on the antero-lateral margins, and the statement by Chilton and

Bennett that the pubescence is apparently transient is at least doubtful.

HABITS: The sparse data with the specimens indicate depths of 30–100 fathoms, and the long slender limbs and sparse hairs suggest a preference for deep water. Most specimens are exceptionally clean, but some carry serpulid tubes, barnacles (*Balanus decorus*), and sponges on the dorsum and chelipeds; some from Otago have a denser tomentum than usual with much mud and a mass of sponges, the latter extending on to the legs as well as the dorsum, disguising the crab but leaving the chelipeds exposed.

The amount of tomentum differs greatly in the collections, being perhaps lost through long storage in spirit. It is ordinarily more conspicuous in the smaller specimens, but the very large male collected by Suter at Akaroa is everywhere densely tomentose except on the hands, the hairs covering even the third maxillipeds, epistome, and basal joint of the antenna.

MATERIAL EXAMINED:

2 males, Sumner; 1 male, no data; *ex* Hutton coll. (C).
1 male, Stephens Island, –/6/16; 1 male, Puysegur Point, –/7/14; coll. T. B. Smith (Ch).
2 males juv., 2 females (1 juv.), 10 miles NW from Cape Maria, *Hinemoa* Exped., 1914 (Ch).
1 male juv., 2 females (1 ovig.), 29/12/14 (C, 21).
1 male, Wellington, coll. F. G. Maskell, –/12/29 (C).
1 male, Timaru, drift on beach; 12/6/27 (B).
1 male, east coast of South Island, *Doto* Exped., –/4/1900 (●).
1 male, 1 female ovig. (●, 16).
1 male, off Sandfly Bay, 30 fm, in stomach of sea perch (*Helicolenus percoides*); coll. D. H. Graham. 10/3/30 (P).
3 males, 3 females (2 ovig.), east of Papanui Inlet, 40 fm, coll. D. H. Graham, 5/2/30 (P).
1 male, Akaroa, coll. H. Suter (Length 59 mm) (A).

PREVIOUS RECORDS:

N.Z. (Miers); Stewart Island, 30 fm (Filhol).
Near Three Kings, 100 fm (*P.* (*L.*) *affinis* Borradaile).
Dunedin and a few of the above records (Chilton & Bennett).
Off Cape Saunders, 60 fm, –/3/30, several males (Graham, MS).

TYPE: British Museum (if extant);[27] type loc., New Zealand.

DIMENSIONS (mm): Largest male: length 64; breadth 56; cheliped 153; hand 76; legs 1–4 respectively 92, 85, 77, 68.

DISTRIBUTION: New Zealand mainland.

Leptomithrax (Leptomithrax) australis (Jacquinot), Figs. 34, 41–45, 118

Maia australis Jacquinot in Jacq. & Lucas. *Voy. Pole Sud. Zool. 3* : Crust. p. 11, pl. 2, fig. 1; 1853.
Paramithrax (*Leptomithrax*) *australis* Miers, *Ann. Mag. nat. Hist.* (4) *17* : 220; 1876.
Miers, Cat. N.Z. Crust., p. 7; 1876.
Leptomithrax australis Filhol, Mission de l'Ile Campbell, p. 361, pl. 38; 1886.
Thallwitz, *Abh. zool. anthrop.-ethnogr. Mus. Dresden*, 1892, p. 49.
Rathbun, *Proc. U.S. nat. Mus. 16* : 66, 82; 1893 (1894).
Chilton, Subant. Isls. N.Z., Crust., p. 607; 1909.
Thomson, *Trans. N.Z. Inst. 45* : p. 237; 1913.
Stephensen, *Vedensk. Meddel. Dansk. Naturh. Foren. 83* : 292; 1927.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : p. 738; 1929.

Carapace (figs. 41, 118) very large, widened (especially in old males) across the branchial regions, antero-lateral outline comparatively straight. Regions well defined by deep grooves, less so than in *L. longimanus* with sides of grooves less steep. Branchial regions inflated, standing at least as high as the gastric.

The median and submedian series of tubercles includes three frontal conical pairs (third almost spinose) and three gastric pairs, forming two rather distant parallel rows with some granules between the rows; two median nodules with granules intermingled; on the metagastric regions a transverse row behind the groove, median members scarcely marked off; three to five confluent urogastrics; an enlarged blunt fused or confluent cardiac pair, then a strong median conical or bifid tubercle, and an enlarged conical pair in front of the posterior margin. The whole series is rather variable and is disguised by the encroachment of asymmetrically scattered granules, which also spread over the rest of the dorsum, becoming spiniform towards the antero-lateral margins.

Large specimens are almost completely glabrous, those of moderate size are covered with minute hairs between the dorsal tubercles and longer ones on the latter; legs covered with very short stubbly hairs with larger ones sparsely intermixed, hooked above. Abdomen, sternum, and lower surfaces of legs sparsely haired, chelipeds naked except upper side of merus and base of carpus.

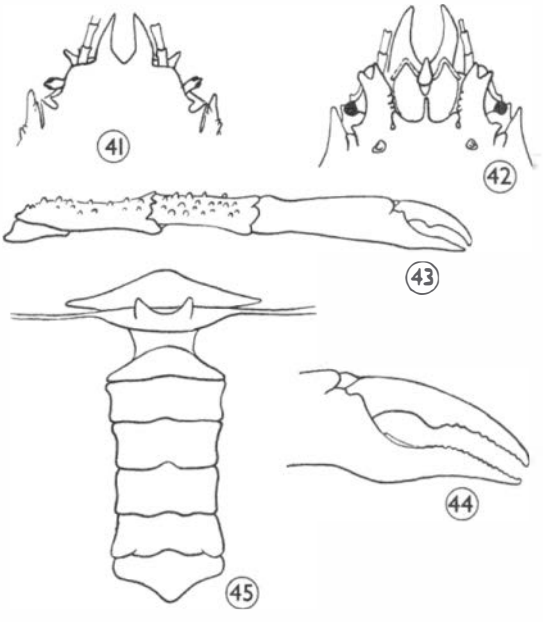

FIG. 41-45: *Leptomithrax australis* Miers, adult male; 41, fronto-orbital area, × ⅔; 42, facial region, × ⅔; 43, cheliped, × ¼; 44, fingers, × ⅔; 45, abdomen.

[27]Holotype male (Reg. No. 52.12) from "New Zealand" in British Museum (Nat. Hist.), 1962; Dr I. Gordon (pers. comm.).

The pseudorostral horns (fig. 41) are short, deflexed, outer margins regularly convex and distally converging, inner margins parallel through distal two-thirds. Basal joint of antenna (fig. 42) with two to four irregular stout granules on inner margin, outer margin with a sharp conical spine below, separated by a deep notch from the spinose tubercle which, as in *L. longimanus*, occupies the base of the orbital notch; this spine or tubercle may have one or two subsidiary granules. Distal spines less slender than in *L. longimanus*, stouter and less acute, inner one stronger, both prominent in dorsal view.

Eave (fig. 41) semicircular, almost longitudinal in dorsal view; the spine forming an obtuse rounded angle with it, short, acute, posterior margin about three times as long as anterior. Intercalary spine separated by a deep U, sloping away, rather broadly triangular, sides straight, distinctly higher than the spine of the eave, one or two small tubercles or spines on outer surface. The postocular spine is separated by a deep V-shaped notch, anterior margin running straight as far as tip of a conical spine beyond the middle of the length, this accessory spine reaching the same height as the intercalary; margin concave beyond the spine, rising much higher, so that the accessory spine is lateral and scarcely approaches the bifid condition in *L. sternocostulatus*; posterior margin scarcely keeled but with a ridge bearing three conical granules towards the base; upper surface channelled, lower flat and much wider.

Hepatic region with two sharp conical spines, the anterior one very stout; branchial region with five conical spines, the first and third very large, second small and at a lower level than the others, rather close to them, and strictly belonging to a submarginal series, fifth small and dorsal; some other spinules intervene, and the curve can be traced inwards and forwards through two other tubercles broader than their neighbours on the dorsum. The subhepatic region bears three to four long sharp spines in a row, visible from above in front of the hepatics, and some scattered ones below the first hepatic; subbranchial region with numerous spinules and tubercles in several irregular rows.

Posterior margin produced in the middle behind the transverse ridge which bears the two large tubercles, as in *L. longimanus*.

The ischium of the male cheliped (fig. 43) is minutely granulated distally, and extends two-fifths of the length of the merus. The latter is less than one and a half times the length of the wrist; merus and wrist cylindrical and thickly covered on upper and outer surfaces with stout acute but rather low spinous tubercles, minutely and sparsely granulate below, densely granulate distally. The palm is much stouter than the merus, becoming higher distally, both surfaces inflated, lower margin rounded, upper margin less broadly rounded; granules on anastomosing coloured background as in *L. longimanus*. The lower margin of the fixed finger (fig. 44) is deflexed, then parallel to lower margin of hand, then deflexed again. Gape deep, long, not terminating in a distinct angulation, with vestigial basal tubercle. Movable finger curved with large flat tubercle beyond the middle of the gape. On the fixed finger the denticulations extend to about the middle of the gape, on the movable finger they extend to the tubercle.

Legs stout, long, regularly decreasing, last longer than carapace with pseudorostrum; merus unarmed; all joints cylindrical, dactylus and claw nearly straight.

In the female (fig. 118, above) the chelipeds are nearly as long as the first legs and a little stouter, granules on wrist and arm smaller and fewer than in the male, hand smooth, palm tapering, fingers cylindrical with linear gape and minute denticulations throughout their length.

Abdomen of male (fig. 45) with second segment twice as wide as first and as wide as the last, intervening outline (segments three to six) lightly and regularly concave; tip produced, rounded.

HISTORICAL: This distinctive species, described by Jacquinot and Lucas in 1853, has remained free from synonymic complications. As discussed on p. 48, the juvenile specimens referred to it by Balss appear to belong to *L. longimanus*. The differences between the adults of the two species have been discussed by Chilton and Bennett (1929) where however the specific names have been interchanged on p. 739, lines 1–3.

Filhol's figure (1886, pl. 38) exaggerates the lateral spines, omits the second hepatic, and shows the orbit and posterior margin incorrectly; the gastric region is represented as divided by a longitudinal groove, which however does not extend beyond the frontal region.

HABITS: This fine crab greatly exceeds any other New Zealand crabs in size, except *Jacquinotia edwardsi*; it is not common, and appears to prefer moderately deep water. The carapace and limbs are densely covered with sessile animals, most of which bear shells – serpulids, *Spirorbis*, prostrate calcareous Polyzoa, less commonly sabellids, cirripedes, sponges, and hydroids. Where these occur in quantity, the hairs are lost. The epifauna, especially *Spirorbis*, spreads freely to the limbs and ventral surfaces; more than 100 specimens of the worm mentioned occurred on one of the outer maxillipeds of a large crab, and the corresponding appendage had a still more massive burden of serpulids.

COLOUR: Reddish-brown (Filhol). The present series after long preservation shows traces of this colour and of the anastomosing pattern on the chelipeds, described under *L. longimanus*.

MATERIAL EXAMINED:

4 males, 1 female ovig., *ex* Hutton coll. (C).
3 females, Auckland Islands, *Aurora* Exped., 5/7/12 (C).
1 male, dry, Cape Saunders (O).
1 female, east of Papanui Inlet, 40 fm, coll. D. H. Graham, 5/2/30 (P).

PREVIOUS RECORDS:

Auckland Islands (Jacq. & Lucas, Thallwitz, Stephensen, Chilton).
Stewart Island, 30 fm (Filhol).
Dunedin (Chilton & Bennett; omit records from Hauraki Gulf and Little Barrier).
Otago; "Not uncommon on the coast. Occasionally taken on the sandbanks by the seine net". (Thomson).

TYPE: Paris Museum (if extant),[28] a female; type loc., Auckland Islands (Jacquinot and Lucas). Filhol mentions a male in the Paris Museum collected by Jacquinot and Lucas, presumably from the type locality.

DIMENSIONS:

	Male	*Male*	*Largest Female*
Length	108	105	80
Breadth	96	93	63
Cheliped	285	267	81
Hand	144	130	36
Legs 1–4	156, 141, —, —.	149, 142, 128, 111.	87, 83, 79, 72

The female is narrower than the male and the legs as well as the chelipeds are relatively shorter.

DISTRIBUTION: Auckland Islands, southern part of South Island. A distinctly southern distribution.

Subgenus **Austromithrax** n. subg.

Basal joint of antenna greatly broadened distally; outer distal spine very long, acute, directed upwards and outwards and prominently visible in dorsal view, broadly in contact with the eave and filling up the front part of the orbit to a level midway between the pseudorostrum and the postocular joints, arising near the inner margin of the basal article, close to the pseudorostral horn and widely excluded from the orbit. Postocular spine acute, truncate, or bifid; upper margin produced, touching the intercalary spine, closing the fissure or at most leaving a tear-drop shaped foramen below. Spine of the eave erect and acute or reduced to a transverse tooth, separated from the intercalary spine by an open fissure. Third maxillipeds with or without a boss at the articulation of ischium and merus. Abdomen and sternum of male with a deep pit on each side of each segment, or smooth.

TYPE SPECIES: *Leptomithrax* (*Austromithrax*) *mortenseni* n. sp. (Below).

DISTRIBUTION: New Zealand (one species), Australia five or six species).

The characters mentioned all represent an advance on *Leptomithrax* s. str., except that in some species the spine of the eave remains erect and conical, and the pseudorostrum and various spines do not tend to be flattened as constantly as in *Zemithrax*; the postocular spine is commonly truncate and may be bifid. The basal joint of the antenna has become highly specialised, shortening the orbit from in front by filling up the large V-shaped notch occurring in the other subgenera at the fusion of the joint with the eave. The sternum of the male may be somewhat excavated, as in *L.* (*A.*) *australiensis* and *L.* (*A.*) *globifer*, or distinctly excavated into a series of well defined gutters, as in *L.* (*A.*) *mortenseni*; in this case the sternal plate between the chelipeds bases has a Y-shaped cavity, the stem of the Y forming a deep recess immediately behind the mouth frame, with or without a large tubercle adjacent to the latter – save that in *L.* (*A.*) *sternocostulatus* this plate has four excavations instead of the Y-figure.

The outer maxillipeds retain the primitive condition in *L.* (*A.*) *mortenseni*, in that there is no boss, but in *L.* (*A.*) *globifer* there is a boss on the merus, while in *L.* (*A.*) *australiensis* the ischium is also a little swollen (it is however uncertain how far this difference is constant, or how far it may serve to distinguish these close species). Finally, *L.* (*A.*) *waitei* reaches the condition found in *Zemithrax*, the boss spreading equally on to the ischium and merus across their point of junction. The paired spines above the posterior margin provide another link with *Leptomithrax* s. str. and a contrast with *Zemithrax*.

The distribution of the six or seven species narrows the possibilities as to the identity of *L. gaimardi*, which, as Milne Edwards and Filhol make quite clear from the description of the basal joint of the antenna, belongs to *Austromithrax*; Filhol further describes the postocular spine as strong, triangular, with two small secondary spines; two hepatic spines, the second bifurcate; five large branchial spines with smaller ones between them; towards the outer side of the carapace there are smooth tubercles bearing hooked hairs and alternating with numerous spines; the median series is numerous and elevated; the wrist is covered all over with spinulose granules. Though stated by Milne Edwards to have been taken in New Zealand by Quoy and Gaimard, the species does not agree with any known New Zealand species. Rathbun (1918b, p. 21) suggests that it may be *L. spinulosus* Haswell, but has evidently overlooked Fulton and Grant's decision (see synonymy above) that Haswell's species, as believed also by Miers, is but a synonym of *L. australiensis* Miers. Balss (1935, p. 125) has likewise overlooked the decision of Fulton and Grant (1906, p. 6) with however a suggestion to the same effect. A female specimen of *L. australiensis* in the author's collection has the posterior hepatic spine bifurcate on one side; in others the acute subspinulose tubercles between the first and second of the four large branchial spines, or between the second and third, or even both, may be long and spinose, giving the *spinulosus* condition of Haswell, with eight lateral spines (including the hepatics). A combination of these characters gives *L. gaimardi* as characterised by Filhol, for in all other respects the agreement (i.e., with the *spinulosus* rather than with the globifer form of *L. australiensis*) is close. The boss on the outer maxillipeds and the cavities in the sternum are inconspicuous in *L. australiensis*; and the French authors Milne Edwards and Filhol mention neither in *L. gaimardi*.

Since *L. sternocostulatus* and *L. gaimardi* were originally described by Milne Edwards in the same work, and the highly distinctive characters of the former emphasised in the the specific name, they are no doubt distinct; in including the name "*gaimardii* Miers 1876b" in the synonymy of *L. sternocostulatus*, Balss (1935b, p. 125) evidently intends "not of M. Edw." to be understood.

[28] Type-female, and male specimen, both seen in Paris Museum by E. W. Dawson, 13/4/56.

Leptomithrax (Austromithrax) mortenseni n. sp., Figs. 36, 46–48, 119, 120

Carapace (figs. 46, 119) small, uneven and tuberculate, antero-lateral margins comparatively straight. Regions rather obscurely defined, mesogastric and cardiac elevated, branchials low and nearly flat with the sides overhanging, metabranchials short and depressed; a pit on each side of the intestinal region; a moderate marginal constriction behind the hepatic regions.

The median and submedian series include: one to three frontal and 1 gastric pairs of rounded nodules and some irregularly placed ones; two blunt erect median gastric spines on large bases, the second one the higher; a pair of rounded nodules followed by a median one on the strongly depressed urogastric region; a confluent pair at the apex of the very high cardiac region and a smaller one on the hinder slope; an intestinal group of three confluent nodules; and a nearly horizontal pair of spines overhanging the posterior margin, their slopes finely granulated.

Pseudorostral horns moderately long, slender, sharp, horizontal, outer sides divergent, the intervening angle narrowly rounded.

The eave of the orbit is strongly arched, semicircular, longitudinal in dorsal view, rising high above the level of the frontal region; posteriorly it is produced by a broad curve, which continues the curve of the orbit, into a short tooth, of which the anterior margin is convex, the hinder straight, tip rounded or truncate. There is an open U-shaped shallow fissure between the tooth and the intercalary spine, which is short and triangular, reaching only half way to the tooth of the cave, with the hinder margin twice as long as the anterior; the hinder margin lies along the postocular spine, closing the posterior fissure above, but leaving a linear button-hole foramen below. Postocular spine with upper margin angled opposite the tip of the intercalary; upper surface concave and bearing a few granules, tip truncate and blunt; posterior margin keeled, bluntly angled near the base, slightly concave distally and obsoletely granulate; lower margin with a raised granulate rim which makes the lower surface a little concave distally.

The hepatic region is little inflated, with two transverse conical spines, the anterior one much the larger; subhepatic margin with an inflated granulous protuberance contrasting with the adjacent smooth areas, but not projecting nor visible from above. Branchial region with four long slender sharp subequal and equidistant spines, second and third almost horizontal, last one well up on the dorsum, directed backwards and a little upwards, rarely bifid; behind the second spine the lower margin and the adjacent inframarginal slope are granular. The dorsum bears small rounded granules of varying size; on the eave they are obsolete except at the base; the pseudorostral horns are smooth or with vestiges of granules near the base.

The larger dorsal tubercles bear a few short hooked hairs; pseudorostrum with hooked hairs; undersurface glabrous except for a sparse and very short covering on the third maxillipeds. There are scattered long hairs on the legs, including hooked hairs on the upper margins of merus and carpus; tarsi with minute rigid scale-like hairs, a few also on propod.

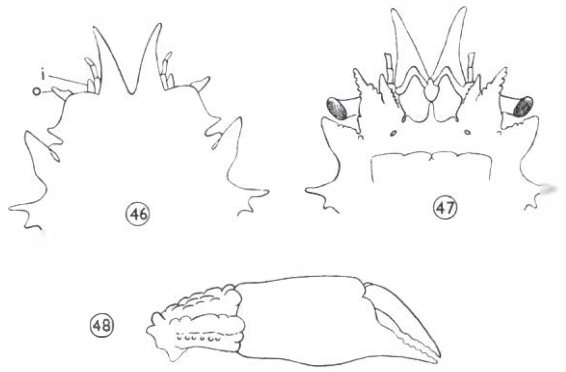

FIG. 46–48: *Leptomithrax (Austromithrax) mortenseni* n. sp., male (type), × 1½; 46, fronto-orbital area, o. outer spine of basal joint of antenna, i. inner spine of same; 47, facial region; 48, wrist and hand.

The basal joint of the antenna (figs. 36, 47) is exceptionally broad, the inner margin forming an oblique denticulate ridge ending in a stout acute spine whose tip is external to the insertion of the flagellum and visible from above. The outer corner is produced into a long sharp trigonal spine, with a prominent nodule on the inner side near the base, so that the joint appears almost trifid; the spine is directed obliquely upwards and outwards, its upper surface and outer and lower margins granular; upper margin widely fused with the eave. In the lower orbital margin, the postocular spine is granular, the antennal joint bears sharp conical granules, the edges of the two approximate at the base and form a broad shallow opening, which however is deepened by a smooth-sided U-notch at the base. Behind a shallow groove running from this notch to the corner of the mouth frame there is an obsolescent granule, well outside the margin.

The eyestalk is short and stout; cornea large, ventral and spreading well up to the sides, a subspinulose terminal papilla above.

Outer maxillipeds (fig. 119) without a boss at the junction of ischium and merus. Sternum of male with three pairs of cavities, not bounded on the inner side but reaching the abdominal groove; cavity on cheliped-sternite deep in the middle with a median nodule immediately behind the mouth-frame.

The cheliped of the male is moderately stout, longer than the carapace with pseudorostrum. The ischium extends nearly half the length of the merus, which is short, stout, nearly cylindrical, granulated all over, the upper granules and a row of three on the lower margin prominent, the rest mainly microscopic. There is a stout obtuse denticulated spine above between the distal articulations. The carpus

(fig. 48), in addition to scattered granules, has two rows of elevated nodules, scarcely crested, the rows meeting proximally in an elevated subspiniform nodule. The palm is short and stout, microscopically granulate; upper and lower outlines a little convex; lower margin broadly rounded; upper subangled, especially at the base. Fingers short with linear gape, fixed finger a little excavated, movable finger angled at the middle, inner margins finely denticulate along the distal half. In the female and young male the hand is small, tapering, upper margin subcarinate, fingers very slender with a linear gape, inner margins regularly curved with minute denticulations.

Legs very slender, smooth, unarmed, dactyli long and lightly curved.

Relationships: There are many detailed points of resemblance to *L.* (*A.*) *tuberculatus* Whitelegge (1900), but in the Australian species the branchial spines are "rather more than twice their length apart", and therefore shorter; the spines at the hinder margin are also shorter; the fissure between the intercalary spine and the postocular tooth is not quite closed above (possibly variable); and there is a boss on the third maxillipeds. There is however detailed agreement in the dorsal granules, the under surface (including sternal cavities and the glabrous and smooth surfaces and the subhepatic tumidity), the antennary spines, and the chelipeds and legs. This relationship verifies the implication in the subgeneric diagnosis, that the presence or absence of a boss on the third maxillipeds is not a character of major importance. There are points of resemblance also to *L.* (*A.*) *sternocostulatus*, in which the antennary spines and orbit are similar, the postocular acute, the branchial spines long, the outer maxillipeds without a boss, and the sternites excavated; but the under surface is granulated, the sternite between the chelipeds has several excavations, the maxillipeds and abdomen are densely setose, and there are only three branchial spines.

Habits: The species is known from 30 to 35 fathoms from a very limited northern area. The crabs are exceptionally free from attached organisms, but sponges, serpulids, and polyzoans occur on them in small quantities; one male is well covered with a branching sponge. The limbs are almost all detached, as is commonly the case (cf. Leucosiidae) when the exoskeleton is porcellanous; but some appear to have been in formalin at one time.

Colour: Uniformly white and porcellanous after preservation.

Growth Variations: The intercalary spine is variable and suggests plasticity according to the pressure of neighbouring parts. It lies against the postocular spine and looks as if the latter is pressing upon it; the intercalary spine may stand side by side with its neighbour, being in that case more slender than otherwise, or the tip may turn up and spread outwards in such a way as to overlap the postocular, or more frequently the tip turns a little downward and lies within the orbital margin.

Material Examined:[29]

1 male, 1 female ovig., 1 female imm. off Little Barrier, 35 fm, *Hinemoa* Exped. 29/12/14 (C).
4 males imm., 6 females (3 ovig.), Colville Channel, 37 fm, *Hinemoa* Exped., 22/12/14 (C).
5 males, 1 female ovig., Hauraki Gulf, 50 fm, *Hinemoa* Exped., –/12/14 (C).
1 female, 10 miles NW of Cape Maria, *Hinemoa* Exped., 5/1/15 (C).
1 female, probably from *Hinemoa* Exped. (Ch).
1 female, ovig., off Cuvier Isl., 32 fm, coll. Capt. Bollons (Ch).

Type: Male in Canterbury Museum;[30] type loc., off Little Barrier, 35 fm.

Dimensions:

	Female (paratype)	*Male (type)*
Length	39	30
Breadth	26	21
Cheliped	40	21
Hand	18	10
Legs 1–4	48, 43, 38, 32	—

The legs are rigid and flexed and the measurements approximate.

Distribution: Endemic; Auckland district.

Subgenus **Zemithrax** n. subg.

Basal joint of antenna broadened distally, broadly fused with the front of the eave; flagellum short, peduncular articles small, inserted rather towards the inner side of the joint, close to the pseudorostrum and distant from the orbit. Outer distal spine of basal joint a short spine or tooth, directed downwards or transversely and not related to the eave. Spine of the eave reduced to a deflexed transverse tooth which continues the curve of the eave. Postocular spine obtuse or truncate, not bifid, upper margin expanded and touching the intercalary spine or almost so, closing the fissure above but leaving a tear-drop shaped foramen below or with the fissure narrowly open; fissure between the tooth of the eave and the intercalary spine similarly closed or open. Third maxillipeds with a prominent white hemispherical boss at the articulation of the ischium with the merus, spreading on to both joints. Abdomen and sternum of the male with a deep pit on each side of each segment.

Type Species: *Paramithrax longipes* Thomson 1902.

Distribution: New Zealand; perhaps endemic.

In each of the characters mentioned in the diagnosis there is an advance on *Paramithrax* and *Leptomithrax* s. str. There is a distinct tendency for the pseudorostral horns and all the spines to become flattened, except the marginal series. The orbit is more closely shut in by the tendency for the upper fissures to become closed and by the closer

[29] Two specimens also in the Australian Museum, Sydney (pers. comm., Dr J. C. Yaldwyn, 13 July 1962; P. 9962, Hauraki Gulf, 32–50 fm, *Hinemoa* Exped., Dec. 1914, presented by E. W. Bennett, 1931).

[30] Type and paratypes present in Canterbury Museum, 1962; C. M. Crus. 3.

approximation of the margins of the postocular spine and the basal antennary joint; the basal granule, as in *Austromithrax*, is reduced and excluded from the margin. The legs are greatly elongated, especially the propod and dactylus. Hooked hairs are reduced. There is a single median spine or tubercle above the posterior margin, a point of minor theoretic importance, but a very convenient means of distinction among the species here studied. The subgenus is not rigorously separated from *Austromithrax* by the characters of the maxillipeds or the pits of the sternum and abdomen, yet the structure of the orbit, and especially the form of the outer spine of the basal antennary joint and its relation to the eave, are so different that an independent origin of the two subgenera from *Leptomithrax* s. str. appears likely. In view of the great advance on *Paramithrax* it is surprising that the type species should have been allowed to remain associated with that genus for so long.

KEY TO SPECIES

A. Lateral spines low and broad; pseudorostrum short and flattened; distal spines of basal joint of antenna small and obtuse ..... **L. (Z.) longipes**

B. Lateral spines slender and sharp; pseudorostrum long and slender; distal spines of basal joint of antenna prominent ..... **L. (Z.) moloch**

Leptomithrax (Zemithrax) longipes (G. M. Thomson), Figs. 35, 49–51, 121

Paramithrax longipes G. M. Thomson, *Ann. Mag. nat. Hist* (7), *10* : 361, pls. 7, 8; 1902.
Chilton, *Rec. Cant. Mus. 1* : 289, pl. 57, figs. 1–3; 1911 (part).
Chilton & Bennett, *Trans. N.Z. Inst. 58* : 738; 1929.
Young, *ibid. 60* : 150; 1929.

Carapace (fig. 121) rather large, very uneven, regions well defined; branchial regions expanded laterally, overhanging at the sides, metabranchials depressed, a pit on each side of the cardiac region; antero-lateral margin strongly contracted behind the hepatic region. The gastric region stands higher than the branchials, rising to a prominent longitudinal granulous and nodular ridge. The median series includes: three pairs of small frontal tubercles; three gastric groups, of which the first includes about six tubercles and a few granules, the second and third each consisting of a broadly conical inflation with granulated slopes and an enlarged apical granule; a pair of conical tubercles and a larger erect spine; the high conical cardiac region is granulated and is surmounted by an erect spine; intestinal region with a submedian conical pair and then a fused group of three; an acute almost horizontal spine on the intestinal region on a strongly granulated prominent transverse ridge above the posterior margin, which is produced vertically downwards below the margin.

Apart from the median series and lateral spines, the dorsum is unevenly granular and tuberculate. The metabranchials, a lobe on each side of the gastric region, and the orbits (eave and spines) are densely granulate; pseudorostrum smooth save for a prominent band across the upper outer margin, becoming obsolete distally; from the second and fourth lateral branchial spines there passes inwards and forwards a rather obscure row of granules, several in each row enlarged and conical and about one spinose.

Large specimens nearly glabrous except for the third maxillipeds, which are always covered with a tomentum much longer and denser than elsewhere; the rest of the facial region, as well as the sternum and abdomen, are completely glabrous. Specimens of moderate size have sparse short dorsal hairs, few or none hooked; legs and chelipeds with microscopic hairs, sparse on propod of legs but dense on dactylus; male hand glabrous, that of female and juvenile male smooth within but palm elsewhere microscopically hairy, hairs spreading on to the fingers.

Pseudorostrum (fig. 50) very short, depressed, outer margins strongly tapering. Eave semicircular, longitudinal in dorsal view, its spine flat, triangular, transverse, depressed, continuing the curve of the eave, reaching to or nearly to or overlapping the postocular spine, anterior margin sloping backwards, hinder margin granulate and transverse, distal half usually in contact with the intercalary spine. The latter is triangular, swollen and granular without meeting or overlapping the postocular except basally. The two upper sutures are thus narrowly open, or closed above and open below with a tear-drop shaped foramen. Postocular spine very broad, upper and outer margins nearly parallel, upper with a broad almost rectangular curve at the middle where it reaches the eave, strongly truncate with tip slightly produced; outer margin a blunt ridge with obsolete granules, upper surface swollen and convex, lower surface smaller, triangular, slightly swollen, smooth.

Basal joint of antenna (fig. 50) with distal spines subequal, short and blunt, their margins granular, outer one horizontal and turning out towards the orbit, inner one longitudinal, deflexed, terminating a ridge along the inner margin of the joint. Upper outer corner produced into a small peg which overlaps the orbit. Flagellum without peduncular joints as long as pseudorostrum. The granule at the base of the V-notch of the lower orbital margin is small, round, almost absorbed into the margin of the postocular spine.

Eyestalk short, stout, with terminal spine above the cornea; the latter is enlarged, thicker than the stalk, mainly ventral and terminal, shielded above and below by fringes of hairs inserted on the postocular spine.

Hepatic region small with one short blunt spine, below which the margin is a strongly projecting ridge visible from above, with about five closely set marginal granules and other granules above. Four lateral branchial spines, subequal, small but longer and more acute than the hepatic, last one dorsal. A submarginal ridge of strong granules below first and second laterals.

Male cheliped (fig. 51) about one and a half times median carapace length, stouter than legs, hand massive. Ischium smooth, extending along two-fifths of the length of the merus. Merus with sparse conical tubercles and granules

irregularly scattered above, and a small upper terminal spine. Carpus with an upper and an outer low ridge converging opposite the meral spine, proximal half of each with about three bluntly conical granules. Palm with both surfaces inflated, the inner the more strongly, upper margin straight and formed by a semi-cylindrical ridge, lower margin broadly rounded and longitudinally convex. The whole hand except the distal half of the fingers is densely and microscopically granulate. Fixed finger straight, slightly deflexed, shallowly excavated through more than half of the length, with an obsolete basal tooth; movable finger with inner margin straight beyond the base, which is concave above the tooth of the fixed finger and in large specimens angled. Inner margins with closely set flat square denticles, small distally, spreading into the gape.

Cheliped of female a little stouter than legs, palm slender, upper and lower margins parallel, the upper semicylindrical ridge strong and forming a slight furrow on both surfaces; fingers slender, nearly straight, with linear gape or none, denticles microscopic and beadlike, tips grooved within.

Legs very long, lengths steadily decreasing after the first pair, which are twice the median carapace length, fifth longer than cheliped or carapace with pseudorostrum. Legs unarmed, merus without terminal spine but strongly produced at the articulation with the carpus; the latter flattened and grooved above; propod and dactylus exceptionally elongated.

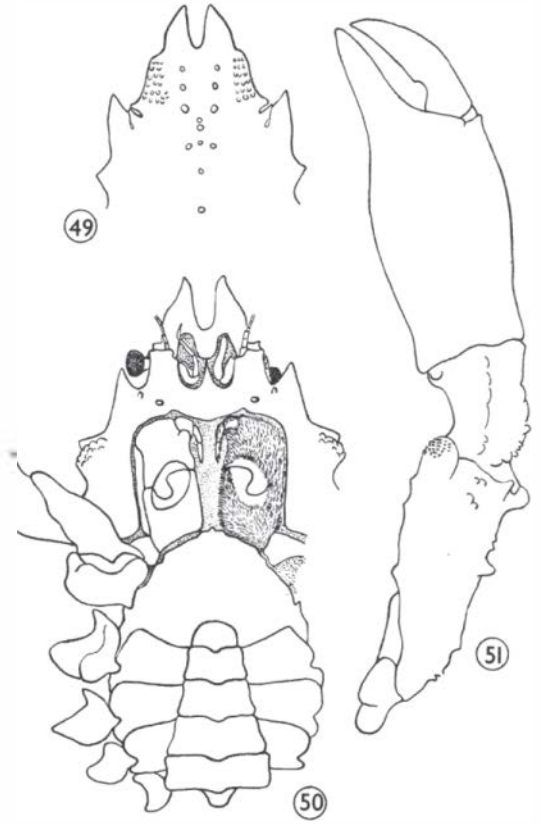

FIG. 49–51: *Leptomithrax* (*Zemithrax*) *longipes* (Thompson), male, nat. size; 49, fronto-orbital area; 50, ventral view; 51, cheliped.

HISTORICAL: The species has been rather infrequently taken, and has scarcely been dealt with critically since its first discovery by Thomson in 1902; otherwise it would not have been left in *Paramithrax*, for it has none of the distinctive characters of that genus,[31] and all those of *Leptomithrax* s.l., except that the ridges of the wrist might be compared with the crests of *Paramithrax*, a trivial point in comparison with the characters of the orbit, antennae, and ventral surface. The original description requires modification with respect to the ridges, and also in that the male abdomen is seven-segmented, the male hand is granular and externally convex, and the fingers are denticulate. The rostral and orbital regions of specimens hitherto illustrated have not been cleaned and so do not show detail.

HABITS: Living specimens are known only from comparatively deep water. Thomson (1902, p. 361) suggests that since the crab was abundant at the type locality but had not been seen again, it may perform seasonal migrations. In accordance with the depth, there is no mask of weeds, and the hairy covering is vestigial; the dorsum however is usually covered with massive sessile animals, including *Balanus*, large actinozoans, compound ascidians, and most frequently sponges; associated chiefly with the latter are small cirripedes, tubicolous worms, and prostrate polyzoans. Chilton (1911, pl. 58, figs. 1–3) has illustrated the masses of barnacles on his specimens; that shown in fig. 3 has 12 large specimens of *Balanus decorus* and some smaller ones, also *Coronula*, sponges, serpulids, and a cluster of *Anomia*. A specimen in an aquarium during the author's visit to Portobello was captured by a seastar (*Coscinasterias calamaria*).

MATERIAL EXAMINED:

1 male, between Oamaru and Cape Saunders, 1899 (O).
4 males, 2 females, E of Taiaroa Heads, 30–50 fm, *Doto* Exped., 7/4/00 (O).[32]
1 male, Macquarie Island (?), taken in fish trap; *Aurora* Exped., 1912 (C) (see below).
7 males, 7 females (5 ovig.), *Nora Niven* Stn. 4, remains of those recorded by Chilton 1911 (C).
1 male, E of Papanui Inlet, 40 fm, coll. D. H. Graham, 23/4/30 (P).
1 male, Timaru, taken in fish trawl, 28/8/35 (C).
1 male, dry, drift at Taylor's Mistake (C).
1 male, in stomach of ling taken in 200 fm, 16/9/29; 2 females (1 ovig.), /4/29; coll. A. Hansen (C, 10).

PREVIOUS RECORDS:

10 miles off Cape Saunders, 50 fm (Thomson; type loc.).
Nora Niven Stations 4, 5, 7, 17, 23, 26; numerous specimens (Chilton 1911).

TYPE: No record; type loc., 10 miles off C. Saunders, 50 fm.[32]

[31]But note Richardson (1949b, p. 58) who has already recognised the need for this change.

[32]Presumably type material; cf. details given by Thomson, 1902.

DIMENSIONS:

	Large male	*Ovig. female*
Length	75	52
Breadth	57	37
Cheliped	105	48
Hand	55	22
Legs 1–4	160, 120, 131, 106	83, 80, 73, 66

DISTRIBUTION: Otago district;[33] reputedly Macquarie Island.

Leptomithrax (Zemithrax) moloch n. sp., Figs. 52–54, 122, 123.

Paramithrax longipes Chilton, *Rec. Cant. Mus. 1* : 289; 1911 (part; not of Thompson).

Carapace (figs. 52, 122) small, elongate, posterior part almost circular, regions fairly well defined; branchial regions expanded laterally, overhanging at the sides; metabranchials large and much depressed; a strong marginal constriction behind the hepatic regions; a pit at each side of the cardiac region. The gastric region stands higher than the branchials, rising to a high spinulose ridge.

The median series includes: three pairs of frontal nodules, distant on either side of the broad and almost smooth longitudinal groove; two median spines at the middle and the hinder margin respectively of the mesogastric region, with some granules between them, and some larger conical nodules in front, one or two of which may be spiniform. A pair of mesogastric spinules are followed by a long erect spine; a long backwardly directed cardiac spine. Intestinal region with a median nodule with several paired and unpaired granules, and a strong triangular backwardly directed spine, flat and smooth below; the granular ridge on the posterior margin continues on to the slope of the spine, but the margin proper is produced a little below the spine. Granules of dorsum as in *L.* (*Z.*) *longipes* except that they are sharper, the two pairs of oblique branchial rows include each about three enlarged spiniform nodules, and the pseudorostral row is narrower. In general, the surface is more spinulose than in *L.* (*Z.*) *longipes*, but the spines become blunt with age.

The dorsum is comparatively closely covered with hairs, hooked but not strongly so, dense and long between the pseudorostral horns and on the upper margin of the merus of the legs, a few on the carpus; legs elsewhere with microscopic hairs, dense on dactylus and distal half of propod; cheliped of young male hairy to base of fingers. Outer maxillipeds with long dense tomentum. Sternum and abdomen glabrous in both sexes.

Psuedorostral horns long, slender, depressed and especially so towards the tips; inner margins convex, outer concave and divergent. Eave and intercalary spine as in *L.* (*Z.*) *longipes*, postocular spine more regularly curved above and tapering to a stout horizontal forwardly directed tip; posterior margin angulated and strongly granulate; usually a few small granules below. The fissures of the upper orbital margin are ordinarily closed, save for the two foramina, but in one specimen there is an open notch between the intercalary spine and the spine of the eave.

Basal joint of antenna (fig. 53) oblique; distal spines trigonal with the front margins of both granulate, and the hinder a smooth ridge; very dissimilar, the inner spine being long, acute, directed forwards and downwards, while the outer is transverse, horizontal, tip bluntly rounded. Flagellum reaching tip of pseudorostrum. Lower orbital margin a broad U with a basal granule outside the margin. Eye and stalk as in *L.* (*Z.*) *longipes*.

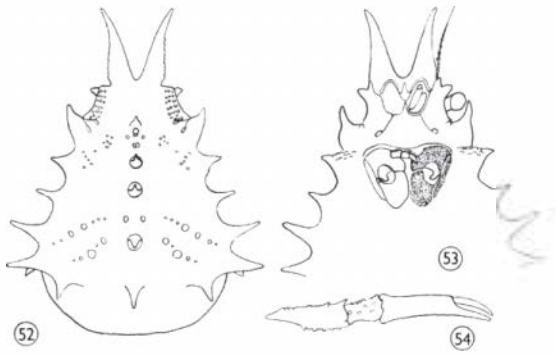

FIG. 52–54: *Leptomithrax* (*Zemithrax*) *moloch* n. sp., small male, × 1½; 52, carapace in dorsal view (hinder part damaged, possibly imperfectly reconstructed); 53, facial region; 54, cheliped.

Marginal and submarginal spines and granules as in *L.* (*Z.*) *longipes*, but all are more acute; branchial spines long and slender, especially third and fourth; first three arising nearly horizontally and curving upwards.

In the male the cheliped (fig. 54) equals the median length of the carapace, stouter than the legs, hand slender (immature ?). Ischium smooth, extending along two-fifths of the length of the merus. Latter with three to four nodules above, tending to become spiniform distally, and a few granules; an acute upper terminal spine; a row of about four granules on the lower margin. Carpus not ridged but with a few nodules above in two rows which converge proximally. Hand narrow, upper margin straight, lower concave or convex; inner and outer surfaces swollen and lightly grooved at junction with obscure semicylindrical ridge along upper margin. Fixed finger deflexed and curving down, upper strongly curved; fingers slender, finely denticulate within; gape narrow, almost linear, occupying nearly half the length, without tubercles.

Legs not exceptionally elongated, steadily decreasing, last equal to median carapace length; distal articulations of merus projecting, not spiniform above, but on the first pair the distal articulation of the carpus on the anterior side is spiniform; legs otherwise unarmed; joints cylindrical except the carpus, which is horizontally compressed and grooved above; propod and dactylus very long.

[33] It has since been found widely distributed from Cook Strait south. For Chatham Island occurrences see Dell, 1960, p. 2.

HABITS: This is a rare species known only from dredgings. All the specimens are rather small, the females are non-ovigerous, and the males have hands like those of juvenile males of *L.* (*Z.*) *longipes*; probably the adult male is still unknown, and will prove to be less prominently spinose than the above description would imply.

The specimens carry a moderately dense covering of sessile animals of the usual kinds. One specimen has the dorsum covered, behind the level of the hepatic spines, by compound ascidians, which fit accurately along the lateral and posterior margins; a patch of prostrate sponge on the frontal and hepatic regions is partly overlain and killed.

All the specimens are more or less broken.

MATERIAL EXAMINED:

1 male, off east coast of Otago, 20 fm; coll. D. H. Graham, 5/2/30 (type) (P).
1 male, D. H. Graham (P, 4).
1 male, 1 female (O, 19); 1 female, measurements above (O, 16).
1 male, off east coast of South Island, *Doto* Exped., –/4/00 (O).
1 male, *Nora Niven* Stn. 30 (*Paramithrax longipes* Chilton, not of Thomson) (C).

TYPE: A male (figs. 122, 123) in Portobello coll.;[34] type loc., off east coast of Otago, 20 fm.

NAME: The specific name is derived from Moloch, the fire god of the Ammonites; cf. *Moloch horridus*, a spiny lizard.

DIMENSIONS:

	Male Type	*Large Female*
Length	27	38
Breadth	15·5	24
Cheliped	29	30
Hand	9	15
Legs 1-4	34, 33, 30, 27	—

Breadth of type from tips of third branchial spines 20 mm.

DISTRIBUTION: Mainly Otago District; Nelson.

Genus **Acanthophrys** Milne Edwards

Chorinus H. Milne Edwards, Hist. Nat. Crust., Vol. 1, p. 314; 1834 (part).
Adams & White, Zool. HMS "Samarang", Crust., p. 11; 1848 (part).
Acanthophrys A. Milne Edwards, *Ann. Soc. ent. Fr.* (*4*), *5* : 141; 1865.
Miers, *J. Linn. Soc., Zool. 14* : 656; 1879.
Chlorinoides Haswell, *Proc. Linn. Soc. N.S.W. 4* : 442; 1879.
Haswell, *Ann. Mag. nat. Hist.* (—) *5* : 146; 1880.
Haswell, Cat. Austr. Crust., p. 17; 1882.
Entomonyx Miers, Zool. HMS "Alert", p. 525; 1884.
Chlorinoides Miers, *Challenger Rep. Zool. 17* : 51; 1886.
Acanthophrys Miers, *tom. cit.*, p. 52; 1886.
Alcock, *J. asiat. Soc. Bengal* (*2*) *64* : 165, 241; 1895.
Macrocoeloma Alcock, *tom. cit.*, p. 255; 1895 (not of Miers).
Paramithrax (*Chlorinoides*) Alcock, *tom. cit.*, p. 240; 1895.
Chlorinoides Whitelegge, *Mem. Aust. Mus. 4* : 143; 1900.
Acanthophrys Rathbun, *U.S. Fish Comm. Bull. 1903*, p. 882; 1906.
Bouvier, *Bull. Mus. Hist. nat., Paris, 12* : 485; 1906.
Parisi, *Atti Soc. ital. Sci. nat. 54* : 290; 1915.
Chlorinoides Rathbun, *Biol. Res. "Endeavour" 5* (*1*) : 25; 1918.
Rathbun, *Ark. Zool. 16* : 3; 1924.
Acanthophrys Balss, *Arch. Naturges. A90* : 29; 1924.
Chlorinoides Hale, Crust. S. Austr., p. 137; 1927.
Acanthophrys Balss, *Denkschr. Akad. Wiss. Wien. 102* : 19; 1929.
Chlorinoides Yokoya, *J. Coll. Agric., Tokyo, 12* : 159; 1933.
Acanthophrys Sakai, *Sci. Rep, Tokyo Bunrika Daig., B, 1* : 296; 1934.
Balss, *J. roy. Soc. W.A. 21* : 126; 1935.

The limits of the genus, as indicated by the synonymy, have been a matter of considerable disagreement, the main point at issue being the distinctness or otherwise of *Chlorinoides* Haswell 1879 type *C. tenuirostris* Haswell; Torres Straits from *Acanthophrys* A. M. Edw. 1865 type specified by Miers 1879 *A. cristimanus* A. M. Edw. The admirable revision by Bouvier leads to the amalgamation of the two genera, though *C. waitei* Whitelegge, which is a *Leptomithrax*, must be omitted and, as shown by Balss (1929), *A. goldsboroughi* Rathbun 1906 and *Entomonyx spinosus* Miers 1884 (= *Macrocoeloma nummifer* Alcock 1895) must be added. The name *Chlorinoides* has been used by Rathbun (1918, 1924), Hale (1927), and Yokoya (1933), the latter promptly corrected by Sakai (1934). *Chlorinoides spatulifer* (Haswell) (*Paramithrax spatulifer* Hasw., 1882a, p. 540; 1882, p. 14; *Chlorinoides coppingeri* Miers 1886, pl. 7, figs. 3, 3a–b, not of Haswell; *C. spatulifer* Rathbun 1918, p. 24), of which the type in the Australian Museum has been seen by the author, does not appear to be generically separable from the New Zealand species.

Acanthophrys filholi A. Milne Edwards, Figs. 55–57, 124

Acanthophrys filholi A. Milne Edwards, *Ann Soc. ent. Fr.* (*4*), *5* : 141; pl. 5, fig. 3; 1865.
A. Milne Edwards, *Ann. Sci. nat.* (*vi*), *4* : Art. 9, p. 4; 1876.
Filhol, Mission de l'Ile Campbell, p. 365; pl. 39, figs. 1-3; pl. 40, figs. 6, 8; 1886 (see above, *P. minor*, Historical).
Miers, *Challenger Rep., Zool. 17* : 52; 1886.
Chilton, *Rec. Cant. Mus. 1* (*3*) : 290; 1911.
Thomson, *Trans. N.Z. Inst. 45* : 237; 1913.
Chilton & Bennett, *ibid. 59* : 741; 1929.

Carapace (fig. 124) moderately large, uneven, facial region excluding pseudorostrum occupying half the length. Gastric and cardiac regions higher than epibranchials, but all three inflated, decidedly more so in the female than in the male. Hepatic, metabranchial, and intestinal regions greatly depressed, metabranchials very short, intestinal defined in some specimens by pronounced transverse linear groove in male, with a broad pit on either side.

The median and submedian series includes: five distant pairs of low and rounded frontal and gastric tubercles; a small median vertical acute spine, flattened longitudinally, followed by two pairs of flat tubercles (the five forming a wide V) and a second spine which is similar to the first but larger and a little divergent from it. The high conical cardiac region is surmounted by an erect and very high transverse lamella, usually bifurcating into two flattened spines. Intestinal region smooth or with an obscure median granule, followed by a large thin crescentic lamella, which is highly variable in form; it is concave in front in both the longitudinal and the transverse directions,

[34]Type transferred to Canterbury Museum (C. M. Crus. 6) by courtesy of the Director, Portobello Marine Biological Station, 1962.

the lateral edges nearly vertical or sloping at about 45°, the upper rim concave, straight, or a little convex; or the lamella may be decidedly lower with the rim crenulate and cut into about six lobes.

The gastric region has a row of flat tubercles external to the submedian series, making four rows altogether; there is a tuberculate epibranchial area adjacent to the marginal spines, forming with the help of two large paired tubercles nearer the hinder gastric spine an oblique tract more or less continuous with the gastric series of tubercles. The eave of the orbit and in some specimens the hepatic region and antero-lateral part of the branchial region are finely granulate; the rest of the dorsum is smooth.

The hepatic region (fig. 55) has a marginal lamella, more or less bifid, with the two lobes coalescent or sharply distinct, both lobes rounded in outline or the posterior one acute, horizontal with the marginal rim slightly upturned. There are two to four subhepatic tubercles, usually rounded but in some cases one is lamellate; an acute sublamellate spinule nearer the buccal frame. The branchial margin bears a short lamella, higher than long, oval or clavate, margin smooth or crenulate; nearly horizontal, tip upturned, posterior margin higher than anterior; the upper surface may be decidedly concave and the whole lamella spatulate. Immediately below is a smaller submarginal lamella. Much further back are two long slender acute branchial spines, the second one dorsal. The edge of the carapace is strongly produced all round, with a cristate rim.

The pseudorostral horns (figs. 55, 56) are long but very variable in size, slender, horizontal, acute, strongly divergent, the inner margins meeting at more or less than a right angle, under surface flat or channeled.

The upper orbital margin (fig. 55) is highly variable; eave produced into a strong lamella twice as high as long, tip rounded-truncate, curving upwards and forwards, under surface channelled; separated by a U-notch is a second lamella corresponding to the spine of the eave, shorter, truncate, either simple and curving forward or T-shaped with the anterior lobe reaching the supraocular lamella or almost so and the posterior underlapping the intercalary lamella. The latter is flat, parallel-sided but curving forward, tip rounded, more than twice as long as broad, separated from postocular by a narrow deep fissure. Postocular tooth trigonal with cristate margins, tip rounded-truncate, surfaces flat or concave; anterior margin nearly straight, expanded a little near the base; posterior margin expanded into a large convex lamella.

Basal joint of antenna (fig. 56) concave below with cristate margins; inner distal tooth consisting of a nearly transverse triangular lamella with rounded-acute tip, the inner margin of the joint running up the hinder surface and forming a third cristate margin; outer distal spine nearly transverse, lower surface concave, outer margin strongly concave, inner strongly convex, upper underlapping the supra-orbital lamella and forming a narrow U-notch. The inner margin of the basal joint is short and produced into a rectangular lobe which nevertheless leaves the lower orbital margin widely open, the notch three-sided and broad at the base. There is a conical tubercle outside the base.

The eyestalk is long and slender, the cornea reaching the postocular, with an acute subterminal spine above and another near the base of the cornea above; eyestalk granulate below.

FIG. 55–57: *Acanthophrys filholi* Milne Edwards, adult male, × 1½; 55, fronto-orbital area; 56, anterior facial region; 57, wrist and hand.

The male chelipeds are massive, parthenopid-like, all joints except dactylus with acute straight or crenulate cristate rims and concave surfaces near the rims. Merus with two upper and two lower crests, upper ones uniting basally into a single crest; outer surface swollen with a strong row of tubercles and a few others; a short high distal lamella above and a large distal inner tubercle. Carpus (fig. 57) with a strong upper crest, an inner ridge, and an antero-inferior crest. Hand very long, crested above and below, swollen on both surfaces and especially the inner, microscopically granulate. Fixed finger scarcely deflexed; movable finger nearly straight; a linear gape through half the length, opposed margins with stout denticles but no excavation or tubercles. The cheliped of the female is precisely similar but much smaller, with the crests less pronounced in some specimens.

Legs slender; merus with three rows of small bead-like granules, two above and one on the broadly rounded ridge of the lower margin, defined by an inner and an outer groove; carpus grooved above and below, flattened, with about two tubercles on anterior surface and two on posterior; propod with one or two granules and a hinder row of about three tubercles. Dactylus slender, unarmed, curved, both surfaces grooved, claw very small.

Sternal plate sunken behind the mouth frame, with an anteriorly emarginate rim around the end of the abdominal sulcus; sternites corresponding to legs 1 to 3 with one to three conical tubercles, that of fourth leg concealed. Abdomen seven-segmented in male, segments 1 to 3 crested marginally, segments 3 to 4 with a pair of oblique crests. Female sternum completely excavate, abdomen with obsoletely tuberculate transverse ridge on segments 3 to 5.

The dorsal tubercles bear tufts of hooked hairs, which are also dense on the pseudorostrum; legs with a row of tufts of hooked hairs above and below, a few other tufts on the hinder surface of the merus; dactylus with a short dense fur. Chelipeds, abdomen, and sternum glabrous save for a few tufts on the basal cheliped joints.

HISTORICAL: The only description hitherto available is that by Milne Edwards in 1865; it is quite inadequate, and errs in interpreting the lamella at the antero-lateral branchial margin as hepatic. Filhol copied this description, and added some figures, which he labelled as *Paramithrax minor* (see synonymy).[35]

HABITS: Crabs of this species are densely covered with sessile animals growing on the limbs and carapace, and fragments of animal and weed held by the hooked hairs. The animals include sponges, ascidians, hydroids, and especially calcareous polyzoans; prostrate polyzoans generally fill the concave surfaces of the chelipeds between the marginal crests.

As indicated chiefly by Mr D. H. Graham's records – save the shore specimen, which may have been drift – the crabs scarcely occur in shallower depths than 20 fathoms; the vague "8–17 fathoms" of the *Doto* Expedition should presumably be interpreted accordingly. The Auckland specimens, already noted as smaller in size, are from 60–65 fathoms; the rarity and depth in the north contrast with the fairly numerous southern records from shallower waters, and with Filhol's statement that the species is common at the Stewart Island oyster beds.

The specimens are very hard, almost porcellanous, and mostly broken or with the limbs flexed and rigid.

The crabs are described by Mr Graham as feeble in life, easily overturned and finding it difficult to regain their normal posture.

VARIATIONS: The tubercles and lamellae of the carapace are highly variable, as indicated by the description. The specimens from West King, the only northern locality from which the crab is known, are all small, and include an ovigerous female with a median length of 16 mm. Suter's more southern specimen is of the same size, but is immature. The sternum is deeply excavated in the mature female, and the dorsum is correspondingly inflated, the influence of the marsupial structure on the dorsal topography being as pronounced as in any leucosiid.

MATERIAL EXAMINED:

1 male (O, 5); 2 males, 1 female (O, 16).
2 males, 4 females ovig., *Doto* Exped., east coast of Otago, –/4/00 (O).
2 specimens, 20–30 fm, between Oamaru and C. Saunders, 1899 (O).
2 females (1 ovig.), part of *Nora Niven* collection – see below (C).
1 female, shore, 6/6/30, coll. D. H. Graham (P, 4).
2 males (1 juv.), 7 females (1 ovig.), from eight localities, 20 and 40 fm, off Otago Heads and Papanui Inlet, coll. D. H. Graham, 1930 (P).
1 female imm., New Brighton, coll. H. Suter (Ch).
3 males, 1 female ovig., off West King, 10 miles NW from C. Maria, *Hinemoa* Exped., 5/1/15 (Ch).

PREVIOUS RECORDS:

Stewart Island (Milne Edwards, Filhol).
Nora Niven Stations 17, 26, 44 (Chilton).

TYPE: Paris Museum (if extant);[36] type loc., New Zealand.

DIMENSIONS (mm): Length 46; breadth 26; cheliped 44; hand 38; legs 1–4 respectively 39, —, —, 31.

DISTRIBUTION: Endemic, chiefly Otago District, including Stewart Island.

Genus **Campbellia** Balss

Campbellia Balss, *Senckenbergiana 12* : 200; 1930.

Carapace pyriform. Pseudorostrum two-horned, deflexed. Eave of the orbit armed with spines. There is an intercalary spine, lying close against the eave and the postocular spine, with the sutures closed. The postocular spine closely approaches the basal joint of the antenna below the orbit. Limbs of normal length, the walking legs flattened above, the margins beset with protuberances (Balss). The basal article is very broad, outer distal spine produced, flagellum widely excluded from the orbit; peduncular articles small. There are no bosses on the outer maxillipeds and no cavities in the sternum of the male.

TYPE SPECIES: *Campbellia kohli* Balss (below); monotypic.

Close to *Leptomithrax*, but differing in the spines of the eave and the processes on the legs. In the form of the eave it approaches *Micippe*, so that it forms a connecting link between the subfamily Majinae (Balss, 1929) and the Mithracinae (Balss, 1929). The form of the carapace resembles that of *Micippoides* (only species *M. angustifrons* A. Milne Edwards, from Samoa, etc.), among the Hyasteniinae (Balss).

[35] See also figs. 1, and 4 to 6, in Dell, 1960.

[36] Type seen in Paris Museum by E. W. Dawson, 13/4/56.

The closed upper orbital fissures and the distal broadening of the basal joint of the antenna and its wide exclusion from the orbit are reminiscent of *Austromithrax*, but no description has been given of the fusion of the basal article with the eave. The lower orbital margin is much more narrowly closed than in *Leptomithrax*.

In general, *Acanthophrys* and *Campbellia* have diverged far from *Paramithrax*, but have branched off early from the *Austromithrax-Zemithrax* complex.

Campbellia kohli Balss

Campbellia kohli Balss, *Senckenbergiana 12* : 200, figs. 1–4; 1930.

Carapace elongate-pyriform, upper surface finely granulate, its anterior half finely haired. Regions well defined by furrows. Median series of nodules thus: gastric region four small nodules, urogastric region two close nodules and a hinder median nodule; cardiac region seven (2 + 3 + 2); intestinal region one.

Hepatic spine large, with smaller accessory spines; branchials five, the last two large, fifth dorsal; branchial region with five or six additional smaller nodules.

Pseudorostrum of two triangular deflexed plates fused along about half of their length, finely haired above, marginally spinulate.

Eave armed with three blunt but not distally expanded spines. Intercalary spine close to the eave in front and to the postocular spine behind, sutures closed; two to three smaller nodules at the base of the postocular spine. True rostrum a small interantennulary spine.

Basal article of the outer antenna a pentagonal plate, broadly truncate distally, lower outer margin separated from the postocular spine by a small hiatus. The flagellum (missing on both sides in the holotype) arises at the side of the rostral horn, distant from the orbit. Ocular peduncles short and stout, with a small spine above the cornea. Outer maxillipeds as in *Leptomithrax*, i.e., the distal end of the ischium is curved and produced somewhat on the inner side.

Male chelipeds (holotype is young) only slightly longer than the first walking legs; joints rounded without sharp keels; merus and carpus strongly granulated; hand almost smooth, outer proximal half of the palm granulate; fingers slightly bent downwards, no gape.

First walking leg the longest, others regularly decreasing in length. Trigonal, the lower margins rounded; the upper surface is level with the anterior and posterior margins; these upper margins bear lateral processes or lobes, similar to those of the American *Teleophrys cristulipes* Stimpson, e.g., first merus bears seven such lobes on each side distally increasing; carpus with three anterior and two posterior, propod with three on each side.

Dactyli shorter than the propodi, not lobed, laterally compressed, somewhat bent downwards, horny terminal spinule, rather long, several smaller spinules on the lower margin.

Sternum normal, without excavations, elongate-oval; abdomen of male with seven movable segments, the first three somewhat granulated.

HISTORICAL: This interesting species is known only from the holotype, collected by Dr L. Kohl-Larsen in his first voyage to the Southern Ocean (Stewart and Campbell Islands, 1924). The above is a slightly reworded translation of the admirable description by Balss, which readily overrides the usual requirement that only species known to the author by autopsy are to be admitted to the list of New Zealand species.

PREVIOUS RECORD: 1 male, Perseverance Harbour, Campbell Island; coll. L. Kohl-Larsen, March, 1924; 23 fm.

TYPE: Senckenberg Museum, Frankfurt-am-Main, Krustaceen, No. 367.

DIMENSIONS (mm): Length 11; breadth 8; cheliped 14; hand 9.

DISTRIBUTION: Campbell Island.

Subfamily MITHRACINAE Balss

Mithracinae Balss, *Denkschr. Akad. Wiss. Wien 102* : 16; 1929

The orbits are complete below. An intercalary spine is present.

The subfamily includes those members of Alcock's Pericerоida which possess an intercalary spine. Only a single monotypic genus is known from New Zealand, for the record of *Paramicippa spinosa* Stimpson by Miers (1876, p. 9) remains unsubstantiated, and is evidently another geographic error; Hutton (1882, p. 263) at first questioned its occurrence in New Zealand, but later (1904, p. 248) without explanation he included it in the "Index Faunae Novae Zealandiae"; perhaps he considered Hector's *P. grandis*, which he did not mention, a synonym (see below, *Jacquinotia edwardsi*).

Genus **Jacquinotia** Rathbun

Prionorhynchus Jacq. in Jacq. & Lucas, *Voy. Pole Sud, Zool. 3*, Crust. p. 5, 1853 (not *Prionorhynchus* Leach).
Miers, Cat. Crust. N.Z., p. 10; 1876.
Miers, *J. Linn. Soc., Zool. 14* : p. 662; 1879.
Alcock, *J. Asiat Soc. Bengal (2) 64* : 165; 1895.
Jacquinotia Rathbun, *Proc. biol. Soc. Wash. 28* : 142; 1915.
Balss, *Senckenbergiana 12* : 199; 1930.

Carapace ovate, very large, glabrous; dorsum and margins tuberculate and granulate; two more or less distinct hepatic tubercles and five branchials, the last pair dorsal. Pseudorostrum of two flat depressed plates fused through most of their length. Eave entire with small transverse posterior tooth; intercalary spine present; upper orbital sutures closed; postocular spine broadly fused with

basal joint of antenna, completing the orbit below. Basal joint broad, widely fused with the eave, with two small distal conical tubercles, outer one subterminal only. Orbit very small, closed, circular. Antenna minute, distant from the orbit. Legs normal, male chelipeds exceptionally massive. Abdomen sevensegmented in both sexes.

TYPE SPECIES: *Prionorhynchus edwardsi* Jacq. = *Jacquinotia edwardsi* (Jacq.) Rathbun; monotypic and endemic to New Zealand.

The name *Prionorhynchus* Jacq. 1853 has been shown by Rathbun to be preoccupied.

Jacquinot pointed out differences from *Maia* and *Paramithrax* in the structure of the orbit. Miers (1879b) referred the genus to the Periceroida, close to *Libinia*, which however proves unrelated in that it has no intercalary spine and in the redistribution of genera is transferred to the Hyasteniinae. Alcock (1895), who had no specimens, went further astray in placing the genus among the Pisinae, from which it differs in the closure of the orbit. Balss (1930) has finally located the genus in the Mithracinae, on the grounds of the occurrence of an intercalary spine, and the retention of seven abdominal segments in both sexes; he has pointed out the relationship with the American genus *Mithrax*, from which however *Jacquinotia* differs "through the more primitive abdomen of the male, which at the base, in accordance with the less broadened carapace, is not widened and L-shaped, but narrow". The carapace however is broadened quite as much as in some species of *Mithrax*, and it is doubtful whether the difference mentioned is of any great significance, or even whether the genera can be kept apart. There is a marked similarity, for example, to *Mithrax belli* Gerstaecker (Rathbun 1925, p. 403, pls. 142, 143); and several species of *Mithrax* are large in size, *Mithrax spinosissimus* (Lmk.) for example reaching a length of 170 mm (median length 163 mm), and equalling the New Zealand species.

In any case the kinship pointed out by Balss establishes an important link with the American fauna.

Jacquinotia edwardsi (Jacquinot), Figs. 58–61, 125, 126

Prionorhynchus edwardsi Jacq. in Jacq. & Lucas, *Voy. Pole Sud. Zool. 3*, Crust. p. 8; pl. 1, fig. 1; 1853.
Miers, Cat. Crust. N.Z. p. 11, p. 340; 1876.
Hutton, *Trans. N.Z. Inst. 11* : 340, 1878.
Miers, *J. Linn. Soc. (Zool.) 14* : 662; 1879.
Filhol, Mission de l'Ile Campbell. p. 367; pl. 42, figs. 1–4; 1886.
Rathbun, *Proc. U.S. nat. Mus. 15* : 243; 1892.
Paramicippa grandis Hector, *Trans. N.Z. Inst. 32* : 423; (1899) 1900.
Prionorhynchus edwardsi Hodgson, Rept. Southern Cross, Crust. p. 230; 1902.
Chilton, Subant. Islands N.Z., Vol. 2, p. 608; 1909.
Chilton, *Rec. Cant. Mus. 1* : 290; 1911.
Thomson, *Trans. N.Z. Inst. 45* : 237; 1913.
Jacquinotia edwardsi Rathbun, *Proc. biol. Soc. Wash. 28* : 142; 1915.
Prionorhynchus edwardsi Stephensen, *Vidensk. Medd. dansk naturh. Foren. Kbh. 83* : 292; 1927.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 742; 1929.
Jacquinotia edwardsi Balss, *Senckenbergiana 12* : 200; 1930.

Carapace (fig. 125) exceptionally large, longer than broad, ovate; regions well defined. Branchial, gastric, and cardiac regions inflated to about equal heights, a pair of epibranchial and the pair of cardiac nodules standing highest; branchial margins overhanging. Dorsum and submarginal areas covered with granules of varying size, closely packed, less than their own diameter apart, spreading to basal joints of antennae, antennules, and third maxillipeds; pseudorostrum smooth below, abdomen, sternum and epistome almost so.

The median series is distinct and elevated; usually three pairs of enlarged frontal granules followed by a median one; the rest of the series consists of rounded or conical granulated tubercles on granulated bases, and includes four median gastrics (of which some may be double), a mesogastric pair and a median urogastric, a cardiac pair, and a median one on the swollen conical intestinal region; the whole series is interspersed with granules, a few of the larger ones recognisable as pairs, especially an anterior cardiac pair.

Apart from the marginal row and its dorsal continuation there are five large mesobranchial tubercles on each side, and one to four smaller ones in front; a large protogastric and a small one in front, and a small hepatic. The gastric region bears a stout conical granulated subspiniform tubercle capped by an enlarged granule, and a smaller tubercle on the hinder slope; an oblique subhepatic ridge with three conical tubercles visible from above.

The branchial series consists of six stout conical lobes each surmounted by a large granule, the slopes granulated, the interspaces regularly curved and on the branchial region about twice the height; the last two are dorsal, the last further forward than the penultimate. About two enlarged granules on the slope behind these, and a nodulous and granulous transverse metabranchial ridge. From behind the first walking legs the granules extend to the margin of the carapace and form a ridge above the latter, with four tubercles above the hinder margin.

Pseudorostrum (fig. 58) of two strongly depressed lamellae, each nearly as broad as long, fused through two-thirds of the length, with four enlarged granules on the outer slope and three on the inner, and others near the margins.

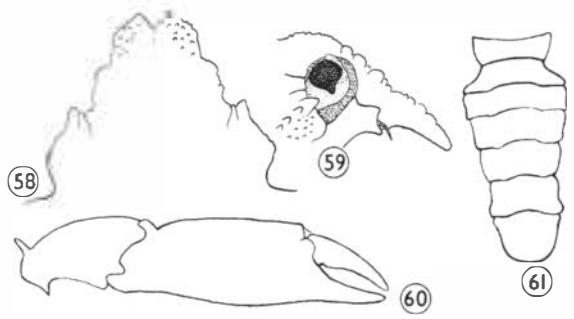

FIG. 58–61: *Jacquinotia edwardsi* Jacquinot, adult male; 58, fronto-orbital area, × ½; 59, orbital region in lateral view, × ¾; 60, hand and wrist, × ¼; 61, male abdomen, × ½.

Eave high with about four conical marginal granules, ending posteriorly in a small tooth, of which the anterior margin is transverse and continues the curve of the eave; intercalary spine large and broadly truncate, sides straight; both fissures closed or with linear foramina; postocular spine with upper margin nearly right-angled opposite the tip of the intercalary, truncate, upper surface concave, lower surface flat and much larger, hinder margin a strong keel with two or more sharp tubercles.

Basal joint of antenna (fig. 59) concave, pentagonal, half as long again as broad, with a conical inner distal tooth and a smaller subterminal outer one, fusion with eave extensive and closing the orbit in front so that the length of the orbit is less than the height, the latter less than the width of the joint. The outer margin of the joint has a conical tooth where it meets the postocular spine, the fissure deep and closed or with a linear foramen. Flagellum small, distant from the orbit, concealed under pseudorostrum and reaching half way to its tip.

Merus of third maxillipeds with an inner distal truncate lobe, outer margin expanded and toothed at insertion of palp, which arises from antero-external notch. Exognath broad, granulated, reaching to mid-length of merus.

Chelipeds (fig. 60) a little longer than the carapace in small specimens (length 35–60 mm), twice as long in large ones, and massive. Ischium inflated, granulate in small specimens but smooth in adult, merus cylindrical with about 20 conical tubercles, some obsolescent in adult, with scattered granules all over but obsolescent in adult except distally; carpus with more numerous tubercles and granules all over except within; palm granulate proximally above and below and without, and covered everywhere with microscopic granules, which spread half way along the lower margin of the fixed finger and still further on the movable finger above. Upper and lower margins of palm nearly straight, evenly rounded, inner surface a little more inflated than the outer. Fingers nearly straight, fixed finger deflexed, a linear gape through more than half the length, no inner tubercles; inner margins with flattened denticles nearly to the base, tips channelled in young. Cheliped of female about as long as carapace, all tubercles and larger granules sharper and more numerous, fingers more slender, a small basal gape and thereafter a narrow linear gape through half the length.

Male abdomen (fig. 61) occupying whole width of sternum at base, first segment as wide as fifth or sixth; second and third one and a quarter times as wide, last segment narrowest and longest, rounded in young but truncate in adult. Female abdomen occupying the whole sternum.

Walking legs steadily decreasing from in front, first nearly equal to cheliped (longer in female), last longer than carapace. Tubercles and larger granules as in chelipeds. Dactylus nearly straight with very large horny claw.

The dorsum, legs, and upper half of the merus and ischium of the cheliped are beset with very short hairs, almost microscopic, arising between the dorsal granules and on their bases. The dactyli of the legs are covered, except for a line along the anterior and posterior surfaces, by short but much denser hair.

HISTORICAL: The crab is too unmistakable, on account of size alone, to allow confusion in the synonymy, yet Hector as late as 1900 failed to recognise the species and attached the name *Paramicippa grandis* to specimens (1 male, 10 females, Campbell Island, presumably collected by Capt. Fairchild, and chelae collected by Hector) in the Dominion Museum.[37] The report in which the name was published was not formally under his signature but undoubtedly sanctioned by him. No precise description was given, but the locality was mentioned, together with comments on the enormous size; the location in *Paramicippa* and the mention of "spider-crabs" and of the "pointed turned-down nose" leave no doubt as to the species referred to; no types were designated, but specimens are still extant in the Dominion Museum.[38] It is perhaps because of these irregularities that the whole matter has been overlooked in the bibliographies, but it appears that the name should enter the synonymy with Hector as its author.

Perhaps Hutton's reason for reinstating *Paramicippa spinosa* Stimpson (see above, subfamily) was the assumption that Hector's record referred to and substantiated Stimpson's species.

HABITS: Filhol states that the crabs occur at depths of 4–5 metres, where they collect together, two or three hundred at a time, and cover a wide area. Thomson (1913, p. 237) records that "In August 1900 the trawlers picked up great numbers of them outside of Otago Heads. On rare occasions since they have come across them again". Chilton (1911b, p. 290) likewise refers to the swarming habits; "According to the settlers it has only been seen once at Stewart Island; about three years ago [1908] specimens were first taken there in shallow water, and soon after they are said to have come ashore in thousands, walking about on the beaches". This disposes of Filhol's assertion that they are never found on beaches, and of his recommendation of the anchorage of the *Venus* as an especially prolific spot; the swarming is sporadic and is a phase of migratory movements which are not understood. In 1934 the bays and beaches around Melbourne were similarly invaded by *Leptomithrax australiensis*.

The dorsum and upper surfaces of the legs are sparsely covered with prostrate calcareous polyzoans and in the case of some smaller specimens with sponges. Large ones are free from organisms or carry serpulid tubes (possibly *Pomatoceros strigiceps*, according to Chilton, 1911b) and occasionally small lamellibranchs (*Anomia* sp.).

[37] Probably D. M. Cr. 426 and 427.

[38] But see Hector, 1901; descriptions and dimensions of 20 Auckland Island specimens, collected by Mr Yuill, taxidermist of the Colonial Museum, at Carnley Harbour. Hector states that it is the same species as the one illustrated by Filhol as *Prionorhynchus edwardsi*.

COLOUR: Brick-red; in some the hand is of a brighter uniform colour, in others it is yellowish-white marbled with red patches, in some cases the latter arranged in a circle (Filhol). After long preservation (28 years) the dorsum and upper surfaces of the limbs are dull brown, under surfaces greyish white or tinged with brown, hands white or whitish with patches of bright red. The colour is better retained in large specimens.

MATERIAL EXAMINED:

8 dried specimens, Campbell Island (see above) (D).
1 female, Campbell Island, coll. Hector; 1 male, Auckland Is., (O).
1 male, off Otago Heads, 23 fm, 1900 (O).
1 male small, *Nora Niven* Stn. 20; 4 males, 3 females (2 ovig.) and a large male Chela, *Nora Niven* Stn. 5 (C).
1 male, Port Ross, Campbell Island, taken in fish trap, 3 fm, coll. E. R. Waite, *Aurora* Exped., 3/7/12 (C).

PREVIOUS RECORDS:

Auckland Islands (Jacquinot and Lucas, Hutton, Rathbun, Stephensen).
Campbell Island (Filhol, Hodgson, Hector, Balss).
Stewart Island (Chilton 1909).
Off Otago Heads (Thomson 1902, 1913).
Nora Niven Stations 5, 15, 17, 20, 47, 48 (Chilton 1911).

TYPE: Paris Museum (if extant);[39] type loc. Auckland Islands.

DIMENSIONS (mm):

	Male	*Female (ovig.)*
Length	167	115
Breadth	151	100
Cheliped	329	128
Hand	153	60
Legs 1–4	320, 290, 245, 202	147, 137, 124, 118

The lengths mentioned, measured between movable blocks, include the pseudorostrum; on account of the strong inclination of the latter the median length is less by only $2\frac{1}{2}$ and $1\frac{1}{2}$ mm respectively.

The figures are not maxima. A *Nora Niven* specimen from Station 5 is represented by a dried chela of which the hand measures 158 mm, this belonging presumably to the male recorded by Chilton (1911b) as measuring 175 × 150 mm. Two dried females in the Canterbury Museum measure 128 × 110 mm. Filhol quotes the figures 102 × 114 for the female, but as noted by Chilton has obviously interchanged the numbers.

The eggs are about 0·5 mm in diameter.

DISTRIBUTION: Otago, Stewart Island, Auckland and Campbell Islands; endemic and distinctly southern.

Subfamily MACROCOELOMINAE Balss

Macrocoelominae Balss, *Denkschr. Akad. Wiss. Wien, 102* : 16, 20; 1929.

Periceroid Majinae without an intercalary spine.
Not represented in New Zealand.

[39]Type specimen seen in Paris Museum by E. W. Dawson, 13/4/56.

Family PARTHENOPIDAE (M. Edw.) Miers

Genus **Eurynolambrus** Milne Edwards & Lucas

Eurynolambrus Milne Edw. & Lucas, *Arch. Mus. Hist. nat. Paris 2* : 481; 1841.

The status of this monotypic genus, the only local representative of the family, requires investigation in a wider context.

Eurynolambrus australis Milne Edwards & Lucas,[40] Fig. 127

Eurynolambrus australis Milne Edw. & Lucas, *Arch. Mus. Hist. nat. Paris 2* : p. 481; pl. 28, figs. 14, 15; 1841.
Dana, *U.S. Explor. Exped.*, Crust. p. 141, pl. 6, figs. 9a–c; 1852.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : p. 743; 1929 (refs.).

The punctulated condition, thought by Filhol to justify a variety *stewarti*, is much commoner than previous records suggest, especially but not exclusively in females; all gradations occur among specimens from the same locality, and the variety cannot be upheld. The outline is variable, but there is nothing to support the suggestion by Lenz (1901) that it varies according to age.

COLOUR: "Bright red with lighter yellow markings" (Graham, MS).

MATERIAL EXAMINED:

1 male, 2 females, Foveaux Strait (O).
1, Cook Strait (O).
2 males, 3 females (1 ovig.), (O, 16).
1 female ovig., *Doto* Exped., 1900 (O).
2 males juv., Moko Hinau (T).
1 (P, 6); 2 females, 23 and 40 fm, off Otago Heads, coll. D. H. Graham, 1931.
1 female, near Oamaru, 20 fm, coll. Capt. Bollons, 1914 (C).
3 males, Wellington, coll. F. G. Maskell, 1929; 1 male, no data (C).
1, Wellington; 2, no data (D).
1 male, 1 female, Chatham Islands, coll. Otago Inst. Exped. 1924 (O, 5).

PREVIOUS RECORDS: N.Z. (Miers); Bay of Islands (Dana); Stewart Island, Cook Strait, Massacre Bay (Filhol); French Pass, Akaroa (Lenz); Otago (Thomson); Chatham Islands (Young); Sumner, Chatham Islands, Stewart Island, C. Maria, Oamaru, Moko Hinau, Kapiti Island (Chilton and Bennett).

DISTRIBUTION: Endemic to mainland and Chatham Islands, commoner in the south.

Family HYMENOSOMIDAE Stimpson[41]

Hymenosomidae Stimpson, *Proc. Acad. nat. Sci. Philad. 10* : (54), 108; 1858.
Kemp, *Rec. Ind. Mus. 13* : 243; 1917.

Although well represented in New Zealand, this family has had to be omitted from the present survey. The

[40]Krefft (1952) clearly demonstrated that *Eurynolambrus australis* is not a parthenopid and, from early post-larval characters, established it as a majid and probably subfamily Pisinae.

[41] = Hymenosomatidae, *fide* Balss, 1957, p. 1632.

problems which it presents are so complex that any attempt to deal with them in geographic order, as distinct from the taxonomic order, would be premature. Two species of economic and zoogeographic importance are illustrated (figs. 128, 129).[42]

Superfamily BRACHYRHYNCHA[43]

Family CANCRIDAE Miers

Genus **Cancer** Linnaeus

Cancer Linn., Syst. Nat., ed. 10, Vol. 1, p. 625; 1758.
Rathbun, *Bull. U.S. nat. Mus. 152* : 176; 1930 (refs. and synon.).

Cancer novaezelandiae (Jacquinot)

[44]*Platycarcinus novaezelandiae* Jacq. in Jac. & Lucas, *Voy. Pole Sud, Zool. 3*, Crust. p. 34; pl. 3, fig. 6; 1853.
Cancer novaezelandiae Chilton & Bennett, *Trans. N.Z. Inst. 59* : 744; 1929 (refs.).
McNeill & Ward, *Rec. Aust. Mus. 17* : 377, pl. 61, figs. 3–7; 1930 (refs.).

Reference has been made above to the discovery of rhizocephalan parasites on members of this species (B, 14 below), and in the discussion of geographical distribution in a later chapter comment will be required on the distribution of the genus, and on the recent appearance of the species in Australia as recorded by McNeill and Ward. In view of comments above on dwarfing this species, it will be of interest to note the size attained in the new home, and also to verify that the small light-coloured sluggish specimens found sheltering among weeds, polyzoans, etc., in intertidal stations, and about 35 mm in breadth, are the young of the large deeply-coloured form occurring at deeper levels and reaching a breadth of 100 mm. Mr Graham has a record of a male with a width of 144 mm, considerably in excess of the supposed monster-specimen recorded by Chilton and Bennett.

In young specimens up to about 10 mm in length, the frontal teeth are upturned and prominent, the antero-lateral lobes upturned, and the 10 lobes are all clearly incised and not subdivided; the whole surface, including the male abdomen and the hands, is covered with rather scattered hairs, which are longest on the dorsum and there collect considerable quantities of silt. In the adult the hairs are few and inconspicuous, occurring chiefly on the meri and dactyli of the walking legs and below the lateral margins.

The front of the specimen described by Lenz (1901) is abnormal, evidently in consequence of breakage and irregular healing.

The eggs number about 12,000 and are 0·25 mm in diameter.

MATERIAL EXAMINED:

1 male, 10 fm, 1 juv., 1 megalopa; H. R. Millar.
1 female ovig. (O, 16); 1 male, 2 females ovig. –/1/36 (C, 10), 1 female juv. (O, 18).
1 male, 5 miles N of Cape Saunders, 46 fm (O).
1 juv., Blueskin Bay, 7/9/31; 1 male, 1 female, near Stn. 3 but intertidal, 1/2/30; about 20, male and female and juv., common in littoral of Otago Harbour, 1/2/30; coll. D. H. Graham (P).
3 juv., 7 miles NE of Otago Heads, 40 fm, coll. D. H. Graham, 9/2/31 (P).
1 female ovig., in stomach of ling, off Papanui Inlet, 10 fm, coll. D. H. Graham, 6/5/30 (P).
Occasional drift specimens (B, 11, 12, 13).
1 male, 1 female ovig., both with rhizocephalids (B, 14).
7 males, 2 females (A, 22); 9 males, 4 females (A, 29).

DISTRIBUTION: Mainland, Auckland and Chatham Islands; Tasmania and Victoria (introduced). Depth, 0–60 fm.

FOOD: Mr Graham records that these crabs can open cockle and oyster shells, breaking away the thin edges of the oyster shell till the chela can be inserted; in the aquaria about one mollusc per crab was eaten each night.

Family PORTUNIDAE Miers

Genus **Ovalipes** Rathbun

Platyonichus Latr., Encycl. Meth., Entom., Vol. 10, p. 151; 1825 (not *Platyonichus* Latr. 1818).
Anisopus de Haan, Fauna Japonica, Crust., pp. 3, 12; 1833 (not *Anisopus* Meigen 1803).
Ovalipes Rathbun, *Proc. U.S. nat. Mus. 21* : 597; 1898.
Rathbun, *Bull. U.S. nat. Mus. 152* : 18; 1930 (refs. and synon.).

Ovalipes punctatus (de Haan)

Corystes (Anisopus) punctata de Haan, Fauna Japonica, Crust., 1833, p. 13; 1835, p. 44, pl. 12, figs. 1–1d.
Platyonichus bipustulatus Milne Edwards, *Nouv. Archiv. Mus. 10* : 413; 1861.
Ovalipes bipustulatus Chilton & Bennett, *Trans. N.Z. Inst. 59* : 755 (refs. and synon.).
Ovalipes punctatus Rathbun, *Bull. U.S. nat. Mus. 52* : 24; 1930 (refs. and synon.).

The synonymy follows Rathbun's decision that De Haan's name is not a *nomen nudum*, as concluded by Stebbing (*Mar. Invest. S. Afr. 1* : 14; 1902). To the distribution as given by Chilton and Bennett (1929, pp. 756–7) may be added Uruguay (Rathbun 1930) and China (Kellogg 1928, p. 353).[45]

[42]A new species of hymenosomid (*Halicarcinus innominatus*), has since been described by Richardson (1949), see also Gordon (1940).

[43]The Subfamily Atelecyclinae Rathbun, 1930, Family Atelecyclidae Ortmann, 1893, has been subsequently represented in New Zealand by a new species of *Trichopeltarion*, a joint description of which is to be issued by Dell and Richardson (Dell, 1961, p. 5).

[44]Type seen in Paris Museum by E. W. Dawson, 13/4/56.

[45]See also Stephenson and Campbell, 1960, p. 90.

MATERIAL EXAMINED:

1 female, coll. W. B. Benham, 4/2/00, Warrington Point, Otago (O).
2 females, Muriwai, coll. D. H. Graham, 25/12/28 (A; "abundant").
Dactylus of right chela, subrecent sand dunes, Auckland district, coll. L. T. Griffin (A).[46]
Chela, drift, Woodpecker Bay, Westland, 3/3/35 (B).

This implies an extraordinary paucity of material, as compared with the numbers in the Canterbury Museum. Waite (Chilton 1911, p. 292) recorded "enormous bags" at the Chatham Islands, presumably taken in an otter trawl, and fragments are common on Canterbury beaches; good specimens are not commonly taken by casual collecting methods, and the distribution and frequency in N.Z. are not reliably indicated by the available collections.

Genus **Liocarcinus** Stimpson

Portunus subg. *Liocarcinus* Stimpson, *Bull. Mus. comp. Zool., 2* : 146; 1870.

Liocarcinus corrugatus (Pennant)[47]

Cancer corrugatus Pennant, Brit. Zool., Vol. 4, p. 5, pl. 5, fig. 9; 1777.
Portunus pusillus Kirk, *Trans. N.Z. Inst. 11* : 402; 1879 (not of Leach).
"*Portunus*" *corrugatus* Palmer, *J. Mar. Biol. Ass. 14* : 881, figs. 2a–h; 1927 (refs. and synon.).
Portunus corrugatus Borradaile, *Brit. Ant. Exped. 1910, Zool. 3* : 97, fig. 9; 1916.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 753; 1929 (refs.).
Portunus borradailei Bennett, *Rec. Cant. Mus. 3* : 256, figs. 1–4; 1930.
Liocarcinus corrugatus Hale, *Trans. roy. Soc. S. Aust. 51* : 311; 1927.
Hale, Crust. S. Aust. p. 148, fig. 149; 1927.
McNeill & Ward, *Rec. Aust. Mus. 17* : 379; 1930 (refs. and synon.).

The local synonymy includes a wrong identification (*P. pusillus*), a somewhat tentative but probably correct identification (*P. corrugatus* Borr.), a new specific name (*P. borradailei* Bennett), and now the rejection of the latter. The previously expressed doubts, anticipated long ago by Miers (1881a, p. 219), as to Kirk's identification (cf. Bennett 1930, p. 256) have been confirmed by the examination of Kirk's specimens in the Dominion Museum. The series recorded below provides a commentary on the small female specimen which Borradaile (1916) considered distinct from the European species; in local specimens the orbital tooth is more advanced and acute than he represents it, and distinctly in advance of the inner supra-orbital notch; the spine above the hand is more prominent and arises from a more distinct keel.

The name *borradailei* (Bennett 1930) is equally superfluous. It was proposed for a small and badly preserved dried specimen which, on account of the narrow abdomen and the glimpse obtained of abdominal appendages, was taken for a male; the parts have since been softened, and the supposed copulatory organs prove to be a bunch of female pleopods stuck together with varnish. The variations in the shape of the frontal lobes and in the proportions of the carapace of Australian specimens have also since been discussed by McNeill and Ward (1930), who have agreed with Miers in identifying them with the European *L. corrugatus*. In view of this decision based on direct comparison of specimens, the agreement of the New Zealand specimen with that of the Australian ones, and the range of variability, the name *borradailei* may lapse; yet there are several differences from the figure and description given by Palmer (1927), in that the swimming dactylus is narrower, the antero-lateral margins of the third maxillipeds are more oblique, and there is no distinct subsidiary tooth on the lower orbital margin; the ratio of length to breadth ranges from 0·82 to 0·88, a narrower but higher range than in the Australian specimens and decidedly higher than the European. The median frontal lobe is rounded or straight-sided with a distinct angle; the adjacent frontal lobes are round or subangled; there are equally great variations in the curvature or angulation of the intervening recesses.[48]

The Japanese form *Portunus strigilis* Stimpson, united with the present species by Miers (1879c, p. 33), has been given varietal rank as *L. corrugatus strigilis* by Yokoya (1933, p. 173; refs.).

MATERIAL EXAMINED:

1 female, New Zealand; MacLeay Collection, Sydney University (type of *P. borradailei*).
3 specimens, dried, Cook Strait; *Portunus pusillus* Kirk 1879, not of Leach (D).
1 male, 2 females, dredged off north end of Ponui Island; coll. A. W. B. Powell, 12/11/27 (A).
2 females, 28/3/30 and 15/5/30 (A, 26).
1 male, off Rangitoto Island, 7 fm (A).

DISTRIBUTION: To the New Zealand records listed above is to be added Borradaile's record (11–20 fm, Spirits Bay); NW Pacific, Mediterranean, Indo-Pacific, South Australia, New South Wales; not, however, California as stated by Filhol (1885, p. 381), denied by Rathbun (1930, p. 36).

Genus **Nectocarcinus** Milne Edwards

Nectocarcinus A. M. Edw., *Ann. Sci. nat. Zool. (4) 14* : 220, 228; 1860.
A. M. Edw., *Arch. Mus. Hist. nat. Paris 10* : 404; 1861.
Balss, *J. roy. Soc. W.A. 21* : 129; 1935.

Including *N. bullatus* Balss (Juan Fernandez), *N. tuberculosus* A. M. Edw. (Tasmania, S. Austr.), *N. integrifrons* (Latr.) (E., S., and W. Austr.), and the following species.

Nectocarcinus antarcticus (Jacq.),[49] Fig. 130

Portunus antarcticus Jacq. in Jacq. & Lucas, *Voy. Pole Sud. Zool. 3*, Crust. p. 51, pl. 5, fig. 1; 1853.
Nectocarcinus antarcticus Chilton & Bennett, *Trans. N.Z. Inst. 59* : 754; 1929 (refs.).
Balss, *J. roy. Soc. W.A. 21* : 129; 1935.

[46] See Glaessner, 1960, p. 22.

[47] *Portunus* Fabr. 1798, *fide* Balss, 1957 : 1640, = *Liocarcinus* Stimpson 1870, *fide* Richardson, 1949, p. 130; but = *Macropipus* Prestandrea, 1833 (*Op. int. Comm. zool. Nom. 394, 12 (17)* : 315–36; 1956).

[48] See also Stephenson and Campbell, 1960, p. 93.

[49] Type seen in Paris Museum by E. W. Dawson, 13/4/56.

HABITS: Common in shallow waters and down to 60 fathoms; not intertidal as far as known; a swimming crab, common in trawls, and of outstanding importance as food for fish. Agile, often at the surface, active at night (in the vicinity of harbour lights at least).

COLOUR: Reddish brown above, pubescence on carapace and limbs muddy grey, under surface cream, hands mostly white, movable finger with a large red basal patch.

MATERIAL EXAMINED:

1 male, Auckland Islands (O); 4 females (3 ovig.) (O, 4).
12 males, 9 females (O, 5, 8, and 9).
1 female ovig., St. Kilda, Dunedin, -/10/27 (O).
1 male, Dusky Sound, over 40 fm, coll. G. M. Thomson (O).
1 female, Chatham Islands, north coast, among spawn of *Doris* sp., Otago Inst. Exped., 29/7/25 (O).
8 males, 9 females (2 ovig., 1 imm.), 7/1/30 (P, 3).
2 males, 2 females, 10 fm, in trawls, 17/4/30 (P, 6).
5 males, 2 females, E of Papanui Inlet, Otago Penin., 40 fm, coll. D. H. Graham, 22/4/30 (P).
2 males, 1 female; Otago, 23 and 40 fm, coll. D. H. Graham; reported numerous; 1931 (P).
Several, macerated, in stomach of red cod, 20 fm, off Otago Heads; coll. D. H. Graham, 10/3/30 (P).
Numerous (B, 14).
1, Wellington, coll. T. W. Kirk (D).
1 male (O, 19); 1 male (O, 20); 1 male (A, 30); 1 male, 8 fm, 8/12/30 (A, 24); 2 males, 1 female, 28/3/30 (A, 26).

DISTRIBUTION: Endemic, including Auckland, Campbell, and Chatham Islands, commoner in the south.

Family XANTHIDAE Alcock

Xanthidae Alcock, *J. Asiat. Soc. Bengal, (2) 67* : 69; 1898 (refs.).
Brehm, *J. roy. Soc. W.A. 21* : 132; 1935.

Section HYPEROLISSA Alcock

Hyperolissa Alcock, *l. c.*, pp. 70, 77.

The efferent branchial canals are not defined by a complete ridge on either side of the palate (the ridges are either absent or else low and confined to the posterior part of the endostome).

The sections Hyperolissa and Hyperomerista were instituted by Alcock in preference to Dana's families Cancridae and Eriphiidae, to which they roughly correspond, on the grounds that these families depended on a single variable character scarcely sufficient of itself to separate families or subfamilies. Alcock distinguished seven subfamilies, which have been accepted by Ortmann and Borradaile but rejected by Rathbun (1930, p. 234) because "no satisfactory arrangement to include all genera has yet been made". The arrangement since proposed by Balss (1930) is provisionally followed here.

Genus **Heterozius** Milne Edwards[50]

Heterozius M. Edw., *Ann. Soc. Ent. Fr. 7* : 275; 1867.
Miers, Cat. Crust. N.Z., p. 15; 1876.
Balss, *Senckenbergiana 12* : 203; 1930.

Balss points out the close relationship of this monotypic and endemic genus to *Homalaspis* Milne Edwards (Peru to Magellan Strait), the two genera being primitive xanthids which serve to lessen the gap between this family and *Acanthocyclus* among the Corystidae. There is no relationship with *Ozius*, as the unfortunately chosen generic name suggests, nor with the Australian *Megametope* Filhol (McNeill 1926, p. 128), which it resembles in general appearance.

Heterozius rotundifrons A. Milne Edwards, Figs. 72, 131.

Heterozius rotundifrons A. M. Edw., *Ann. Soc. Ent. Fr. 7* : 275; 1867.
McNeill, *Rec. Aust. Mus. 15* : 131; 1926.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : p. 746; 1929 (refs.).
Balss, *Senckenbergiana 12* : 204, text-figs. 5, 6; 1930.

The assertions that the hands are subequal (Milne Edwards), that in males they are occasionally very unequal (Miers), and that the right cheliped is enlarged in the female (Filhol), are all incorrect. In females the hands are normally equal, the right rarely enlarged (e.g., in one out of 18 specimens in the Otago Museum); the right is regularly enlarged in the male, and evidently is not readily lost in combat or otherwise.

This agrees with an MS note by Chilton on the habits: "In Queen Charlotte Sound it lives on the shore between tide marks among stones, and appears to be usually half buried in the mud with its body vertical, or concealed between two stones, and the enlarged right chela is kept folded over the exposed surface of the animal, protecting it and also concealing it, since the swollen chela has a general resemblance to the pebbles among which the crab is partially buried. In accordance with this habit the hairs on the surface are usually more or less clogged with fine particles of mud".

The tips of the fingers are light yellow in both sexes (late Dr F. G. Maskell, pers. comm.).

"The form of the carapace agrees fairly well with Filhol's figure, except that obviously only the lower edge of the hinder margin is shown, whereas the upper edge is turned more inwards, so that the last of the lateral lobes stands out distinctly" (Lenz 1901, transl.).

Of 211 specimens, only 60 (28%) were found to be females, a smaller minority than implied by Chilton and Bennett (1929), who suggested that ovigerous females may remain secluded; this is discredited by the proportion of ovigerous females in the following list; they have been found in mid-summer (February) and mid-winter (July).

[50] Placed in Family Atelecyclidae by Balss (1957), subfamily Acanthocyclinae; placed in Cancridae by Richardson (1949a, p. 32) but restored to Xanthidae by Richardson (1949c, p. 130), following Balss (1930).

MATERIAL EXAMINED:

2 males, 6 females (1 ovig.), 5-12/98 (O, 10).
3 males, 10 females (6 ovig.), Kenepuru, coll. McMahon (O).
1 female, Nelson (O).
1 male, 1 female ovig., coll. W. B. Benham, 16/7/30 (P, 4).
1 female ovig., coll. D. H. Graham, 16/7/30 (P, 4).
Numerous, Island Bay, coll. F. G. Maskell, 1929.
Numerous (B, 14).
1 female ovig., (A, 23); 5 females (4 ovig.) (A, 25); 1 male (A, 27); 1 female (A, 28); 1 male, 3 females ovig. (A, 29).
1 male, 2 females, coll. H. Suter (T, 29).

DISTRIBUTION: Endemic to the mainland and the Chatham Islands (type locality not New Caledonia cf. Filhol 1886); throughout the mainland, but comparatively rare in the south. There are numerous records from Auckland; it is "common on the shores of Cook Strait" (Chilton, MS.), and "abundant at Lyall Bay, commonest of all" (Maskell, letter); there are five records from Stewart Island in the extreme south, but only one record each from Banks and Otago Peninsulas. Sufficient data are not available to allow firm conclusions on distribution to be drawn.

Section HYPEROMERISTA Alcock

Hyperomerista Alcock, *J. Asiat. Soc. Bengal (2) 67* : 70; 1898.

The efferent branchial channel on either side is usually defined by a ridge on the palate, extending right up to the anterior border of the buccal cavern.

Balss distinguishes two subfamilies, separated by the characters of the male pleopods.

Subfamily MENIPPINAE Ortmann emend. Balss

Menippinae Balss, *Zeit. wiss. Zool. 142* : 512; 1932.

The second pair of male pleopods (figs. 68, 71) are long cylindrical rods from which arise a slender curved flagellum, the point of origin of the latter being distinctly marked off.

Balss unites in this subfamily the subfamilies Menippinae, Oziinae, and Eriphiinae as understood by Alcock, except in so far as the structure of the male copulatory organs may necessitate a redistribution of genera; the distinctions based on the relation of the antenna to the front and orbits are therefore abandoned, at least for the purpose of major subdivision.

Genus **Pseudozius** Dana

Pseudozius Dana, *Proc. Acad. nat. Sci. Philad.*, p. 81; 1852 (part).
Dana, *U.S. Explor. Exped.*, Crust. pt. 1, p. 232; 1852 (part).
Sphaerozius Stimpson, *Proc. Acad. nat. Sci. Philad. 10* : 32, 35; (1858) 1859 (part).
Stimpson, *Smiths. misc. Coll. 49* : 62; 1907 (part).
Pseudozius Miers *Challenger Rep. Zool. 17* : 141; 1885 (part).
Alcock, *J. Asiat. Soc. Bengal (2) 7* : 180; 1898 (part).
Balss, *Zeit. Wiss. Zool. 142* : 511; 1932.

The characters of the genus are clarified by the removal from it of the Australian and Pacific *P. dispar* Dana (1852, p. 235, pl. 13, fig. 9; Calman 1900, p. 14; McNeill 1926, p. 315). Stimpson (1859) provided the genus *Sphaerozius* for this species and for *S. nitidus* Stimpson (1859, p. 35, and 1907, p. 62, pl. 7, figs. 5, 5a), and it was again described as *Pilumnus nitidus* by Milne Edwards (1873, p. 249, pl. 10, fig. 2; de Man 1887, p. 305; Lanchester, *Proc. zool. Soc. Lond., 1901, 2* : 542), the identity of the specific name being evidently a coincidence. It differs from *Pseudozius* in the structure of the front and of the male pleopods, and is the type species of *Glabropilumnus* Balss (1932, p. 516), with *Pilumnus seminudus* Miers, *P. edamensis* de Man and *P. laevis* Dana as congeners, in the subfamily Pilumninae; for *G. laevis* Dana, see further Balss 1934, p. 518. This leaves *Sphaerozius nitidus* Stimpson (= *Menippe convexa* Rathbun 1893 = *M. ortmanni* de Man 1899 – cf. Balss 1934, p. 517; not *Pilumnus nitidus* M. Edw., = *G. dispar*) available as type species of *Sphaerozius*, to which genus Balss (1935, p. 46, pl. 2, figs. 3, 4; refs.) has added *Actumnus nudus* A. M. Edw. 1867 (*nec* Grant and McCulloch 1906, p. 17; cf. McCulloch 1908, p. 57).

The following remarkable species, which adds a genus to the New Zealand fauna, conforms to *Pseudozius* as reconstituted by Balss.

Pseudozius sp., Figs. 62–68, 132.

Carapace (figs. 62, 132) completely glabrous, slightly convex transversely, more strongly so fore and aft, front vertical. Regions undefined; a shallow median postfrontal groove quickly bifurcates and disappears, and separates two faint postfrontal lobes. Dorsum sparsely punctulated, otherwise smooth except for a patch of small flat granules, white and shining and obscurely arranged in rows, opposite the antero-lateral margin, and a minutely roughened area behind the front, spreading obscurely to the postfrontal lobes and thence to the granulated area, behind a smooth track adjacent to the orbital margin.

Antero-lateral margins regularly arched longitudinally, and tending to continue up on to the dorsum at the boundary of the epi- and meso-branchial regions; obscurely four-lobed, the lobes (which are scarcely recognisable in dorsal view) each with a granule in front at the highest part and one or two granules behind it; granules similar to those of the dorsum. Margin a slightly raised rim; a somewhat enlarged granule at the junction with the orbit, which is otherwise regularly curved without interruption round the outer corner.

Orbits transversely oval, width one-third greater than the height, margin a continuous and slightly raised granulated rim without spines, upper and lower margins in contact below the front with a narrow notch at the suture. Front bilobed, the lobes and the intervening median recess broadly rounded, outer slope two and a half times as long as inner, not separated from the orbit by a notch; margin a raised granulated rim like that of the orbit.

The merus of the third maxillipeds is slightly longer than broad, antero-internal margin faintly convex, almost straight, antero-external margin a little concave, forming a permanent narrow gape with the rim of the epistome opposite the respiratory aperture. The epistomial rim is strongly raised, not hollowed out at the gape, with a median linear notch and one on either side. The basal antennary joints occupy two-thirds of the distance from their base to the orbital margin; an outer distal angulation reaches to the tip of the triangular lobe below the front. (Flagellum broken, leaving a single minute joint sheltering below the front.)

Right cheliped (fig. 63) greatly enlarged in both sexes. Merus smooth, with a few long hairs along both lower margins; upper margin acutely angled, almost crested, with an obsolete shallow subterminal notch followed by a small blunt tooth, scarcely toothed on the proximal side of the notch. Carpus with sparse long hairs on inner surface and a few distal ones on the outer; outer surface with a row of granules along the distal margin and a few others near by, larger than those of the carapace but otherwise similar; a higher conical granule opposite the upper articulation, another still higher near by towards the inner surface, and a small acute spinule at the middle of the latter, a little concealed by the hairs on the ridge. Palm evenly inflated on both surfaces, upper and lower margins nearly straight, with a patch of sparse hairs at the middle of the inner surface and another on the outer near the gape of the fingers. Outer surface uniformly granulated except that the granules are reduced or almost absent along the upper and lower margins, though reappearing as a short proximal row on the inner side of the upper margin; the larger granules conical, especially distally; inner surface with a few obsolete granules. Fingers short, widely gaping, brown except for the tips and teeth; four teeth on movable finger, largest basally; three on fixed finger, middle one much the largest, or the two smaller may be obsolete.

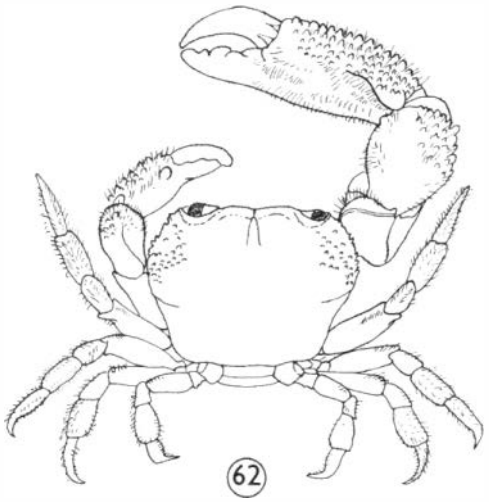

Fig. 62: *Pseudozius* sp.. Campbell Island specimen, male, × $1\frac{3}{5}$.

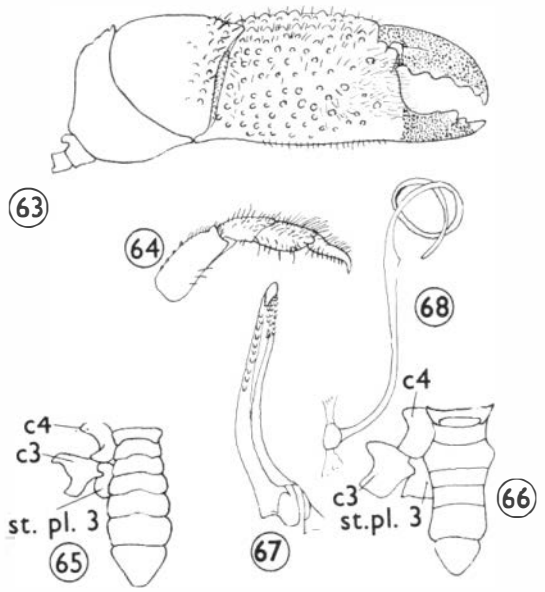

Fig. 63–68: *Pseudozius* sp.. Campbell Island specimens; 63, major cheliped of male, × $2\frac{2}{3}$; 64, fourth right leg of male, × $2\frac{2}{5}$; 65, female abdomen, × $2\frac{2}{5}$, c3, coxa of 3rd leg, c4, coxa of 4th leg, st. pl. 3, sternal plate corresponding to c3; 66, abdomen of male, × $1\frac{4}{5}$, lettering as in fig. 65; 67, first pleopod (copulatory style) of male; 68, second pleopod of male.

The left cheliped has a distal row of small granules on the upper margin of the merus, and a few conical ones on the upper margin of the carpus (including the large one towards the inner surface, but there is no medial spinule); both surfaces of the palm are sparsely but uniformly haired, inner surface without granules, outer with a few distinct, prominent, acute granules, spreading on to the upper surface and fixed finger; fingers nearly straight, grooved, opposed margins forming a lamellate crest, internally to which the fingers are deeply hollowed out with a broad terminal trilobed spatula.

Last leg the shortest, others subequal. Ischium (fig. 64) with a distal row of three to five granules below, nearly transverse and therefore at an angle to the oblique margin. Limbs otherwise unarmed, except that in the last pair the merus, which is serrate along the upper margin, has about three granules on the proximal margin and posterior surface, the carpus has a double row on the distal half, and the propod a few above, about 16 granules on the whole limb. Merus of all legs with a few hairs above and below, carpus hairy on and near the upper margin and with a row on the posterior surface, propod with four rows on each surface and additional hairs on the upper margin, rows becoming obsolete on last pair, dactylus with about six ill-defined rows. Merus flattened, angled above, propod of last pair high, other joints swollen on both surfaces and with rounded margins; dactylus slender with the long hooked claw inserted at an angle.

Material Examined: 2 males, 2 females, labelled "Campbell Island", in Suter's writing but without further data. An MS note by Chilton (1904) implies that they were

collected by Suter during a trip of the *Hinemoa*; two specimens retained by Chilton in 1902, if additional to the above, are now lost. In view of this somewhat inconclusive evidence, and the surprising distribution, additional material is greatly to be desired.

STUDY SPECIMEN: A female from the above series; right cheliped detached but present in Canterbury Museum, much damaged.[51]

LOCALITY: Campbell Island.

DIMENSIONS (mm): Type: Carapace length 8·5; carapace width 11·5; interorbital width 5; fronto-orbital width 8; right cheliped 24; hand (lower margin) 15; hand, height 8; legs 1-4 respectively 14·5, 15, 14·5, 11.

RELATIONSHIPS: Allegedly new species in this genus require to be clearly separated from *Pseudozius caystrus* (Adams and White, 1848, p. 42, pl. 9, fig. 2; Whitelegge 1897, p. 136; Alcock 1898, p. 181), which has a very wide distribution in the Indo-Pacific, including Australia and Tasmania, and which has also been recorded from both coasts of Panama by Finnegan (1931, p. 645). It differs from the Campbell Island *Pseudozius* in that the "chelipeds (are) . . . quite smooth to the naked eye . . . Legs smooth, dactyli furred, a few fine scattered silky bristles on the protopodite" (Alcock), and the front is narrower. The granulated condition of the hands in the Campbell Island *Pseudozius* is matched by an unnamed *Pseudozius* sp. of Dana (1852, p. 235; 1885: pl. 13, figs. 8a–b) from Charlotte's Island (evidently Apaiang, in the Gilbert Islands, a Polynesian locality). As his specimen was lost in the wreck of the *Peacock* prior to publication and as his figures show dentate antero-lateral margins and numerous differences from the Campbell Island species in the characters of the hand, his species remains unknown. It would therefore seem probable that the alleged Campbell Island specimens represent a species new to science.

DISTRIBUTION: The occurrence of this species at Campbell Island but not on the mainland is remarkable, the genus being mainly Indo-Pacific.

Genus **Ozius** Milne Edwards

Ozius Milne Edwards, Hist. Nat. Crust., Vol. 1, p. 404; 1834.
Rathbun, *Bull. U.S. nat. Mus. 152* : 539; 1930.

Ozius truncatus Milne Edwards, Fig. 71

Ozius truncatus Milne Edwards, Hist. Nat. Crust., Vol. 1, p. 406; pl. 16, fig. 11; 1834.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 750; 1929 (refs. and synon.).

Comparison shows the species to be identical with the Australian. The crabs occur rather sparsely under stones, close inshore but apparently always in the water. To previous records (Chilton and Bennett 1929, p. 751) may be added Tiri-Tiri, Auckland (Lenz 1901).

MATERIAL EXAMINED: 1 male, –10/26 (A, 30); 1 male (A, 22); 1 male, 2 females (A, 29).

DISTRIBUTION: Common on the northern shores of New Zealand – from Portland Island northwards, scarcely extends to the South Island. Australia, Kermadecs (*O. lobatus*).

Subfamily PILUMNINAE Ortmann

Pilumninae Ortmann, *Zool. Jb., Syst. 7* : 429–32; 1893 (part).
Alcock, *J. Asiat. Soc. Bengal, (2) 67* : 176; 1898.
Balss, *Z. wiss. Zool. 142* : 516; 1932.

Second pair of male pleopods (figs. 69, 70) short, without flagellar process.

Genus **Pilumnus** Leach

Pilumnus Leach, *Trans. Linn. Soc. Lond. 11* : 309, 321; 1815.
Alcock, *J. Asiat. Soc. Bengal (2) 67* : 190; 1898 (refs.).
Rathbun, *Biol. Res. "Endeavour" 5* : (3) : 108; 1923.
Rathbun, *Bull. U.S. nat. Mus. 152* : 481; 1930 (refs. and synon.).
Brehm, *Capita zool. IV, 3* : 1; 1933.

The tentative opinion of Chilton and Bennett in 1929 is here upheld, that *P. tomentosus* Latr. and *P. vespertilio* M. Edw. are not members of the New Zealand fauna. The relatively common species is *P. novaezelandiae* Filhol, of which *P. spinosus* Filhol is at most a variety, while *P. maori* Borradaile is a synonym; so also is *P. vespertilio* Miers *nec* M. Edw., as established by Calman and de Man (Chilton and Bennett 1929, p. 749).

The opportunity may be taken to remark that *Pilumnus contrarius* Montgomery (1931, p. 444), not of Rathbun (1923, pp. 110, 113, pl. 23), from the Swan River, Western Australia, is no doubt *Heteropanope serratifrons* Kinahan (*J. roy. Soc. Dublin 1* : 113, pl. 4, fig. 1; 1856; Miers 1876b, p. 20; Haswell 1882c, p. 70; Hale 1927, p. 161, fig. 162; Chilton and Bennett 1929, p. 749, refs. and synonymy); this species has been collected by the present author in Montgomery's locality and agrees with his account.

KEY TO NEW ZEALAND SPECIES

A. Hairs short and dense, completely concealing the carapace; a few long hairs on the legs and chelipeds. Hairs extending over two-thirds and granules extending over most of the outer surface of the major palm ..... **P. lumpinus** n. sp.

B. Hairs long and short intermixed, not dense and not concealing hinder part of carapace; hairs on legs and chelipeds nearly all long. Hairs not covering more than one-third and granules one-half of the outer surface of the major palm.

1. Upper orbital margin without spines, except at the outer corner, or at most with a single spinule ..... **P. novaezelandiae**
2. Upper orbital margin with two spines near the middle. ..... var. **spinosa.**

[51]Present in Canterbury Museum, 1962; C. M. Crus. 5.

Pilumnus novaezelandiae Filhol,[52] Figs. 70, 73–75, 133.

Pilumnus vespertilio Miers, Cat. N.Z. Crust., p. 19; 1876 (not of M. Edw.).
Pilumnus novaezelandiae Filhol, Mission de l'Ile Campbell, p. 375, pl. 44, figs. 1, 2; 1886.
Pilumnus maori Borradaile, *Brit. Ant. Exped 1910, Zool. 3* : 99, t. fig. 10; 1916.
Pilumnus novaezelandiae Chilton & Bennett, *Trans. N.Z. Inst. 59* : 749; 1929.
Pilumnus vespertilio Young, *Trans. N.Z. Inst. 60* : 151; 1929 (part, not of M. Edw.).
Pilumnus novaezelandiae Bennett, *Rec. Cant. Mus. 3* : 258; 1930.

Carapace (figs. 73, 133) rather sparsely covered with long and short hairs intermixed, which posteriorly do not conceal the surface. The under surface is bare, and most of the submarginal areas, but there is some short hair opposite the chelipeds and first legs, usually long and silky opposite the merus of the cheliped. Hairs long on the larger limbs; the greater part of the outer surface of the major palm (fig. 75) and half that of the lesser palm are bare.

The antero-lateral margins have three or four spines in addition to the extra-orbital. There are three sharp forwardly-curved spines of moderate size, the first midway between the outer orbital spine and the succeeding one; commonly there is a fourth marginal spine close behind the outer orbital spine, in some cases confluent with it, in others adjacent but distinct, in others replaced by a cluster of granules of which one may be spinulous.

Front (figs. 73, 74) advanced, deeply incised, smooth above with a denticulated margin, lobes regularly rounded, outer slopes the longer. At the outer end there is a small pointed tooth, detached, a little upturned, pyramidal and sharp.

[52]However, Balss (1933, p. 23, pls. 3 and 4) used the name *Pilumnus tomentosus novaezealandiae* Filhol for this species.

The regions are obscurely marked. There are four broad depressions at the corners of the cardiac region, more distinct in the larger specimens, and there may be two pairs of smaller pits further forward on the hinder gastric region. Apart from the median post-frontal groove, bifurcated on the gastric region, the carapace is otherwise smooth below the hairs.

The upper orbital margin is distinctly oblique at the inner end in most specimens, but becomes almost longitudinal in larger specimens, in which also a faint notch may occur. Outer orbital spine small, acute, variable in size but never large, rarely double. Lower orbital margin conspicuously denticulate, rising at the inner end into a broad lobe; the denticulations become subspinulous on the lobe, and the row ends in an acute spinule.

Subbranchial regions with small sharp granules close to the marginal spines, rapidly becoming smaller lower down; rarely they spread downwards without becoming microscopic. In front of this area, near the buccal margin, there are close-set and very sharp minute spinules.

The chelipeds are unequal, the right usually the larger. The merus has a thin line of hairs on the upper crest; subterminal spine large, sharply acuminate, separated by a deep rounded notch (scarcely a groove) from the slender acute terminal spine. Carpus sparsely haired over the whole of the outer surface, with low scattered granules which become sharp near the inner and distal margins; an erect acute spine at the upper inner corner. The palm of the major hand (fig. 75) has a small patch of hairs near the articulation, not approaching the lower margin and scarcely reaching the base of the movable finger. The granules are conical except distally, and in specimens of moderate size those nearer the articulation and the upper surface are

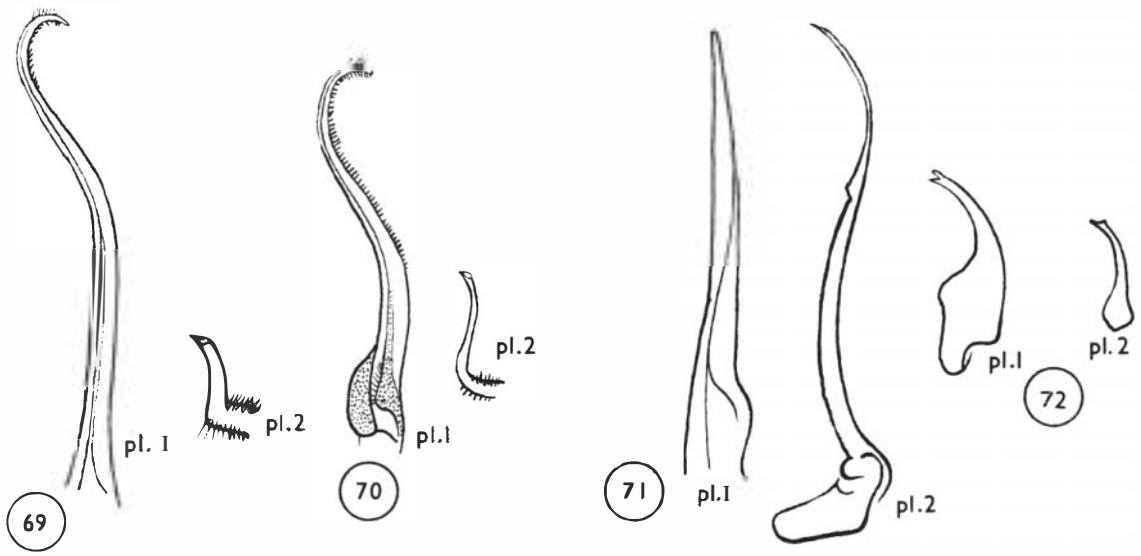

FIG. 69–72: copulatory styles of Xanthidae, all × 10, pl. 1, first pleopod, pl. 2, second pleopod; 69, *Pilumnus lumpinus* n. sp. carapace length 17 mm; 70, *Pilumnus novaezelandiae* Filhol, c.l. 13 mm, shaded areas = calcified sclerites; 71, *Ozius truncatus* Milne Edwards, c.l. 17 mm; 72, *Heterozius rotundifrons* Milne Edwards, c.l. 13 mm.

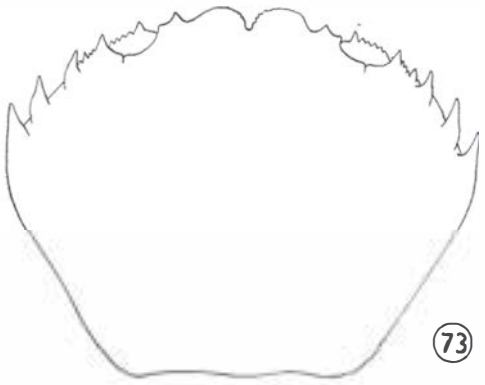

FIG. 73: *Pilumnus novaezelandiae* Filhol; carapace, dorsal, × 3.

commonly subspiniform. The granules and spinules occupy not more than half of the outer surface. The fingers are short, usually gaping to the tip, the teeth broad and regularly triangular or obtuse, the second one on the fixed finger being the largest. Fingers black, extreme tips white, tips of teeth of major hand white; on the fixed finger the boundary between black and white is a straight transverse line a little beyond the base. In the lesser cheliped, the granules of the carpus are spinulous, especially on the lower outer distal surface, and also on the palm, especially on the upper margin; the fingers are grooved and do not gape.

FIG. 74: *Pilumnus novaezelandiae* Filhol; frontal view, × 3.

The merus of the legs has a small sharp terminal spine; the upper margin of the carpus has usually three long erect slender spines. The outer maxillipeds are finely granulate; the antero-internal margin of the merus is concave.'

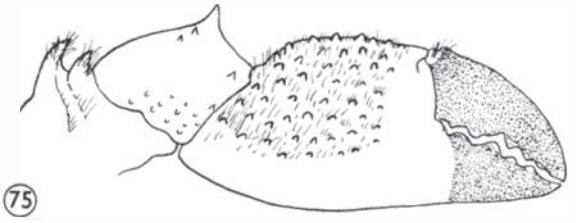

FIG. 75: *Pilumnus novaezelandiae* Filhol; major cheliped of male, × 2½.

HISTORICAL: Filhol claims to have taken some hundreds of specimens in 8–11 fathoms off Stewart Island and in Massacre Bay and records the species as abundant; yet except for de Man's identifications of specimens sent by Chilton to the British Museum (Chilton and Bennett, 1929, p. 749), the species has not since been recognised. Filhol states that on the lower distal margin "Il existe deux tout petits tubercles" external to the pair of spinules; evidently "deux" is a lapsus for "de", as there are not two small tubercles but a row. Filhol states also that the granules of the major palm occupy two-thirds of the outer surface and sometimes spread to the lower margin, and figures them as more acute than in the present series.

The identification of Chatham Islands material by Young as *P. vespertilio* M. Edw. has already been denied (Bennett 1930, p. 258), and examination of the specimens now shows that they include *P. novaezelandiae* and *P. lumpinus* but not *P. vespertilio*.

Borradaile's *P. maori*, based on a male of minute dimensions, differs from typical specimens only in trivial features save that his figure of the hand (t. fig. 10a), presumably the major hand, is more granulous than usual; this cannot distinguish his species from Filhol's, the figure of which (Filhol 1885, pl. 44, fig. 2) shows precisely the same exaggeration.

RELATIONSHIPS: The key to the Australian species (Rathbun 1923, p. 108) brings this species close to *P. tantalus* Rathbun, from which it differs by the hairs on the major palm, etc. In the American fauna (Rathbun 1930, p. 481), the closest relative – in so far as the rather arbitrary and trivial characters necessary in keys to species of this genus are indicative of relationships – is *P. quoyi* M. Edw., from Rio de Janeiro and Guiana, in which species, however, the lower orbital margin is spinulous and the antero-internal margin of the outer maxillipeds is truncate.

HABITS: The crab occurs between tide marks and down to 11 fathoms; it is not solitary, like the next species, as many as 14 specimens (though all juvenile) being present in one tube. The ragged appearance of the crab is due to the inequality of the hairs and the mud collected by them.

VARIABILITY: In spite of the marked variability and the qualifications in the above description, not more than one species can be distinguished. The variations occur not only in specimens from a single locality, but on two sides of a single specimen; thus one orbit may be smooth and the other notched and one side may have four marginal spines and the other five. Only one specimen has five lateral spines as regular figures by Borradaile (1916, t. fig. 10). The differences may to some extent be correlated with age but not with sex.

MATERIAL EXAMINED:

1 male (Ch, 9); 14 juv. (T, 8); 5 males, 3 juv., det. Hutton (C, 8).
6 males, 2 females, Akaroa, 4/10/03, coll. C. Chilton (Ch).
1 female (Ch, 10); 2 juv., Moko Hinau, coll. L. R. Gow, 6/9/14 (Ch).
1 female, Portland Island (T).
3 males, 1 female, Ponui Island, coll. W. J. Barr (Ch).
1 male, 1 female ovig., Ponsonby Reef, Auckland, coll. W. R. B. Oliver, 23/8/14 (Ch).
1 female ovig., Auckland (Ch).
10 males, 4 females (A, 22).
2 males, 3 females, small; Chatham Islands, coll. by Otago Institute Exped., 1924 (O).
1 female, 2 4 fm, coll. Capt. Bollons, –/9/06 (Ch, 30).

PREVIOUS RECORDS:

Stewart Island; Massacre Bay: common, 8–11 fm (Filhol).
N.Z. (Miers, as *P. vespertilio*).
70 fm, off North Cape (Borradaile, as *P. maori*).
Chatham Islands (Young, as *P. vespertilio*, part).

Chilton's MS indicates that the material seen by de Man was from wharf piles at Auckland, not Lyttelton as might be inferred from Chilton and Bennett (1929).

TYPE: Paris Museum, if extant;[53] type loc. not specified (Stewart Island and Massacre Bay).

DIMENSIONS: Length 14·5; breadth 20; interorbital width 7; exorbital width 12·5; outer orbital corner to last marginal spine 6·5; major cheliped 25; upper margin of major hand 15; height 10; legs 1–4 resp. 21, 22, 23, 20.

DISTRIBUTION: Endemic to mainland and Chatham Islands; commonest in Auckland district, but extending south to Banks Peninsula and, according to Filhol, to Stewart Island.

Pilumnus novaezelandiae var. **spinosa** Filhol

Pilumnus spinosus Filhol, Mission de l'Ile Campbell, p. 377, pl. 44, fig. 9; 1886.

Filhol's type material was collected in New Zealand by M. Leclancher, and in essentials was described as follows: Margins of front denticulate, supero-internal orbital spine acute, upper orbital margin with two almost contiguous spines near the middle; three very long and slender marginal spines, curved at the ends, and increasing posteriorly in size. Carapace smooth except for small irregularly placed granules near the margins. Carpus of cheliped and upper margin of hand with numerous close spines, becoming less elevated on the palm and flat and rounded towards the smooth lower border. Legs with small and very sharp spines along the upper borders of merus and carpus. Body and legs covered with fine hairs. Length 8, breadth 12 mm (the original evidently misprinted). Male unknown.

The species has remained unrecognised, but a large male in the Otago Museum, collected by the *Doto* in 1901 between Mahia Peninsula and Hicks Bay, agrees with the description, even as regards the upper orbital margin, though the dorsal granules are not apparent, perhaps through imperfect preservation. The denticulations of the front and lower orbital margin are sub-spinulose, the first marginal spine distinct and a little below the margin; there are a few granules near the middle of the inner surface of the major palm. In other words, the specimen differs from *P. novaezelandiae* in that some of the granules or denticulations are spinose or subspinose (viz, on the front, upper and lower orbital margins, carpus and palm); the original description implies nothing more than that, and the species s. str. varies in this direction. The retention of varietal rank is highly provisional.

[53]Type seen in Paris Museum by E. W. Dawson, 13/4/56.

Pilumnus lumpinus n. sp., Figs. 69, 76–78, 134

Pilumnus vespertilio Young, *Trans. N.Z. Inst. 60* : 151; 1929 (part, not of M. Edw.)

Carapace (figs. 76, 134) large, completely concealed by short and very dense tomentum, which spreads also over exposed parts of legs and chelipeds; sparser below the margin and on abdomen and sternum, though dense patches occur; fingers and lower margins and inner surfaces of both palms bare, major palm (fig. 78) bare over one-third of outer surface. On the walking legs, especially on the distal joints, there are also some longer hairs.

Three large marginal spines, broad at the base, conical and sharp; a small spine, sometimes obsolete, below the margin, midway between the outer orbital corner and the first marginal spine.

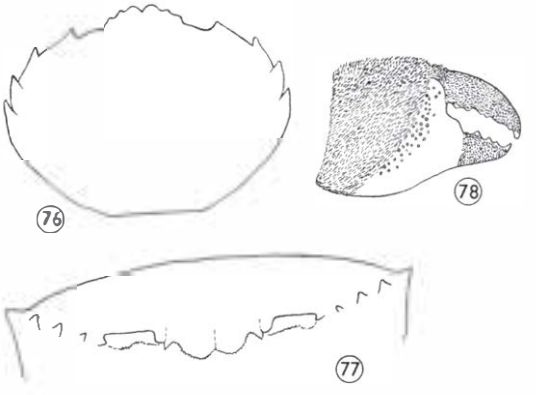

FIG. 76–78: *Pilumnus lumpinus* n. sp.; 76, carapace, dorsal, × 2; 77, frontal view, × 2¾; 78, major palm of male, × 2.

Regions defined, surface uneven; four depressions at the corners of the cardiac region; a deep median post-frontal groove, bifurcated close to the front and defining a long narrow mesogastric region; there is a transverse row of six broad flat swellings, of which the outermost (which may be obsolete) is behind the orbital notch.

Front (figs. 76, 77) advanced, lobes rounded, inner slope scarcely shorter than outer, smooth above but with denticulate margins; followed by a small acute horizontal peg, which is separated from the orbital margin by a distinct groove. The upper orbital margin has no inner spine; it is almost longitudinal on the inner side, then transverse, finely denticulate especially towards the inner and outer ends; there is a small shallow notch, occasionally obscure, at the middle of the transverse part; a sharp horizontal extra-orbital spine, followed by a small gap, beyond which the lower margin is strongly denticulate, rising at the inner end to a large rounded lobe with denticulations on the outer surface as well as marginally. The submarginal areas have sharp granules near the margin, becoming minute, closely packed, and sharper below.

Merus of cheliped with acute subterminal spine (fig. 78) separated by a very deep groove from a much larger conical tooth behind on the upper margin, stout, moderately acute. Carpus with a few flat obsolete tubercles towards lower and distal margins of outer surface; distal upper margin with a stout lobe bearing a small sharp spine. The lower margin of the major palm is smooth, glabrous, subangled; outer surface with stout rounded granules which continue over the upper margin as far as the tomentum, and beyond the tomentum towards the bare lower distal corner. Inner surface smooth and glabrous, except for a few flat granules near the centre. Fingers black to the base, extreme tips and the larger teeth white; fingers gaping to the tips; teeth large, bluntly rounded; movable finger with two large teeth, fixed finger with four, the second the largest. The minor hand is granulate to the lower margin, the hairs stopping short close to the margin; fingers black, tips white, grooved, not gaping.

The merus of the walking legs has an obscure spine on the distal half of the upper margin, no terminal spine; other joints unarmed; hairs sparse on merus, other joints with tomentum and long close-set clavate hairs. Outer maxillipeds as in *P. novaezelandiae.*

Relationships: The key to the Australian species (Rathbun 1923, p. 108) leads to the neighbourhood of *P. humilis* Miers (1884, p. 221), from which however it differs in the extraorbital and lateral spines and the teeth of the movable finger. The nearest American relative (Rathbun 1930, p. 481) appears to be *P. lacteus* Stimpson (*Bull. Mus. Comp. Zool. 2* : 142, 1871; Rathbun 1930, p. 511), in which however the major hand is smooth and bare over a larger proportion of the outer surface.

Habits: Intertidal, sheltering among rocks; solitary, except for a mention of mud flats by Thomson, precise data as to the station is available only from the writer's collections, but probably all the records result from shore collection.

Material Examined:

1 male, near Godley Heads, Banks Peninsula; on broken reef between tide marks; 26/11/27 (B). Holotype.
2 males, among stones between tide marks, –/8/27 (B, 10).
1 male, small, Tom Bowling Bay; 3/1/15; 1 male, Taylor's Mistake, 10/6/06 (C).
1 female, Kenepuru, mud flats (T).
1 male, Cuvier Island, coll. Grenfeld and Barr, –/3/14 (Ch).
2 males, Stephen Island, coll. T. B. Smith, –/12/15 (Ch).
3 juv., Moko Hinau, coll. C. R. Gow, 6/9/14 (Ch).
2 males, small, Pelorus Sound; coll. T. B. Smith, –/1/17 (Ch).
1 male (C), 2 males, 3 females (Ch); localities unknown.
1 female, Waitangi, Chatham Islands; coll. W. R. B. Oliver, –/12/09 (C).
1 male, Chatham Islands, coll. Otago Institute Exped. 1924 (O).

Type: 1 male, Canterbury Museum;[54] type loc., near Godley Heads.

[54]A specimen in the Canterbury Museum (1962), C. M. Crus. 4, bears the label: "*Pilumna confusa* Bennet Type Godley Heads 6/11/27 Det. E. W. Bennet (original label dropped to pieces, specimen dried out. R.R.F. 1948)."

Name: The specific name is an anagram of the generic name.

Dimensions (mm): Length 17·5; breadth 22·5; interorbital width 7; exorbital width 13; outer orbital corner to last lateral spine 9; major cheliped 26; hand 17·5; height 11·5; legs 1–4 respectively 24, 23, 23, 22.

Distribution: Endemic to New Zealand and Chathams.

Family GONEPLACIDAE Dana[55]

Goneplacidae Dana, *Amer. J. Sci.* (*2*) *12* : 285; 1851.
Dana, *U.S. Explor. Exped. 13*, Crust., pt. 1, pp. 308, 310; 1852.
Alcock, *J. Asiat. Soc. Bengal* (*2*) *69* : 283, 286, 292, 297; 1900 (synon.).
Rathbun, *Bull. U.S. nat. Mus. 97* : 15; 1918.

Subfamily GONEPLACINAE Miers

Goneplacinae Miers, Challenger Rep., *Zool. 17* : 237, 245; 1886.
Alcock, *J. Asiat. Soc. Bengal*, (*2*) *69* : 286, 293, 316; 1900.
Rathbun, *Bull. U.S. nat. Mus. 97* : p. 24; 1918.

The subfamily was founded by Miers (1886) to include *Goneplax* Leach (in D. Brewster (Ed.) "The Edinburgh Encyclopaedia" Vol. 7, pp. 293, 430, (Edinburgh, 1814); Rathbun 1918, p. 25) and *Ommatocarcinus* White (1852), but it is highly doubtful whether the grouping is a natural one. The characterisation by Miers (1886, p. 237), viz, "Post-abdomen in the male occupying the whole width of the sternum, between the bases of the fifth ambulatory legs", was adopted by Alcock (1900, p. 286) and Rathbun (1918, p. 24). This decision was surprising, as the description does not apply to all species of *Goneplax*, but was perhaps due largely to the account of *Ommatocarcinus* of which Miers (1886, p. 247), describing a small male from Queen Charlotte Sound, says that "the two basal segments occupy the whole of the interspace between the bases of the ambulatory legs". It now appears that the first and second segments (fig. 82) are narrow and do not cover much more than half the interspace, while the third segment, though much wider, falls short by nearly a millimetre on each side in an adult male and leaves more than a millimetre of the external spermiduct exposed.

With respect to the basal width of the male abdomen the Goneplacinae therefore occupy an intermediate position between the Carcinoplacinae Miers and the Prionoplacinae Alcock; but the supposed characters of the subfamily have collapsed.

[55]The subfamily Carcinoplacinae has since been recorded in New Zealand waters from *Carcinoplax victoriensis* Rathbun, 1923 (in Dell. 1960, p. 4, pl. 1).

Genus **Ommatocarcinus** White

Ommatocarcinus White, Voy. Rattlesnake, Vol. 2, p. 393; 1852.
Miers, *Challenger Rep., Zool. 17* : 246; 1886.
Alcock, *J. Asiat. Soc. Bengal, 69* : p. 293; 1900.

In addition to the above mistake with regard to the basal width of the male abdomen, Miers (1886, p. 247) is also in error in stating that there are seven free segments, for in the adult male the third, fourth, and fifth segments are fused and the sutures obliterated (fig. 82).

In addition to the following species, which may prove to be a complex with specifically distinct representatives in New Zealand, Australia, and Japan, this Western-Pacific genus includes:

1. *O. orientalis* Tesch 1918, p. 186 (and figure). Malay Archipelago.
2. *O. fibriophthalmus* Yokoya 1933, p. 199, text-fig. 66, with abnormally elongated ophthalmopods. Japan.
3. *O. corioensis* (Cresswell, *Vict. Nat. 3* : 86, 1886), from Eocene beds in Victoria, Australia, and supposed by Hall (*Proc. roy. Soc. Vict. 17 (2)* : 356; 1905) to have burrowed into the substratum and to have become buried *in situ*. This species differs from the New Zealand form in the outline of the carapace, the shape of the lateral spines, the regional markings (the cardiac being triangular), in the granulate posterior margin, etc., but by analogy with the New Zealand recent species, the length and spinulation of the chelipeds seem to have less significance than supposed by Hall.

The extraordinary length of the ocular peduncles (fig. 135) invites speculation on the functioning of the eyes. In Grapsinae the eyes are situated near the antero-lateral corners, and the angle of vision is correspondingly wide; but in contrast to say the hammer-headed sharks, the angle is not constant because of the mobility of the stalks. In genera like *Ommatocarcinus* or *Ocypode* the stalks arise near the median line, so that when the eyes are in the position of rest the angle is wide, but when the crab assumes the "policeman" attitude the angle almost disappears and almost a cyclopean condition is assumed. This contrast between the wide angle of the Grapsinae and the variable angle of the Goneplacidae-Ocypodidae is, however, less than that between the compound arthropodan eye and the functionally distinct binocular vision of the vertebrates.

Ommatocarcinus macgillivrayi White,[56] Figs. 79–83, 135.

Ommatocarcinus macgillivrayi White, Voy. Rattlesnake, p. 393, pl. 5, fig. 1; 1852.
Ommatocarcinus huttoni Filhol, Mission de l'Ile Campbell, p. 384, pl. 43, figs. 1, 2; 1886.
Ommatocarcinus macgillivrayi Chilton & Bennett, *Trans. N.Z. Inst. 59* : 757; 1929 (refs.).
Balss, *Arch. Naturg. 88* : 138; 1922.
Ommatocarcinus sp., Yokoya, *J. Coll. Agric. Tokyo, 12* : 198, text-fig. 65; 1933.
Ommatocarcinus macgillivrayi Sakai, *Sci. Rep. Tokyo Bunrika Daig., B, 25* : 314, text-fig. 22; 1934.

[56]Type in dry collection (Reg. No. 50.11), from Port Curtis, British Museum (Nat. Hist.), 1962; Dr I. Gordon (pers. comm.).

Filhol's description and figure of the chela, reputedly of the right, applies to the left chela of young specimens, the teeth being acute and nearly uniform; this difference from those of the right chela is not wholly lost in the adult. Filhol and also Chilton and Bennett describe the spinulation of the merus of the young cheliped incorrectly; there are three to five acute spinules on the upper margin, one on the distal half of the lower margin, and one at the middle of the posterior margin. These spinules disappear in the adult, in which also the power of movement becomes markedly restricted.

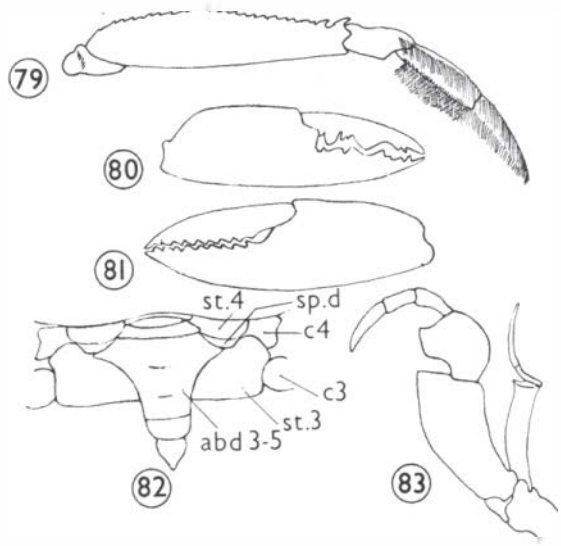

FIG. 79–83: *Ommatocarcinus macgillivrayi* White, × 2: 79, second walking leg, anterior view; 80, right chela of young specimen; 81, left chela of young specimen; 82, abdomen and posterior sternum of male, abd. 3–5 fused abdominal segments 3+4+5, st. 3, sternite corresponding to c3, coxa of third leg, st. 4 and c4, corresponding parts of last thoracic segment, sp.d. external spermiduct; 83, third maxilliped.

Other growth differences include a relative shortening of the ophthalmopod, so that the exorbital spine in the adult reaches a little beyond the tip of the cornea instead of just beyond the base, and a pronounced elongation of the chelipeds, which in immature specimens are less than the carapace width but in the adults nearly two and a half times the width (not five times as stated by Chilton and Bennett).

Filhol's discussion of the walking legs is also imperfect; the merus (fig. 79) in young and old specimens is serrate along the upper margin, almost smooth in the last pair; there is a subterminal spine, the adjacent serrulation commonly contributing another small spine on the second or more frequently on the third pair. The carapace and limbs are glabrous in the adult except that the merus of the chelipeds has a few short hairs above, the anterior surface of the propod and dactylus of the second and third pair has a dense row of long straight hairs near the upper margin,

and the lower margins of the same four joints bear a row of hairs, duplicated on the propod of the second pair. In the young there are also short hairs on the upper and lower margins of the other joints (vestiges in adult), on the chelipeds (especially the merus, with signs of five rows on the hand), and below the margins of the carapace.

In spite of the marked growth differences, the New Zealand specimens represent only one species, whose identity with the Australian form is however doubtful. If distinct, the New Zealand form will take the name *O. huttoni* Filhol. The problem has recently acquired a new aspect in that *O. macgillivrayi* has been recorded from Japan (Balss 1922, Yokoya 1933, Sakai 1934). The first of these references has not been seen, but the New Zealand species differs from the figure given by Yokoya in that the palp of the third maxilliped (fig. 83) is much longer and fills the median gape between the basal joints; there is no "obtuse transverse ridge" on the dorsum; the buccal frame is narrower in front, whereas Yokoya describes it as wider; in specimens of the size figured by him (carapace length 6 mm), the merus of the cheliped is not smooth, nor are the legs subequal (the order of length, as shown below, is 3, 2, 1, 4); and finally Yokoya does not mention or figure the upper distal spinule of the merus of the legs.

HABITS: Known from 10–37 fathoms, and down to 60 fathoms (Graham), in small numbers except for a lot of seven from Cloudy Bay. A female in an aquarium at Portobello had a tuft of hydroids on the merus of the first leg. Mr Graham states that in the aquarium the crabs stand high on the dactyli with the eyes held erect; in time they lose their bright purple colours, and become almost white, and overgrown with algae up to 3 in. in length.

MATERIAL EXAMINED:

1, off Otago Heads, coll. G. M. Thomson, –/5/04 (O).
2 males, off Otago Heads, –/8/23 (O).
2 females (1 ovig.), from fish stomachs (O).
2 from gurnets (Ch); 1, no data (D).
1 female ovig., 4 miles NE of Otago Heads, coll. D. H. Graham, 21/3/30 (P).
1 female, off Akitio River, 20 fm, coll. D. H. Graham (P).

Material previously recorded by Chilton and Bennett has been studied again, but subsequent collections by D. H. Graham have not been seen. "Large numbers are taken in trawl nets 7 miles NE of Otago Heads in 20 fathoms, especially in parts not frequently trawled" (Graham, MS).

PREVIOUS RECORDS:

N.Z. (Filhol); Queen Charlotte Sound, 10 fm (Miers).
"Occasionally taken in trawlers, and found in the stomachs of fishes, from outside Otago Heads" (Thomson).
10 miles from Cloudy Bay, 19 fm; Whale Rock, Bay of Islands, 15 fm; Stewart Island; Bare Island, near C. Kidnappers, 37 fm; off Akaroa, Banks Peninsula, 20 fm (Chilton & Bennett).
Nora Niven Station 29 (not 19 as stated by Chilton & Bennett), 10 miles N and E of Oamaru, 25–30 fm, shell gravel, 3/7/07 (Chilton).

DIMENSIONS (mm): Male: Length 14·5; breadth 34·5; cheliped 68; merus 27; hand 34·5; legs 1-4 respectively 39, 43, 48, 38. The corresponding figures for another male were: 15, 37·5, 86, 33, 45, legs 38, 44, 48, 38. The specimen measured by Chilton and Bennett proves to be far below the size attained, and Mr Graham records an Otago specimen with a breadth of 40 mm.

DISTRIBUTION: Endemic to New Zealand, mainly off Otago district.[57] Australia? Japan?

Family PINNOTHERIDAE Dana

Pinnotheridea de Haan, Fauna Jap., Crust., p. 5; 1833; p. 34, 1835 (part).
Pinnotheridae Dana, *Amer. J. Sci.* (2) *2* : 289; 1851.
Dana, *U.S. Explor. Exped. 13*, Crust., p. 378; 1852 (part).
Rathbun, *Bull. U.S. nat. Mus. 97* : 61; 1917 (refs.).

Genus **Pinnotheres** Latreille[58]

Pinnotheres Latr., Hist. Nat. Crust., Vol. 3, p. 25; 1801–2.
Pinnotheres Alcock, *J. Asiat. Soc. Bengal* (2) *69* : 337; 1900 (refs.).
Pinnotheres Rathbun, *Bull. U.S. nat. Mus. 97* : 62; 1917 (refs.).

LOCAL SPECIES[59]: The genus was not overhauled by Chilton and Bennett (1929, p. 775), who listed the three alleged species *P. pisum* Linn., *P. novaezelandiae* Filhol, and *P. schauinslandi* Lenz. The record of *P. latipes* Jacq. and Lucas (1835) may be dismissed as part of their error in treating Raffles Bay in northern Australia as a New Zealand locality. The statement by Chilton and Bennett that *P. pisum* is "probably correctly identified" is incorrect, and it is now confirmed that the common pea-crab in this country, like its usual host *Mytilus planulatus* Lmk. (cf. W. R. B. Oliver, *Proc. Malac. Soc. Lond. 15* : 181; 1923) has been masquerading under the name of a European congener. *P. pisum* does not occur. The common species is *P. novaezelandiae* Filhol; *P. schauinslandi* Lenz, imperfectly described and subsequently unrecognised, is valid, with a superficial similarity and also a glaring contrast to *P. novaezelandiae*.

FEEDING MECHANISM: The hairs on the legs in at least many species of this genus, and especially the two long fringes of branched hairs on the propods of the second and third pairs, are strongly reminiscent of the food-capturing mechanisms of calanoid Copepoda and many other marine invertebrates; but in contrast to the zoea (see below) the commensal habits make unnecessary a mechanism for creating a water-current or for straining it, or for binding the food in mucus, because these processes are carried out

[57] See also Dell (1960, p. 5) for Chatham Island records.

[58] But note "Direction 45, Substitution of *Pinnotheres* Bosc, [1801–1802] for *Pinnotheres* Latreille, [1802–1803] (Class Crustacea, Order Decapoda on the *Official List of Generic Names in Zoology* (correction of an error in the ruling given in *Opinion* 85)." *Op. int. Comm. zool. Nom. 1 (D (D9)* : 233–242.

[59] Scott (1961), with access to Dr Bennett's manuscript, reviewed the New Zealand Pinnotheridae: "The family Pinnotheridae is represented in New Zealand by a single polymorphic species, *Pinnotheres novaezelandiae*. Previous records of *Pinnotheres pisum* are shown to be erroneous, and the two species are briefly compared." (Abstract. Scott. 1961, p. 303).

by the host. Presumably the crab uses the leg brushes to brush the food, collected in a mucus stream by the host, to the mouth. Both are microphages as defined by H. J. Jordan and G. C. Hirsch "Handbuch der normalen und pathologischen Physiologie" *3B* (*2*); 1927), yet the crab lacks the major part of the microphagous mechanism (see also Yonge, *Biol. Rev. 3* (*1*) : 21–76; 1928).[60]

This partial retention of a larval feeding mechanism, characteristic of many zoeae at least but perhaps unparalleled in the adult stages in any other family, invites speculation on the origin of the commensal habit; may this represent a retention of a larval habit, formerly temporary but now permanent, with perhaps elimination of the fully adult stage? Unpublished studies by the present author suggest that this tendency, together with a shifting forward of sexual maturity to an earlier or even larval stage, which thereupon becomes the adult or terminal stage, is commonly associated in many groups of marine invertebrates with the adoption of microphagy.

Female Gonad: The commensal habits are no doubt also the key to the hypertrophy of the female gonad, which in *P. novaezelandiae* occupies at maturity about half of the body cavity and spreads forwards across the hepatic regions and laterally across the branchials, and even backwards through the abdomen as far as the anus. Females of this species become ovigerous when only 7 mm in length.

Key to Species and Sex

A. Abdomen (fig. 84) markedly enlarged, wider than carapace. ..... **P. novaezelandiae** female

B. Abdomen (figs. 85–87) about one-third as wide as carapace.
1. Female, with normal female pleopods. ..... **P. schauinslandi** female
2. Male, with copulatory styles:
(a) Last abdominal segment trapezoidal, merus of second walking leg five times as long as high. ..... **P. novaezelandiae** male
(b) Last abdominal segment semicircular, merus of second walking leg two and a half times as long as high. ..... **P. schauinslandi** male

Pinnotheres novaezelandiae Filhol, Figs. 84, 85, 88, 92, 93.

Pinnotheres pisum Heller, *Novara-Exped. Zool.* (*2*) *3* (*1*) : Crust., p. 67; 1868 (not of Linnaeus).
Miers, Cat. Crust. N.Z., p. 48; 1876 (not of Linn.).
Filhol, Mission de l'Ile Campbell, p. 394; 1886.
Chilton, *Rec. Cant. Mus. 1* : 295; 1911.
Thomson, *Trans. N.Z. Inst. 45* : 238; 1913.
Borradaile, *Brit. Ant. Exped. 1910, Zool. 3* : 100; 1916 (part; not text-fig. 12).
Gurney, *ibid. 8* : 195; 1924.
Pinnotheres novae-zelandiae Filhol, *tom. cit.*, p. 395, pl. 46, figs. 1–6; 1886.
Lenz, *Zool. Jb., Syst. 14* : 467, pl. 32, figs. 11–14; 1901.
Rathbun, *Biol. Res. Endeavour, 5* : 98, text-fig. 2, pl. 16, fig. 2; 1923 (descr.).
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 775; 1929.
Young, *ibid. 60* : p. 152; 1929.

[60] See also (S. M. Marshall and A. P. Orr, pp. 227–258 *in*: T. H. Waterman (Ed.) 1960, "The Physiology of Crustacea, Vol. 1." Academic Press, New York and London. xvii + 670 pp.

Of 192 specimens of *Pinnotheres* in 49 lots, 172 specimens (90%) from 39 lots (80%) belong to this species, to which therefore the extraordinarily persistent records of *P. pisum* are at least mainly due. Authors have perhaps not realised that Heller's identification has scarcely received support from Miers confirmation, as so many of his specimens were not of neozelanic origin. *P. novaezelandiae* as described by Rathbun (1923), and further below, differs in the female abdomen (fig. 84) and the hairs of the chelipeds and walking legs; also, there is a prominent inter-antennulary septum and a median epistomial projection which separates the outer maxillipeds in front and the proportions are different, the dactyli of the walking legs for example being shorter.

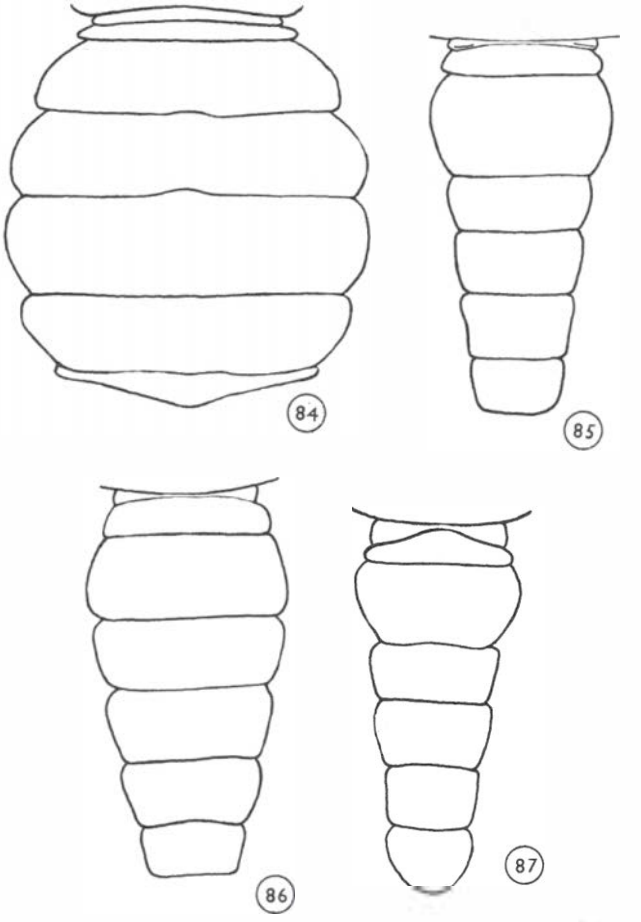

Fig. 84–87: *Pinnotheres novaezelandiae* Filhol and *P. schauinslandi* Lenz, × 5; 84, *P. novaezelandiae*, abdomen of female; 85, abdomen of male; 86, *P. schauinslandi*, abdomen of female; 87, abdomen of male.

The loss of hairs after preservation, and the wrinkling and folding (especially round the front and orbits) consequent upon the feeble calcification, together with growth differences in the abdomen and chelipeds, give a false appearance of variability. Specimens occur with hair on the lower margin of the carpus of the walking legs and scattered over both surfaces of the propod, but it does not follow that the species is different from the Australian analogue. Correlations with depth, latitude, or host are elusive, but specimens from the large fan mussel *Atrina* are usually much larger

than those from mussels or trough shells (Mytilidae, Mactridae) and in large specimens the legs tend to be relatively longer and the propod (except in the last pair) to exceed the dactylus in length. The second and third pairs are normally 1·2 times the carapace length, but the ratio may reach 1·5 or even 1·75.

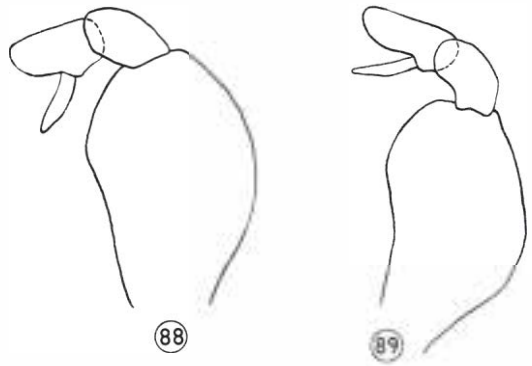

FIG. 88 89: 88, *Pinnotheres novaezelandiae* Filhol, third maxilliped, × 5; 89, *P. schauinslandi* Lenz, third maxilliped, × 5.

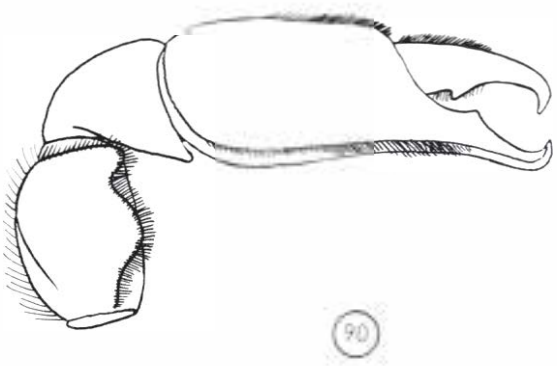

FIG. 90: *Pinnotheres schauinslandi* Lenz, cheliped of male, × 5.

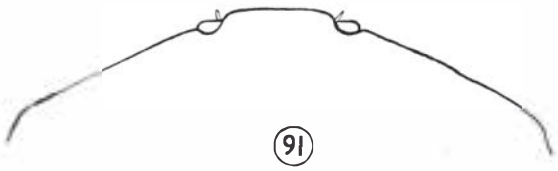

FIG. 91: *Pinnotheres schauinslandi* Lenz, front, × 5.

The front is rarely straight in frontal view, as described by Rathbun, but faintly angulated at the sides where it passes somewhat downwards to define the inner orbital margin. Filhol and Rathbun describe the carapace as being nearly as long as broad; in well grown females the breadth is greater in the ratio 9 : 8, or 8 : 7 if measured above the bases of the legs. As noted by Lenz, the outline is less regularly circular than represented by Filhol.

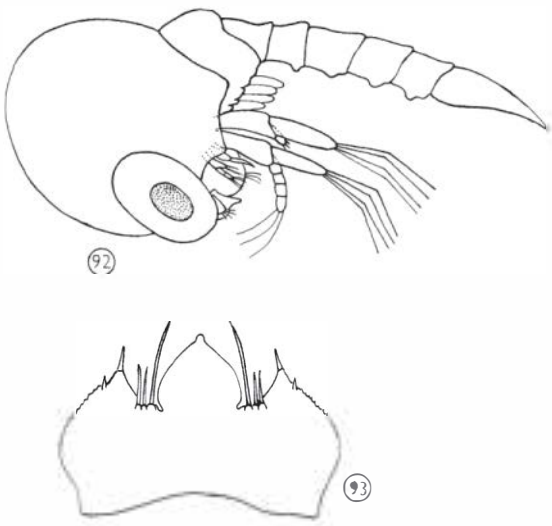

FIG. 92–93: *Pinnotheres novaezelandiae* Filhol; 92, zoea, dorsal, × 65; 93, zoea, lateral, × 90.

HABITS: Details of habitats in the collections are all too scanty.[61] The crab occurs commonly throughout New Zealand at depths of 0–110 fm, and is known only from pelecypodan hosts, including, as determined by the writer, *Mytilus planulatus* Lamk., *M. canaliculatus*, *Atrina zelandica* Gray, *Mactra discors* Gray, *Spisula aequilageralis*.[62]

A specimen dredged in 110 fathoms near Otago Heads by Mr D. H. Graham in 1931 lived for several days in a shallow aquarium exposed to the light, after removal from the host. Traill, in a letter to Chilton in 1916, found that of 50 mussels from oyster-beds in 15 fathoms at Stewart Island, 41 contained one crab each; all but two of the 28 specimens of this series still in Chilton's collection are *P. novaezelandiae*. Waite records the genus from *Nora Niven* stations 31, 36, 37, and 41, in addition to those mentioned below, and states that "almost every *Pinna* had its commensal *Pinnotheres*".

COLOUR: In spirit, cream, limbs brighter than carapace, chela mottled with brown on both surfaces; the viscera and especially the ovaries are clearly visible through the papery exoskeleton. Traill stated that the ovary is dark purple in life but reddens in spirit; after long preservation it becomes brown. It occupies the dorsum except the frontal, meso- and meta-gastric, cardiac, and metabranchial regions, and forms also a median abdominal band which conceals the alimentary tract and occupies nearly a third of the width of the abdomen.

[61] Cf. List of hosts given by Scott, 1961, p. 307.

[62] Names of Mollusca mentioned in the text have not been altered to present-day usage.

MATERIAL EXAMINED:

4 females (1 ovig.), coll. H. R. Millar, –/1/36 (C, 10).
2 males, 24 females (1 ovig.), in mussels, 15 fm, coll. W. Traill, –/4/16 (Ch, 5).
6 males, 7 females (3 ovig.), (O, 5 and 9).
4 females (2 ovig.), in mussels (O); 4 females (3 ovig.), (O, 4).
3 females (1 ovig.), –/11/04 (Ch, 4).
2 females (1 ovig.), in mussels, "plentiful", coll. D. H. Graham, 1931 (P, 4).
1 female ovig., off Otago Heads, 110 fm, in fan mussel, coll. D. H. Graham, –/2/31 (P).
1 female ovig., St. Kilda, in mussel, –/10/27 (O).
4 females ovig., Moeraki, from large mussels, 23/1/99 (T).
16 females (12 ovig.), Robin Hood Bay, coll. R. Bigg-Wither, 30/8/13 (Ch).
5 females (1 ovig.), *Nora Niven* stns. 5, 20, 44 (Chilton 1911) (C).
1 female, Riverton; 1 male, Lyttelton, in mussel, 16/11/06 (Ch).
1 male, 9 females (8 ovig.), Ponui Passage, coll. W. J. Barr, –/8/15 (Ch).
1 female, Timaru, 1928 (B); 3 females (2 ovig.), in mussels (B, 14).
9 females, *ex* Hutton coll. (C, 9).
2 females (1 ovig.), in *Mactra* and *Spisula*, 1926 (B, 9).
5 females, New Brighton, *ex* Hutton coll. (C).
6 females (1 ovig.), New Brighton, in *Mactra* and *Spisula*, 1923 (B).
8 females (1 ovig.), New Brighton, coll. A. Dendy (Ch).
1 male, 1 female, coll. H. Suter (A, 8).
2 males, 1 female, coll. W. H. Gaze (T, 12).
4 females (2 ovig.), in mussels (B, 12); 1 female, in *Spisula* (B, 11).
4 females, *ex* Hutton coll. (C); 1 male, 3 females (C); 1 female (D); all without data.
1 male (O, 20).
2 females, Manukau Harbour, 2–4 fm, coll. Capt. Bollons (Ch).
2 females ovig., Ponsonby Reef, Auckland (Ch).
2 females, Takapuna, in fan mussels, 26/9/14 (Ch).
1 male, Cheltenham Beach, in fan mussel (Ch).
1 male, 7 females (1 ovig.), (A. 30).
1 female ovig., in mussel, 28/3/30 (A).
1 female ovig., dredged off Devonport, –/10/27 (A, 29).
5 females, Chatham Islands, *ex* Hutton coll. (C).
1 female, Chatham Islands, north coast among spawn of *Doris* sp., coll. Otago Institute Exped., 29/7/24 (O).

PREVIOUS RECORDS:

Auckland (Heller); N.Z. (Miers) (as *P. pisum*).
Massacre Bay; Cook Strait (Filhol).
Elmsly Bay, French Pass (Lenz).
Otago Harbour (Thomson).
Nora Niven stations 5, 20, 44 (Chilton); with Waite's records, this means E coast of S Island from mid-Canterbury to Stewart Island.
Off Cuvier Island, 32 fm, coll. Capt. Bollons; 1 female (Chilton, MS).

TYPE: Paris Museum, if extant;[63] type loc. not specified – Massacre Bay or Cook Strait (Filhol).

DISTRIBUTION: Throughout the mainland; Chatham Islands; Australia.

Rathbun (1923, p. 98) records the species from Bass Strait. In the author's collection is a small female from Rockingham, Western Australia, found in a disused cirripede shell by R. Owen, –/10/29; its condition does not permit close comparison, but it is at least very near to the New Zealand species.

THE ZOEA[64]: Zoeae of two pinnotherids were recorded from New Zealand by Gurney (1924, p. 195), of which one ("Brachyura incertae sedis") from Spirits Bay has been determined by Lebour (1928b, p. 553) as "almost certainly a *Pinnixia*" [*sic*]. The structure of the telson and the lateral lobes of the preceding abdominal segment are closely similar to those of *Pinnixa sayana* Stimpson (cf. Hyman 1924, p. 6, pl. 6, fig. 62), but the genus is otherwise unknown in New Zealand, and Gurney's record cannot at present be further elucidated.

The second species (North Cape, Bay of Islands, Melbourne) was identified by Gurney as *Pinnotheres pisum*. The zoea of this European species was hatched out by J. V. Thompson in 1835 (Thompson 1836, *Entom. Mag. 3*: 85–90) and was therefore one of the earliest crab larvae recognised as such. It was made clear by Thompson and in 1853 by T. Bell ("A History of British Stalk-eyed Crustacea", London) whereas the dorsal spine of the carapace is lacking, the rostral and lateral spines are well developed; but, when Gurney wrote, it was not known that species of *Pinnotheres* show stages in the further reduction of the spines in accordance with bottom-frequenting habits, and perhaps the identification is not to be taken as an assurance that the spinulation agreed with that of *P. pisum* but was merely an echo of the incorrect identification of adult *Pinnotheres* collected during the same expedition (see below). G. M. Thomson (1913) stated that *P. pisum* spawns in Otago Harbour in December and January, and in an MS note refers to hatching of the eggs in January and February; it is however shown below that this author identified specimens of *P. novaezelandiae* as *P. pisum*. The dates have been confirmed in the same locality by Mr D. H. Graham, who has submitted for examination some 50 mounted specimens hatched in captivity (1/2/33); these zoeae are undoubtedly *P. novaezelandiae*, which is common in Otago Harbour, whereas the rarer *P. schauinslandi* is not known from there.

Mr Graham records from 1,600 to 5,000 eggs per parent; they differ from those of *P. pisum* (cf. Lebour 1928a, p. 114) in being scarlet to wine-red, changing to orange-red and yellow before hatching; the zoeae curled up soon after hatching and dropped to the bottom. In the mounted specimens (figs. 92, 93) the pigmentation is lost. In contrast to *P. pisum*, the carapace spines are completely absent, as in the American species *P. ostreum* Say and *P. holothuriae* Semper (Hyman 1924, pp. 3, 4). In most specimens the thorax bulges conspicuously through the deep median recess in the posterior carapace margin. Eyes sessile, rostrum minute, antennae small and unjointed with three long and two short setae and no squame; first and apparently second maxillary palps two-jointed, the former with four terminal bristles, the latter with a serrate and a smooth spine. Endopod of first maxilla five-jointed, that of second pair unjointed (possibly very obscurely 2–3-jointed; there are two joints in *P. ostreum*, three in *P. pisum*). At least four other pairs of thoracid limbs, unjointed and unarmed but as long as the telson, project postero-laterally beyond the carapace margin; this and the occurrence of pleopod-buds on abdominal segments two to five suggest that there may

[63]The type specimen, from Cook Strait, was seen in the Paris Museum by E. W. Dawson, 13/4/56.

[64]Cf. Atkins, D., 1955: The Post-embryonic Development of British *Pinnotheres* (Crustacea). *Proc. zool. Soc. Lond. 124* (4): 687–715, 17 text figs.

be only two or three zoeal instars. The second and third segments of the abdomen have well-marked obtuse lateral angulations. The telson is trilobed, outline and armature and marginal sculpture as in *P. pisum*. Length (largest specimen) 1·34 mm, width in front of eyes 0·52 mm.

Though commonly described as swimming organs, the maxillipeds of zoeae no doubt function chiefly as food-capturing organs, the exopods creating a current of water with the aid of the long terminal plumes, and the endopods straining the current by means of the bristles along the inner side.[65] In the present series the endopods are commonly folded forwards or to the mouth, and the exopods exhibit a character perhaps not hitherto noted – the terminal plumes are jointed at the mid-length, suggesting that they become folded during the return stroke so that the back-pressure is lessened.

Pinnotheres schauinslandi Lenz, Figs. 86, 87, 89, 90, 91.

Pinnotheres schauinslandi Lenz, *Zool. Jahrb., Syst. 14* : 468; pl. 32, figs. 15–18; 1901.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 775; 1929.

Carapace strongly calcified and rigid in both sexes, strongly arched in both directions except that the female is only moderately arched transversely. Front projecting and prominent in dorsal view, slightly convex; in frontal view it is angulated at the middle; interantennulary septum slight and not separating the prominent antennules; sides of front curving abruptly downwards and projecting forwards beyond the orbital rim; the latter sharply raised, minutely denticulate below, orbits circular, eyestalks subspherical, tapering, bulging prominently beyond the orbits; eyes minute, terminal, slightly oval, visible in dorsal view.

Merus of cheliped (fig. 91) with a sharp angulation at middle of lower margin, and a stronger terminal tooth than in *P. novaezelandiae*; there is a short dense row of hairs between these points and a continuous fringe on the upper margin along the length of the limb and continuing through more than half the length of the carpus. Fixed finger with a fringe of hairs on the inner surface, continuing across the palm; movable finger with a short line of hairs on the upper margin, continuing briefly on to the palm. Palm inflated, especially within, the upper and lower margins convex, fingers short and strongly curved, tips hooked and crossing, movable finger with a stout sharp proximally directed tooth at the base, fixed finger with stout obtusely angled tooth placed more distally at a third of the length; cutting margin finely denticulate on fixed finger.

Walking legs much longer than in *P. novaezelandiae*, second and third pairs equal and longest, fourth shortest; merus with dense fringe of short hairs on upper margin, other joints glabrous above; all joints with fringe along lower margin except distally on dactylus, the lower fringe short and stubbly except on the carpus, and in the case of the second and third pairs of the female on the propod and dactylus, where they are long, silky, and microscopically branched; in these two limbs there is also a similar fringe on the posterior surface near the upper margin. Joints greatly flattened.

Abdomen narrow in both sexes (figs. 86, 87), including large females, but ultimately becoming at least a little broadened; third segment widest and longest with sides regularly curved in female but in the male expanding rapidly behind the proximal suture; last segment trapezoidal in male, semicircular in female.

History and Relationships: This interesting species has hitherto been known only from an incomplete description of two specimens of unspecified sex, taken together with *P. novaezelandiae* in mussels at French Pass (Lenz 1901). Chilton (1911, p. 295, and repeatedly in MS.) suspected that Lenz had described the males of the common species, but failed to recognise that two species were present even in one bottle in his collections, and evidently overlooked the deceptive similarity of Lenz's species, both males and females, to the males of Filhol's. This similarity extends not only to the projecting front and protruding eyes but also to the abdomen, which is narrow in both sexes in *P. schauinslandi*; the females in the collections may be immature, but all are large, and only one has the abdomen a little wider than in the male. In *P. novaezelandiae* the female abdomen is voluminous and wider than the carapace, overlapping the bases of the legs, chelipeds, and mouth parts, and this condition is assumed long before the adult size has been attained. These females outnumber the narrow-"tailed" specimens of both species and sexes by more than 4 : 1, a ratio which maintains the deception.

According to Lenz, the species is close to *P. pholades* de Haan (1839, p. 16, fig. 7), which Adensamer (*Ann. naturh. Hofmus., Wien, 12* : 107, 1897) would unite with *P. pisoides* Ortmann 1894, p. 698); and is also related to *P. glaberrimus* Bürger (*Zool. Jb. Syst. 8* : 366). No recent opinions on the point have been offered. The agreement with Lenz's account is not complete; the fingers are less excavated than in his fig. 16, and the lateral margins more expanded than in his fig. 15; the dactylus of the last leg is similar to the others with a strongly hooked claw. The wrist is not two-thirds as long as broad, as he states, but longer, as shown in his fig. 16.

Habits: The relatively strong calcification, the compact abdomen, and the reorientation of the facial region, whereby the sensory organs are placed well forward, are characteristics ordinarily associated with males in this genus, and correlated with their freer mode of life; possibly the occurrence of a female of *P. schauinslandi* sheltering among seaweed, as recorded below, may be of significance in that the females share the characters mentioned with the males, in which case the commensalism characteristic of the genus would seem to be less obligatory in this species than in others. Both sexes have been taken free by the author, and this is not free from doubt because Chilton

[65] Cf. Atkins, 1955. *Proc. zool. Soc. Lond.* 124 : 712–3.

sometimes put together into one bottle material from several localities, a procedure which has already caused confusion in the case of *Cyclograpsus whitei* M. Edw. (Chilton and Bennett 1929, pp. 769, 770).

MATERIAL EXAMINED:

1 male, 1 female, in mussels, 15 fm, coll. W. Traill, –/4/16 (Ch. 5).
4 males, Ponui Passage, coll. W. J. Barr, –/8/15 (Ch).
4 males, Robin Hood Bay, coll. R. Bigg-Wither. 30/8/13 (Ch).
1 male, Riverton (Ch).
2 females, coll. G. E. Archey (C, 8).
1 female, Taylor's Mistake, among algae near low water, –/5/27 (B).
2 males, 1926 (B, 9).
1 male, New Brighton, sheltering in drift polyzoan *Flustrella binderi* along with hymenosomids, 2/7/27 (B).
1 female, Channel Island, Hauraki Gulf, coll. H. Suter, 1904 (Ch).
2 females, Cheltenham Beach, Auckland, in fan mussel *Atrina*, (Ch).

PREVIOUS RECORD: French Pass (Lenz); some records of *P. pisum* may refer to this.

DIMENSIONS (mm): Length 7·3, breadth 7·5, front 1·7, fronto-orbital width 2·6, cheliped 7·8, hand 5, legs 1-4 resp. 10, 5, 12·8, 13·9.

DISTRIBUTION: Endemic to mainland, including Stewart Island, but not known from Chathams. Except for Traill's material, reliably known only from the tidal zone.

Family GRAPSIDAE Dana

Grapsidae Dana, *Amer. J. Sci.* (2) *12* : 287; 1851.
Dana, *U.S. Explor. Exped. 13*, Crust. 1, 329; 1852.
Alcock, *J. Asiat. Soc. Bengal, 69* : 283, 288, 295; 1900 (refs. and synon.).
Rathbun, *Bull. U.S. nat. Mus. 97* : 224; 1917.

Subfamily GRAPSINAE Dana

Grapsinae Dana, *l.c.*, 1851, p. 287, and 1852, p. 331 (part).
Rathbun, *Bull. U.S. nat. Mus. 97* : 226; 1917.

Genus **Leptograpsus** Milne Edwards

Leptograpsus M. Edw., *Ann. Sci. nat.* (Zool.) *20* (137) : 171; 1853.
Rathbun, *Bull. U.S. nat. Mus. 97* : 234; 1917.

Leptograpsus variegatus (Fabricius)

Cancer variegatus Fabr., Ent. Syst. *2* : 450; 1793.
Sesarma pentagona Hutton, *Ann. Mag. nat. Hist. 15* : 41; 1875.
Hutton, *Trans. N.Z. Inst. 7* : 279; 1875.
Miers, Cat. Crust. N.Z., p. 44; 1876.
Filhol, Miss. de l'Ile Campbell, p. 393; 1885.
Thomson, *Trans. N.Z. Inst. 45* : 238; 1913.
Leptograpsus variegatus Rathbun, *Bull. U.S. nat. Mus. 97* : 234, pl. 56; 1917 (refs. and synon.).
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 763; 1929 (refs. and synon.).
Balss, *J. roy. Soc. W.A. 21* : 142; 1935 (refs.).

HABITS: The crab is much more common than the list of material examined would imply; it occurs in great numbers but is difficult to capture, as it runs rapidly on rocks above or within reach of the waves. The author has heard the appropriate vernacular name "runabout crab" used in Australia. The flatness of the body allows it to creep into narrow crevices, such as the chinks between the beams of jetties where it is hunted by boys armed with spears or knives; the stiff setae of the dactyli (the "spines" of Hale 1927b, p. 180) which enable it to run with such agility on wharf piles and rocks and to defy rough seas, are similar to those resulting in unique habits and an even wider distribution in the case of the related *Planes minutus* Linn., and it may be than *L. variegatus* reached New Zealand on ships' hulls.

According to a verbal communication by Mr L. Glauert, of the Perth Museum, the crab feeds on the sea lettuce *Ulva*, in which case the size and strength of the crab and its exceptional agility are adaptations to the physical conditions under which it lives, rather than to the requirements of food capture. The hollowed spoon-like fingertips are perhaps also to be explained in terms of the feeding habits.

MATERIAL EXAMINED:

1 male, Westport (O); 1 male (B, 12).
1 female, Wellington (D).
1 male (A, 22).
1 male, Doubtless Bay, –/3/31, coll. L. T. Griffin (A).
1 male (? Dunedin; labelled *Sesarma pentagona*; see above).
1 juv., Tom Bowling Bay, 3/1/15 (C).

PREVIOUS RECORDS:

N.Z. (White, Miers, Filhol, Chilton 1911).
Bay of Islands (Borradaile).
Cuvier Island, Bay of Islands, Mahia Peninsula, Slipper Island, Portland Island, C. Maria van Dieman, Eastern Chicken Island, Kapiti Island, Castlecliff; "Common on shores of the North Island, one of the most active of our shore crabs" (Chilton & Bennett 1929, pp. 763-4.)

TYPE: Not extant; type loc., in *Americae meridionalis Insulis* (Fabricius).

DISTRIBUTION: North Island; South Island to Westport and Kaikoura; Kermadec Islands. Norfolk Island. Australia, Easter Island; Juan Fernandez, Chile, Peru. Balss (1935b, p. 142) extends the range in Australia to the western coast, where the writer has seen it in abundance; Balss is no doubt correct in denying Heller's record from Shanghai and Kingsley's from Pernambuco. The distribution is southern, but not typical circum-austral nor circum-Pacific.

Genus **Planes** Leach

Planes minutus (Linnaeus)[66]

Planes minutus Rathbun, *Bull. U.S. nat. Mus. 97* : 253; 1917 (refs. and synon.).
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 768; 1929 (refs.).

This most cosmopolitan of all Brachyura has been only occasionally taken in New Zealand.[67] The collections

[66]Chace (1951) considers all Pacific material of the genus *Planes* as probably *P. cyaneus* Dana, which he redescribes in detail.

[67]See coloured figure in Sivertsen and Holthuis (1956: *Rep. Sci. Res. "Michael Sar" North Atl. Deep-Sea Exped.* 1910 5 (12) : 1–54, 4 pls., 32 text-figs.).

include a megalopa from driftwood, presumably stranded, at the Chatham Islands, and a few juveniles. The megalopa has a narrow pointed front, vertical in position and very long, reaching to the lower margin of the eyestalk. It is concave along the median line, and appears U-shaped in dorsal view. Behind the eye there is a shallow depression followed by a rounded elevation.

MATERIAL EXAMINED:

1 male, juv., Moko Hinau, 1888 (T); 1 male, washed ashore on a piece of pumice, coll. C. R. Gow (Ch); possibly part of same collection.

11 males, 9 females (1 ovig.), Chatham Islands, Otago Institute Exped., 24/4/25 (O). As in some other cases an incorrect identification was made of specimens obtained from the Chatham Islands in 1925, and perhaps on account of uncertainty no mention of the crabs was made in the report (Young 1929), which evidently does not give a representative idea of the Chatham Island Brachyura.

3 juv. (length 4 mm), 1 megalopa; Wharekauri Beach, Chatham Islands, on driftwood; Otago Institute Exped., 23/1/24 (O).

The only other New Zealand record is by Miers, and is now well substantiated.

Subfamily VARUNINAE Alcock

Varuninae Alcock, *J. Asiat. Soc. Bengal, (2) 64* : 288, 296, 400; 1900.

Genus **Hemigrapsus** Dana[68]

Hemigrapsus Dana, *Amer. J. Sci., (2) 12* : 288; 1851.
Dana, *U.S. Explor. Exped. 13 (1)* : 348; 1852.
Rathbun, *Bull. U.S. nat. Mus. 97* : 264; 1918 (refs.).

The location of the two New Zealand species must remain doubtful until the generic limits of *Hemigrapsus* Dana, *Brachynotus* de Haan (1835, p. 34; Miers 1886, p. 264), and *Heterograpsus* Lucas ("Exploration Scientifique de l'Algérie . . . 1840-42, Zoologie Tome 2, Hist. nat. Anim. Artic., Pt. 1, p. 18; 1849) have been elucidated. The name *crenulatus*, for example, (shown below to be in use for more then one species), is associated with *Hemigrapsus* by Rathbun (1918), and with *Brachynotus* by Balss (1930, p. 204; but whereas Alcock (1900, p. 296) united all three genera, Rathbun in a paper (1931) not available for the present study separated *Brachynotus* from *Hemigrapsus*. The two New Zealand species contrast with the Australian *Brachynotus* from *Hemigrapsus*. The two New Zealand species contrast with the Australian *Brachynotus octodentatus* Haswell as follows:

(1) The front has a continuous transverse granulated rim projecting well beyond the epistome, which however is met by a small median slightly notched inflation of the under surface of the front; in *B. octodentatus* the rectangular granulated ridge across the middle of the front is not continuous with the rim of the latter, which turns down along the edge of the enlarged bilobed and deeply notched plate which is at right angles to it, sharply marked off, and broadly in contact with the epistome at the middle.

(2) The last thoracic sternite is not concealed by the male abdomen.

(3) The spermiduct is covered by a calcareous plate intercalated between the last two thoracic sternites; the Australian analogue has no such sclerite.

(4) The carapace is widest at the last lateral tooth, but in *B. octodentatus* is widest behind the tooth.

In *H. sexdentatus* the fourth and fifth segments of the male abdomen are fused, in *H. crenulatus* and *B. octodentatus* there is a faint movement.

Leptograpsodes Montgomery (1931, p. 452) is no doubt a synonym of *Brachynotus*, and *L. webhaysi* Montg., of which the types were lost before publication, is probably (as concluded also by Balss 1935b, p. 142) the common Australian *B. octodentatus* Haswell, known to the present writer from south-western Australia and up the west coast as far as Bunbury.

Hemigrapsus crenulatus[69] (Milne Edwards), Figs. 95, 136

Cyclograpsus crenulatus M. Edw., Hist. Nat. Crust., Vol. 2, p. 80; 1837.
Brachynotus crenulatus Tesch, *Siboga Exped. 39c* : 105; 1918.
Hemigrapsus crenulatus Rathbun, *Bull. U.S. nat. Mus. 97* : 264; 1918 (refs.) (part; not pl. 68).
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 766; 1929 (refs.).
Brachynotus crenulatus Balss, *Senckenbergiana 12* : 204; 1930.

Front with a row of small granules close below the rim; granules of antero-lateral margin conspicuous in ventral view; orbital hiatus wide, the third joint of the antenna extending into the orbit well beyond the infra-orbital tooth; infra-orbital (stridulating) ridge continuously granulate in the female, but in the male the inner part is granulate, the middle smooth, and the outer cut into two lobes; male hand densely pilose within near the bases of the fingers, not pulvinate, the granulated ridge on outer surface of palm and fixed finger distinct; fixed finger bent down from the palm; arm sharply trigonal, margins with a distinct line of granules, and a transverse row on the under surface; fifth segment of male abdomen a little movable.

VARIATION: The legs are much more hairy in males, especially distally. In some rather small specimens from Auckland the hinder lateral tooth is almost absent. Auckland specimens attain a larger size than southern ones, the hairs of the male palm become greatly elongated, and the fingers gape widely. It may be necessary to revive the name *barbimanus* Heller 1865, either specifically or as a varietal name.

HISTORICAL: Rathbun (1918a) confirms the traditional view that the New Zealand species is identical with the South American (Chile, west coast of Patagonia) but the suborbital stridulating ridge seems different, and in a personal letter Dr Balss states: "I agree with the suggestion made in your paper of 1930 [Bennett 1930, p. 259] that

[68] = *Brachynotus* de Haan 1835, *fide* Balss, 1957, p. 1668, but *Hemigrapsus fide* Richardson 1949, p. 130.

[69] Garth (1957) examined New Zealand material of *Hemigrapsus crenulatus* and could not separate it from Chilean material: "The male first pleopods correspond in detail."

Hemigrapsus crenulatus from Chile and New Zealand are two different forms; I have received specimens from Chile and have compared them with some from Stewart Island." Since the type locality of *C. crenulatus* M. Edw. was not specified, the retention of the names for the New Zealand species might be challenged; but later M. Edwards (1853, pp. 182, 216) himself used the name *granulatus* for Chilian specimens; the latter are now *Hemigrapsus granarius* (Nicolet) (*Trichodactylus granarius* Nicolet 1849, p. 151; Atlas, Vol. 2, pl. 1, fig. 2; type loc., Chile).

HABITS: The habits have been discussed by Chilton and Bennett (1929, p. 767) and Bennett (1930, p. 259); the aeration and drainage of soil in semi-terrestrial habitats in consequence of the burrowing habits have been referred to by Cockayne (*Trans. N.Z. Inst. 39* : 316; 1906) and by Miss B. D. Cross (*ibid., 42* : 547; 1909); but much ecological work remains to be done. The crabs are very common under stones and burrowing in sand, mud, clay, or earth, in marine, estuarine, or virtually terrestrial habitats. There are no records from below low-water mark.

Mr E. F. Stead relates that crabs, evidently this species, appeared in Lake Ellesmere in 1910, near the outlet; where the waves break across the shingle bar in stormy weather, the seaward end of the lake becoming salt and the whole lake brackish. Later the crabs appeared on the opposite side of the lake, on sandy mud, and were numerous in 1912, when they suddenly disappeared and have not been seen there again.

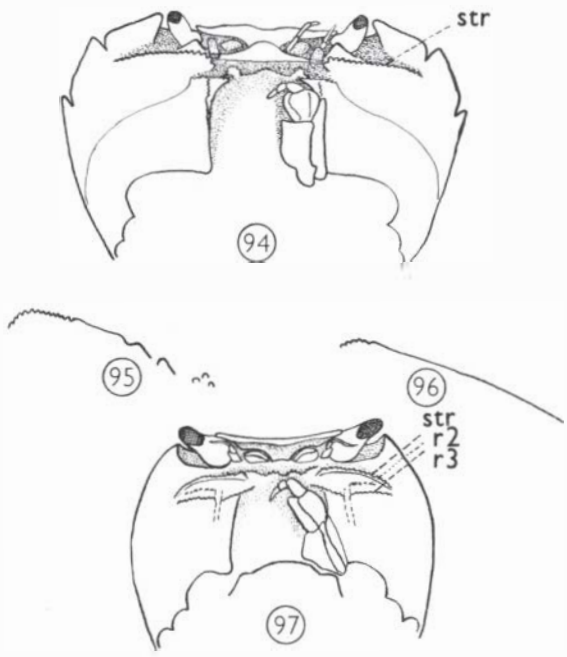

FIG. 94-97: stridulating ridges in grapsoids; 94, *Hemigrapsus sexdentatus* (Milne Edwards), carapace in ventral view, × ½ str. stridulating ridge; 95, *Hemigrapsus crenulatus* (Milne Edwards), stridulating ridge; 96, *Brachynotus octodentatus* (Haswell), stridulating ridge; 97, *Cyclograpsus audouinii* Milne Edwards, carapace in ventral view, × ¾, str. stridulating ridge, r 2, r 3, accessory ridges.

MATERIAL EXAMINED: Numerous specimens from stations 4, 6, 7 (O); 22, 23, 24, 25, 27, 30, and 11 other localities included in station 29 (A); Hokitika River mouth, –/2/31 (B); Parorari River mouth, 2/3/35 (B); Chilton in MS. also records Picton. There are numerous previous records from all parts.

DISTRIBUTION: Throughout the mainland. Not known from Chathams nor from the southern islands. For American records see Rathbun (1918a).

Hemigrapsus sexdentatus[70] (Milne Edwards), Figs. 94, 137, 138.

Cyclograpsus sexdentatus Milne Edw., Hist. Nat. Crust., Vol. 2, p. 79; 1837.
Thomson, *Trans. N.Z. Inst. 38* : 546; (1905) 1906).
Chasmagnathus subquadratus Thomson, *ibid. 45* : 238; 1915 (not of Dana).
Hemigrapsus sexdentatus Chilton & Bennett, *ibid. 59* : 764; 1929 (refs. and synon.).

Front below the margins with obsolete spreading granules; antero-lateral margins upturned, so that the margin appears smooth in ventral view; infra-orbital tooth enlarged, narrowing the orbital hiatus and standing higher than the third antennary joint; transverse (stridulating) ridge below the orbit continuously granulate in both sexes; male hand pulvinate, glabrous, the granulated ridge absent from the fixed finger of the male and becoming obsolete on the palm; fixed finger in line with the palm; arm with posterior margin rounded, anteriorly bluntly angled; marginal granules spreading, not in a single row.

HISTORICAL: Although Thomson left no named material, the above addition to the synonymy is open to little doubt. The record of *C. subquadratus* by Miers (1876, p. 42) was rightly challenged by Hutton (1882, p. 263) as apochryphal; there have been no further records, and there is nothing in Thomson's collection or MS. to support the statement that the species is common in Otago Harbour. Thomson first (1906, p. 546) stated this of *H. sexdentatus*, and later (1915, p. 238) of *C. subquadratus*, each time omitting mention of the other name; undoubtedly the same species was intended.

If the species proves to be a *Brachynotus*, it clashes with *Goneplax sexdentatus* Risso 1826 = *Brachynotus sexdentatus* (Risso) Heller 1863, a northern hemisphere species; see for example Calman 1927, p. 215. In that case the New Zealand species becomes *Brachynotus edwardsi* Hilgendorf (Hilgendorf 1882, p. 68).[70]

ABNORMALITY: In an Auckland specimen which has healed asymmetrically after breakage, the fossa of the antennule is irregular and twice as large as usual, and an interantennulary septum has developed; the basal joint of the antennule is abnormally enlarged, accurately filling the fossa.

[70]Apparently more correctly called *Hemigrapsus edwardsi* (Hilgendorf, 1882). See Richardson (1949c, p. 130).

REPRODUCTION: Ovigerous females occur chiefly in winter, but as also in *H. crenulatus* there are hints of a summer breeding period as well. Thomson (1906, p. 546) records that a berried female kept in an observation tank at Portobello spawned on 28 Aug 1904; "The zoeae swarmed in the water, and the parent crab immediately commenced to eat them up wholesale." Mr Graham records the hatching of eggs in August and September, and found also mature eggs in April; eggs 26,000 per crab, diam. 0·35 mm.

MATERIAL EXAMINED: Numerous specimens from Stations 1, 2, 4 (P); 10 (O); 8–15 (B); 22–25, 27–29, including 13 localities under 29 (A); Island Bay (F. G. Maskell); Punakaikai, 2/3/35 (B).

PREVIOUS RECORDS: To list in Chilton and Bennett 1929, p. 766, from all parts of mainland, add: French Pass (Lenz); Picton and elsewhere in Queen Charlotte Sound (Chilton, MS).

DISTRIBUTION: Throughout the mainland; not known from Chathams nor southern islands. The provisional record from Australia by Haswell (1882, p. 100), repeated by Whitelegge (1889, p. 229) has been refuted by McCulloch (Chilton and Bennett 1929, p. 765).

Subfamily SESARMINAE Dana

Sesarminae Dana, *U.S. Explor. Exped.*, Vol. 13, Crust., pt. 1, p. 333; 1852.
Rathbun, *Bull. U.S. nat. Mus. 97* : 283; 1917.

Genus **Helice** de Haan

Helice de Haan, Fauna japonica, Crust., p. 28; 1835.
Miers, *Challenger Rep. Zool. 17* : 268; 1886.

Helice crassa Dana, Fig. 140

Helice crassa Dana, *Proc. Acad. nat. Sci.* Philad. 1851, p. 252.
Miers, *Challenger Rep. Zool. 17* : 269; 1886.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 772; 1929 (refs.).
Helice lucasi M. Edw., *Ann. Sci. nat. (3) 20* : 190; 1853.
Chilton & Bennett, 1929 : 773 (refs.).

Helice crassa Dana was founded on material from New South Wales and *H. lucasi* on New Zealand specimens. Milne Edwards' description of the latter was based on the female, but when Filhol in 1885 described the male he attempted to prove the two species distinct. Heller (1868), Miers (1876b), Hutton (MS.), Thomson (1913), and Chilton and Bennett (1929) have agreed in uniting the two, but no reasons of weight appear to be forthcoming.

MATERIAL EXAMINED:

1 male, 1 female, coll. D. H. Graham, 1927 (A, 29).
1 male, swamp lagoon, coll. W. B. Benham, 4/2/04 (O, 6).
7 males, mud flats (A, 22).
4 males, 1 female (A, 29).
Abundant, burrowing in mud banks at times flooded with fresh water, mouth of Hokitika River, 23/1/31 (B).

DISTRIBUTION AND HABITS: Throughout the mainland, not known from the Chathams or southern islands; common on mudflats and in mangrove swamps in the Auckland district, among stones on sand beaches, and in estuaries, at times above high-water level.[71] Mr Graham records the hatching of eggs from the last week of November to mid-December; ovigerous females come high up on the beaches, but towards low tide mark the proportions of the two sexes are about equal.

Genus **Cyclograpsus** Milne Edwards

Cyclograpsus Milne Edwards, Hist. Nat. Crust. *2* : 77; 1837.
Rathbun, *Bull. U.S. nat. Mus. 97* : 325; 1918.
Tesch, *Siboga Exped. 39c* : 125; 1918.

There has been repeated confusion between *C. punctatus*, *C. audouinii*, and the two New Zealand species *C. lavauxi* and *C. whitei*; these are all undoubtedly distinct. *C. punctatus* M. Edw. (1847, p. 78; type loc., Indian Ocean) occurs in South Africa, and according to Rathbun (1918, p. 328) is identical with the South American *C. minutus* Jacq. and Lucas (1853, p. 75; 1855, pl. 6, figs. 8 and H). The superfluous name *Gnathochasmus barbatus* Macleay (Invertebratae, p. 65, pl. 3, Vol. 5 *in* A. Smith, "Illustrations of the Zoology of South Africa", 1838; type loc., South Africa), which is merely a synonym of *C. punctatus*, was applied by White (1847, p. 40) to South African and New Zealand specimens. New Zealand specimens were referred by Dana (1852, p. 359) to *C. audouinii* M. Edw. (1847, p. 78; type loc., New Guinea), but were separated by Milne Edwards (1853, p. 197) into the two endemic species *C. lavauxi* and *C. whitei*; this decision is upheld in the present discussion. In the interim the two were united by Miers (1876, p. 41), undistinguished by Chilton (1911, p. 560), but recognised as distinct by Chilton and Bennett (1929, p. 769) who tabulated the main differences, though missing one in the chelipeds (see below).

Some of the authors who have mentioned *C. lavauxi* may have had specimens of *C. whitei* instead, and there has also been confusion with the Australian *C. audouinii*. Deceived perhaps by Milne Edwards' incorrect specification of New Guinea as the source of *C. audouinii*, Haswell (1882, p. 103) recorded *C. lavauxi* from New South Wales and followed Jacq. and Lucas (1853, p. 76) in recording *C. punctatus* from Tasmania; Whitelegge (1889, p. 229) identified specimens from New South Wales as *C. lavauxi*, but Fulton and Grant (1906, p. 19) identified Victorian specimens as *C. punctatus*, influenced perhaps by an unfortunate proposal by Ortmann (1894, p. 729) to unite *C. lavauxi* and *C. audouinii* with that species. That *C. audouinii* is quite distinct from *C. punctatus* has been maintained by de Man, (*Zool. Jb., Syst. 2* : 690, 1887; *9* : 352, 1896; cf. Rathbun 1918, pp. 328–9), but Balss (1935, p. 142) treats the former as a subspecies of the latter. As a heritage of this confusion, *C. audouinii* continues to be occasionally recorded from New Zealand (Rathbun 1918, p. 329; Montgomery 1931, p. 456; Balss 1935b, p. 142).

[71] Beer (1959) has given an account of some aspects of the behaviour and ecology of *Helice crassa* and *Hemiplax hirtipes*.

C. lavauxi does not attain the dimensions nor the depth of colour of the Australian *C. audouinii* and is further readily separated by the relative slenderness of the walking legs; all the joints are high in *C. audouinii* and the dactyli are short, especially on the first and fourth pairs; in *C. lavauxi* the dactyli are long, slender and more curved. In *C. lavauxi* the front is more declivous; it is difficult to understand the statement by Rathbun (1918, p. 329) that in *C. audouinii* the front is invisible in dorsal view, especially as it is clear that there is no confusion with *C. whitei*, in which the front is strongly deflexed and the margin not a prominent beaded rim. Rathbun's statement that the thumb bears a prominent lobe in *C. audouinii* applies to large males and especially to the major hand if one is enlarged. Possibly this species is separable into two forms, a large deeply pigmented marine form in which the upper orbital margin is distinctly notched and the upper distal margin of the propod of the first and fourth walking legs has a tuft of hairs, and a smaller paler marine or estuarine form in which the upper margin is entire or inconspicuously interrupted, and the propodi of all the walking legs bear a distal tuft of hairs on the upper margin.

STRIDULATING ORGANS: Structures are present in members of this genus which, although apparently not hitherto described as such, evidently constitute a stridulating mechanism (fig. 97). There are two transverse deep suborbital grooves, no doubt part of the respiratory apparatus referred to by Fritz Müller ("Facts and Arguments for Darwin"; transl. W. S. Dallas, 1869, p. 32); the two grooves, each with a row of cilia, are separated by a high ridge bearing a row of about 16–18 conical denticles. Almost connecting the two ridges, one on each side, is a denticulate ridge on the lower epistomial border, which however is less elevated and can scarcely be used in stridulation. Two or three of the inner denticles on the suborbital ridge are small and crowded, the succeeding ones high and distinctly separate, but becoming small beyond the level of the outer corner of the orbit. Bounding the grooves below are two accessory ridges. On the inner surface of the palm, at about the middle of the height and near the basal articulation, there is a strong inflation, which in *C. whitei* is smooth, but in *C. lavauxi* bears a short row of sharp denticles, while in *C. audouinii* there are additional scattered denticles in the adult. Experiment shows however that this part of the palm cannot be brought into contact with the stridulating ridge. The same result applies to the ridge on the inner distal surface of the carpus, which is smooth in *C. whitei* and granulate in the other two species. The inner distal margin of the merus and the inner proximal upper margin of the carpus, and also the upper part of the inner distal surface of the palm can however be drawn across the ridge, and in so doing produce a typical stridulating sound. The structure is similar in females, in which however the merus is short and can reach only the smaller outer denticles of the stridulating ridge. The writer heard this stridulation (Chilton and Bennett 1929, p. 771) eight years before discovering the organ which produces it; no doubt the "clicking sounds . . . almost like distant artillery", by which the presence of crabs in an intertidal rocky station was detected before they were seen, were stridulating sounds, though there is no proof that the sound is heard by the crabs.

Cyclograpsus lavauxi Milne Edwards, Figs. 98–100

Gnathochasmus barbatus White, List. Crust. Brit. Mus., p. 40; 1847 (part).
Cyclograpsus audouinii Dana, *U.S. Explor. Exped 13*, Crust., p. 359, pl. 23, fig. 2; 1852 (not of M. Edw.).
Cyclograpsus lavauxi Milne Edwards, *Ann. Sci. nat. (3) 20* : 197; 1853.
Miers, Cat. Crust. N.Z., p. 41; 1876 (part).
Filhol, Mission de l'Ile Campbell, p. 390, pl. 41, figs. 4–6; 1886.
Thomson, *Trans. N.Z. Inst. 45* : 328; 1913.
Lenz & Strunck, *Dtsch. Sudpol-Exped. 15* : 283; 1914.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 770; 1929 (part; not synon. nor distribution).

MATERIAL EXAMINED:

7 males, 6 females (5 ovig.) (O, 2); 1, Centre Island (O, 2).
1 male, Moeraki, 19/1/99 (T).
1, Wellington (D); common, Island Bay, coll. F. G. Maskell, 1929.
Common (B, 11, 13, 15).
2 males, 3 females, coll. D. H. Graham (A, 29, 30).
4 males, Islington Bay, Motutapu shore, 15/5/30 (A).
2 males, 3 females (A, 29, 30).

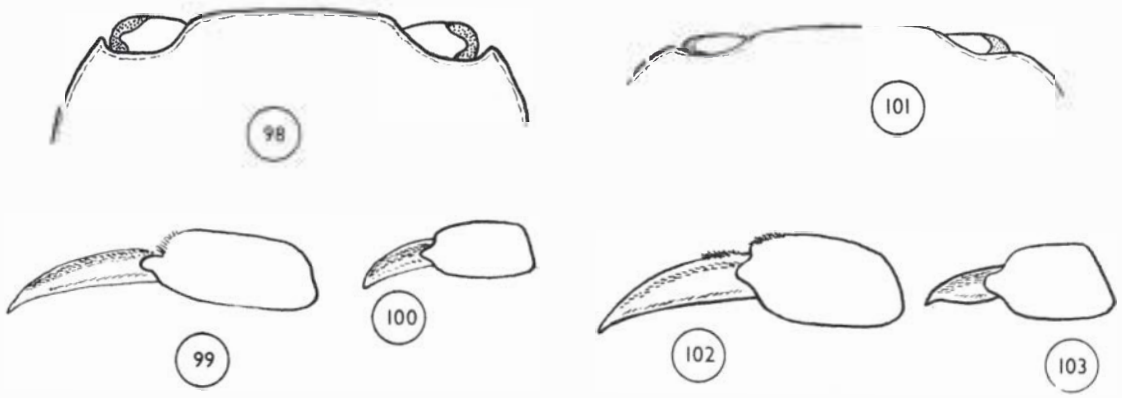

FIG. 98–103: *Cyclograpsus lavauxi* Milne Edwards and *C. whitei* Milne Edwards; 98, *C. lavauxi*, front and orbits, nat. size; 99, *C. lavauxi*, propod and dactylus of third leg, × 2; 100, *C. lavauxi*, propod and dactylus of fourth leg, × 2; 101–103, *C. whitei*, corresponding parts and magnifications to those in fig. 98–100 respectively.

DISTRIBUTION: Endemic, common throughout the mainland, especially in the south. Not known from the Chathams, the southern islands, nor (except for Filhol, 1886) from Stewart Island. Chatham Island specimens so determined by Young (1929) prove to be *Planes minutus*. The record from the Kermadec Islands by Chilton (1911c, p. 560), repeated by Balss (1935, p. 143), refers to *C. whitei*.

HABITS: Chiefly in and above the upper intertidal zone; among and under stones on bottoms of rock, pebbles, sand, or mud; in crevices but not burrowing; commonly the only macroscopic organism in the habitat. Not on loose shingle, as at South Beach (Timaru) or the Lake Ellesmere spit, unless large stable rocks are also present, as at Point Elizabeth in Westland.

Cyclograpsus whitei Milne Edwards, Figs. 101–103, 139.

Cyclograpsus whitei M. Edw., *Ann. Sci. Nat. (3) 20* : 197; 1853.
Epigrapsus politus Lenz, *Zool. Jb., Syst. 14* : 471; 1901 (not of Heller).
Cyclograpsus whitei Chilton and Bennett, *Trans. N.Z. Inst. 59* : 769; 1929 (refs. and synon.).
Balss, J. roy. Soc. W.A. *21* : 143; 1935

The surprising record by Lenz of the tropical Indo-Pacific *Epigrapsus politus* has been shown by Balss, after examining one of the original specimens, to rest on a misidentification. In contrast to its congener, *C. whitei* is rare,[72] and its distribution (Chilton and Bennett 1929, pp. 769–770) is obscure; the only additional record is a female from Tom Bowling Bay, 3/1/15 (C).

Subfamily PLAGUSIINAE Dana

Genus **Plagusia** Latreille

Plagusia chabrus (Linnaeus)[73]

Cancer chabrus Linn., Mus. Lud. Ulr., p. 438; 1764.
Plagusia chabrus Lenz, *Zool. Jb., Syst. 14* : 473; 1901.
Rathbun, *Bull. U.S. nat. Mus. 97* : 336; pl. 104; 1918 (refs. and synon.).
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 774; 1929 (refs. and synon.).
Plagusia capensis Balss, *J. roy. Soc. W.A. 21* : 143; 1935 (refs. and synon.).
Marestia mawsoni Rathbun, *Aust. Ant. Exped. 5* : 1; 1918 (Megalopa).

MATERIAL EXAMINED:

1 male, 1 female, Cook Strait (O).
1 male juv., Moko Hinau, 1888 (T).
1, Wellington (D); 1, Waikanae (D).
1, drift (B, 11).
1 male, 1 female (A, 22).
1 male, Doubtless Bay, N. Auckland, coll. L. T. Griffin, 13/3/31 (A).
2 males, in water among rocks (B, 12).

PREVIOUS RECORDS AND DISTRIBUTION: Chilton and Bennett have several records from Lyttelton Harbour, but the crab is rare in the south and Filhol's record from Otago is doubtful. In the north it is commoner than the records suggest, for "it is very active and alert and was very difficult to catch" (Chilton) and has no doubt been much more commonly seen than collected. The best method of collection is by a baited line without a hook.

The overseas distribution includes Australia and Tasmania, South Africa, Chile, Juan Fernandez, and the Kermadec and other western Pacific islands, though not as yet the Chathams. The range in Australia has been extended to the west coast by Balss (Rottnest Island, Bunbury), where also the present author has found it to be common from Middleton Beach (Albany district) to North Beach (Fremantle district); at Rottnest Island it overlaps with the warm-water *P. depressa tuberculata* Lmk., hitherto known in Australia only from Port Jackson on the east coast (Haswell 1882, p. 110) and Shark Bay on the west (Balss 1935b, p. 143).

MEGALOPA: The recognition by the author (Bennett 1930, p. 257) of the identity of *Marestia* Dana with *Plagusia* was anticipated on different grounds by Stebbing (1914, p. 266), and the identity of *Marestia mawsoni* Rathbun (1918c, p. 1) with the megalopa of *P. chabrus* is now confirmed by the study of early post-megalopae from Point Peron, Western Australia.

Family OCYPODIDAE Ortmann

Genus **Hemiplax** Heller

Hemiplax Heller, Voy. Novara, Crust. p. 40; 1865.

Hemiplax hirtipes (Jacquinot)

Cleistostoma (?) *hirtipes* Jacq. in Jacq. and Lucas, *Voy. Pole Sud, Zool. 3*, Crust. p. 69; 1853.
Metaplax hirtipes Heller, *Verh. Zool.-bot. Ges. Wien 12* : 251; 1862.
Hemiplax hirtipes Heller, *Novara-Exped.*, Crust., p. 40, pl. 40, fig. 3; 1865.
Chilton & Bennett, *Trans. N.Z. Inst. 59* : 759; 1929 (refs. and synon.).

The above synonymy uncritically follows the usual view that Heller's New Zealand species is the same as the Samoan one described by Jacquinot and Lucas, and that, as in the case of *Pilumnus nitidus* already noted, notwithstanding different generic locations, the specific name happened to coincide. The identity of the two is however highly provisional, not to say improbable.

HABITS: Common on mud flats in harbours and estuaries; gregarious, burrowing.[74]

MATERIAL EXAMINED:

Several, coll. W. Traill (T, 5).
6 males, 2 females (1 ovig.) (O, 4); 1 male, dredged, 1/3/84 (T, 4).
1 male, small, stomach of pigfish, coll. D. H. Graham, 16/6/30 (P, 4).
4 males, 8 females (2 ovig.), coll. D. H. Graham, 7/1/30 (P, 3).
Common, Wyckliffe Bay, Otago, on mud flats; coll. D. H. Graham, 9/2/30 (P).
1 male, 1 female, Hooper's Inlet, mud flats (T).
Abundant, burrowing in mud flats (B, 13).
2 females, (1 ovig.), off Devonport (A, 29).
1 female, Mission Bay, Kohimarama, on black mud; 28/3/30 (A).

DISTRIBUTION: Samoa (type locality): throughout the N.Z. mainland and according to Filhol at Campbell Island.

[72]Specimens from "New Zealand" seen in Paris Museum by E. W. Dawson, 13/4/56 (cf. Chilton and Bennett, 1929, p. 769).

[73]Richardson (1949c, p. 130), following a communication from Gordon, considers that this *Plagusia* "is better recognised now" as *P. capensis* (de Haan, 1835).

[74]Beer (1959) has discussed aspects of the behaviour and ecology of this species.

GEOGRAPHICAL DISTRIBUTION OF THE NEW ZEALAND BRACHYURA

The Data

This study of the distribution of Brachyura within New Zealand is based almost exclusively on littoral species, for collections from deeper water are too scanty to give a true picture. For example, the crab-like pagurid *Porcellanopagurus edwardsi* Filhol (Bennett 1932, p. 470) is known from four of the islands in the south and from a single specimen taken near North Cape; *Cyrtomaia hispida* (Borradaile) is likewise known in New Zealand only from Otago and off North Cape; even the common and widely ranging *Ovalipes punctatus* (de Haan) and *Plagusia chabrus* (Linn.) would appear to be rare in the North Island, if existing records were to be trusted.

Of the southern islands, only Campbell Island has endemic species, viz., *Campbellia kohli*, a majid with local affinities, and *Pseudozius* sp., a still more remarkable case in that the genus is mainly Indo-Pacific but is not known from the mainland. *Halicarcinus planatus* (Fabr.) (fig. 128) occurs at the southern islands and has a circumpolar distribution, but in spite of repeated statements to the contrary does not occur on the mainland (Bennett 1930, p. 259).[75] *Leptomithrax* (*Leptomithrax*) *australis* Miers and *Jacquinotia edwardsi* (Jacq.) are commoner at the southern islands than on the mainland, and a few others – *Hombronia depressa* Jacq., *Cancer novaezelandiae* (Jacq. & Lucas), *Nectocarcinus antarcticus* (Jacq.), and *Hemiplax hirtipes* (Jacq.) – occur in both localities; this gives a list of only nine species (of which five are oxyrhynchs) from the southern islands, the restriction in numbers being presumably attributable to latitudinal differences as well as to geographic barriers. The brachyurous fauna indicates that the Auckland and Campbell Islands, though commonly referred to as the subantarctic islands, are not subantarctic, but strictly neozelanic.[76] Species that might suggest antarctic connections, with the exception of *Halicarcinus planatus*, are equally represented.

On the mainland, a few species are exclusively southern, such as *Leptomithrax* (*L.*) *australis*, *L.* (*Z.*) *longipes*, *L.* (*Z.*) *moloch*, *Acanthophrys filholi*, *Jacquinotia edwardsi*, and *Hombronia depressa*, these being all oxyrhynchs; some are chiefly but not exclusively southern, viz, *Paramithrax ursus*, *Eurynolambrus australis*, *Ommatocarcinus macgillivrayi*, *Cyclograpsus lavauxi*, *Helice crassa*, and *Hemiplax hirtipes*. A few on the other hand are chiefly northern but spread to the south, viz, *Ebalia laevis*, *Pilumnus novaezelandiae*, *Heterozius rotundifrons*, and perhaps *Liocarcinus corrugatus*; while *Leptomithrax* (*A.*) *mortenseni*, *Leptograpsus variegatus*, *Latreillopsis petterdi*, *Plagusia chabrus*, *Petalomera wilsoni*, and *Ozius truncatus* are confined to the northern and middle area, including the northern part of the South Island; if any boundary can be drawn between north and south, it is about the latitude of Westport and Kaikoura, not at Cook Strait.[77] Conspicuous examples are *Plagusia chabrus* and *Leptograpsus variegatus*.

Zoogeographic Subdivisions

In general the precise range of marine organisms in New Zealand is very imprefectly known, and Finlay (*Trans. N.Z. Inst. 27* : 328; 1927), while aware of the counter evidence, prefers, though with clearly expressed reservations, to name Cook Strait as the boundary between the molluscan provinces. It does not follow that the boundaries should agree for different marine groups, independently of the age of the group or the opportunities for dispersal, nor should provinces be defined at all in terms of such a small group as the Brachyura; the distribution of the latter does not give grounds for drawing a boundary between a Cookian (North Island) province and a Forsterian province (South Island), nor for including the Kermadec Islands within the Maorian (New Zealand) subregion (see Chilton 1911c), while the Moriorian province (Chatham Islands) has a limited Forsterian fauna with no peculiarities of its own,[78] and even the Rossian province (southern islands, including Macquarie I.), as already indicated, scarcely justifies its name, but represents a southern neozelanic district.[79]

The geographical subdivision which would best agree with the distribution of the Brachyura therefore includes three districts; (1) Southern Islands; (2) Southern mainland, with Stewart Island and the Chathams as outlying extensions; (3) Northern mainland. northwards from Kaikoura and Westport and not including the Kermadecs.[80]

In general, there is no indication that the distribution of the Brachyura within New Zealand depends on barriers to distribution other than latitudinal differences, which directly or indirectly resolve mainly into differences of

[75] "According to Dr Richardson, *Halicarcinus planatus* is a rarity in New Zealand, where it has been confused until recently with a more common species characterised as *H. innominatus* Richardson (1949)". (Garth 1958, p. 35.)

[76] See S. P. Ekman, 1953 ("Zoogeography of the Sea", Transl. E. Palmer, Sidgwick & Jackson, London, p. 207), and Dell, 1952 (pp. 144, 147, *in*: F. A. Simpson "The Antarctic Today; a Mid-century Survey by the New Zealand Antarctic Society". Reed and N.Z. Antarctic Soc.

[77] Cf. Powell, 1961 (*Tuatara 9* (*1*) : 1–8).

[78] Cf. Dell (1960, p. 6).

[79] Cf Powell, 1955 (*N.Z. Dep. sci. industr. Res. Cape Exped. Ser. Bull. 15* : 6–8).

[80] Cf. Powell, 1961 (*Tuatara 9* (*1*) : 1–8).

temperature; the two endemic species of Campbell Island, but not the widely spread *Halicarcinus planatus*, are the only ones that might perhaps depend on a barrier to dispersal in the form of intervening deep water.

There is little evidence that cold-water species occurring in the south in shallow water can survive in the north at greater depths; but in this connection, in addition to the pagurid *Porcellanopagurus edwardsi* (Filhol), the overseas range of *Cyrtomaia hispida* (Borr.) is of interest.

Analysis of Species and Genera

The small number of species and the way in which they are scattered through numerous families and genera illustrate the geographic isolation and, to an extent difficult to estimate, the oceanic nature of part of the fauna. The family Majidae in New Zealand is unique in that it includes seven genera and 13 species, one genus (*Paramithrax*) having three species and another (*Leptomithrax*) with three subgenera) no less than five. It is interesting to note that an original neozelanic origin for the group to which these genera belong has been deduced on independent grounds. No other genus has more than two local species; including these two and excluding the *Hymenosomidae* (and the probable *Pinnixa*) there are 41 species in 30 genera, and excluding these there are 33 species in 28 genera. The 30 genera represent 14 families (average 2·07 per family), of which three are further subdivided into 10 subfamilies; here equally the Majidae are less scattered than the rest.

Transoceanic Dispersal

Zoogeographical relationships with areas beyond New Zealand hinge in part on an indeterminate factor, the possibility of transoceanic dispersal. This is invoked for such genera as *Plagusia* and *Planes* in view of their wide distribution and the known habits of the adults; the distribution of *Ovalipes* and *Leptograpsus* is also oceanic rather than benthic, and the same explanation is strongly suggested even though the known habits are less evidential. But in general there is insufficient evidence for estimating the probability of dispersal of adult or larval stages by currents, with the aid of floating kelp or wood or otherwise. Transport by kelp has been referred to by the author in *Nature*, 126 : 646, 1930. The abbreviated development in the oxyrhynch *Naxioides serpulifera* (Rathbun 1914, p. 653) and the dromids *Paradromia lateralis* (Gray) (Montgomery, *Proc. zool. Soc. Lond.*, 1922, p. 193; Hale 1925, p. 405) and *Cryptodromia octodentata* Haswell (Hale 1925, p. 405) excludes the likelihood of larval dispersal in such cases. Finlay (1927, p. 326) stated "The Notonectian current, sweeping southwards far past Tasmania, and then up the coast of New Zealand, is probably responsible for the introduction of many (molluscan) forms of Maugean (i.e., east Tasmanian) affinity. Introduction by this means within quite recent times seems the most feasable explanation of the occurrence on New Zealand shores of most of our present Cymatiidae . . ." In general, such a method of dispersal may be expected to result in the presence of identical species in the two countries; paleogeographic relationships as discussed below would imply more distant faunistic similarities.

Transport by ships is probably of only slight importance. Such lists as those quoted by Stebbing (1893, p. 98) or Chilton (1911b, pp. 131–3) of species transported on the hulls of ships are not lists of accidental acclimatisations, for it does not follow that the crabs could establish themselves in their new homes. No species are known to have reached New Zealand in this way (*Leptograpsus variegatus* is a possibility), but two have reached Australia, the European *Carcinus moenas* (Linn.) (Alcock 1896, p. 13; Fulton and Grant 1901, p. 55; *Vict. Nat.* *17* : 147, 1900; Chilton 1911b, p. 131), and the New Zealand *Cancer novaezelandiae* (Jacq.) (McNeill and Ward 1930, p. 377). Even if, as suggested by Iredale, the latter case is explicable by the introduction of New Zealand oysters to Tasmania about half a century ago, it illustrates the possibility of establishment in a new home without assistance by artificial culture, provided that the new locality is in the same latitude as the old and acclimatisation in the strict sense of the word is not called for. This is a simple matter in comparison with the passage through the tropics and the finding of a favourable latitude in the same hemisphere (*Eriocheir*) or almost at the antipodes (*Carcinus*); but apart from species tolerant of wide latitudinal differences, such as *Plagusia chabrus* and *Leptograpsus variegatus*, even this is more likely to occur than establishment in a different latitude.

The possibility of dispersal by whales may be worthy of study. Such an agency would help to overcome a theoretic difficulty arising from the general eastward trend of the West Wind Drift, which with the aid of progressive centres of distribution such as Kerguelen and Macquarie Islands, might allow South American organisms to reach New Zealand; a reciprocal spread from New Zealand to South America, if by the passive agency of currents, would be across the South Pacific, where no such intermediate stations occur. The fact that *Halicarcinus planatus* (a species as likely to shelter among whale-borne barnacles as any other) occurs at the stations named, and has undoubtedly spread from a Tasman centre, may imply westward transport by whales across the South Indian and Atlantic Oceans.

Australian Relationships

Although numerous erroneous records by Heller and Miers exaggerated the kinship with the Australian fauna, the present purged list still clearly supports the view expressed by Chilton and Bennett (1929, p. 258) that the evidence of relationships with the Australian fauna, but not with any other, is extensive and unmistakable. *Latreillopsis petterdi*, *Pinnotheres novaezelandiae*, *Petalomera wilsoni*, *Merocryptus lambriformis*, and perhaps *Paramithrax minor*, are recently recognised links supplementing those previously

known. Of the 27 non-oxyrhynch species, about half occur in Australia, viz, in addition to those just mentioned, *Ebalia tuberculosa*, *Ovalipes punctatus*, *Liocarcinus corrugatus*, *Ozius truncatus*, *Ommatocarcinus macgillivrayi*, *Planes minutus*, *Leptograpsus variegatus*, *Plagusia chabrus*; to these may be added *Cyclograpsus whitei*, which is known from the Kermadec Islands; on the other hand, future studies may show the Australian counterparts to be specifically separable in some cases, and it is likely that *Helice crassa* and *Cyclograpsus lavauxi*, and certainly *Hemigrapsus sexdentatus*, *Paramithrax ursus*, and *P. peroni*, do not occur in Australia. Of the remaining non-oxyrhynch Brachyura, all belong to genera well represented in Australia except the following:

[81] *Hemigrapsus:* somewhat doubtfully distinct from the Australian *Brachynotus.*

Hemiplax: related to the Australian *Macrophthalmus.*

Cancer: eastern Asia, Europe, North and South America; not Australia save by recent introduction.

Heterozius: endemic and monotypic, related to the American *Homalaspis.*

It is tempting to infer from the brevity of this non-Australian list that there has been a recent close link with Australia, the species in common being too numerous to be accounted for in terms of trans-oceanic dispersal or of chronologically remote geographical relationships; but on the other hand some of the common and wide-ranging crabs of Australia, such as *Portunus*, *Thalamita*, *Mictyris*, *Ocypode*, and the Actaeidae, are absent from New Zealand, and some other major groups such as the porcellanids, parthenopids, and dromids are very scantily represented. Further, the Oxyrhyncha present such a different picture from the rest of the Brachyura, and from the Australian oxyrhynchs, that they forbid the assumption that there has been any recent direct link.

The Majidae are represented in New Zealand by seven genera, three subgenera, and 13 species; of these, only the genera *Paramithrax*, *Leptomithrax*, and *Acanthophrys* occur in Australia; probably only one subgenus (*Austromithrax*) of *Leptomithrax* occurs there, and possibly not a single species of Majidae is common to the two countries. Only the genera *Cyrtomaia* and *Acanthophrys* and the subgenus *Austromithrax* (which is the most specialised group in *Leptomithrax*) have northern affinities, and the occurrence of four species at the southern islands and the preference for cold waters by several mainland species, as mentioned above, suggest a southern origin for the local members of the family or at least for the subfamily Majinae.

McCulloch (1906, p. 231) has commented on the southern extension of the range of species originally described from Japan, to northern and eastern Australia; the method of statement refers not to the direction in which the species have spread but to the chronological order in which they have been recognised in the areas concerned. An interesting recent outcome of the work of Rathbun, Balss, Shen, Kellogg, Yokoya, and Sakai in China and Japan is the northern extension (in the above sense) of the range of southern species, and it is noteworthy that the species common to New Zealand and eastern Asia occur also in Australia, e.g., *Merocryptus lambriformis*, *Liocarcinus corrugatus* (var. *strigilis* in Japan), and *Ommatocarcinus macgillivrayi*; while *Cyrtomaia hispida* links New Zealand with Timor and perhaps Japan but not Australia. These relationships will scarcely be impaired even if further critical comparisons increase the proportions of endemism.

These relationships, and others revealed by kindred genera and clusters of species, and the differences between the Australian and New Zealand faunas in spite of marked similarities, are best explained by a conception already familiar from the distribution of insects (Tillyard, "Insects of Australia and New Zealand", 1926, p. 480), of birds and their migration routes, of the pulmonate *Placostylus* (Chilton 1915, p. 319), and of *Xiphocaris*[82] among the decapods (Chilton 1915, p. 318); viz., a connection with Australia, not by a southern or direct trans-Tasman route, but by a tropical and perhaps Papuan junction.[83] In other words, the brachyurous fauna of New Zealand is not derived from the Australian, but in the main from a common ancestral fauna of Indo-Pacific origin. In that case, *Pseudozius* has perhaps disappeared from the mainland, or has remained undiscovered there; and the fresh-water *Halicarcinus lacustris* still persists along the two migratory routes from the north. This explanation does not refer to the whole brachyurous fauna, as a southern element may be detected; it accords well, however, with the distribution of *Leptomithrax* subg. *Austromithrax*, in spite of the apparent paradox in that a southern origin for the Majinae has been suggested; for in the words of Hedley (*Trans. Linn. Soc. N.S.W. 24*, p. 391, 1899), "Along the tortuous route by which the Malayan forms crept south to New Zealand from New Guinea, there flowed a return current of Antarctic life". A similar crossing of two streams is to be found on the west coast of Australia, where the author has taken southern forms such as *Paralomis hirta* (M. Edw.) (Hale 1927, p. 96) and *Brachynotus octodentatus* Hasw., in the neighbourhood of branching corals containing *Trapezia cymodocea*; see also above, *Plagusia chabrus*, and cf. Balss 1935b, p. 144. In terms of Hedley's conception, we may explain the distribution of the majoids by saying that the ancestral *Paramithrax* ranges northwards from the southern islands and the New Zealand mainland, where it is most strongly represented, to Norfolk Island and (perhaps by way of Macquarie Island and Tasmania) to the Australian mainland; of the subgenera of *Leptomithrax*, the primitive *Leptomithrax* s.str. and also *Zemithrax* reach only as far north as the mainland, *Austromithrax* ranges freely to Australia and eastern Asia and intermediate islands. Perhaps *Acanthophrys* and *Cyrtomaia* have spread in the reverse direction. These considerations seem to justify a

[81] See Gordon (*in litt.*) *in* Richardson, 1949c, p. 130).

[82] Now known as *Paratya*; see Kemp, 1917 (*Rec. Indian Mus. 13* : 301), Richardson & Yaldwyn, 1958 (*Tuatara, 7* : 30).

[83] Cf. Fleming, 1957 (*In*: Callaghan, "Science in New Zealand", pp. 228–46).

remark by Haswell (1880, p. 145), that, of the majoid crabs of Australia, "By far the greatest number of the species characteristic of the northern region belong to the families Periceridae and Parthenopidae, while the southern species belong almost exclusively to the Inachidae and Maiidae". The Hymenosomidae have spread from an Indo-Pacific source, a specialised and isolated group of three species (one undescribed) having arisen in South Africa, and the rest having spread through India, China, and Japan, and throughout the east Indies, and also southwards to Australia and New Zealand and thence to South America (Bennett 1930, p. 259).

Magellanic Relationships

The kinships with South America, first enunciated by Hutton (*Trans. N.Z. Inst. 5* : 227, 1872; *Ann. Mag. nat. Hist. (ser. 4) 13* : 25, 1873; *ibid. (ser. 5) 13* : 425 *15* : 77, 1884; *N.Z. J. Sci. 2* : 1, 249, 1883), suggesting a former land connection through some Antarctic junction, were stated by Chilton (1909, p. 602; 1909, p. 797); they have been controverted by Stephensen (1927, p. 389), and indeed one of the outstanding results of studies of material in the Copenhagen Museum collected by Dr Th. Mortensen in New Zealand in 1914–15 has been the challenging of the classical viewpoint as to these southern connections. Mortensen, for example (*Arch. zool. ital. 15* : 309, 1930), has concluded from a study of the cidarids that there is only "a very faint indication of a former relation between the New Zealand fauna and the Magellanic region".[84]

Among the Brachyura, even though it is now known that the New Zealand *Paramithrax peroni* and probably *Hemigrapsus crenulatus*[85] are not identical with their magellanic counterparts, as long believed, the relationship with them remains; similarly *Cancer plebeius* is not conspecific with the New Zealand species, but the two are related by important common features. Still more important is the clear recognition of the point at issue, and its isolation from kindred problems; although there is unquestionably an antarctic element in the New Zealand fauna and flora, it does not follow that this applies to comparatively recent groups such as the Brachyura, and it is clear that identical or analogous species in the two areas are not to be accounted for in terms of land connections that ceased to exist before the modern genera and species arose. The inclusion of the Brachyura with chronologically ancient groups, or groups whose date of origin is unknown – for example, the Isopoda and Amphipoda (Chilton 1909, pp. 602–3), or the Parastacidae and Temnocephaloidca (Balss 1930, p. 207) – is an anachronism. It is only by a chronological fallacy that the Brachyura have been treated as providing cumulative evidence to be added to that from older groups. On the one hand, as concluded by J. A. Thomson (*Austr. Antarct. Exped.*, C, *4 (3)* : 51; 1918), from the evidence afforded by the brachiopods, "The circum-Pacific southern connections were all broken much as at present by the Miocene, and since that date there have been no renewed connections between the southern continents and island districts, except possibly between South America and the Antarctic and adjacent islands". On the other hand the origin of the Brachyura is not much more ancient than this date; homolodromoids appear as far back as the Jurassic, and primitive corystoids and raninoids in the Cretaceous, but the modern groups do not emerge till the Eocene at least, and it was only at about the time when New Zealand lost contact with other southern land masses that the Brachyura were beginning to become a prominent group and to assume a modern facies.[86] In that case, kinship between genera and even species in New Zealand and South America may be evidential in theories concerning land bridges, but identity of species can hardly be so.

Yet it is partly on such evidence that Balss (1930, p. 205) has relied in reverting, in opposition to Stephensen and to recent papers evidently then unknown to him (Chilton and Bennett 1929, p. 734; Bennett 1930, p. 258), to the classical viewpoint. Of the 11 species in his list of allegedly identical species only six are Brachyura, and, of these, *Cyclograpsus punctatus* M. Edw. of South America and South Africa is now known to be distinct from the New Zealand *C. lavauxi* M. Edw. and the Australian *C. audouinii* M. Edw., while according to a later private communication from Dr Balss *Brachynotus* or *Hemigrapsus crenulatus* (M. Edw.) is not common to the two areas.[87] The amended list of neozelanic-magellanic Brachyura is as follows:

	N.Z. Mainland	Southern Islands	Australia	Kerguelen	South Africa	South America
Halicarcinus planatus (Fabr.)	—	×	—	×	—	×
Ovalipes punctatus (de Haan)	×	—	×	—	×	×
Leptograpsus variegatus (Fabr.)	×	—	×	×	—	×
Plagusia chabrus (Linn.)	×	—	×	—	×	×

A list as short as this is of little significance, especially as all four species have a wide range and their occurrence in any southern island might be expected. *Ovalipes punctatus* is a strong swimmer widely distributed in the Indo-Pacific, including China and Japan as well as the localities shown in the table, but is not known, as Balss supposed, from the southern islands. The range of *Plagusia chabrus* is much the same, except that the megalopa *Marestia mawsoni* Rathbun from Macquarie Island is likely to be its larval stage. Members of this genus, like the well known *Planes minutus*, have been recorded from drift timber on the open sea, this presumably accounting for the very wide range of some of the species (Alcock 1900, p. 437; Rathbun 1917, p. 332; cf. also Miers, Narrative HMS *Challenger, 1 (2)* : 586; 1886). *Leptograpsus variegatus* has a wide distribution (southern, but not typical circum-austral nor circum-Pacific), and somewhat analogous habits. These species

[84]And see Fell, 1954 (*N.Z. geol. Surv. paleont. Bull. 23* : 13).
[85]This species does occur in Chile (Garth, 1957, p. 99).
[86]For details see Glaessner, 1960.
[87]But Garth (1957, p. 99) could not easily distinguish the Chilean species from that of New Zealand.

are not antarctic but Indo-Pacific with an extension into the Magellanic region, and are conspicuous members of the Australian fauna. There remains *Halicarcinus planatus*, which, in spite of erroneous records from the New Zealand mainland, the Chatham Islands, and Australia, has a narrow latitudinal range distinctly further south than these localities; this narrowness was not known to those authors who have emphasised so repeatedly the wide longitudinal range. The unmistakably Indo-Pacific range of the family to which it belongs has equally been overlooked by those who have regarded the species as a remnant of an ancient Antarctic fauna now dispersed in southern areas. Of much more significance is *Halicarcinus lacustris* (Chilton), a freshwater species with a circum-Tasman distribution in New Zealand, Norfolk Island, Australia, and Tasmania – a zoogeographic link that remains equally impressive whether these crabs are conspecific or prove to be a cluster of related forms.

Relationships between analogous genera in the two areas (*Trichoplatus*, *Jacquinotia*, *Heterozius*) and between species within a genus common to both areas are shown in the following list:

Trichoplatus: Monotypic and endemic to mainland; allied to *Eurypodius* of South America and Falkland Islands.

Paramithrax: 3 spp. in N.Z., one spreading to southern islands, 2 in Australia, 1 in Norfolk Island, 1 in Juan Fernandez.

Jacquinotia: Monotypic, endemic (N.Z. mainland and southern islands), related to *Mithrax* of America.

Halicarcinus: 1 sp. in southern islands of N.Z., Kerguelen Isl., Macquarie Isl., South America and South Atlantic islands; others in N.Z. and Australia, 1 other (undescribed) in Argentina.

Cancer: 1 sp. in N.Z., including southern islands, 5 in South America, others in North Atlantic and North Pacific; not in Australia save by introduction.

Ovalipes: 1 spp. in N.Z., South America, and throughout the Indo-Pacific, including Australia; 1 endemic to northern and tropical America.

Nectocarcinus: 1 sp. in N.Z., including the southern islands, 2 in Australia, 1 in Juan Fernandez.

Heterozius: Monotypic, endemic to N.Z., related to the monotypic *Homalaspis* of South America.

Leptograpsus: 1 sp. in N.Z., South America, Australia, Norfolk Island, etc., and possibly China.

Hemigrapsus: 2 spp. in N.Z., 1 or 2 in Australia, 4 on Atlantic coasts of South America, others in Pacific.

Cyclograpsus: 2 spp. in N.Z., one spreading to Kermadec Isls., 2 in Australia, 3 in America (one of which spreads to South Africa), others in Pacific and east Atlantic.

Plagusia: 1 sp. in N.Z., South America, South Africa, Australia, others with Indo-Pacific distribution, of which 3 spread to America.

Other genera common to the two countries – *Pseudozius*, *Pinnotheres*, *Planes*, *Ozius*, *Pilumnus*, *Ebalia* – do not even remotely suggest an antarctic origin, and some of those in the list are not impressive. In four of the genera, identical species occur in New Zealand and South America, their distribution can be accounted for by trans-oceanic dispersal – *Ovalipes* because of its ability to keep afloat if carried out to sea, and *Halicarcinus*, *Leptograpsus*, and *Plagusia* on drifting wood or kelp, or on whales or perhaps ships.

Some of the other examples may be similarly explicable, the migration having been effected at a sufficiently remote date for divergence into specifically distinct forms to have occurred. On these grounds the Indo-Pacific *Pseudozius*, *Cyclograpsus*, and probably *Hemigrapsus*, may also be discounted; *Nectocarcinus* again is a strong swimmer not confined to the upper littoral. But after making full allowance for such dispersal, we are still confronted with five genera – *Trichoplatus*, *Paramithrax*, *Jacquinotia*, *Cancer*, and *Heterozius*, these including three of the monotypic genera – which appear to represent a genuine antarctic element in the brachyurous fauna of New Zealand; the faint evidence mentioned by Mortensen is recognisable in this group also. If this interpretation is correct, evidence from recent forms, supplementary to that available from paleontology, is provided, whereby an estimate may be made of the degree of constancy of these genera through the greater part of the Tertiary.

Summary of Distribution

1. The Auckland and Campbell Islands (the latter with two endemic species) represent, in terms of the Brachyura, a southern neozelanic (not subantarctic) district, 10 species (of which six are oxyrhynchs) occurring also on the mainland; *Halicarcinus planatus* is absent from the mainland.
2. Westport and Kaikoura mark the boundary between a northern and a southern mainland district, the latter including also the Chatham Islands. The Kermadecs are excluded.
3. In explanation of external zoogeographic relationships, the agency of currents, floating kelp and wood, and ships, as well as of paleogeographic links, is discussed, with three examples of accidental acclimatisation. The agency of whales is suggested.
4. After purging the list of many erroneous records, a strong Australian element is still found, but several groups conspicuous in Australia are absent and the relationship is qualified with respect to the Majidae. The relationships, though theoretically explicable in part in terms of trans-oceanic dispersal, are in the main better accounted for in terms of a common Papuan relationship, as indicated also by other groups of animals.
5. The Majidae are of southern origin, the two southern districts being a focus for the more primitive members (*Paramithrax*, *Leptomithrax* s.str.), the higher members spreading freely to Australia and eastern Asia.
6. The modern Brachyura arose after the severance of any former geographic connection with South America, hence the four species common to the two areas must be otherwise accounted for; but five genera with no species in common suggest a more ancient and perhaps a fairly direct link.

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[Lists the following species from New Zealand, presumably based on Miers (1876b) and Haswell (1882c); *Scylla serrata* (Forskal). p. 417, *Neptunus pelagicus* (Linn.), p. 419, *Thalamita crenata* Milne Edwards, p. 424, *Actæa savignyi* (Milne Edwards), p. 432, *Varuna litterata* (Fabr.), p. 518; see also Stephenson and Hudson (1957), Stephenson and Campbell (1960), Stephenson (1962), and Sankarankutty (1961).]

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[Ninety species of Brachyura from New Zealand, of which 14 are in common with the Tahiti-Tuamotu region, but the authors note (p. 51): "Les Brachyoures de Nouvelle-Zélande sont insuffisamment connus; certaines espèces indo-pacifiques n'y ont été signalées qu'une fois et leur présence dans cette région peut être mise en doute. Les chiffres donnés ici ne le sont donc qu'à titre indicatif."]

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[*Scylla serrata* (Forskal) recorded from New Zealand, p. 105, after Chhapgar (1957).]

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[List of New Zealand portunids, pp. 315, 317, 318.]

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[Species recorded from New Zealand, after Miers (1876b) and Doflein (1904); *Thalamita danae* Stimpson, p. 337, *T. sima* H. Milne Edwards, p. 354.]

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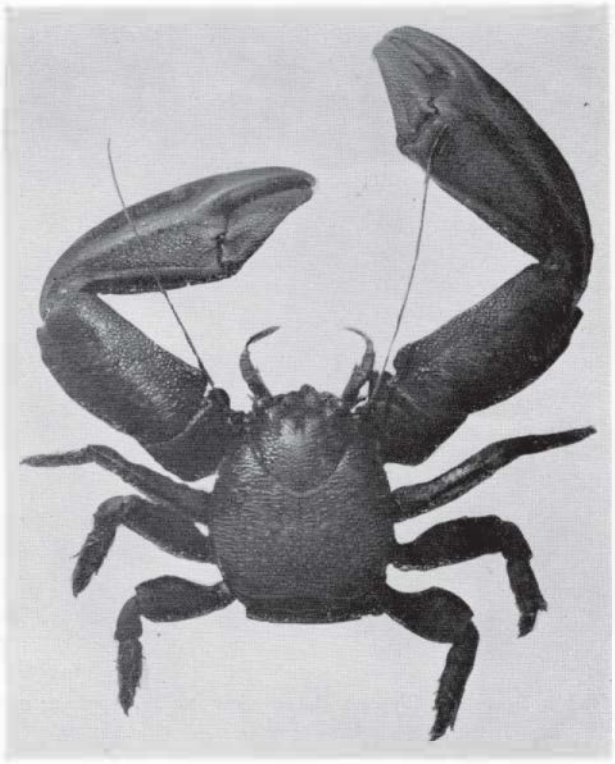
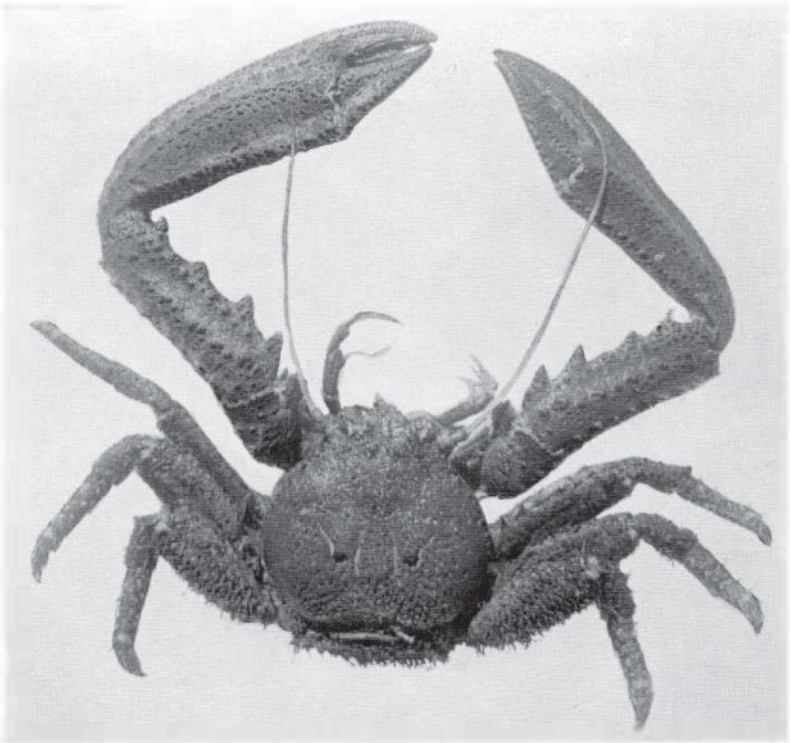
YALDWYN, J. C.; GRIFFIN, D. J. G. (in press): A Record of the Majid Brachyuran Genus *Achaeus* from New Zealand Waters, with Notes on the Australian species. *Trans. roy. Soc. N.Z. Zool.*



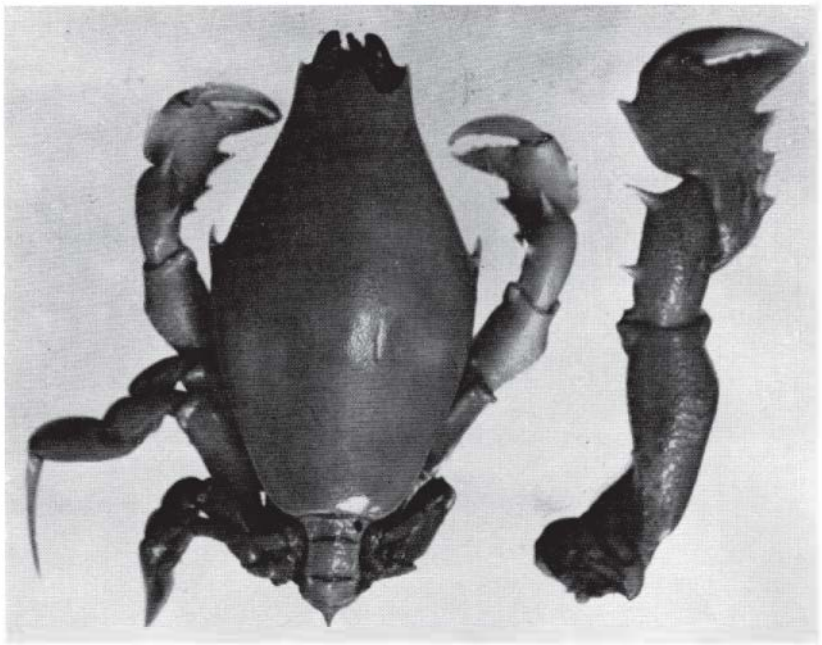
Photo, D. H. Graham

FIG. 104. *Petrolisthes elongatus* (Milne Edwards); dorsal view, × 3.



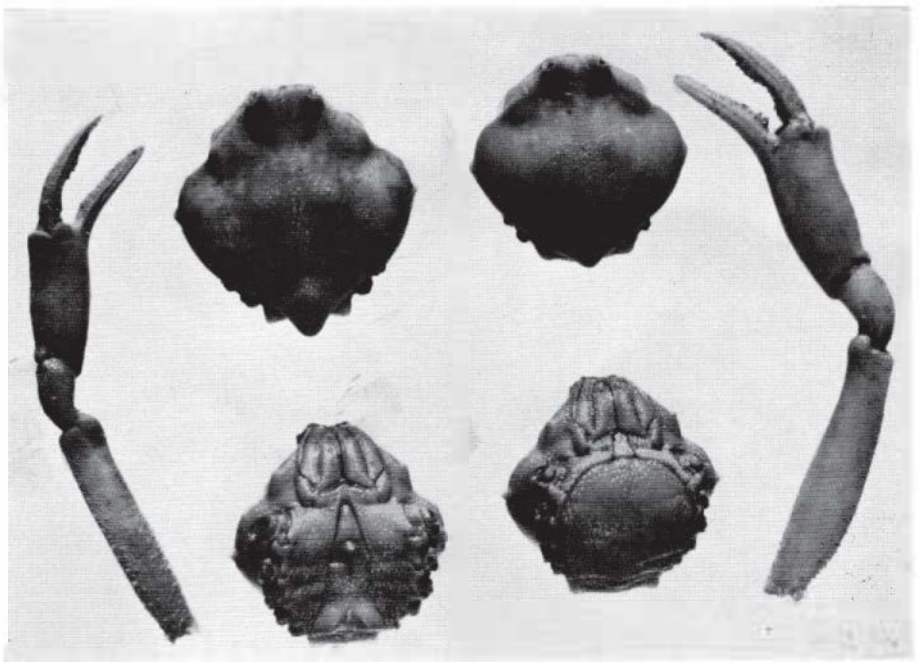
Photo, D. H. Graham

FIG. 105. *Petrocheles spinosus* Miers; dorsal view, × 4.



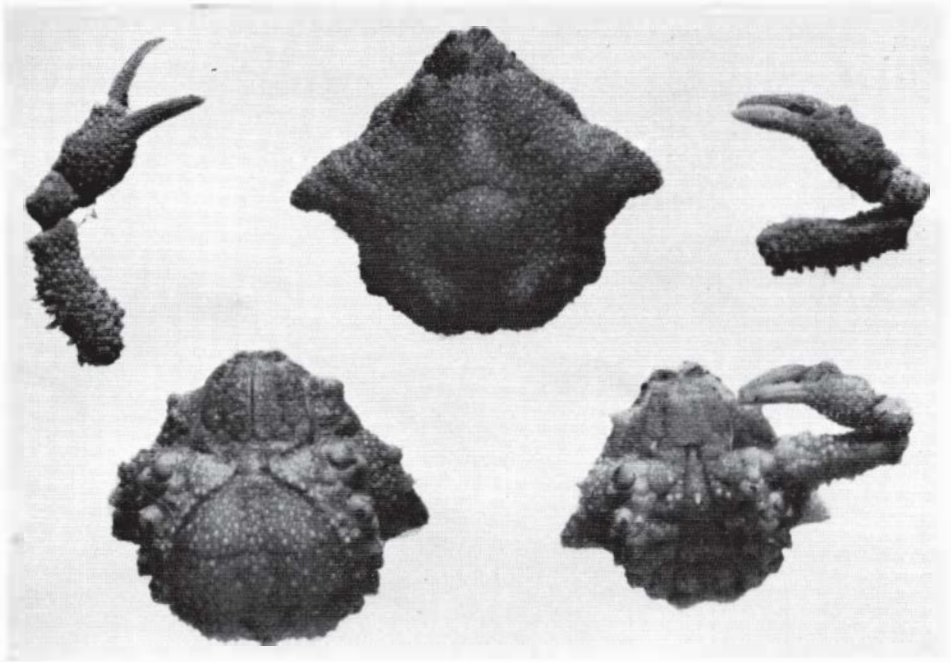
Photo, E. W. Bennett

FIG. 106. *Lyreidus fossor* n.sp. Type in dorsal view × 1·7 approx.; male cheliped (Page 24.)



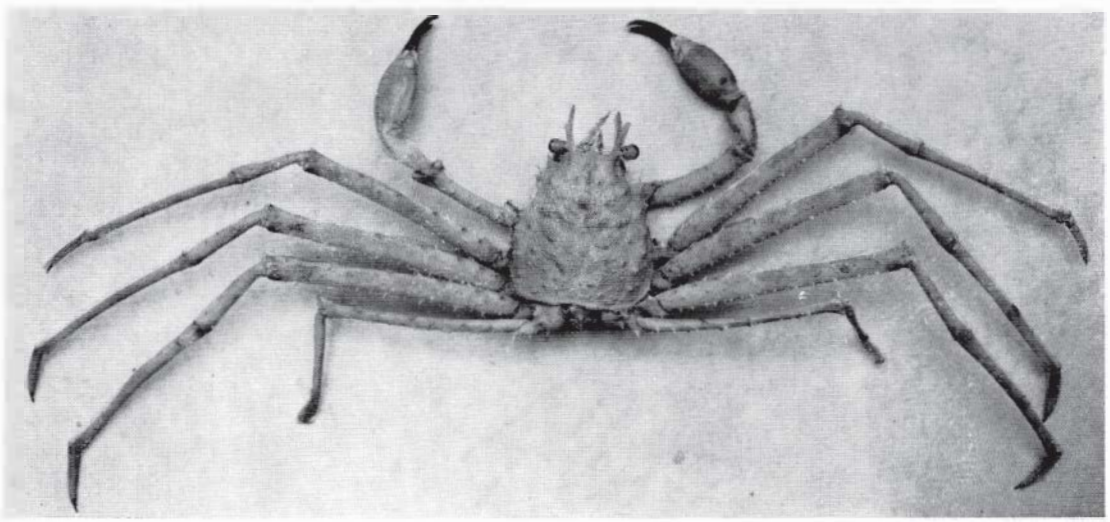
Photo, E. W. Bennett

FIG. 107. *Ebalia laevis* (Bell); both sexes in dorsal and ventral views, × 4, chelipeds in proportion. (Page 20.)



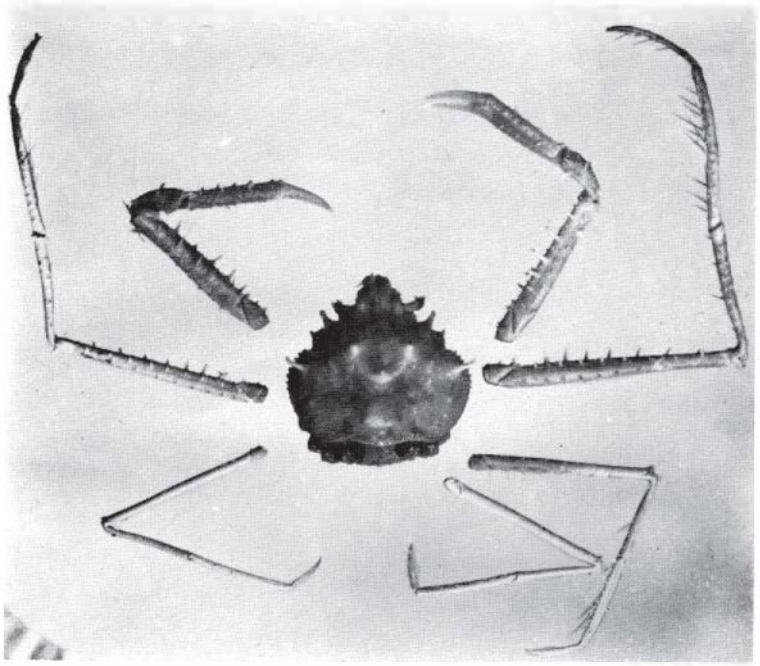
Photo, E. W. Bennett

FIG. 108. *Merocryptus lambriformis* (Milne Edwards); female in dorsal view, male and female in ventral view, × 2. (Page 22.)



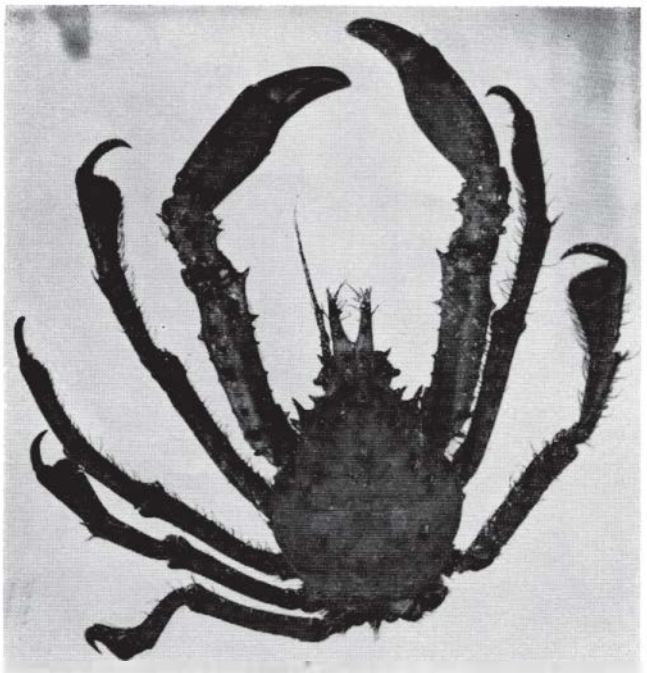
Photo, C. J. Lindsay

FIG. 109. *Latreillopsis petterdi* Grant; dorsal view, much reduced. (Page 27.)



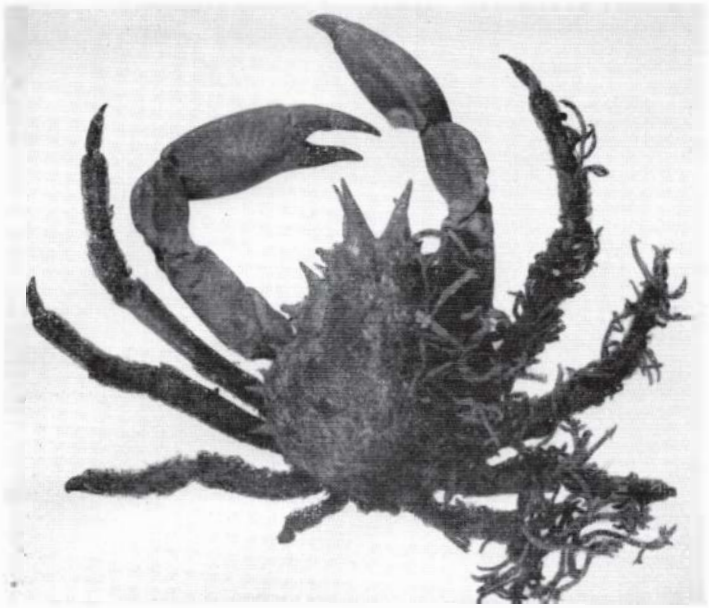
Photo, E. W. Bennett

FIG. 110. *Cyrtomaia hispida* (Borradaile;) male from Otago, × 2¼. (Page 30.)



Photo, E. W. Bennett

FIG. 111. *Trichoplatus huttoni* Milne Edwards; male in dorsal view, × ⅔. (Page 33.)



Photo, F. W. Bennett

FIG. 112. *Paramithrax peroni* Milne Edwards; male in dorsal view, × $\frac{3}{5}$. Polyzoa (*Flustrella binderi* Harvey) removed from legs and carapace on left side. (Page 38.)

Photo, E. W. Bennett

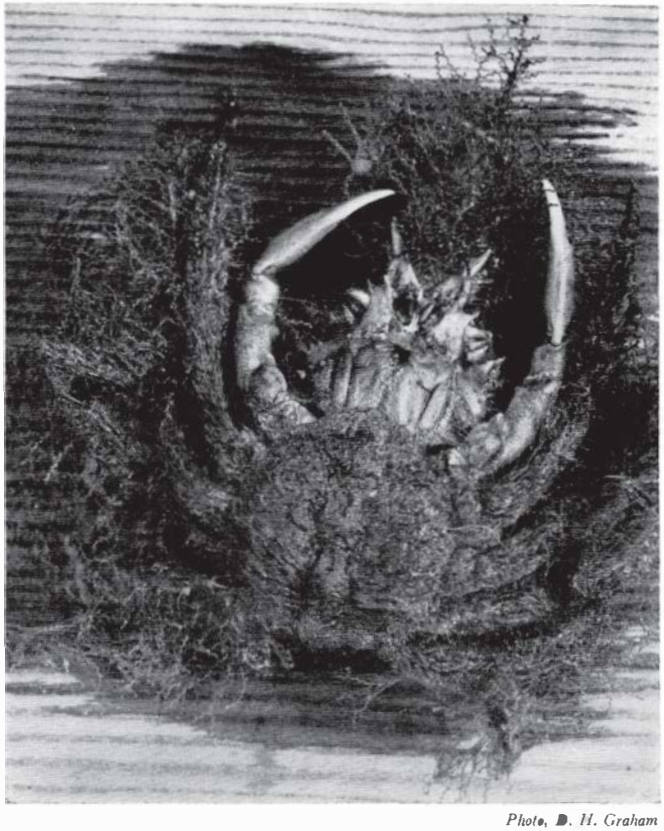
FIG. 113. *Paramithrax minor* Filhol; male in dorsal view, × $1\frac{1}{5}$. Corallines and prostrate Polyzoa partly cleaned from right side and from meri of chelipeds. (Page 40.)

Photo, E. W. Bennett

FIG. 114. *Paramithrax minor* Filhol; same specimen as fig. 113, ventral view, × $1\frac{1}{5}$. Left side partly cleaned. (Page 40.)

Photo, D. H. Graham

FIG. 115. *Paramithrax ursus* (Herbst); dorsal view showing hairs, × 1. (Page 42.)

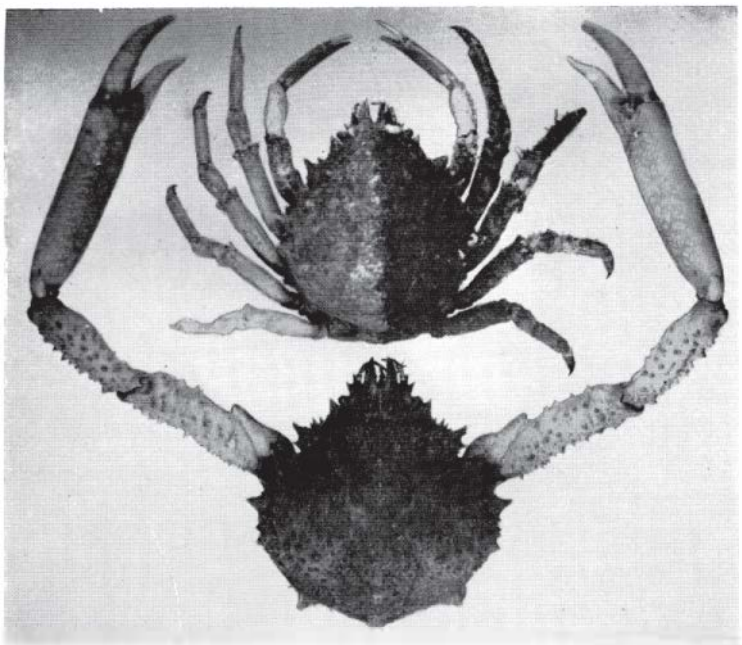


Photo, D. H. Graham

FIG. 116. *Paramithrax ursus* (Herbst); same specimen as fig. 115, ventral view, × 1. Hydroids on limbs and front, hairs on abdomen. (Page 42.)

Photo, E. W. Bennett

FIG. 117. *Leptomithrax longimanus* Miers; small male, × $\frac{3}{5}$. (Page 47.)



Photo, E. W. Bennett

FIG. 118. *Leptomithrax australis* (Jacquinot); female (above) and male (below), × $\frac{1}{4}$. (Page 49.)

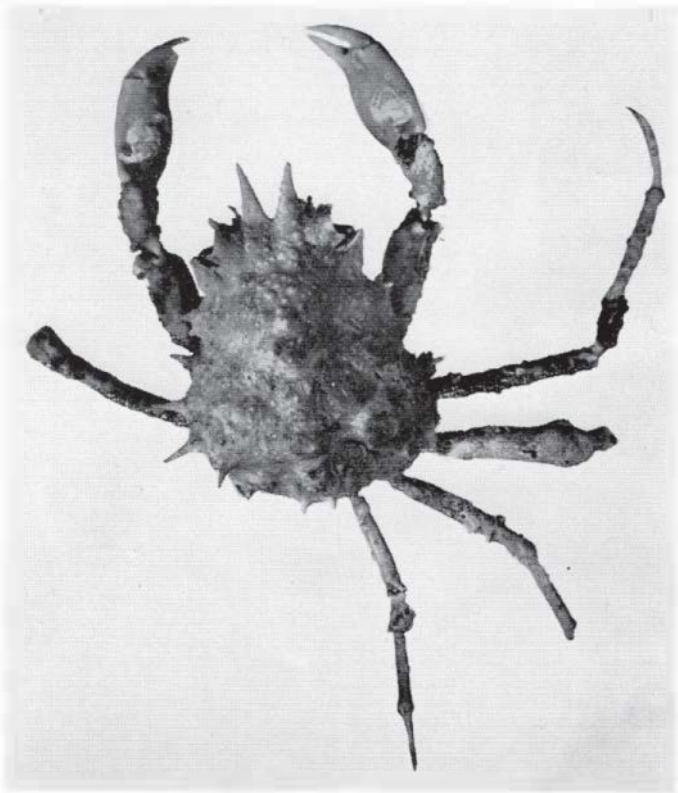
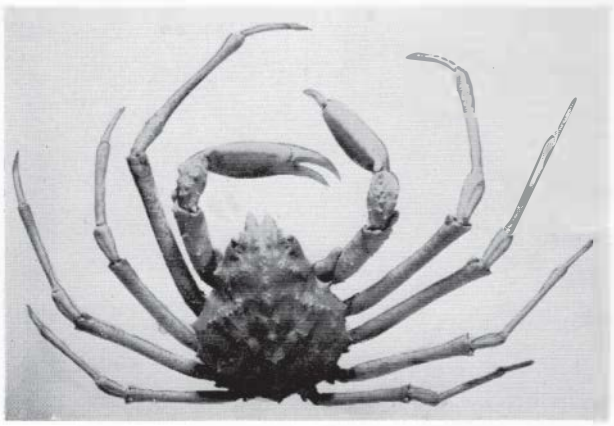


Photo. E. W. Bennett

FIG. 119. *Leptomithrax* (*Austromithrax*) *mortenseni* n.sp.; type in dorsal view, × 1¼. (Page 52.)

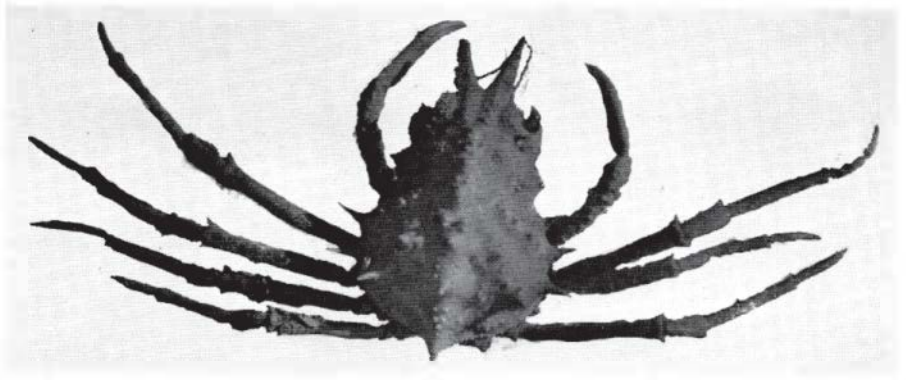
Photo, E. W. Bennett

FIG. 120. *Leptomithrax* (*Austromithrax*) *mortenseni* n.sp.; type in ventral view, × 1¼. (Page 52.)



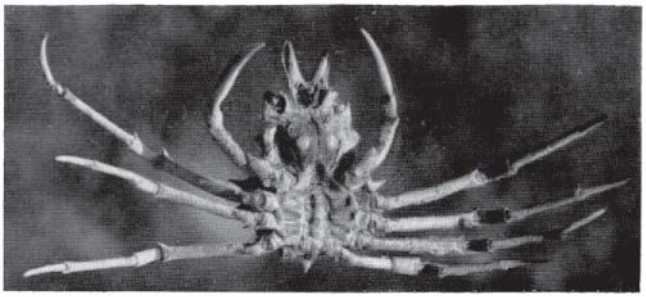
Photo, E. W. Bennett

FIG. 121. *Leptomithrax* (*Zemithrax*) *longpipes* (Thompson); male in dorsal view. × ⅓. (Page 54.)



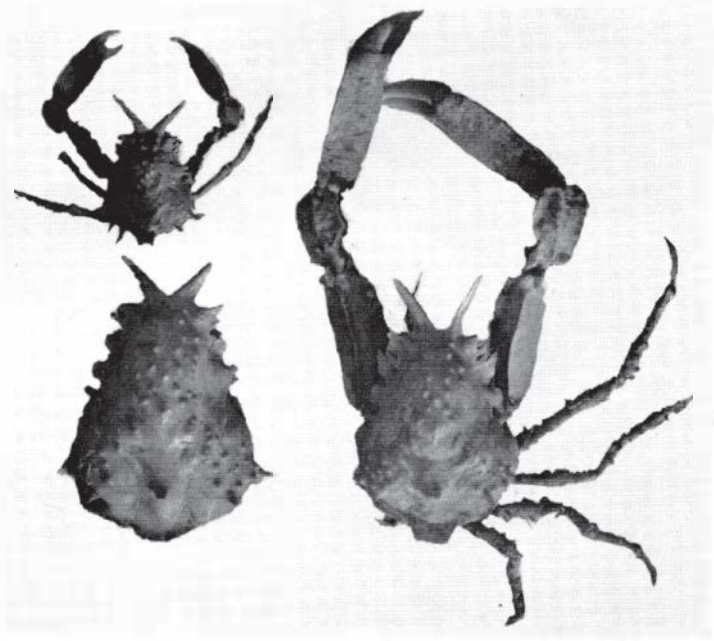
Photo, D. H. Graham

FIG. 122. *Leptomithrax* (*Zemithrax*) *moloch* n.sp.: type in dorsal view, × 1½. (Page 56.)



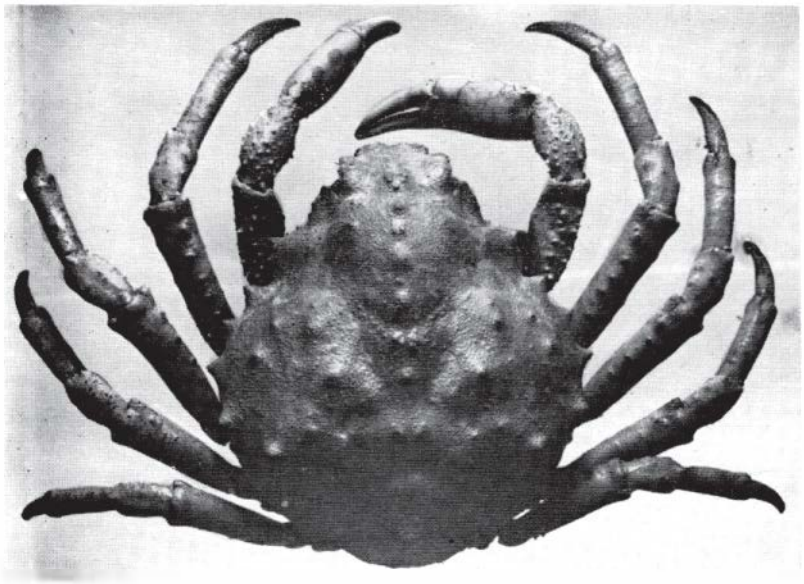
Photo, D. H. Graham

FIG. 123. *Leptomithrax* (*Zemithrax*) *moloch* n.sp.; type in ventral view, × ⅝. (Page 56.)



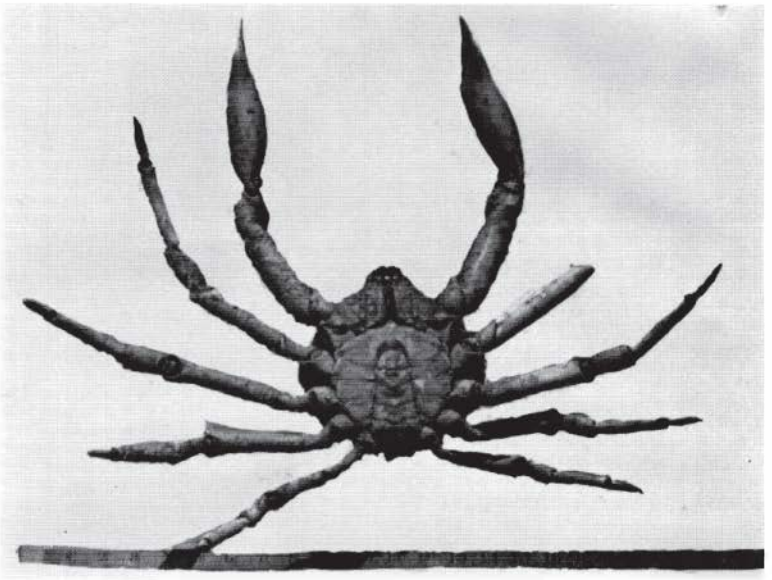
Photo, E. W. Bennett

FIG. 124. *Acanthophyrs filholi* Milne Edwards. Large male from Otago, 40 fathoms; young male from Cape Maria showing relatively longer spines; and female limbless, ex *Nora Niven* Coll. All × ½. (Page 57.)



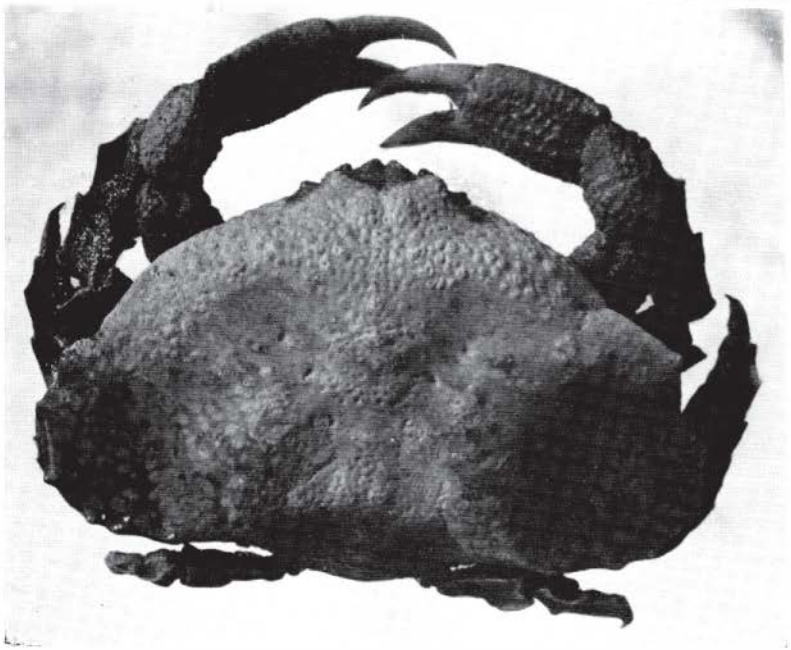
Photo, D. H. Graham

FIG. 125. *Jacquinotia edwardsi* (Jacquinot); female in dorsal view, × 1⅓. (Page 61.)



Photo, D. H. Graham

FIG. 126. *Jacquinotia edwardsi* (Jacquinot); male in ventral view, × ⅙. (Page 61.)

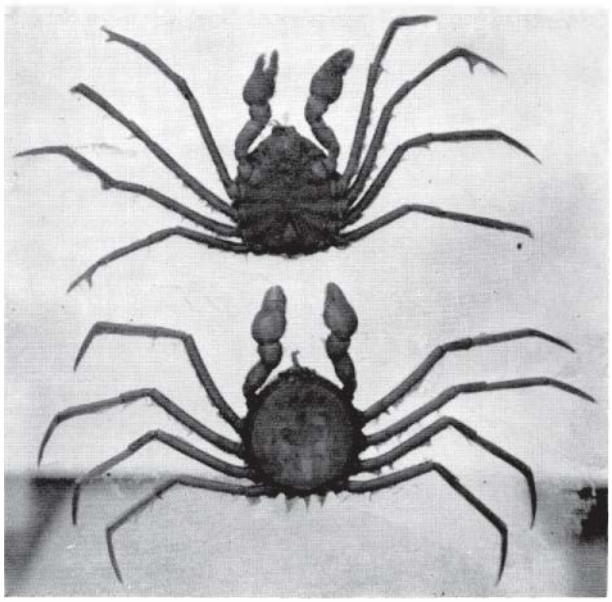


Photo, D. H. Graham

FIG. 127. *Eurynolambrus australis* Milne Edwards; dorsal view, × 1⅞. (Page 63.)

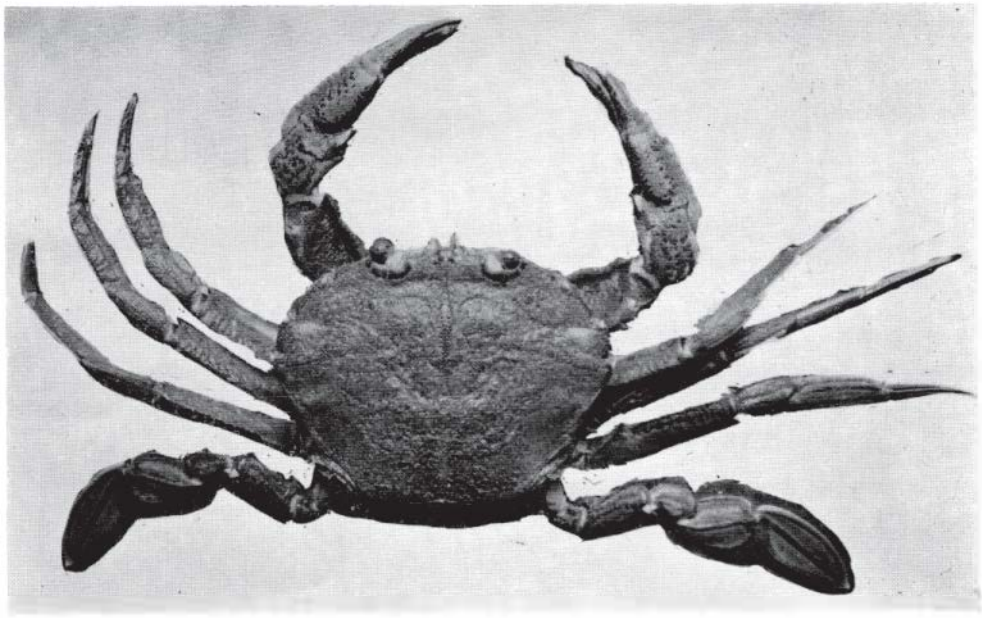
Photo, E. W. Bennett

FIG. 128. *Halicarcinus planatus* (Fabricius); male, Kerguelen Island, × $3\frac{2}{3}$. (Not described in this bulletin.)



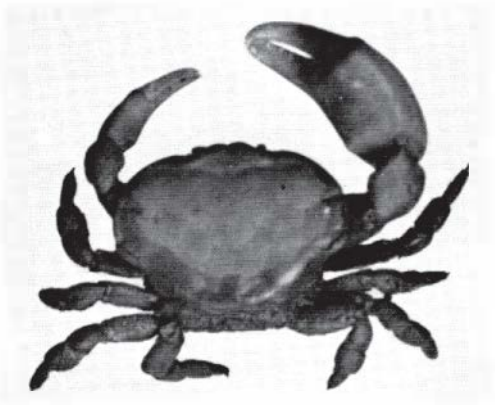
Photo, E. W. Bennett

FIG. 129. *Hombronia depressa* Jacquinot; males from Otago Harbour, dorsal and ventral, × $\frac{3}{4}$. (Not described in this bulletin.)



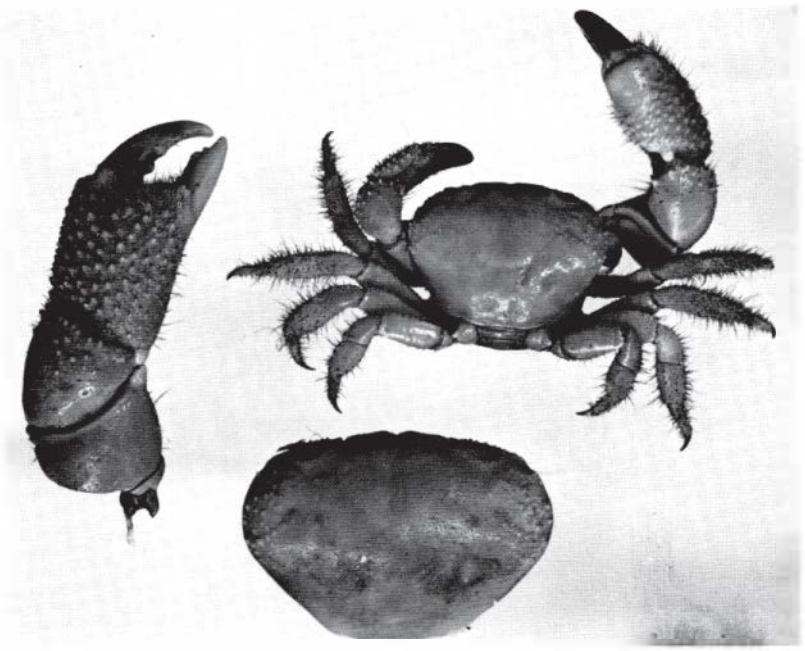
Photo, D. H. Graham

FIG. 130. *Nectocarcinus antarcticus* (Jacquinot); dorsal view, natural size, (Page 65.)



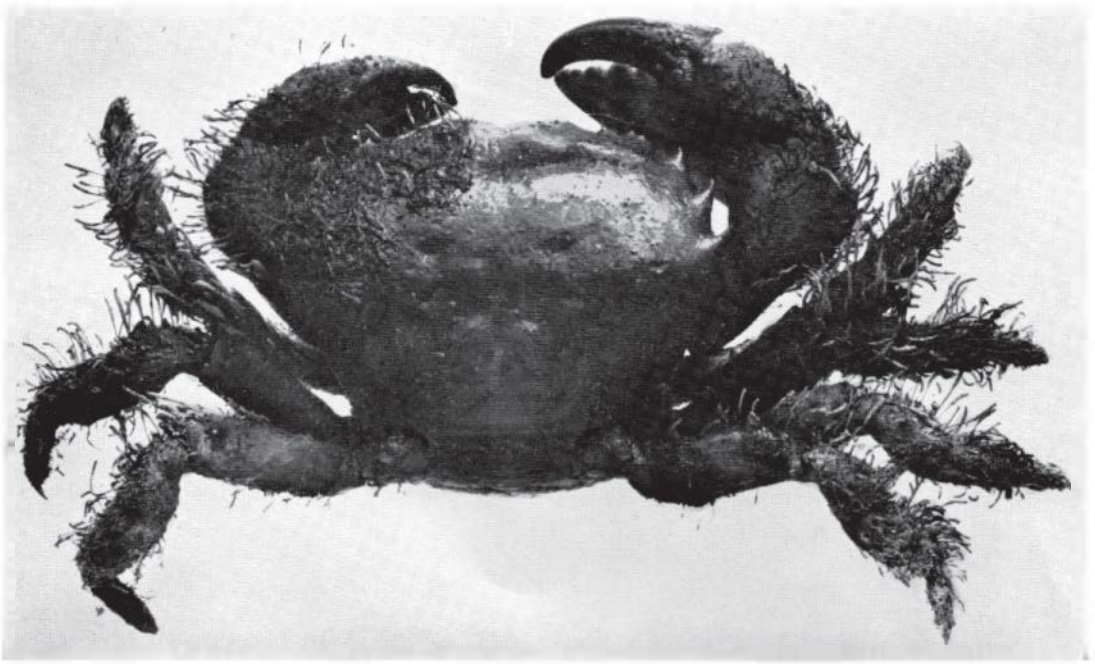
Photo, E. W. Bennett

FIG. 131. *Heterozius rotundifrons* Milne Edwards; dorsal view, × $\frac{8}{10}$. (Page 66.)



Photo, E. W. Bennett

FIG. 132. *Pseudozius* sp.: complete, major cheliped; major cheliped of larger male; and carapace; × 2½. (Page 67.)

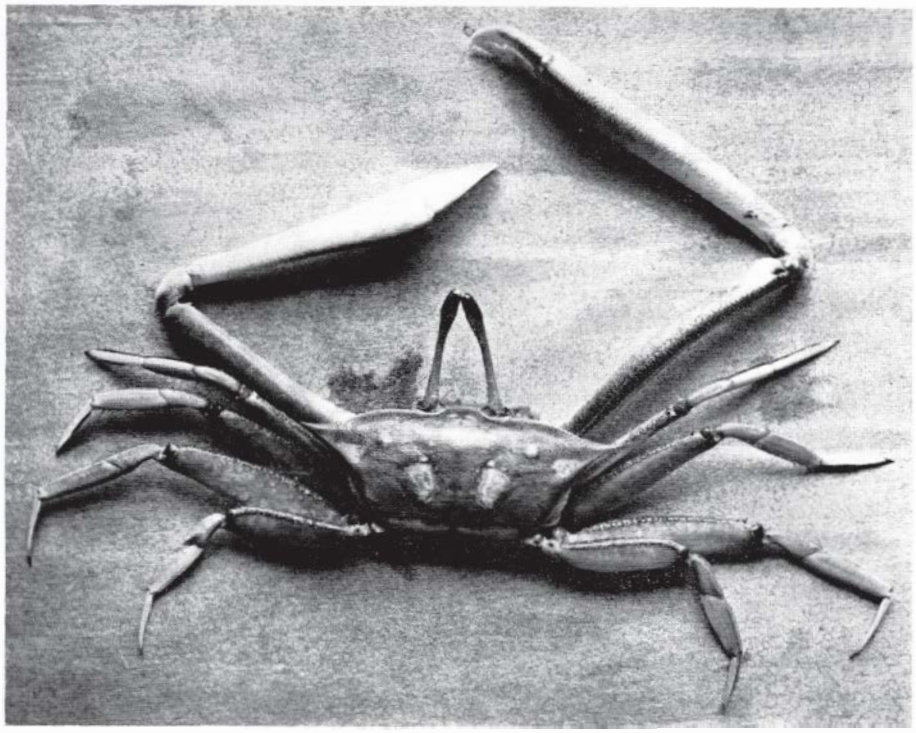


Photo, E. W. Bennett

FIG. 133. *Pilumnus novaezelandiae* Filhol; dorsal view, × 3. (Page 70.)

Photo, E. W. Bennett

FIG. 134. *Pilumnus lumpinus* n. sp.: small male in dorsal view, and depilated major cheliped of large male × 1¾. (Page 72.)

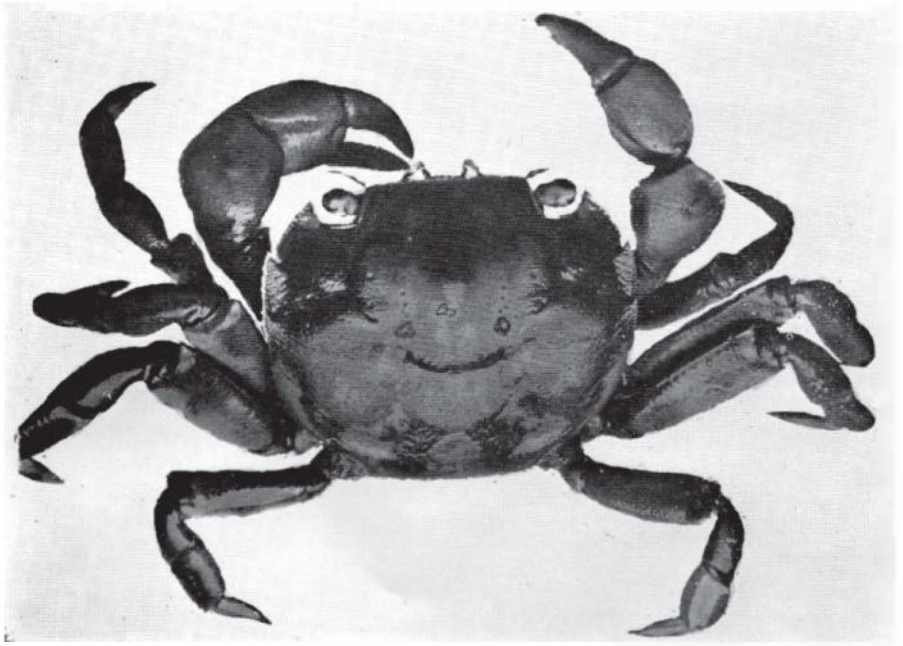


Photo, E. W. Bennett

FIG. 135. *Ommatocarcinus macgillivrayi* White; dorsal view, with eyes in "policeman" attitude, natural size. (Page 74.)

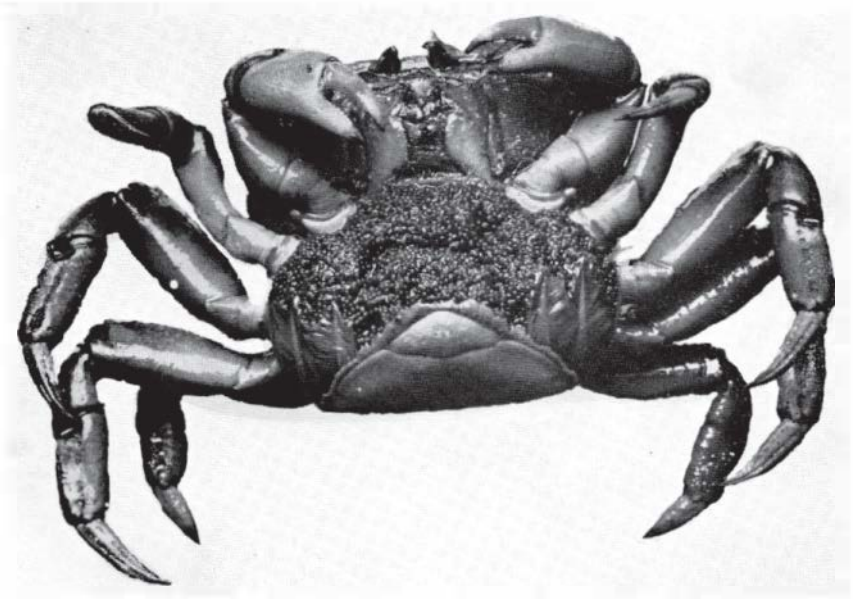
Photo, D. H. Graham

FIG. 136. *Hemigrapsus crenulatus* (Milne Edwards); dorsal view, × 1⅛. (Page 81.)



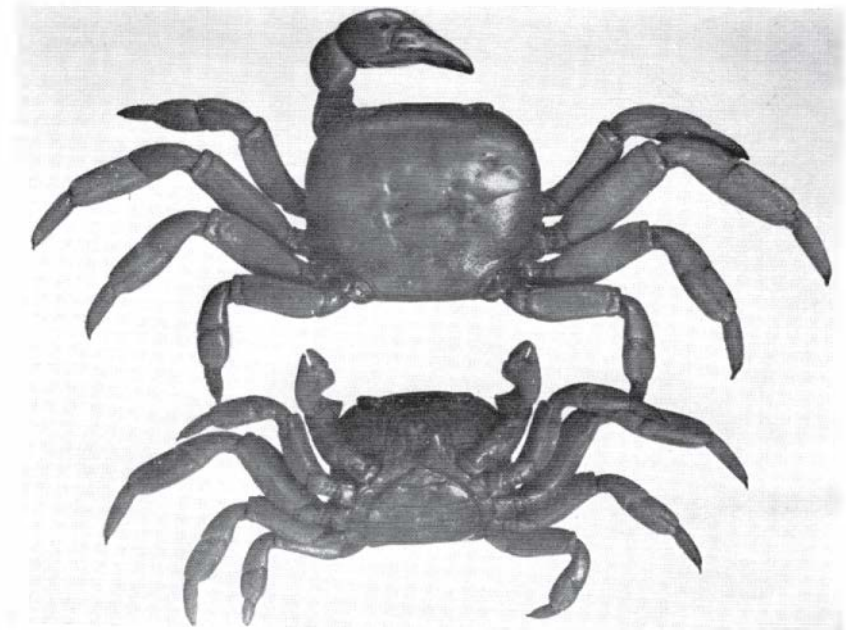
Photo, D. H. Graham

FIG. 137. *Hemigrapsus sexdentatus* (Milne Edwards); dorsal view, natural size. (Page 82.)



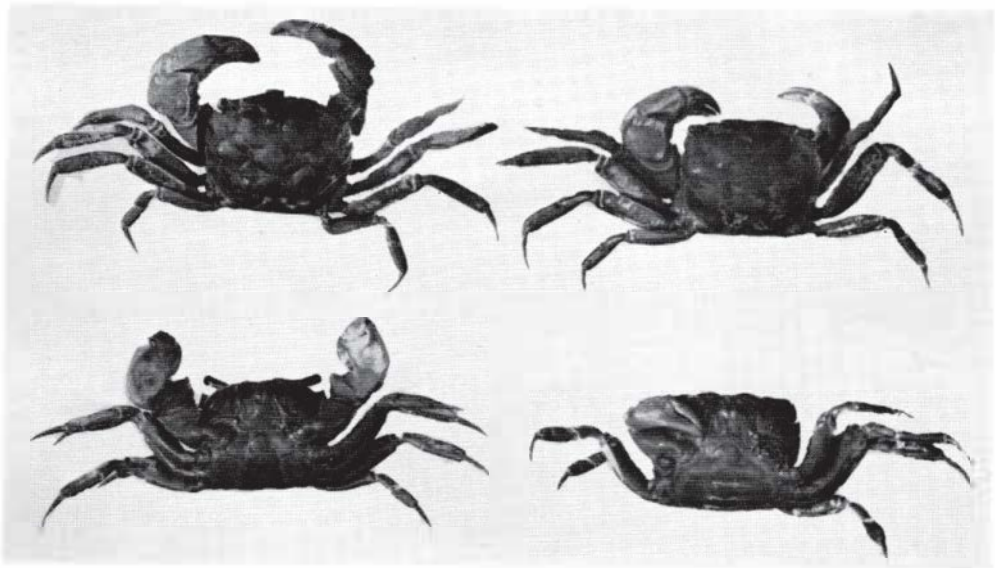
Photo, D. H. Graham

FIG. 138. *Hemigrapsus sexdentatus* (Milne Edwards): ventral view, berried female, natural size. (Page 82.)



Photo, E. W. Bennett

FIG. 139. *Cyclograpsus whitei* Milne Edwards; male in dorsal view, female in ventral, × 1¼. (Page 85.)



Photo, E. W. Bennett

FIG. 140. *Helice crassa* Dana; both sexes, dorsal and ventral, × ⅔. (Page 83.)

Photo, E. W. Bennett

FIG. 141. *Petalomera wilsoni* (Fulton Grant); female, Hauraki Gulf, natural size. (Page 27.)

INDEX

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